



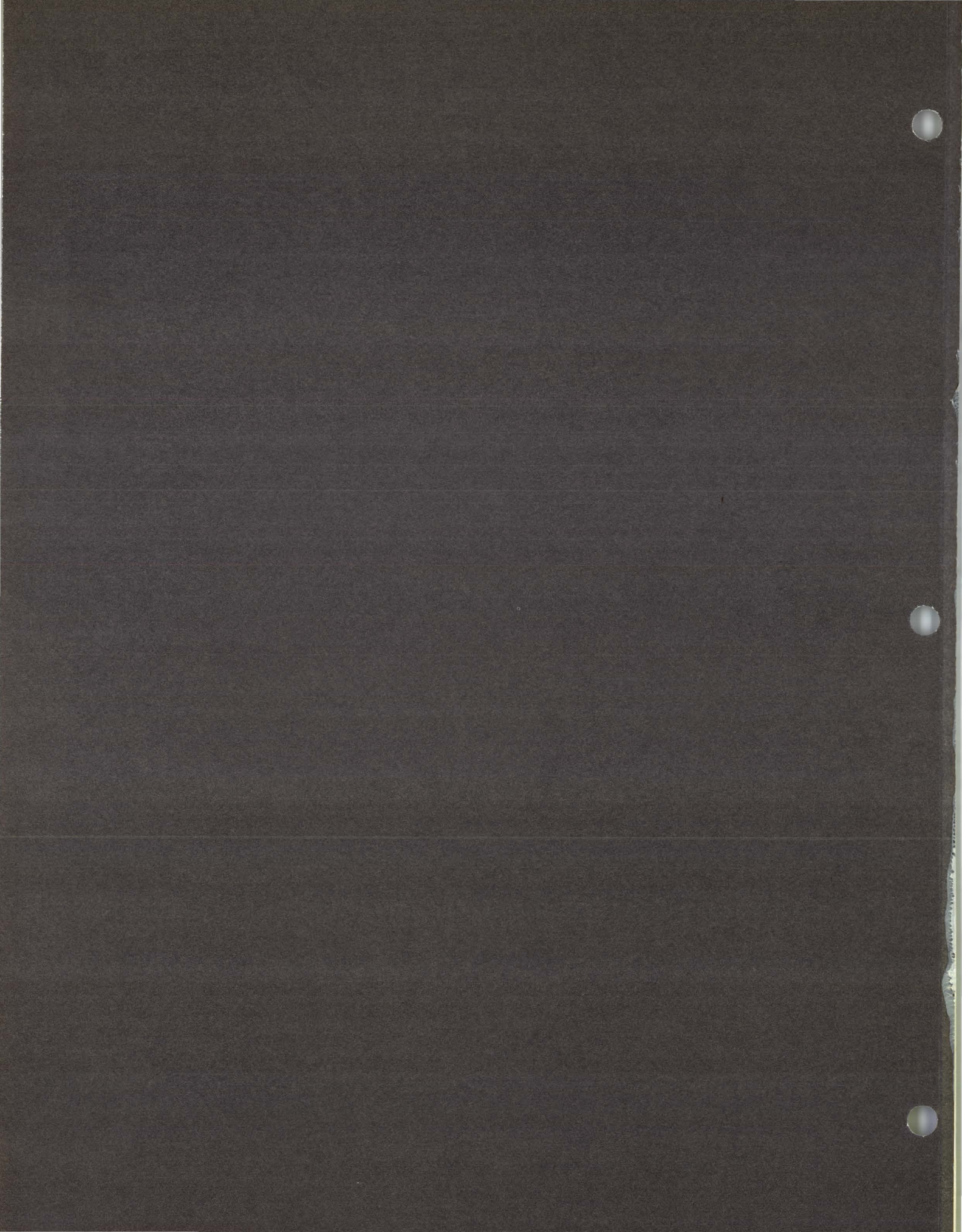
Represented by:

JUL 21 1989

Nikola V. Vidovic

**Semiconductor
Accessories**

- Heat Sinks
- Insulators
- Mounting Pads
- Power Sockets
- P.C. Board Accessories



Dear Customer,

Thermalloy's main goal is to solve your heat dissipation problems. With this goal in mind, for the past 25 years we have been developing and tooling the industry's most extensive line of stamped and extruded heat sinks and related accessories. And we are continually adding new products and innovative designs to keep pace with new technologies.

Technical Assistance . . . Thermalloy's skilled, heat-transfer engineers can assist you in selecting a heat dissipator to meet your thermal and physical configuration needs. We also make our database of technical and engineering reports available to you upon request. Using highly sensitive thermal test equipment, we can provide you with the most accurate test data in the industry.

Proprietary Products . . . Thermalloy offers over 500 standard catalog heat sinks. These products have been designed, tooled and tested to meet a broad range of applications. Standard products are immediately available, with no tooling charges in prototype or production quantities from your local distributor stock.

Custom Fabrication . . . In the event a standard product is not the answer to your design problems, we can custom fabricate a heat sink to your specifications. We inventory raw material and provide complete in-house tooling, fabricating and metal finishing. Our highly automated fabrication capability saves you valuable time and money.

Manufacturing Capabilities . . . We maintain the most advanced machinery available for consistent quality to meet your exact specifications. Some of our manufacturing capabilities include:

- Computerized, tool-changing machinery centers — to meet close tolerance requirements.
- Stamping punch presses — 15 to 60 ton punch presses with coil feeding and straightening equipment to use with high production, progressive dies.
- Deburring equipment — vibratory, chemical etch, wire wheel, sand or abrasive pad deburring are available options.
- Metal finishing — hard, black, red and clear anodize, gold and clear chromate, tin plate and black pre-anodized aluminum coil.
- Automatic screw machines — precision turning of aluminum up to 2⁵/₈" diameter with support equipment for a variety of secondary operations.
- Plastic injection molding — 28 to 150 ton plastic injection molding equipment for thermoset and thermoplastic materials.

Worldwide Availability . . . In addition to Thermalloy's 200,000 square foot manufacturing facility in Dallas, Texas, we now have manufacturing plants located in Corby, England and Kowloon, Hong Kong. You will no longer have to re-source heat sink suppliers overseas. Thermalloy products are manufactured and inventoried at all three locations for quick delivery and savings on customs and freight. Our sales representative and distribution network is also worldwide, contact the factory for the office in your area.

We'd like to help you with your heat dissipation problems. Please call or use the business reply card enclosed with this catalog if you need engineering samples or the name of the sales engineer or stocking distributor nearest you.

Thermalloy, Inc.
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Dallas, Texas 75381-0839
214/243-4321

Thermalloy Headquarters
Located in Dallas, Texas.



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B-250-130-62	83	57-77-14 CAP.	84	5005-08	90	6282	35	7717-247	94
B-375-120-30	83	103	88	5005-09	90	6283	35	7717-300	92
B-375-120-62	83	109	88	5005-20	90	6298	35	7721-1	88
B-470-235-40	83	110	88	5005-25	90	6299	35	7721-2	88
B-510-200-40	83	113	88	5009	90	6300	35	7721-3	88
B-800-260-30	83	249	85	5021	90	6351	40	7721-4	88
B-800-260-62	83	250	85	5022	90	6351-2	40	7721-5	88
43-02-10	78	251	85	5023	90	6352	40	7721-6	88
43-02-25	78	252	85	5024	90	6352-2	40	7721-7	88
43-02-27	78	349	85	5030	90	6353	40	7721-8	88
43-02-95	78	350	85	5032	90	6353-2	40	8113 PF 603	87
43-03-1	78	351	85	5033	90	6354	40	8118 PF 303	87
43-03-2	78	1115	20	5034	90	6354-2	40	8118 PF 603	87
43-03-2 AP	84	1130	22	6000	23	6370	18	8161E40	11
43-03-3	78	2207/PR11	23	6001-2	39	6390	40	8161M2	11
43-03-4	78	2211	22	6002-2	39	6391	40	8161M93	11
43-03-6	78	2212-5	23	6003-2	39	6392	40	8162E40	11
43-05-1	78	2215	22	6004-2	39	6398	35	8162M2	11
43-05-2	78	2224	20	6010	19	6399	35	8162M93	11
43-18-1	78	2225	21	6011	19	6400	35	8164E40	11
43-66-1	78	2226	21	6012	19	6401	41	8164M2	11
43-66-2	78	2227	21	6013	37	6401-2	41	8164M93	11
43-66-2 AP	84	2228	21	6014	37	6403	41	8180E1	11
43-77-1	78	2240	23	6015	37	6403-2	41	8180E3	11
43-77-2	78	2257	20	6016	37	6421	41	8180E40	11
43-77-6	78	2260	20	6017	37	6421-2	41	8180E93	11
43-77-8	78	2268	21	6018	37	6423	41	8180M2	11
43-77-9	78	2280	16	6019	37	6423-2	41	8180M93	11
43-77-9 AP	84	2281	16	6021	31	7001-2	40	8181E1	11
53-02-10	80	2284	16	6022	29	7002-2	40	8181E3	11
53-02-15	80	2285	16	6025	28	7019	32	8181E40	11
53-02-20	80	2286	16	6030	30	7020	32	8181E93	11
53-02-25	80	2287	17	6031	39	7021	33	8181M2	11
53-02-95	80	2288	17	6032	29	7022	33	8181M93	11
53-02-102	80	2290	16	6033	39	7023	34	8182E1	11
53-02-103	80	2291	16	6034	30	7024	34	8182E3	11
53-03-2	80	2292	17	6038	31	7025	33	8182E93	11
53-03-11	80	2293	17	6041	24	7717-2	94	8182M2	11
53-03-12	80	2294	17	6043	24	7717-3	92	8182M93	11
53-03-14	80	2297	17	6045	24	7717-4	92	8183E1	11
53-03-15	80	2298	17	6046	24	7717-5	92	8183E3	11
53-03-16	80	2300	18	6047	24	7717-6	93	8183M2	11
53-66-2	80	2301	18	6051	38	7717-7	92	8183E93	11
53-66-9	80	2302	18	6052	38	7717-8	93	8183M93	11
53-66-10	80	2303	18	6053	38	7717-10	93	8183NE1	11
53-66-11	80	2304	18	6054	38	7717-15	92	8183NE2	11
53-77-2	80	2311	17	6060	38	7717-16	92	8190E40	11
53-77-3	80	2312	17	6061	38	7717-18	92	8191E40	11
53-77-4	80	2313	17	6063	27	7717-19	94	8820-2	89
53-77-5	80	2314	17	6070	27	7717-21	94	8820-4	89
53-77-9	80	4003	83	6071	27	7717-22	92	8820-6	89
53-77-10	80	4003-1	83	6072	27	7717-26	94	8820-8	89
53-77-11	80	4005	83	6073	25	7717-30	93	8822-1	89
53-77-13	80	4005-15	83	6078	25	7717-38	93	8822-2	89
53-78-1	80	4066	83	6079	25	7717-43	94	8822-5	89
53-78-3	80	4103	82	6080	35	7717-44	94	8827-2	89
54-02-10	80	4104	82	6081	35	7717-46	92	8827-3	89
54-02-15	80	4170	82	6082	35	7717-79	92	8827-5	89
54-02-20	80	4177	82	6083	35	7717-81	93	8903NW	88
54-02-25	80	4180	82	6084	25	7717-86	92	8903VB	88
54-02-95	80	4200	78	6085	19	7717-89	92	8909NB	88
54-02-102	80	4300	78	6086	19	7717-93	94	8920N	14
54-02-103	80	4500	78	6087	19	7717-94	92	8921N	14
54-03-2	80	4703A	82	6088	19	7717-107	94		
54-03-11	80	4705A	82	6098	34	7717-108	93		
54-03-12	80	4720A	82	6099	34	7717-109	92		
54-03-14	80	4726A	82	6100	34	7717-112	93		
54-03-15	80	4777A	82	6103	36	7717-113	94		
54-03-16	80	4778A	82	6104	36	7717-114	92		
54-66-2	80	4801	86	6105	36	7717-117	94		
54-66-9	80	4801M	86	6106	26	7717-122	93		
54-66-10	80	4801S	86	6107	26	7717-124	93		
54-66-11	80	4804	86	6109	26	7717-129	94		
54-77-2	80	4804M	86	6110	26	7717-130	94		
54-77-3	80	4804S	86	6111	41	7717-131	92		
54-77-4	80	4818	86	6111-11	41	7717-133	94		
54-77-5	80	4818M	86	6166	36	7717-137	94		
54-77-9	80	4818S	86	6168	36	7717-139	94		
54-77-10	80	4860	86	6213	37	7717-148	93		
54-77-11	80	4860M	86	6214	37	7717-149	94		
54-77-13	80	4860S	86	6216	37	7717-152	93		
54-78-1	80	4870	86	6225	28	7717-153	93		
54-78-3	80	4870M	86	6230	31	7717-156	93		
56-02-10	79	4870S	86	6232	29	7717-157	93		
56-02-72	79	4875	87	6234	30	7717-158	92		
56-02-95	79	4875M	87	6237	28	7717-159	92		
56-03-2	79	4875S	87	6238	32	7717-161	92		
56-03-2 AP	84	4876	87	6239	32	7717-167	92		
56-03-8	79	4876M	87	6251	38	7717-175	94		
56-66-2 AP	84	4876S	87	6252	38	7717-178	92		
56-77-8	79	4880	86	6253	38	7717-204	93		
56-77-10	79	4880M	86	6254	38	7717-220	93		
56-77-11	79	4880S	86	6273	26	7717-222	94		
56-77-11 AP	84	4951	85	6278	25	7717-223	93		
57-03-2 CAP	84	4952	85	6279	25	7717-238	92		
57-66-2 CAP	84	5001	90	6280	35	7717-239	93		
57-77-9 CAP	84	5003	90	6281	35	7717-241	93		

Heat Sink and Accessories Index by Case Style

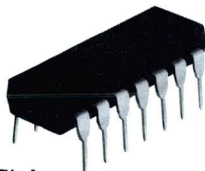
To make it easier for you to find exactly what you want for the particular case style you're working with, this listing shows the page number of each heat sink and accessory listed under the case style for which it's designed.

Pin Grid Arrays and Chip Carriers



Heat Sink Model Number	$R_{\theta}^{\circ}\text{C}/\text{W}^*$	Page
2280	34.1	16
2281	28.8	16
2284	28.8	16
2285	32.6	16
2286	32.6	16
2287	26.8	17
2288	25.9	17
2290	27.8	16
2291	26.8	16
2292	23.4	17
2293	28.8	17
2294	31.3	17
2297	17.9	17
2298	16.3	17
2300	13.9	18
2301	18.3	18
2302	17.0	18
2303	22.1	18
2304	17.0	18
2311	42.5	17
2312	41.5	17
2313	40.0	17
2314	38.5	17
Accessories		
Thermalbond		85

Dip Packages



Heat Sink Model Number	$R_{\theta}^{\circ}\text{C}/\text{W}^*$	Page
6010	60.0	19
6011	68.0	19
6012	68.0	19
6085	38.0	19
6086	33.0	19
6087	27.0	19
6088	20.0	19
6370	27.8	18
Accessories		
Thermalbond		85

*Thermal Resistance, natural convection, black anodized @ 75°C rise.

NOTE: Thermalloy, Inc. reserves the right to make minor configuration and dimensional changes to proprietary products that do not affect fit or function.

TO-5 Cases



Heat Sink Model Number	$R_{\theta}^{\circ}\text{C}/\text{W}^*$	Page
1115	71.0	20
1130	15.0	22
2207/PR11	41.0	23
2211	49.0	22
2212-5	30.0	23
2215	37.0	22
2225	46.0	21
2226	57.5	21
2227	21.0	21
2228	35.0	21
2257	62.0	20
2260	56.0	20
Insulators		
Beryllium Oxide		83
Insul-Cote (Pre-Coated)		83
Mounting Pads		92
Thermalfilm		78

TO-8 Cases



Heat Sink Model Number	$R_{\theta}^{\circ}\text{C}/\text{W}^*$	Page
2240	28.8	23
2268	30.0	21

TO-18 Cases



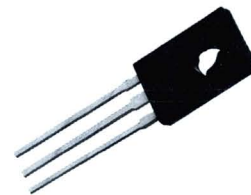
Heat Sink Model Number	$R_{\theta}^{\circ}\text{C}/\text{W}^*$	Page
2224	92.0	20
Insulators		
Beryllium Oxide		83
Insul-Cote (Pre-Coated)		83
Mounting Pads		92
Thermalfilm		78

TO-92, TO-236, TO-237 Cases



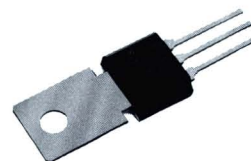
Heat Sink Model Number	$R_{\theta}^{\circ}\text{C}/\text{W}^*$	Page
2224	92.0	20

TO-126 Cases



Heat Sink Model Number	$R_{\theta}^{\circ}\text{C}/\text{W}^*$	Page
6041	42.0	24
Insulators		
Hard Anodized Aluminum		82
Insul-Cote (Pre-Coated)		83
Thermalfilm		78

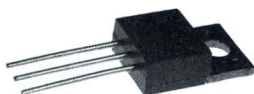
TO-202 Cases



Heat Sink Model Number	$R_{\theta}^{\circ}\text{C}/\text{W}^*$	Page
6034	9.0	30
6046	25.0	24
6047	25.0	24
6063	14.0	27
6098	14.0	34
6099	11.0	34
6100	9.0	34
6234	9.0	30
6273	21.0	26
6278	23.0	25
6279	20.0	25
Accessories		
Conducta-Cote		84
Grafoil		83
Shoulder Washers		88
Thermalcote		85

Heat Sink and Accessories Index by Case Style

TO-220 Cases



Heat Sink		Page
Model Number	$R_{\theta}^{\circ}\text{C/W}^*$	
6021	11.5	31
6022	18.8	29
6025	19.0	28
6030	12.0	30
6032	9.2	29
6038	18.0	31
6043	23.0	24
6045	26.0	24
6060	6.5	38
6061	5.9	38
6070	16.0	27
6071	15.0	27
6072	7.1	27
6073	21.0	25
6078	22.0	25
6079	18.5	25
6080	6.3	35
6081	5.9	35
6082	4.4	35
6083	3.3	35
6084	22.5	25
6098	14.0	34
6099	11.0	34
6100	9.0	34
6106	17.0	26
6107	20.0	26
6109	17.0	26
6110	21.0	26
6225	15.5	28
6230	12.0	31
6232	9.2	29
6237	25.0	28
6238	13.6	32
6239	13.6	32
6251	9.0	38
6252	7.0	38
6253	6.0	38
6254	4.4	38
6280	6.3	35
6281	4.7	35
6282	3.9	35
6283	3.3	35
6298	3.9	35
6299	3.6	35
6300	3.1	35
6390	13.6	40
6391	10.0	40
6392	7.5	40
6398	4.4	35
6399	3.3	35
6400	2.7	35
7001	5.2	40
7002	4.2	40
7019	10.1	32
7020	8.7	32
7021	6.8	33
7022	6.5	33
7023	4.4	34
7024	5.6	34
7025	6.8	33
Insulators		
Aluminum Oxide		82
Conducta-Cote		84
Hard Anodized Aluminum		82
Insul-Cote (Pre-Coated)		84
Mica		79
Mounting Kits		86
Thermalfilm		78
Thermalsil		80
Other Accessories		
Grafoil		83
Insulating Covers		88
Power Sockets		87
Shoulder Washers		88
Thermalcote		85
Transistor Mounts		86

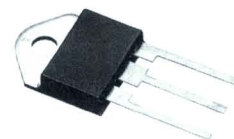
Thermalfilm	78
Thermalsil	80
Other Accessories	
Grafoil	83
Shoulder Washers	88
Thermalcote	85
Transistor Mounts	11

TO-3 Cases



Heat Sink		Page
Model Number	$R_{\theta}^{\circ}\text{C/W}^*$	
6001	7.2	39
6002	6.1	39
6003	5.2	39
6004	4.2	39
6013	11.5	37
6014	8.6	37
6015	6.9	37
6016	6.2	37
6031	3.7	39
6033	2.8	39
6051	9.0	38
6052	7.0	38
6053	6.0	38
6054	4.4	38
6060	6.5	38
6061	5.9	38
6103	11.0	36
6104	11.0	36
6105	11.0	36
6213	5.8	37
6214	4.7	37
6216	3.9	37
6251	9.0	38
6252	7.0	38
6253	6.0	38
6254	4.4	38
6351	7.5	40
6352	6.2	40
6353	5.0	40
6354	4.2	40
6401	2.8	41
6403	1.8	41
6421	1.1	41
6423	.77	41
7001	5.2	40
7002	4.2	40
7023	4.4	34
Insulators		
Aluminum Oxide		82
Beryllium Oxide		83
Conducta-Cote		84
Hard Anodized Aluminum		82
Insul-Cote (Pre-Coated)		84
Mica		79
Mounting Kits		86
Thermalfilm		78
Thermalsil		80
Other Accessories		
Grafoil		83
Insulating Covers		88
Power Sockets		87
Shoulder Washers		88
Thermalcote		85
Transistor Mounts		11

TO-218 Cases



Heat Sink		Page
Model Number	$R_{\theta}^{\circ}\text{C/W}^*$	
6298	3.9	35
6299	3.6	35
6300	3.1	35
6390	13.6	40
6391	10.0	40
6392	7.5	40
6398	4.4	35
6399	3.3	35
6400	2.7	35
7020	8.7	32
7021	6.8	33
7022	6.5	33
7023	4.4	34
7024	5.6	34
7025	6.8	33
Insulators		
Aluminum Oxide		82
Hard Anodized Aluminum		82
Insul-Cote (Pre-Coated)		84
Mica		79
Thermalfilm		78
Thermalsil		80
Mounting Kits		86
Other Accessories		
Grafoil		83
Shoulder Washers		88
Thermalcote		85

TO-66 Cases



Heat Sink		Page
Model Number	$R_{\theta}^{\circ}\text{C/W}^*$	
6017	12.2	37
6018	7.9	37
6019	6.7	37
6060	6.5	38
6061	5.9	38
6111	10.7	41
6166	14.5	36
6168	14.5	36
7001	5.2	40
7002	4.2	40
7023	4.4	34
Insulators		
Aluminum Oxide		82
Beryllium Oxide		83
Hard Anodized Aluminum		82
Insul-Cote (Pre-Coated)		84
Mica		79
Thermalfilm		78
Thermalsil		80
Mounting Kits		86
Conducta-Cote		84
Other Accessories		
Grafoil		83
Power Sockets		87
Shoulder Washers		88
Thermalcote		85
Transistor Mounts		11

1. Thermal Performance

Calculate the thermal resistance ($R_{\theta SA}$) required to meet the given specifications of ambient temperature, maximum junction temperature and power dissipation for a given transistor. See sample calculations on pages 6 and 7 and interface resistance data on pages 8 and 9.

2. Selecting the Heat Sink

Use the graph below to determine the approximate required space for natural convection. If there is not enough available space for natural convection, consider forced convection.

Then, using the part numbers shown on the graph, locate the heat sinks in the catalog and determine a number of possible selections considering heat sink configuration and mounting orientation. "Heat Sink Index by Case Style" on page 2 is also useful in selecting a number of likely choices.

3. Labor-Saving Options

After initial heat sink selection, consider the labor-saving options on pages 10 through 15.

4. Extrusions

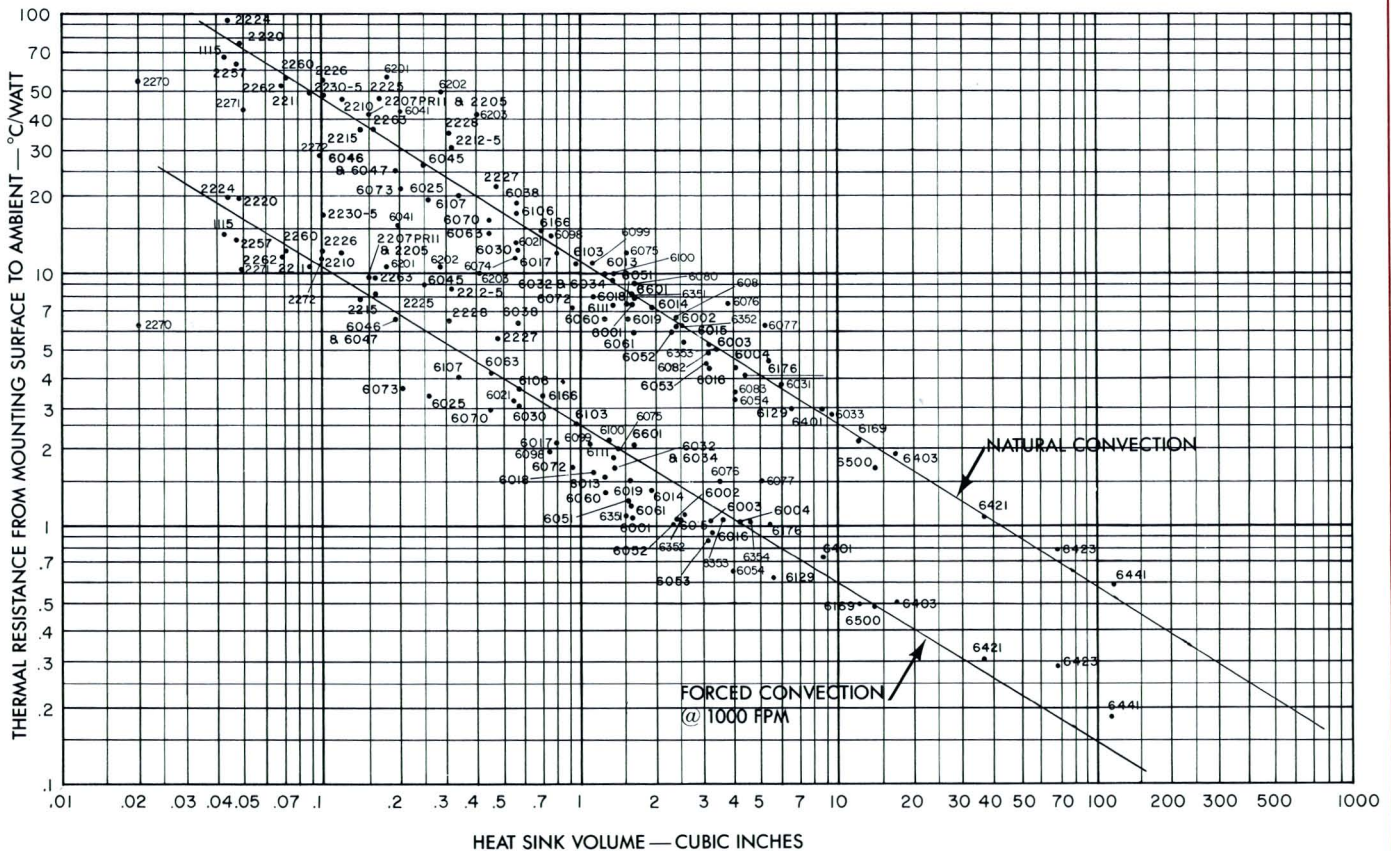
Customer requirements may preclude use of standard heat sinks. Refer to the extrusion profiles section of this catalog, beginning on page 42, if an extruded shape is required to meet your thermal and package requirements.

5. Custom Designs

If a standard catalog heat sink is not the answer to your design problems, Thermalloy can custom fabricate a heat sink to your specifications.

6. Cost

Contact your local distributor, representative or Thermalloy.



How to Order

So that we can supply the exact unit you require, please furnish the following information on your order:

1. Small (ASM machined parts) and medium (stamped or formed) heat sinks:

- Basic type — specify model number such as #6054, 6051, etc.
- Finish — see Available Finishes below.

Example:

6054 B

Basic Type Finish

- Options — basic type and finish are suffixed by SE-___, SM-___, SF-___, etc. See Options listed below.

Example:

6054B SE-2

2. Extruded heat sinks:

- Basic type — specify model number such as #10747, #10902, etc.
- Finish — see Available Finishes below.
- Hole pattern — see Recommended Layouts on page 44.
- Specify length.

Example:

10747 B -2 -2

Basic Type Finish First Second
 Hole Hole
 Pattern Pattern

3. Sockets, Insulators, Mounting Kits, etc.:

- Basic type — specify model number such as #43-03-2, 4880, 8827-2, etc.

Example:

43-03-2

Basic Type

4. Mounting pads:

- Basic type — specify model number such as #7717-5, 7717-18, etc.
- Material — specify N for nylon, DAP for Diallyl Phthalate and PPS for Polyphenylene Sulfide.
- Color — Unless specified, all pads will be natural in color. DAP pads are available in black only.

Example:

7717-5 N
 Basic Type Material Color

Part Marking — Part marking will be at Thermalloy's discretion and may consist only of the basic type and hole pattern designation (if applicable).

Packaging — Small and medium power heat sinks are bulk packaged unless otherwise specified. Special packaging is available at a slight additional cost.

Available Finishes

The following finishes should be indicated by catalog number suffix:

"A" suffix — Hard anodized insulating finish .001 inch thick minimum per MIL-A-8625, Type III. Reference Thermalloy Engineering Information Report (EIR) #74-1052. "File hard" surface resists scratches and punctures. Electrical insulation of 400 VDC typical between transistor case and mounting surface. If electrical insulation is critical, mounting torque recommendations must be followed and Thermalcote thermal compound used.

"B" suffix — Black anodize finish per MIL-A-8625, Type II. Recommended for increased thermal performance. Not to be used for electrical insulation.

"B-TT" suffix — Black enamel paint finish with tin-plated tabs for soldering heat sink to PC board (tin plating per MIL-T-10727, Type I.)

"C" suffix — Gold chromate finish per MIL-C-5541. No electrical insulation. Color variation may be expected with this finish. For corrosion protection or painting only.

"D" suffix — Tin plating per MIL-T-10727, Type I, for soldering heat sink to PC board.

"R" suffix — Red anodize finish per MIL-A-8625, Type II.

"PB" suffix — Black pre-anodized material per MIL-A-8625, Type II (prior to forming). Will show bare metal at edges.

"U" suffix — Clean, no finish, uninsulated.

Options

See Heat Sink Labor-Saving Options section beginning on page 10 for details.

"G" suffix — Grafoil Conducta-Pad

"MT" suffix — solderable mounting tab

"P" suffix — solderable roll pins

"SE" suffix — solderable stud, English thread

"SF" suffix — device mounting stud

"SM" suffix — solderable stud, metric thread

"SNE" suffix — solderable nut, English thread

"SNM" suffix — solderable nut, metric thread

"SS" suffix — solderable pins

"TC" suffix — Thermalclip

"Y" suffix — snap-on solder mount

Military Specifications

Thermalloy is listed as one of the prime suppliers in the government's MIL-SPEC MIL-H-87111, "Heat Sinks, Semiconductor Devices, General Specifications For." Most of the heat sinks and hard anodized insulators within this document are similar to products within this catalog but must be manufactured for detailed compliance with requirements of the military specification. Contact the factory for additional information.

Quality Assurance

Quality assurance provisions shall be in accordance with MIL-I-45208. Sampling inspection will be utilized per MIL-STD-105, AQL 1.0 unless otherwise specified.

Materials

Type of Manufacture	Alloy	Federal Specification	Standard Specifications		
			ASTM ⁽¹⁾	ANSI ⁽²⁾	AMS ⁽³⁾
Stamping	Aluminum 1100-H14	QQ-A-250/1	B209	H38.2	4003
Screw Machine	Aluminum 2024-T4	QQ-A-225/6	B211	H38.4	4120
Stamping	Aluminum 3003-H14	QQ-A-250/2	B209	H38.2	4008
Stamping	Aluminum 5052-H34	QQ-A-250/8	B209	H38.2	4017
Extrusion	Aluminum 6063-T5	QQ-A-200/9	B221	H38.5	4156
Stamping	Copper CDA 110, ¼ Hard	QQ-C-576 (ETP)	B152 (ETP)	—	4500D

⁽¹⁾ ASTM — American Society for Testing and Materials

⁽²⁾ ANSI — American National Standards Institute

⁽³⁾ AMS — Aerospace Material Specifications

Basic Equations

Electronic cooling devices (heat sinks, coolers, dissipators) are generally rated by a statement of their thermal resistance. That is, temperature rise per unit of heat transfer or power dissipated, expressed in units of degrees centigrade per watt. For a particular application it is necessary to determine the thermal resistance which the cooler must have in order to maintain a junction temperature which is not detrimental to the operation, performance and reliability of the semiconductor device.

The basic relation for heat transfer or power dissipation may be stated as follows:

$$P_D = \frac{\Delta T}{\Sigma R_{\theta}}$$

where,

P_D = the power dissipated by the semiconductor device in watts.

ΔT = the temperature difference or driving potential which causes the flow of heat.

ΣR_{θ} = the sum of the thermal resistances of the heat flow path across which ΔT exists.

The above relationship may be stated in the following forms:

$$(1) \quad P_D = \frac{T_J - T_A}{R_{\theta JC} + R_{\theta CS} + R_{\theta SA}}$$

$$(2) \quad P_D = \frac{T_C - T_A}{R_{\theta CS} + R_{\theta SA}}$$

$$(3) \quad P_D = \frac{T_S - T_A}{R_{\theta SA}}$$

where,

T_J = the junction temperature in °C (maximum is usually stated by manufacturer of semiconductor device).

T_C = case temperature of semiconductor device in °C.

T_S = temperature of mounting surface (cooler) in thermal contact with semiconductor device in °C.

T_A = ambient temperature in °C.

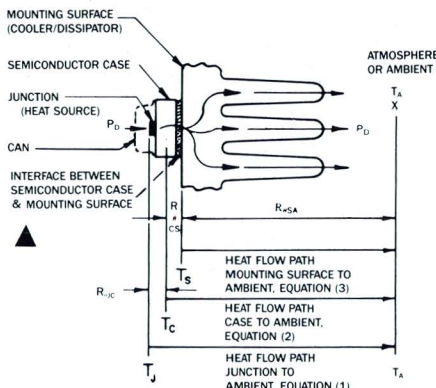
$R_{\theta JC}$ = thermal resistance from junction to case of semiconductor device in °C per watt (usually stated by manufacturer of semiconductor device).

$R_{\theta CS}$ = thermal resistance through the interface between the semiconductor device and the surface on which it is mounted in °C per watt.

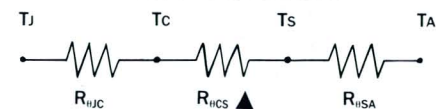
$R_{\theta SA}$ = thermal resistance from mounting surface to ambient or thermal resistance of cooler in °C per watt.

The above equations are generally used to determine the required thermal resistance of the cooler ($R_{\theta SA}$) since the heat dissipation, maximum junction and/or case temperature, and ambient temperature are known or set.

The following schematic diagram indicates the location of the various heat flow paths, temperatures and thermal resistances.



The common practice is to represent the above system with a network of series resistances as shown below.



Heat Sink Selection

The use of catalog test data in heat sink selection is best demonstrated through the use of examples.

Example No. 1

Given: TO-220 case style dissipating 5 watts

$R_{\theta JC} = 3.0^{\circ}\text{C/Watt}$ (from semiconductor manufacturer)

$T_J \text{ max.} = 150^{\circ}\text{C}$

$T_A \text{ max.} = 50^{\circ}\text{C}$

Find: The proper heat sink to keep the semiconductor junction from exceeding 150°C in natural convection.

Solution: Use equation (1).

$$P_D = \frac{T_J - T_A}{R_{\theta JC} + R_{\theta CS} + R_{\theta SA}}$$

Solving for $R_{\theta SA}$:

$$R_{\theta SA} = \frac{T_J - T_A}{P_D} - (R_{\theta JC} + R_{\theta CS})$$

Assume the device is mounted without an insulator and with Thermalcote, the thermal resistance from case to mounting surface ($R_{\theta CS}$) can be obtained from Figure 9, page 9 for a TO-220 case style.

$R_{\theta CS} = 1.0^{\circ}\text{C/Watt}$ at 6 in.-lbs. mounting screw torque.

therefore,

$$R_{\theta SA} = \frac{150^{\circ}\text{C} - 50^{\circ}\text{C}}{5 \text{ Watts}} - (3.0^{\circ}\text{C/W} + 1.0^{\circ}\text{C/W})$$

$$R_{\theta SA} = 16^{\circ}\text{C/Watt}$$

Thermalloy P/N 6030B at 5 watts power dissipation has a mounting surface temperature of 66°C above ambient, therefore:

$$R_{\theta SA} = \frac{66^{\circ}\text{C}}{5 \text{ Watts}} = 13.2^{\circ}\text{C/Watt}$$

which meets this requirement of natural convection.

Example No. 2

Given: TO-3 case style dissipating 28 watts.

$R_{\theta JC} = 1.0^{\circ}\text{C/Watt}$ (from semiconductor manufacturer)

$T_J \text{ max.} = 150^{\circ}\text{C}$

$T_A \text{ max.} = 50^{\circ}\text{C}$

Find: The proper heat sink to keep the semiconductor junction from exceeding 150°C in natural convection.

Solution: From the previous example,

$$R_{\theta SA} = \frac{T_J - T_A}{P_D} - (R_{\theta JC} + R_{\theta CS})$$

Assume the device is mounted with P/N 4703A hard anodized washer (.020" thick) and with Thermalcote, the thermal resistance from case to mounting surface ($R_{\theta CS}$) can be obtained from Figure 8, Page 9 for a TO-3 case style.

$R_{\theta CS} = 0.28^{\circ}\text{C/Watt}$ at 6 in.-lbs. mounting screw torque.

therefore,

$$R_{\theta SA} = \frac{150^{\circ}\text{C} - 50^{\circ}\text{C}}{28 \text{ Watts}} - (1.0^{\circ}\text{C/W} + 0.28^{\circ}\text{C/W})$$

$$R_{\theta SA} = 2.29^{\circ}\text{C/Watt}$$

Thermalloy P/N 6403B at 28 watts power dissipation has a mounting surface temperature of 56°C above ambient, therefore:

$$R_{\theta SA} = \frac{56^{\circ}\text{C}}{28 \text{ Watts}} = 2.00^{\circ}\text{C/Watt}$$

which meets this requirement for natural convection.

Example No. 3

Given: Example No. 2 except power dissipation is 40 watts.

Find: The required length of 10270 extrusion to keep junction temperature from exceeding 150°C in natural convection.

Solution: From the previous example,

$$R_{\theta SA} = \frac{T_J - T_A}{P_D} - (R_{\theta JC} + R_{\theta CS})$$

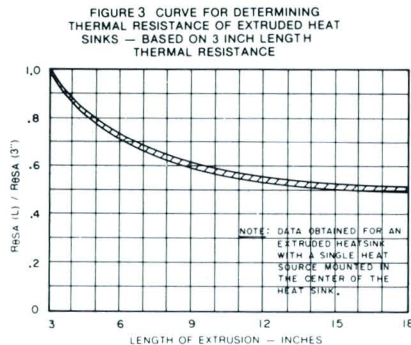
$$R_{\theta SA} = \frac{150 - 50}{40} - (1.0^{\circ}\text{C/W} + 0.28^{\circ}\text{C/W})$$

$$R_{\theta SA} = 1.22^{\circ}\text{C/Watt}$$

A three-inch length of extrusion 10270 (shown on page 61) has a thermal resistance of 1.8°C/W .

Test Procedures

Figure 3 presents data for determining the approximate thermal resistance of an extruded heat sink based on the 3 inch thermal performance. Determine the R_L/R_3 thermal resistance ratios for use with Figure 3.



$$R_L/R_3 = \frac{1.22^\circ\text{C/Watt}}{1.80^\circ\text{C/Watt}} = 0.67$$

$$\text{Length} \approx 7.0 \text{ inches } \frac{R_L}{R_3} = 0.67$$

Therefore, you should specify approximately 7.0 inches of the extrusion - 10270.

Example No. 4

Given: TO-3 case style dissipating 50 watts
 $R_{\theta JC} = 1^\circ\text{C/Watt}$ (from semiconductor manufacturer)
 $T_J \text{ max} = 150^\circ$
 $T_A \text{ max} = 50^\circ\text{C}$

Find: The proper heat sink to keep the semiconductor junction from exceeding 150°C in forced convection (≈ 600 feet per minute).

Solution: From equation (1)

$$R_{\theta SA} = \frac{T_J - T_A}{P_D} - (R_{\theta JC} + R_{\theta CS})$$

Assume the device is mounted without an insulator and with Thermalcote, therefore from Figure 8, Page 9.

$R_{\theta SA} = 0.125^\circ\text{C/Watt}$ at 6 in.-lbs. mounting screw torque therefore,

$$R_{\theta SA} = \frac{150^\circ\text{C} - 50^\circ\text{C}}{50 \text{ Watts}} - (1^\circ\text{C/W} + .125^\circ\text{C/W})$$

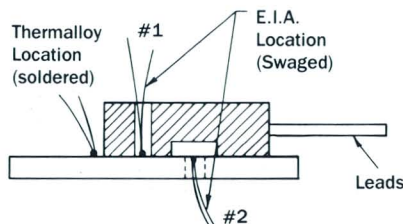
$$R_{\theta SA} = 0.88^\circ\text{C/Watt}$$

Thermalloy P/N 6403B at 600 feet per minute air velocity has a $R_{\theta SA} = 0.68^\circ\text{C/Watt}$ which meets this requirement.

For more information on selecting the proper heat sink, technical report (EIR-84-1012) "Determining The Thermal Performance of Extruded Heat Sinks" is available upon request.

Thermalloy's test procedures for the evaluation of heat sinks are in accordance with the Electronics Industries Association's *Components Bulletin No. 5* with the exception of the method of thermocouple location and installation. Thermocouples are installed in a manner to eliminate immersion depth errors. Where practical, they are soldered or welded to the point to be monitored. For instance, Thermalloy solders the thermocouple to the tab of a TO-220 instead of swagging it in a blind hole drilled in the molded body. Since the device tab is constructed of a highly conductive material, this procedure results in an insignificant error.

The TO-220 plastic power package is shown below with the E.I.A. and Thermalloy thermocouple location.



The maximum difference in bulk thermal resistance of the semiconductor base is approximately 1°C/Watt between the Thermalloy location and the E.I.A. #1 location. This assumes that the E.I.A. method is in perfect contact with the device tab. Should this be the case, when a 6045B clip sink is attached to the TO-220, a 4% lower case temperature would be measured using Thermalloy's location. However, should the E.I.A. swaged thermocouple be as little as 0.050 " from the true surface the resulting error would be approximately 5% of the true surface temperature.

Thermalloy has also observed that the temperature of a TO-3 base varies only $\pm 2^\circ\text{C}$ depending on location. Therefore, the Thermalloy procedure offers easier thermocouple installation and higher repeatability due to the elimination of immersion depth errors.

When testing cooling units that are designed only for particular semiconductor components and the method of interfacing is predictable, the thermocouple will be attached to the component case. For instance, the 2207/PR11 is designed to be used exclusively with TO-5 components which are held in place with threaded inserts. In testing this part, the thermocouple is soldered to the weld flange of the TO-5. When testing cooling units designed exclusively for TO-3 components, the thermocouple is soldered to the component case and the device is mounted dry, without an insulator, and

under 6-8 in.-lbs. torque. When testing cooling units for various semiconductor components, the temperature is monitored on the cooling unit mounting surface.

Natural Convection Tests:

When testing in natural convection, the heat sinks are mounted in a free standing manner; that is, non-board mounted and without flow blockage by neighboring structures. The reason Thermalloy tests in this manner is to provide a common basis for heat sink performance since it would be impractical to provide test data for all applications. Therefore, some performance degradation can be expected depending upon packaging, i.e., orientation, flow blockage, and higher temperature devices nearby.

If the heat sinks are mounted directly on the circuit board without additional heat sources on the board, Thermalloy generally finds little change in a heat sink's performance over a free standing configuration. In board mounted applications with other heat sources on the board, heat sink orientation with respect to gravity can be important with as much as 20% degradation in performance.

Forced Convection Tests:

Two types of forced convection tests are run; open flow and confined or ducted flow. For open flow, no duct is used. A blower is mounted such that the direction of flow is parallel to the fins. Velocity is varied either by changing the distance between the blower and cooler by throttling. This velocity is measured in the vicinity of the fins with a hot wire anemometer for velocities up to 1000 feet per minute and with a pitot tube for velocities over 1000 feet per minute.

For confined flow, the parts to be tested are installed in a close fitting duct. A static pressure tap is placed immediately upstream of the test section. Volume airflow is measured with a sharp edge orifice in accordance with SAE Aero-Space Applied Thermodynamics Manual.

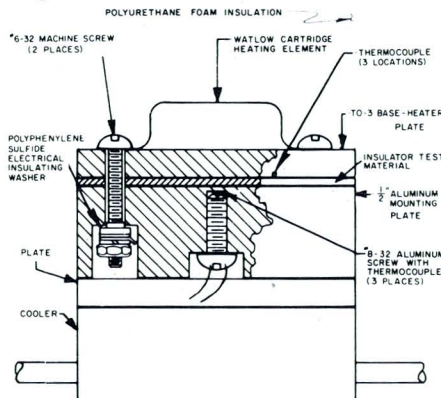
Test Data — General

The curves of interface thermal resistance for different materials were obtained in carefully controlled laboratory tests at Thermalloy. The curves illustrate the comparative interface thermal resistance values of different insulating materials as a function of mounting screw torque and in interface pressure. Typical values of interface thermal resistance are shown with and without thermal joint compound in the interface area and with the semiconductor device mounted in direct surface contact (bare) with the sink.

Description of Test Set-Up

The insulating material tested was installed in the test fixture, reference Figure 4, with a heater plate above the test material and a mounting plate below it. The heater plate was an actual base of a TO-3 or TO-220 semiconductor device with a typical 32 microinch surface finish. The heater plate, test material and mounting plate were all cut to the outline dimensions of a standard TO-3 or TO-220 semiconductor device. The heater plate was attached to the mounting plate with 6-32 machine screws. An insulating shoulder washer was located under the nut to simulate actual installation of the semiconductor device, and eliminate the thermal short through the mounting screws.

Figure 4. TO-3 laboratory set-up for testing insulator materials.



Three thermocouples were soldered in place and evenly spaced in the heater plate 0.010 inch above the interface of the test material. Three thermocouples were also installed in the 1/2 inch aluminum mounting plate 0.020 inch below the interface of the test material. The thermocouples were connected to the recording equipment with 36 AWG copper constantan wire to increase the recording accuracy by minimizing heat conduction losses along the thermocouple wires. Heat was generated by a 3/8 inch diameter, Watlow 250-watt cartridge heating element soldered to the top of the heater plate.

Before each test the surfaces of the heater base and the top of the mounting

plate were thoroughly cleaned with alcohol. An insulator plate was installed below the mounting plate and a liquid (water) heat exchanger was attached to the bottom of the insulator plate. The water flow rate through the liquid heat exchanger was set at 0.5 gpm and kept constant throughout all tests.

Polyurethane foam insulation ($k=0.030$ BTU/hr.-ft.-°F) was installed around the test fixture to force the heat through the interface material and minimize heat losses to the surrounding environment.

The power levels were varied for each test in order to test all insulating materials at approximately the same mounting plate temperature and at a temperature close to actual operation. The readings of the three thermocouples in the heater plate were taken and averaged for the actual heater plate temperature. Likewise, the average reading of the three thermocouples in the mounting plate was used to determine the actual temperature of the mounting plate. All tests were run at a mounting plate temperature of $75^{\circ}\text{C} \pm 5^{\circ}\text{C}$. A temperature difference of sufficient magnitude was maintained across the test interface to minimize any errors due to inaccuracies of the temperature recording by the thermocouples. All temperatures were stabilized before any recordings were made.

Test Results

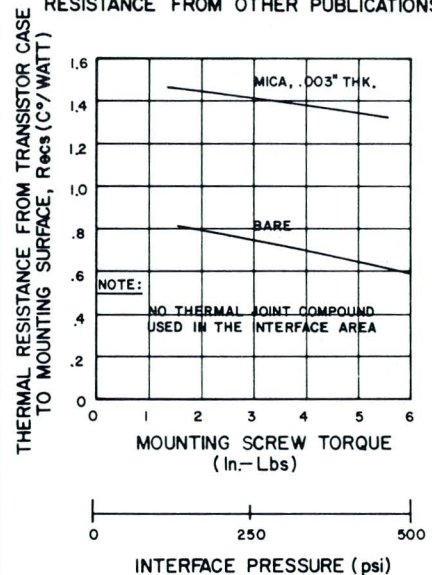
Interface thermal resistance versus mounting screw torque and interface pressure for different insulating materials and for a bare joint are shown in Figures 6 and 7. No thermal grease or joint compound was used either above or below the test material. The finish of the mounting surface was 32 microinches.

Figures 8 and 9 present the same materials under identical test conditions and surface finish except that for these tests thermal joint compound was used above and below the test material. As expected, all of the insulator materials had a lower joint interface thermal resistance and, in most cases, an improvement of 60% to 70% in interface thermal resistance was noted with the addition of the thermal joint compound. Thermal joint compound fills the minute voids existing between the mating surfaces and displaces the air at the mating surfaces.

Data was also taken to determine the effect of interface thermal resistance when a typical TO-3 semiconductor device is mounted in direct contact with surfaces of various degrees of surface finish. No specific differences were noted in the interface thermal resistance values with $\pm 2.5\%$ of the nominal value, as the mounting surface finish was varied from 16 to 64 microinches and the device installed with mounting screw torques from 2 to 6 inch-pounds.

Care must be taken in determining the values of interface thermal resistance as the measurements are very sensitive and the results obtained are highly dependent upon the care exercised in each test setup. The data and curves presented in these graphs are believed to be representative of typical applications. For reference and comparison purposes, Thermalloy has reproduced, in Figure 5, curves of joint interface resistance versus mounting screw torque for a 0.003" mica insulator as shown in McGraw-Hill's *Handbook of Electronic Packaging* (p. 11-25) edited by Charles Harper, and the Navelex Publication No. 0967-437-7010 entitled *Reliability/Design Handbook, Thermal Applications*, Volume 4 (p. A-18), dated July, 1973.

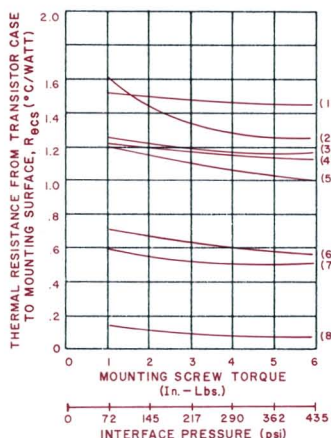
FIGURE 5. TO-3 INTERFACE THERMAL RESISTANCE FROM OTHER PUBLICATIONS



Without Thermal Grease

Figure 6
JEDEC TO-3

Interface thermal resistance versus mounting screw torque for a TO-3 semiconductor device using various insulating materials.* No thermal joint compound used in the interface area.

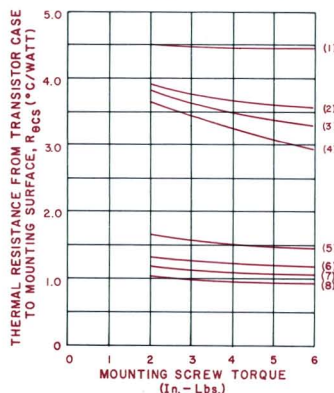


- (1) *Thermalfilm*, .002 (.05) thick.
- (2) *Mica*, .003 (.08) thick.
- (3) *Mica*, .002 (.05) thick.
- (4) *Hard anodized*, .020 (.51) thick.
- (5) *Aluminum oxide*, .062 (1.57) thick.
- (6) *Beryllium oxide*, .062 (1.57) thick.
- (7) *Bare joint* — no finish.
- (8) *Grafoil*, .005 (.13) thick.*

* GRAFOIL IS NOT AN INSULATING MATERIAL.

Figure 7
JEDEC TO-220

Interface thermal resistance versus mounting screw torque for a TO-220 semiconductor device using various insulating materials.* No thermal joint compound used in the interface area.



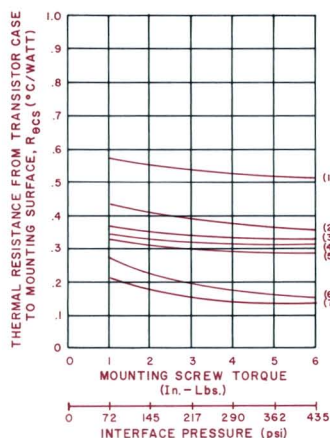
- (1) *Thermalfilm*, .022 (.05) thick.
- (2) *Mica*, .003 (.08) thick.
- (3) *Mica*, .002 (.05) thick.
- (4) *Hard anodized*, .020 (.51) thick.
- (5) *Thermalsil II*, .009 (.23) thick.
- (6) *Thermalsil III*, .006 (.15) thick.
- (7) *Bare joint* — no finish.
- (8) *Grafoil*, .005 (.13) thick.*

* GRAFOIL IS NOT AN INSULATING MATERIAL.

With Thermal Grease

Figure 8
JEDEC TO-3

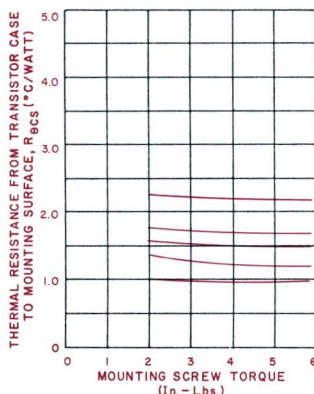
Interface thermal resistance versus mounting screw torque for a TO-3 semiconductor device using various insulating materials. Thermalcote thermal joint compound used in the interface area.



- (1) *Thermalfilm*, .002 (.05) thick.
- (2) *Mica*, .003 (.08) thick.
- (3) *Mica*, .002 (.05) thick.
- (4) *Aluminum oxide*, .062 (1.57) thick.
- (5) *Hard anodized*, .020 (.51) thick.
- (6) *Beryllium oxide*, .062 (1.57) thick.
- (7) *Bare joint* — no finish.

Figure 9
JEDEC TO-220

Interface thermal resistance versus mounting screw torque for a TO-220 semiconductor device using various insulating materials. Thermalcote thermal joint compound used in the interface area.

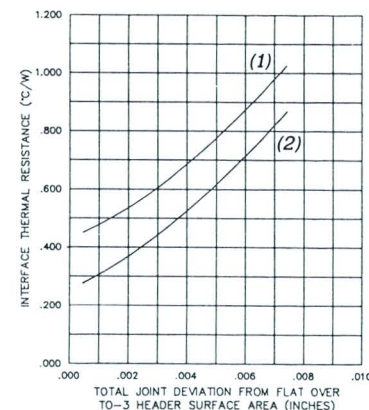


- (1) *Thermalfilm*, .002 (.05) thick.
- (2) *Mica*, .003 (.08) thick.
- (3) *Mica*, .002 (.05) thick.
- (4) *Hard anodized*, .020 (.51) thick.
- (5) *Bare joint* — no finish.

Silicone Rubber

Figure 10
THERMALLOY TEST METHOD

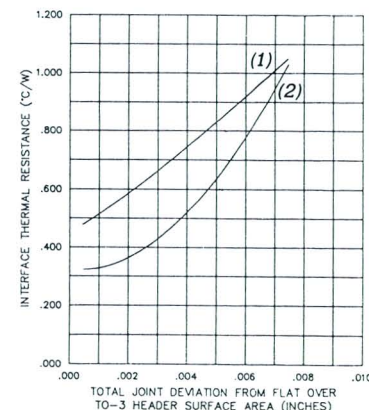
All values at 6 inch-pounds of torque and 30 watts of power.



- (1) *Thermalsil II*, .009 (.23) thick.
- (2) *Thermalsil III*, .006 (.15) thick.

Figure 11
MIL-SPEC TEST METHOD (MIL-I-49456)

All values at 6 inch-pounds of torque and 30 watts of power.



- (1) *Thermalsil II*, .009 (.23) thick.
- (2) *Thermalsil III*, .006 (.15) thick.

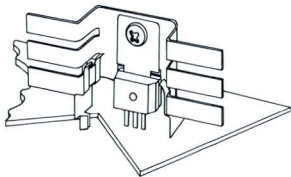
Every Wasted Minute on the Production Line is Costing You Money.

Over time, saving seconds in assembly time can save you large sums in labor costs. Thermalloy recognizes the importance of labor cost savings to you. That's why we've made it our primary goal in 25 years of business to engineer innovative heat dissipation products requiring an absolute minimum of assembly labor.

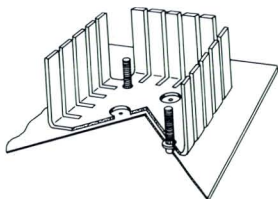
How Can Thermalloy Save You Time on the Assembly Line?

Using our labor-saving options, you can eliminate hand soldering and extra inspections, and reduce the number of steps when assembling heat sinks to transistors. *Here's how:*

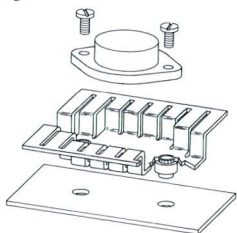
- **Solderable Mounting Tabs** — eliminates hand soldering and extra inspection, holds heat sink upright for wave soldering.



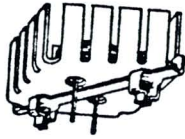
- **Solderable Studs** — for quick pre-assembly of the heat sink and transistor, converting both to a single, solderable component.



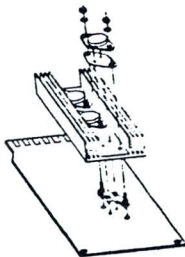
- **Solderable Nuts** — for those who prefer using screws, rather than nuts, to mount heat sink to transistor for wave soldering.



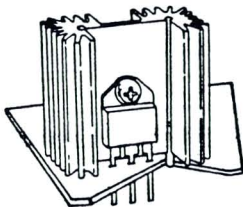
- **Snap-on Solder Mounts** — a low-cost alternative to solderable nuts.



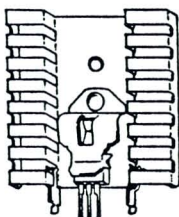
- **Solderable Transistor Mounts** — eliminates hand soldering and provides electrical isolation when using more than one transistor per heat sink.



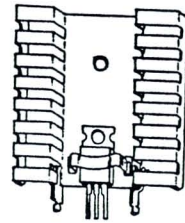
- **Solderable Roll Pins** — converts small, extruded heat sinks to wave solderable.



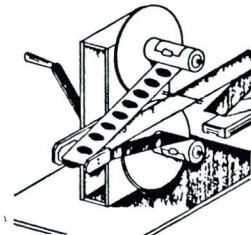
- **Thermalclips** — eliminates the use of screws and nuts in assembling the heat sink and transistor.



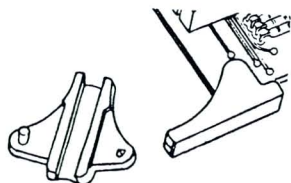
- **Secondary Spring Clips** — replaces the use of screws and nuts in assembling the heat sink and transistor.



- **Insulcote** — pre-greased insulators, eliminate messy hand application of thermal grease.
- **Grafoil® Conducta-Pad™** — A non-insulating, dry material used as an alternative to thermal grease.



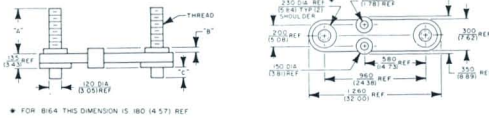
- **Snap-on Card Ejectors and Pullers** — eliminates roll pin insertion. Ejectors and pullers simply snap in place.



Solderable Transistor Mounts

TO-66 Mounts: 8160 Series

Figure 1



TO-3 Mounts: 8180 Series

Figure 2

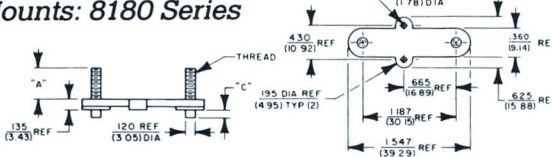


Figure 3

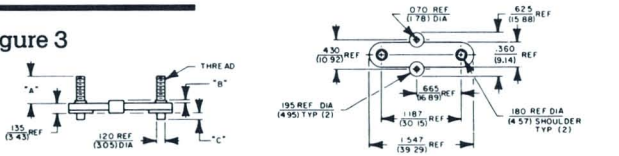
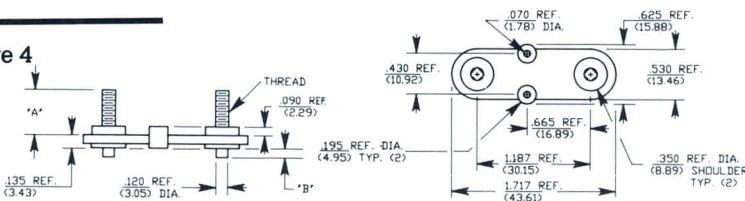


Figure 4



Model	Dim.			Thread	Weight Lbs/Grams	Figure
	A	B	C			
8161E40	.260(6.60)	.045(1.14)	.095(2.41)	4-40 UNC-2A	.004/1.81	1
8161M2	.495(12.57)	.045(1.14)	.095(2.41)	M3x0.5	.004/1.81	1
8161M93*	.580(14.73)	.045(1.14)	.160(4.06)	M3x0.5	.004/1.81	1
8162E40	.260(6.60)	.090(2.29)	.095(2.41)	4-40 UNC-2A	.004/1.81	1
8162M2	.495(12.57)	.090(2.29)	.095(2.41)	M3x0.5	.004/1.81	1
8162M93*	.580(14.73)	.090(2.29)	.160(4.06)	M3x0.5	.004/1.81	1
8164E40	.260(6.60)	.090(2.29)	.095(2.41)	4-40 UNC-2A	.004/1.81	1
8164M2	.495(12.57)	.090(2.29)	.095(2.41)	M3x0.5	.004/1.81	1
8164M93*	.580(14.73)	.090(2.29)	.160(4.06)	M3x0.5	.004/1.81	1
8180E1	.395(10.03)	N/A	.095(2.41)	6-32 UNC-2A	.005/2.27	2
8180E3	.580(14.73)	N/A	.095(2.41)	6-32 UNC-2A	.005/2.27	2
8180E40	.260(6.60)	N/A	.095(2.41)	4-40 UNC-2A	.005/2.27	2
8180E93*	.580(14.73)	N/A	.160(4.06)	6-32 UNC-2A	.005/2.27	2
8180M2	.495(12.57)	N/A	.095(2.41)	M3x0.5	.005/2.27	2
8180M93*	.580(14.73)	N/A	.160(4.06)	M3x0.5	.005/2.27	2
8181E1	.395(10.03)	.045(1.14)	.095(2.41)	6-32 UNC-2A	.005/2.27	3
8181E3	.580(14.73)	.045(1.14)	.095(2.41)	6-32 UNC-2A	.005/2.27	3
8181E40	.260(6.60)	.045(1.14)	.095(2.41)	4-40 UNC-2A	.005/2.27	3
8181E93*	.580(14.73)	.045(1.14)	.160(4.06)	6-32 UNC-2A	.005/2.27	3
8181M2	.495(12.57)	.045(1.14)	.095(2.41)	M3x0.5	.005/2.27	3
8181M93*	.580(14.73)	.045(1.14)	.160(4.06)	M3x0.5	.005/2.27	3
8182E1	.395(10.03)	.090(2.29)	.095(2.41)	6-32 UNC-2A	.005/2.27	3
8182E3	.580(14.73)	.090(2.29)	.095(2.41)	6-32 UNC-2A	.005/2.27	3
8182E93*	.580(14.73)	.090(2.29)	.160(4.06)	6-32 UNC-2A	.005/2.27	3
8182M2	.495(12.57)	.090(2.29)	.095(2.41)	M3x0.5	.005/2.27	3
8182M93*	.580(14.73)	.090(2.29)	.160(4.06)	M3x0.5	.005/2.27	3
8183E1	.395(10.03)	N/A	.095(2.41)	6-32 UNC-2A	.007/3.18	4
8183E3	.580(14.73)	N/A	.095(2.41)	6-32 UNC-2A	.007/3.18	4
8183M2	.495(12.57)	N/A	.095(2.41)	M3x0.5	.007/3.18	4
8183E93*	.580(14.73)	N/A	.160(4.06)	6-32 UNC-2A	.007/3.18	4
8183M93*	.580(14.73)	N/A	.160(4.06)	M3x0.5	.007/3.18	4
8183NE1	N/A	N/A	.140(3.56)	4-40 UNC-2B	.007/3.18	5
8183NE2	N/A	N/A	.140(3.56)	6-32 UNC-2B	.007/3.18	5
8183NM1	N/A	N/A	.140(3.56)	M3x0.5	.007/3.18	5
8190E40	.260(6.60)	N/A	.095(2.41)	4-40 UNC-2A	.001/.45	6
8191E40	.260(6.60)	.032(0.81)	.095(2.41)	4-40 UNC-2A	.001/.45	6

Designed to eliminate hand soldering and provide electrical isolation. Mounts can be pre-assembled with the device and treated as a single component on the production line. Simply place the transistor over the threaded studs, install the lock washers and nuts and drop the completed assembly into plated-thru holes on the PC board. When using the solderable nut version, screws install from the top. Then wave solder and inspect once. Assembly steps are cut in half by eliminating costly hand soldering and extra inspection.

The 8183 is the largest of the 8180 series transistor mounts and meets UL and VDE requirements for greater electrical isolation. Designed for use with high power TO-3 transistors, the 8183 features 3mm mounting-screw-to-heat-sink spacing.

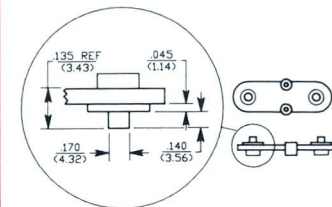
Additional features:

- Elevates device for cleaning.
- Tin-plated posts offer excellent solderability for mechanical and electrical integrity.
- Posts extend only .040" (1.02) below .062" (1.57) board to clear lead trimming saw.
- Glass-reinforced nylon material.

Note:

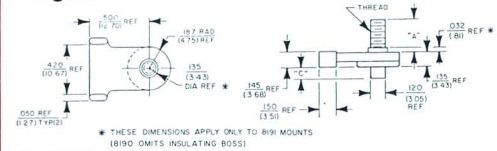
Mounts are compatible with standard device hole patterns, except plated-thru hole diameter for solderable studs must be .145" ± .05" (3.68 ± .13) and for solderable nuts must be .195" ± .005" (4.95 ± .13). Optional pin jack is nominal .073" (1.85) diameter; recommended plated-thru hole diameter is .100" + .005" (2.54 ± .13).
 U.S. Patent No. 4,446,504

Figure 5



TO-220 Mounts: 8190 Series

Figure 6

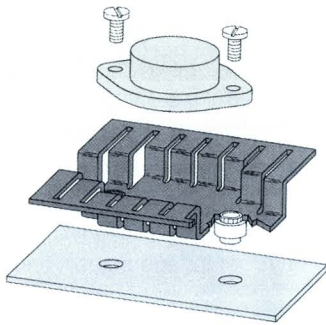


Note:

The 8180 through 8183 series may be fitted with tin-plated pin jacks. To order with pin jacks, add the letter "C" after the part number, i.e., 8181M2-C.

*Solderable studs in these parts are designed to be used with .090 (2.29) thick PC boards.

Solderable Nuts

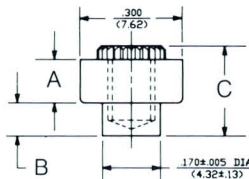


Like the solderable stud, solderable nuts are permanently swaged into the heat sink for quick pre-assembly with the transistor. The device is mounted to the heat sink with screws installed from the top. Heat sink and transistor are then handled as a single component and dropped into plated-thru holes in the PC board for wave soldering. (Solderable nuts require slightly larger printed circuit board hole sizes.)

A significant feature of the solderable nut is the closed end, which prevents solder from wicking into threads and trapping contaminants or flux. As a result, you can use carbon steel screws, rather than higher priced, stainless steel screws. The 3mm standoff meets most VDE specifications.

Additional features:

- Pre-mounted to heat sink at Thermalloy.
- Ease of pre-assembly in production.
- Mechanical and electrical integrity.
- Wave solderability.
- Reduced in-house and field labor costs.
- Minimum of six full internal threads.



▲ 195 ± .055 Plated-thru hole in PCB recommended (4.95 ± .13)

To order:

Add the four character suffix to the standard part number ordered. For example:

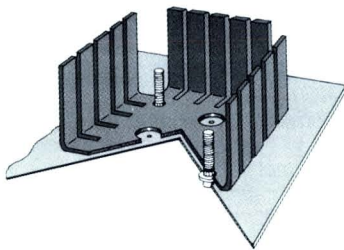
6054	B	SNE-1
Heat Sink Part No.	Heat Sink Finish	Solderable Nut Type And Thread

Suffix	Thread	Dim. A	Dim. B	Dim. C
SNM-1	M3 X 0.5	.129 (3.28)	.140 (3.56)	.305 (7.75)
SNE-1	4-40 UNC-2B	.129 (3.28)	.140 (3.56)	.305 (7.75)
SNE-2	6-32 UNC-2B	.129 (3.28)	.140 (3.56)	.305 (7.75)
SNE-3	6-32 UNC-2B	.100 (2.54)	.100 (2.54)	.236 (5.99)

Note:

To specify the number of solderable nuts required in some models, (i.e., 6054, 6072 and 6080), add the number of nuts to the solderable nut suffix as follows: 6072B-SNE-1/1 for one nut and 6072B-SNE-1/2 for two.

Solderable Studs



Heat sinks ordered with solderable studs have threaded studs permanently swaged in place for quick pre-assembly with the transistor. The device is placed over the stud(s) followed by the lock washer and nut. This single component is then dropped into plated-thru holes in the printed circuit board for wave soldering. The end of the stud is tin-plated for excellent solderability and extends only .040" below a .062" PC board to clear lead trimming saws.

The addition of solderable studs has no effect on the thermal performance rating shown for the heat sink.

Test Data on Pullout Force (after soldering)	Plated-thru Holes	Non Plated-thru Holes
Mean Pull-out force (F)	112.7 lbs.	94.4 lbs.
Standard Deviation (6)	11.1 lbs.	25.0 lbs.
Sample Size Tested	45	14

A detailed report (EIR #80-1004) entitled "Thermalloy Solderable Studs, Design Guidelines for Packaging Under Static and Dynamic Loadings," is available upon request.

U.S. Patent Nos. 4,403,102 and 4,521,827
 Canadian Patent Nos. 1,162,324 and 1,130,466
 U.K. Patent No. 2,042,260 German Patent No. P3067404.5-08
 EPC Patent No. 0014558 French Patent No. 8001955
 Other Foreign Patents Pending

Stud Figure No. Length Thread Type

SE-1	A	.350(8.89)	6-32
SE-2	A	.485(12.32)	6-32
SE-3	A	.350(8.89)	4-40
SE-4	B	.350(8.89)	6-32
SE-5	B	.485 (12.32)	6-32
SE-6	A	.350(8.89)	6-32
SE-7*	B	.350(8.89)	6-32
SM-1	B	.350(8.89)	M3
SM-2	A	.875(22.22)	M3
SM-3	A	.350(8.89)	M3
SM-4*	B	.350(8.89)	M3
SM-5*	A	.485(12.32)	M3

*These studs are designed for .092 (2.34) and thicker PC boards.

Note:

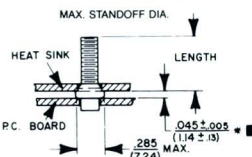
Numbers within the solderable stud symbol next to selected heat sinks in the catalog, denote the recommended English thread for the heat sink referenced.

To order:

Add the three character suffix to the standard part number ordered. For example:

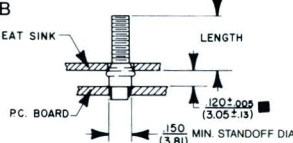
6033	B	43	SE-1
Heat Sink Part No.	Heat Sink Finish	Hole Pattern (if required)	Stud No.

Figure A



* SE-6 STUD HAS NOMINAL STANDOFF OF ±.010 (±.25) AND IS CONSIDERED A FLUSH MOUNT.

Figure B

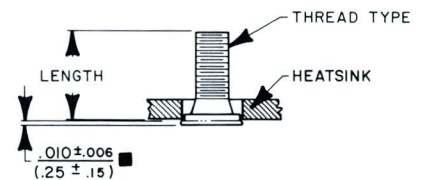


▲ .145 ± .005 (3.68 ± .13) PLATED-THRU HOLE IN PCB RECOMMENDED.

Device-Mounting Stud

Device-mounting studs are available as options on certain vertical and board-mount heat sinks as a labor-saving aid for mounting semiconductors. This optional feature speeds up production assembly time and reduces hardware requirements.

Stud No.	Length	Thread Type
SF-1	.302	4-40 UNC-2A
SF-2	.305	M3 x 0.5
SF-3	.302	6-32 UNC-2A
SF-4	.740	8-32 UNC-2A



To order:

Add the three character suffix to the standard part number ordered. For example:

6098	B	SF-1
Heat Sink Part No.	Heat Sink Finish	Device-Mounting Stud

NEW

Snap-on Solder Mounts

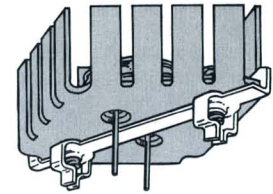
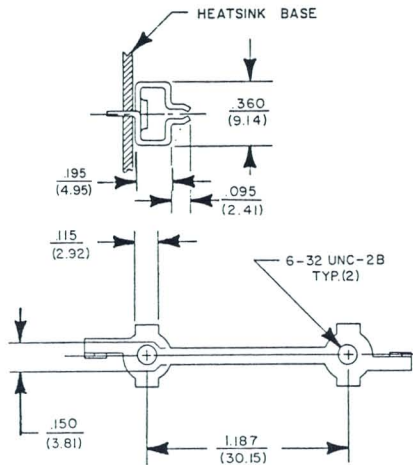
Snap-on solder mounts are applicable to the following parts:

6013	6051	6251	6213
6014	6052	6252	6214
6015	6053	6253	6216
6016	6054	6254	

To order:

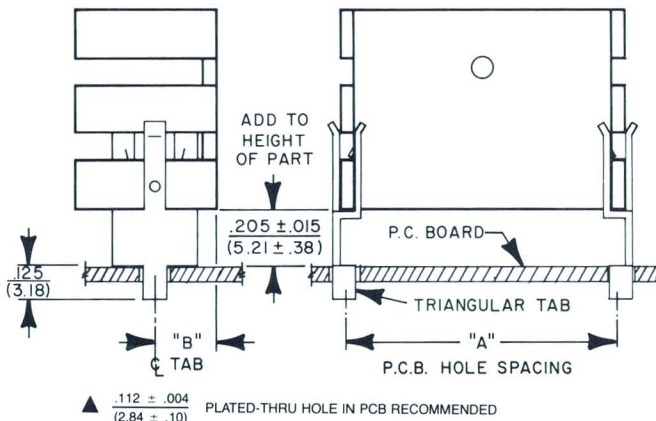
Add the three character suffix to the standard part number ordered. For example:

6013	B-	YO1
Heat Sink Part No.	Heat Sink Finish	Snap-on Solder Mount

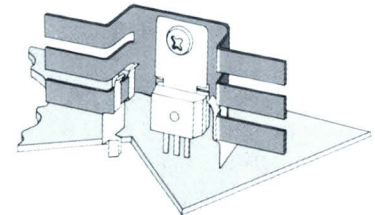


A low-cost alternative to solderable nuts, snap-on solder mounts allow pre-assembly of device and heat sink for wave soldering. The transistor is mounted to the heat sink with screws installed from the top. Both are then handled as a single component and easily pressed into plated-thru holes in the PC board. In addition, screw length is variable and threads are not exposed to solder. Material is tin-plated steel.

Patent Pending



Solderable Mounting Tabs



Heat sinks ordered with solderable mounting tabs have tin-plated spring steel tabs permanently locked onto the heat sink to provide wave solderability. The solderable tabs are mounted on the heat sink at Thermalloy — after anodizing — thus eliminating any special coating or handling. The result is a wave solderable heat sink with black anodized performance for 28% lower cost than other processes.

The tabs lock securely to the heat sink fins for positive retention. Spring action between tab and plated-thru hole holds heat sink upright and in place for wave soldering. Solderable heat sinks cut production steps in half by eliminating hand soldering and extra inspection.

Mounting tab failure load (pull-off force with two tabs) varies with heat sink, but minimum values are approximately 24 lbs. for straight pull and 16 lbs. for pull at 45° from surface of heat sink. Tab pull-out from PC board plated-thru hole is approximately 80 lbs. per tab (after soldering).

Mounting tabs have unique locking features built into their design and must have matching features, such as Thermalloy adds to their standard or custom heat sinks. For this reason, mounting tabs must be factory mounted and cannot be sold separately.

Patent No. 4,388,967

Recommended PC Board Hole Spacing for Applicable Parts

Heat Sink	Dim. A ± .010 (.25)	Dim. B ± .010 (.25)
6063	.730 (18.54)	.200 (5.08)*
6070	.730 (18.54)	.200 (5.08)*
6072	.730 (18.54)	.200 (5.08)*
6106	.940 (23.88)	.210 (5.33)
6107	.940 (23.88)	.210 (5.33)
6109	.940 (23.88)	.210 (5.33)
6110	.940 (23.88)	.210 (5.33)
6225	.700 (17.78)	—
6232	1.000 (25.40)	—
6234	1.000 (25.40)	—
6238	.945 (24.00)	.400 (10.16)
6239	.945 (24.00)	.275 (6.98)
7019	1.500 (38.10)	.175 (4.44)
7020	1.250 (31.75)	.240 (6.10)
7021	1.700 (43.18)	.240 (6.10)
7022	.956 (24.28)	.175 (4.44)
7023	1.100 (27.94)	.175 (4.44)
7024	.950 (24.13)	.400 (10.16)
7025	1.100 (27.94)	.175 (4.44)

*Indicates tolerance of ± .020 (.51).

▲ Use this dimension to specify plated-thru hole in PC board.

To order:

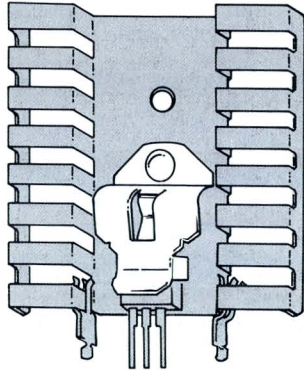
Add the suffix "MT" as shown below.

6063	B-	MT
Heat Sink Part No.	Heat Sink Finish	Mounting Tab Option

Thermalclips



Factory-installed thermalclips, available on many standard heat sinks (shown below), eliminate the use of screws and nuts in assembling the heat sink and transistor. Plastic case transistors slip into place for easy assembly. Clips are available in a variety of configurations. Locking clips have an internal tab to lock the transistor permanently in place. Alignment guides, offered on some clips, line up the transistor for insertion. For applications to meet V.D.E. specifications, a clip with 3mm standoff can be used with an insulating cover.



Patent Pending

To order:

Add the three character suffix to the standard part number ordered. For example:

7022 **B-** **MT-** **TC4**
 Heat Heat Mounting Thermal-
 Sink Sink Tab clip
 Part No. Finish Option Option

Clip Configurations

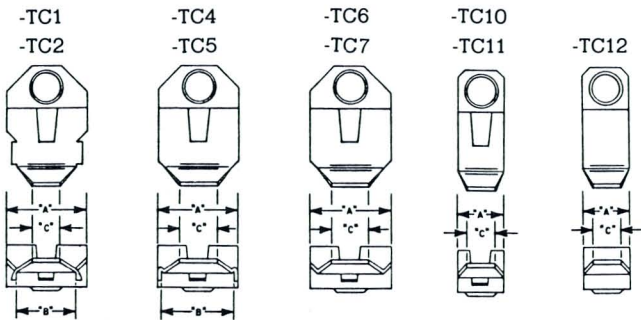


Figure 1
Locking Clip

Figure 2
Insulated Clip**

Figure 3
V.D.E. Clip

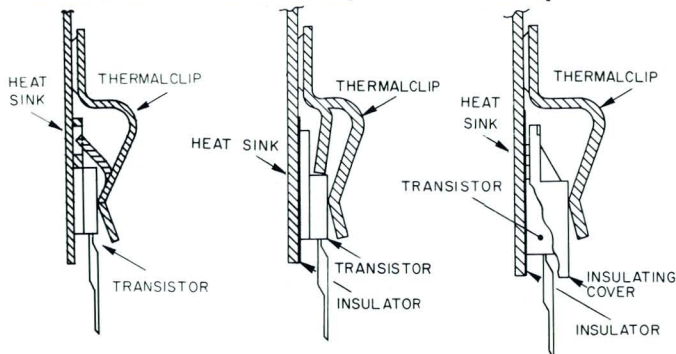
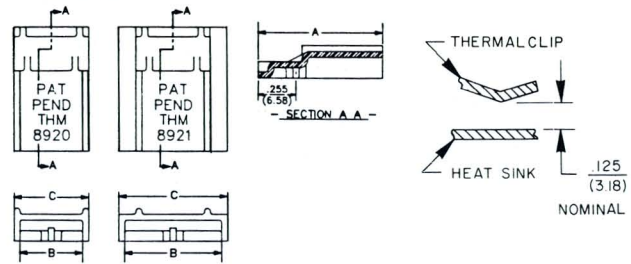


Figure 4
V.D.E. Cover



Heat Sinks Available with Thermalclip

Heat Sink Part Number	Clip Option Suffix Number		
	For TO-220	For TO-218	For Multiwatt
6025B	-TC10, -TC11		
6032B	-TC1, -TC2, -TC12	-TC4, -TC5	
6072B-MT*	-TC10, -TC11, -TC12		
6099B*, 6100B*	-TC10, -TC11		
6106B-MT	-TC1, -TC2, -TC12	-TC4, -TC5	
6106-14B-MT	-TC1, -TC2, -TC12	-TC4, -TC5	
6109B-MT	-TC1		
6225B-MT	-TC10, -TC11		
6232B-MT	-TC1, -TC2, -TC12	-TC4, -TC5	
6298B, 6299B, 6300B	-TC10, -TC11	-TC10, -TC11	
6398B, 6399B, 6400B	-TC1, -TC2, -TC12	-TC4, -TC5, -TC12	-TC6, -TC7
7020B-MT*	-TC10, -TC11, -TC12	-TC10, -TC11	
7021B-MT*	-TC10, -TC11, -TC12	-TC10, -TC11	
7022B-MT	-TC1, -TC2, -TC12	-TC4, -TC5	
7023B-MT	-TC1, -TC2, -TC12	-TC4, -TC5, -TC12	-TC6, -TC7
7024B-MT	-TC1, -TC2, -TC12	-TC4, -TC5, -TC12	-TC6, -TC7

*Parts marked with an asterisk will not have mounting holes or transistor cut-outs as in the standard heat sinks.

**This clip can be used with or without an insulator.

Thermalclip and Cover Specifications

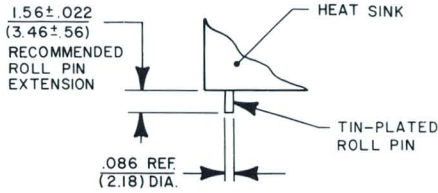
Suffix No.	Clip/Cover Features	Fig.	Transistor Case Style	Dimensions		
				A	B	C
-TC1	Locking	1	TO-220	.700	.400	.250
-TC2	Insulated	2	TO-220	.700	.400	.250
-TC4	Locking	1	TO-218	.700	.590	.340
-TC5	Insulated	2	TO-218	.700	.590	.340
-TC6	Locking	1	TO-218, TO-220 Multi-watt	.700	—	.340
-TC7	Insulated	2	TO-218, TO-220 Multi-watt	.700	—	.250
-TC10	Locking	1	TO-220	.400	—	.250
-TC11	Insulated	2	TO-220	.400	—	.250
-TC12	V.D.E.	3	TO-218, TO-220	.400	—	.250
8920N Cover	V.D.E.	4	TO-220	.835	.420	.500
8921N Cover	V.D.E.	4	TO-218	.905	.650	.730

Note:

Insulating covers, made of 33% glass-reinforced nylon, are used with Thermalclip - TC12 to provide insulation to meet V.D.E. requirements. Covers are ordered separately.

Solderable Roll Pins

-P1



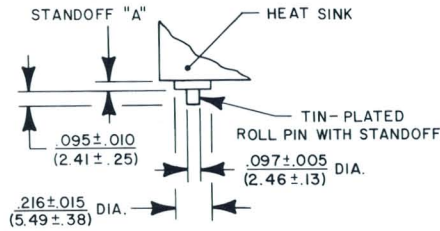
Solderable Roll Pin Suffix No.

Standoff "A" Height

-P1	N/A	
-P2	.050	+.015 - .005 (1.27 - .13)
-P3	.125	+.015 - .005 (3.18 - .13)

Vertically mounted, extruded heat sinks are converted to wave solderable with the addition of solderable roll pins. Roll pins without stand-off shoulders (P1) are standard on the following series part numbers: 6098, 6298, 6390 and 6398. Optional roll pins (P2, P3) are available with stand-off shoulders in two different heights for easier cleaning after wave soldering.

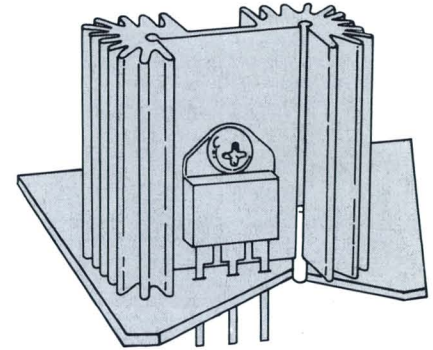
-P2, -P3



To order

Add two character suffix to standard part number. For example:

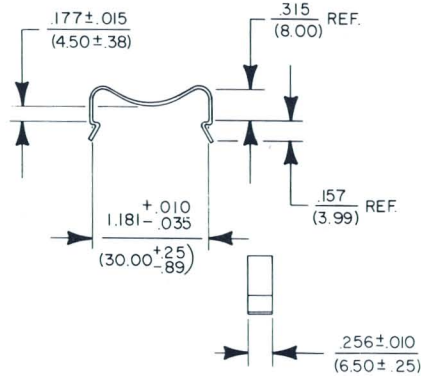
6398	B-	P2
Heat Sink Part No.	Heat Sink Finish	Solderable Roll Pin



U.S. Patent No. 4,602,315

NEW Secondary Clips

CLP-101



Secondary Clip Part Number

Transistor Case Style

Heat Sink Material Thickness

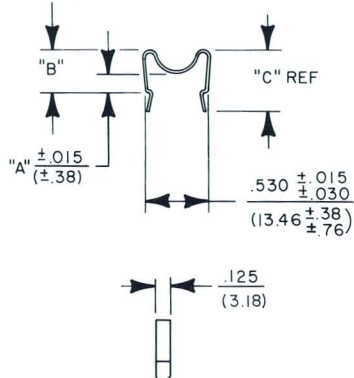
CLP-101	TO-218, Multi-watt	.050-.080
CLP-201	TO-220	.050-.080
CLP-202	TO-220	.090-.125
CLP-203	TO-220	.050-.080

Spring-steel clips replace torqued hardware in assembling transistors to heat sinks. Clips snap into heat sink slots to hold the device in place for PC board insertion. Clips are available in four sizes for various heat sink thicknesses and transistor case styles.

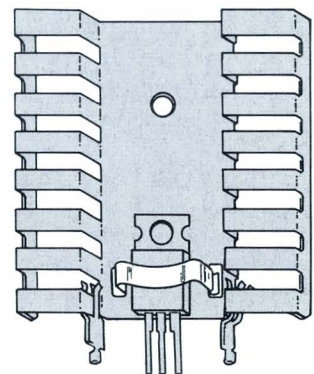
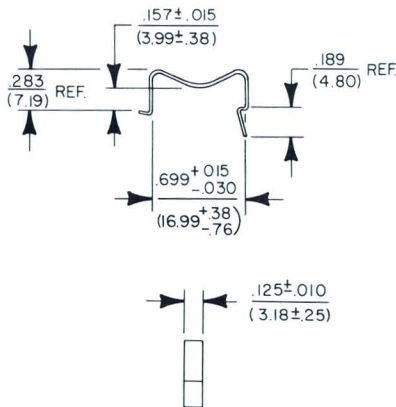
For custom applications, a detailed report (EIR #83-1004) entitled "Instructions for Spring Clip Mounting of TO-220's and TO-218's," is available upon request.

Two of Thermalloy's most popular heat sinks (7022, 7023) come standard with cut-out slots for assembling the transistor and heat sink using secondary clips. Clips are ordered separately.

CLP-201, CLP-202



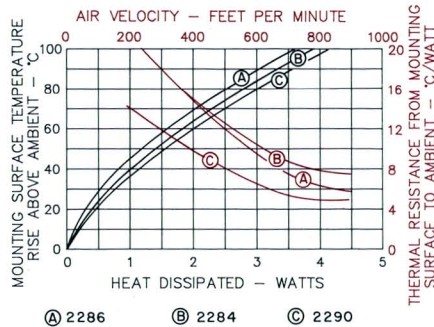
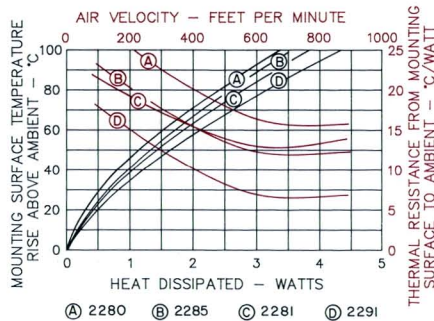
CLP-203



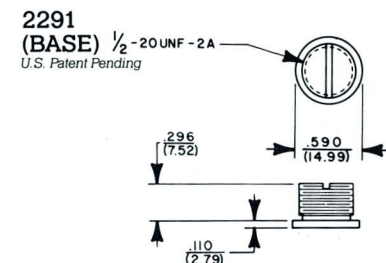
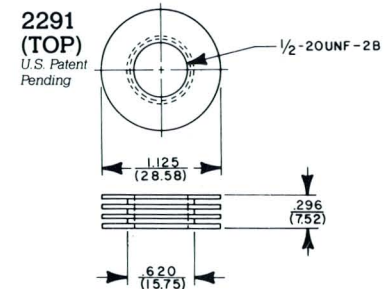
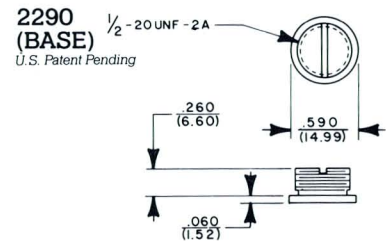
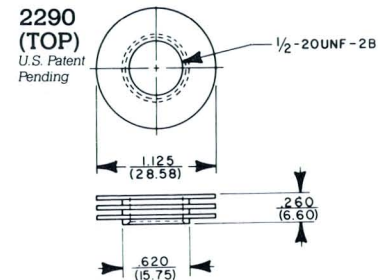
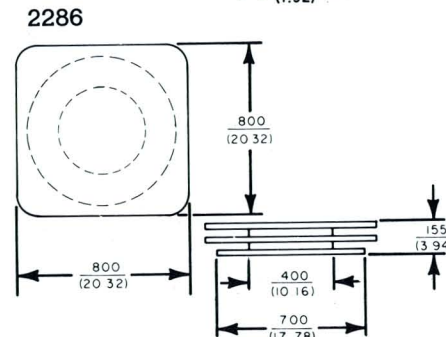
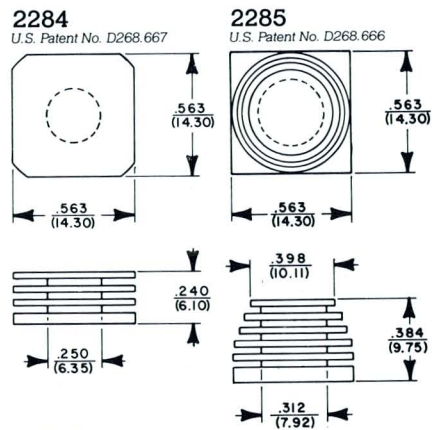
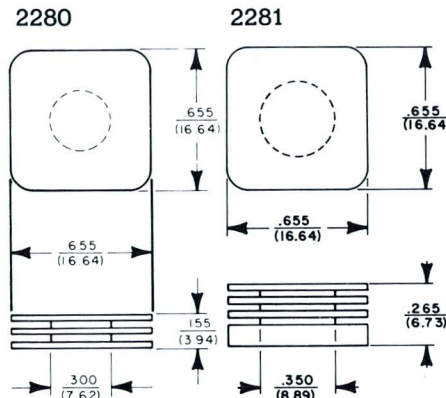
CATALOG NO.	DIM "A"	DIM "B"	DIM "C"
CLP-201	.165 (4.19)	.350 (8.89)	.535 (13.59)
CLP-202	.225 (5.72)	.410 (10.41)	.595 (15.11)

2280 and 2290 Series

- Bond-on heat sinks for leadless chip carriers and flat packs.
- Primarily designed for 68-position devices.
- The 2280, 2281, 2284 and 2286 are ideally suited to limited board space applications with high air flow.
- The 2290 and 2291 are designed for sockets with an opening in the latch cover. The heat sink base is bonded to the chip carrier with the threaded portion extending up through the latch cover opening. The top is then screwed onto the base.



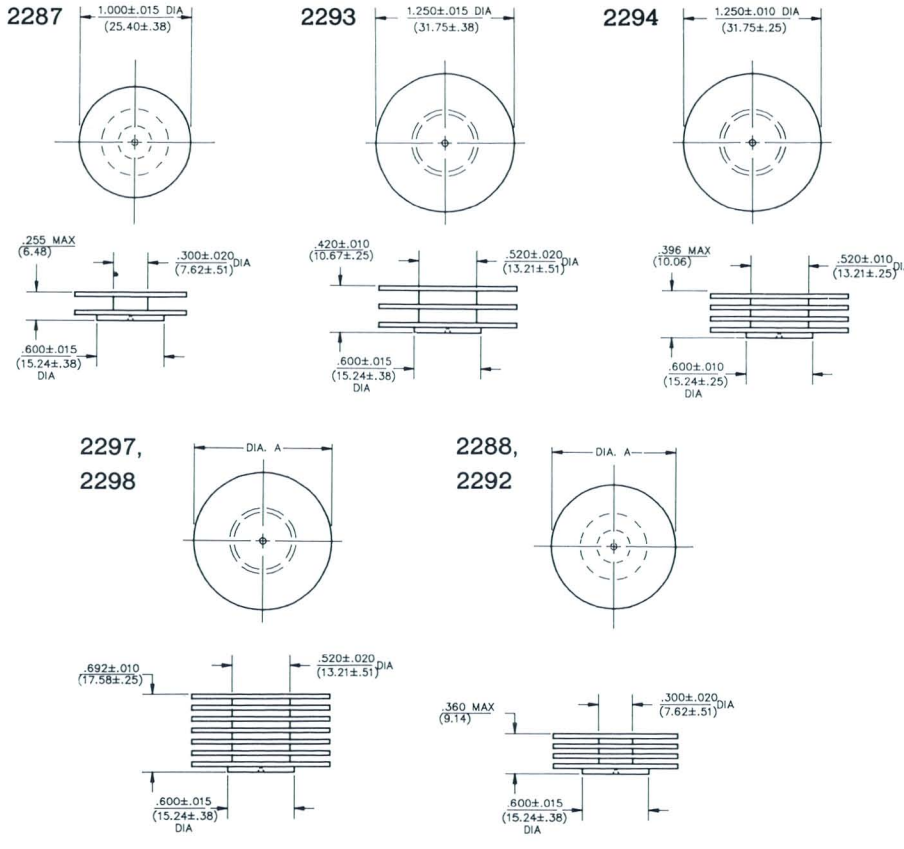
Model	Weight (lbs./grams)
2280B	.004 (1.81)
2281B	.008 (3.40)
2284B	.005 (2.18)
2285B	.006 (2.90)
2286B	.005 (2.22)
2290B	.017 (7.62)
2291B	.022 (9.93)



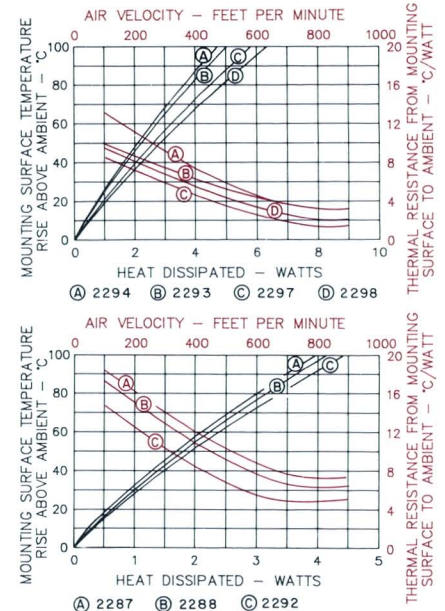
NEW 2280 and 2290 Series

Note:

Thermalloy's engineers will gladly assist in the application of the designs shown or will custom design a heat sink that meets your exact thermal and mechanical specifications.

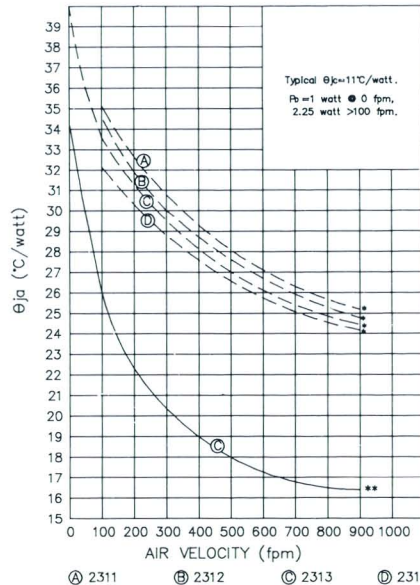
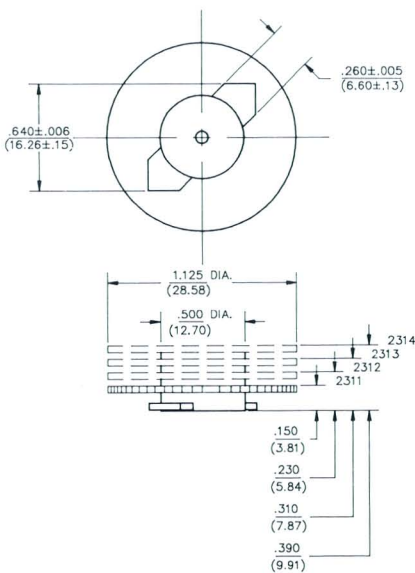


- New family of heat sinks designed for gate arrays packaged in pin grid arrays.
- Seven alternatives for differing pin grid array sizes and heat sink heights.
- The 2287 and 2293 offer wide fin spacing allowing air flow to several in-line heat sinks.

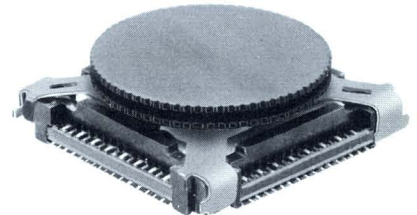


Model	Dia. A	Weight (lbs./grams)
2287B		.008 (3.63)
2288B	1.000	.014 (6.36)
2292B	1.125	.021 (9.53)
2293B		.023 (10.44)
2294B		.024 (10.90)
2297B	1.250	.040 (18.16)
2298B	1.500	.050 (22.70)

NEW 2311 Series



- Omnidirectional heat sink for AMP 55159-1 68-position chip carrier socket.
- Available in one to four fins.
- Heat sink twist-locks into socket latch-cover.
- No thermal bonding required.



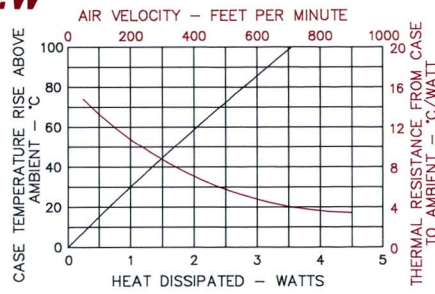
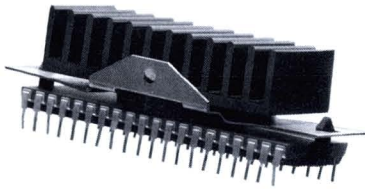
Model	Weight (lbs./grams)
2311B	.006 (2.72)
2312B	.010 (4.54)
2313B	.014 (6.36)
2314B	.018 (8.17)

**With thermal grease.
 *Without thermal grease.

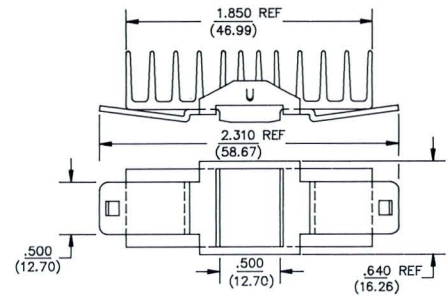
6370

NEW

- Clip-on extrusion for 40-pin DIP.
- No thermal bonding required.
- Two-piece heat sink provides easy assembly.
- Heat sink and attached spring fit over top of DIP. Insulating plastic retainer fits up underneath DIP and snaps into spring ends.
- Extrusion base extends through spring, coming in direct contact with the DIP.



Heat Sink/Spring Assembly

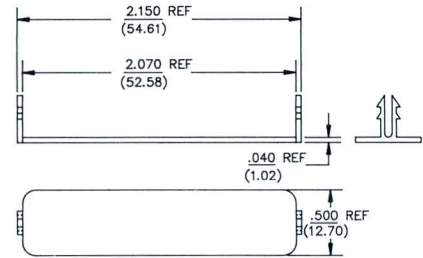


Model	Weight (lbs./grams)
6370B	.027 (12.26)

Part	Material	Finish
Extrusion	6063-T5 Aluminum	Black Anodize
Spring	1075 Spring Steel	Zinc Plate
Retainer	Glass-rein. Nylon	N/A

Patent Pending

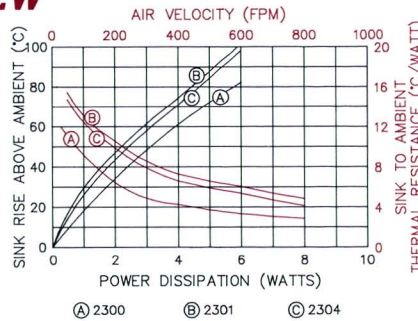
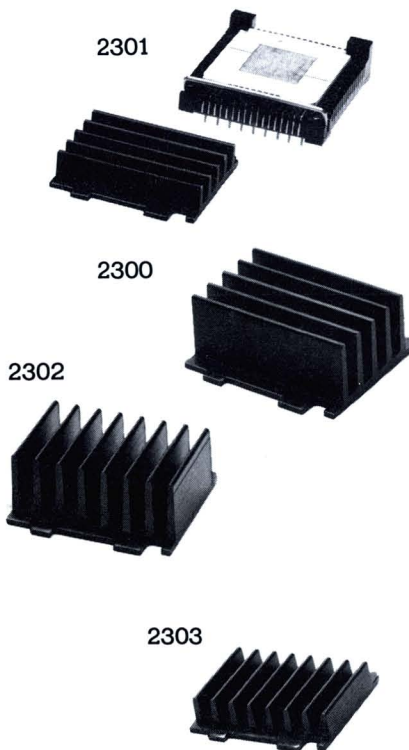
Plastic Retainer



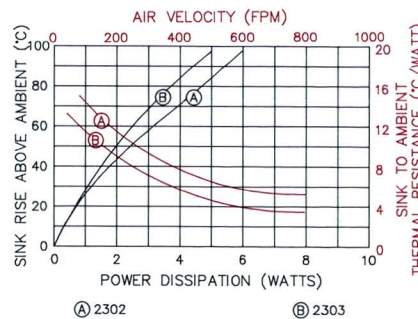
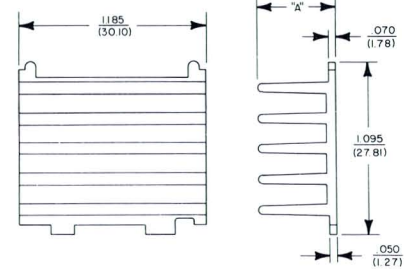
2300 Series

NEW

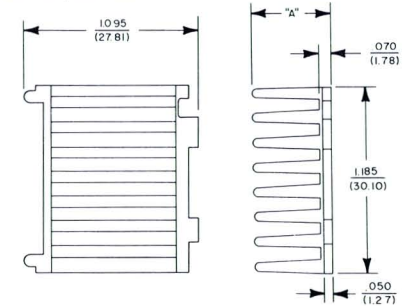
- Extruded heat sinks for Textool socket accepting JEDEC "Type A" chip carrier.
- Heat sink "lid" is placed over chip and snapped into 68-lead Textool socket No. 268-5400.
- No thermal bonding required.



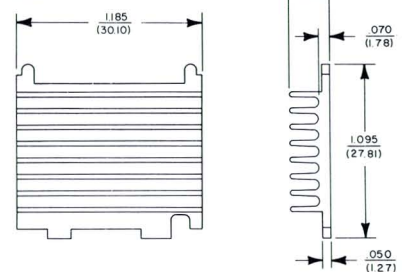
2300, 2301



2302, 2303

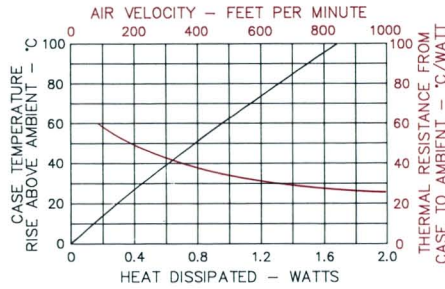
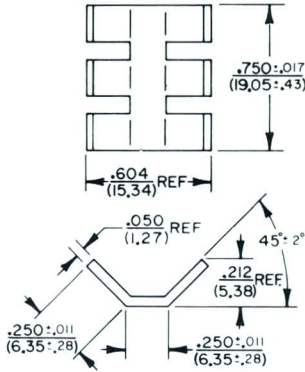


2304

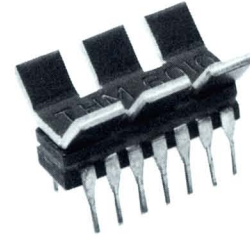


Model	Dim. A	Weight (lbs./grams)
2300B	.500	.021 (9.53)
2301B	.260	.013 (5.90)
2302B	.500	.018 (8.17)
2303B	.260	.012 (5.45)
2304B	.260	.014 (6.36)

6010

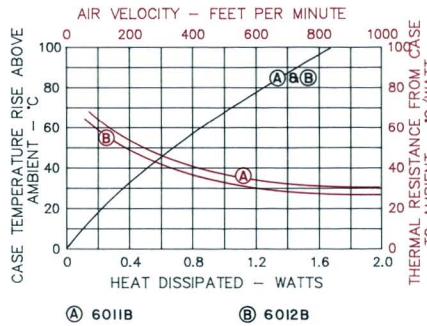
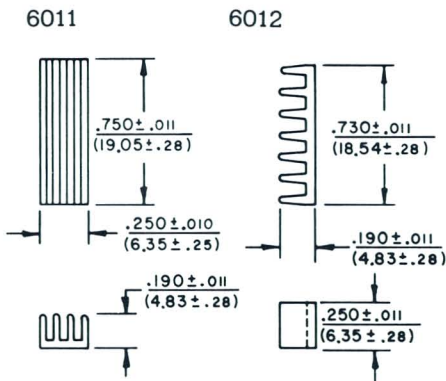


- Bond-on DIP heat sink.
- For 14 or 16 pin DIP.
- Can be added after assembly.

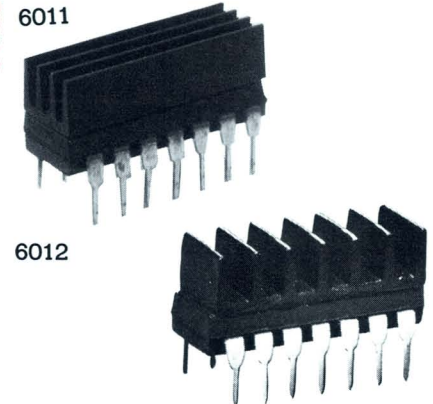


	Weight
	(lbs./grams)
Model	
6010B .....	.0018 (.82)
6010PB .....	.0018 (.82)

6011, 6012

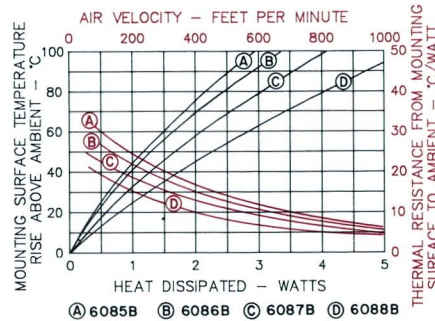
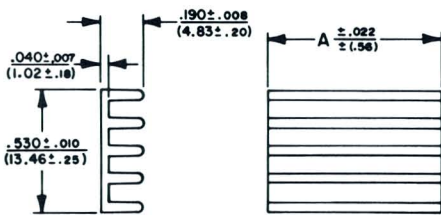


- Bond-on DIP extrusion.
- For 14 or 16 pin DIP
- Choice of fin direction for airflow preference.

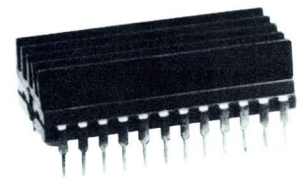


	Weight
	(lbs./grams)
Model	
6011B .....	.0019 (.86)
6012B .....	.0019 (.86)

6085 Series



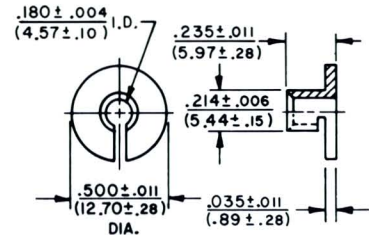
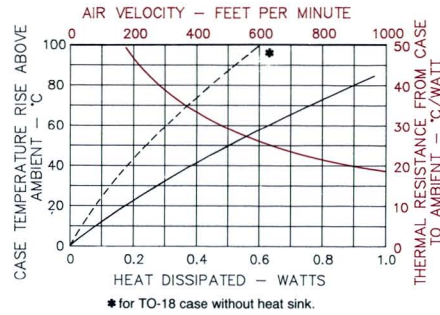
- Bond-on DIP extrusion.
- For 24, 28, 40 and 60 pin DIP.
- Requires no extra board space.



		Weight
		(lbs./grams)
Model	Dim. A	
6085B	1.25 .....	.0063 (2.86)
6086B	1.45 .....	.0074 (3.36)
6087B	2.00 .....	.0103 (4.67)
6088B	3.20 .....	.0160 (7.26)

2224

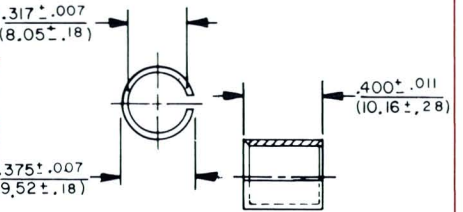
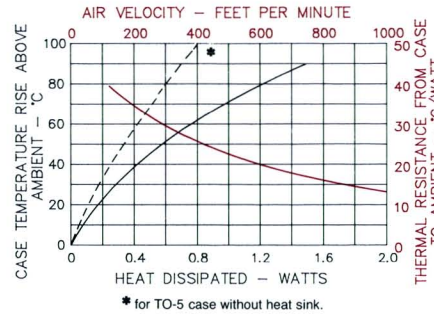
- Press-on heat sink for TO-18, TO-92.
- Fits round and D-shape TO-18.
- One-piece, easy installation.



Model	Weight (lbs./grams)
2224B	.0003 (.14)

1115

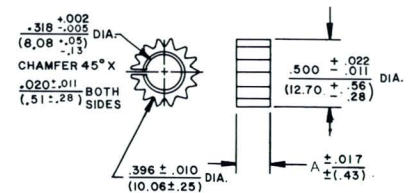
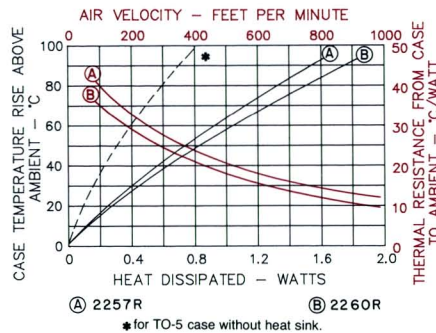
- Press-on TO-5 heat sink.
- No insertion tool required.
- Low cost.



Model	Weight (lbs./grams)
1115B	.0008 (.36)

2257, 2260

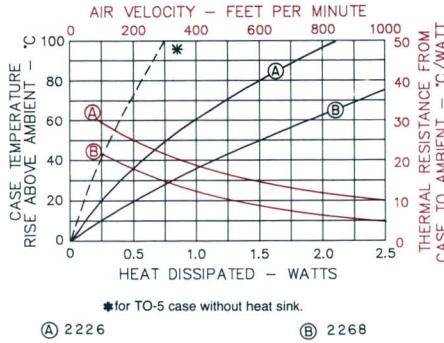
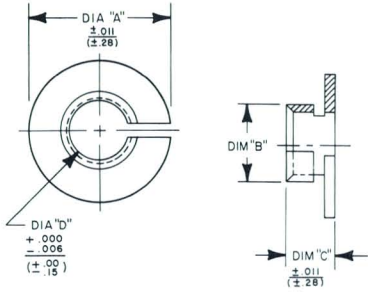
- Press-on TO-5 heat sink.
- Can be mounted after assembly.
- Low cost.



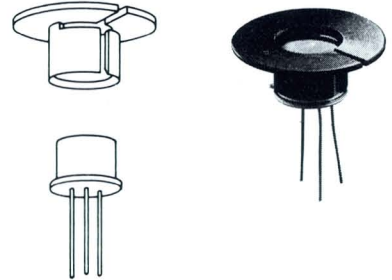
Model	Dim. A	Weight (lbs./grams)
2257R	.250	.0016 (.73)
2257B	.250	.0016 (.73)
2260R	.375	.0025 (1.13)



2226, 2268

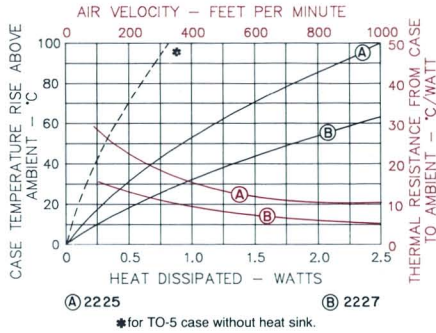
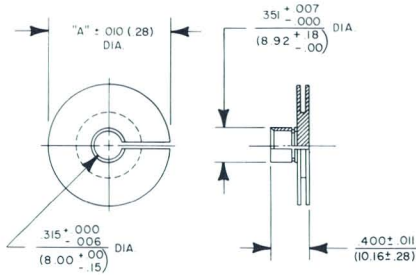


- Press-on heat sink for TO-5 and TO-8-style (H12A).
- No insertion tool required.
- 2226 fits the TO-5 and the 2268 fits the TO-8-style (H12A).

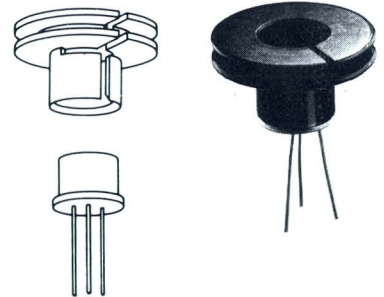


Model	Dia. A	Dim. B	Dim. C	Dia. D	Weight (lbs./grams)
2226B.....	.750	.351	.250	.315	.0020 (.91)
2268B.....	1.250	.592	.315	.540	.0051 (1.90)

2225, 2227

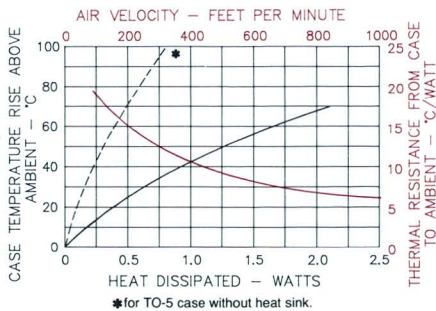
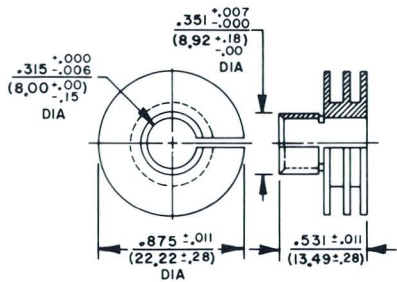


- Press-on TO-5 heat sink.
- One-piece construction.



Model	Dia. A	Weight (lbs./grams)
2225B.....	.750	.0024 (1.09)
2227B.....	1.250	.0097 (4.40)

2228



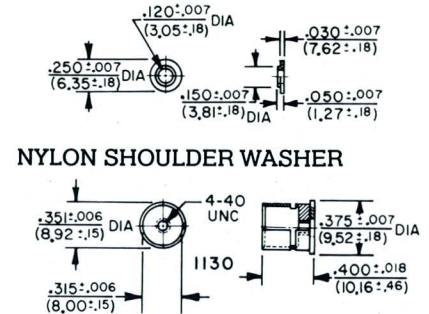
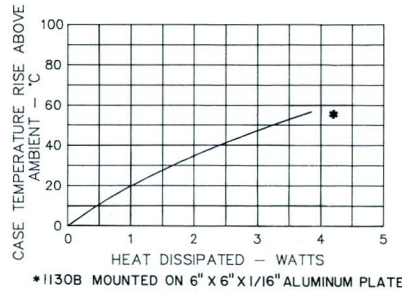
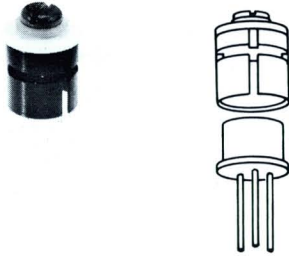
- Press-on TO-5 heat sink.
- One-piece construction.
- Three-fin design enhances thermal performance.



Model	Weight (lbs./grams)
2228B.....	.0086 (3.90)

1130

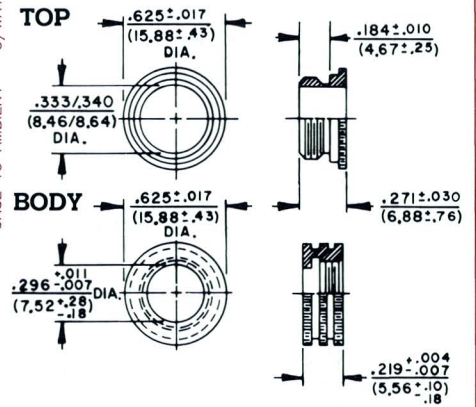
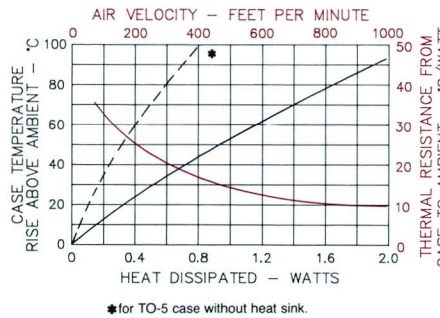
- Thermal link with BeO insulator for TO-5.
- High dielectric strength.
- Low electrical capacitance.



Model	Weight (lbs./grams)
1130B	.0055 (2.49)

2211

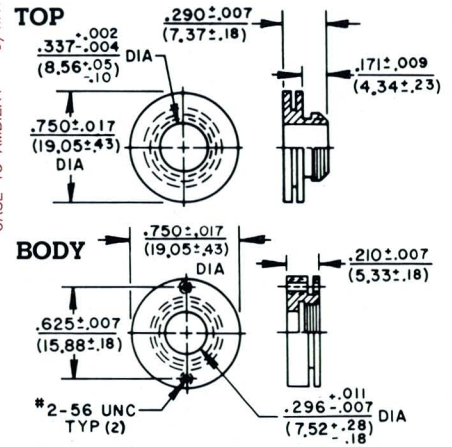
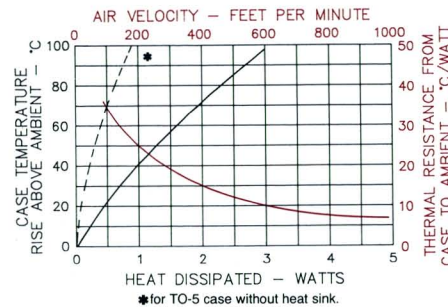
- Two-piece heat sink for TO-5.
- Top and body grip the weld flange for maximum thermal transfer.



Model	Weight (lbs./grams)
2211A	.0038 (1.72)
2211B	.0038 (1.72)

2215

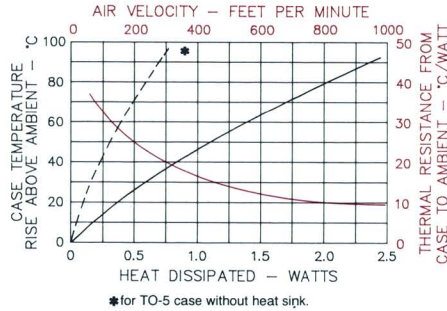
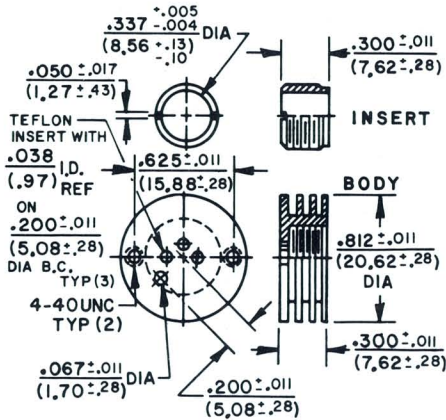
- Two-piece heat sink for TO-5.
- Tapped mounting-holes provide board retention.



Model	Weight (lbs./grams)
2215A	.0090 (4.08)
2215B	.0090 (4.08)

Note: The 2215 has a special solderable stud option, SS-1, without threads. To order studs, add SS-1 suffix to part number.

2207/PR11



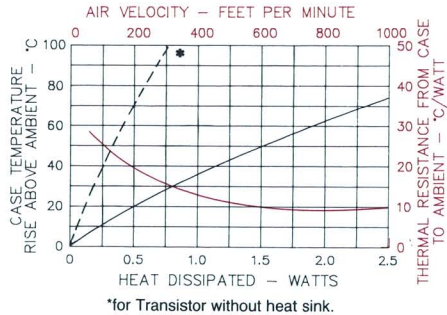
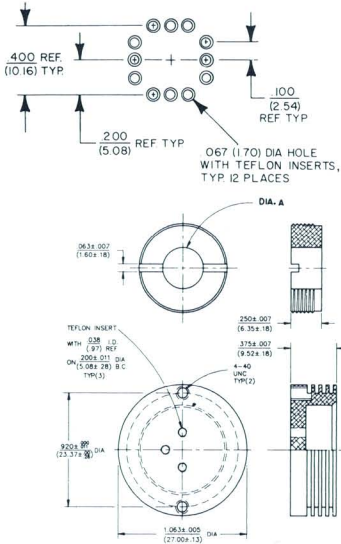
- Small, efficient TO-5 heat sink.
- Lead holes are teflon insulated.
- Tapped mounting-holes provide board retention.



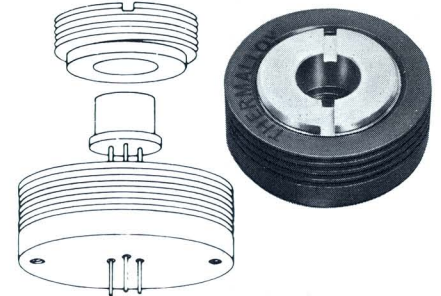
Model	Insert Finish	Weight (lbs./grams)
2207/PR11	None	.0086 (3.90)
2207/PR11B	Black	.0086 (3.90)
2207/PR11B-2*	Black	.0086 (3.90)

* (2207/PR11B-2 insert is .200" high)

LEAD HOLE PATTERN FOR 2240

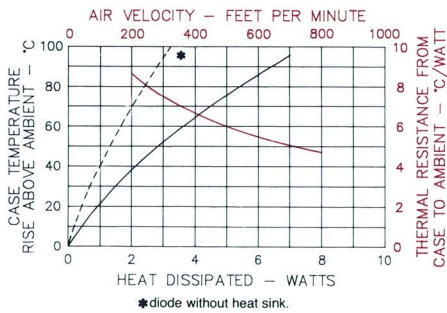
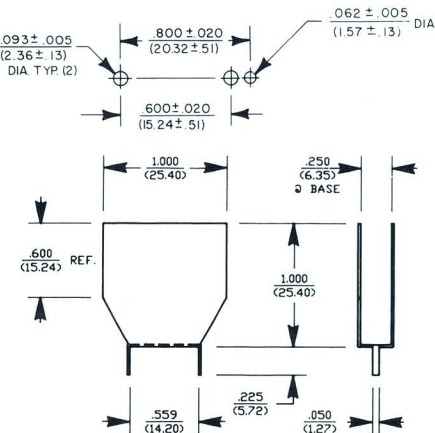


- High performance heat sink for TO-5 and TO-8-Style (H12A).
- Lead holes are teflon insulated, insert is unfinished aluminum.
- Tapped mounting-holes provide board retention.
- 2212-5 fits TO-5 and the 2240 fits the TO-8-style (H12A).

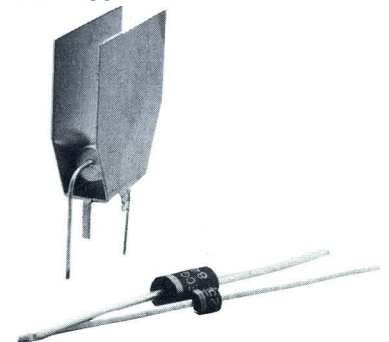


Model	Dia. A	Weight (lbs./grams)
2212B-5	.333/.340	.0280 (12.70)
2240B	.560/.565	.0249 (11.29)

SUGGESTED HOLE PATTERN



- Axial lead device heat sink.
- One lead solders to heat sink leg, other solders into PC board.
- Requires no extra board space.
- Material is copper, CDA 110, 1/4 hard, .021 (.53) inch thick. Also in tin-plated copper.



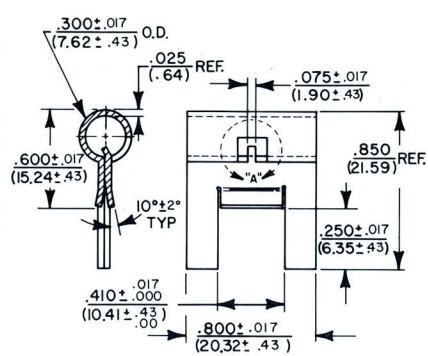
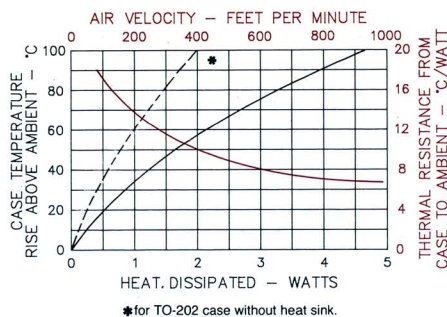
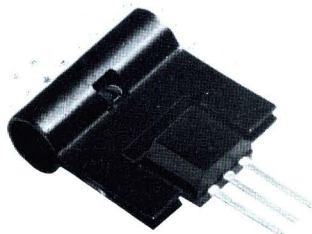
Model	Weight (lbs./grams)
6000U	.009 (4.08)
6000D	.009 (4.08)

Note: Tolerances are .017 (.43) unless otherwise specified.

NEW 6000

6046, 6047

- Clip-on heat sink for TO-202, Motorola 152 and 306-02.
- Low cost.
- Easy installation.
- Positive device catch on 6046 only (see detail "A").

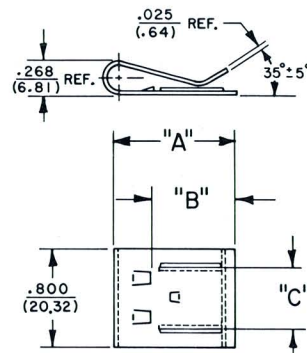
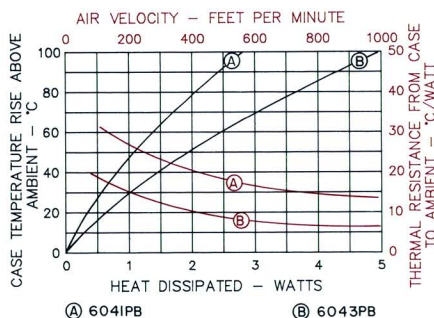
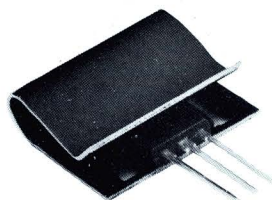


Model	Weight (lbs./grams)
6046PB.....	.0032 (1.45)
6047PB.....	.0032 (1.45)

U.S. Patent No. 4,012,769

6041, 6043

- Clip-on heat sink for TO-126, TO-220.
- Lock-in tab prevents dislodging device.
- Side runners ensure proper alignment.
- 6041 fits the TO-126 and 6043 fits the TO-220.

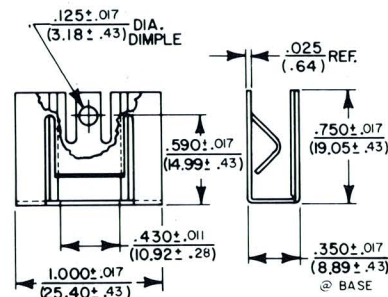
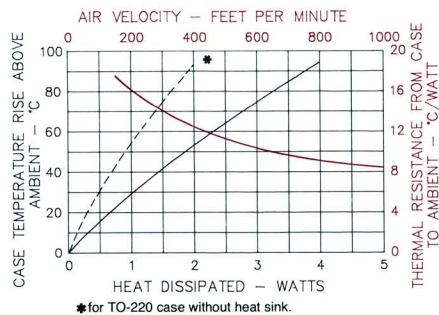


Model	Dim. A	Dim. B	Dim. C	Weight (lbs./grams)
6041PB.....	.800	.435	.330	.0031 (1.41)
6043PB.....	1.000	.650	.430	.0038 (1.72)

Note: Tolerances are ±.011 (.28) unless otherwise specified.

6045

- Clip-on heat sink for TO-220.
- Device can be inserted from top or bottom.
- Easy installation in the field.

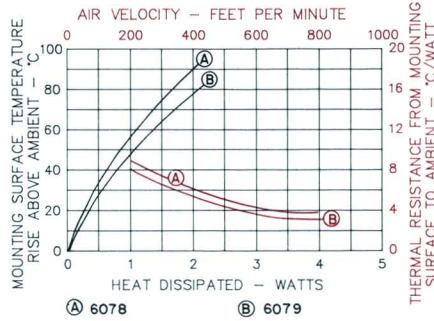
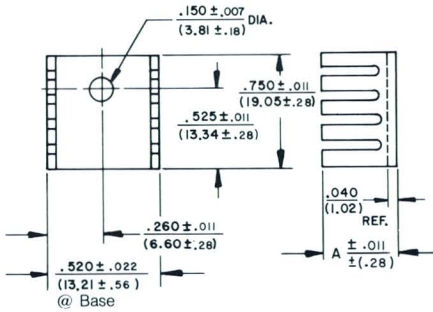


Model	Weight (lbs./grams)
6045B.....	.0037 (1.68)

U.S. Patent No. 4,054,901



6078, 6079, 6084



- Low cost heat sink for TO-220.
- Low profile — 0.375" and 0.50" tall.
- Ideal for use on PC board with 0.50" centering between boards.

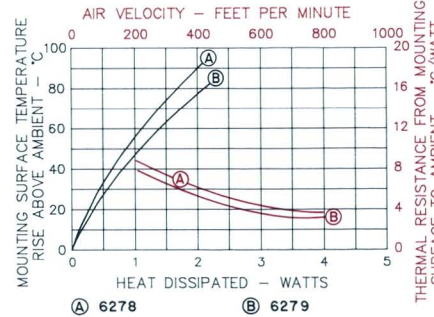
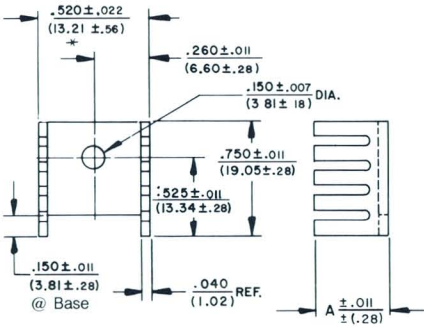


Model	Dim. A	Weight (lbs./grams)
6078B	.375	.002 (.91)
6079B	.500	.003 (1.36)
6084B	.330	.001 (.45)

Note: This heat sink design has been modified so that fins on the 6079 are connected to prevent bending. It does not change the performance or function of the heat sink.



6278, 6279



- Low cost heat sink for TO-202.
- Low profile — 0.375" and 0.50" tall.
- Ideal for use on PC board with 0.50" centering between boards.

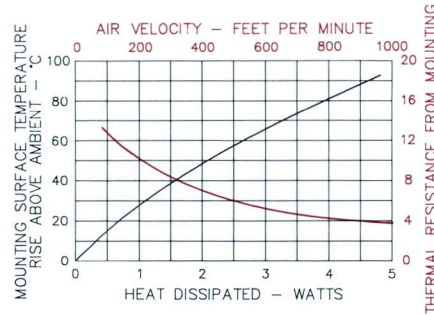
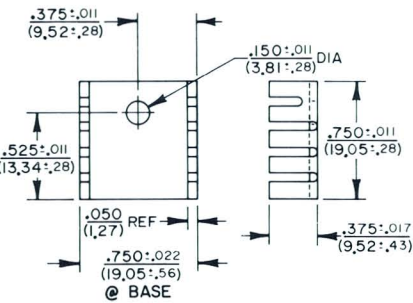


Model	Dim. A	Weight (lbs./grams)
6278B	.375	.002 (.91)
6279B	.500	.003 (1.36)

Note: This heat sink design has been modified so that fins on the 6279 are connected to prevent bending. It does not change the performance or function of the heat sink.



6073



- Low cost heat sink for TO-220.
- Low profile — only 0.375" tall.
- Ideal for use on PC board with 0.50" centering between boards.

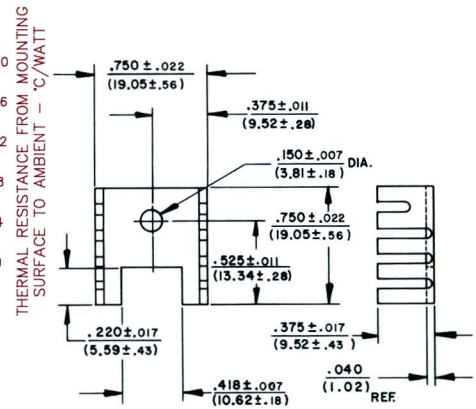
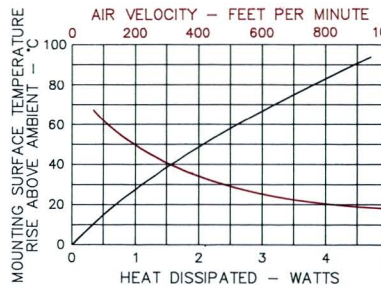
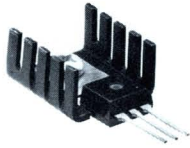


Model	Weight (lbs./grams)
6073B	.0040 (1.81)
6073PB	.0040 (1.81)



6273

- Low cost heat sink for TO-202.
- Low profile — only 0.375" tall.
- Ideal for use on PC board with 0.50" centering between boards.



Model	Weight (lbs./grams)
6273B	.004 (1.81)

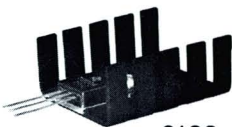


6106, 6107

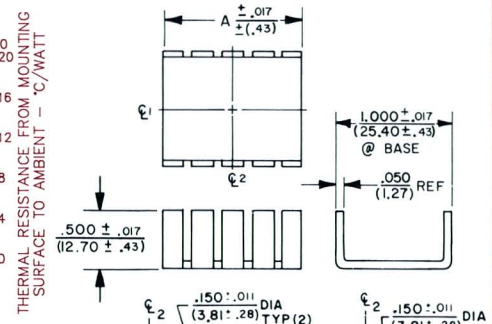
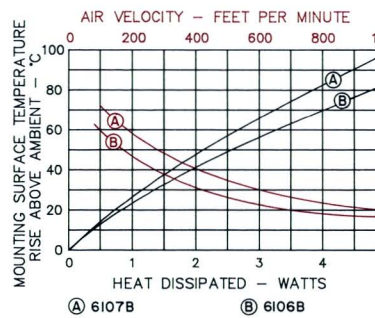
- Low cost heat sink for TO-220.
- For PC board applications with 0.150" diameter hole for device and board mounting.
- Can be mounted vertically or horizontally.
- 6106 is available with -13 and -14 hole patterns, 6107 with -14 only.



6107



6106

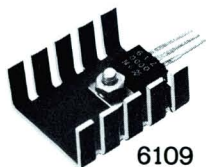


Model	Dim. A	Weight (lbs./grams)
6106B	1.18	.0093 (4.22)
6107B	.71	.0059 (2.68)



6109, 6110

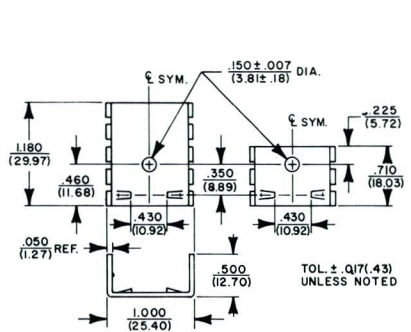
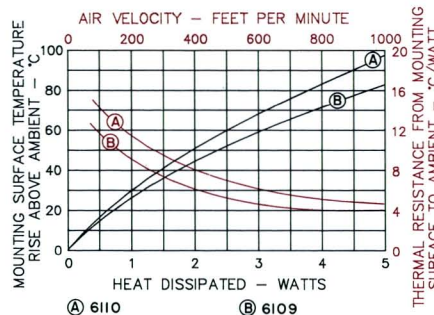
- Low cost heat sink for TO-220.
- Alignment tabs prevent transistor from rotating while applying torque to mounting hardware.



6109



6110



Model	Weight (lbs./grams)
6109PB	.0108 (4.90)
6110PB	.0074 (3.36)



Thermalclip



Roll Pin



Solderable Stud



Solderable Nut

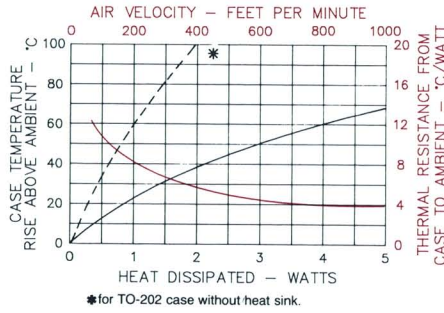
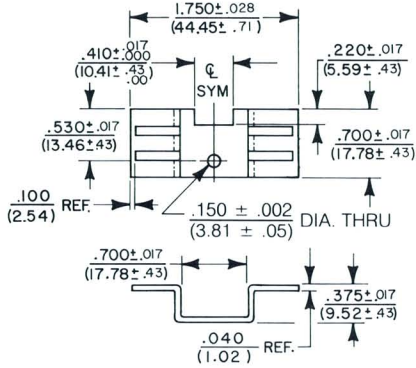


Mounting Tab

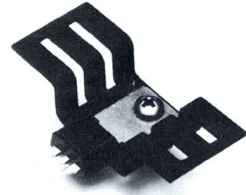


Device Mounting Stud

6063



- For use with TO-202, and Motorola 152 and 306-02.
- Low profile — 0.375" tall.
- Ideal for use on PC board with 0.50" centering between boards.

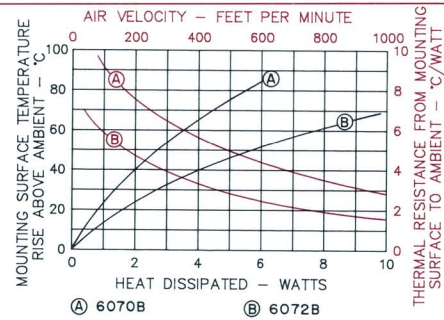
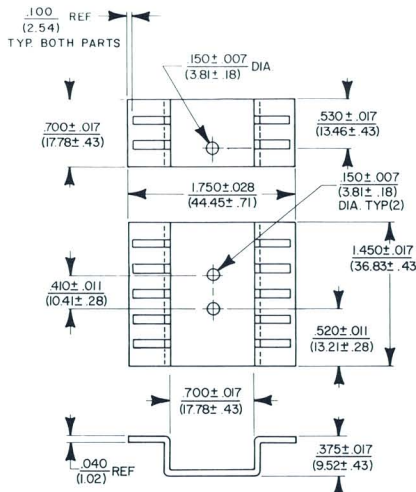


Model	Weight (lbs./grams)
6063B	.0048 (2.18)

Note: This heat sink design has been modified so the fins are connected to prevent bending. It does not change the performance or function of the heat sink.

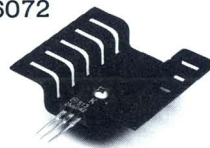


6070, 6072

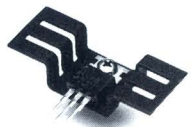


- Low profile heat sink for TO-220.
- Can be mounted vertically with solderable mounting tabs or horizontally with studs.
- 6072 can be used with one or two transistors.

6072



6070

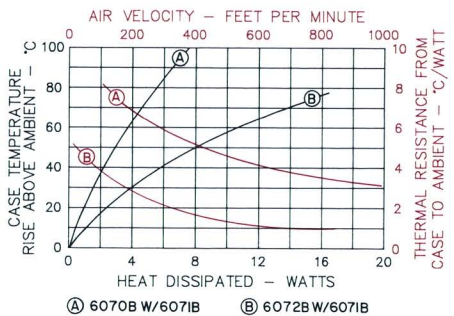
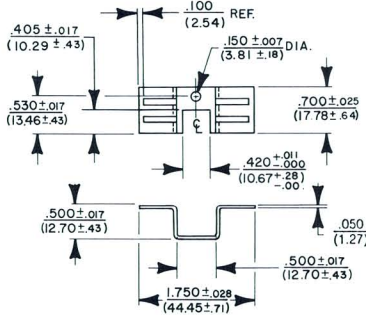


Model	Weight (lbs./grams)
6070B	.005 (2.27)
6072B	.010 (4.53)
6270B*	.005 (2.27)
6272B*	.010 (4.53)

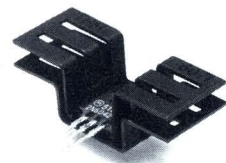
*Overall height is .820 (20.83) REF.
 Note: This heat sink design has been modified so the fins are connected to prevent bending. It does not change the performance or function of the heat sink.



6071 "Hat"



- "Hat" heat sink can be added to the 6070 and 6072 for double-sided cooling of a TO-220 device.



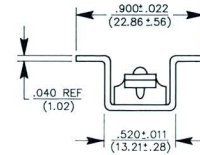
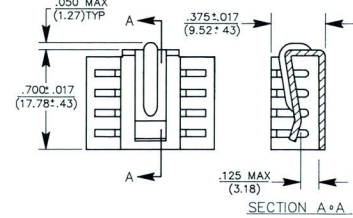
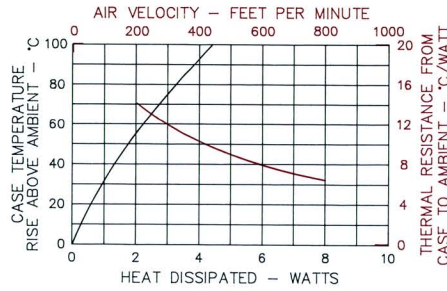
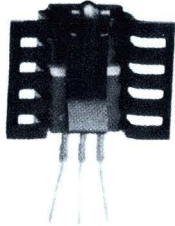
Model	Weight (lbs./grams)
6071B	.005 (2.27)
6271B*	.005 (2.27)

*Overall height is 1.045 (26.54) REF.
 Note: This heat sink design has been modified so the fins are connected to prevent bending. It does not change the performance or function of the heat sink.

6237

NEW

- Clip-on heat sink for TO-220.
- Labor-saving — eliminates hardware.
- Strong, reinforced clip allows maximum heat sink performance.
- Integral, locking tab secures transistor in place.

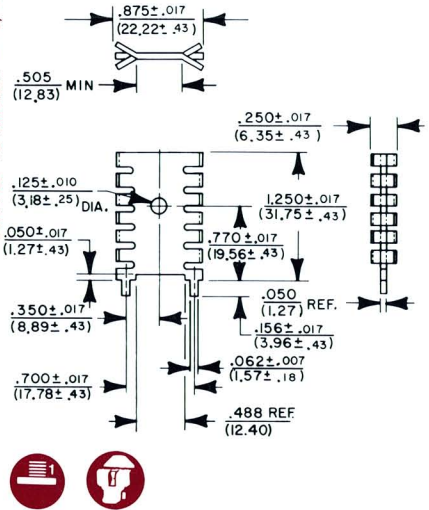
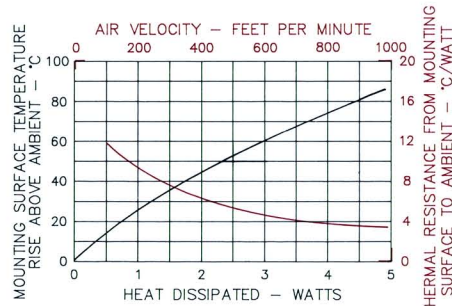
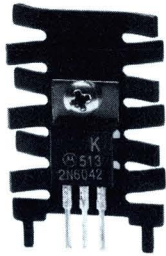


Model	Weight (lbs./grams)
6237B	.001 (.45)

Patent Pending

6025

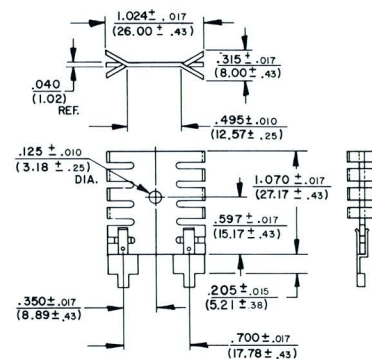
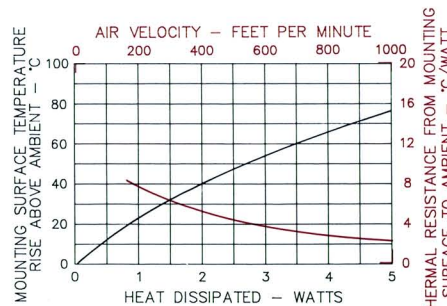
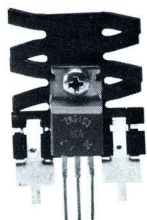
- Vertical mount heat sink for TO-220.
- Integral, scored mounting tabs may be bent for PC board retention or the tinned-tab version soldered directly into PC board.
- Alternated slotted fins minimize boundary layer effect and increase turbulence.



Model	Weight (lbs./grams)
6025B	.0046 (2.09)
6025PB	.0046 (2.09)
6025B-TT	.0134 (6.08)
6025D	.0134 (6.08)

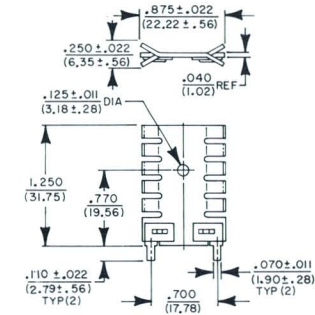
6225

- Vertical mount heat sink for TO-220.
- Labor-saving, solderable mounting tabs.
- Alternating, slotted fins minimize boundary layer effect and increase turbulence.



Model	Weight (lbs./grams)
6225B-MT	.004 (1.81)

6022



Note: Tolerances .017 (.43) unless otherwise specified.

Recommended Hole Pattern



Dim. A	Dim. B
.700 ± .005 (17.78 ± .13)	.093 ± .005 (2.36 ± .13)

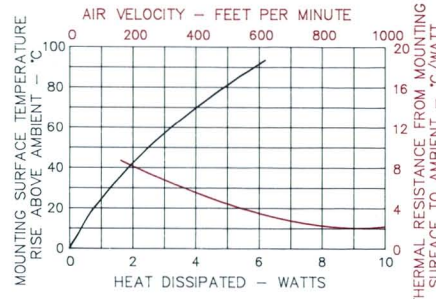


Model

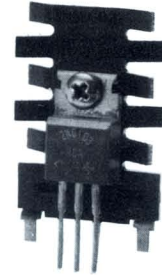
Weight
(lbs./grams)

6022PB..... .0056 (2.54)

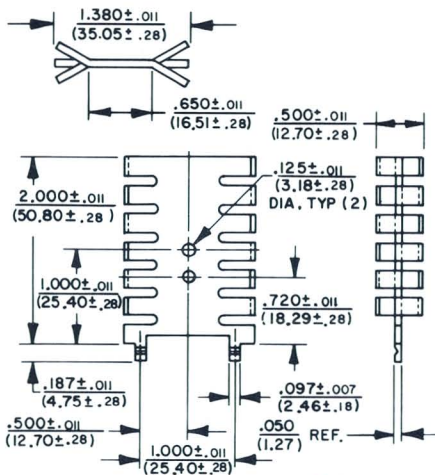
U. S. Patent No. D260,761



- Stake-on, solderable tab heat sink for TO-220.
- Low cost alternative to tinned-tab version.



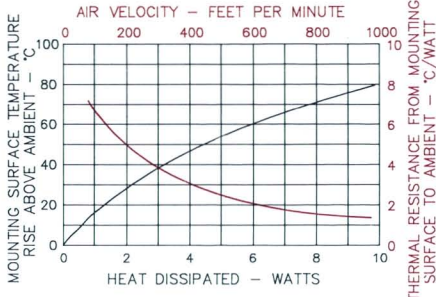
6032



Model

Weight
(lbs./grams)

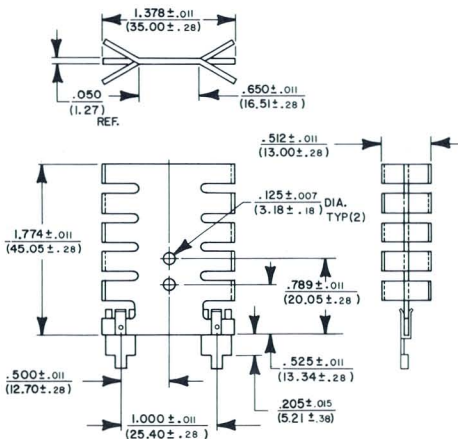
6032B..... .011 (4.99)
 6032B-TT..... .032 (14.51)
 6032D..... .032 (14.51)



- Vertical mount heat sink for TO-220.
- Integral, scored mounting tabs add stability.
- Tabs can be bent for mounting or the tinned-tab version soldered directly to the board.



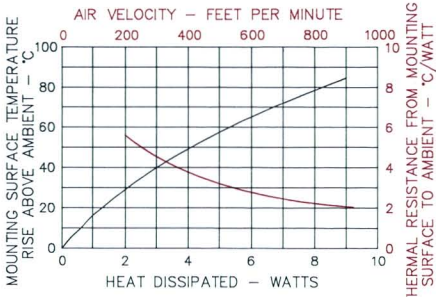
6232



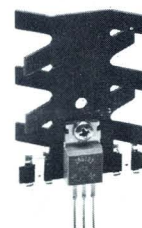
Model

Weight
(lbs./grams)

6232B-MT..... .011 (4.99)

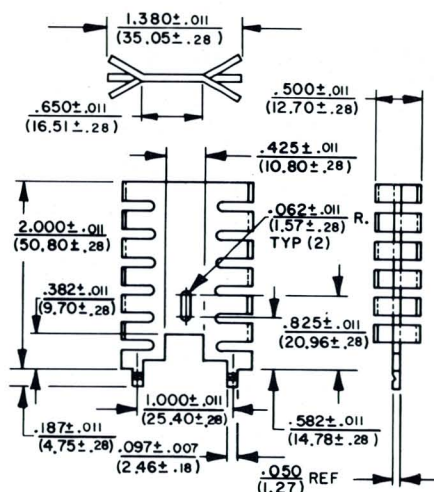
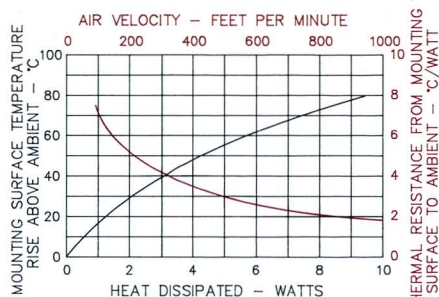


- Vertical mount heat sink for TO-220.
- Labor-saving solderable mounting tabs.
- Alternating, slotted fins minimize boundary layer effect and increase turbulence.



6034

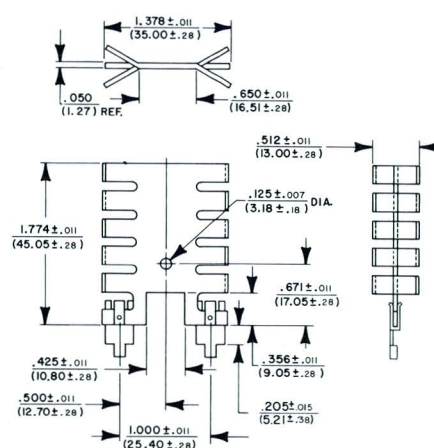
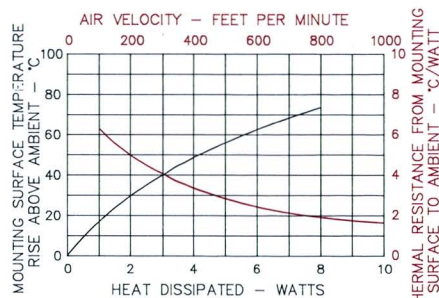
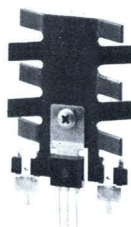
- Vertical mount heat sink for plastic case style transistors.
- Bottom cut-out allows use with center tab devices such as the TO-202 and Motorola 152 case styles.
- Integral, scored mounting tabs may be bent for PC board retention or the tinned-tab version soldered directly to the board.



Model	Weight (lbs./grams)
6034B	.010 (4.53)
6034B-TT	.029 (13.15)
6034D	.029 (13.15)

6234

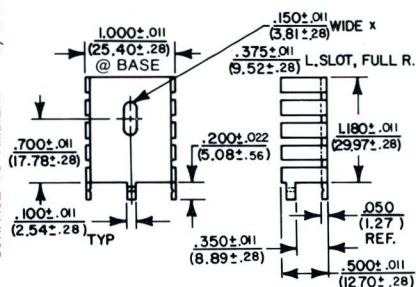
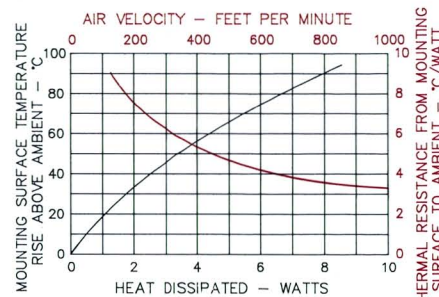
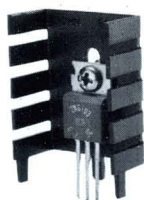
- Vertical mount heat sink for plastic case style transistors.
- Bottom cut-out allows use with center-tab devices such as the TO-202 and Motorola 152 case styles.
- Labor-saving solderable mounting tabs.



Model	Weight (lbs./grams)
6234B-MT	.010 (4.54)

6030

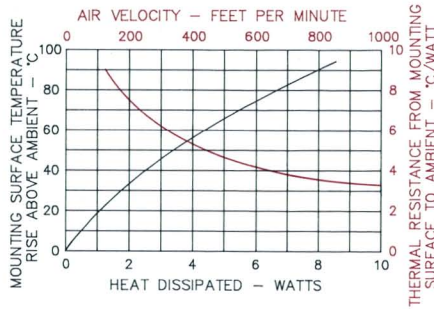
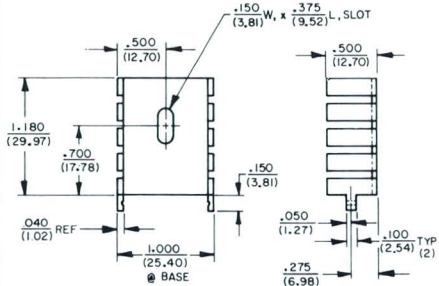
- Vertical mount heat sink for TO-220.
- Three scored mounting tabs add stability.



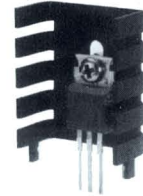
Model	Weight (lbs./grams)
6030B	.0086 (3.90)
6030PB	.0086 (3.90)
6030B-TT	.0251 (11.39)
6030D	.0251 (11.39)



6230

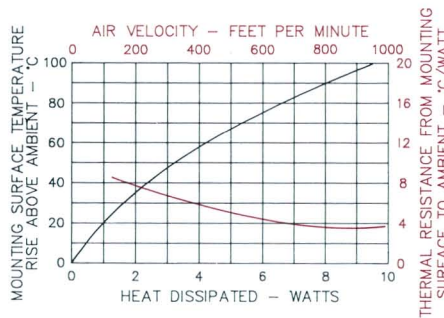
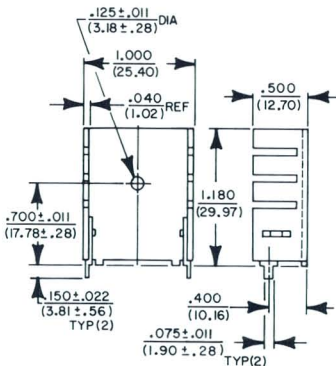


- Vertical mount heat sink for TO-220.
- Integral, scored mounting tabs are centered on bottom fins for added stability.

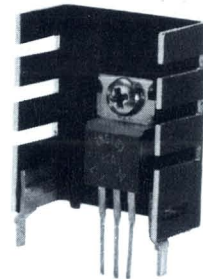


Model	Weight (lbs./grams)
6230B.....	.0069 (3.13)
6230B-TT.....	.0200 (9.07)
6230D.....	.0200 (9.07)

6021

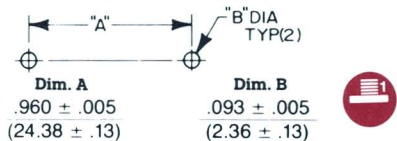


- Stake-on, solderable tab heat sink for TO-220.
- Low cost alternative to tinned-tab version.



Note: Tolerances ± .017 (.43) unless otherwise specified.

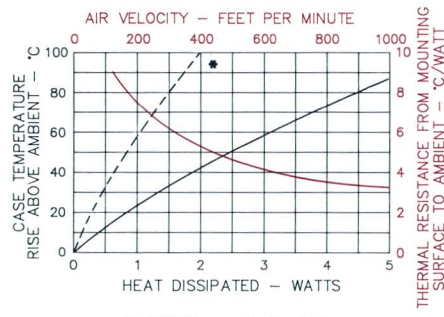
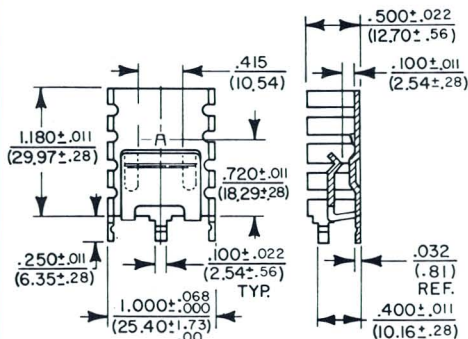
Recommended Hole Pattern



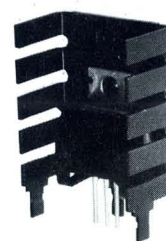
Model	Weight (lbs./grams)
6021PB.....	.0093 (4.22)

U.S. Patent No. D260,388.

6038



- Vertical mount, clip-on heat sink for TO-220.
- Labor-saving — eliminates hardware.
- Tabs can be bent for mounting or the tinned-tab version soldered directly to the board.



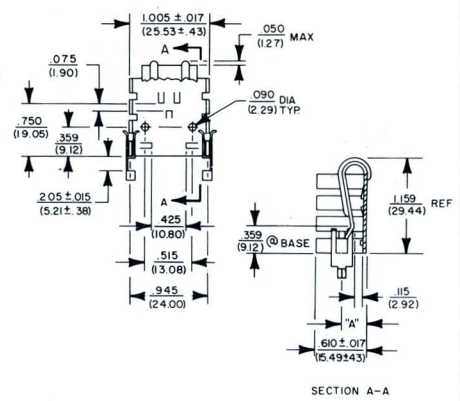
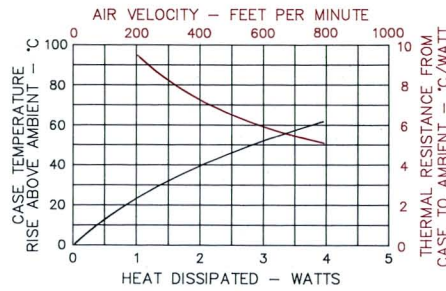
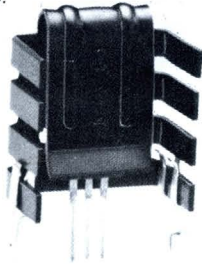
Model	Weight (lbs./grams)
6038B.....	.0077 (3.49)
6038PB.....	.0077 (3.49)
6038B-TT.....	.0077 (3.49)

U.S. Patent No. 4,054,901

6238, 6239

NEW

- Labor-saving, clip-on heat sink for TO-220.
- Can be mounted vertically using solderable mounting tabs, or horizontally without tabs.
- Strong, reinforced clip allows maximum heat sink performance.
- Integral, locking tab secures transistor in place.



Note: Tolerances are ± .011 (.28) unless otherwise specified. Refer to page 13 for mounting tab PCB hole pattern.

Model	Dim. A	Weight (lbs./grams)
6238B	400	.008 (3.63)
6238B-MT	400	.008 (3.63)
6239B	275	.008 (3.63)
6239B-MT	275	.008 (3.63)

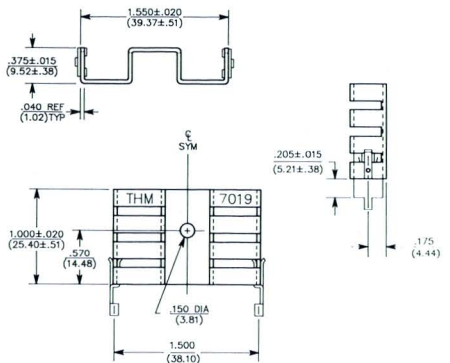
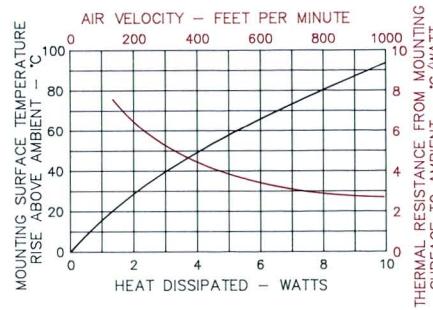
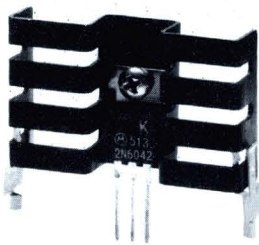
Patent Pending



7019

NEW

- High performance heat sink for TO-220.
- Vertically mounted with solderable mounting tabs.
- Horizontally mounted with solderable studs or nuts.



Note: Tolerances unless otherwise noted ± .010 (.25).

Model	Weight (lbs./grams)
7019B	.006 (2.72)
7019B-MT	.006 (2.72)

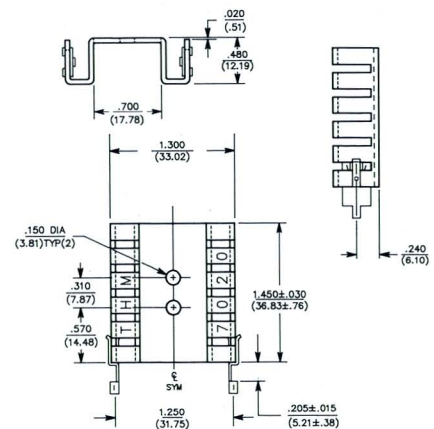
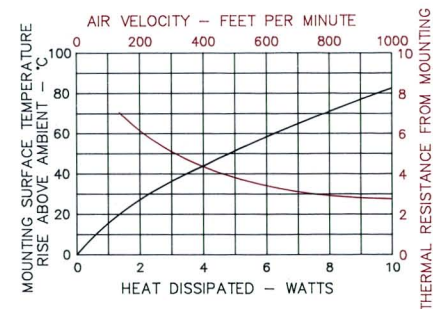
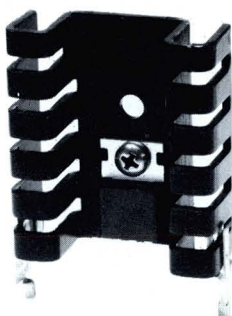
Patent Pending



7020

NEW

- High performance heat sink for TO-218, TO-220.
- Vertically mounted with solderable mounting tabs.
- Horizontally mounted with one or two transistors.



Note: Tolerances unless otherwise noted ± .010 (.25).

Model	Weight (lbs./grams)
7020B	.015 (6.80)
7020B-MT	.015 (6.80)

Patented U.S. and Foreign



Thermalclip



Roll Pin



Solderable Stud



Solderable Nut

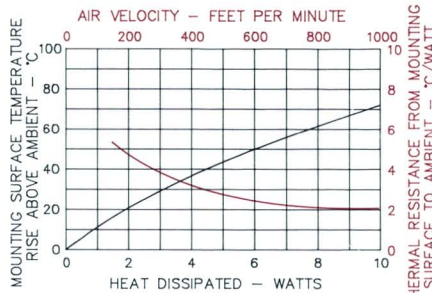
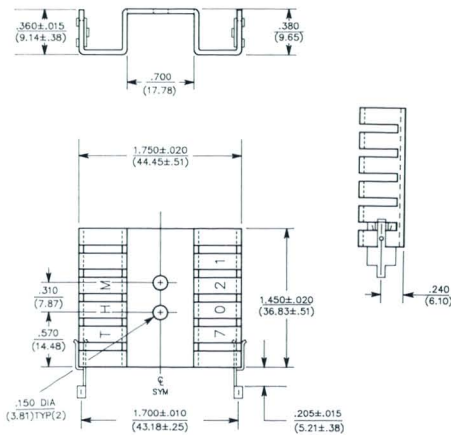


Mounting Tab

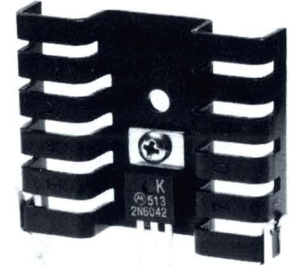


Device Mounting Stud

NEW 7021



- High performance heat sink for TO-218, TO-220.
- Vertically mounted with solderable mounting tabs.
- Horizontally mounted with one or two transistors.



Weight
(lbs./grams)

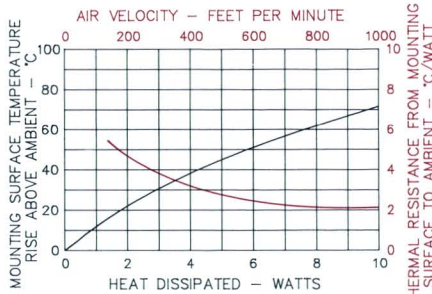
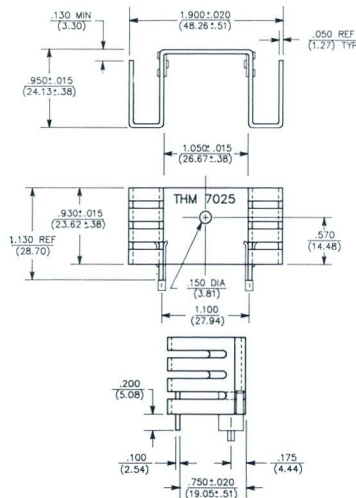
Model

7021B .....	.015 (6.80)
7021B-MT .....	.015 (6.80)

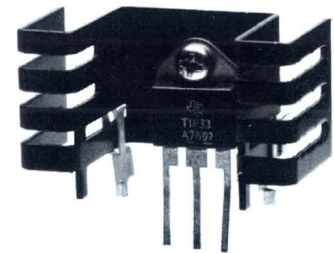
U.S. Patent No. D280,811



NEW 7025



- High performance heat sink for TO-218, TO-220.
- Vertically mounted with solderable mounting tabs.
- Horizontally mounted with solderable studs or nuts.



Weight
(lbs./grams)

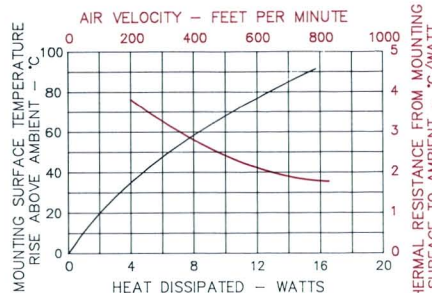
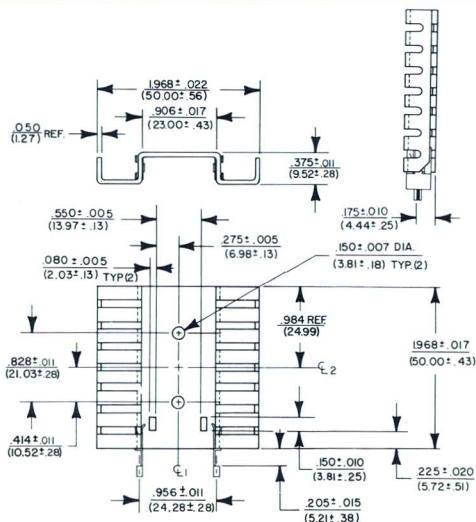
Model

7025B .....	.018 (8.17)
7025B-MT .....	.018 (8.17)

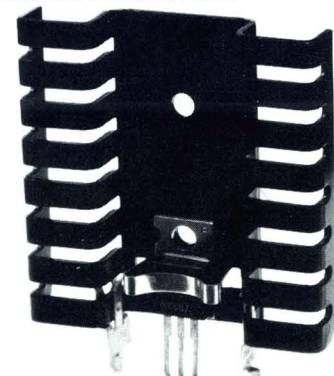
Patented U.S. and Foreign



7022



- High performance heat sink for TO-218, TO-220.
- Optional, labor-saving clip (CLP-201). Eliminates nut and bolt for assembly.
- Vertically mounted with solderable mounting tabs.
- Horizontally mounted with solderable studs or nuts.



Weight
(lbs./grams)

Model

7022B .....	.021 (9.53)
7022B-MT .....	.021 (9.53)

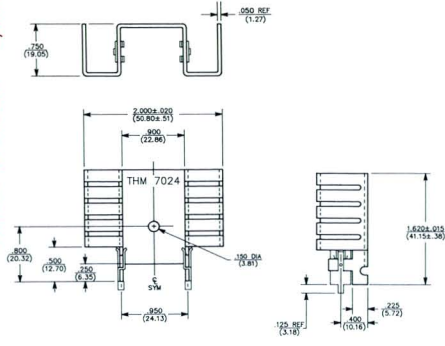
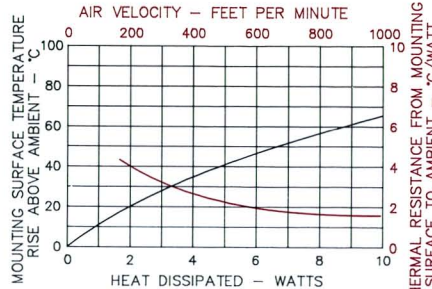
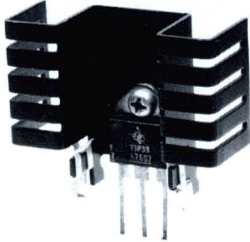
U.S. Patent No. D280,811



7024

NEW

- High performance heat sink for TO-218, TO-220.
- Vertically mounted with solderable mounting tabs.
- Horizontally mounted with solderable studs or nuts.



Note: Tolerances unless noted ± .010 (.25).

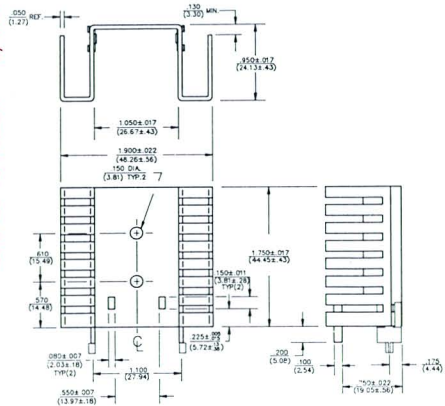
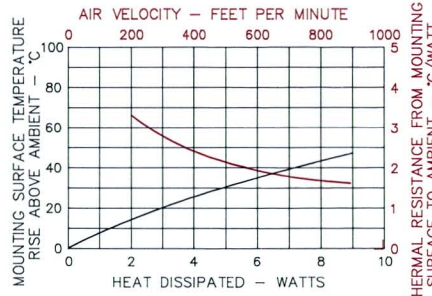
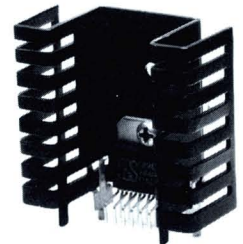
Model	Weight (lbs./grams)
7024B	.022 (9.98)
7024B-MT	.022 (9.98)



7023

NEW

- High performance heat sink for TO-220 and multi-watt devices.
- Optional, labor-saving clip (CLP-201) eliminates nut and bolt for assembly.
- Hole patterns available for TO-3, two- and four-lead TO-66, TO-218 and TO-220.
- Designed for heat dissipation of 10 watts or higher.



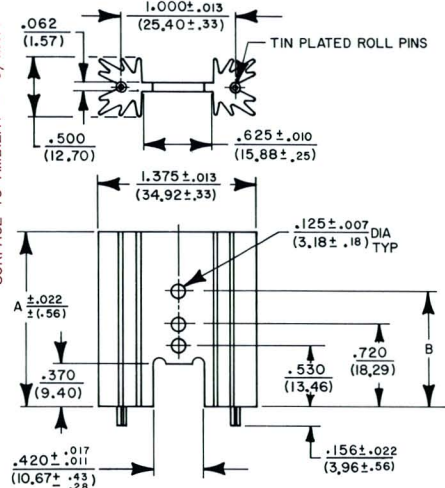
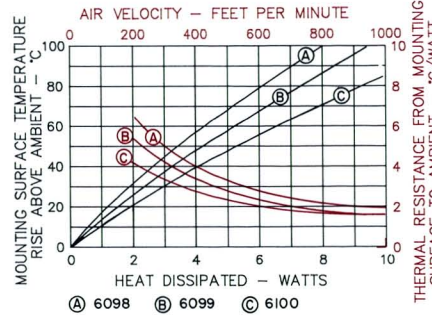
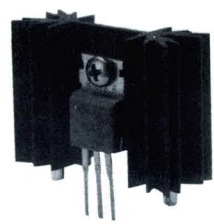
Note: Tolerances ± .011 (.28) unless otherwise specified.

Model	Weight (lbs./grams)
7023B	.031 (14.06)
7023B-MT	.031 (14.06)



6098, 6099, 6100

- Solderable pin heat sink for TO-202, TO-220.
- Solderable pins allow vertical board mounting without stress on device leads.

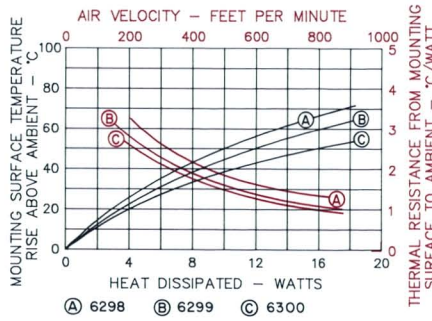
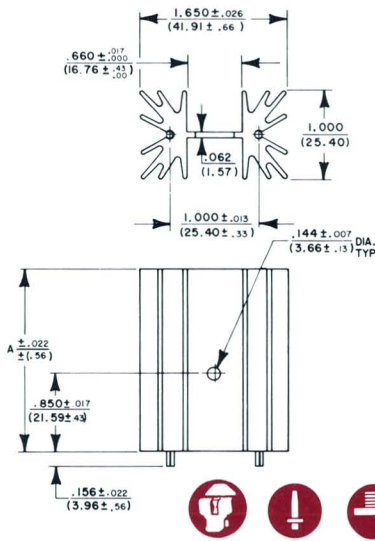


Model	Dim. A	Dim. B	Weight (lbs./grams)
6098B	1.00	—	.023 (10.43)
6099B	1.50	1.00	.035 (15.88)
6100B	2.00	1.00	.047 (21.32)

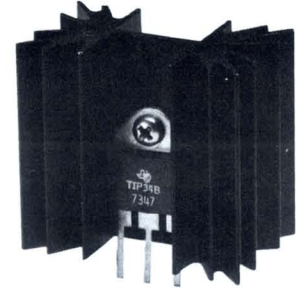
Note: To order optional solderable roll pin with shoulder, add suffix "P2", i.e., 6098B-P2. Shoulder is .045/.050" (1.14/1.27) thick.



6298, 6299, 6300



- Large solderable pin heat sink for TO-218, TO-220.
- Designed for heat dissipation of 10 watts or higher.

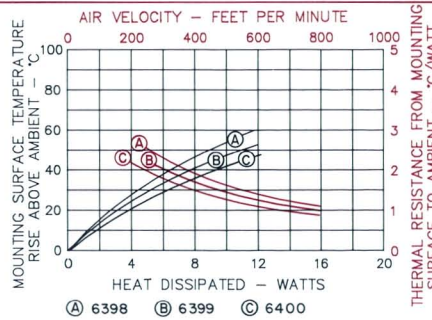
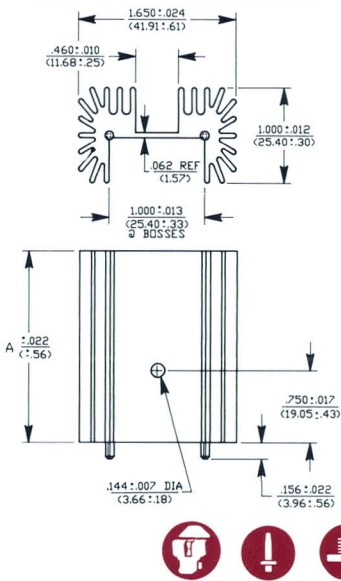


Model	Dim. A	Weight (lbs./grams)
6298B	1.50	.075 (34.02)
6299B	2.00	.104 (47.17)
6300B	2.50	.125 (56.70)

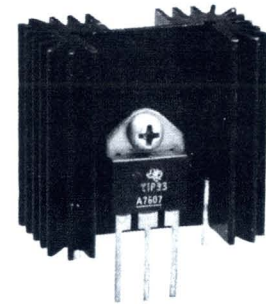
Note: To order optional solderable roll pin with shoulder, add suffix "P2" i.e., 6298B-P2. Shoulder is .045/.050" (1.14/1.27) thick.



NEW 6398, 6399, 6400



- High performance extrusion for TO-218, TO-220 and multi-watt devices.
- Solderable pins allow vertical board mounting without stress on device leads.
- Designed for heat dissipation of 10 watts or higher.

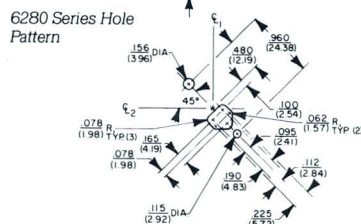
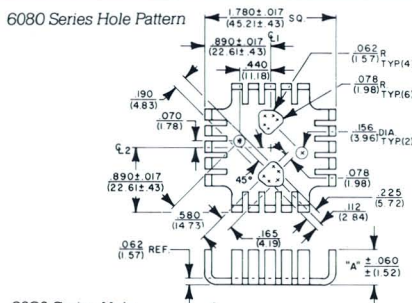


Model	Dim. A	Weight (lbs./grams)
6398B	1.50	.081 (36.74)
6399B	2.00	.105 (47.63)
6400B	2.50	.136 (61.67)

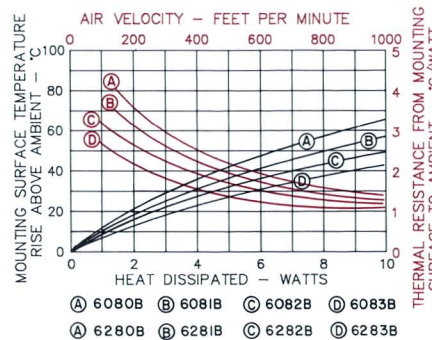
Note: To order optional, solderable roll pin with shoulder, add suffix "P2" i.e., 6398B-P2. Shoulder is .045/.050" (1.14/1.27) thick.



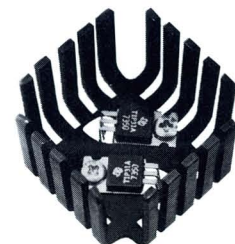
6080 and 6280 Series



Note: This heat sink design has been modified so that fins on the 6082, 6282, 6083 and 6283 parts are connected to prevent bending. It does not change the performance or function of the heat sink.



- High performance cooling for dual and single TO-220's.
- The 6080 series accepts two TO-220 transistors.
- The 6280 series accepts a single TO-220 transistor.

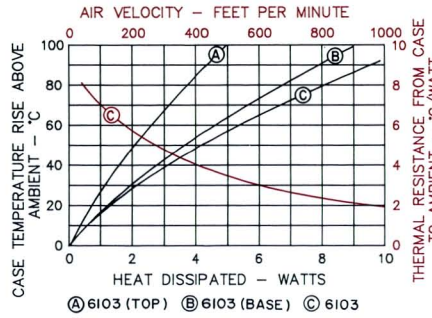


Model	Dim. A	Weight (lbs./grams)
6080B	0.50	.015 (6.80)
6081B	0.75	.022 (9.98)
6082B	1.00	.028 (12.70)
6083B	1.25	.034 (15.42)
6280B	0.50	.015 (6.80)
6281B	0.75	.022 (9.98)
6282B	1.00	.028 (12.70)
6283B	1.25	.034 (15.42)



6103, 6104, 6105

- Two-piece heat sink for TO-3 utilizes space above and below transistor.
- The top contacts the upper surface of the transistor mounting flange.
- When electrical contact is needed through mounting screws, gold chromate finished tops with black anodized base can be ordered.
- Add prefix letter "P" to order two, 6-32 x 7/16" screws with matching nuts and lockwashers, i.e., P6103B.



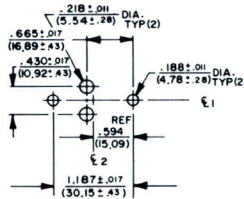
Weight

Model Dim. A Dim. B (lbs./grams)

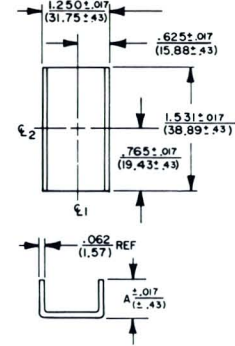
6103B	.515	.167	.025	(11.34)
6104B	.515	.234	.028	(12.70)
6105B	.515	.300	.029	(13.15)

Note: If only the top or base are desired, specify by adding the word "Top" or "Base" as a suffix to the part number.

HOLE PATTERN

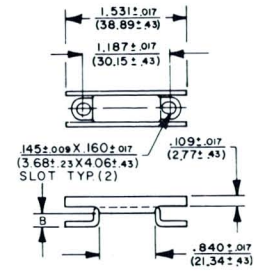


BASE



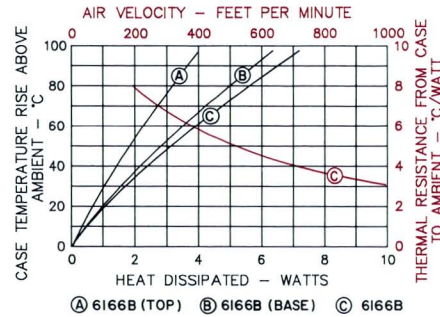
Note: Solderable stud or nut for use with base only.

TOP



6166, 6168

- Two-piece heat sink for TO-66 utilizes space above and below transistor.
- The top contacts the upper surface of the transistor mounting flange.
- For electrical contact, gold chromate finished tops with black anodized base can be ordered.
- Add prefix letter "P" to order two 6-32 x 7/16" screws with matching nuts and lockwashers, i.e., P6166B.



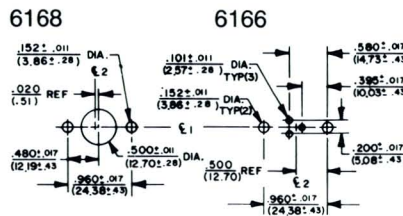
Weight

Model (lbs./grams)

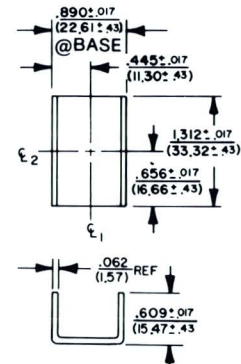
6166B	.020	(9.07)
6166C	.020	(9.07)
6168B	.019	(8.62)
6168C	.019	(8.62)

Note: If only the top or base are desired, specify by adding the word "Top" or "Base" as a suffix to the part number.

HOLE PATTERN

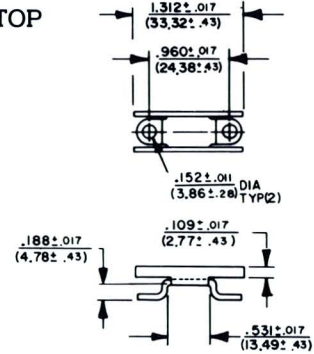


BASE



Note: Solderable stud or nut for use with base only.

TOP



Thermalclip



Roll Pin



Solderable Stud



Solderable Nut

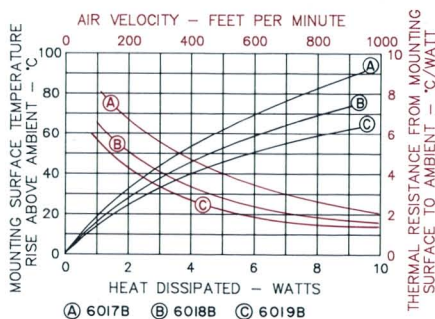
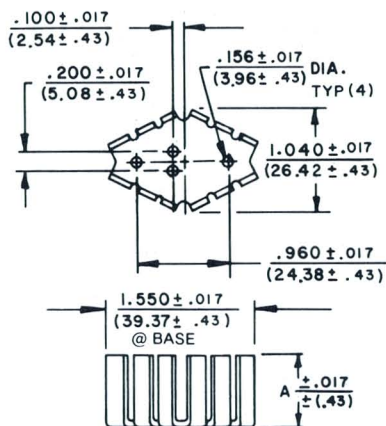


Mounting Tab



Device Mounting Stud

6017, 6018, 6019



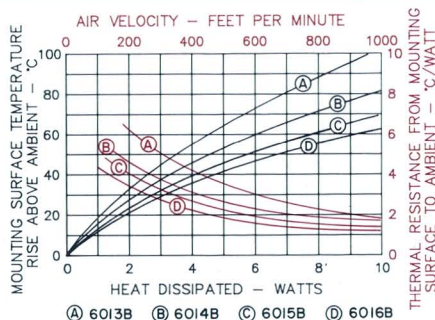
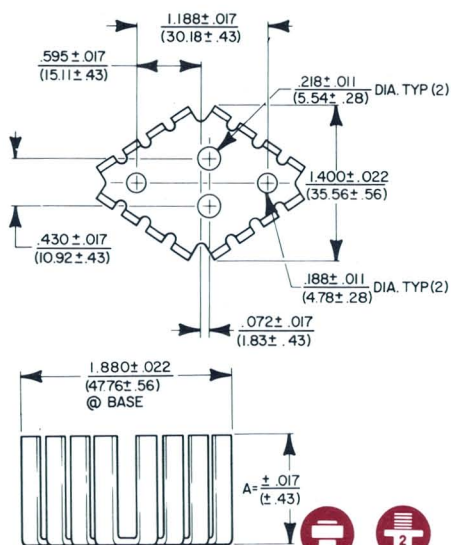
- Space saving heat sink for TO-66.
- Ideal for high density board space applications.
- Also available in four lead hole pattern.
- Material thickness is .062 (1.57).



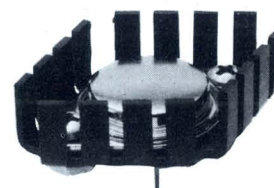
Model	Dim. A	Weight (lbs./grams)
6017B	.50	.0114 (5.17)
6018B	.75	.0161 (7.30)
6019B	1.00	.0183 (8.30)

Note: This heat sink design has been modified so that fins on the 6019 are connected to prevent bending. It does not change the performance or function of the heat sink.

6013 Series



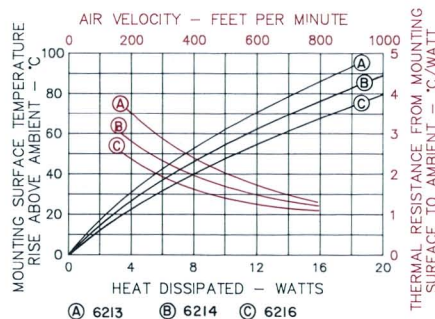
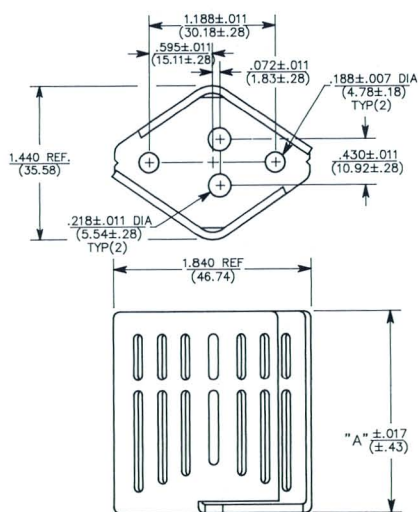
- Space saving heat sink for TO-3.
- Design conforms to diamond shape of transistor package using less board space.
- Material thickness is .062 (1.57).



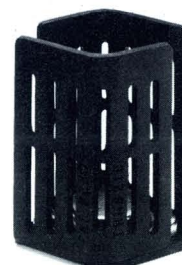
Model	Dim. A	Weight (lbs./grams)
6013B	.50	.0154 (6.99)
6014B	.75	.0198 (8.98)
6015B	1.00	.0242 (10.98)
6016B	1.25	.0286 (12.97)

Note: This heat sink design has been modified so that fins on the 6015 and 6016 are connected to prevent bending. It does not change the performance or function of the heat sink.

NEW 6213, 6214, 6216



- High performance TO-3 heat sink for limited PC board space.
- Thick metal construction (.090" thick) enhances heat transfer.
- Tall fins increase heat dissipating surface area.



Model	Dim. A	Weight (lbs./grams)
6213B	1.50	.0545 (24.72)
6214B	1.75	.0594 (26.98)
6216B	2.25	.0692 (31.40)

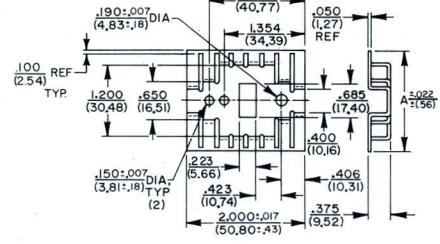
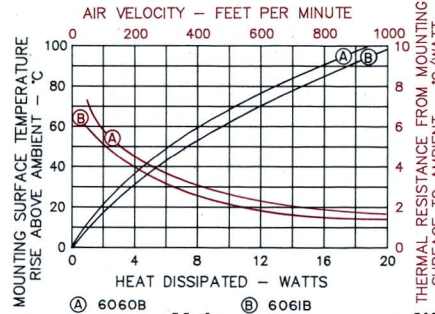
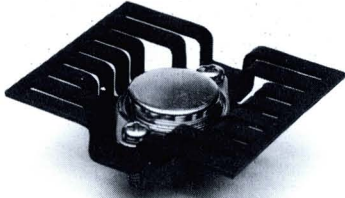
U.S. Patent No. 4,588,028

TO-3, TO-66, TO-220 Heat Sinks

Thermalclip Inc.
 P.O. Box 810839 • 2021 West Valley View Lane
 Dallas, Texas 75381-0839 • TEL: 214-243-4321

6060, 6061

- Low profile heat sink for TO-3, TO-66 and TO-220.
- Ideal for use on PC board with 0.50" centering between boards.



Model	Hole Pattern	Dim. A	Weight (lbs./grams)
6060B	Universal	1.75	.0178 (8.07)
6060B-2	TO-3	1.75	.0178 (8.07)
6060B-11	TO-66	1.75	.0178 (8.07)
6061B	Universal	2.25	.0207 (9.39)
6061B-2	TO-3	2.25	.0207 (9.39)
6061B-11	TO-66	2.25	.0207 (9.39)

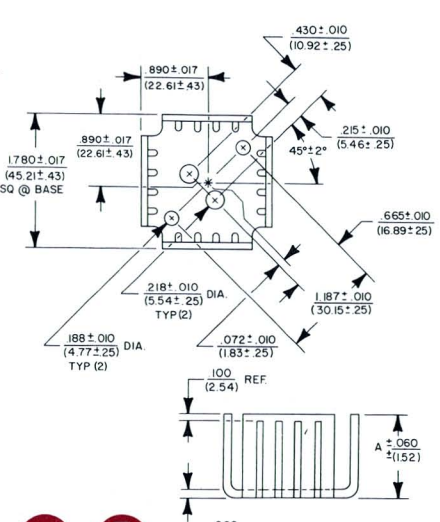
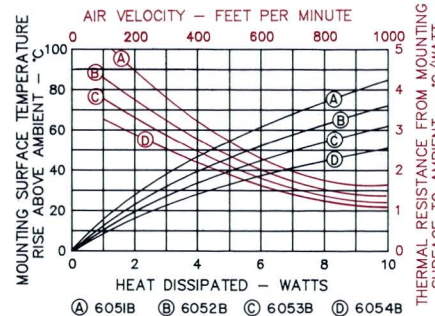
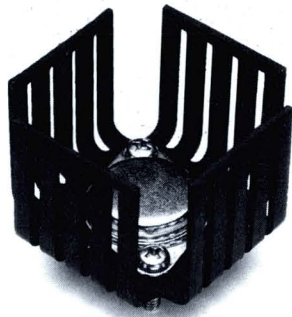
Note: This heat sink design has been modified so that the fins are connected to prevent bending. It does not change the performance or function of the heat sink.



Note: Tolerances are ± .011 (.28) unless otherwise specified.

6051 Series

- High performance cooling for TO-3.
- Outperforms many extruded shapes.



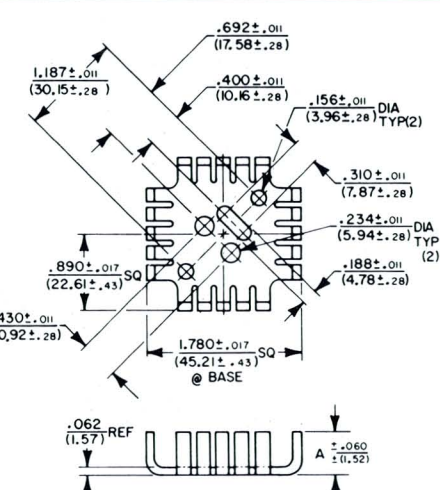
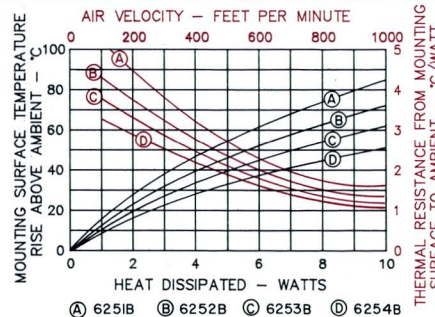
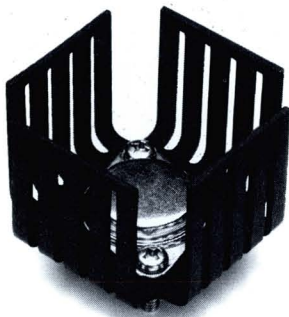
Model	Dim. A	Weight (lbs./grams)
6051B	.50	.015 (6.80)
6052B	.75	.022 (9.98)
6053B	1.00	.028 (12.70)
6054B	1.25	.034 (15.42)

Note: This heat sink design has been modified so that the fins are connected on the 6053 and 6054 to prevent bending. It does not change the performance or function of the heat sink.



6251 Series

- Heat sink with universal hole pattern for 2-, 3- and 4-lead TO-3.
- Also accepts TO-220 and other plastic power case styles.



Model	Dim. A	Weight (lbs./grams)
6251B	.50	.015 (6.80)
6252B	.75	.022 (9.98)
6253B	1.00	.028 (12.70)
6254B	1.25	.034 (15.42)

Note: This heat sink design has been modified so that the fins are connected on the 6253 and 6254 to prevent bending. It does not change the performance or function of the heat sink.



Thermalclip



Roll Pin



Solderable Stud



Solderable Nut



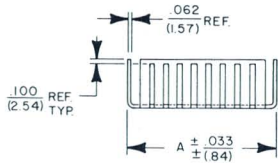
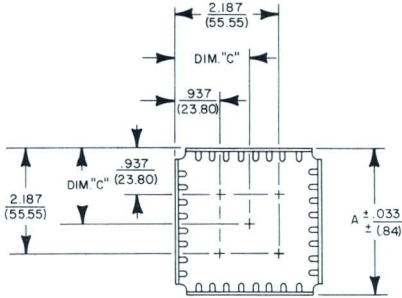
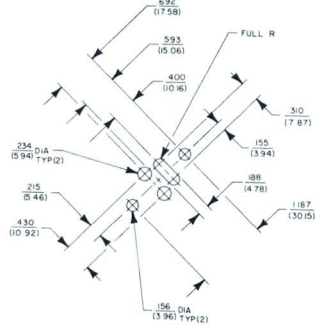
Mounting Tab



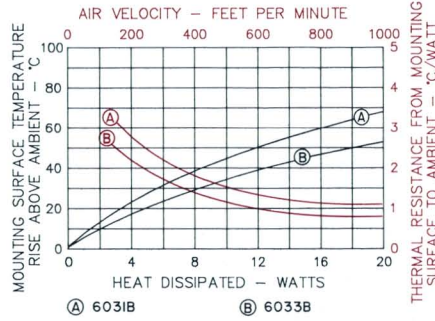
Device Mounting Stud

6031, 6033

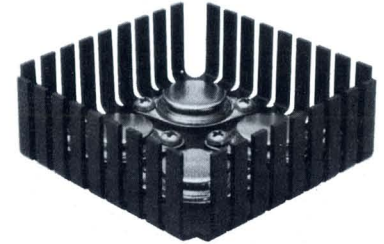
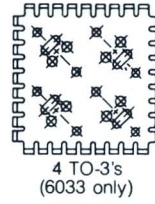
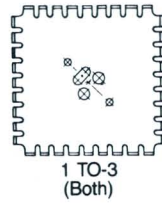
-43 Hole Pattern.



Note: Location tolerances ± .011 (.28).



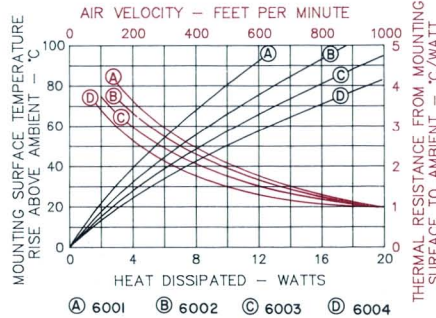
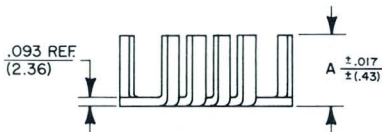
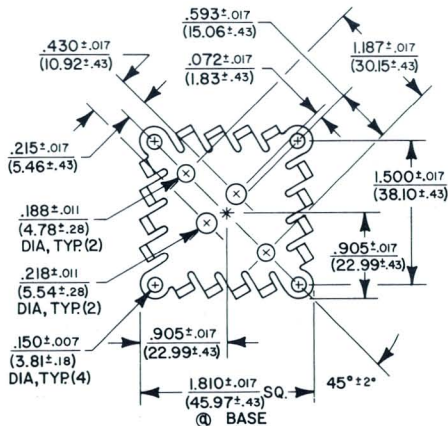
- High performance heat sink for TO-3.
- Comparable performance to many 3-inch extrusions but at a lower cost and lighter weight.
- The 6031 accommodates one transistor (order number 6031B-43).
- The 6033 accommodates four transistors (order number 6033-4x43).



Model	Dim. A	Dim. B	Dim. C	Weight (lbs./grams)
6031B	2.50	.90	1.25	.052 (23.59)
6033B	3.12	1.00	1.56	.081 (36.74)

Note: This heat sink design has been modified so that the fins are connected to prevent bending. It does not change the performance or function of the heat sink.

6001 Series



- High performance heat sink for TO-3.
- Slanted fins create turbulence for high thermal efficiency.
- Material is .093" thick.

Model	Dim. A	Weight (lbs./grams)
6001B-2	.50	.0315 (14.29)
6002B-2	.75	.0377 (17.10)
6003B-2	1.00	.0438 (19.87)
6004B-2	1.25	.0500 (22.68)

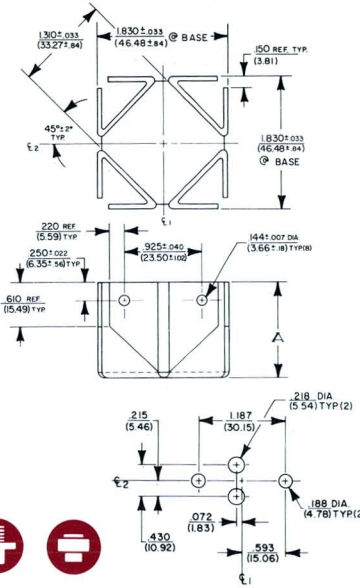
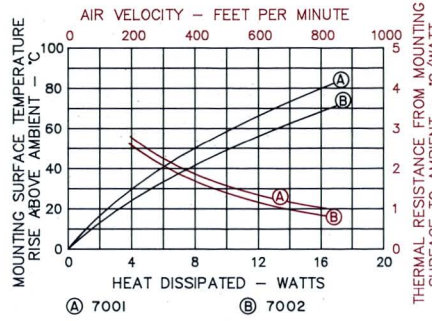
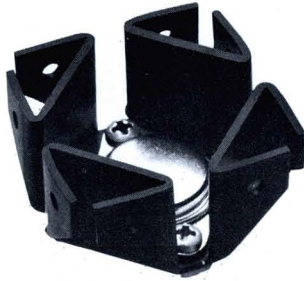


Medium Power Heat Sinks

Thermalclip Inc.
P.O. Box 810839 • 2021 West Valley View Lane
Dallas, Texas 75381-0839 • TEL: 214-243-4321

7001, 7002

- Unique "folded" design heat sink for TO-3, TO-66 and TO-220.
- Utilizes airflow from any direction.

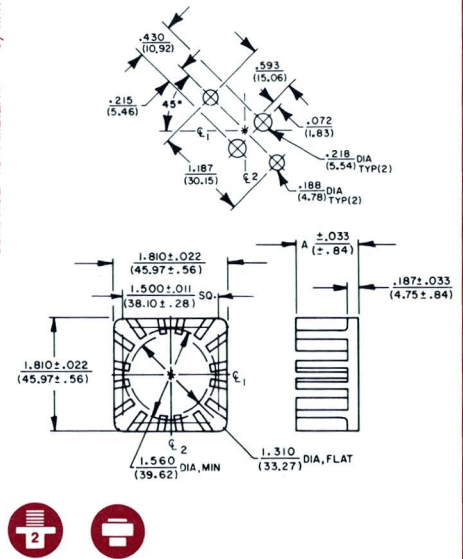
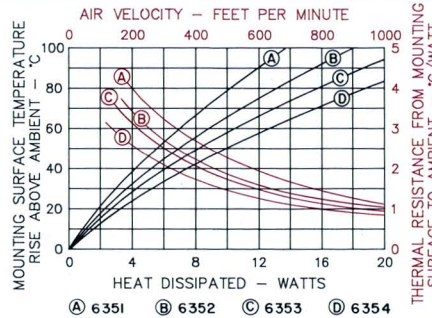
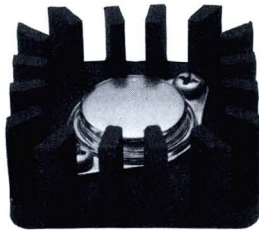


Model	Dim. A	Weight (lbs./grams)
7001B-2	1.00	.051 (23.13)
7002B-2	1.31	.069 (31.30)



6351 Series

- High performance, impact extrusion for TO-3.
- Available with no hole pattern.



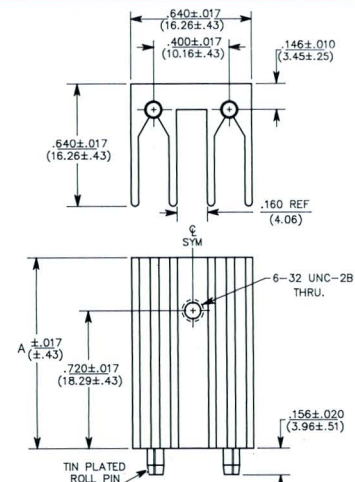
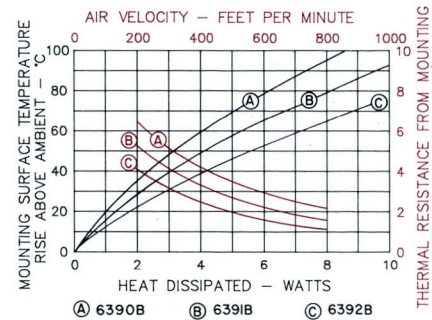
Model	Dim. A	Pattern	Weight (lbs./grams)
6351B	.50		.080 (36.29)
6351B-2	.50	TO-3	.075 (34.02)
6352B	.75		.089 (40.37)
6352B-2	.75	TO-3	.084 (38.10)
6353B	1.00		.098 (44.45)
6353B-2	1.00	TO-3	.092 (41.73)
6354B	1.25		.117 (53.07)
6354B-2	1.25	TO-3	.110 (49.89)



6390 Series

NEW

- Vertical mount, extruded heat sink for TO-218 and TO-220.
- Solderable pins allow vertical board mounting without stress on device leads.



Model	Dim. A	Weight (lbs./grams)
6390B	1.00	.016 (7.26)
6391B	1.50	.024 (10.88)
6392B	2.00	.032 (14.51)

Note: To order optional solderable roll pin with shoulder, add suffix "P2" i.e., 6390B-P2. Shoulder is .045/.050 (1.14/1.27) thick.



Thermalclip



Roll Pin



Solderable Stud



Solderable Nut

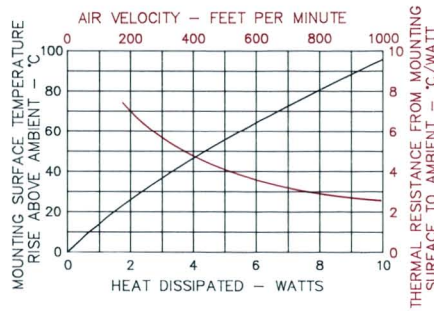
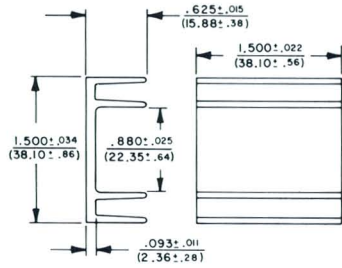


Mounting Tab



Device Mounting Stud

6111



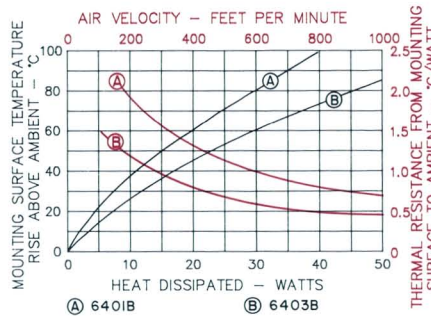
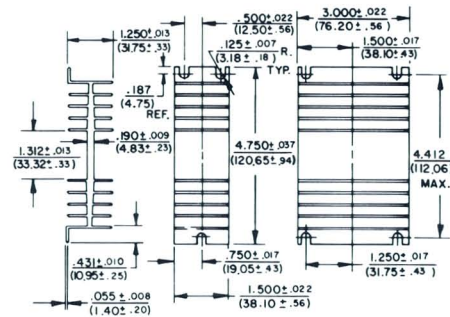
- Low profile extrusion for TO-66 and DO-4, DO-5 stud mount cases.
- For additional custom hole patterns, see page 44.



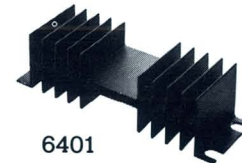
Model	Hole Pattern	Weight (lbs./grams)
6111B	None	.038 (17.24)
6111B-11	TO-66	.038 (17.24)



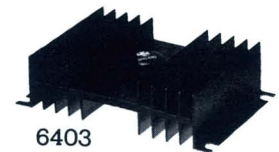
6401, 6403



- Extrusions for power semiconductors.
- For additional custom hole patterns, see page 44.



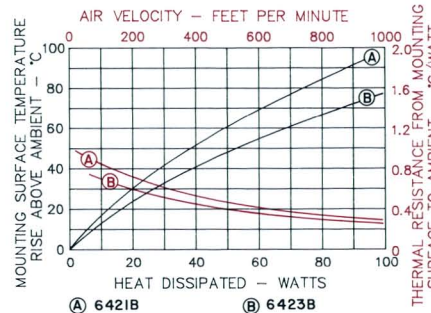
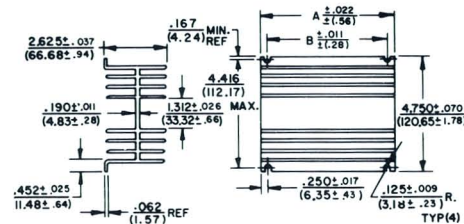
6401



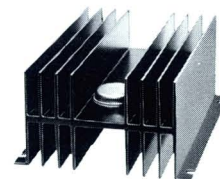
6403

Model	Hole Pattern	Weight (lbs./grams)
6401B	None	.185 (83.91)
6401B-2	TO-3	.185 (83.91)
6403B	None	.369 (167.37)
6403B-2	TO-3	.369 (167.37)

6421, 6423



- Extrusions for power semiconductors.
- For additional custom hole patterns, see page 44.



Model	Dim. A	Dim. B	Hole Pattern	Weight (lbs./grams)
6421B	3.00	2.50	None	.54 (244.94)
6421B-2	3.00	2.50	TO-3	.54 (244.94)
6423B	5.50	5.00	None	.99 (449.05)
6423B-2	5.50	5.00	TO-3	.99 (449.05)

Standard Designs

Thermalloy has an extensive group of extrusion profiles. Basic popular extruded shapes, many stocked with your local distributor or available from factory stock, are indicated by an asterisk. Average delivery of nonstocked extrusion shapes is four to six weeks.

Selecting one of these catalog shapes can eliminate the time and expense of custom designs. Every shape in this catalog is tooled, therefore no tooling is necessary and lead times are reduced by weeks. Performance characteristics, in most cases, are known in advance. Thermal performance in other cases is estimated and given as a guide to evaluating them for your application.

Raw extrusion stock is normally available in 3, 6 or 12 foot lengths or if requested custom cut to length.

Lengths of up to 3 feet may be anodized or chromated.

Custom Designs

Thermalloy will design or assist in design of custom extruded shapes. To assist you, Thermalloy has the following technical reports (TR) and Engineering Informational Reports (EIR) available on request:

- TR 108** — Guidelines for Mechanical Design of Heat Sinks
- TR 110** — Guidelines for Positional Tolerancing Usage in the Design of Heat Sinks
- EIR 74-1053** — Effect of Increasing the Length of an Extrusion
- EIR 75-1012** — Interpretation of Commercial Aluminum Extrusion Tolerancing
- EIR 76-1004** — Optimum Fin Spacing in Natural Convection or Free Convection
- EIR 76-1005** — Estimate of Convective Heat Transfer Coefficient for Two Plates Vertically "b" Apart and of Length "L"
- EIR 77-1004** — Heat Transfer Effectiveness of Straight Fins
- EIR 79-1001** — Forced Convection Design Charts — Extrusions
- EIR 82-1002** — The Effects of Interface Surface Flatness and Similar Conditions on Overall Thermal Performance and Design/Cost Considerations of Heat Sinks. Presented at WESCON/82
- EIR 84-1012** — Determining the Thermal Performance of Extruded Heat Sinks

Standard Manufacturing Tolerances for Extruded Heat Sinks

Drilled Hole Tolerances:

.040 to .250	+ .005
	- .002
.251 to .375	+ .006
	- .002
.376 to .500	+ .007
	- .003
.501 to 1.000	+ .010
	- .005

Punched Hole Tolerances:

+ .005
- .002

Cutoff Length Tolerance: ± .020 on lengths up to one foot.

Location and Machining Tolerances: Thermalloy recommends the use of X-Y coordinate dimensioning for custom extruded heat sinks with the following design considerations:

.xx ± .015
.xxx ± .010
.xxx ± .005 (within the hole pattern area if necessary.)

Hole Patterns: Hole patterns located to customer specifications will maintain the same tolerances as Thermalloy standard hole patterns. Refer to page 44.

Tolerances for location and machining tighter than our standards must be reviewed by Thermalloy and determined by the complexity of the extruded shape.

Extrusion Tolerances: Standard commercial extrusion tolerances apply.

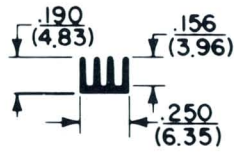
Legend

- WT.** = Weight in pounds per foot.
- S.A.** = Surface area, based on the total perimeter per one inch length.
- R_θ** = Thermal resistance, measured from the mounting surface to ambient air with the mounting surface positioned in the vertical plane. The thermal resistance is based on a three inch extrusion length in natural convection with a black anodized surface at a 75°C mounting surface temperature rise.

Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page	Part No.	Page
10088	62	11498	56	14438	62	15217	49	15964	50	16633	66
10220-1	63	11511	60	14443	72	15227	64	15985	72	16635	46
10220-2	63	11519	74	14444	72	15244	60	15989	76	16640	48
10229	61	11520	58	14445	63	15246	70	15990	73	16644	53
10233	67	11550	61	14468	48	15251	45	15991	68	16699	50
10270	61	11587	74	14476	60	15271	47	15992	76	16711	48
10271	59	11596	66	14479	51	15274	69	15993	54	16712	61
10273	60	11599	67	14487	53	15290	73	16013	67	16718	52
10417	72	11609	49	14489	51	15302	59	16021	57	16719	47
10429	54	11611	61	14494	53	15314	56	16056	64	16721	70
10450	67	11643	46	14495	57	15318	59	16057	73	16728	54
10470	59	11680	56	14567	45	15320	75	16059	67	16745	65
10490	67	11689	49	14570	72	15323	49	16071	61	16778	52
10500	67	11699	47	14579	65	15341	62	16073	62	16793	75
10514	55	11700	61	14580	56	15351	51	16074	57	16795	47
10544	54	11715	66	14581	76	15354	69	16075	58	16807	46
10548	65	11741	60	14584	75	15355	53	16095	74	16832	74
10549	51	11753	62	14624	45	15377	50	16100	62	16833	52
10550	60	11756	69	14639	69	15431	73	16101	61	16845	55
10590	67	11767	68	14641	62	15457	46	16108	65	16861	52
10592	67	11768	51	14659	57	15458	70	16111	70	16865	45
10593	67	11773	51	14671	55	15460	65	16114	64	16890	50
10595	67	11784	70	14684	73	15468	57	16115	57	16907	67
10609	58	11803	68	14685	73	15477	56	16116	60	16914	46
10638	55	11804-1	71	14689	53	15484	62	16119	58	16919	46
10655	55	11804-2	71	14693	49	15485	48	16171	74	16925	74
10669	48	11815	49	14711	73	15495	50	16188	55	16933	46
10678	59	11817	65	14716	54	15509	69	16197	66	16936	48
10747	61	11822	58	14730	49	15518	54	16221	50	16952	68
10749	61	11858	66	14744	60	15524	56	16230	59	16955	47
10753	61	11859	60	14754	47	15525	50	16242	53	16972	50
10762	49	11907	56	14769	48	15530	47	16251	53	16980	76
10808	64	11942	57	14772	55	15531	68	16252	76	16983	54
10826	58	11953	62	14773	61	15540	57	16255	56	16993	75
10852	65	11957	70	14787	54	15541	65	16265	66	16995	68
10859	51	11969	71	14806	74	15543	75	16267	53	16996	66
10868	61	11970	70	14808	55	15548	47	16280	68	17006	57
10870	55	11971	71	14811	53	15555	55	16288	54	17007	70
10871	50	11972	71	14821	47	15556	52	16289	50	17019	52
10878	60	11988	59	14823	64	15558	49	16291	65	17035	75
10879	51	12274	60	14824	63	15579	50	16298	76	17038	56
10902	48	12361	64	14825	63	15594	68	16320	51	17041	54
10930	62	14043	63	14858	46	15603	69	16329	45	17048	46
10980	65	14087	71	14861	54	15608	61	16345	46	17052	46
10989	61	14088	71	14895	59	15624	55	16351	75	17065	45
11032	50	14090	73	14918	63	15629	50	16353	76	17068	73
11039	53	14093	62	14920	54	15636	76	16360	51	17070	73
11069	63	14094	52	14934	68	15640	59	16370	67	17073	74
11070	64	14096	59	14937	69	15662	47	16372	74	17081	46
11074	52	14100	76	14938	52	15671	72	16382	47	17083	57
11080	56	14119	51	14955	63	15679	66	16385	69	17088	48
11083	60	14122	52	14957	71	15683	50	16390	60	17091	45
11085	69	14131	50	14963	72	15710	58	16401	63	17092	46
11087	45	14153	47	14990	74	15711	73	16402	63	17106	72
11089	45	14154	52	14994	63	15714	73	16403	64	17114	45
11092-1	71	14159	60	15012	51	15715	53	16465	56	17123	76
11092-2	71	14181	48	15014	45	15718	57	16473	53	17128	76
11092-3	71	14189	54	15017	47	15719	57	16477	52	17141	70
11096	58	14216	69	15018	73	15727	59	16480	73	17145	49
11098	53	14242	72	15030	69	15785	52	16485	76	17149	50
11106	63	14243	50	15035	45	15786	55	16508	57	17152	71
11137	66	14274	45	15081	48	15817	49	16509	57	17156	52
11138	53	14288	49	15092	72	15819	54	16512	65	17159	73
11140	55	14302	69	15093	72	15820	53	16513	56	17164	51
11149	48	14313	76	15113	47	15839	54	16519	55	17165	54
11152	66	14331	51	15126	50	15852	74	16528	49	17177	70
11165	56	14336	55	15129	58	15859	51	16529	49	17178	50
11193	59	14348	62	15141	57	15861	68	16531	46	17179	54
11215	59	14349	62	15149	75	15883	70	16544	56	17180	49
11221	53	14365	48	15157	48	15886	46	16551	58	17186	52
11244	56	14366	64	15166	58	15894	68	16559	68	17191	58
11269	68	14368	73	15167	70	15910	66	16567	63	17194	48
11279	45	14372	47	15169	71	15916	45	16572	75	17195	47
11300	58	14380	64	15178	64	15923	64	16586	55	17208	46
11319	75	14387	58	15196	72	15928	60	16587	57	17224	48
11343	49	14389	59	15199	49	15939	74	16591	57	17225	47
11344	48	14393	59	15210	69	15940	75	16592	50	17228	71
11364	75	14418	72	15215	62	15948	47	16604	62	17233	49
11485	66	14437	64	15216	69	15952	48	16609	74	17287	67

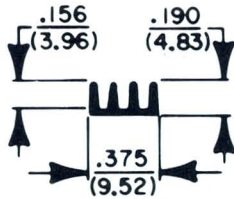
11087*

S.A. 1.73
 WT. .04
 R_θ 20.8
 SQ."/I"
 LB./I"
 °C/W



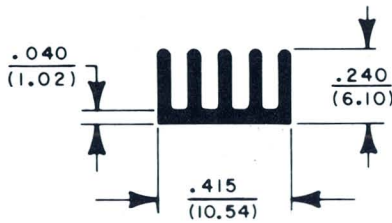
14567

S.A. 1.80
 WT. .05
 R_θ 20.0
 SQ."/I"
 LB./I"
 °C/W



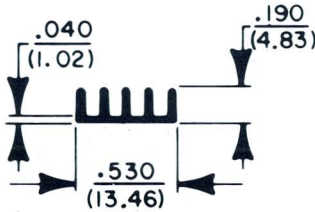
11279

S.A. 2.90
 WT. .06
 R_θ 15.3
 SQ."/I"
 LB./I"
 °C/W



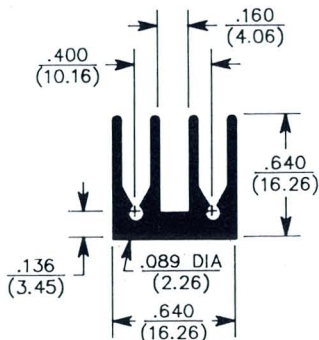
15035

S.A. 2.64
 WT. .06
 R_θ 16.8
 SQ."/I"
 LB./I"
 °C/W



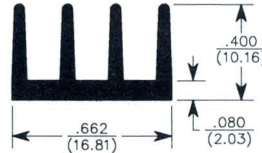
17065

S.A. 5.54
 WT. .20
 R_θ 9.0
 SQ."/I"
 LB./I"
 °C/W



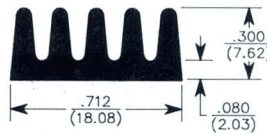
16865

S.A. 3.88
 WT. .14
 R_θ 10.4
 SQ."/I"
 LB./I"
 °C/W



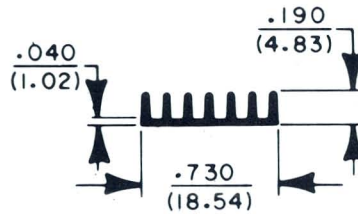
17114

S.A. 3.45
 WT. .16
 R_θ 10.4
 SQ."/I"
 LB./I"
 °C/W



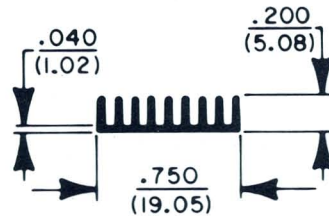
11089*

S.A. 3.54
 WT. .08
 R_θ 12.5
 SQ."/I"
 LB./I"
 °C/W



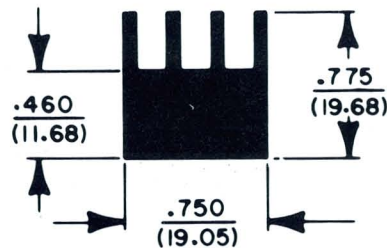
15251

S.A. 5.00
 WT. .10
 R_θ 8.9
 SQ."/I"
 LB./I"
 °C/W



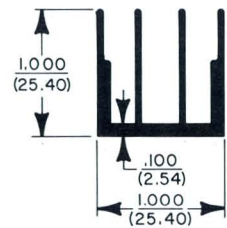
14624

S.A. 4.82
 WT. .50
 R_θ 9.2
 SQ."/I"
 LB./I"
 °C/W



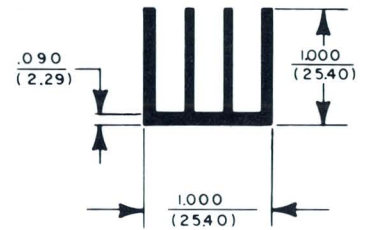
15916

S.A. 9.14
 WT. .45
 R_θ 4.8
 SQ."/I"
 LB./I"
 °C/W



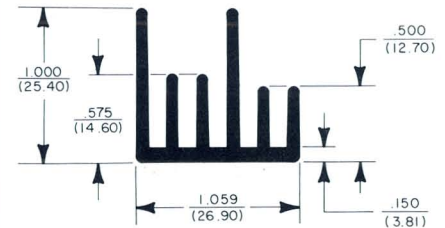
14274

S.A. 10.02
 WT. .98
 R_θ 4.2
 SQ."/I"
 LB./I"
 °C/W



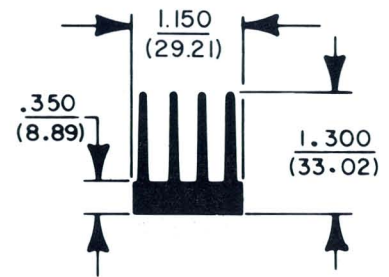
16329

S.A. 8.61
 WT. .44
 R_θ 6.0
 SQ."/I"
 LB./I"
 °C/W



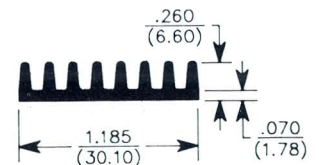
15014

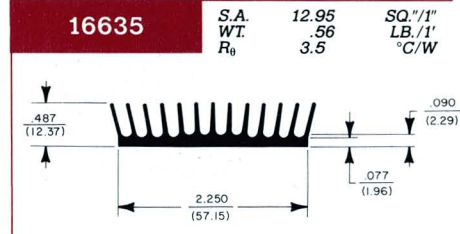
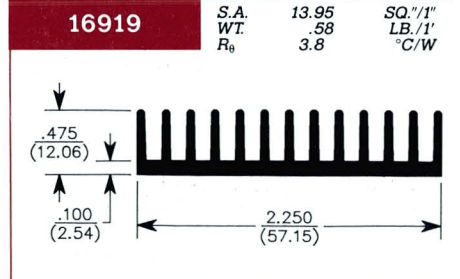
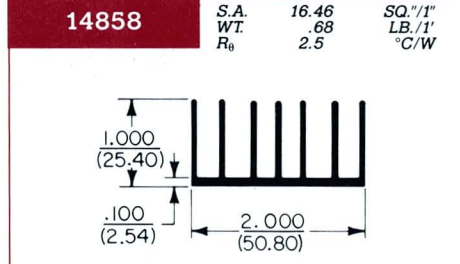
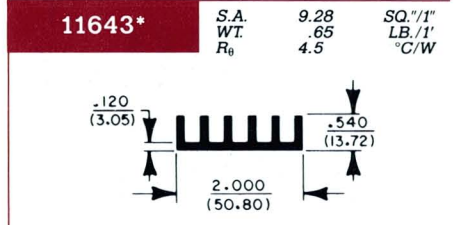
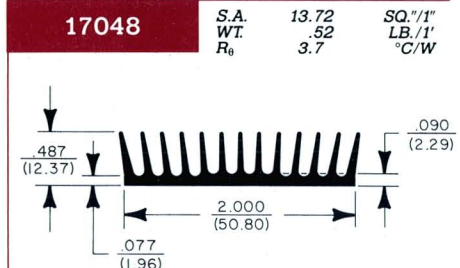
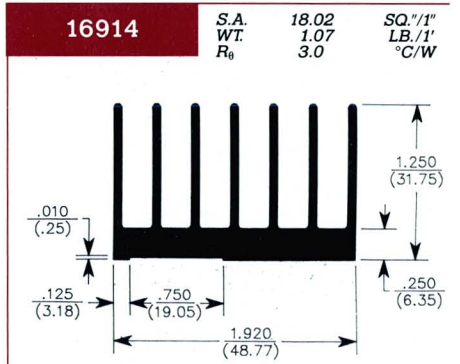
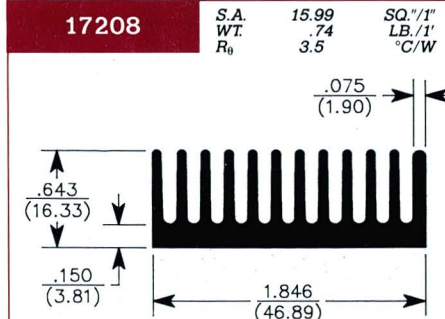
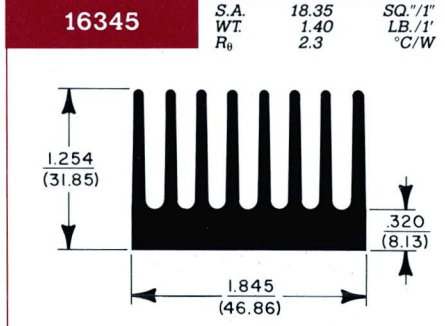
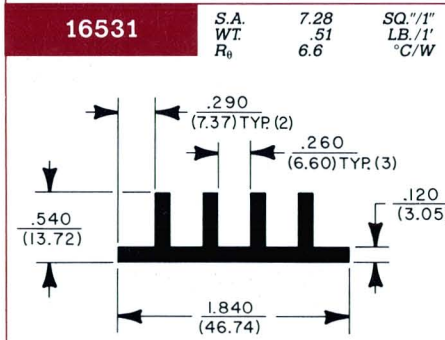
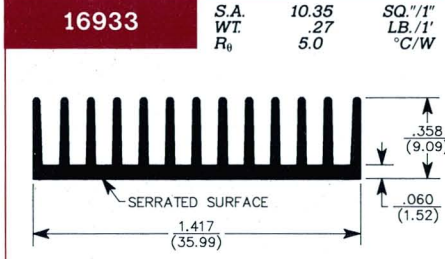
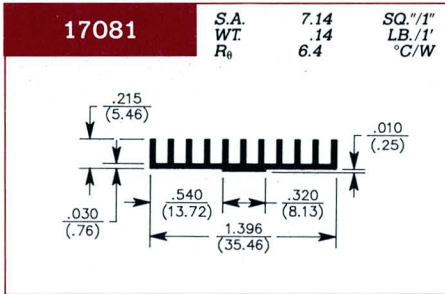
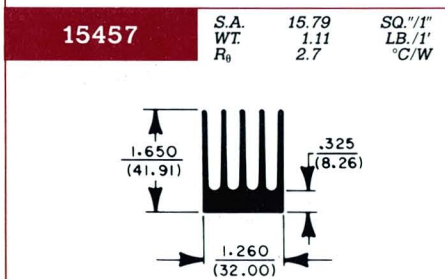
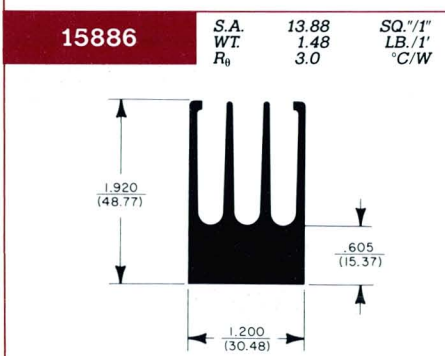
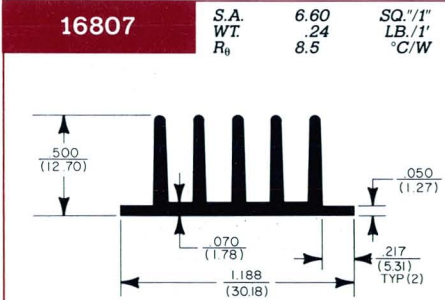
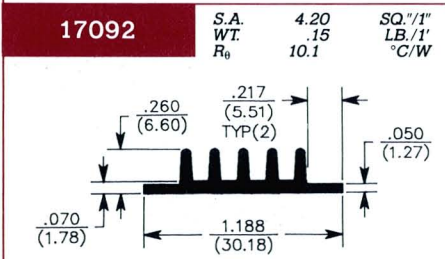
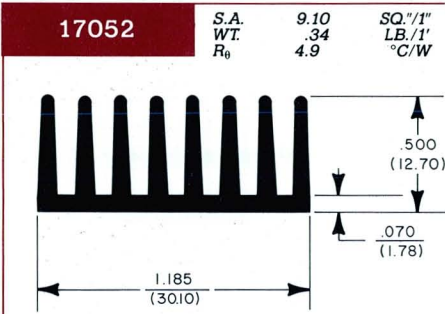
S.A. 11.11
 WT. .64
 R_θ 3.8
 SQ."/I"
 LB./I"
 °C/W

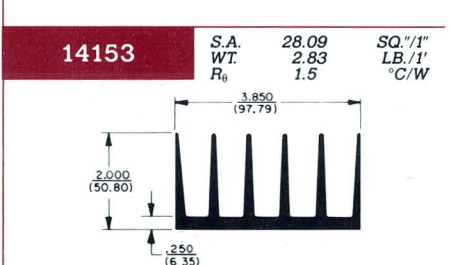
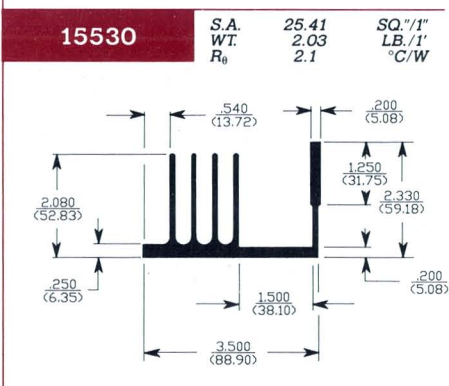
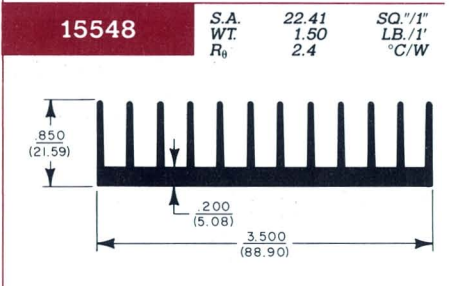
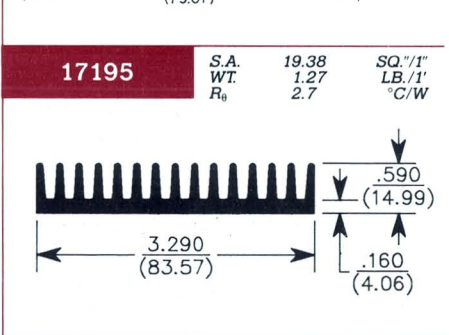
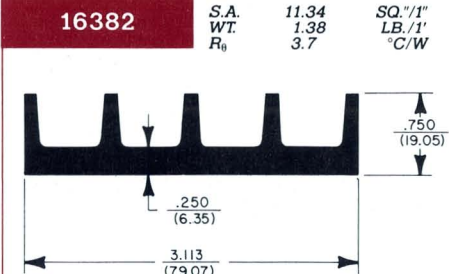
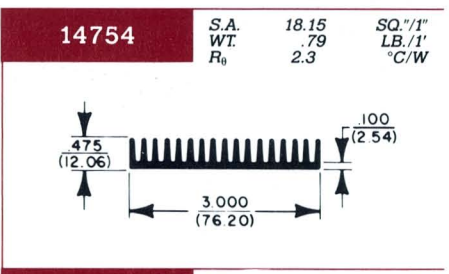
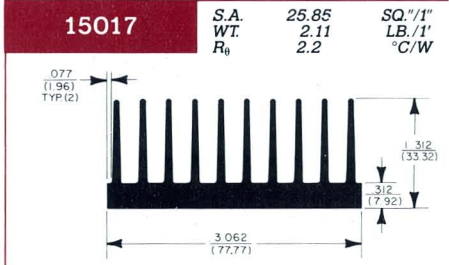
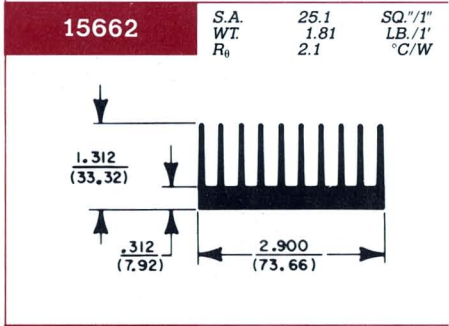
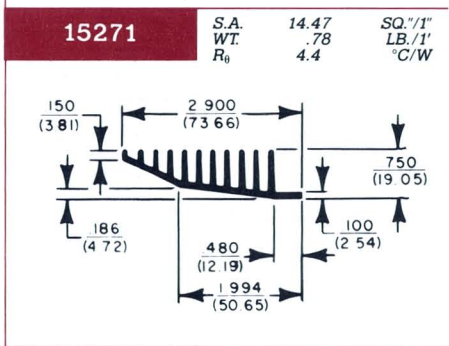
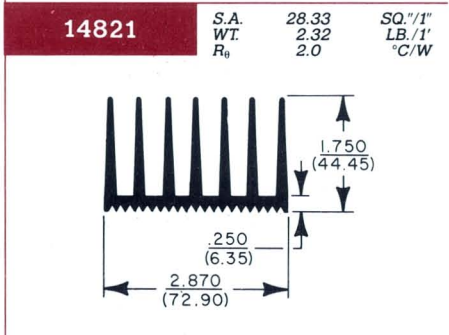
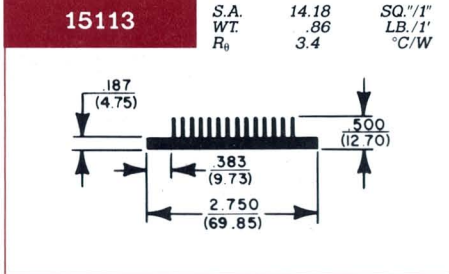
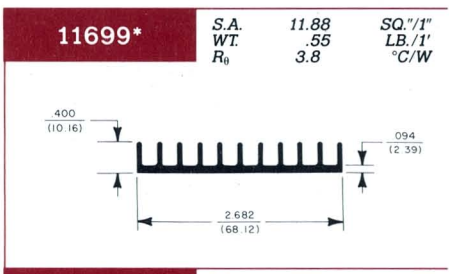
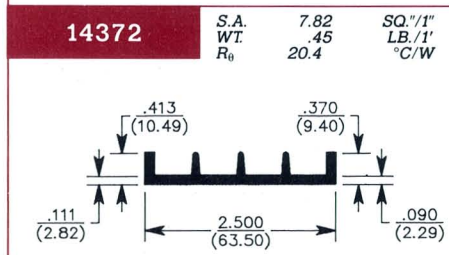
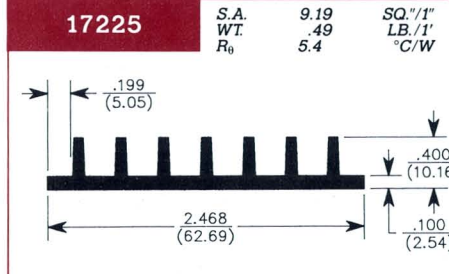
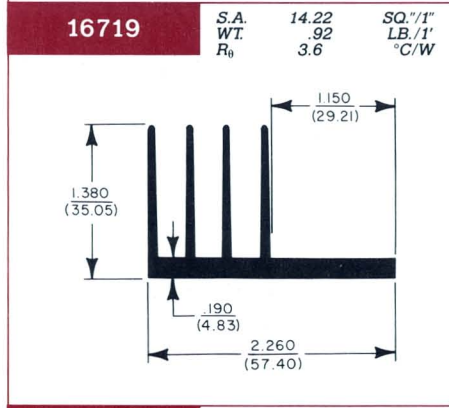
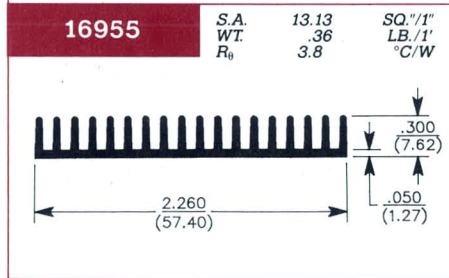
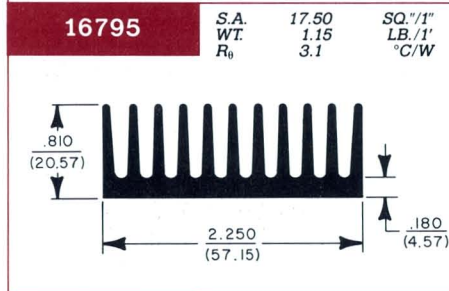
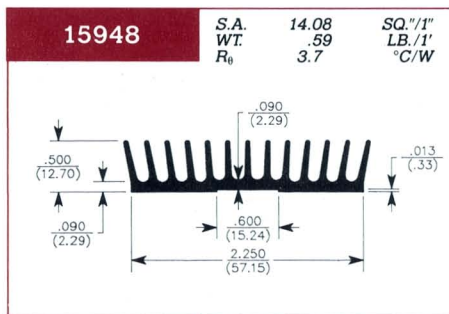


17091

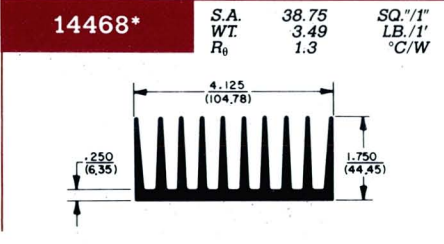
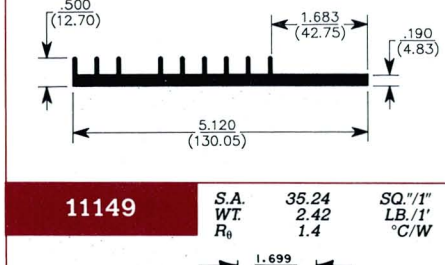
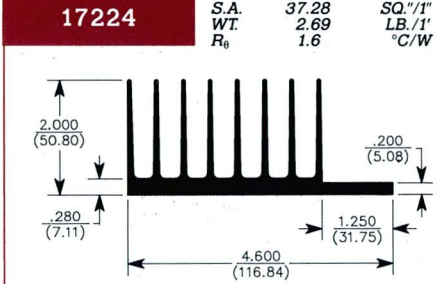
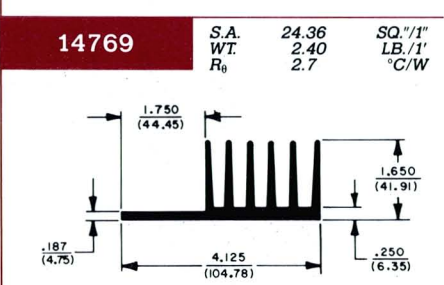
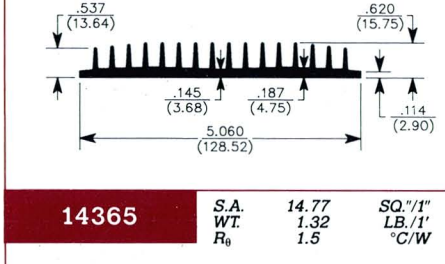
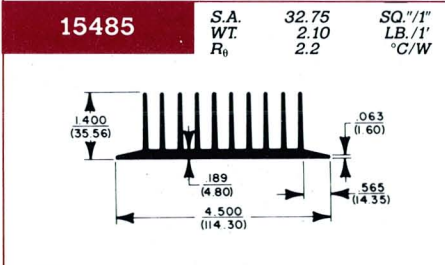
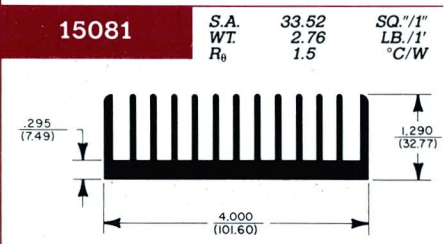
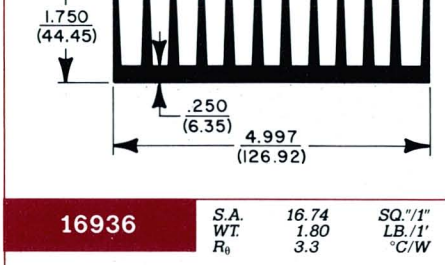
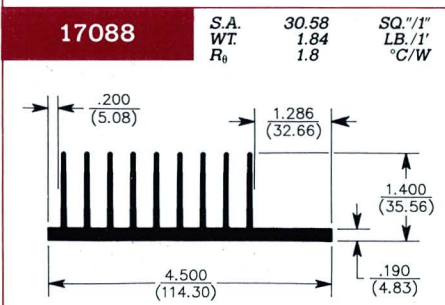
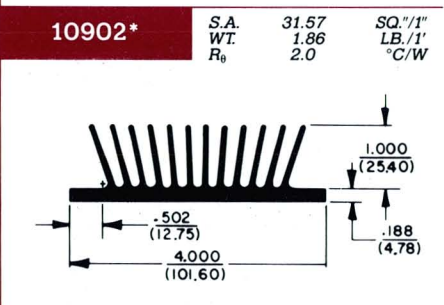
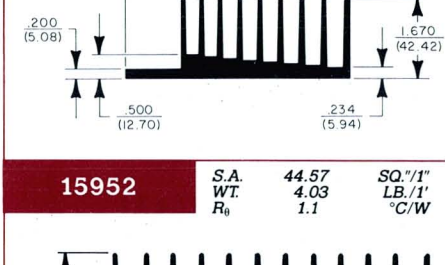
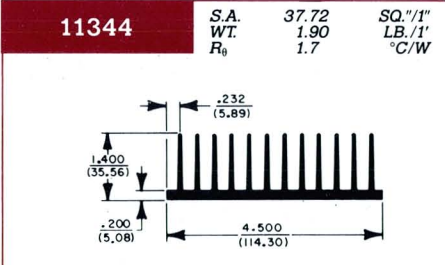
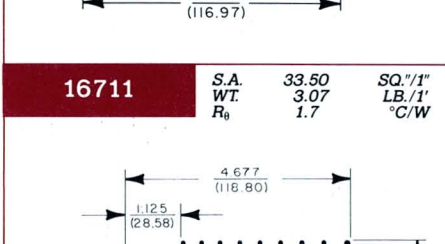
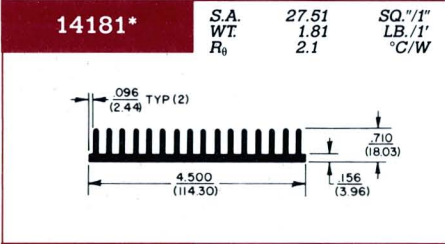
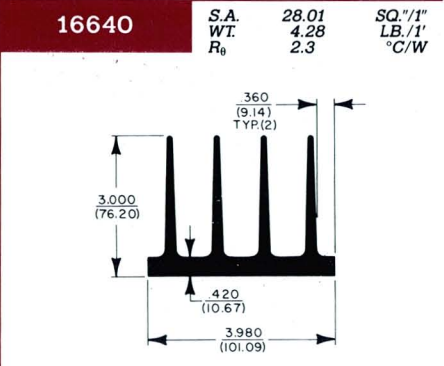
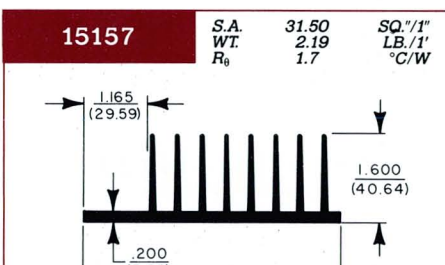
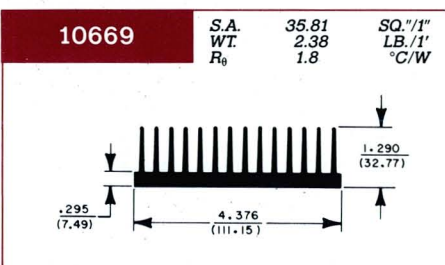
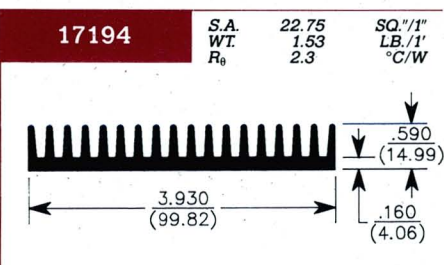
S.A. 5.26
 WT. .20
 R_θ 9.0
 SQ."/I"
 LB./I"
 °C/W







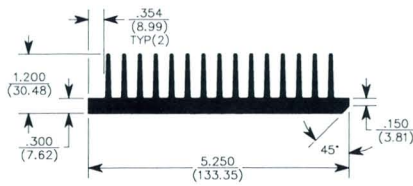
*NORMALLY STOCKED.



*NORMALLY STOCKED.

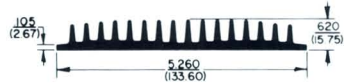
17233

S.A. 25.26 SQ."/1"
 WT. 3.10 LB./1'
 R_θ 2.3 °C/W



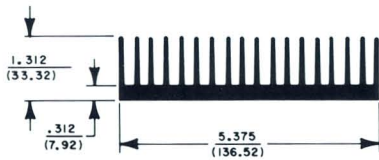
11609

S.A. 22.95 SQ."/1"
 WT. 1.75 LB./1'
 R_θ 2.4 °C/W



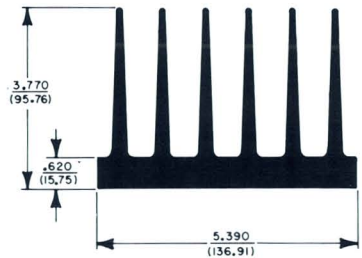
14730

S.A. 46.13 SQ."/1"
 WT. 3.48 LB./1'
 R_θ 1.1 °C/W



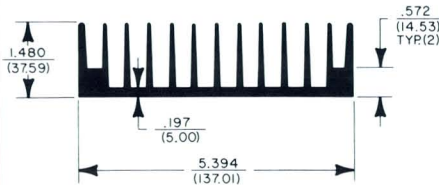
15217

S.A. 47.29 SQ."/1"
 WT. 8.50 LB./1'
 R_θ 1.2 °C/W



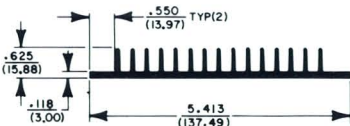
16528*

S.A. 42.08 SQ."/1"
 WT. 3.39 LB./1'
 R_θ 1.2 °C/W



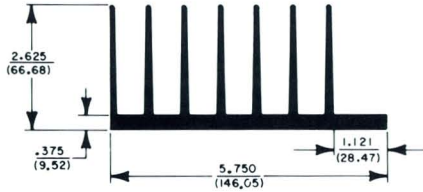
15817

S.A. 25.44 SQ."/1"
 WT. 1.44 LB./1'
 R_θ 2.3 °C/W



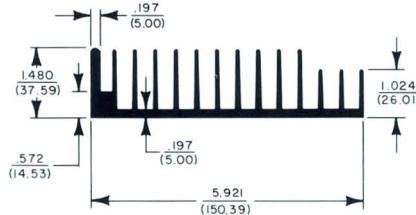
11815

S.A. 37.63 SQ."/1"
 WT. 4.14 LB./1'
 R_θ 1.3 °C/W



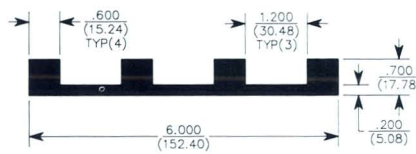
16529*

S.A. 44.07 SQ."/1"
 WT. 3.19 LB./1'
 R_θ 1.3 °C/W



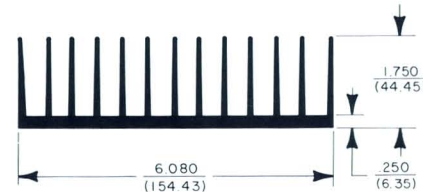
17180

S.A. 16.40 SQ."/1"
 WT. 2.88 LB./1'
 R_θ 3.2 °C/W



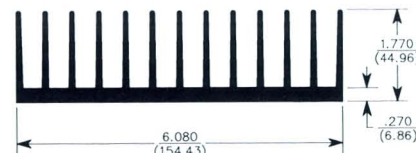
15323

S.A. 50.32 SQ."/1"
 WT. 4.08 LB./1'
 R_θ 1.2 °C/W



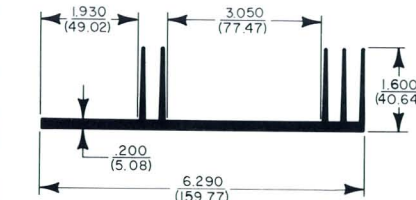
17145

S.A. 51.00 SQ."/1"
 WT. 4.25 LB./1'
 R_θ 1.17 °C/W



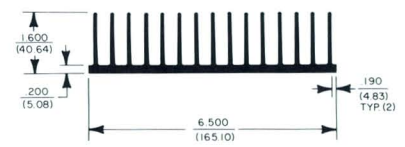
14693

S.A. 26.53 SQ."/1"
 WT. 2.14 LB./1'
 R_θ 2.1 °C/W



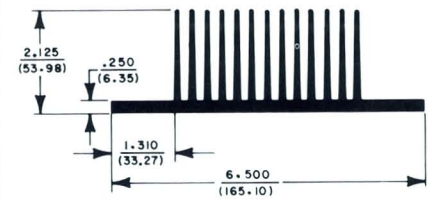
11343

S.A. 54.59 SQ."/1"
 WT. 3.60 LB./1'
 R_θ 1.3 °C/W



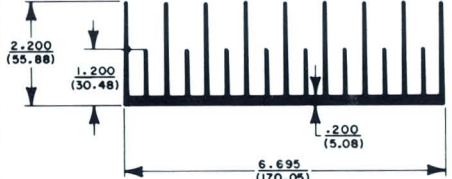
15199

S.A. 61.86 SQ."/1"
 WT. 4.44 LB./1'
 R_θ 1.6 °C/W



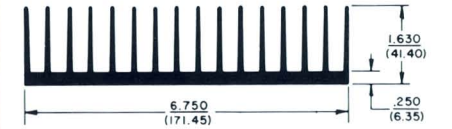
15558

S.A. 72.08 SQ."/1"
 WT. 4.00 LB./1'
 R_θ .8 °C/W



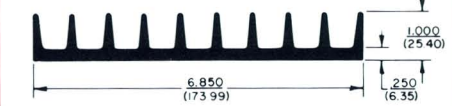
14288*

S.A. 57.05 SQ."/1"
 WT. 4.09 LB./1'
 R_θ 1.0 °C/W



11689*

S.A. 27.50 SQ."/1"
 WT. 3.31 LB./1'
 R_θ 1.5 °C/W



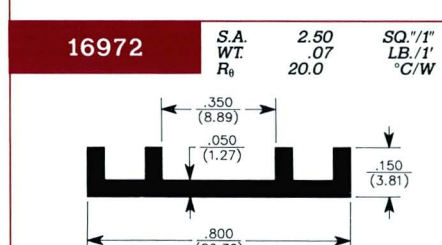
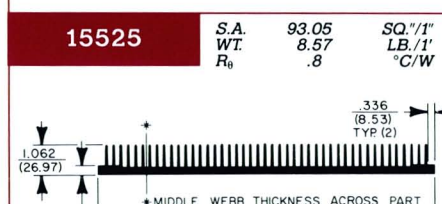
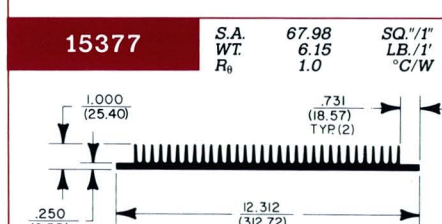
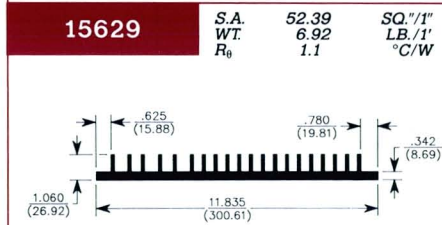
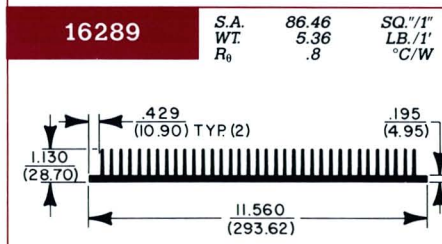
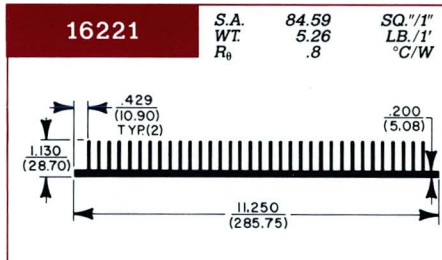
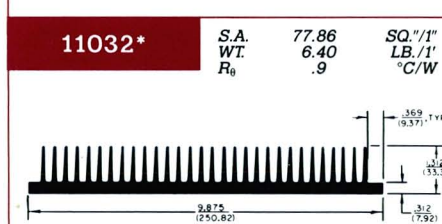
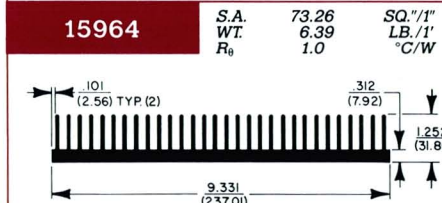
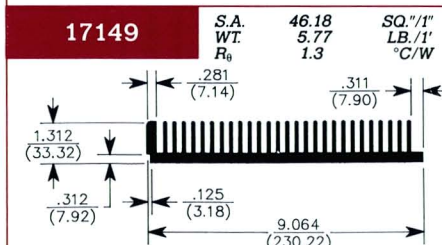
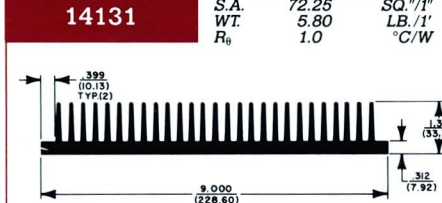
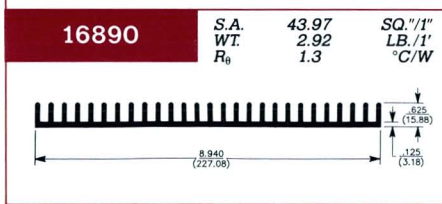
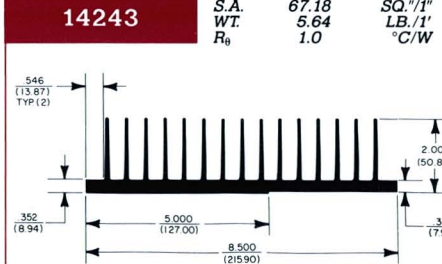
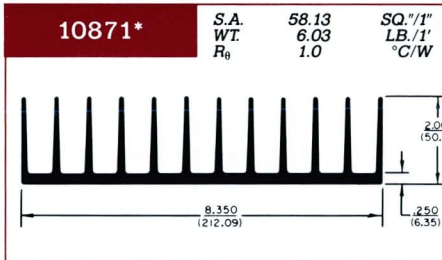
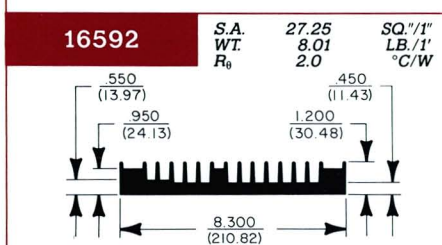
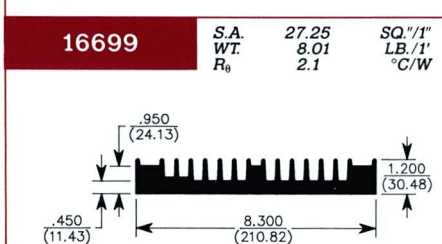
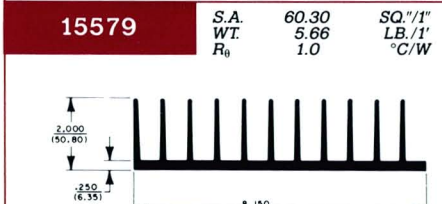
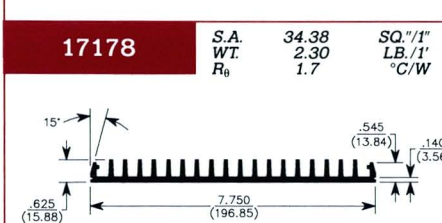
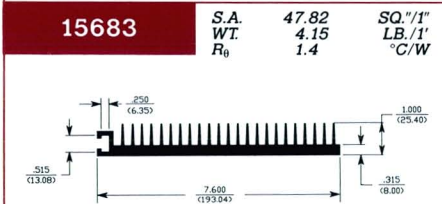
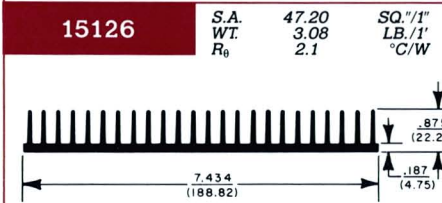
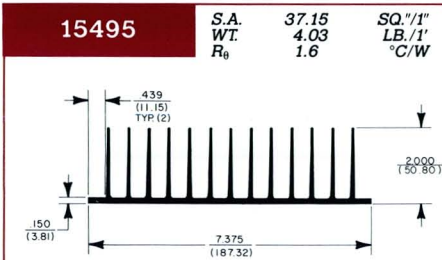
10762*

S.A. 43.86 SQ."/1"
 WT. 5.44 LB./1'
 R_θ 1.7 °C/W



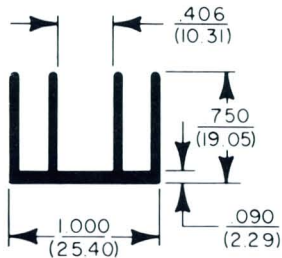
Extruded Heat Sink Profiles

Thermalloy Inc.
 P.O. Box 810839 • 2021 West Valley View Lane
 Dallas, Texas 75381-0839 • TEL: 214-243-4321



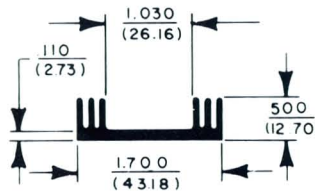
14479

S.A. 7.21 SQ."/1"
 WT. .26 LB./1'
 R₀ 6.4 °C/W



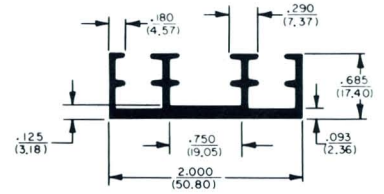
14331

S.A. 8.00 SQ."/1"
 WT. .40 LB./1'
 R₀ 5.3 °C/W



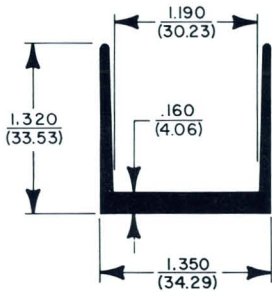
11773*

S.A. 11.37 SQ."/1"
 WT. .55 LB./1'
 R₀ 3.7 °C/W



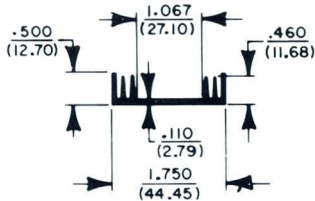
16360

S.A. 7.57 SQ."/1"
 WT. .46 LB./1'
 R₀ 6.9 °C/W



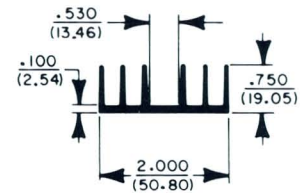
11768

S.A. 7.95 SQ."/1"
 WT. .37 LB./1'
 R₀ 5.3 °C/W



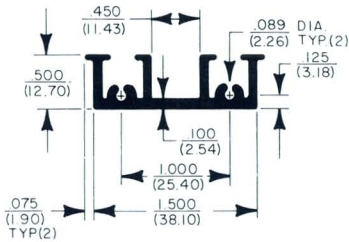
15351

S.A. 11.07 SQ."/1"
 WT. .50 LB./1'
 R₀ 3.2 °C/W



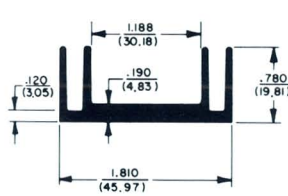
16320

S.A. 8.19 SQ."/1"
 WT. .39 LB./1'
 R₀ 6.0 °C/W



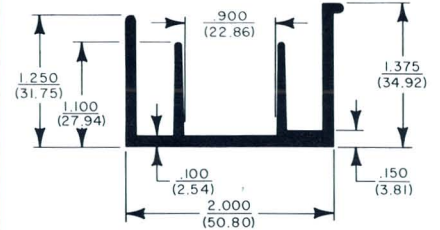
10859

S.A. 8.51 SQ."/1"
 WT. .60 LB./1'
 R₀ 5.0 °C/W



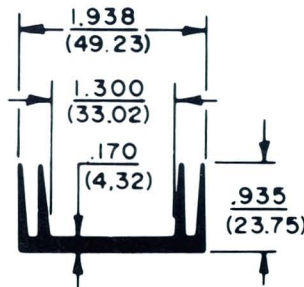
15859

S.A. 12.93 SQ."/1"
 WT. .78 LB./1'
 R₀ 4.0 °C/W



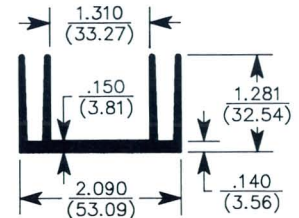
10549*

S.A. 10.34 SQ."/1"
 WT. .68 LB./1'
 R₀ 4.6 °C/W



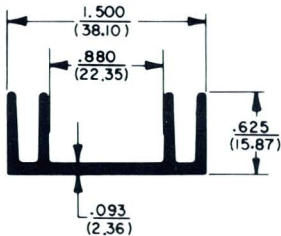
17164

S.A. 13.58 SQ."/1"
 WT. .76 LB./1'
 R₀ 3.7 °C/W



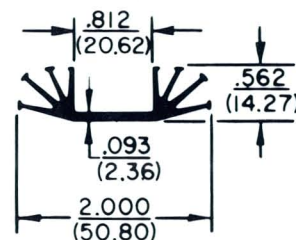
14119*

S.A. 7.21 SQ."/1"
 WT. .32 LB./1'
 R₀ 7.2 °C/W



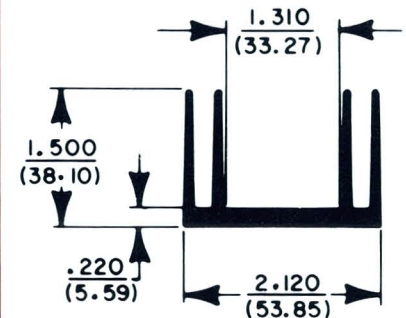
10879*

S.A. 9.52 SQ."/1"
 WT. .38 LB./1'
 R₀ 5.6 °C/W



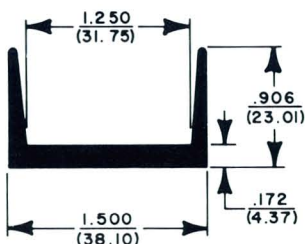
15012

S.A. 16.24 SQ."/1"
 WT. .94 LB./1'
 R₀ 2.9 °C/W



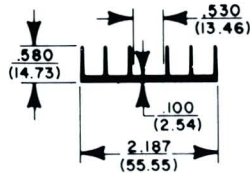
14489

S.A. 6.10 SQ."/1"
 WT. .47 LB./1'
 R₀ 8.5 °C/W



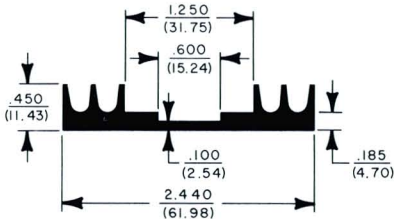
15785

S.A. 9.44
 WT. .45
 R_θ 4.4
 SQ."/1" LB./1" °C/W



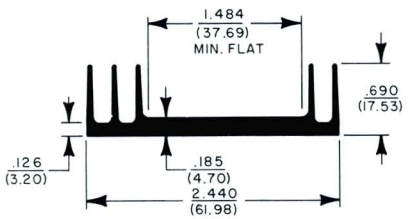
16861

S.A. 8.13
 WT. .61
 R_θ 6.0
 SQ."/1" LB./1" °C/W



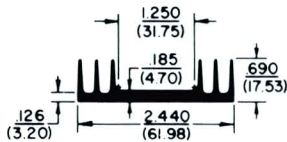
16833

S.A. 10.16
 WT. .65
 R_θ 4.8
 SQ."/1" LB./1" °C/W



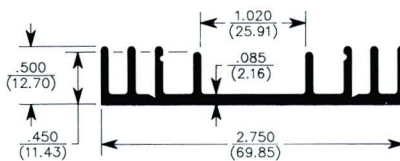
14094*

S.A. 11.21
 WT. .69
 R_θ 3.2
 SQ."/1" LB./1" °C/W



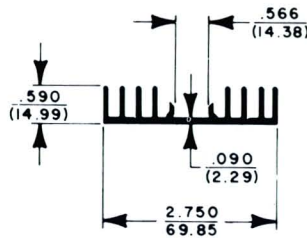
17156

S.A. 12.05
 WT. .53
 R_θ 4.2
 SQ."/1" LB./1" °C/W



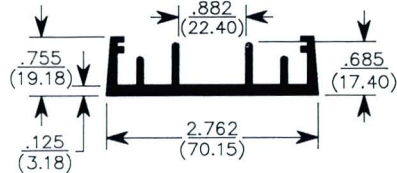
15556

S.A. 14.50
 WT. .61
 R_θ 3.1
 SQ."/1" LB./1" °C/W



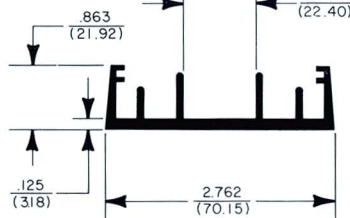
16718

S.A. 12.58
 WT. .73
 R_θ 4.2
 SQ."/1" LB./1" °C/W



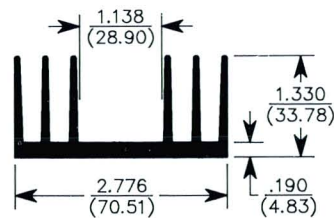
16778

S.A. 13.58
 WT. .75
 R_θ 3.4
 SQ."/1" LB./1" °C/W



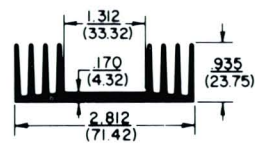
17186

S.A. 21.59
 WT. 1.18
 R_θ 2.6
 SQ."/1" LB./1" °C/W



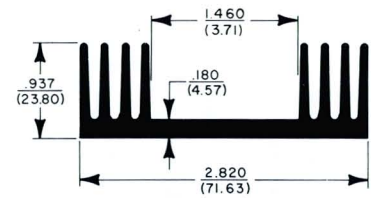
11074*

S.A. 18.12
 WT. 1.25
 R_θ 2.8
 SQ."/1" LB./1" °C/W



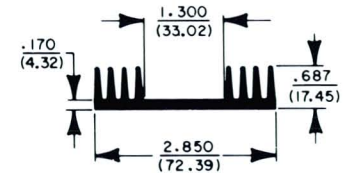
16477

S.A. 15.95
 WT. 1.18
 R_θ 3.2
 SQ."/1" LB./1" °C/W



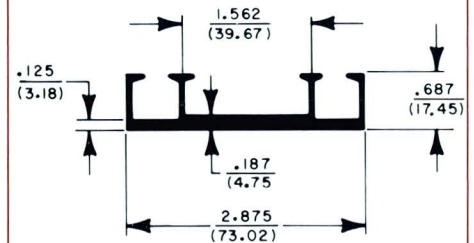
14122

S.A. 13.53
 WT. 1.00
 R_θ 3.0
 SQ."/1" LB./1" °C/W



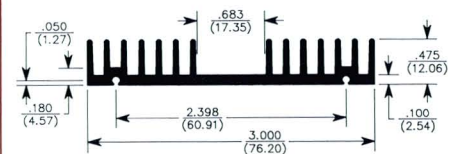
14154

S.A. 11.40
 WT. .94
 R_θ 3.7
 SQ."/1" LB./1" °C/W



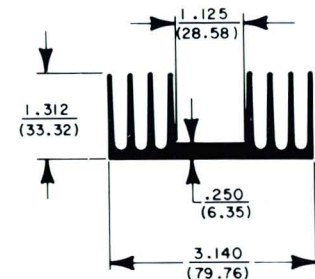
17019

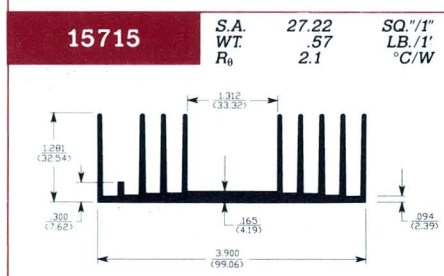
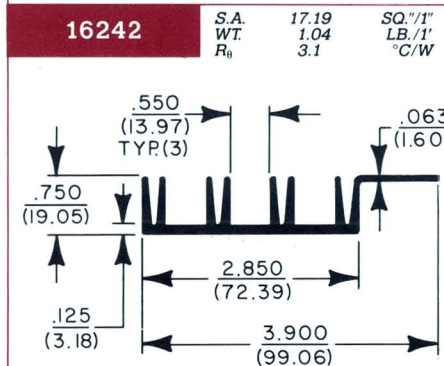
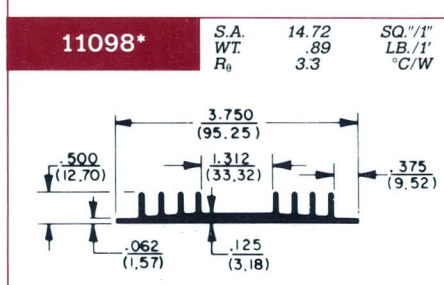
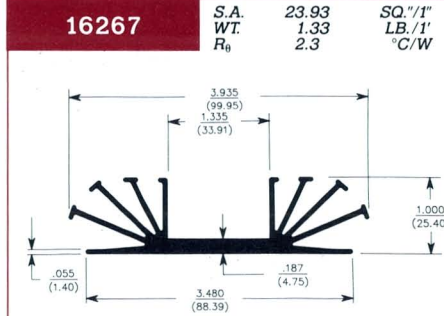
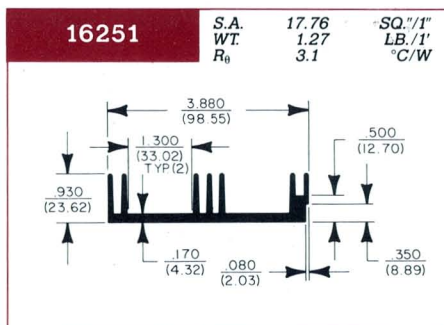
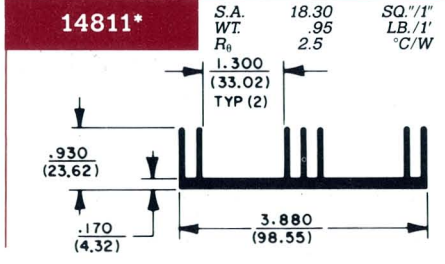
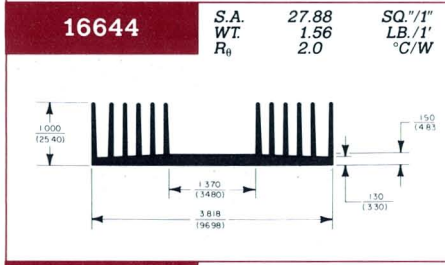
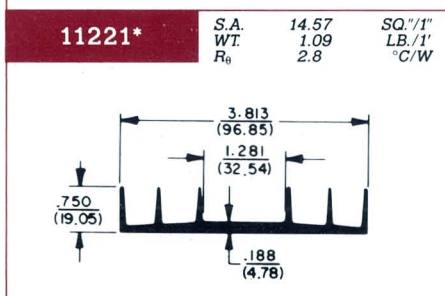
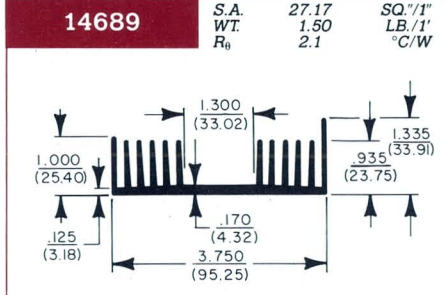
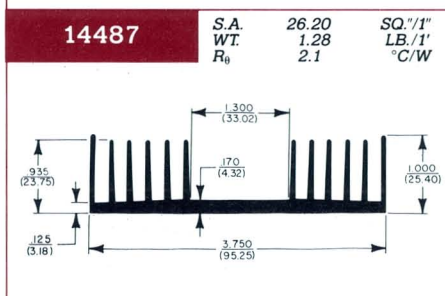
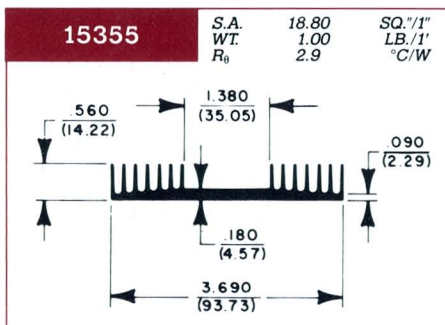
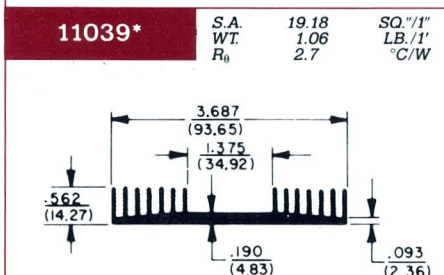
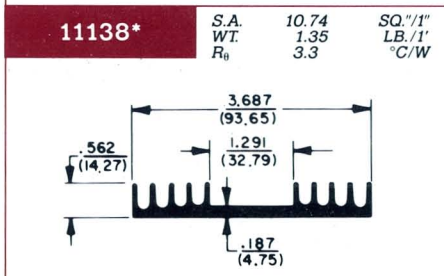
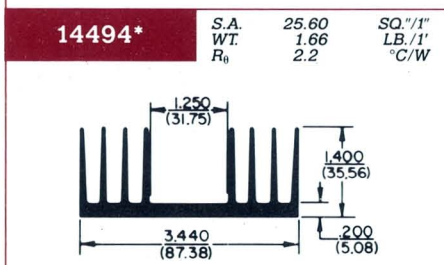
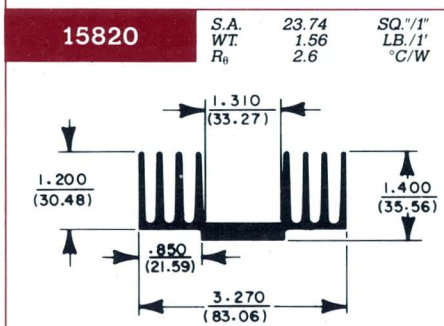
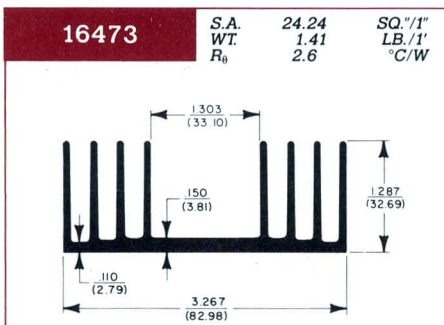
S.A. 16.23
 WT. .70
 R_θ 3.3
 SQ."/1" LB./1" °C/W



14938

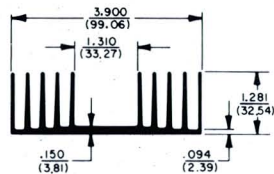
S.A. 24.41
 WT. 1.62
 R_θ 2.3
 SQ."/1" LB./1" °C/W



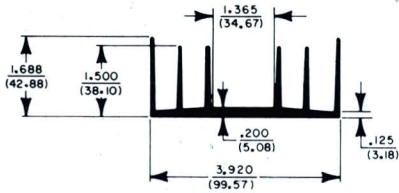


*NORMALLY STOCKED.

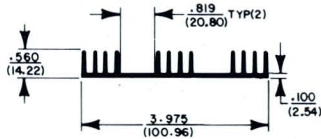
10544* S.A. 31.13 SQ."/I" WT. 1.64 LB./I" R_θ 2.0 °C/W



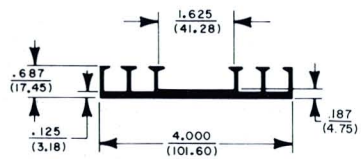
15518 S.A. 23.84 SQ."/I" WT. 1.34 LB./I" R_θ 2.4 °C/W



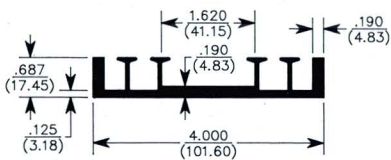
15819 S.A. 19.12 SQ."/I" WT. .95 LB./I" R_θ 2.4 °C/W



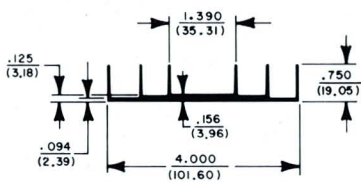
14189 S.A. 16.97 SQ."/I" WT. 1.05 LB./I" R_θ 2.8 °C/W



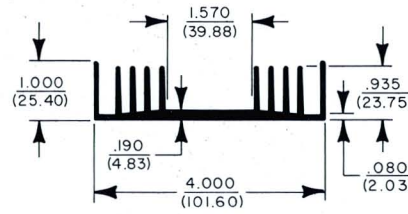
17041 S.A. 16.61 SQ."/I" WT. 1.22 LB./I" R_θ 3.3 °C/W



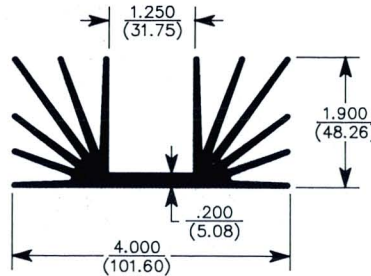
14861 S.A. 15.50 SQ."/I" WT. .88 LB./I" R_θ 2.6 °C/W



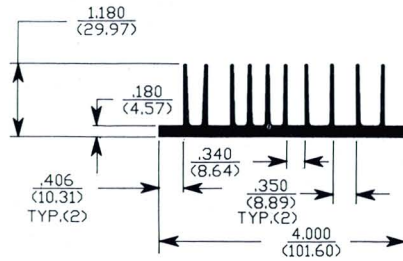
14920 S.A. 24.30 SQ."/I" WT. 1.32 LB./I" R_θ 2.3 °C/W



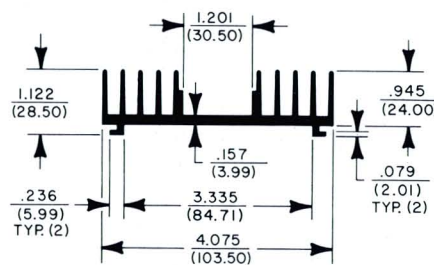
16983 S.A. 35.75 SQ."/I" WT. 2.31 LB./I" R_θ 1.6 °C/W



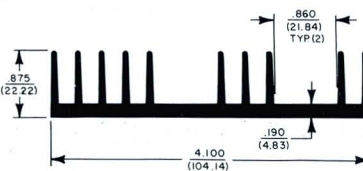
14787 S.A. 27.50 SQ."/I" WT. 1.61 LB./I" R_θ 1.7 °C/W



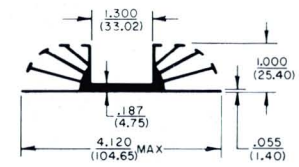
15839 S.A. 24.46 SQ."/I" WT. 1.84 LB./I" R_θ 2.1 °C/W



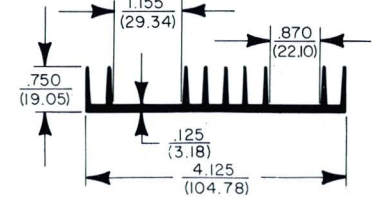
15993 S.A. 21.54 SQ."/I" WT. 1.59 LB./I" R_θ 2.5 °C/W



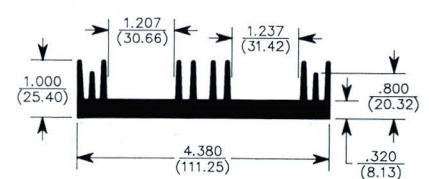
10429* S.A. 24.21 SQ."/I" WT. 1.23 LB./I" R_θ 2.1 °C/W



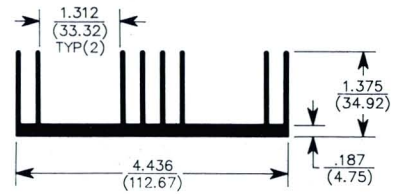
16288 S.A. 19.07 SQ."/I" WT. 1.05 LB./I" R_θ 2.7 °C/W



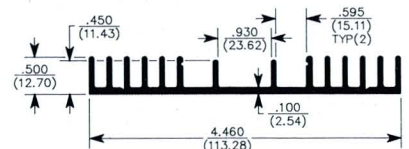
16728 S.A. 20.52 SQ."/I" WT. 2.23 LB./I" R_θ 2.6 °C/W



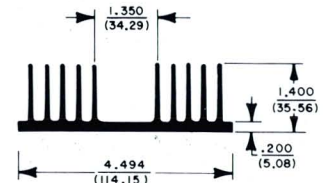
17179 S.A. 28.24 SQ."/I" WT. 1.69 LB./I" R_θ 2.0 °C/W



17165 S.A. 19.68 SQ."/I" WT. .95 LB./I" R_θ 2.7 °C/W

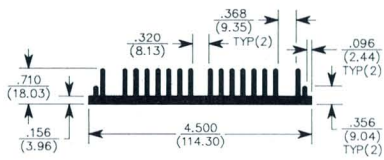


14716 S.A. 32.18 SQ."/I" WT. 2.16 LB./I" R_θ 1.9 °C/W



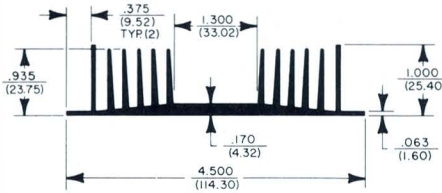
16845

S.A. 27.31
 WT. 1.68
 R₀ 2.1
 SQ."/I"
 LB./I"
 °C/W



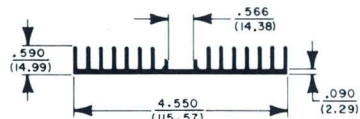
16586

S.A. 28.51
 WT. 1.60
 R₀ 1.6
 SQ."/I"
 LB./I"
 °C/W



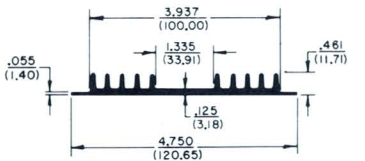
15555

S.A. 24.00
 WT. 1.05
 R₀ 2.4
 SQ."/I"
 LB./I"
 °C/W



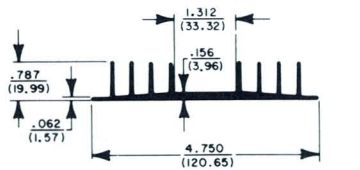
10655*

S.A. 15.90
 WT. .96
 R₀ 2.9
 SQ."/I"
 LB./I"
 °C/W



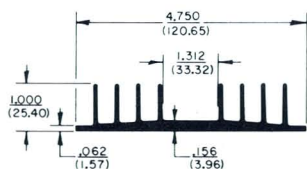
15624

S.A. 23.88
 WT. 1.1
 R₀ 2.2
 SQ."/I"
 LB./I"
 °C/W



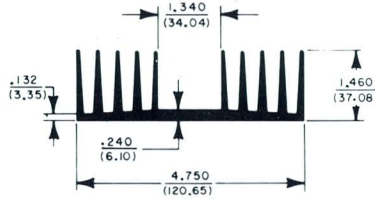
10638*

S.A. 24.68
 WT. 1.48
 R₀ 2.1
 SQ."/I"
 LB./I"
 °C/W



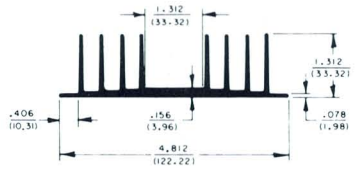
14772

S.A. 34.74
 WT. 2.84
 R₀ 1.9
 SQ."/I"
 LB./I"
 °C/W



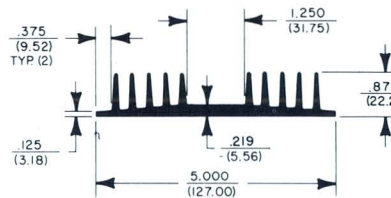
11140*

S.A. 28.25
 WT. 1.64
 R₀ 1.9
 SQ."/I"
 LB./I"
 °C/W



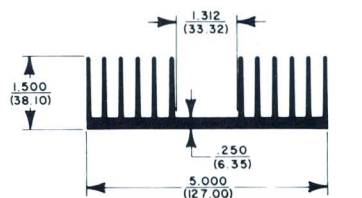
16188

S.A. 35.05
 WT. 1.83
 R₀ 1.6
 SQ."/I"
 LB./I"
 °C/W



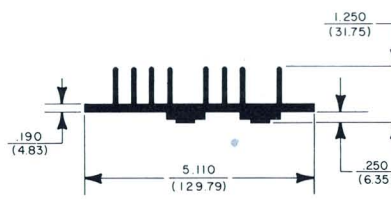
15786

S.A. 40.29
 WT. 2.83
 R₀ 1.3
 SQ."/I"
 LB./I"
 °C/W



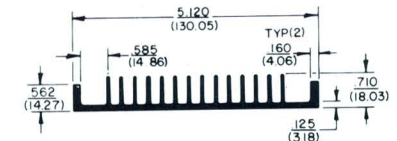
14336

S.A. 24.24
 WT. 2.37
 R₀ 2.2
 SQ."/I"
 LB./I"
 °C/W



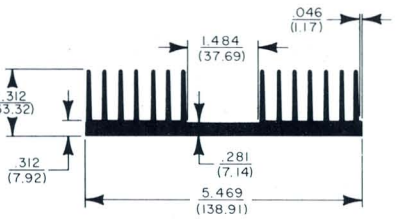
10870*

S.A. 28.62
 WT. 1.27
 R₀ 2.2
 SQ."/I"
 LB./I"
 °C/W



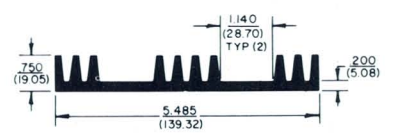
14671

S.A. 38.38
 WT. 3.27
 R₀ 1.5
 SQ."/I"
 LB./I"
 °C/W



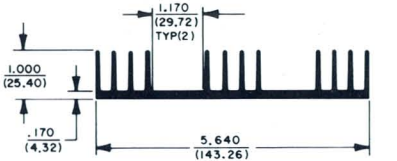
10514

S.A. 22.56
 WT. 2.44
 R₀ 2.1
 SQ."/I"
 LB./I"
 °C/W



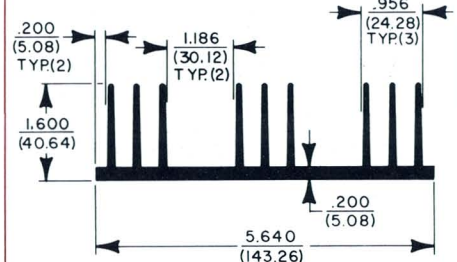
14808*

S.A. 30.70
 WT. 1.94
 R₀ 1.8
 SQ."/I"
 LB./I"
 °C/W



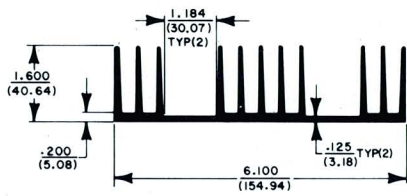
16519

S.A. 36.14
 WT. 2.58
 R₀ 1.5
 SQ."/I"
 LB./I"
 °C/W



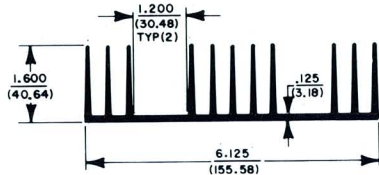
15477

S.A. 43.30
 WT. 2.76
 R₀ 1.2
 SQ."/1" LB./1" °C/W



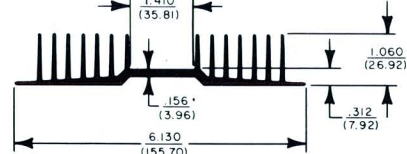
15314

S.A. 44.75
 WT. 2.38
 R₀ 1.2
 SQ."/1" LB./1" °C/W



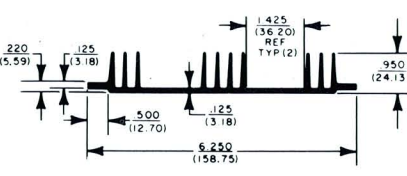
15524

S.A. 38.26
 WT. 1.90
 R₀ 1.7
 SQ."/1" LB./1" °C/W



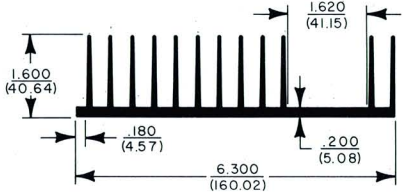
14580

S.A. 27.56
 WT. 1.68
 R₀ 2.0
 SQ."/1" LB./1" °C/W



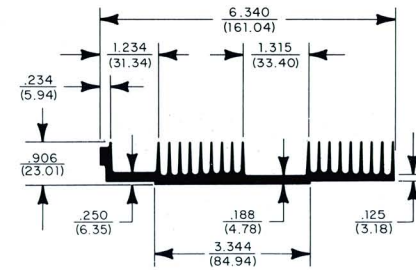
11244

S.A. 46.16
 WT. 3.18
 R₀ 2.7
 SQ."/1" LB./1" °C/W



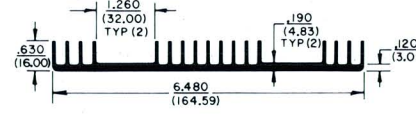
11907

S.A. 36.85
 WT. 2.38
 R₀ 1.6
 SQ."/1" LB./1" °C/W



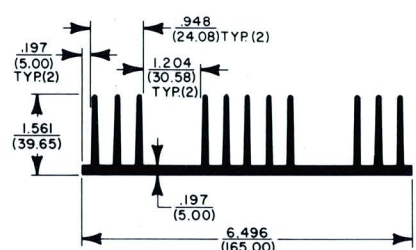
11165*

S.A. 29.35
 WT. 1.78
 R₀ 1.7
 SQ."/1" LB./1" °C/W



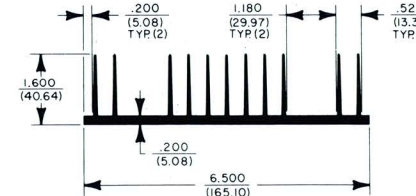
16544

S.A. 42.11
 WT. 2.88
 R₀ 1.3
 SQ."/1" LB./1" °C/W



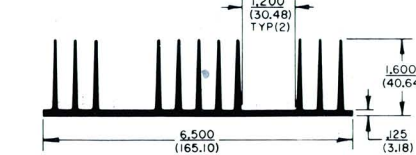
16255

S.A. 43.49
 WT. 2.90
 R₀ 1.2
 SQ."/1" LB./1" °C/W



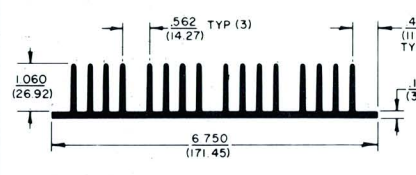
11498*

S.A. 44.67
 WT. 2.35
 R₀ 1.2
 SQ."/1" LB./1" °C/W



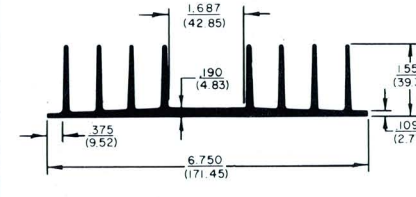
11680

S.A. 46.56
 WT. 2.96
 R₀ 1.4
 SQ."/1" LB./1" °C/W



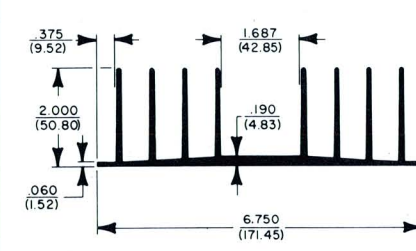
11080*

S.A. 34.55
 WT. 2.35
 R₀ 1.6
 SQ."/1" LB./1" °C/W



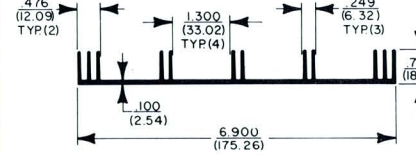
16513

S.A. 37.97
 WT. 2.35
 R₀ 1.5
 SQ."/1" LB./1" °C/W



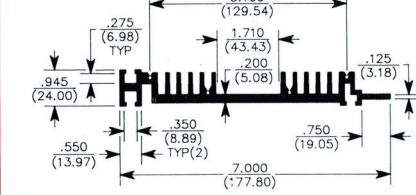
16465

S.A. 24.13
 WT. 1.29
 R₀ 2.1
 SQ."/1" LB./1" °C/W

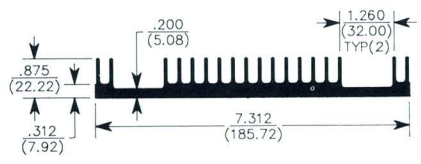


17038

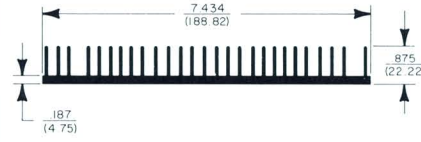
S.A. 33.43
 WT. 2.74
 R₀ 1.7
 SQ."/1" LB./1" °C/W



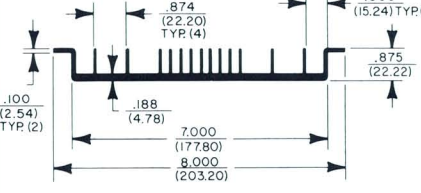
17083	S.A.	34.37	SQ."/1"
	WT.	3.18	LB./1'
	R ₀	1.6	°C/W



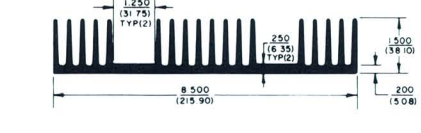
15141	S.A.	51.67	SQ."/1"
	WT.	3.05	LB./1'
	R ₀	1.2	°C/W



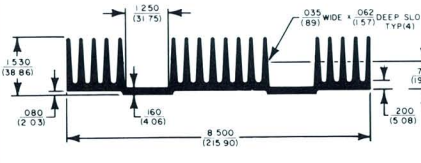
16587	S.A.	36.43	SQ."/1"
	WT.	2.51	LB./1'
	R ₀	1.4	°C/W



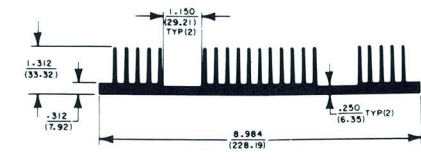
14495*	S.A.	61.61	SQ."/1"
	WT.	5.3	LB./1'
	R ₀	.9	°C/W



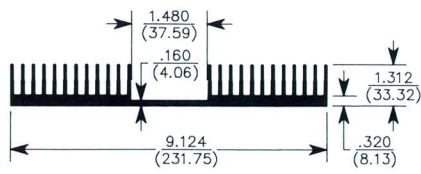
15540	S.A.	61.30	SQ."/1"
	WT.	5.43	LB./1'
	R ₀	1.1	°C/W



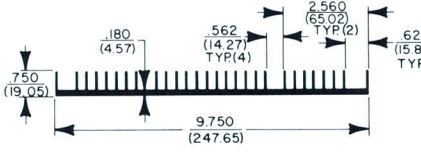
14659	S.A.	58.91	SQ."/1"
	WT.	4.88	LB./1'
	R ₀	.9	°C/W



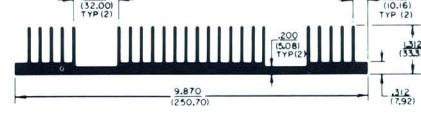
17006	S.A.	65.77	SQ."/1"
	WT.	5.21	LB./1'
	R ₀	1.1	°C/W



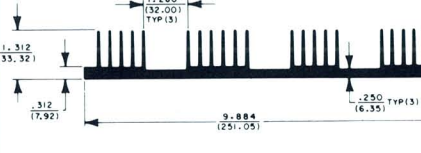
16509	S.A.	51.78	SQ."/1"
	WT.	3.21	LB./1'
	R ₀	1.1	°C/W



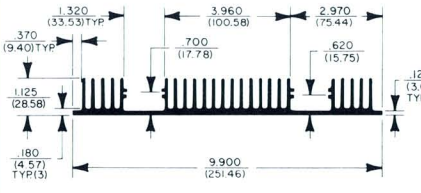
11942*	S.A.	71.13	SQ."/1"
	WT.	5.21	LB./1'
	R ₀	.8	°C/W



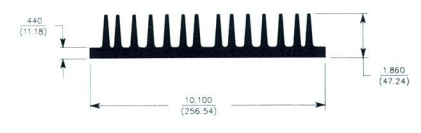
15718	S.A.	64.85	SQ."/1"
	WT.	5.32	LB./1'
	R ₀	1.1	°C/W



16115	S.A.	64.96	SQ."/1"
	WT.	3.91	LB./1'
	R ₀	.9	°C/W



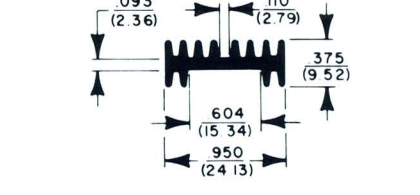
16591	S.A.	56.75	SQ."/1"
	WT.	10.78	LB./1'
	R ₀	1.1	°C/W



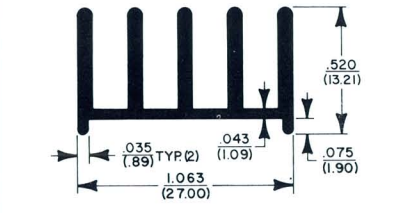
16508	S.A.	56.86	SQ."/1"
	WT.	4.00	LB./1'
	R ₀	1.1	°C/W



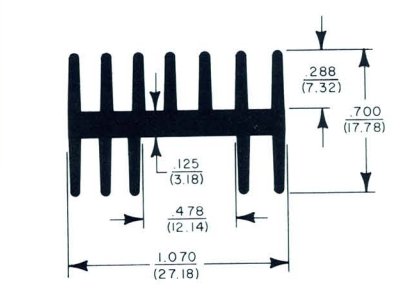
15468	S.A.	4.92	SQ."/1"
	WT.	.20	LB./1'
	R ₀	5.6	°C/W



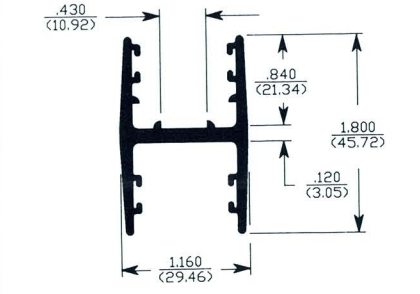
16074	S.A.	6.2	SQ."/1"
	WT.	.24	LB./1'
	R ₀	6.7	°C/W

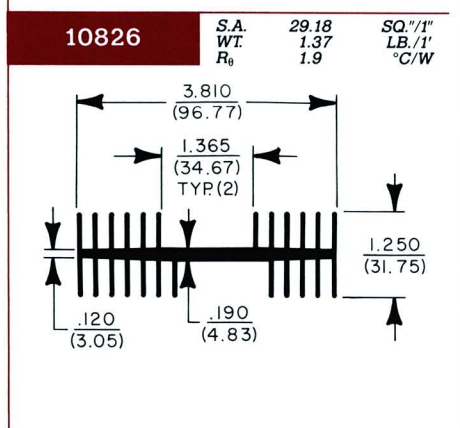
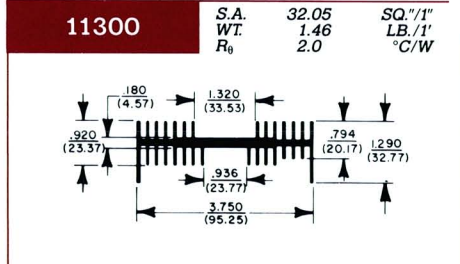
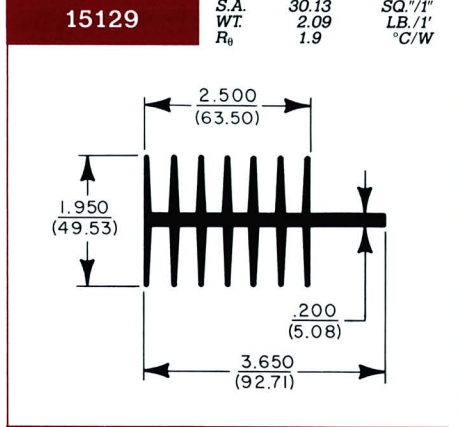
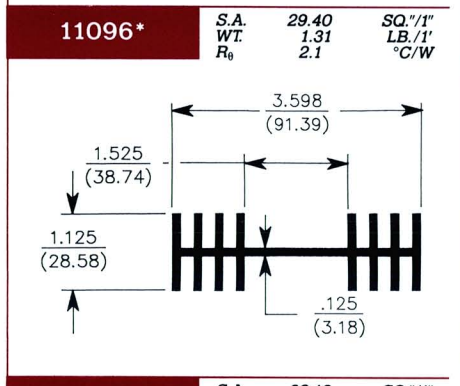
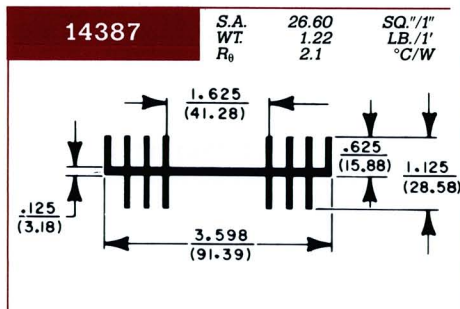
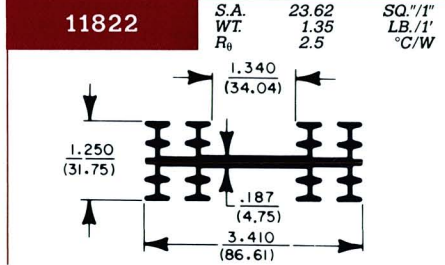
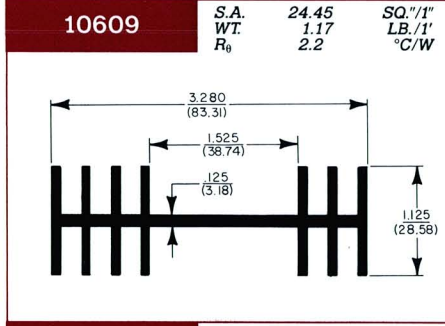
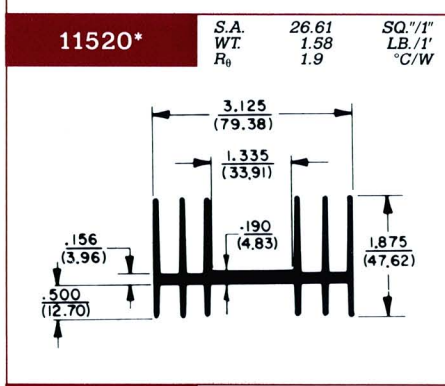
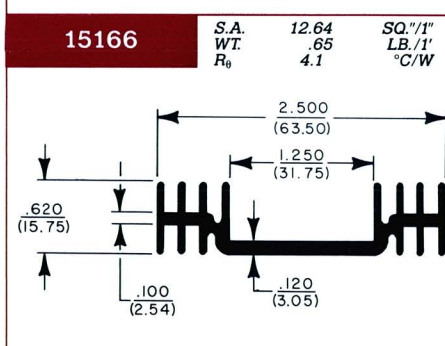
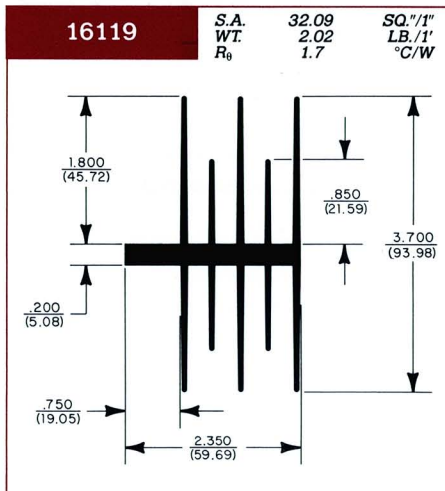
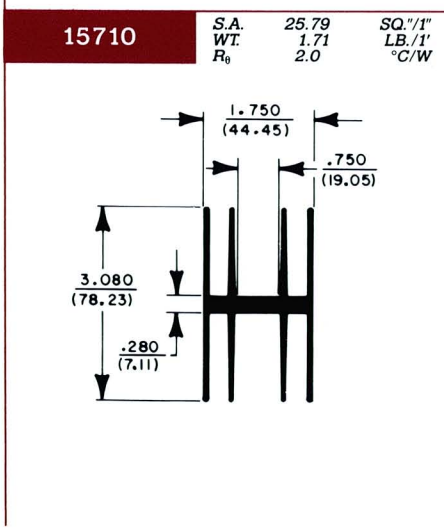
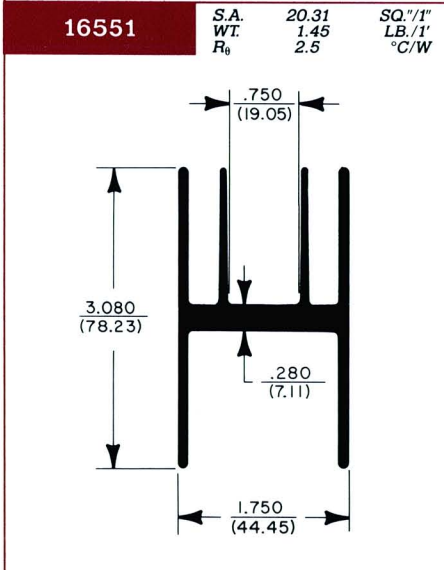
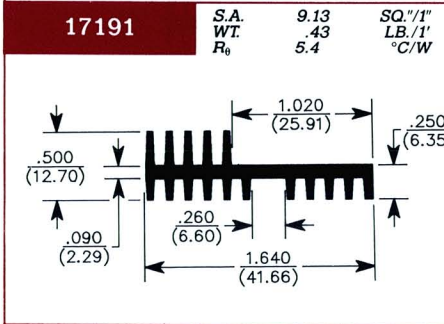
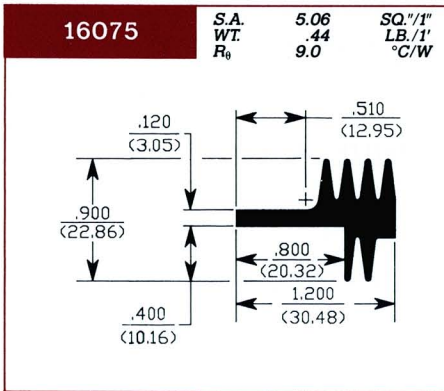


16021	S.A.	8.83	SQ."/1"
	WT.	.38	LB./1'
	R ₀	6.0	°C/W



15719	S.A.	11.47	SQ."/1"
	WT.	.57	LB./1'
	R ₀	4.2	°C/W





14389 S.A. 22.54 SQ./1" 1.200
 WT. 1.26 LB./1' (30.48)
 R₀ 2.9 °C/W

14393 S.A. 24.10 SQ./1" 1.125
 WT. 1.33 LB./1' (28.58)
 R₀ 2.5 °C/W

11193* S.A. 29.24 SQ./1" 1.125
 WT. 1.42 LB./1' (28.58)
 R₀ 2.1 °C/W

15640 S.A. 33.80 SQ./1" 1.875
 WT. 2.60 LB./1' (47.62)
 R₀ 1.8 °C/W

16230 S.A. 26.79 SQ./1" 1.250
 WT. 1.59 LB./1' (31.75)
 R₀ 2.2 °C/W

10271* S.A. 29.94 SQ./1" 1.312
 WT. 1.50 LB./1' (33.32)
 R₀ 2.1 °C/W

15318 S.A. 47.64 SQ./1" 1.750
 WT. 2.72 LB./1' (44.45)
 R₀ 1.8 °C/W

10678* S.A. 36.19 SQ./1" 1.900
 WT. 1.82 LB./1' (50.80)
 R₀ 1.6 °C/W

10470* S.A. 46.68 SQ./1" 2.625
 WT. 2.53 LB./1' (66.68)
 R₀ 1.1 °C/W

11215* S.A. 35.40 SQ./1" 1.500
 WT. 2.33 LB./1' (38.10)
 R₀ 1.7 °C/W

11988 S.A. 50.10 SQ./1" 1.250
 WT. 2.91 LB./1' (31.75)
 R₀ 1.0 °C/W

15727 S.A. 31.67 SQ./1" 2.200
 WT. 3.34 LB./1' (55.88)
 R₀ 1.7 °C/W

15302 S.A. 39.20 SQ./1" 1.375
 WT. 2.13 LB./1' (34.92)
 R₀ 1.8 °C/W

14895 S.A. 55.16 SQ./1" 1.250
 WT. 2.50 LB./1' (31.75)
 R₀ 1.3 °C/W

14096 S.A. 63.00 SQ./1" 2.750
 WT. 4.43 LB./1' (69.85)
 R₀ .8 °C/W

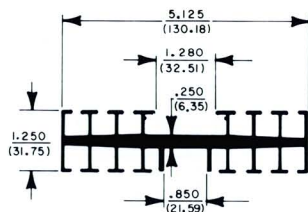
*NORMALLY STOCKED.

Extruded Heat Sink Profiles

Thermalloy, Inc.
 P.O. Box 810839 • 2021 West Valley View Lane
 Dallas, Texas 75381-0839 • TEL: 214-243-4321

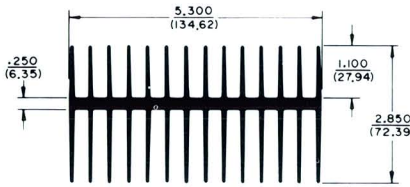
14476

S.A. 38.27
 WT. 2.28
 R_θ 1.7
 SQ."/1" LB./1" °C/W



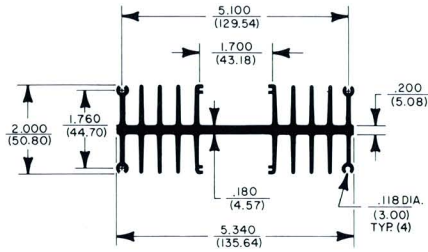
11083

S.A. 79.90
 WT. 4.99
 R_θ 1.4
 SQ."/1" LB./1" °C/W



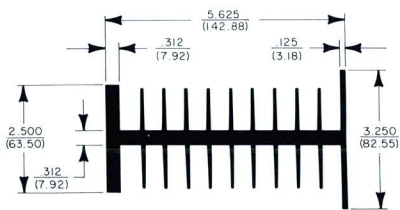
16390

S.A. 48.10
 WT. 3.21
 R_θ 1.3
 SQ."/1" LB./1" °C/W



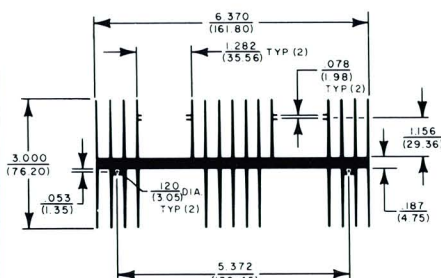
15928

S.A. 57.12
 WT. 4.96
 R_θ 1.1
 SQ."/1" LB./1" °C/W



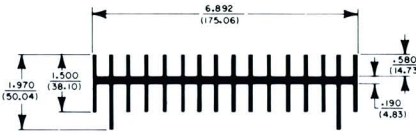
12274

S.A. 92.58
 WT. 3.84
 R_θ 1.0
 SQ."/1" LB./1" °C/W



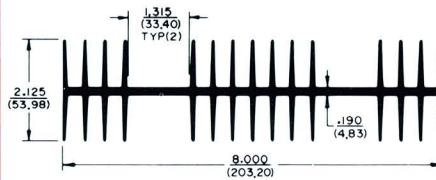
10878

S.A. 57.96
 WT. 3.63
 R_θ 1.1
 SQ."/1" LB./1" °C/W



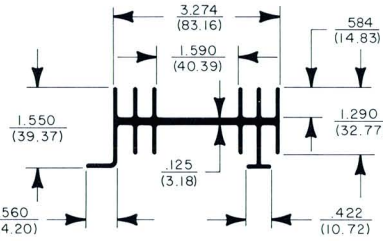
10550*

S.A. 71.76
 WT. 4.76
 R_θ .8
 SQ."/1" LB./1" °C/W



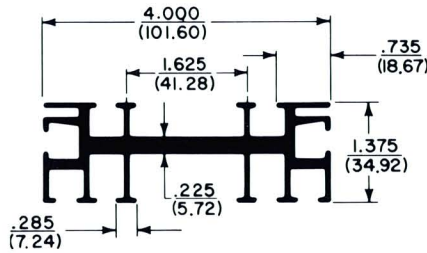
15244

S.A. 23.53
 WT. 1.13
 R_θ 2.3
 SQ."/1" LB./1" °C/W



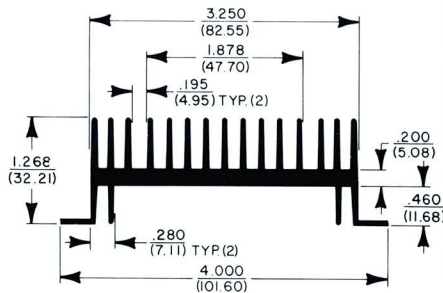
11511*

S.A. 26.34
 WT. 1.83
 R_θ 2.0
 SQ."/1" LB./1" °C/W



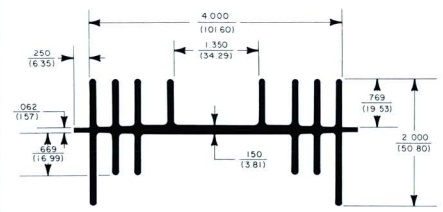
16116

S.A. 29.43
 WT. 1.65
 R_θ 2.4
 SQ."/1" LB./1" °C/W



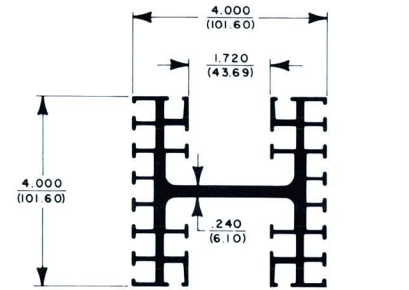
11741

S.A. 30.74
 WT. 1.92
 R_θ 1.9
 SQ."/1" LB./1" °C/W



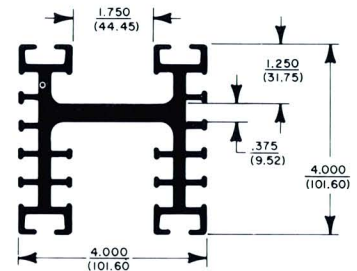
11859

S.A. 54.33
 WT. 4.22
 R_θ 1.2
 SQ."/1" LB./1" °C/W



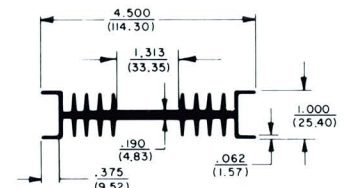
14744

S.A. 48.42
 WT. 4.74
 R_θ 1.3
 SQ."/1" LB./1" °C/W



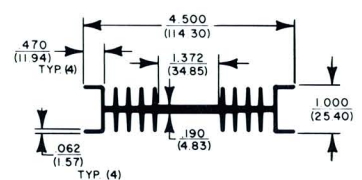
10273*

S.A. 24.75
 WT. 1.68
 R_θ 2.1
 SQ."/1" LB./1" °C/W



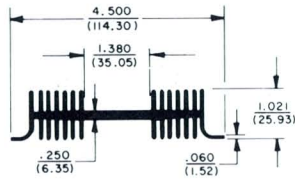
14159

S.A. 24.75
 WT. 1.80
 R_θ 2.1
 SQ."/1" LB./1" °C/W



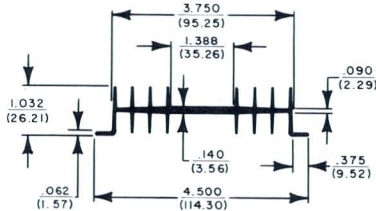
10753*

S.A. 31.76
 WT. 1.84
 R₀ 2.2
 SQ."/I" LB./I" °C/W



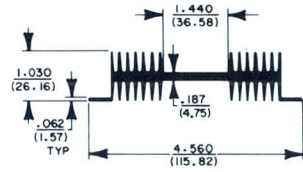
10747*

S.A. 20.53
 WT. 1.02
 R₀ 2.1
 SQ."/I" LB./I" °C/W



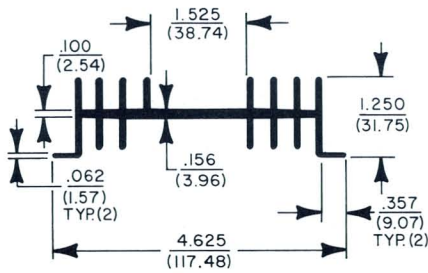
15608

S.A. 37.92
 WT. 1.65
 R₀ 1.8
 SQ."/I" LB./I" °C/W



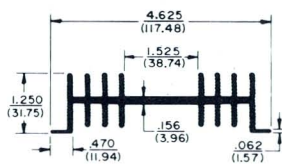
16071

S.A. 29.55
 WT. 1.5
 R₀ 1.9
 SQ."/I" LB./I" °C/W



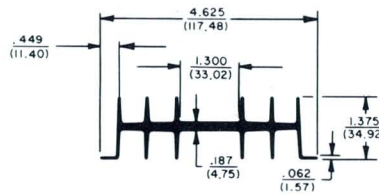
10229*

S.A. 31.76
 WT. 1.84
 R₀ 1.9
 SQ."/I" LB./I" °C/W



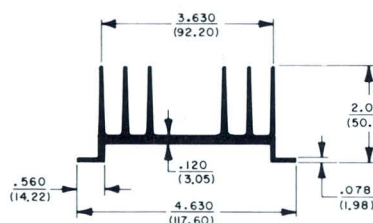
10868

S.A. 22.65
 WT. 1.50
 R₀ 2.1
 SQ."/I" LB./I" °C/W



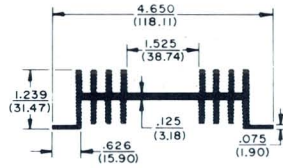
11611

S.A. 27.82
 WT. 1.86
 R₀ 2.2
 SQ."/I" LB./I" °C/W



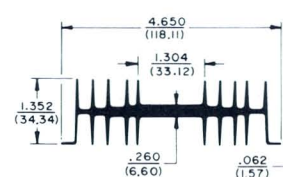
10989*

S.A. 31.96
 WT. 1.44
 R₀ 2.1
 SQ."/I" LB./I" °C/W



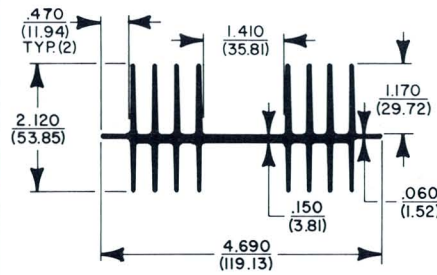
10749*

S.A. 31.49
 WT. 1.74
 R₀ 1.9
 SQ."/I" LB./I" °C/W



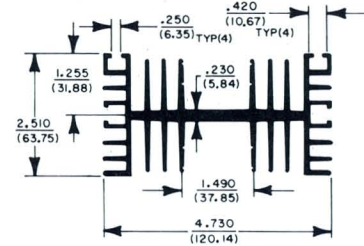
16712

S.A. 40.19
 WT. 2.19
 R₀ 1.5
 SQ."/I" LB./I" °C/W



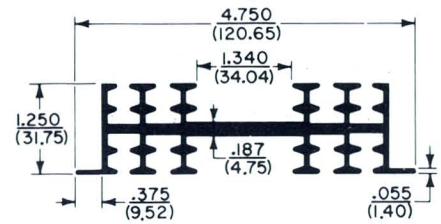
14773

S.A. 62.00
 WT. 3.78
 R₀ .8
 SQ."/I" LB./I" °C/W



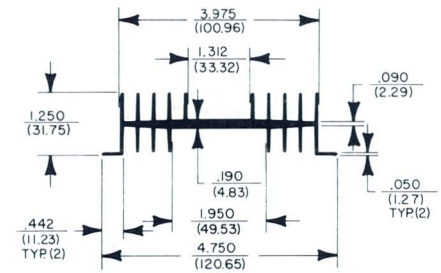
11550

S.A. 31.50
 WT. 1.69
 R₀ 2.0
 SQ."/I" LB./I" °C/W



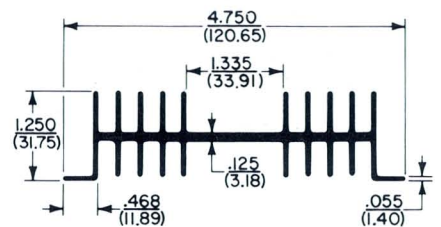
16101

S.A. 28.93
 WT. 1.44
 R₀ 1.9
 SQ."/I" LB./I" °C/W



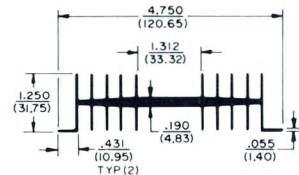
11700

S.A. 30.50
 WT. 1.42
 R₀ 2.0
 SQ."/I" LB./I" °C/W



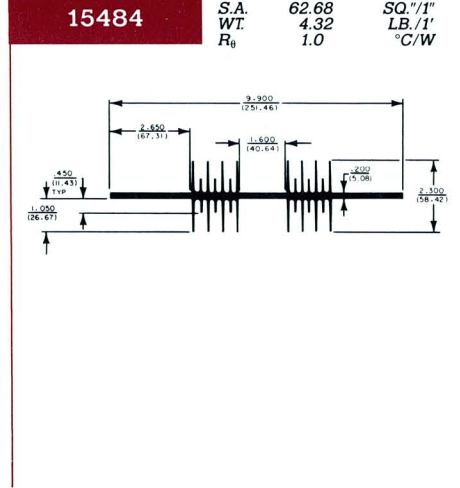
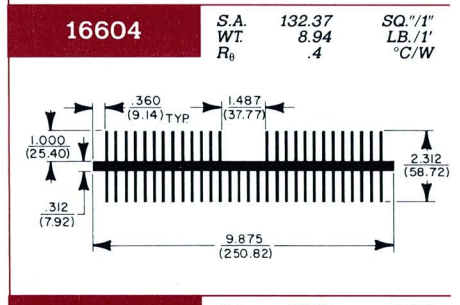
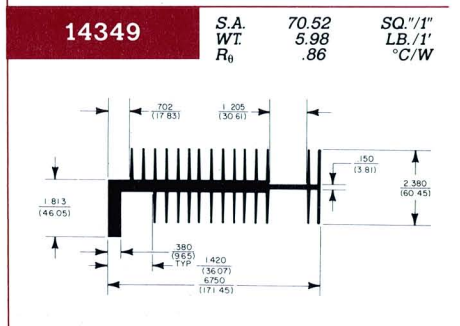
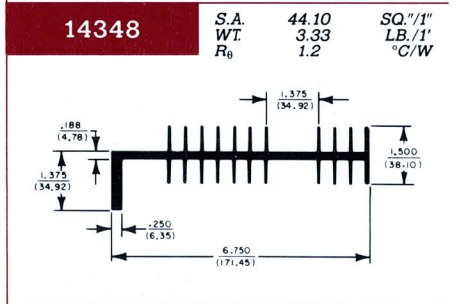
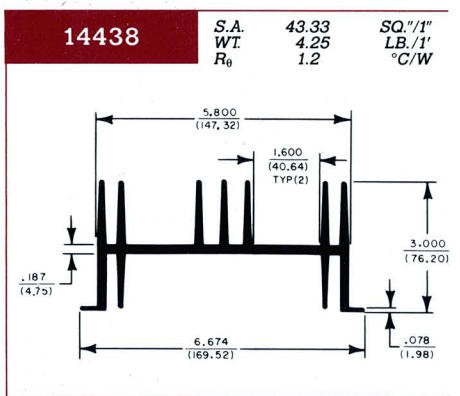
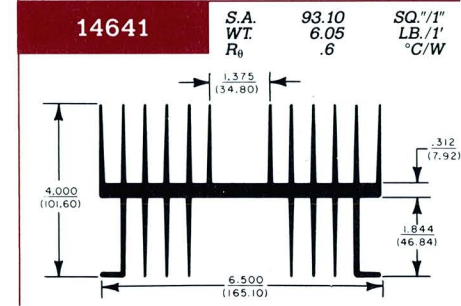
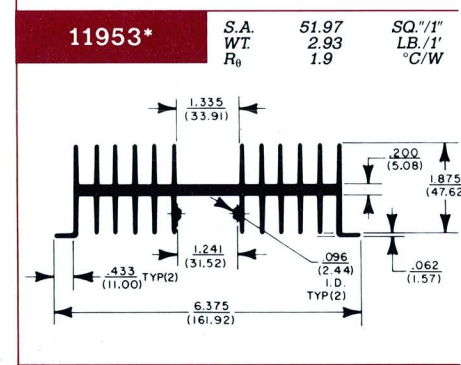
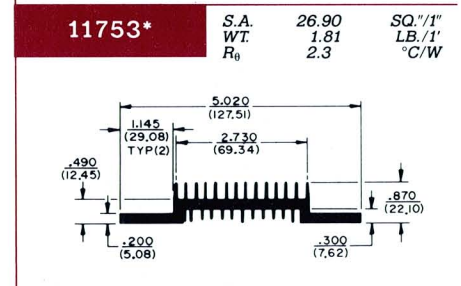
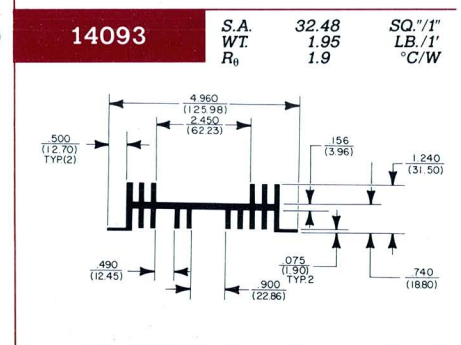
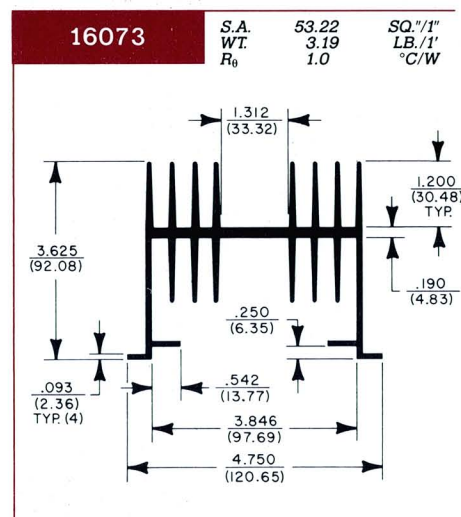
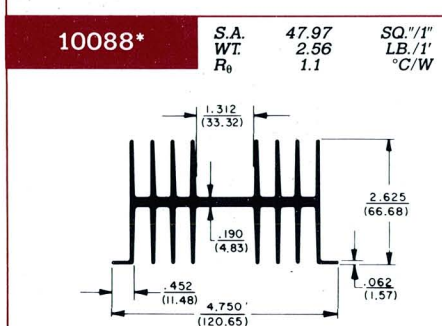
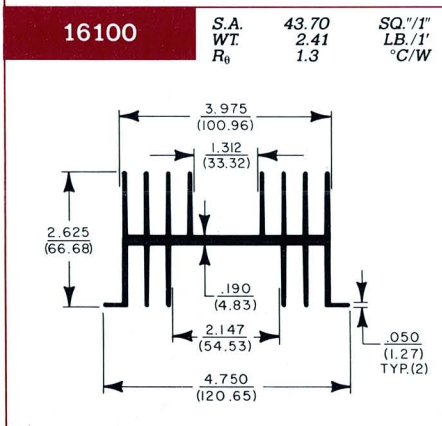
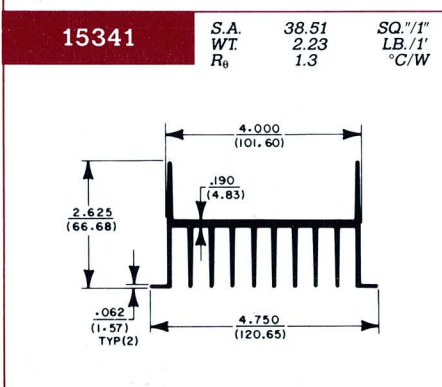
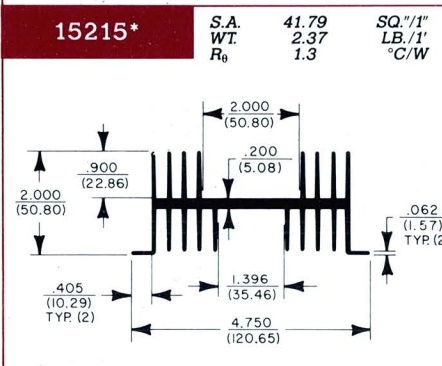
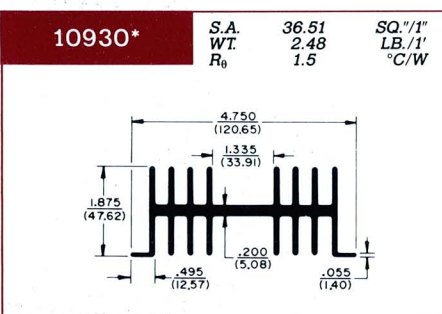
10270*

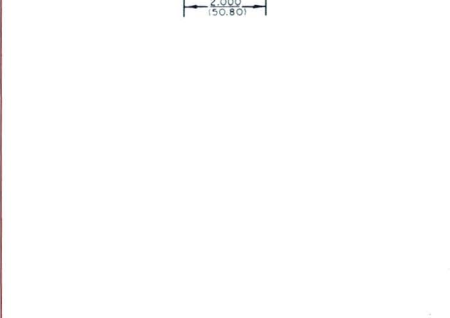
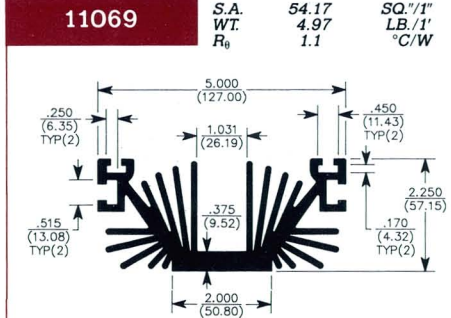
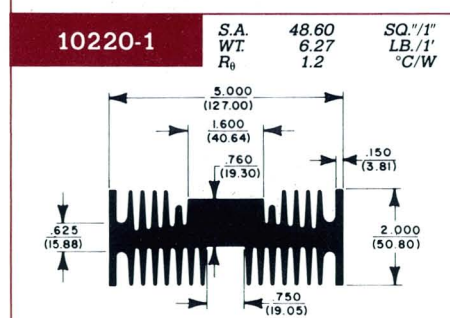
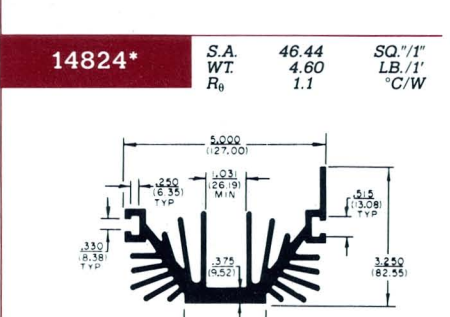
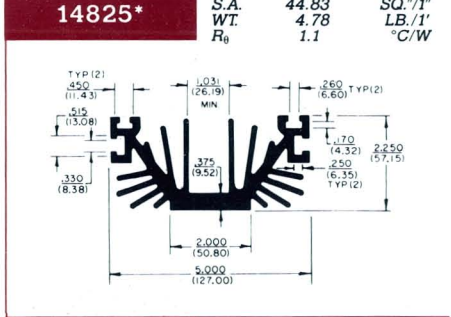
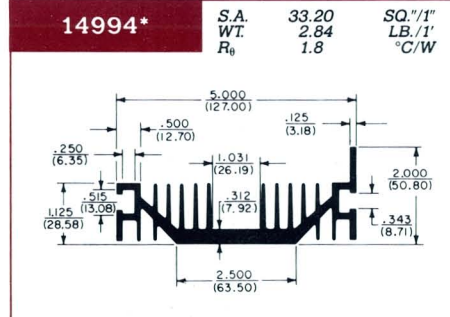
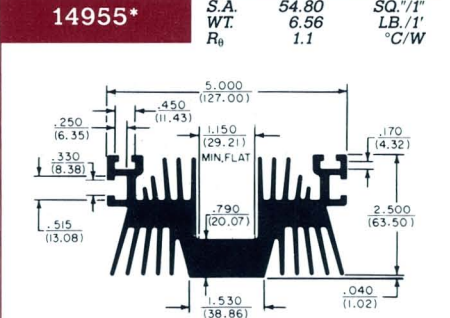
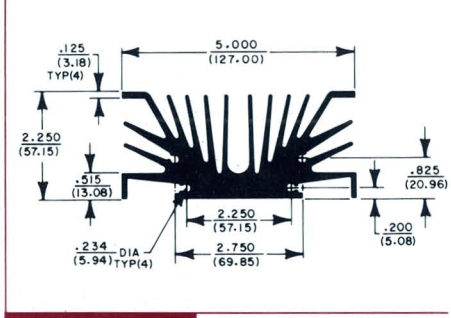
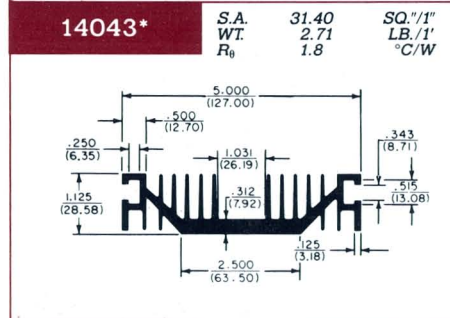
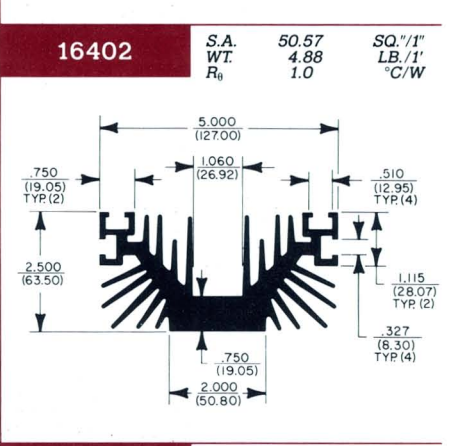
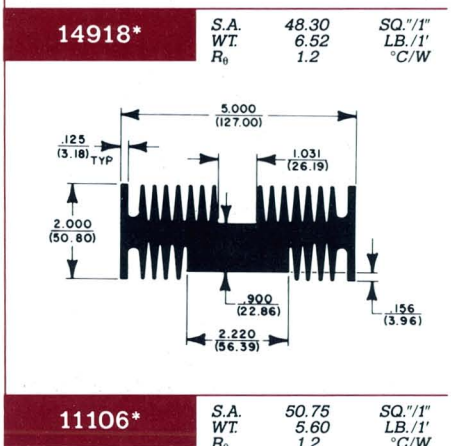
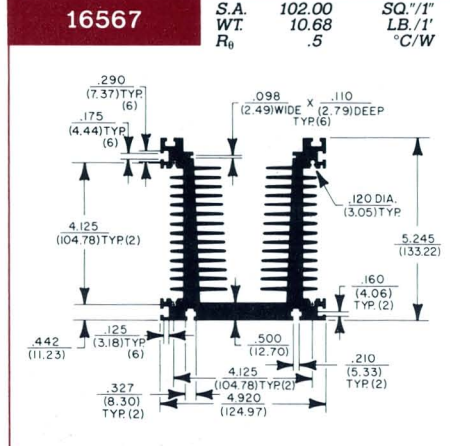
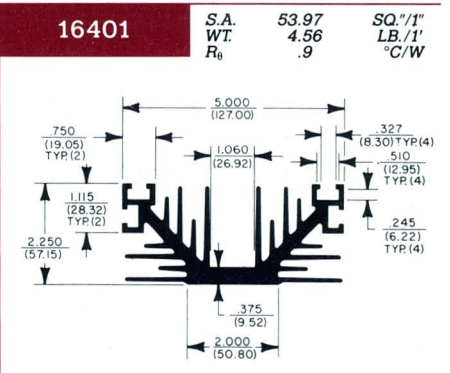
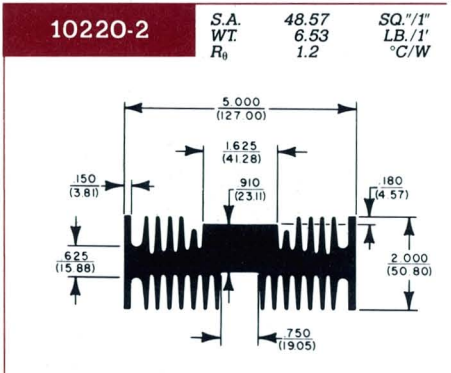
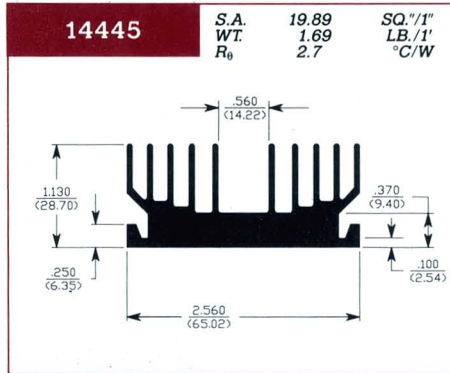
S.A. 30.67
 WT. 1.49
 R₀ 1.8
 SQ."/I" LB./I" °C/W



Extruded Heat Sink Profiles

Thermalloy Inc.
 P.O. Box 810839 • 2021 West Valley View Lane
 Dallas, Texas 75381-0839 • TEL: 214-243-4321

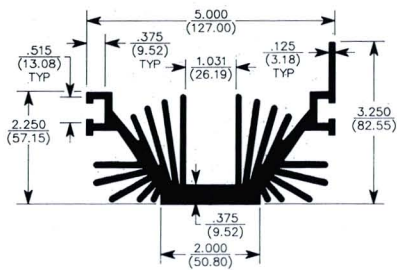




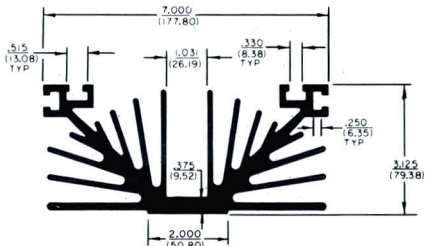
Extruded Heat Sink Profiles

Thermalloy Inc.
 P.O. Box 810839 • 2021 West Valley View Lane
 Dallas, Texas 75381-0839 • TEL: 214-243-4321

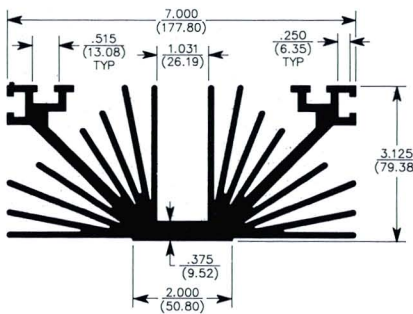
11070	S.A. WT. R ₀	55.90 4.85 1.1	SQ."/1" LB./1" °C/W
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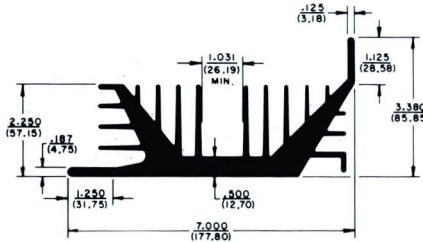
14823*	S.A. WT. R ₀	78.45 8.17 .7	SQ."/1" LB./1" °C/W
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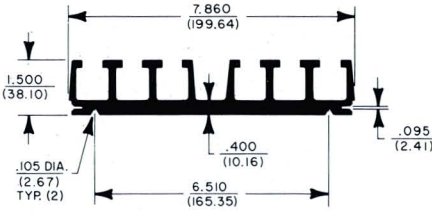
10808	S.A. WT. R ₀	88.50 8.16 .7	SQ."/1" LB./1" °C/W
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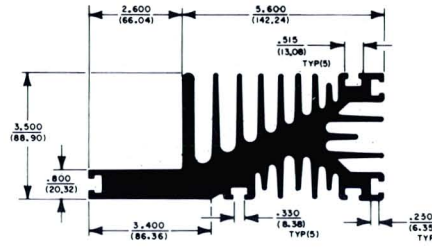
14380	S.A. WT. R ₀	51.08 7.07 .8	SQ."/1" LB./1" °C/W
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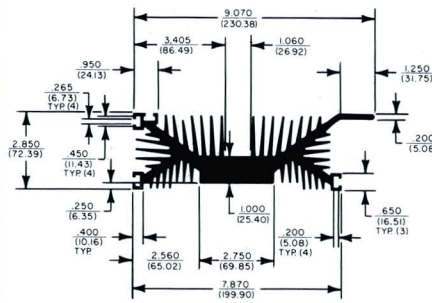
15923	S.A. WT. R ₀	38.44 6.01 1.5	SQ."/1" LB./1" °C/W
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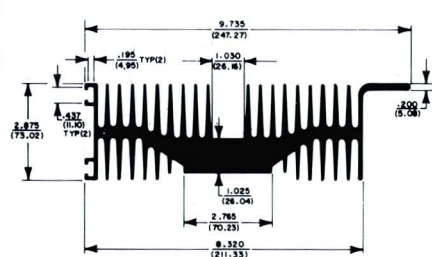
12361	S.A. WT. R ₀	72.10 13.98 .7	SQ."/1" LB./1" °C/W
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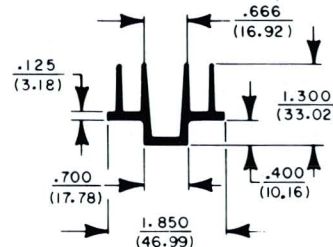
16403	S.A. WT. R ₀	99.62 11.87 .9	SQ."/1" LB./1" °C/W
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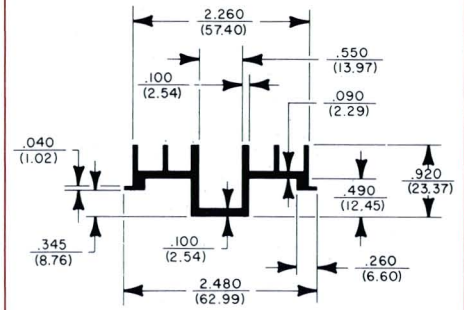
14366*	S.A. WT. R ₀	106.00 11.60 .8	SQ."/1" LB./1" °C/W
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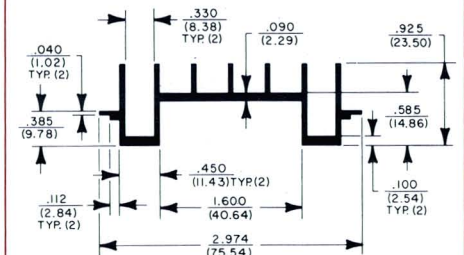
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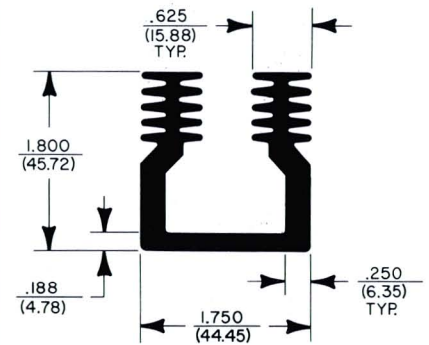
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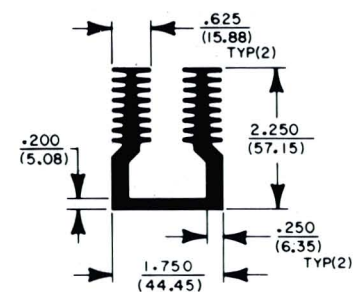
16056	S.A. WT. R ₀	14.81 .63 4.0	SQ."/1" LB./1" °C/W
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15227*	S.A. WT. R ₀	18.40 1.65 4.6	SQ."/1" LB./1" °C/W
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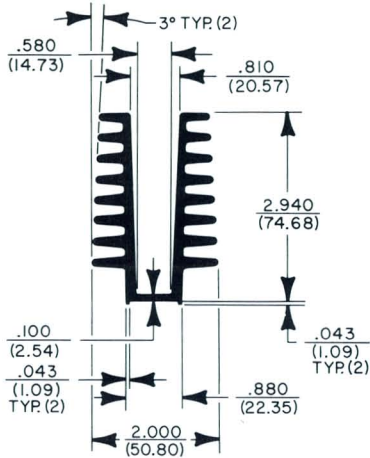


14437*	S.A. WT. R ₀	27.50 2.10 3.0	SQ."/1" LB./1" °C/W
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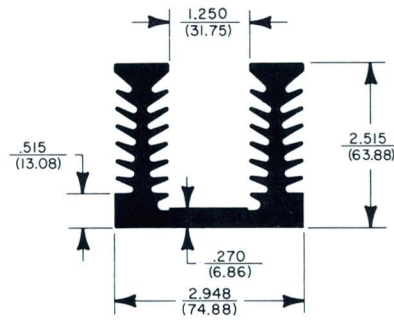
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S.A. 28.12
 WT. 2.38
 R_θ 3.0
 SQ."/1" LB./1" °C/W



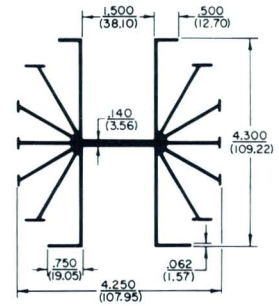
16512

S.A. 41.93
 WT. 3.47
 R_θ 2.0
 SQ."/1" LB./1" °C/W



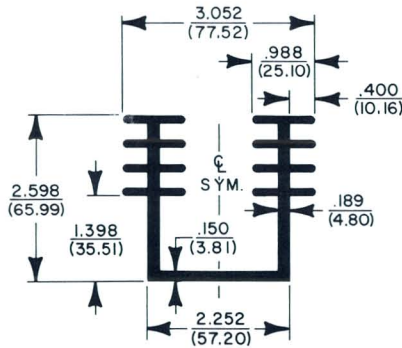
11817

S.A. 56.75
 WT. 2.43
 R_θ 1.3
 SQ."/1" LB./1" °C/W



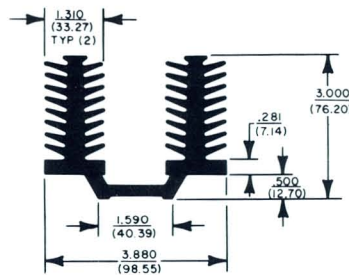
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S.A. 26.76
 WT. 2.19
 R_θ 3.1
 SQ."/1" LB./1" °C/W



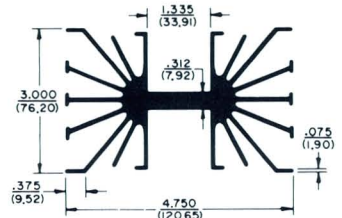
15460

S.A. 47.39
 WT. 5.28
 R_θ 1.8
 SQ."/1" LB./1" °C/W



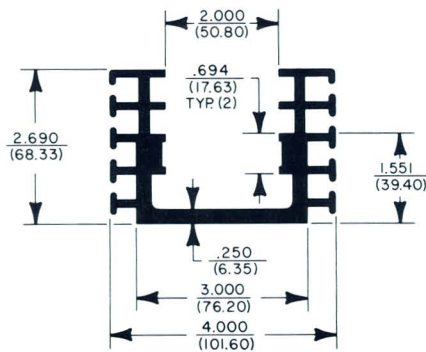
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S.A. 57.42
 WT. 3.72
 R_θ 1.0
 SQ."/1" LB./1" °C/W



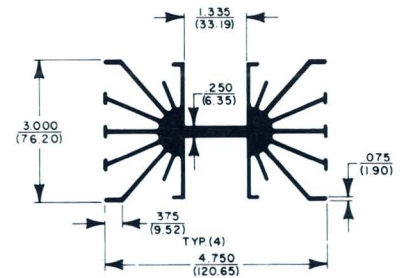
16108

S.A. 32.42
 WT. 3.72
 R_θ 2.6
 SQ."/1" LB./1" °C/W



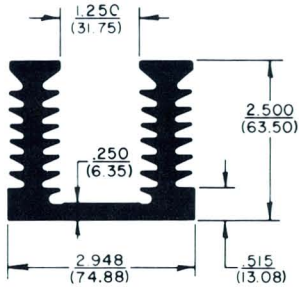
14579

S.A. 65.75
 WT. 3.10
 R_θ .9
 SQ."/1" LB./1" °C/W



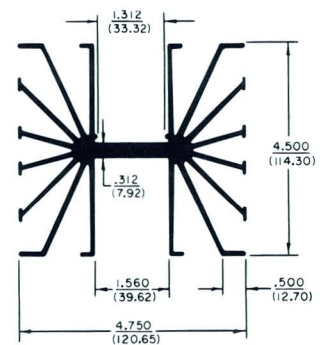
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S.A. 41.93
 WT. 3.47
 R_θ 2.0
 SQ."/1" LB./1" °C/W



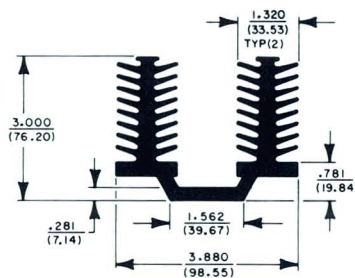
10548*

S.A. 72.75
 WT. 4.25
 R_θ .8
 SQ."/1" LB./1" °C/W

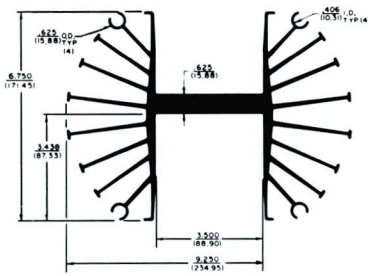


15541

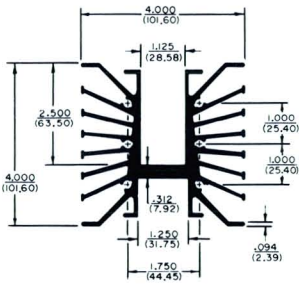
S.A. 56.00
 WT. 5.05
 R_θ 1.5
 SQ."/1" LB./1" °C/W



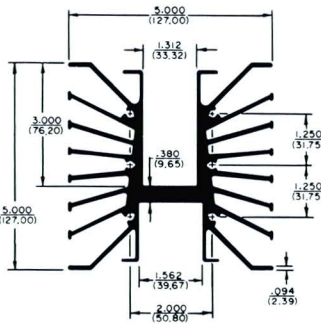
11596* S.A. 115.27 SQ."/1" WT. 10.11 LB./1" R_θ .6 °C/W



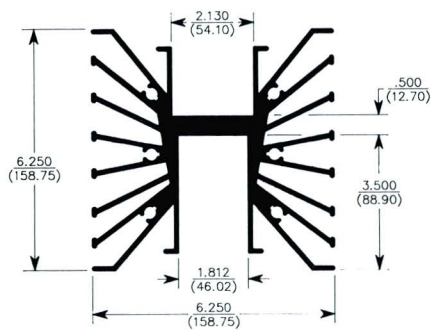
11152* S.A. 64.00 SQ."/1" WT. 4.42 LB./1" R_θ .9 °C/W



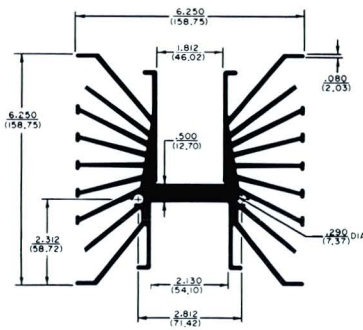
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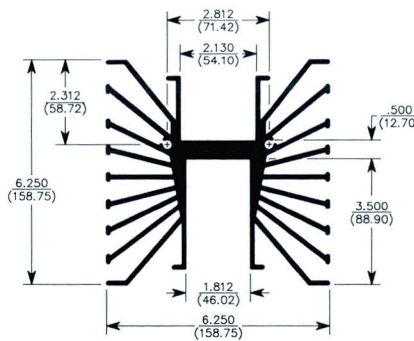
11715 S.A. 102.49 SQ."/1" WT. 7.59 LB./1" R_θ .52 °C/W



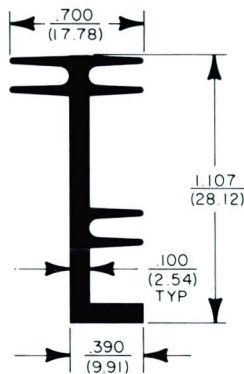
11485* S.A. 107.98 SQ."/1" WT. 7.78 LB./1" R_θ .4 °C/W



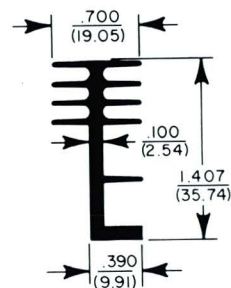
11137 S.A. 107.86 SQ."/1" WT. 9.35 LB./1" R_θ .61 °C/W



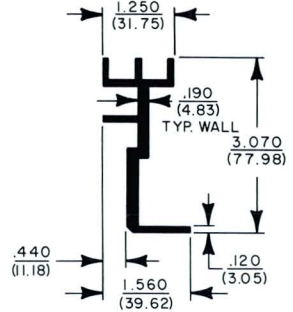
16265 S.A. 6.22 SQ."/1" WT. .25 LB./1" R_θ 7.6 °C/W



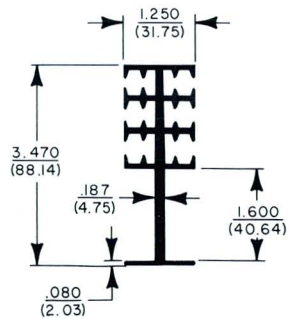
15910 S.A. 8.60 SQ."/1" WT. .33 LB./1" R_θ 6.0 °C/W



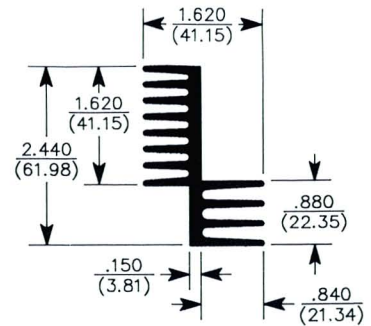
16633 S.A. 13.00 SQ."/1" WT. 1.18 LB./1" R_θ 3.4 °C/W



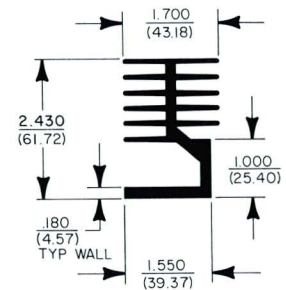
15679 S.A. 21.75 SQ."/1" WT. 1.42 LB./1" R_θ 2.6 °C/W



16996 S.A. 20.70 SQ."/1" WT. 1.21 LB./1" R_θ 2.6 °C/W

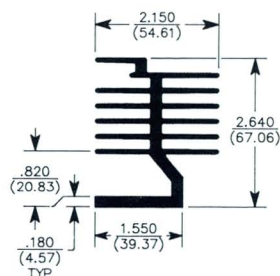


16197 S.A. 25.20 SQ."/1" WT. 1.57 LB./1" R_θ 2.1 °C/W



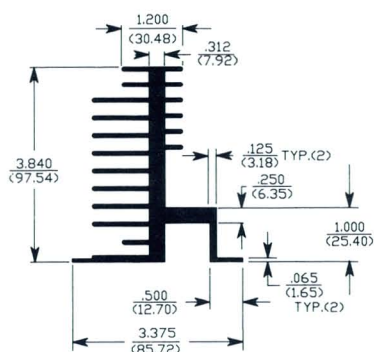
16907

S.A. 29.90
 WT. 1.81
 R₀ 1.9
 SQ."/1" LB./1" °C/W



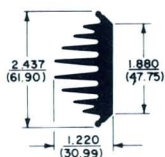
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S.A. 52.20
 WT. 3.12
 R₀ 1.1
 SQ."/1" LB./1" °C/W



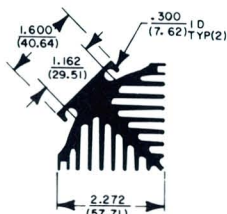
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S.A. 13.73
 WT. 1.94
 R₀ 3.3
 SQ."/1" LB./1" °C/W



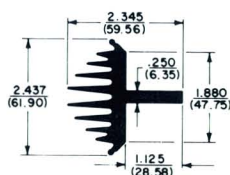
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S.A. 41.26
 WT. 3.32
 R₀ 1.2
 SQ."/1" LB./1" °C/W



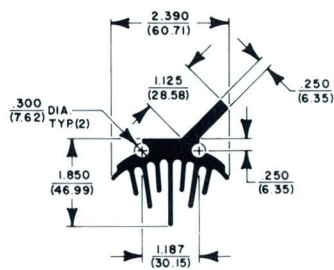
10490

S.A. 15.98
 WT. 2.28
 R₀ 2.9
 SQ."/1" LB./1" °C/W



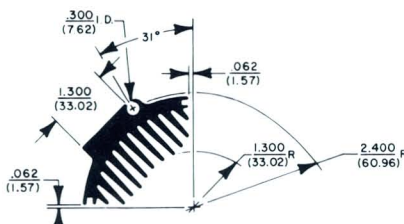
11599

S.A. 17.91
 WT. 1.70
 R₀ 3.2
 SQ."/1" LB./1" °C/W



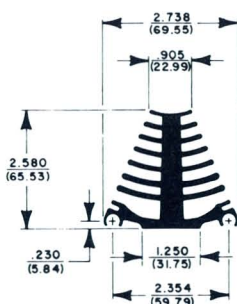
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S.A. 19.18
 WT. 2.37
 R₀ 3.0
 SQ."/1" LB./1" °C/W



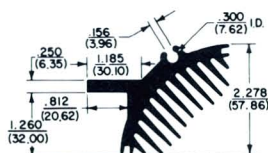
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S.A. 28.87
 WT. 3.22
 R₀ 1.8
 SQ."/1" LB./1" °C/W



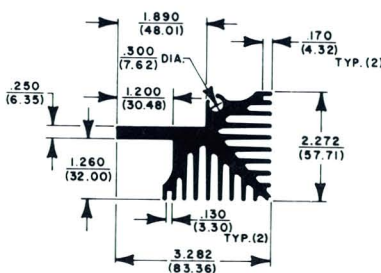
10233

S.A. 26.29
 WT. 2.68
 R₀ 2.2
 SQ."/1" LB./1" °C/W



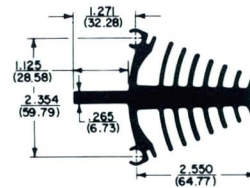
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S.A. 32.56
 WT. 3.05
 R₀ 2.1
 SQ."/1" LB./1" °C/W



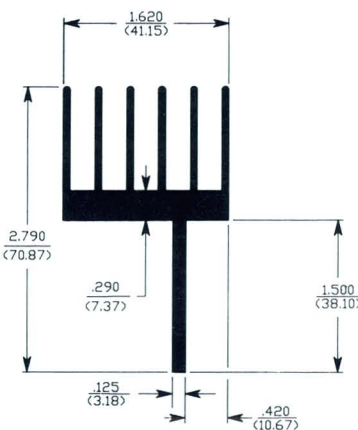
10500

S.A. 29.98
 WT. 3.03
 R₀ 1.7
 SQ."/1" LB./1" °C/W



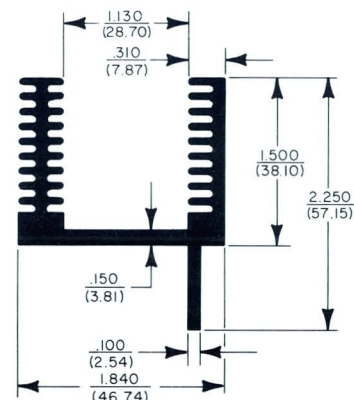
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S.A. 18.66
 WT. 1.23
 R₀ 3.1
 SQ."/1" LB./1" °C/W



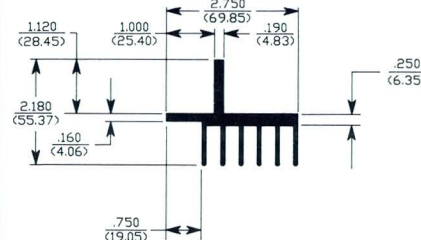
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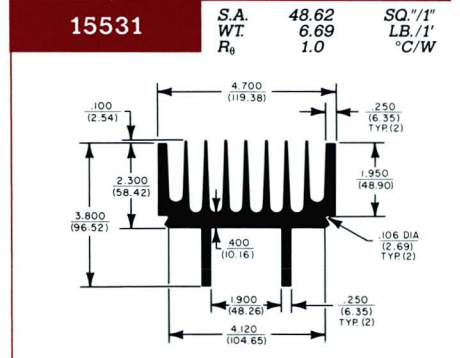
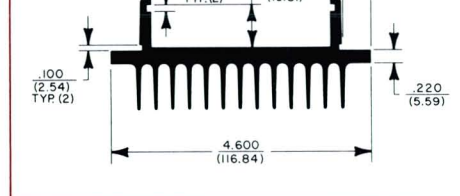
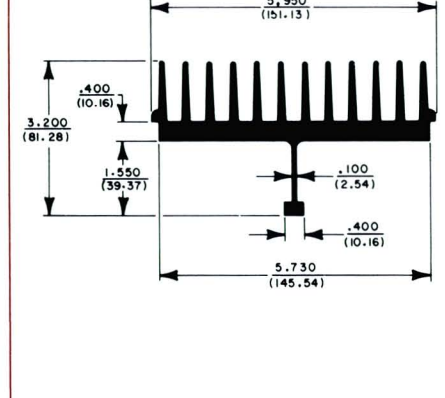
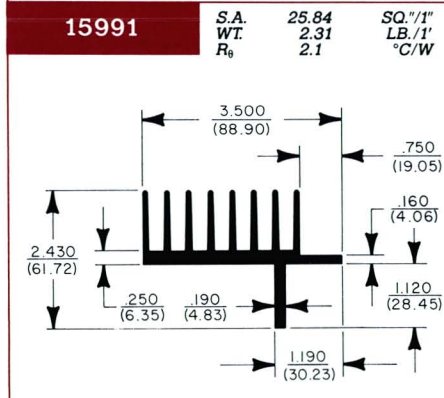
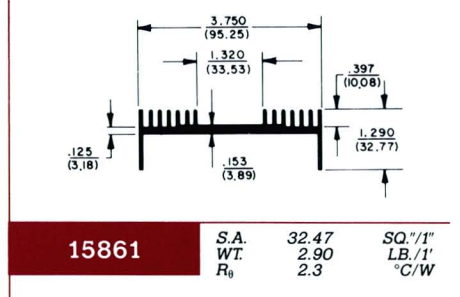
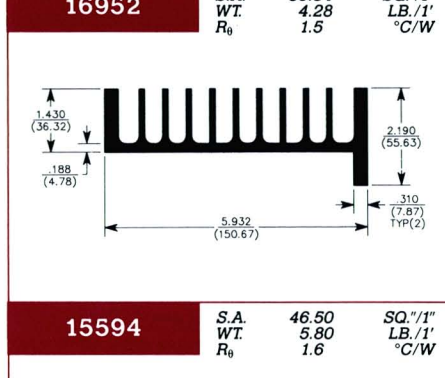
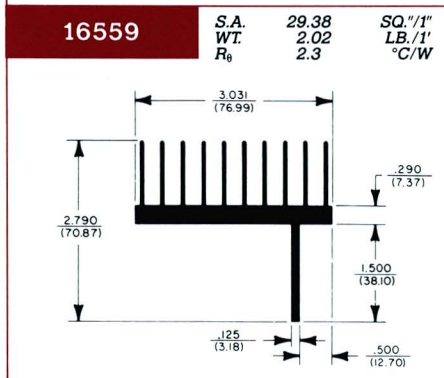
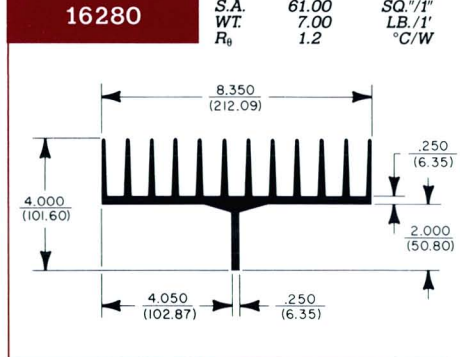
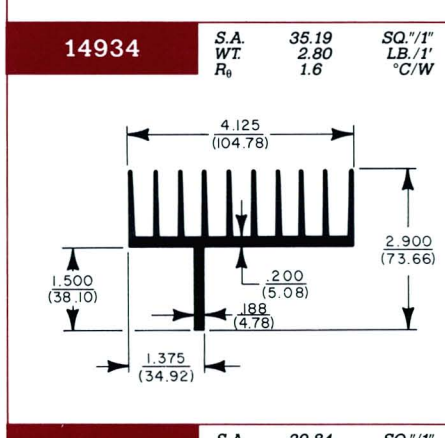
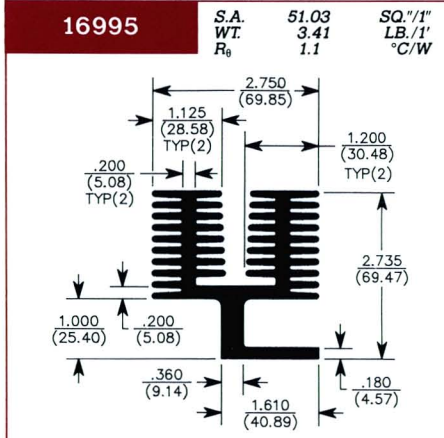
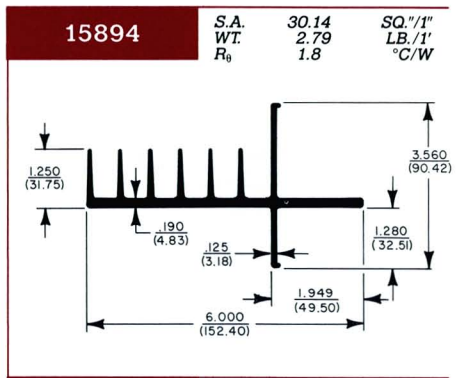
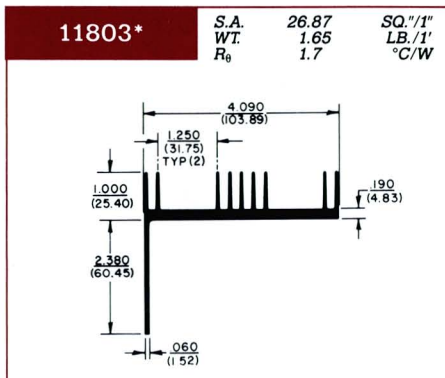
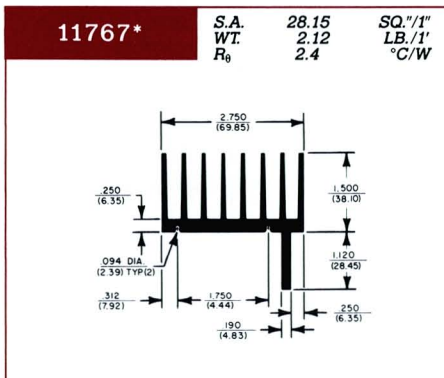
S.A. 24.22
 WT. 1.32
 R₀ 2.2
 SQ."/1" LB./1" °C/W



16059

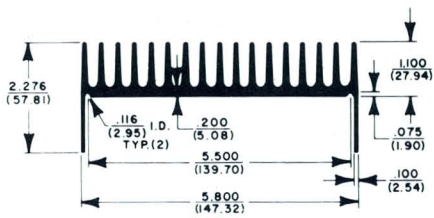
S.A. 17.59
 WT. 1.69
 R₀ 3.0
 SQ."/1" LB./1" °C/W





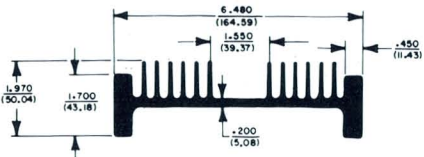
15210

S.A. 45.60 SQ."/I"
 WT. 3.64 LB./I"
 R_θ 1.3 °C/W



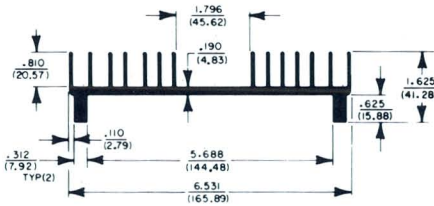
15030

S.A. 48.14 SQ."/I"
 WT. 4.71 LB./I"
 R_θ 1.1 °C/W



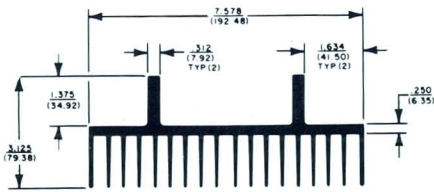
15354

S.A. 30.05 SQ."/I"
 WT. 3.00 LB./I"
 R_θ 1.8 °C/W



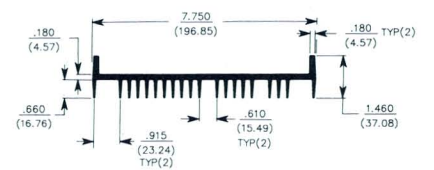
14639

S.A. 72.74 SQ."/I"
 WT. 5.00 LB./I"
 R_θ 0.7 °C/W



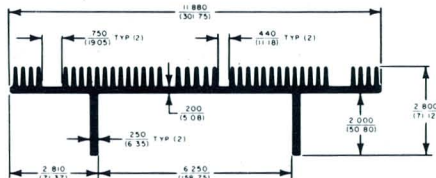
16385

S.A. 42.88 SQ."/I"
 WT. 3.41 LB./I"
 R_θ 1.3 °C/W



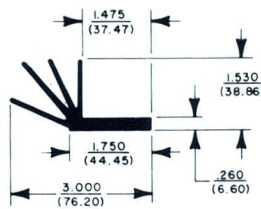
14216

S.A. 64.03 SQ."/I"
 WT. 7.75 LB./I"
 R_θ 0.8 °C/W



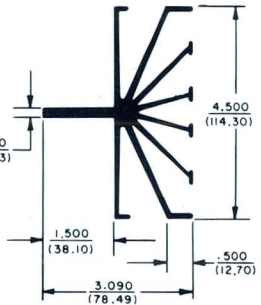
15509

S.A. 16.50 SQ."/I"
 WT. 1.00 LB./I"
 R_θ 3.5 °C/W



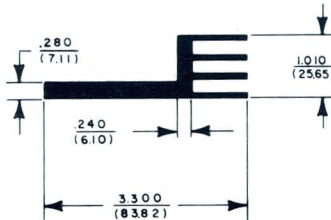
11756

S.A. 36.24 SQ."/I"
 WT. 2.12 LB./I"
 R_θ 1.5 °C/W



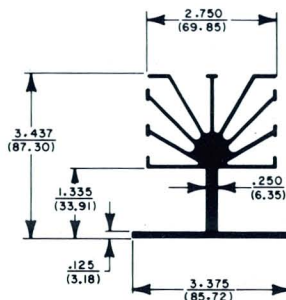
14302

S.A. 13.93 SQ."/I"
 WT. 1.40 LB./I"
 R_θ 4.6 °C/W



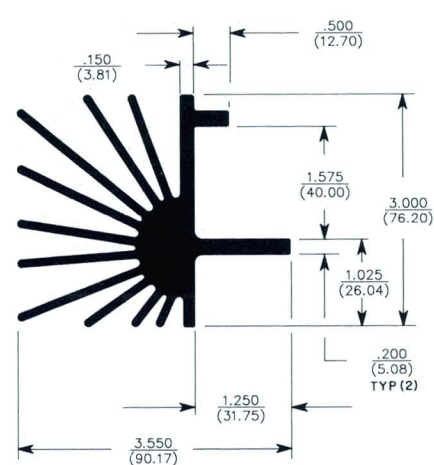
14937

S.A. 40.80 SQ."/I"
 WT. 2.41 LB./I"
 R_θ 1.5 °C/W



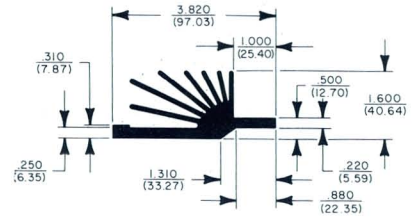
11085

S.A. 29.5 SQ."/I"
 WT. 3.43 LB./I"
 R_θ 2.0 °C/W



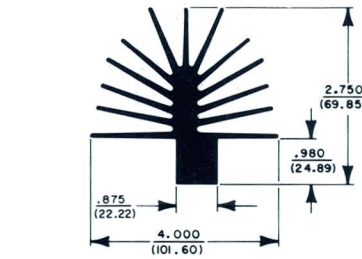
15216

S.A. 26.19 SQ."/I"
 WT. 2.35 LB./I"
 R_θ 2.1 °C/W



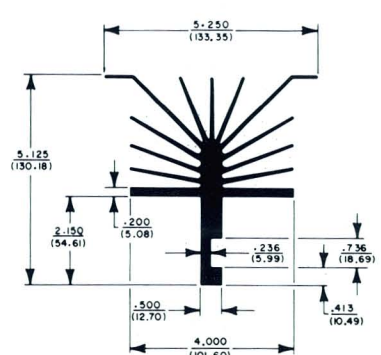
15274

S.A. 45.46 SQ."/I"
 WT. 4.35 LB./I"
 R_θ 1.3 °C/W



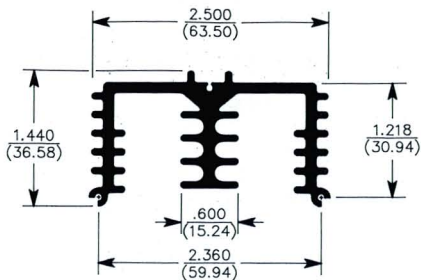
15603

S.A. 63.31 SQ."/I"
 WT. 5.11 LB./I"
 R_θ 1.1 °C/W



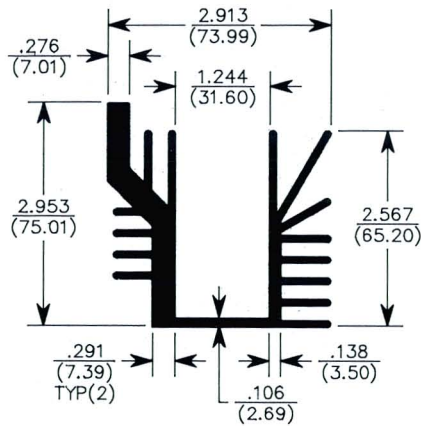
16111

S.A. 18.96
 WT. 1.11
 R_θ 2.9
 SQ."/1" LB./1" °C/W



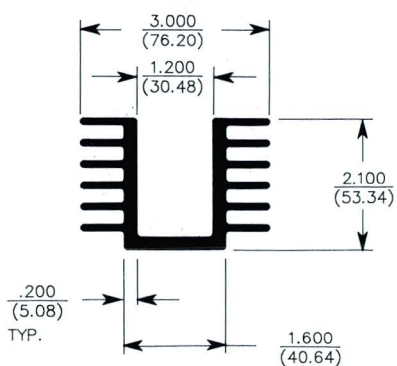
16721

S.A. 31.65
 WT. 2.38
 R_θ 1.7
 SQ."/1" LB./1" °C/W



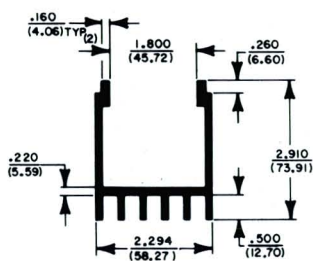
17177

S.A. 26.96
 WT. 2.30
 R_θ 2.1
 SQ."/1" LB./1" °C/W



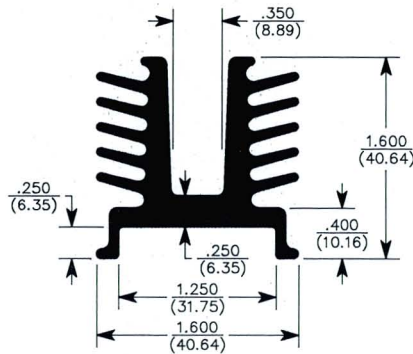
15458

S.A. 20.31
 WT. 1.75
 R_θ 2.8
 SQ."/1" LB./1" °C/W



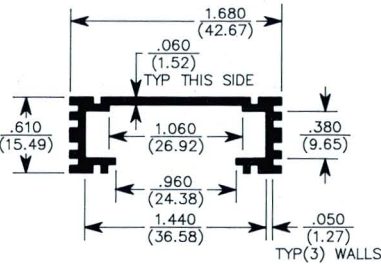
17141

S.A. 15.82
 WT. 1.19
 R_θ 3.4
 SQ."/1" LB./1" °C/W



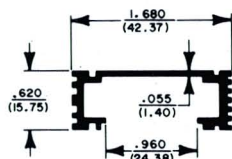
11784

S.A. 8.26
 WT. .29
 R_θ 6.0
 SQ."/1" LB./1" °C/W



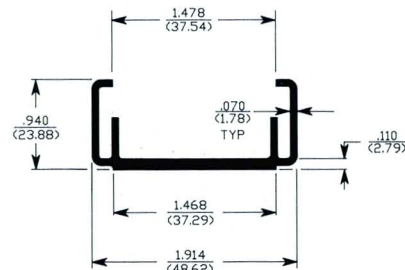
11957

S.A. 8.33
 WT. .31
 R_θ 6.5
 SQ."/1" LB./1" °C/W



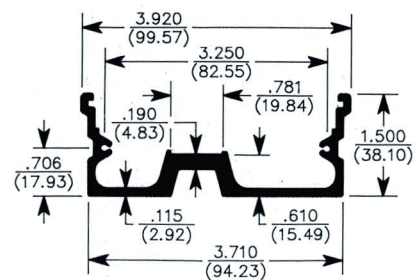
15883

S.A. 9.25
 WT. .45
 R_θ 5.6
 SQ."/1" LB./1" °C/W



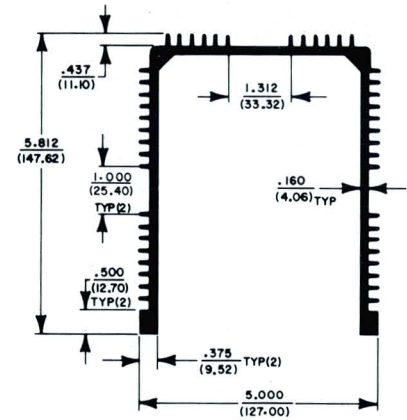
17007

S.A. 16.60
 WT. 1.23
 R_θ 3.1
 SQ."/1" LB./1" °C/W



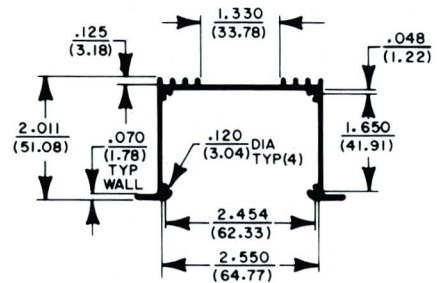
11970

S.A. 54.90
 WT. 4.02
 R_θ 1.3
 SQ."/1" LB./1" °C/W



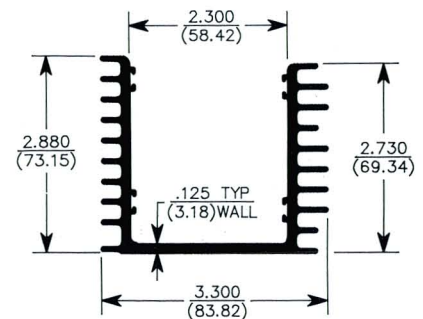
15167

S.A. 16.98
 WT. .69
 R_θ 3.3
 SQ."/1" LB./1" °C/W

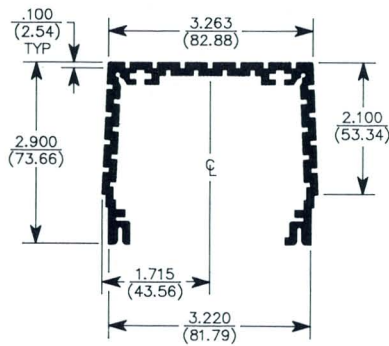


15246

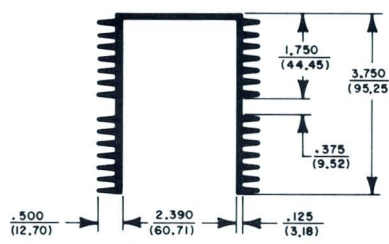
S.A. 31.57
 WT. 1.77
 R_θ 1.7
 SQ."/1" LB./1" °C/W



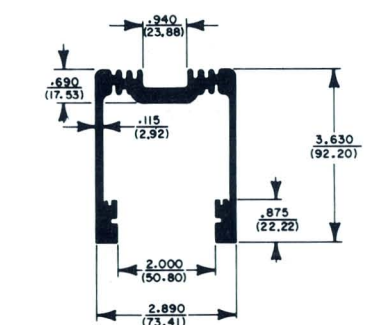
17228	S.A. WT. R _θ	25.49 1.71 2.3	SQ."/1" LB./1" °C/W
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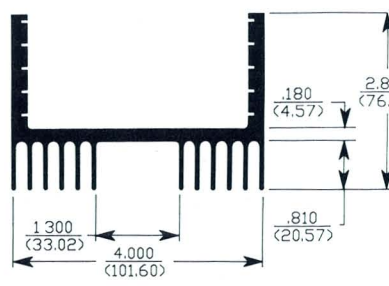
11972	S.A. WT. R _θ	40.77 2.26 2.0	SQ."/1" LB./1" °C/W
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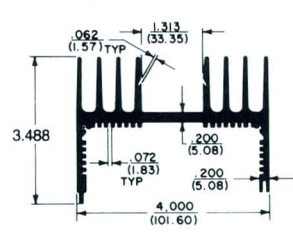
14088	S.A. WT. R _θ	19.41 2.94 2.5	SQ."/1" LB./1" °C/W
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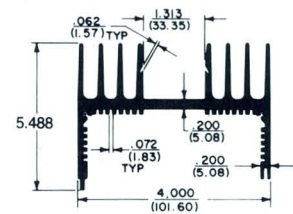
15169	S.A. WT. R _θ	35.65 2.65 1.6	SQ."/1" LB./1" °C/W
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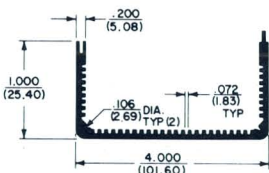
11804-1*	S.A. WT. R _θ	40.30 2.89 1.4	SQ."/1" LB./1" °C/W
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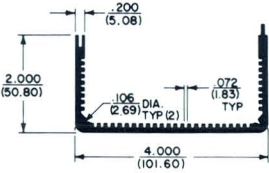
11804-2	S.A. WT. R _θ	43.90 3.62 1.1	SQ."/1" LB./1" °C/W
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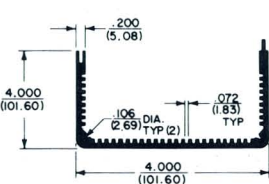
11092-1*	S.A. WT. R _θ	16.95 1.05 8.5	SQ."/1" LB./1" °C/W
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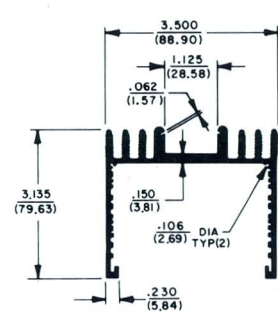
11092-2*	S.A. WT. R _θ	23.35 1.50 2.8	SQ."/1" LB./1" °C/W
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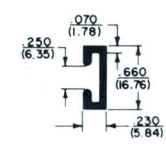
11092-3	S.A. WT. R _θ	36.15 2.21 2.0	SQ."/1" LB./1" °C/W
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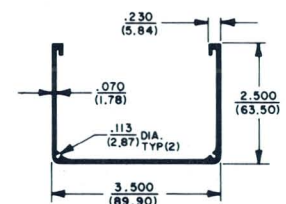
11971*	S.A. WT. R _θ	28.56 1.36 2.0	SQ."/1" LB./1" °C/W
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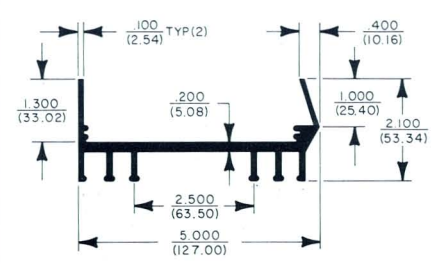
11969	S.A. WT. R _θ	2.59 .10 10.5	SQ."/1" LB./1" °C/W
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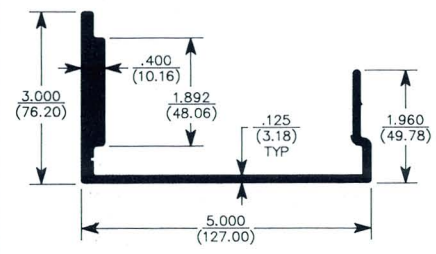
14087	S.A. WT. R _θ	14.31 .66 3.8	SQ."/1" LB./1" °C/W
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14957	S.A. WT. R _θ	23.92 2.07 2.3	SQ."/1" LB./1" °C/W
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17152	S.A. WT. R _θ	20.12 2.18 2.6	SQ."/1" LB./1" °C/W
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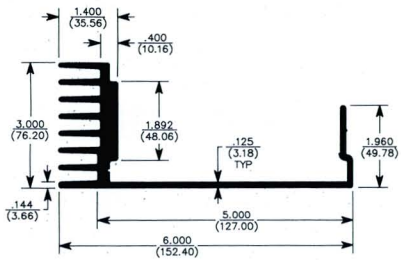
*NORMALLY STOCKED.

Extruded Heat Sink Profiles

Thermal Inc.
 P.O. Box 810839 • 2021 West Valley View Lane
 Dallas, Texas 75381-0839 • TEL: 214-243-4321

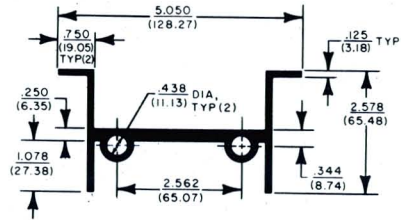
17106

S.A. 40.09
 WT. 3.50
 R_θ 1.4
 SQ."/1' LB./1' °C/W



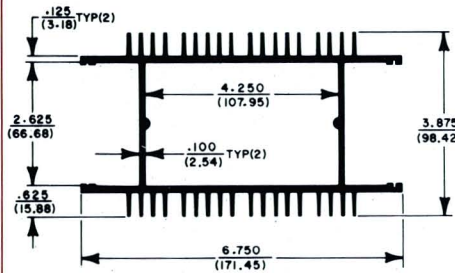
10417*

S.A. 10.35
 WT. 2.27
 R_θ 4.0
 SQ."/1' LB./1' °C/W



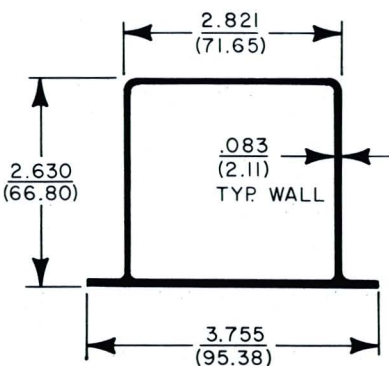
14418

S.A. 71.76
 WT. 3.80
 R_θ .6
 SQ."/1' LB./1' °C/W



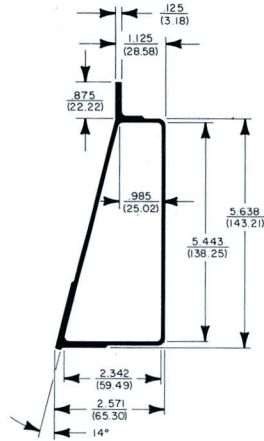
15671

S.A. 22.50
 WT. 1.14
 R_θ 2.5
 SQ."/1' LB./1' °C/W



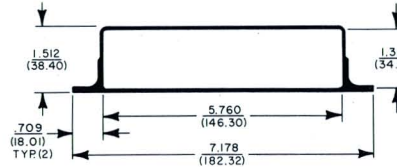
15093

S.A. 31.60
 WT. 2.01
 R_θ 1.8
 SQ."/1' LB./1' °C/W



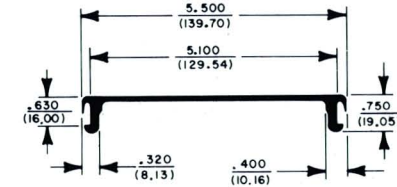
15092

S.A. 31.93
 WT. 1.65
 R_θ 1.8
 SQ."/1' LB./1' °C/W



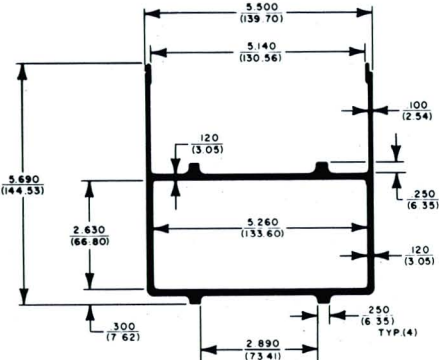
14444

S.A. 14.55
 WT. .96
 R_θ 3.8
 SQ."/1' LB./1' °C/W



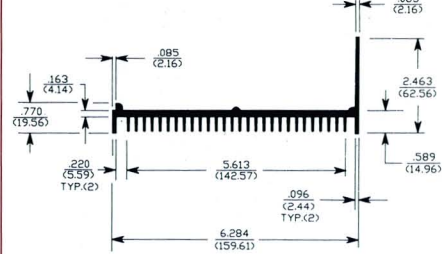
14443

S.A. 44.19
 WT. 3.27
 R_θ 1.2
 SQ."/1' LB./1' °C/W



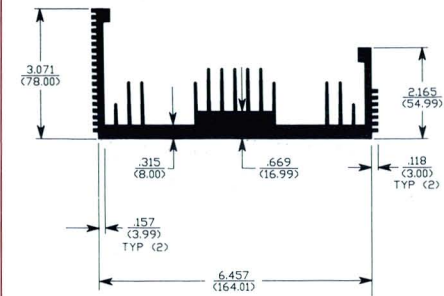
15196

S.A. 39.80
 WT. 2.36
 R_θ 1.5
 SQ."/1' LB./1' °C/W



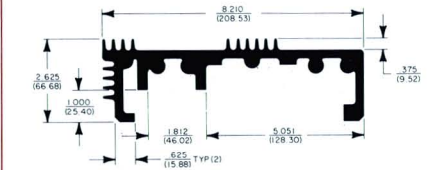
15985*

S.A. 47.52
 WT. 5.45
 R_θ 1.3
 SQ."/1' LB./1' °C/W



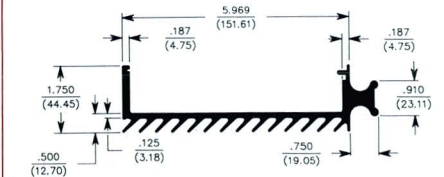
14963

S.A. 38.75
 WT. 6.63
 R_θ 1.5
 SQ."/1' LB./1' °C/W



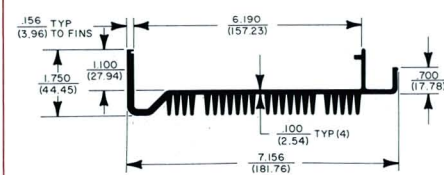
14242

S.A. 30.94
 WT. 2.54
 R_θ 1.8
 SQ."/1' LB./1' °C/W

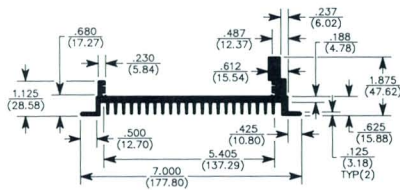


14570

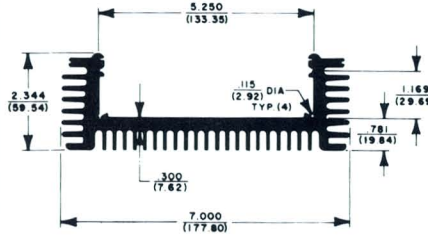
S.A. 49.42
 WT. 2.81
 R_θ 1.2
 SQ."/1' LB./1' °C/W



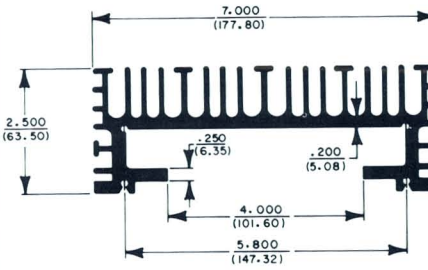
17159	S.A. WT. R _θ	38.80 3.25 1.5	SQ."/1" LB./1" °C/W
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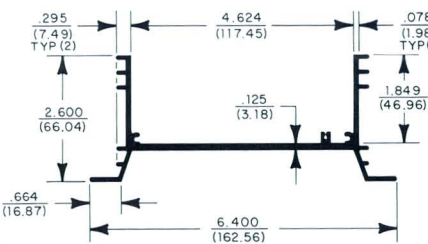
15018	S.A. WT. R _θ	55.75 5.71 1.1	SQ."/1" LB./1" °C/W
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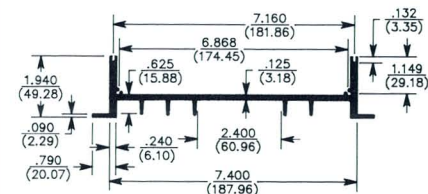
15431	S.A. WT. R _θ	64.03 5.93 1.0	SQ."/1" LB./1" °C/W
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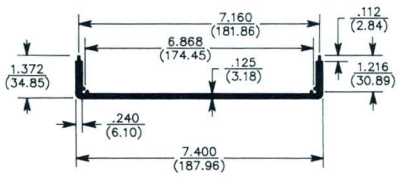
14368	S.A. WT. R _θ	26.45 1.52 1.3	SQ."/1" LB./1" °C/W
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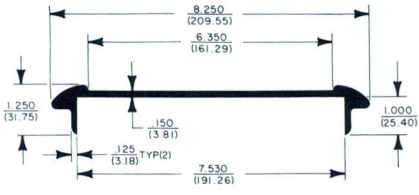
17070	S.A. WT. R _θ	28.81 2.51 2.0	SQ."/1" LB./1" °C/W
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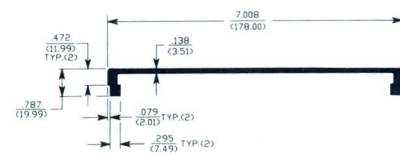
17068	S.A. WT. R _θ	20.30 1.77 2.6	SQ."/1" LB./1" °C/W
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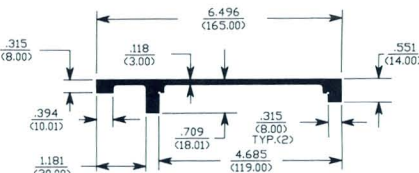
15290	S.A. WT. R _θ	21.17 1.87 2.6	SQ."/1" LB./1" °C/W
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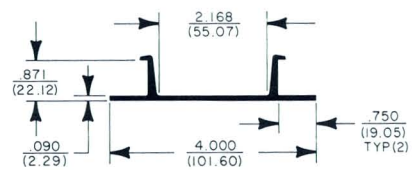
16057	S.A. WT. R _θ	16.61 1.35 3.3	SQ."/1" LB./1" °C/W
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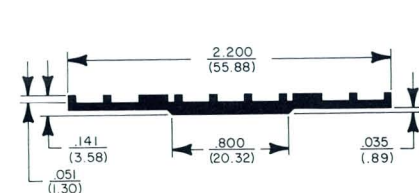
14684	S.A. WT. R _θ	15.69 1.40 3.4	SQ."/1" LB./1" °C/W
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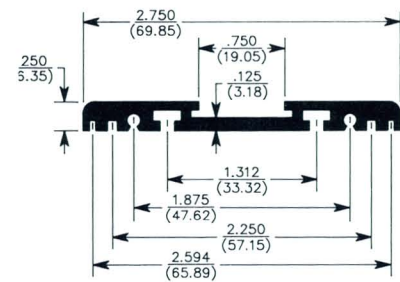
14711	S.A. WT. R _θ	10.37 .71 4.9	SQ."/1" LB./1" °C/W
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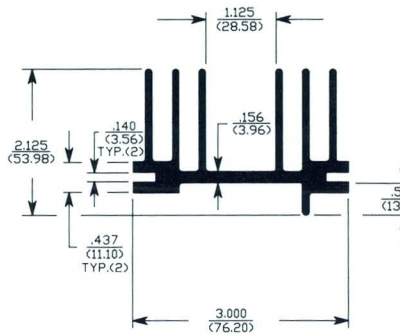
15990*	S.A. WT. R _θ	5.55 .22 9.0	SQ."/1" LB./1" °C/W
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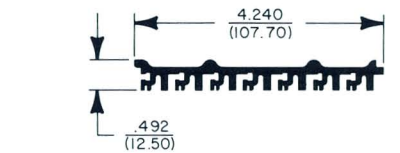
15711	S.A. WT. R _θ	9.44 .54 4.5	SQ."/1" LB./1" °C/W
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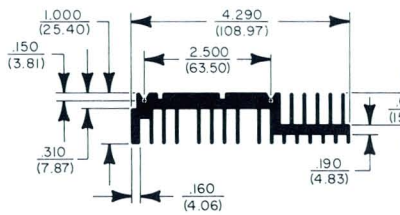
15714	S.A. WT. R _θ	24.62 1.66 2.2	SQ."/1" LB./1" °C/W
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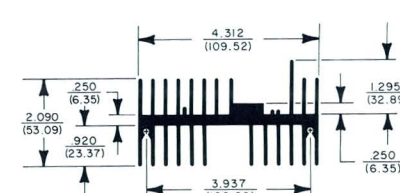
14685	S.A. WT. R _θ	19.79 1.18 2.7	SQ."/1" LB./1" °C/W
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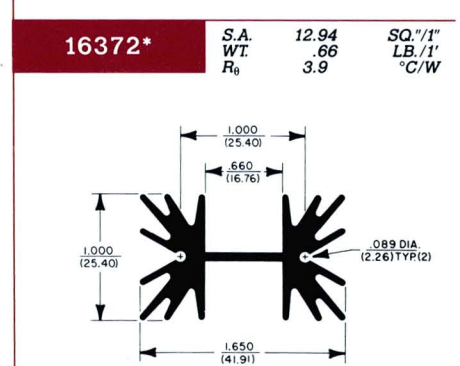
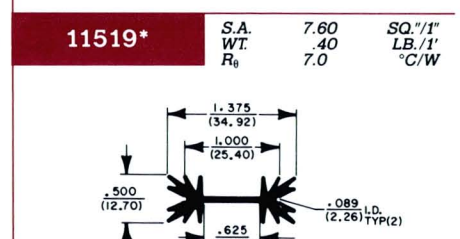
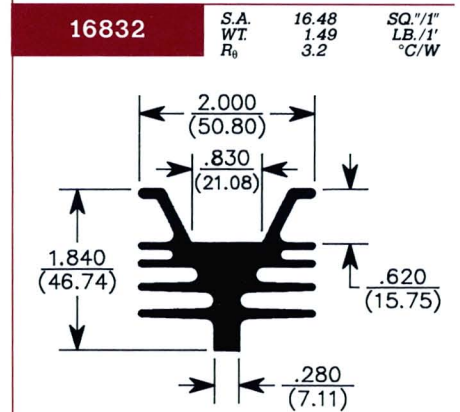
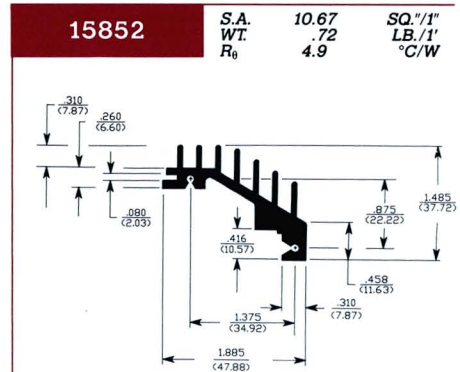
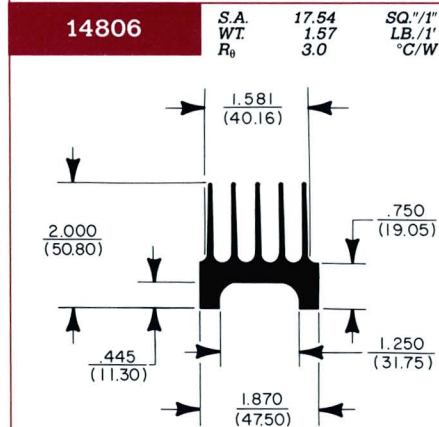
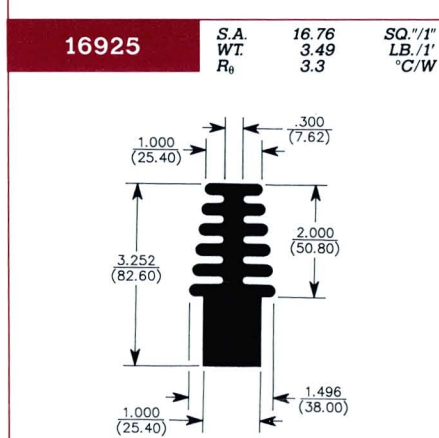
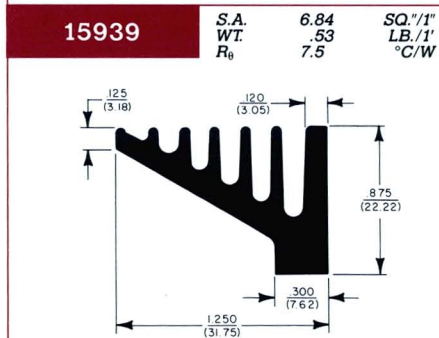
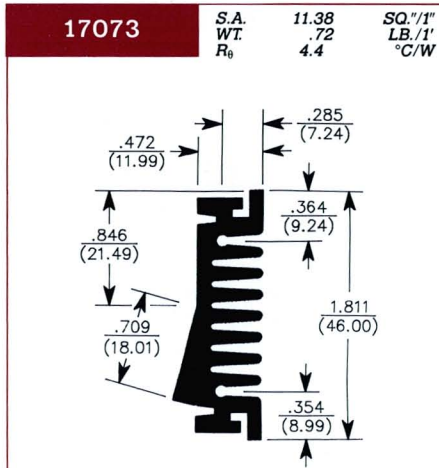
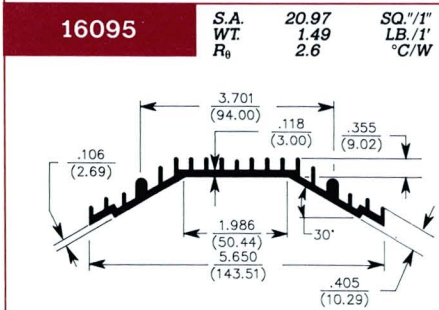
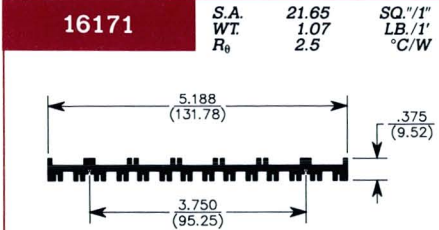
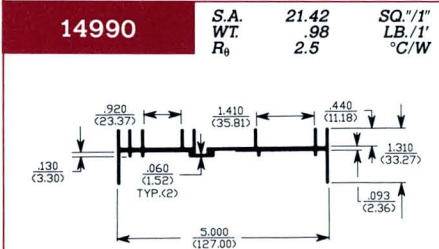
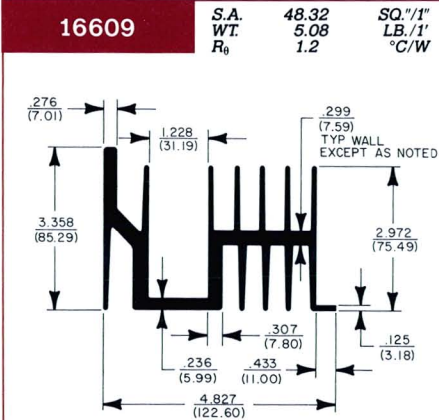
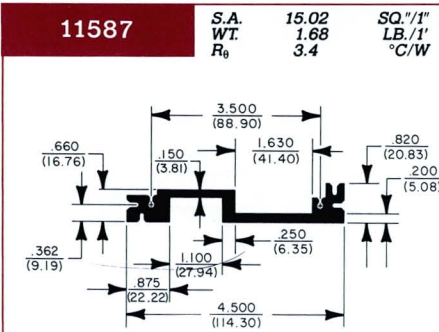
16480	S.A. WT. R _θ	29.89 2.16 1.9	SQ."/1" LB./1" °C/W
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14090	S.A. WT. R _θ	49.20 3.39 1.3	SQ."/1" LB./1" °C/W
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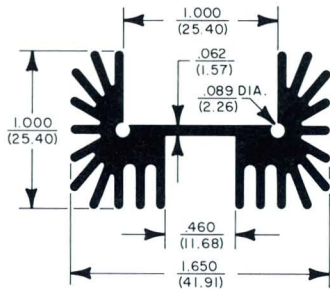


*NORMALLY STOCKED.



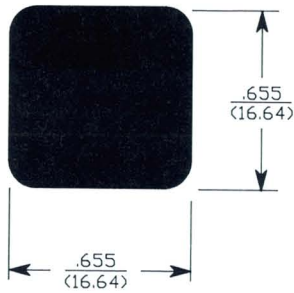
16793*

S.A. 14.31
 WT. .69
 R₀ 3.6
 SQ."/1" LB./1" °C/W



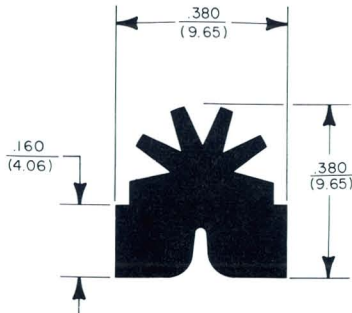
15320

S.A. 2.59
 WT. .50
 R₀ 37.0
 SQ."/1" LB./1" °C/W



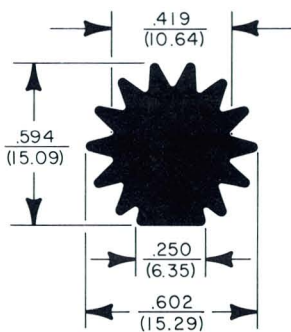
15543

S.A. 1.45
 WT. .11
 R₀ 40.0
 SQ."/1" LB./1" °C/W



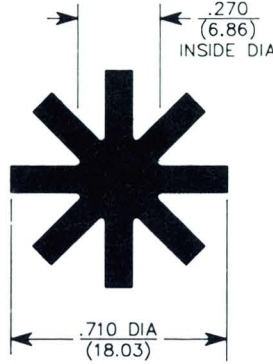
11319

S.A. 1.95
 WT. .24
 R₀ 39.0
 SQ."/1" LB./1" °C/W



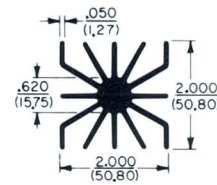
16993

S.A. 4.2
 WT. .35
 R₀ 10.1
 SQ."/1" LB./1" °C/W



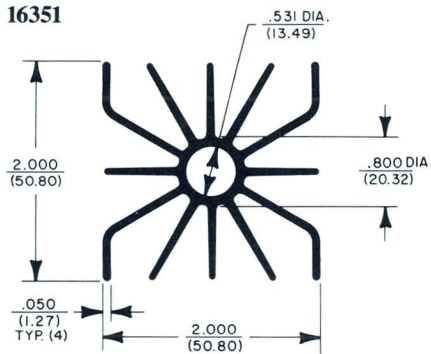
11364*

S.A. 23.80
 WT. 1.00
 R₀ 1.9
 SQ."/1" LB./1" °C/W



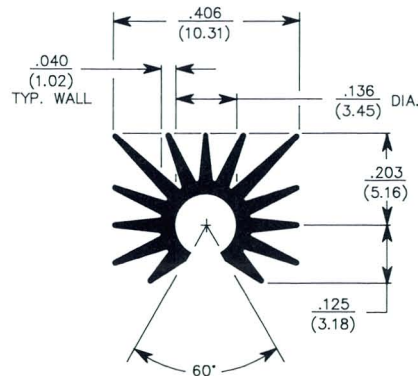
16351

S.A. 23.19
 WT. .91
 R₀ 2.0
 SQ."/1" LB./1" °C/W



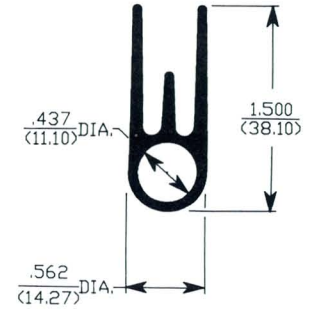
16572

S.A. 3.08
 WT. .06
 R₀ 18.0
 SQ."/1" LB./1" °C/W



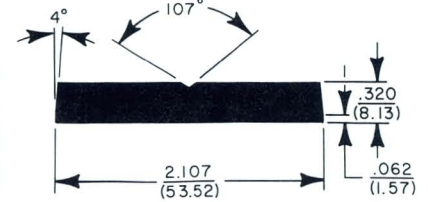
15940

S.A. 7.58
 WT. .27
 R₀ 6.6
 SQ."/1" LB./1" °C/W



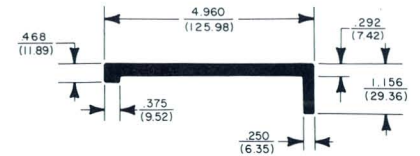
15149

S.A. 4.86
 WT. .81
 R₀ 9.1
 SQ."/1" LB./1" °C/W



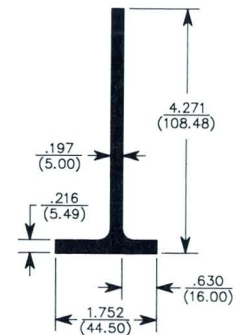
14584

S.A. 12.48
 WT. 2.07
 R₀ 3.5
 SQ."/1" LB./1" °C/W



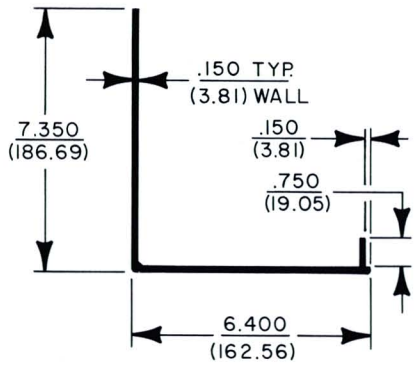
17035

S.A. 11.87
 WT. 1.43
 R₀ 4.4
 SQ."/1" LB./1" °C/W



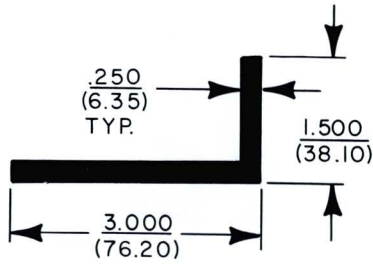
14581

S.A. 28.73 SQ."/1"
 WT. 2.59 LB./1'
 R_θ 2.0 °C/W



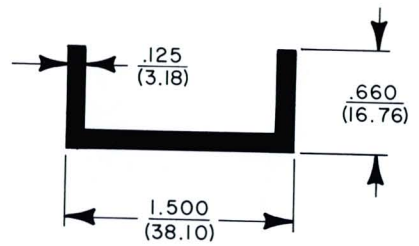
16252

S.A. 9.00 SQ."/1"
 WT. 1.27 LB./1'
 R_θ 5.4 °C/W



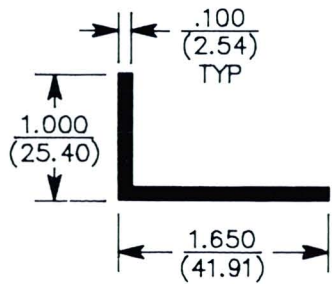
16353

S.A. 5.39 SQ."/1"
 WT. .38 LB./1'
 R_θ 9.0 °C/W



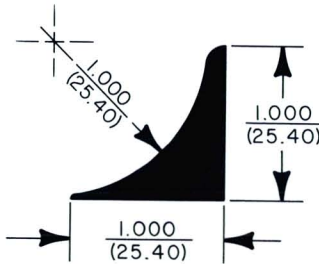
17123

S.A. 5.30 SQ."/1"
 WT. .30 LB./1'
 R_θ 9.0 °C/W



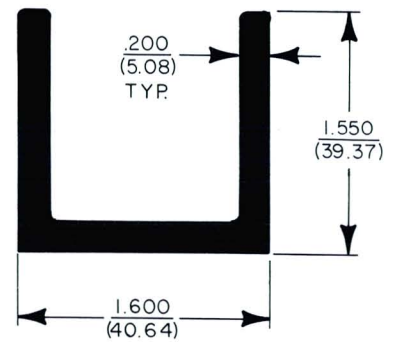
14100

S.A. 3.57 SQ."/1"
 WT. .40 LB./1'
 R_θ 10.9 °C/W



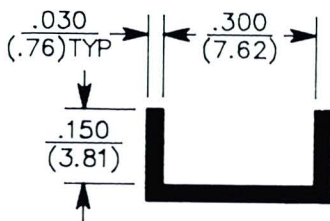
16298

S.A. 9.00 SQ."/1"
 WT. 1.03 LB./1'
 R_θ 5.1 °C/W



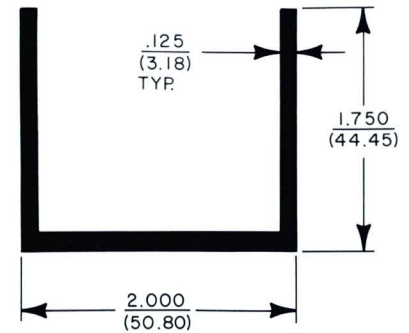
17128

S.A. 1.38 SQ."/1"
 WT. .02 LB./1'
 R_θ 30.5 °C/W



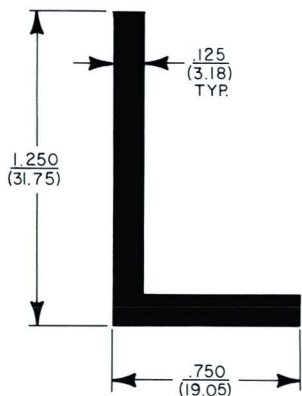
15989

S.A. 10.75 SQ."/1"
 WT. .78 LB./1'
 R_θ 5.0 °C/W



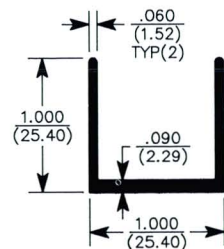
15992

S.A. 4.00 SQ."/1"
 WT. .28 LB./1'
 R_θ 10.1 °C/W



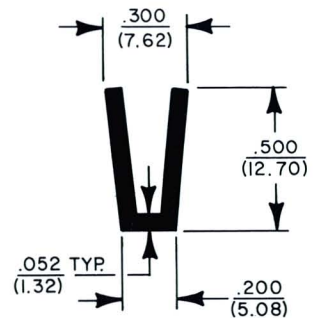
16980

S.A. 5.76 SQ."/1"
 WT. .23 LB./1'
 R_θ 9.0 °C/W



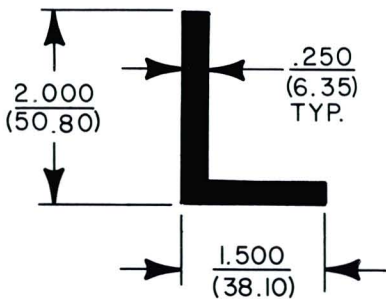
14313

S.A. 2.15 SQ."/1"
 WT. .05 LB./1'
 R_θ 36.0 °C/W



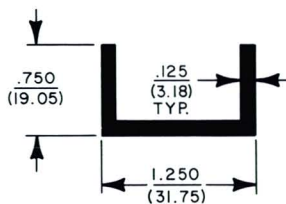
16485

S.A. 7.00 SQ."/1"
 WT. .97 LB./1'
 R_θ 6.4 °C/W



15636

S.A. 5.25 SQ."/1"
 WT. .37 LB./1'
 R_θ 9.1 °C/W



Thermalfilm™

PROPERTY	TYPICAL VALUE 25°C	TEST METHOD
ELECTRICAL		
Dielectric Strength (1-mil)	7,000 volts/mil	ASTM D149-64
Dielectric Constant	3.5	ASTM D150-64T
Dissipation Factor	.003	ASTM D150-64T
Volume Resistivity	10 ¹⁸ ohm-cm	ASTM D257-61
Surface Resistivity	10 ¹⁶ ohms	ASTM D257-61
Corona Start Voltage (1-mil)	465 volts	ASTM D1868-61T
Insulation Resistance	100,000 megohm mfd.	Based on 0.05 mfd. wound capacitor using 1-mil Film
PHYSICAL		
Ultimate Tensile Strength (MD)	25,000 psi	ASTM D882-64T
Bursting Strength Test (Mullen)	75 psi	ASTM D774-63
Tear Strength-Initial	510 gm/mil	ASTM D1004-61
Density	1.42 gm/cc	ASTM D1505-63T
Folding Endurance (MIT)	10,000 cycles	ASTM D2176-63T
THERMAL		
Melting Point	NONE	
Zero Strength Temperature	815°C (1499°F)	Hot Bar (Du Pont Test)
Cut-through Temperature	435°C (815°F)	Weighted Probe on Heated Film (DuPont Test)
	525°C (977°F)	
Service Temperature	-260°C to + 400°C (-436°F to + 752°F)	
Coefficient of Thermal Conductivity	3.72 x 10 ⁻⁴ (cal) (cm) (cm ²) (sec) (°C) 3.89 x 10 ⁻⁴ @ 75°C 4.26 x 10 ⁻⁴ @ 200°C 4.51 x 10 ⁻⁴ @ 300°C	Model TC-1000 Twin Heatmeter Comparative Tester
Flammability	Self-extinguishing	

Aluminum Oxide

PROPERTY	TYPICAL VALUE	TEST METHOD
CHEMICAL		
A 12O3 content	94% nominal	Spectrographic Analysis (100% — % by wt. of total metallic impurity)
ELECTRICAL		
Dielectric Constant (25°C)	8.9 (1 MHz) 8.9 (10 GHz)	ASTM D150-70 ASTM D2520-70
Dissipation Factor (25°C)	0.0001 (1 MHz) 0.0010 (10 GHz)	ASTM D150-70 ASTM D2520-70
Electrical Resistivity (25°C)	> 10 ¹⁴ ohm-cm	ASTM D1829-66
Dielectric Strength (AC)	220 volts/mil (0.250" thick) 425 volts/mil (0.050" thick) 720 volts/mil (0.010" thick)	ASTM D116-69
PHYSICAL		
Density	3.62 g/cm ³	ASTM C20-70
Hardness	78 (Rockwell 45 N)	ASTM E18-67
MECHANICAL		
Flexural Strength (25°C)	46,000 psi (minimum) 51,000 psi (typical)	ACMA TEST #2
Modulus of Elasticity	41 x 10 ⁶ psi	ASTM C623-69T
Poisson's Ratio	0.21	ASTM C623-69T
Tensile Strength (25°C)	28,000 psi	ACMA TEST #4
Compressive Strength (25°C)	305,000 psi	ASTM C528-63T
THERMAL		
Coefficient of Thermal Expansion	7.9 x 10 ⁻⁶ /°C (4.4 x 10 ⁻⁶ /°F) (25-1000°C)	ASTM C372-56
Thermal Conductivity	0.043 cal/cm.-sec.-°C (20°C) 0.034 cal/cm.-sec.-°C (100°C) 0.019 cal/cm.-sec.-°C (400°C)	ASTM C408-58
Specific Heat (100°C)	0.21 cal/gm. °C	ASTM C351-61
Melting Point	>3600°C (6512°F)	
Maximum Temperature for Continuous Use	1700°C (3100°F)	

Mica

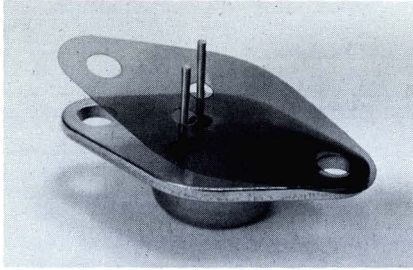
PROPERTY	TYPICAL VALUE	TEST METHOD
ELECTRICAL		
Dielectric Strength (1 to 3 mils thick in air)	3-6000 volts/mil	
Dielectric Constant	6.5 to 8.7	
Dissipation Factor 10 ⁶ Cycles	.0001-.0004	
Volume Resistivity	10 ¹³ —10 ¹⁷ ohm-cm	
PHYSICAL		
Modulus of Elasticity in Tension	20-30 x 10 ⁶ psi	
Tensile Strength	40-50,000 psi	
Hardness Mohs Shore	2.8-3.2 80-150	
Compressive Strength	32,000 psi	
Specific Gravity	2.6-3.2	
THERMAL		
Thermal Conductivity:	25-.36 btu/hrft ² F .00103-.00149 Cal/cm sec°C .00433-.00623 watts/cm ² C .011-.0158 watts/in ² C	
Coefficient of Thermal Expansion	1.8 x 10 ⁻⁵ 1/°F	
Specific Heat	0.02 btu/lb°F	
Melting Point	1260-1290°C	
Max. Operating Temperature	550°C	
CHEMICAL COMPOSITION		
Silica	45.5%	
Alumina	37.5%	
Potash	12.0%	
Water	5.0%	

Beryllium Oxide

PROPERTY	TYPICAL VALUE	TEST METHOD
CHEMICAL		
BeO Content	99.5% min.	Spectrographic Analysis (100% — % by wt. of total metallic impurity)
ELECTRICAL		
Dielectric Constant (25°C)	6.5 (1 MHz) 6.6 (10 GHz)	ASTM D150 ASTM D2520
Dissipation Factor (25°C)	0.0004 (1 MHz) 0.0004 (10 GHz)	ASTM D150 ASTM D2520
Electrical Resistivity (25°C)	> 10 ¹⁵ ohm-cm	ASTM D257-61
Dielectric Strength	240 volts/mil (1/4" thick)	ASTM D149-64
PHYSICAL		
Density	2.85 g/cm ³ (min.)	ASTM C373-56 ASTM F77-67T
Hardness	60 minimum (Rockwell 45N)	ASTM E-18-67
MECHANICAL		
Flexural Strength (25°C)	33,000 psi (min.)	ASTM Microbar 8D25 ASTM D2442-70, A3
Modulus of Elasticity	50 x 10 ⁶ psi	ASTM D2442-70, A4
Poisson's Ratio	0.26	ASTM D2442-70, A4
Tensile Strength (25°C)	22,000 psi	ASTM 565-65T
Compressive Strength (25°C)	225,000 psi	ASTM C528
THERMAL		
Coefficient of Thermal Expansion	9.0 x 10 ⁻⁶ /°C (25-1000°C)	ASTM E-228 ASTM C-372-56 ASTM C-327-56
Thermal Conductivity	0.60 cal/cm.-sec.-°C (25°C) 0.45 cal/cm.-sec.-°C (100°C) 0.35 cal/cm.-sec.-°C (150°C)	ASTM C-408-62
Specific Heat	0.25 cal/gm. °C	ASTM C-351-61
Melting Point	2552°C (4625°F)	
Maximum Temperature for Continuous Use	2149°C (3900°F)	

Notes: 1. One mil equals .001 inch.
 2. See page 80 for ThermalSil silicone rubber typical properties.

Thermalfilm Polyimide Plastic Film



Thermalfilm is a low cost polyimide plastic film insulating material conforming to MIL-P-46112 Type I. Thermalfilm has been designed to be an improved replacement for mica. These insulators have a distinctive amber color and can be easily recognized and assembled on a production line.

Thermalfilm insulators (0.002 in. thick) have a dielectric strength of approximately 5,400 volts/mil in air, thermal conductivity of 3.9×10^{-4} cal/cm - sec - °C at 75°C, surface resistivity of 10^{16} ohms (minimizes corona effects) and a service temperature range of -260°C to +400°C.

Thermalfilm has an extremely high resistance to flow or thin out under high compressive stresses, particularly at elevated temperatures.

Physical, mechanical and electrical properties are excellent and remain nearly constant over a wide range of temperature and frequency. Thermalfilm is radiation resistant, has no melting point, and has no known organic solvents.

The polyimide plastic film is UL listed as a component in UL's publication "Component — Plastic Material" dated September 18, 1969. The UL card number is E 39505, Guide OBHR2 filed by E.I. du Pont de Nemours & Co. Inc.

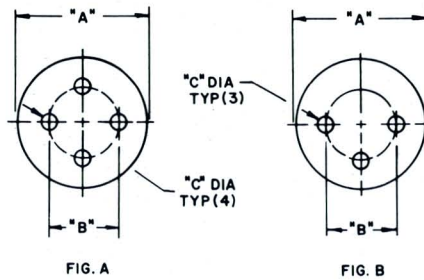
Notes:

1. Insulator thickness is .002 in. (.05 mm) unless otherwise specified. Insulators .001, .003 and .005 inch thick are available on special order.
2. Dimensional tolerances are $\pm .015$ (.38), hole diameters are $\pm .010$ (.25), and angularity is $\pm 1\frac{1}{2}^\circ$ unless otherwise specified.

Bulk Thermalfilm

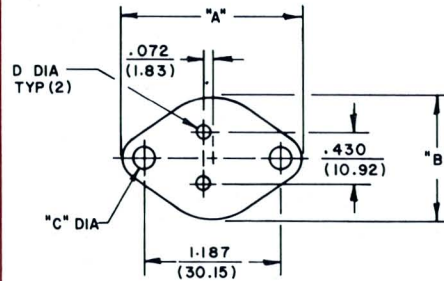
Thermalfilm is available from stock in 12 inch widths from which you may fabricate your own samples and prototype insulators. Three thicknesses are available: Part No. 4200 (.001 in.), 4300 (.002 in.), and 4500 (.005 in.). Specify length desired.

For TO-5 and TO-18



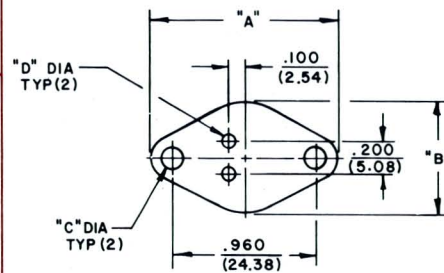
Part No.	Fig.	A	B	C
43-05-1 (TO-5)	A	.390 (9.91)	.200 (5.08)	.036 (.91)
43-05-2 (TO-5)	B	.390 (9.91)	.200 (5.08)	.036 (.91)
43-18-1 (TO-18)	A	.250 (6.35)	.100 (2.54)	.036 (.91)

For TO-3



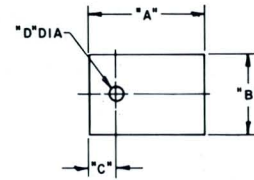
Part No.	A	B	C	D
43-03-1	1.730 (43.94)	1.250 (31.75)	.140 (3.56)	.062 (1.57)
43-03-2	1.655 (42.04)	1.063 (27.00)	.156 (3.96)	.062 (1.57)
43-03-3	1.655 (42.04)	1.063 (27.00)	.156 (3.96)	.166 (4.22)
43-03-4	1.563 (39.70)	1.050 (26.67)	.140 (3.56)	.062 (1.57)
43-03-6	1.655 (42.04)	1.125 (28.58)	.156 (3.96)	.062 (1.57)

For TO-66



Part No.	A	B	C	D	Thickness
43-66-1	1.312 (33.32)	.762 (19.35)	.140 (3.56)	.093 (2.36)	.002 (.05)
43-66-2	1.312 (33.32)	.762 (19.35)	.140 (3.56)	.062 (1.57)	.002 (.05)

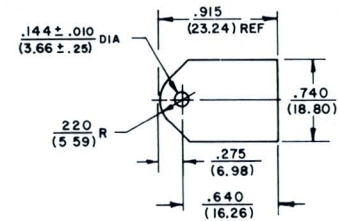
For TO-220, TO-126, Case 77, Case 199, Case 90



Part No.	A	B	C	D
43-77-1 * (b)	.437 (11.10)	.312 (7.92)	.140 (3.56)	.093 (2.36)
43-77-2 (c), (d)	.687 (17.45)	.562 (14.27)	.218 (5.54)	.125 (3.18)
43-77-6 (c), (d)	.812 (20.62)	.562 (14.27)	.281 (7.14)	.156 (3.96)
43-77-8 (c), (d)	.745 (18.92)	.545 (13.84)	.212 (5.38)	.150 (3.81)
43-77-9 (a)	.725 (18.42)	.520 (13.21)	.170 (4.32)	.115 (2.92)

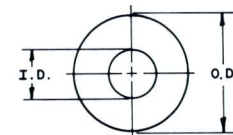
*Style Code
 (a) TO-220
 (b) TO-126, Case 77
 (c) Case 90
 (d) Case 199

For TO-218



Part No. 43-02-95

Washer



Part No.	Thread	I.D.	O.D.
43-02-10	#10	.203 (5.16)	.562 (14.27)
43-02-25	1/4"	.265 (6.73)	.812 (20.62)
43-02-27	1/4"	.265 (6.73)	1.000 (25.40)

Thermalfilm™

Military Specification MIL-M-38527B Cross Reference to Thermalfilm Insulators

Mil Spec Part Number	Thermalloy Part Number	Mil Spec Part Number	Thermalloy Part Number
M38527/8-01P	43-03-1	M38527/8-61P	43-03-53-5 MIL*
M38527/8-02P	43-03-1-5 MIL	M38527/8-62P	43-02-84*
M38527/8-03P	43-03-2	M38527/8-63P	43-02-84-5 MIL*
M38527/8-04P	43-03-2-5 MIL	M38527/8-64P	43-02-4*
M38527/8-05P	43-03-3	M38527/8-65P	43-02-4-5 MIL*
M38527/8-06P	43-03-3-5 MIL	M38527/8-66P	43-02-13*
M38527/8-07P	43-03-4	M38527/8-67P	43-02-13-5 MIL*
M38527/8-08P	43-03-4-5 MIL	M38527/8-68P	43-02-61*
M38527/8-09P	43-03-5*	M38527/8-69P	43-02-61-5 MIL*
M38527/8-10P	43-03-5-5 MIL*	M38527/8-70P	43-02-8*
M38527/8-11P	43-03-6	M38527/8-71P	43-02-8-5 MIL*
M38527/8-12P	43-03-6-5 MIL	M38527/8-72P	43-02-103*
M38527/8-13P	43-03-7*	M38527/8-73P	43-02-103-5 MIL*
M38527/8-14P	43-03-7-5 MIL*	M38527/8-74P	43-02-18*
M38527/8-15P	43-03-8*	M38527/8-75P	43-02-18-5 MIL*
M38527/8-16P	43-03-8-5 MIL*	M38527/8-76P	43-02-10
M38527/8-17P	43-03-9*	M38527/8-77P	43-02-10-5 MIL
M38527/8-18P	43-03-9-5 MIL*	M38527/8-78P	43-02-24*
M38527/8-21P	43-66-1	M38527/8-79P	43-02-24-5 MIL*
M38527/8-22P	43-66-1-5 MIL	M38527/8-80P	43-02-25
M38527/8-23P	43-66-2	M38527/8-81P	43-02-25-5 MIL
M38527/8-24P	43-66-2-5 MIL	M38527/8-82P	43-02-26*
M38527/8-25P	43-66-3*	M38527/8-83P	43-02-26-5 MIL*
M38527/8-26P	43-66-3-5 MIL	M38527/8-84P	43-02-27
M38527/8-27P	43-66-7*	M38527/8-85P	43-02-27-5 MIL
M38527/8-28P	43-66-7-5 MIL*	M38527/8-86P	43-02-32*
M38527/8-29P	43-66-10*	M38527/8-87P	43-02-32-5 MIL*
M38527/8-30P	43-66-10-5 MIL*	M38527/8-88P	43-02-30*
M38527/8-40P	43-05-1	M38527/8-89P	43-02-30-5 MIL*
M38527/8-41P	43-05-1-5 MIL	M38527/8-90P	43-02-31*
M38527/8-42P	43-18-1	M38527/8-91P	43-02-31-5 MIL*
M38527/8-43P	43-18-1-5 MIL	M38527/8-92P	43-02-37*
M38527/8-50P	43-37-1*	M38527/8-93P	43-02-37-5 MIL*
M38527/8-51P	43-37-1-5 MIL*	M38527/8-94P	43-02-50*
M38527/8-55P	43-36-1*	M38527/8-95P	43-02-50-5 MIL*
M38527/8-56P	43-36-1-5 MIL*	M38527/8-96P	43-02-75*
M38527/8-60P	43-03-53*	M38527/8-97P	43-02-75-5 MIL*

Numerical Listing Cross Reference by Case Style

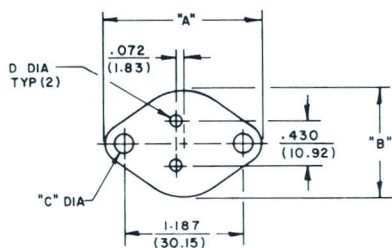
Case Style	Thermalloy Part Number	MIL Spec Part Number
TO-3	43-03-1	M38527/8-01P
	43-03-1 5 MIL	M38527/8-02P
	43-03-2	M38527/8-03P
	43-03-2 5 MIL	M38527/8-04P
	43-03-3	M38527/8-05P
	43-03-3 5 MIL	M38527/8-06P
	43-03-4	M38527/8-07P
	43-03-4 5 MIL	M38527/8-08P
	43-03-5*	M38527/8-09P
	43-03-5 5 MIL*	M38527/8-10P
	43-03-6	M38527/8-11P
	43-03-6 5 MIL	M38527/8-12P
	43-03-7*	M38527/8-13P
	43-03-7 5 MIL*	M38527/8-14P
	43-03-8*	M38527/8-15P
	43-03-8 5 MIL*	M38527/8-16P
	43-03-9*	M38527/8-17P
	43-03-9 5 MIL*	M38527/8-18P
	43-66-1	M38527/8-21P
	43-66-1 5 MIL	M38527/8-22P
	43-66-2	M38527/8-23P
	43-66-2 5 MIL	M38527/8-24P
	43-66-3*	M38527/8-25P
	43-66-3 5 MIL*	M38527/8-26P
	43-05-1	M38527/8-30P
43-05-1 5 MIL	M38527/8-40P	
43-18-1	M38527/8-41P	
43-18-1 5 MIL	M38527/8-42P	
43-36-1*	M38527/8-43P	
43-36-1 5 MIL*	M38527/8-56P	
43-37-1*	M38527/8-50P	
43-37-1 5 MIL*	M38527/8-51P	
43-03-53*	M38527/8-60P	
43-03-53 5 MIL*	M38527/8-61P	
TO-66	43-66-1	M38527/8-21P
	43-66-1 5 MIL	M38527/8-22P
TO-5	43-05-1	M38527/8-30P
	43-05-1 5 MIL	M38527/8-40P
TO-18	43-18-1	M38527/8-41P
TO-36	43-36-1*	M38527/8-43P
	43-36-1 5 MIL*	M38527/8-55P
MD-14, 25, 28	43-37-1*	M38527/8-56P
TO-53	43-37-1 5 MIL*	M38527/8-50P
	43-03-53*	M38527/8-60P
	43-03-53 5 MIL*	M38527/8-61P

Washers — Stud Size

#4	43-02-4*	M38527/8-64P
	43-02-4 5 MIL*	M38527/8-65P
	43-02-13*	M38527/8-66P
#6	43-02-13 5 MIL*	M38527/8-67P
	43-02-84*	M38527/8-62P
	43-02-84 5 MIL*	M38527/8-63P
#8	43-02-61*	M38527/8-68P
	43-02-61 5 MIL*	M38527/8-69P
	43-02-8*	M38527/8-70P
#10	43-02-8 5 MIL*	M38527/8-71P
	43-02-18*	M38527/8-74P
	43-02-18 5 MIL*	M38527/8-75P
1/4"	43-02-103*	M38527/8-72P
	43-02-103 5 MIL*	M38527/8-73P
	43-02-10	M38527/8-76P
5/16"	43-02-10 5 MIL	M38527/8-77P
	43-02-24*	M38527/8-78P
	43-02-24 5 MIL*	M38527/8-79P
3/8"	43-02-25	M38527/8-80P
	43-02-25 5 MIL	M38527/8-81P
	43-02-26*	M38527/8-82P
1/2"	43-02-26 5 MIL*	M38527/8-83P
	43-02-27	M38527/8-84P
	43-02-27 5 MIL	M38527/8-85P
3/4"	43-02-30*	M38527/8-88P
	43-02-30 5 MIL*	M38527/8-89P
	43-02-31*	M38527/8-90P
	43-02-31 5 MIL*	M38527/8-91P
	43-02-32*	M38527/8-86P
	43-02-32 5 MIL*	M38527/8-87P
	43-02-37*	M38527/8-92P
	43-02-37 5 MIL*	M38527/8-93P
	43-02-50*	M38527/8-94P
	43-02-50 5 MIL*	M38527/8-95P
	43-02-75*	M38527/8-96P
	43-02-75 5 MIL*	M38527/8-97P

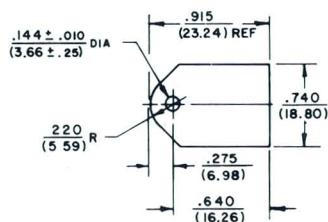
*Not in catalog, contact factory

For TO-3



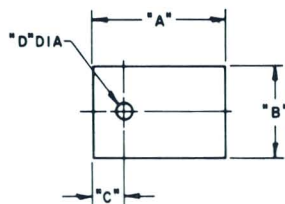
Part No.	A	B	C	D	THK.
56-03-2	1.655 (42.04)	1.063 (27.00)	.156 (3.96)	.062 (1.57)	.002/.004 (.05/.10)
56-03-8	1.687 (42.85)	1.187 (30.15)	.156 (3.96)	.062 (1.57)	.002/.004 (.05/.10)

For TO-18

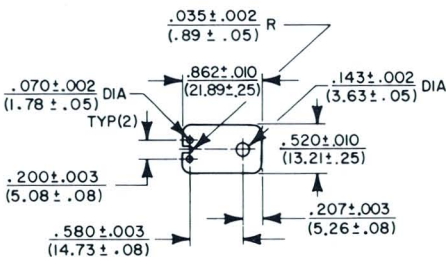


Part No. 56-02-95

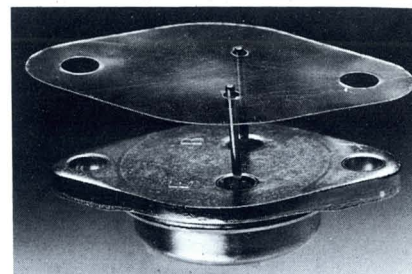
For TO-220



Part No.	A	B	C	D	THK.
56-77-8	.745 (18.93)	.545 (13.84)	.212 (5.38)	.150 (3.81)	.002/.004 (.05/.10)
56-77-11	.745 (18.93)	.545 (13.84)	.212 (5.38)	.120 (3.05)	.002/.004 (.05/.10)

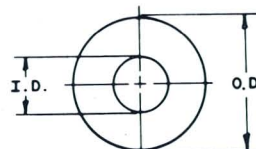


Part No. 56-77-10 Thickness: .002/.004
(.05/.10)



Mica insulators provide high maximum operating temperatures (550°C) and excellent electrical properties. Thermalloy mica insulators are low in cost and available for TO-3, TO-66, TO-127 and TO-220 case styles.

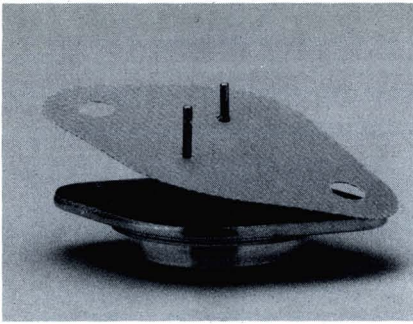
Washer



Part No.	I.D.	O.D.	Diameter tolerances	THK.
56-02-10	.203 (5.16)	.563 (14.30)	± .005 (.13)	.002/.004 (.05/.10)
56-02-72	.258 (6.55)	1.00 (25.40)	± .015 (.38)	.004/.006 (.10/.15)

Thermalsil™ Thermally Conductive, Silicone Rubber Insulators

NEW



The new Thermalsil™ formula has improved thermal conductivity providing excellent thermal resistance. It is used as an electrically isolating interface material composed of silicone elastomer binder with a thermally conductive filler and is reinforced with glass cloth to resist tearing and cut-through due to burrs on transistors or heat sinks.

Thermalsil eliminates the need for grease application and conforms to mounting surfaces under clamping pressure for optimum heat conduction.

Thermalsil II is 9 mils (.009 inch) thick and blue gray in color. It is available in any configuration with adhesive backing for easy application to the heat sink. Order number prefix is "54".

Thermalsil III is 6 mils (.006 inch) thick and gray-green in color. A finely woven glass cloth provides the thinnest possible matrix for enhanced thermal resistance. It is available in any configuration with adhesive backing. Order number prefix is "53". This material complies with MIL-I-49456.

Thermalsil II™

PROPERTY	TYPICAL VALUE	TEST METHODS
ELECTRICAL		
Dielectric Constant	5.9 @ 1 MHz	ASTM Tests Defined in MIL-I-49456 (9/4/84)
Dielectric Breakdown Voltage	275 Volts/mil	
Volume Resistivity	3×10^9 megohm-cm	
PHYSICAL		
Specific Gravity	2.78	
Hardness, Shore A	89	
Breaking Strength — Warp Direction	100 lbs./inch (0.095 mils thick)	
THERMAL		
Continuous Use Temperatures	-77 to 200° C	

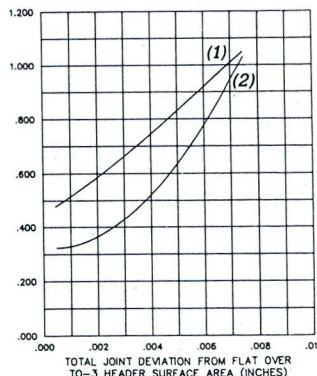
Thermalsil III™

PROPERTY	TYPICAL VALUE	TEST METHODS
ELECTRICAL		
Dielectric Constant	2.2 @ 60 Hz 2.1 @ 10^3 Hz 2.4 @ 10^6 Hz	ASTM D-150
Dielectric Breakdown Voltage	500 Volts/mil	ASTM D-149
Volume Resistivity	0.9×10^{15} megohm-cm	ASTM D-257
Dielectric Dissipation Factor	0.002 @ 60 Hz 0.002 @ 10^3 Hz	ASTM D-150
PHYSICAL		
Tensile Strength	2845 PSI	ASTM D-412
Hardness, Shore A	80	
THERMAL		
Thermal Conductivity	5.68×10^{-4} cal./cm. sec. °C	
Flame Resistance	U.L. 94 V-O	U.L. Card #E-528126(S)

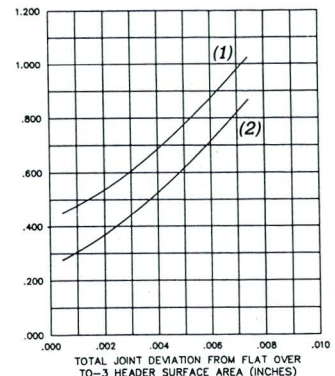
All values at 6 inch-pounds of torque and 30 watts of power.

- (1) **Thermalsil II**, .009 (.23) thick.
- (2) **Thermalsil III**, .006 (.15) thick.

THERMALLOY TEST METHOD



MIL-SPEC TEST METHOD (MIL-I-49456)



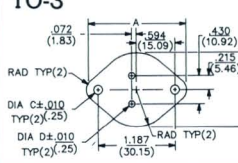
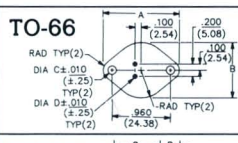
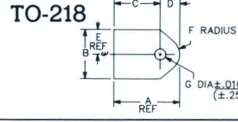
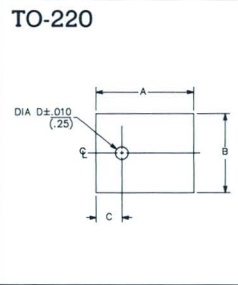

Standard Thermalsil Configurations

Dimensions (Inches)

Ordering Information

When ordering, substitute the "xx" prefix with part number "54" to designate Thermalsil II. (Example: 54-03-2). And "53" to designate Thermalsil III. (Example: 53-03-2).

To order insulators with adhesive-coated backing, add "AC" suffix. (Example: 54-03-2 AC).

Configuration	Part Number	A	B	C	D	E	F	G
 <p>TO-3</p>	xx-03-2	1.655	1.063	.156	.062			
	xx-03-11	1.646	1.125	.156	.093			
	xx-03-12	1.650	1.140	.140	.093			
	xx-03-14	1.563	1.050	.140	.140			
	xx-03-15	1.593	1.100	.156	.070			
	xx-03-16	1.700	1.187	.156	.063			
 <p>TO-66</p>	xx-66-2	1.312	.762	.140	.062			
	xx-66-9	1.507	.955	.140	.062			
	xx-66-10	1.250	.700	.140	.062			
	xx-66-11	1.375	.825	.140	.062			
 <p>TO-218</p>	xx-02-95	.915	.740	.640	.275	.370	.220	.144
	xx-02-102	.865	.650	.650	.215	.325	.160	.140
	xx-02-103	.937	.750	.656	.281	.375	—	.125
	xx-78-3*	1.000	.800					
 <p>TO-220</p>	xx-77-2	.687	.562	.218	.125			
	xx-77-3	.687	.562	.185	.093			
	xx-77-4	.750	.500	.187	.147			
	xx-77-5	.800	.600	.218	.110			
	xx-77-9	.725	.520	.170	.115			
	xx-77-10	.825	.905	.210	.145			
	xx-77-11	1.030	.520	.150	.130			
	xx-77-13	.710	.500	.160	.141			
 <p>Washer</p>	xx-02-10	.562	.203					
	xx-02-15	.625	.200					
	xx-02-20	1.000	.260					
	xx-02-25	.812	.265					

*This insulator is made especially for clip-mount heat sinks, thus requiring no mounting hole.

Thermalloy interface test procedures differ from MIL-I-49456, dated 9/4/84. To clarify those differences, please refer to the table

Test Method Comparison TO-3 Silicone Rubber Insulators		
Test Item	Thermalloy Test Method	Mil-Spec Method (MIL-I-49456, 9/4/84)
Thermal Resistance	Thermalsil II, .52°C/W TYP. Thermalsil III, .33°C/W TYP.	Thermalsil II, .49°C/W TYP. Thermalsil III, .31°C/W TYP.
Mil-Spec Classification	N/A	Type I, Class 2
Heat Sink	Water cooled, base-sized TO-3.	Heat sink, 86 sq. in.
Shoulder Washer — to electrically isolate screws	Ryton (Thermalloy Part #7717-7PPS)	None — electric/thermal short
Thermal Insulation	Foam over top/sides of TO-3 heat source to minimize heat loss to environment and assure accurate measure of heat flow across joint.	None — approximately 15% of energy input radiates and convects from top/sides of TO-3 heat source.
Interface Flatness	Variable	None Specified

Note: Test conditions for thermal resistance given above are at .001 in./in. total deviation from flat with a 6 in.-lb. torque.

Hard Anodized Aluminum



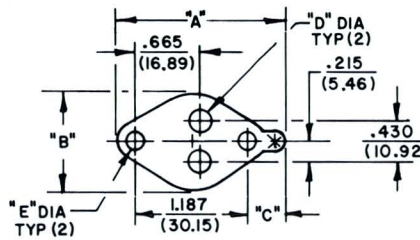
A unique hardcoating process is employed which is optimized for dielectric capabilities and MIL-A-8625 Type III specifications. This process yields a uniform .001 inch minimum coating which is an integral part of the base aluminum insulation. The 0.020 inch thick aluminum provides adequate support for the anodized coating for maximum heat transfer and superior performance.

These durable hard anodized insulators have a high thermal conductance and a minimum breakdown voltage of 400 volts DC RMS through two layers of hard anodized coating (per ASTM B110 test procedures, reference Thermalloy EIR 74-1052 paragraph 2.2).

Notes:

1. Dimensional tolerances and hole diameters are $\pm .010$ (.25), angularity is $\pm 1^\circ$ and flatness is .004 TIR unless otherwise specified.
2. All washers are .020 (.51) thick unless otherwise specified.
3. *denotes racking location.

For TO-3

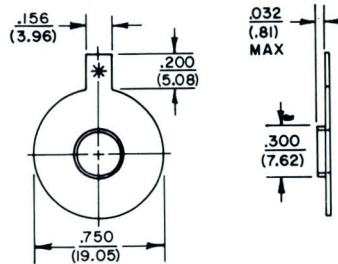


Part No.	A	B	C	D	E
4703A	1.793 (45.54)	1.063 (27.00)	.403 (10.24)	.090 (2.29)	.156 (3.96)
*4720A	1.625 (41.28)	1.150 (29.21)	.235 (5.67)	.220 (5.59)	.190 (4.83)
4726A	1.793 (45.54)	1.063 (27.00)	.403 (10.24)	.220 (5.59)	.190 (4.83)

* Shipped on racks

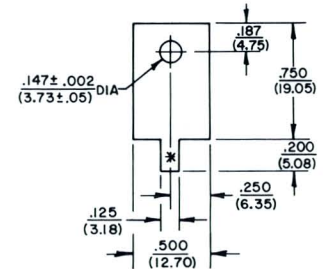
For Stud Mounted Devices

Part No. 4705-A

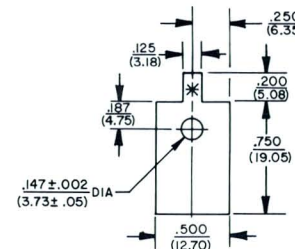


For TO-126, TO-220, Cases 77, 90, and 199

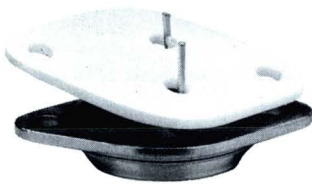
Part No. 4777-A



Part No. 4778-A



Aluminum Oxide Ceramic



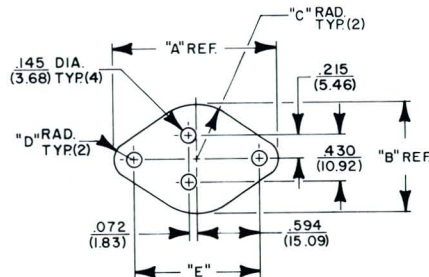
Aluminum oxide insulating washers have a dielectric strength of approximately 550 volts/mil for 0.030 in. material and 430 volts/mil for 0.062 in. material. The thermal conductivity of Aluminum oxide is 0.036 cal/cm-sec-°C at 75°C (167°F).

Aluminum oxide has unique thermal-conductivity qualities and features low loss factors at high frequencies, high compressive strengths, high volume resistivity, low thermal expansion, and is radiation resistant.

Note:

Hole diameters are $\pm .005$ (.13), angularity is $\pm 1^\circ$, and flatness is .002 TIR unless otherwise specified.

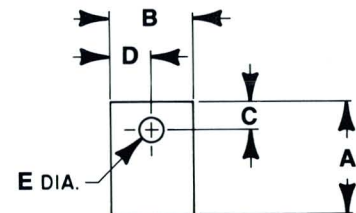
For TO-3



Part No.	A	B	C	D	E
4103*	1.563 (39.70)	1.050 (26.67)	.525 (13.34)	.187 (4.75)	1.197 (30.40)
4104*	1.750 (44.45)	1.250 (31.75)	.625 (15.88)	.282 (7.16)	1.187 (30.15)

*Thickness .060 (1.52)/.080 (2.03)

For TO-220



Part No.	A	B	C	D	E
4170*	.760 (19.30)	.550 (13.97)	.188 (4.78)	.275 (6.98)	.145 (3.68)
4177*	.687 (17.45)	.562 (14.27)	.218 (5.54)	.281 (7.14)	.125 (3.18)

*Thickness .060 (1.52)/.080 (2.03)

For TO-218

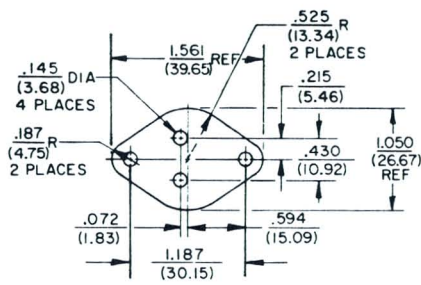
Part No.	A	B	C	D	E
4180*	.915 (23.24)	.740 (18.80)	.275 (6.98)	.370 (9.40)	.156 (3.96)

*Thickness .060 (1.52)/.080 (2.03)

Beryllium Oxide Ceramic

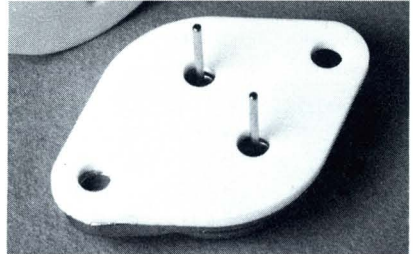
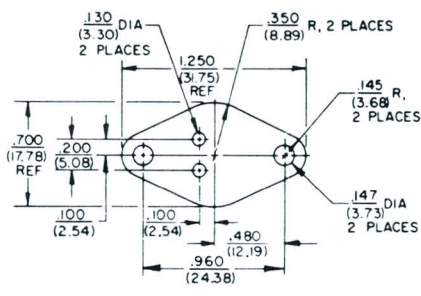
For TO-3

Part No. 4003 Thickness .062 (1.57)
 Part No. 4003-1 Thickness .032 (.81)



For TO-66

Part No. 4066 Thickness .062 (1.57)



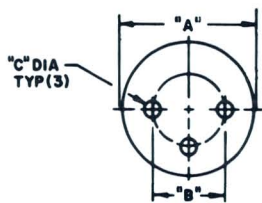
Thermalloy's beryllium oxide insulators (99.5% minimum purity) conforms to MIL-I-10B. Their high dielectric strength allows safe operating voltages of 1500 volts or more. For applications involving high frequency or high pulse rate circuitry, the inherent low electrical capacitance of these insulators prevents circuit detuning and loss of signal power.

Beryllium oxide insulators have a dielectric strength of approximately 580 volts/mil for 0.032 in. material and 450 volts/mil for 0.062 in. material. The thermal conductivity of beryllium oxide is 0.53 cal/cm - sec - °C at 75°C.

Beryllium oxide is chemically inert and completely safe to use in its fired state. Handling of finished parts presents absolutely no health hazards.

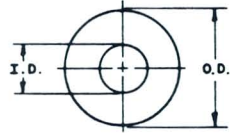
However, beryllium oxide is toxic when dust, mist or fumes containing particles small enough to enter the lungs are inhaled. Therefore, grinding, sanding and pulverizing the material should be avoided.

For TO-5 and TO-18



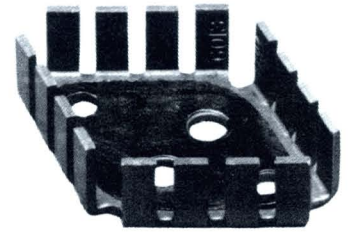
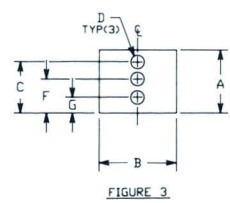
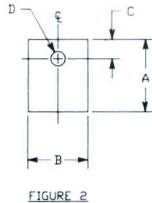
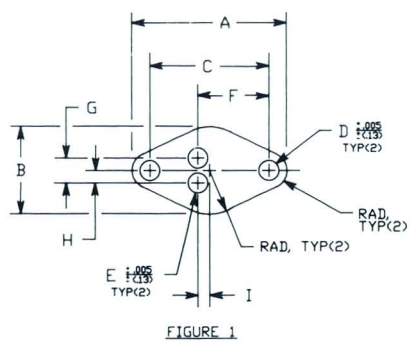
Part No	A	B	C	Thickness
4005 (TO-5)	.360 (9.14)	.200 (5.08)	.040 (1.02)	.030 (.76)
4005-15 (TO-5)	.360 (9.14)	.200 (5.08)	.040 (1.02)	.015 (.38)

Mounting Washers



Part No.	O.D.	I.D.	Thickness
B-250-130-62	.250 ± .005 (6.35 ± .13)	.130 ± .005 (3.30 ± .13)	.062 ± .010 (1.57 ± .25)
B-375-120-30	.375 ± .005 (9.52 ± .13)	.120 ± .005 (3.05 ± .13)	.030 ± .005 (.76 ± .13)
B-375-120-62	.375 ± .005 (9.52 ± .13)	.120 ± .005 (3.05 ± .13)	.062 ± .010 (1.57 ± .25)
B-470-235-40	.470 ± .005 (11.94 ± .13)	.235 ± .005 (5.97 ± .13)	.040 ± .005 (1.02 ± .13)
B-510-200-40	.510 ± .010 (12.95 ± .25)	.200 ± .010 (5.08 ± .25)	.040 ± .005 (1.02 ± .13)
B-800-260-30	.800 ± .010 (20.32 ± .25)	.260 ± .005 (6.60 ± .13)	.030 ± .003 (.76 ± .08)
B-800-260-62	.800 ± .010 (20.32 ± .25)	.260 ± .005 (6.60 ± .13)	.062 ± .005 (1.57 ± .13)

Grafoil® Conducta-Pad™



Note: Tolerances unless noted ± .011 (.28).

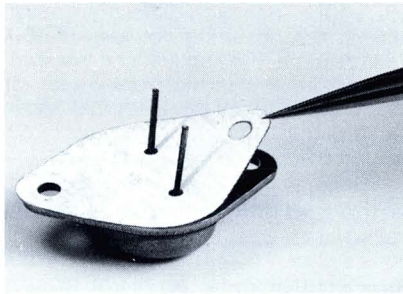
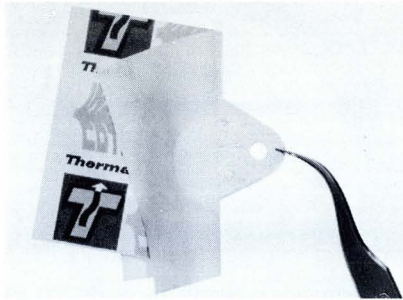
SUFFIX TO ORDER	DEVICE	SPECIAL APPLICATION PART NO.	FIG. NO.	DIM. 'A'	DIM. 'B'	DIM. 'C'	DIM. 'D'	DIM. 'E'	DIM. 'F'	DIM. 'G'	DIM. 'H'	DIM. 'I'
G1	TO-3	N/A	1	1.570 (39.88)	1.050 (26.67)	1.187 (30.15)	188 (4.78)	223 (5.66)	665 (16.89)	430 (10.92)	215 (5.46)	072 (1.83)
G2	TO-66	N/A	1	1.300 (33.02)	.700 (17.78)	.960 (24.38)	.156 (3.96)	.161 (4.09)	.580 (14.73)	.200 (5.08)	.100 (2.54)	.100 (2.54)
G3	TO-202	6234	2	.450 (11.43)	.410 (10.41)	.135 (3.43)	.135 (3.43)	N/A	N/A	N/A	N/A	N/A
G4	TO-218	6298, 7022, 7023	2	.760 (19.30)	.620 (15.75)	.190 (4.83)	.150 (3.81)	N/A	N/A	N/A	N/A	N/A
G5	TO-220	MOST STAMPINGS	2	.650 (16.51)	.420 (10.67)	.135 (3.43)	.135 (3.43)	N/A	N/A	N/A	N/A	N/A
G6	N/A	6098 SERIES	3	.825 (20.96)	.618 (15.70)	.630 (16.00)	.125 (3.18)	N/A	.350 (8.89)	.160 (4.06)	N/A	N/A
G7	MULTI-WATT	6398 SERIES	2	.690 (17.53)	.790 (20.07)	.115 (2.92)	.150 (3.81)	N/A	N/A	N/A	N/A	N/A

Used as an alternative to thermal grease, Grafoil® provides essentially the same thermal performance.

Grafoil is a non-insulating material which reduces interface thermal resistance in a bare joint application. A dry material, basically a graphite compound, Grafoil was originally developed for high temperature gasketing applications and is covered by U.S. Patent 3,404,061 granted to Union Carbide.

Basic shapes in stock are designed to accommodate TO-3, TO-66, TO-202, TO-218, TO-220 and multiwatt case styles. Grafoil is factory applied to the heat sink and is available on all stamped and extruded models except standard clip sinks (such as the 6041, 6043, 6237, etc.). Material is .005 (.13) thick.

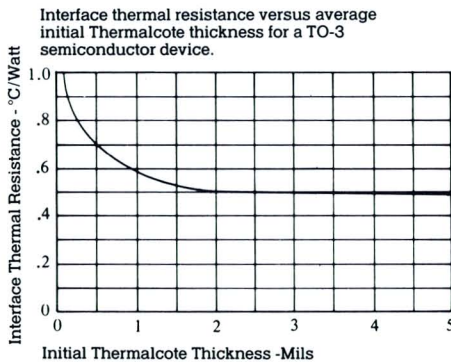
Insul-Cote



- Pre-coated insulators for fast installation.
- Save money by elimination of hand application of thermal grease.
- Provides uniform coating for maximum heat transfer (one mil minimum).
- Eliminates contaminants.

Insul-Cote consists of a reliable Thermalfilm, Mica or other insulator materials PRE-COATED with Thermalcote thermal grease, neatly packaged, and heat sealed as necessary between two strips of 2 3/4" wide tape. One side of the tape is separated into pull tabs for easy opening, or the tape may be "peeled" lengthwise exposing the insulators.

The curve below presents the interface thermal resistance versus initial Thermalcote thickness.



Note:

Quality assurance provisions shall be in accordance with Process Specification PS 113.

Ordering Information

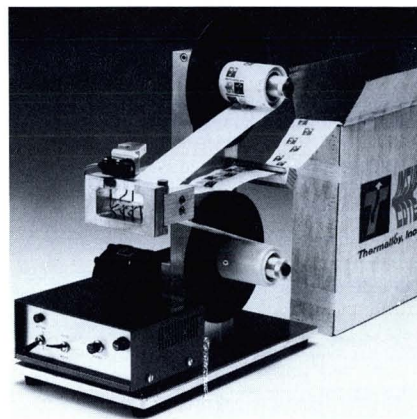
A partial listing of Insul-Cote insulators is shown below. The insulator part number is denoted by the 5 or 6 digits of the Insul-Cote part number. The "AP" suffix denotes "Ammo-Pack" (2,000 piece package).

Insul-Cote With:

Thermalfilm	Mica
43-03-2 AP	56-03-2 AP
43-66-2 AP	56-66-2 AP
43-77-9 AP	56-77-11 AP

Refer to the insulator section pages 77 through 83 of this catalog for descriptions and dimensions of these and other available types and shapes.

Automated Dispenser



Thermal grease application has historically been done by hand. Traditional techniques include brushing, dabbing, and rolling. Hand applications present numerous problems: 1. inconsistent grease thickness, 2. slow production, and 3. mess and contamination.

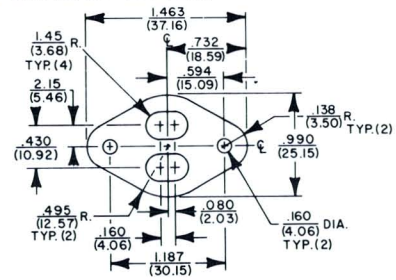
The Insul-Cote automated dispensing machine eliminates time consuming hand operations. Fed by continuous "ammo pack" strips, take-up reels pull the tape apart and dispense the pre-coated insulators one at a time. It eliminates the mess and especially the contamination of hand coating. The dispenser is fast; its output is as fast as your production. Controlled by an electric eye, insulators are indexed as soon as one is removed.

Conducta-Cote

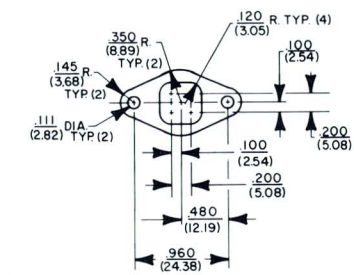
Developed for use where grease application is needed without an insulator. Performs like a greased bare joint application. Packaging is the same as Insul-Cote.

- Pre-coated thermal grease carrier.
- Saves money by elimination of hand application of thermal grease.
- Provides uniform coating for maximum heat transfer (one mil minimum).
- Eliminates contaminants.
- Aluminum carrier 4 mils thick.

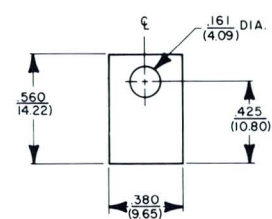
For TO-3
Part No. 57-03-2 CAP



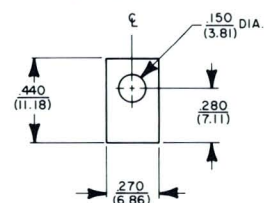
For TO-66
Part No. 57-66-2 CAP



For TO-220
Part No. 57-77-9 CAP



For TO-202
Part No. 57-77-14 CAP



Note:

Dimensional tolerances are $\pm .015$ (.38) unless otherwise specified, hole diameters are $\pm .010$ (.25) and angularity is $\pm 1\frac{1}{2}^\circ$.

Thermally Conductive Epoxy Adhesive

Thermalbond is a thermally conductive, high strength epoxy adhesive. It provides exceptional adhesion to copper, aluminum, steel, glass, ceramics, and most plastics. Thermalbond also has a coefficient of thermal expansion compatible with aluminum, copper, and brass making it particularly well suited for thermally bonding semiconductors and other components to chassis or heat sinks.

Mixing instructions

Mix resin thoroughly before removing material. Add 7.5 parts of RT-7 hardener to 100 parts of resin by weight, or 17 parts of RT-7 hardener to 100 parts of resin by volume. Adhesive will set up in:

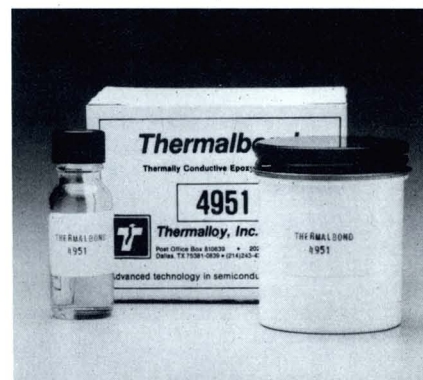
24 hrs. at 25°C (77°F)	1 hr. at 100°C (212°F)
2 hrs. at 65°C (149°F)	30 min. at 130°C (266°F)

Note: For maximum electrical and physical properties, a post cure is necessary. Post cure at room temperature for 4 days or for 4 hrs. at 200°F.

Typical Electrical and Physical Properties at Room Temperature with RT-7 Hardener

Characteristics	Typical Values
Specific gravity	2.35
Working viscosity	25,000 cps
Thermal conductivity	8 BTU/hr ft °F 0.0030 cal/sec cm °C
Thermal resistivity	29.0 °C in/watt
Tensile strength	9,200 psi
Compressive strength	20,900 psi
Bond shear strength	4,600 psi (Aluminum to aluminum, 1" overlap @ 25°C.)
Thermal coefficient of expansion	22 × 10 ⁻⁶ in/in/°C
Heat distortion point	80 °C
Water absorption, % after 10 days @ 25°C.	.15
Hardness, Shore D	.85
Volume resistivity	1.0 × 10 ¹⁶ ohm cm
Dielectric strength	1500 volts/mil
Dielectric constant @ 25°C 100KHz	6.0
Dissipation factor @ 25°C 100KHz	.020
Operating temperatures	Continuous -65 to 155 °C Intermittent -100 to 250°C
Linear Shrinkage	.002 in/in
Shelf Life	Indefinite — If the containers are turned over every 60 days. 12 Months — If not turned, due to settling.

Thermalbond™



Part No.	Size
4951*	3½ oz. (100 grams)
4952*	7 oz. (200 grams)

*Matched quantity of RT-7 hardener included. For larger containers contact factory.

Thermal Joint Compound

Thermalcote is a superior thermal joint compound of thermally loaded silicone-based grease for use with all heat sinks. It improves the transfer of thermal energy across the metal-to-metal interfaces between the transistor or rectifier case and the heat sink.

Thermalcote conducts heat approximately 30 times better than air and more than 4 times better than unloaded silicone grease. It is non-toxic, an excellent insulator, and extremely stable, neither caking nor running, from -40°F to +400°F.

Typical Properties

Color	Opaque White
Working Temperature	-40 to +400°F
Maximum Temperature	800°F
Thermal Conductivity	0.430 Btu/(ft) (hr) (F°) 0.00178 CAL/(cm) (sec) (C°) 0.00745 watts/(cm) (C°) 0.0189 watts. (in) (C°)
Dielectric Strength (.050 gap)	300 volts/mil
Volume Resistivity	4 × 10 ¹⁴ ohm-cm
Cleaning Solvent	1.1 Trichloroethane
Specific Gravity	1.6
Shelf Life	Indefinite (unopened)

Part No.	Net Weight
249	1 oz. (28 grams) tube
250	2 oz. (57 grams) tube
251	1 lb. (454 grams)
252	.5 lbs. (2270 grams)

Thermalcote™ I



An alternative for those concerned about the migration and contamination problem of silicone-based thermal grease.

Thermalcote II was developed as the sensible alternative to silicone-based thermal greases. Thermalcote II employs a highly conductive synthetic base fluid which enables the finished product to exhibit the same thermal characteristics as the silicone-based products.

Thermalcote II contains no silicone, it shows no tendency to creep or migrate while in service. The high lubricity of the base oil permits efficient application to both semiconductor case or heat sink and it will effectively fill the microscopic air gaps present on the metal to metal mating surfaces.

Thermalcote II meets Western Electric Specifications KS 21343.

Typical Properties

Color	Blue
Working Temperature	165°C
Maximum Temperature	200°C
Thermal Conductivity @ 36°C	16.7 × 10 ⁻⁴ cal/sec cm °C, min
Dielectric Strength	.220 volts/mil
Cleaning Solvent	1.1 Trichloroethane
Specific Gravity	2.93 @ 60°F (15.6°C)
Evaporation, 24 hrs @ 200°C, Wt %	0.6 max
Bleed 24 hrs @ 200°C Wt %	0.09% max

Note:

Over a period of time some separation may occur. This may require some stirring before usage.

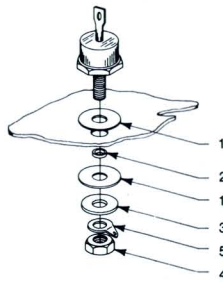
Part No.	Net Weight
349	1 oz. (28 gram) tube
350	2 oz. (57 gram) jar
351	1 lb. (454 gram) can

Thermalcote™ II



Mounting Kits without Sockets

- Pre-packaged in heat-sealed plastic bags for use by individual on assembly line.
- Stock mounting hardware using one number for better control and identification. Your part number can be printed on the bag if requested.
- Military specification approved hardware.
- Selection of insulators — standard kit contains Thermalfilm. Mica and Thermalsil II, silicone rubber are also standard and can be ordered by adding suffix letter "M" (mica) and "S" (Thermalsil II, silicone rubber).
- Other insulator materials available include: hard anodized aluminum, beryllium oxide and aluminum oxide.
- Refer to proper product section for drawings of insulators and shoulder washers used in the mounting kits.

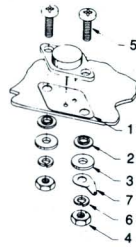


For DO-4 Mounting Kit No. 4860 No. 4860M (mica insulator) No. 4860S (Thermalsil II)

Item	Qty.	Description	Part No.
1	2	Insulator— Thermalfilm Mica Thermalsil II	43-02-10 (56-02-10) (54-02-10)
2	1	Bushing, Teflon	110
3	1	Flat Washer, No. 10	AN960-C10L
4	1	No. 10-32 UNF-2B Hex Nut	MS35650-304
5	1	Terminal, Locking	MS77066-4

For DO-5 Mounting Kit No. 4870 No. 4870M (mica insulator) No. 4870S (Thermalsil II)

Item	Qty.	Description	Part No.
1	2	Insulator — Thermalfilm Mica Thermalsil II	43-02-25 (56-02-93) (54-02-25)
2	1	Bushing, Teflon	113
3	1	Flat Washer, No. ¼	AN960-C416L
4	1	No. ¼-28 UNF-2B Hex Nut	MS51972-1
5	1	Terminal, Locking	MS77069-3

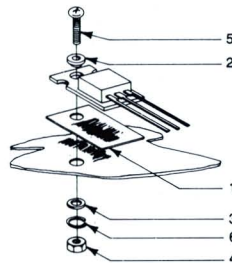


For TO-3 Mounting Kit No. 4804 No. 4804M (mica insulator) No. 4804S (Thermalsil II)

Item	Qty.	Description	Part No.
1	1	Insulator— Thermalfilm Mica Thermalsil II	43-03-2 (56-03-2) (54-03-2)
2	2	Shoulder Washer	7721-5PPS
3	2	Flat Washer, No. 6	MS15795-805
4	2	No. 6-32 UNC-2B Hex Nut	MS35649-264
5	2	No. 6-32 UNC-2A X ½ L PPH Screw	MS51957-30
6	2	Lockwasher, No. 6	MS35338-136
7	1	Solder Lug	10179

Note:

4801, 4801M and 4801S available if desired (identical to 4804, 4804M and 4804S except item 2 is P/N 7721-4PPS).



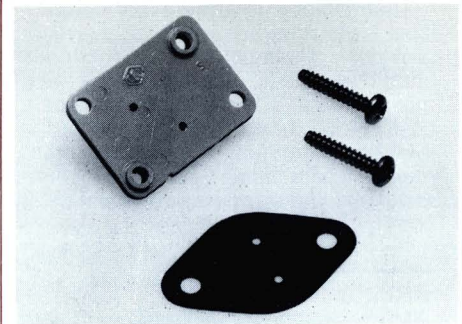
For TO-220 Mounting Kit No. 4880 No. 4880M (mica insulator) No. 4880S (Thermalsil II)

Item	Qty.	Description	Part No.
1	1	Insulator— Thermalfilm Mica Thermalsil II	43-77-9 (56-77-9) (54-77-9)
2	1	Shoulder Washer	7721-7PPS
3	1	Flat Washer, No. 4	MS15795-804
4	1	No. 4-40 UNC-2B Hex Nut	MS35649-244
5	1	No. 4-40 UNC-2A X ½ L PPH Screw	MS51957-17
6	1	Lockwasher, No. 4	MS35338-135

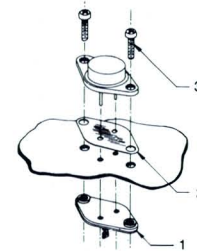
Note:

TO-218 mounting kits are also available using insulator part numbers 43-02-95 (Thermalfilm), 56-02-95 (mica) and 54-02-95 (Thermalsil II), and shoulder washer part number 7721-8PPS. All other kit contents are the same as those in kit No. 4880 for TO-220. Order numbers for the TO-218 kits are: 4818, 4818M and 4818S.

Mounting Kits with Sockets

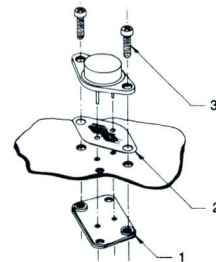


- Pre-packaged in heat-sealed plastic bags for easy use by individual on assembly line.
- Stock mounting hardware using one number for better control and identification. Your part number can be printed on the bag if requested.
- Refer to proper product section for drawings of insulators and laminated sockets used in the mounting kits.



For TO-3 Mounting Kit No. 4875 No. 4875M (mica insulator) No. 4875S (Thermalsil II)

Item	Qty.	Description	Part No.
1	1	Socket	8114 LB 603
2	1	Insulator— Thermalfilm Mica Thermalsil II	43-03-2 (56-03-2) (54-03-2)
3	2	No. 6 x ¾ L PPH Sheet Metal Screw	Type B or AB



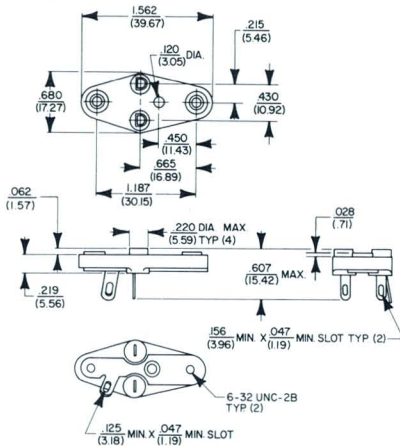
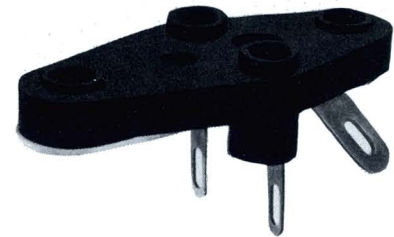
For TO-3 Mounting Kit No. 4876 No. 4876M (mica insulator) No. 4876S (Thermalsil II)

Item	Qty.	Description	Part No.
1	1	Socket	8116 LB 603
2	1	Insulator— Thermalfilm Mica Thermalsil II	43-03-2 (56-03-2) (54-03-2)
3	2	No. 6 x ¾ L PPH Sheet Metal Screw	Type B or AB

8113 PF 603

- For heat sinks with .035 to .25 inch thick mounting areas.
- 6-32 threads in mounting plate.
- Thermalloy hole pattern — 26 recommended.

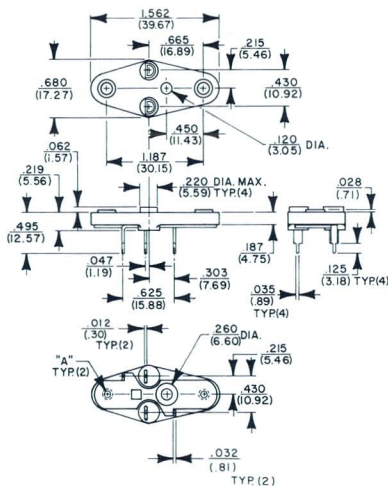
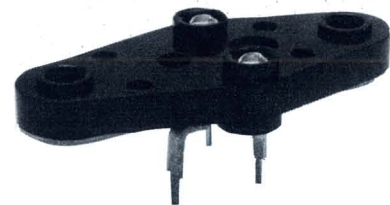
A low cost, high quality one-piece molded socket which allows complete isolation of the base terminal. The compact design of the combination one-piece threaded mounting and ground lug allows direct mounting of the TO-3 package.



8118 PF 303 and 8118 PF 603

- Wave solderable.
- For heat sinks with .035 to .25 inch thick mounting areas.
- For threads in mounting plate (See specifications below).
- Thermalloy hole pattern — 26 recommended.

A low cost, high quality one-piece molded socket which allows complete isolation of the base terminal. Lead tin-plated contacts provide excellent wave solderability.



Part No.	Dim. A
8118 PF 303.....	M3 x 0.5-6H
8118 PF 603.....	6-32 UNC-2B

Specifications

Mechanical:

- Body Material:** Thermoplastic Polyester
- Contact Material:** Phosphor Bronze per QQ-B-750
- Contact Finish:** Tin Plate
- Mounting Lug Material:** Brass per QQ-B-613
- Mounting Lug Finish:** Tin Plate
- Insertion Force:** 5 pounds per contact, maximum (.043 ± .0001 diameter pin)

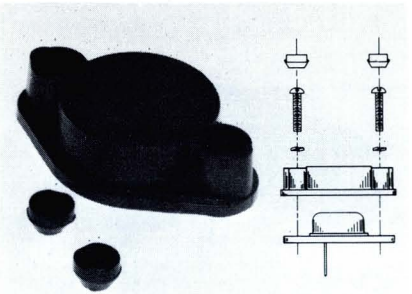
- Durability:** 150 Insertion and withdrawal cycles without electrical or mechanical breakdown.
- Electrical:**
 - Current Rating:**
 - 8113 PF 603 — 5 amperes DC continuous, 15 amperes peak
 - 8118 PF 303 and 8118 PF 603 — 10 amperes DC continuous, 15 amperes peak
 - Contact Resistance:** .0075 ohms @ 5 amperes, maximum
 - Working Voltage:** 450 volts DC
 - Insulation Resistance:** 1000 Megohms minimum

- Capacitance:** 4 Picofarads maximum @ 1 Megacycle (mated)
- Thermal Shock:** per MIL-STD-202 Method 107
- Humidity:** per MIL-STD-202 Method 106
- Vibration:** per MIL-STD-202 Method 204
- Shock:** per MIL-STD-202 Method 202
- Salt Spray:** per MIL-STD-202 Method 101

TO-3 Covers, Insulators, Bushings, Shoulder Washers

TO-3 Insulating Covers

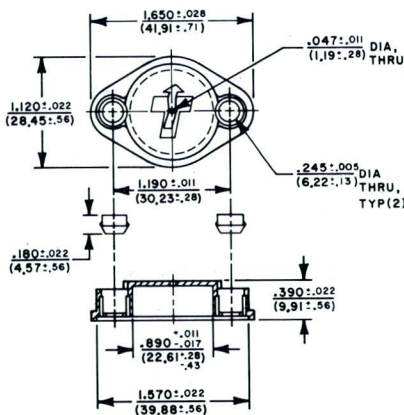
8903



Designed to provide protection from accidental shock during field service or repair. Included are No. 6 split washers as inserts to provide electrical connection of mounting screws to collector, and insulating snap-in cover for the screw heads. A test probe hole is provided in the top of the cover.

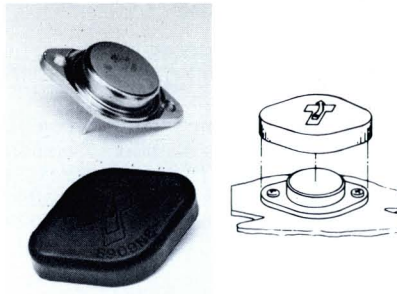
Pan head screws, (not provided), MS 51957-30 or equivalent recommended, secure the cover to the TO-3. At the typical mounting screw torque of 6-8 inch pounds the TO-3 cover material cold flows around the screw head to securely fasten the cover.

The 8903 VB is made from thermoplastic polyester that meets the requirements of U.L. Bulletin 94 V-O. In addition to its excellent flammability rating, thermoplastic polyester offers resistance to most chemical environments, heat deflection temperature to 420°F, and U.L. continuous use temperature rating of 130°C.

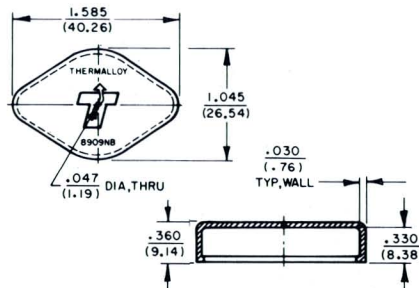


Model	Material	Color	Flammability Standards
8903 NW	Nylon	White	Self-extinguishing, U.L. 94 V-2
8903 VB	Thermoplastic Polyester	Black	Self-extinguishing, U.L. 94 V-O, U.L. 492 Type 1

8909

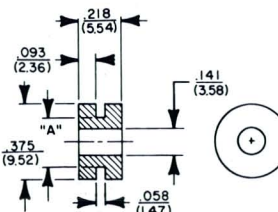


Designed to prevent accidental electrical shock, the 8909 fits TO-3 case styles. Test probe hole in top eliminates need to remove cover for testing. Friction fit for easy snap-on assembly. Recommended for low vibration applications.



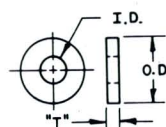
Model	Material	Color	Flammability Standards
8909 NB	Nylon	Black	U.L. 94 V-2

Teflon Filled Acetal Insulators



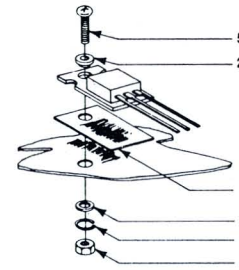
Model	Fits Notch	Dim. A
103	.190 (4.83)	.193 (4.90)
109	.250 (6.35)	.250 (6.35)

Teflon Filled Acetal Bushings



Model	I.D.	O.D.	T
110	.200/.205 (5.08/5.21)	.270/.275 (6.86/6.98)	.062/.055 (1.57/1.40)
113	.255/.260 (6.48/6.60)	.310/.315 (7.87/8.00)	.062/.055 (1.57/1.40)

Insulating Shoulder Washers

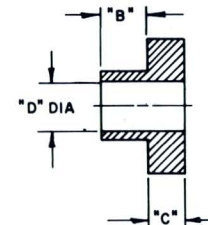
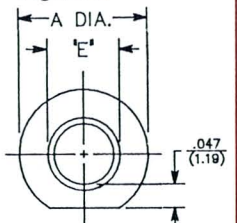


- 40% glass-filled polyphenylene sulfide (PPS).
- Chemically inert (no known solvents under 200°C).
- Maximum recommended service temperature of 260°C.
- Recommended torque is 5 to 6 inch-pounds on all shoulder washers except -7 which has recommended torque of 4 inch-pounds.

Figure 1



Figure 2



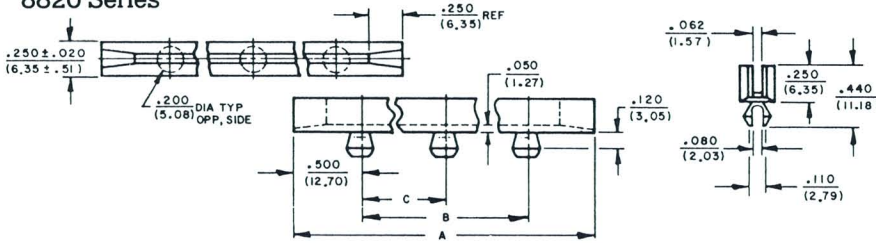
Note:

A single gate extension, not to exceed .025 (.64) in length, is allowable on the outside of all shoulder washers.

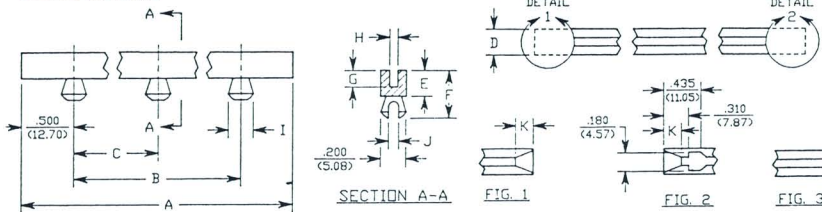
Model	A	B	C	D	E	Screw Size	Fig.
7721-1PPS	.280 (7.11)	.125 (3.18)	.042 (1.07)	.112 (2.84)	.150 (3.81)	4	1
7721-2PPS	.280 (7.11)	.185 (4.70)	.042 (1.07)	.112 (2.84)	.150 (3.81)	4	1
7721-3PPS	.280 (7.11)	.125 (3.18)	.042 (1.07)	.112 (2.84)	.140 (3.56)	4	1
7721-4PPS	.312 (7.92)	.031 (.79)	.047 (1.19)	.146 (3.71)	.190 (4.83)	6	1
7721-5PPS	.312 (7.92)	.031 (.79)	.047 (1.19)	.144 (3.66)	.177 (4.50)	6	1
7721-6PPS	.280 (7.11)	.031 (.79)	.047 (1.19)	.118 (3.00)	.145 (3.68)	4	1
7721-7PPS*	.215 (5.46)	.032 (.81)	.040 (1.02)	.116 (2.95)	.135 (3.43)	4	1
7721-8PPS	.245 (6.22)	.040 (1.02)	.040 (1.02)	.119 (3.02)	.140 (3.56)	4	2

*Design allows insertion in the tab of a TO-220

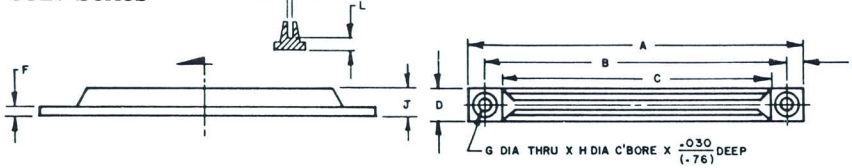
8820 Series



8822 Series



8827 Series



Ordering Information

Model	Dimensions											Details	
	A	B	C	D	E	F	G	H	I	J	K	No. 1	No. 2
8820-2	2.500 (63.50)	1.500 (38.10)	N/A	.250 (6.35)	.250 (6.35)	.440 (11.18)	.200 (5.08)	.80 (2.03)	.200 (5.08)	.110 (2.79)	.250 (6.35)	FIG. 1	FIG. 1
8820-4	4.500 (114.30)	3.500 (88.90)	N/A	.250 (6.35)	.250 (6.35)	.440 (11.18)	.200 (5.08)	.080 (2.03)	.200 (5.08)	.110 (2.79)	.250 (6.35)	FIG. 1	FIG. 1
8820-6	6.000 (152.40)	5.000 (127.00)	N/A	.250 (6.35)	.250 (6.35)	.440 (11.18)	.200 (5.08)	.080 (2.03)	.200 (5.08)	.110 (2.79)	.250 (6.35)	FIG. 1	FIG. 1
8820-8	8.000 (203.20)	7.000 (177.80)	3.500 (88.90)	.250 (6.35)	.250 (6.35)	.440 (11.18)	.200 (5.08)	.080 (2.03)	.200 (5.08)	.110 (2.79)	.250 (6.35)	FIG. 1	FIG. 1
8822-1	2.500 (63.50)	1.500 (38.10)	N/A	.312 (7.92)	.125 (3.18)	.300 (7.62)	.075 (1.90)	.070 (1.78)	.160 (4.06)	.115 (2.92)	.260 (6.60)	FIG. 1	FIG. 3
8822-2	4.500 (114.30)	3.000 (76.20)	N/A	.312 (7.92)	.125 (3.18)	.300 (7.62)	.070 (1.78)	.070 (1.78)	.160 (4.06)	.115 (2.92)	.260 (6.60)	FIG. 2	FIG. 3
8822-5	6.500 (165.10)	5.020 (127.51)	N/A	.312 (7.92)	.125 (3.18)	.300 (7.62)	.075 (1.90)	.070 (1.78)	.160 (4.06)	.115 (2.92)	.260 (6.60)	FIG. 1	FIG. 3

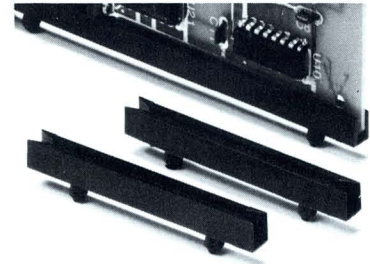
Ordering Information

Model	A + .030 (.76)	B ± .010 (.76)	C ± .030 (.76)	D	E	F	G	H	J	K	L
8827-2	2.000 (50.80)	1.750 (44.45)	1.500 (38.10)	.1230 (5.84)	.125 (3.18)	.062 (1.57)	.081 (2.06)	.150 (3.81)	.210 (5.33)	.063 (1.60)	.080 (2.03)
8827-3	3.500 (88.90)	3.250 (82.55)	3.000 (76.20)	.230 (5.84)	.125 (3.18)	.062 (1.57)	.095 (2.41)	.185 (4.70)	.210 (5.33)	.063 (1.60)	.080 (2.03)
8827-5	5.000 (127.00)	4.750 (120.65)	4.500 (114.30)	.230 (5.84)	.125 (3.18)	.062 (1.57)	.095 (2.41)	.185 (4.70)	.210 (5.33)	.063 (1.60)	.080 (2.03)

Snap-in Guide Selector Chart

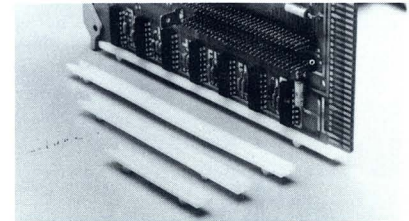
Total Length	No. of Guides Req'd	Lengths	Total Length	No. of Guides Req'd	Lengths	Total Length	No. of Guides Req'd	Lengths
2½"	1		10"	4	2½" + 2½" + 2½" + 2½"	15"	3	2½" + 4½" + 8"
4½"	1		10½"	2	4½" + 6"	16"	2	8"
5"	2	2½"	11"	3	2½" + 2½" + 6"	16½"	3	4½" + 6" + 6"
6"	1		11½"	3	2½" + 4½" + 4½"	17"	3	4½" + 4½" + 8"
7"	2	2½" + 4½"	12"	2	6"	18"	3	6"
7½"	3	2½" + 2½" + 2½"	12½"	2	4½" + 8"	18½"	3	4½" + 6" + 8"
8"	1		13"	3	2½" + 2½" + 8"	19"	4	2½" + 2½" + 6" + 8"
8½"	2	2½" + 6"	13½"	3	4½" + 4½" + 4½"	20"	3	6" + 6" + 6"
9"	2	4½"	14"	2	6" + 8"	22"	3	6" + 8" + 8"
9½"	3	2½" + 2½" + 4½"	14½"	3	2½" + 6" + 6"	24"	3	8"

8820 Series Deep Channel



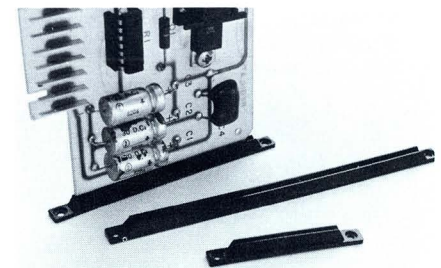
Card Guide snaps into .062 PC board with press-fit pylons — saves time and labor. Deep channel gives a slight pinching action for vibration-resistant grip. Guides are reversible, and may be mounted in tandem to offer many combinations of total guide length. Material is UL 94V0 rated nylon 6/6 per ASTM 4066-82 PA 111F44.

8822 Series Shallow Channel



Shallow channel card guides take less PC board space. Card guide snaps into .062 PC board with press-fit pylons and may be mounted in tandem. Material is UL 94V0 rated nylon 6/6 per ASTM 4066-82 PA 111F44.

8827 Series



This series offers improved packaging flexibility with virtually unlimited board spacing. PC boards are easier to assemble — much more accessible. They're firmly bolted or riveted in place for secure mounting in high shock or vibration applications. Material is UL 94V0 rated nylon 6/6 per ASTM 4066-82 PA 111F44.

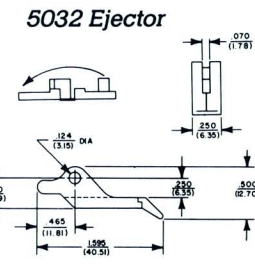
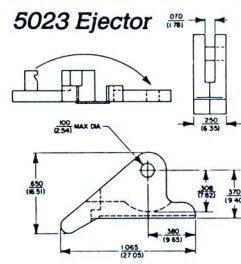
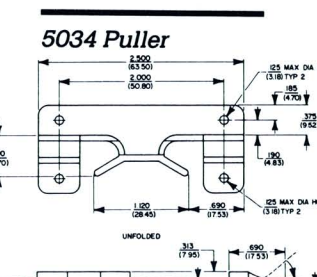
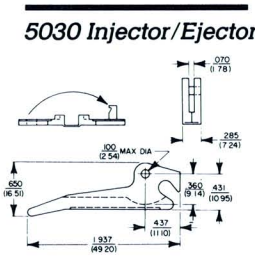
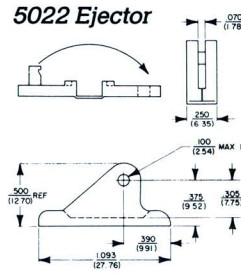
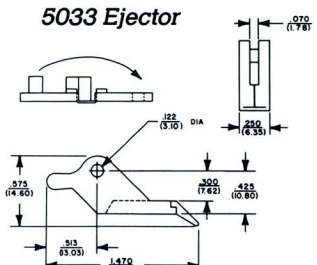
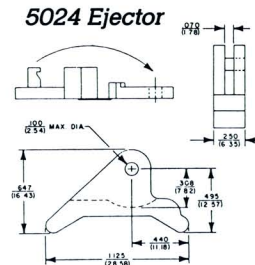
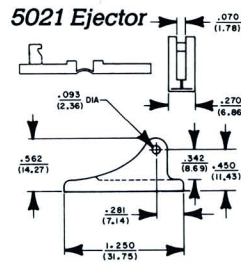
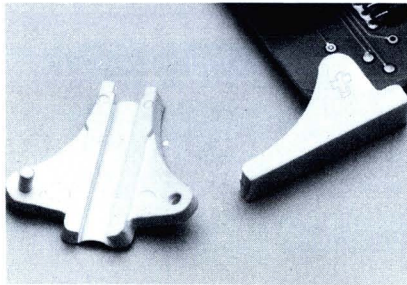
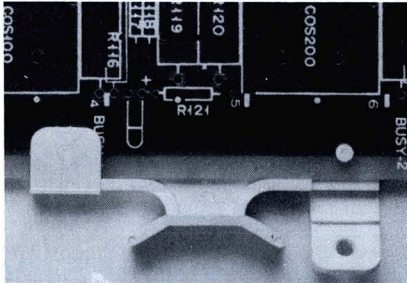
Note:

It is recommended that mounting holes be slotted or elongated for ease of assembly. Pylons press-fit into .187 (4.75) dia. holes in material .046 (1.17) to .093 (2.36) thick.

Snap-On Ejectors/Pullers

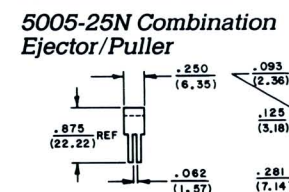
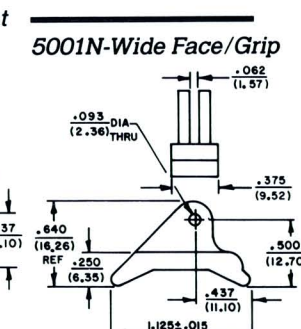
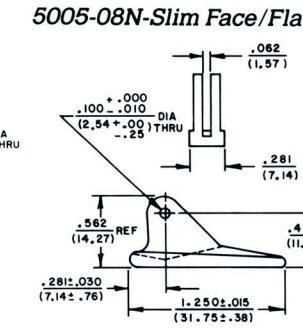
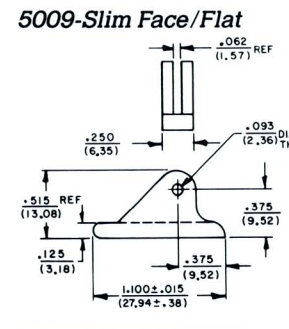
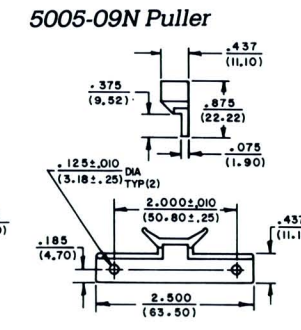
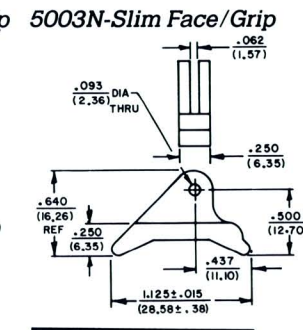
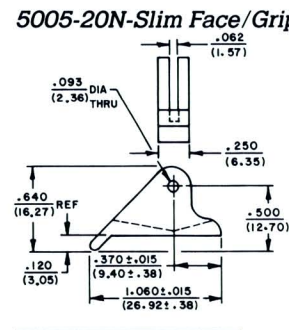
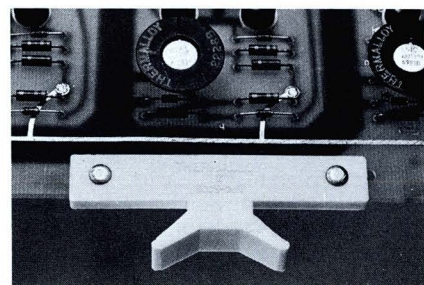
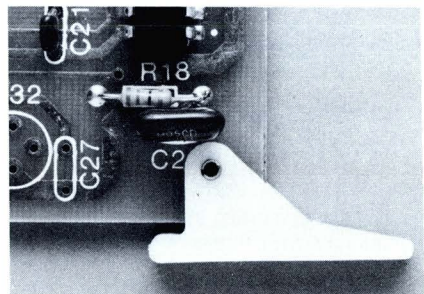
- Saves labor — no roll pin required.
- Costs no more than conventional ejector/puller.
- One piece — no assembly required.
- Excellent for retrofit applications.
- Rated at 50 lbs./ejector force per pair.
- May be heat stamped.
- Material listed on U.L. Card E 41938B.

U.S. Patent Nos. 4261076 and D.261354
 Foreign Patents Pending



Standard Ejectors/Pullers

- Lever action releases card from its connector safely and quickly.
- There is less danger of damage to cards, their components and connectors when extracting PC boards.
- No special extraction tools are needed for board removal.
- Material is nylon per ASTM 4066-8211F22 (natural color).
- Roll pins provided.



Mounting Pads

- Prevent heat damage during soldering.
- Facilitate board clean-up.
- Prevent solder bridges.
- Assure uniform device height.

SUFFIX	BASE MATERIAL*	MAXIMUM OPERATING TEMPERATURE		COLOR**
		Continuous	Deflection	
-N	Nylon base resin per ASTM STD. D4066-82-PA111.	250°F	470°F	Natural
-DAP	Diallyl Phthalate per MIL-M-14G, Type SDG	400°F	540°F	Black only

* Other material available on request.

** Other colors available on request.

Military Specification (MIL-M-38527) Cross Reference

Mil-Spec	Thermalloy Part Number	Mil-Spec	Thermalloy Part Number
M38527/01-032N	7717-108N	M38527/02-018N	7717-15N
M38527/01-032D	7717-108D	M38527/02-018D	7717-15D
M38527/01-035N	7717-46N	M38527/02-019N	7717-178N
M38527/01-035D	7717-46D	M38527/02-025N	7717-109N
M38527/01-036N	7717-153N	M38527/02-031N	7717-8N
M38527/01-036D	7717-153D	M38527/02-031D	7717-8D
M38527/01-037N	7717-112N	M38527/02-002N	7717-133N
M38527/01-038N	7717-7N	M38527/03-002D	7717-133D
M38527/01-038D	7717-7D	M38527/03-007N	7717-26N
M38527/01-039N	7717-124N	M38527/03-007D	7717-26D
M38527/01-040N	7717-16N	M38527/03-008N	7717-43N
M38527/01-040D	7717-16D	M38527/03-008D	7717-43D
M38527/02-002N	7717-148N	M38527/03-014N	7717-113N
M38527/02-004N	7717-122N	M38527/03-014D	7717-113D
M38527/02-004D	7717-122D	M38527/03-015N	7717-149N
M38527/02-010N	7717-3N	M38527/03-017N	7717-161N
M38527/02-010D	7717-3D	M38527/06-005N	7717-156N
M38527/02-011N	7717-238N	M38527/06-005D	7717-156D
M38527/02-016N	7717-167N	M38527/07-001N	7717-81N
M38527/02-017N	7717-22N	M38527/07-001D	7717-81D
M38527/02-017D	7717-22D		

Index of Semiconductor Lead Conversion Pads

For Epoxy Transistors					
Converts Lead Spacing From		Number of Leads	Inches		Basic Part Number
To			O.Dia.	Thk	
.05 In-Line	TO-92 & TO-15	3	.230	.040	7717-130
.05 In-Line	TO-5	3	.305	.125	7717-2
For TO-18					
TO-18	TO-5	3	.280	.150	7717-247
TO-18	TO-5	3	.305	.125	7717-139
TO-18	TO-5	3	.343	.120	7717-26
TO-18	.150 Circle	4	.225	.087	7717-133
TO-18	.150 Circle	4	.230	.040	7717-113
TO-18	.150 Circle	4	.230	.055	7717-93
TO-18	TO-5	4	.230	.100	7717-137
TO-18	TO-5	4	.250	.120	7717-149
TO-18	TO-5	4	.275	.050	7717-43
TO-18	TO-5	4	.305	.125	7717-44
TO-18	TO-5	4	.305	.167	7717-117
For Integrated Circuits					
.200	.350	8	.430	.130	7717-107
.200	.400	8	.500	.275	7717-19
.200	.400	10	.500	.275	7717-21

Index of Semiconductor Mounting Pads

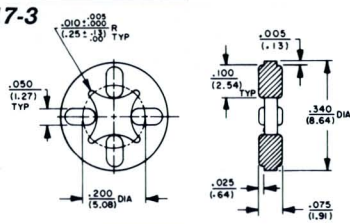
For TO-5			
Number of Leads	Inches		Thermalloy Part Number
	O. Dia.	Thickness	
3	.343	.075	7717-22
3	.343	.075	7717-86
3	.343	.095	7717-109
3	.343	.125	7717-167
3	.350	.021	7717-178
3	.355	.038	7717-79
3-4	.340	.075	7717-161
3-4	.343	.075	7717-3
3-4	.350	.038	7717-94
3-4	.400	.160	7717-238
4	.350	.020	7717-15
4	.350	.038	7717-131
4	.350	.125	7717-5
4	.355	.046	7717-114
4	.375	.075	7717-4
4	.390	.010	7717-158
5	.375	.220	7717-159
For TO-18			
3-4	.200	.025	7717-112
3-4	.200	.045	7717-152
3-4	.230	.080	7717-220
3-4	.240	.180	7717-239
3-4	.300	.150	7717-223
4	.200	.020	7717-16
4	.200	.060	7717-46
4	.200	.100	7717-18
4	.207	.070	7717-108
4	.225	.020	7717-124
4	.250	.010	7717-157
4	.250	.038	7717-153
4	.250	.080	7717-89
4	.250	.125	7717-7
For Integrated Circuits			
6	.375	.075	7717-6
8	.365	.070	7717-122
8	.375	.075	7717-8
8	.375	.075	7717-38
8	.375	.170	7717-148
10	.375	.075	7717-10
10	.375	.075	7717-30
14	.750 x .450	.050	7717-156
16	.850 x .450	.050	7717-241
Universal Mounting Pads			
4 (TO-5)	.500	.045	7717-204
6 (TO-18)	.290	.125	7717-81
8 (TO-5)	.290	.125	7717-81
Misc. Mounting Pads			
Axial Leads	.125	.040	7717-222
1/4 Crystal Can Relay	.300/.600	.050	7717-129
Crystal Can Relay	.400/.800	.050	7717-175

Notes:

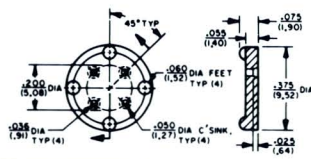
1. Tolerance on 2 place (.xx) = ± .015 (.38)
 3 place (.xxx) = ± .010 (.25)
 Angles: ± 4 degrees
2. Metric dimensions are in parentheses and are expressed in millimeters.
3. Detailed drawings are available upon request.
4. A single gate extension, not to exceed .025 (.64) in length, is allowable on the outside periphery of all pads.

TO-5 Mounting Pads

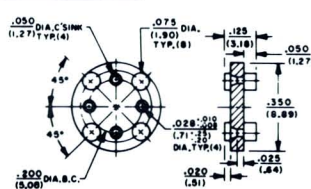
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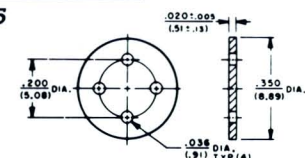
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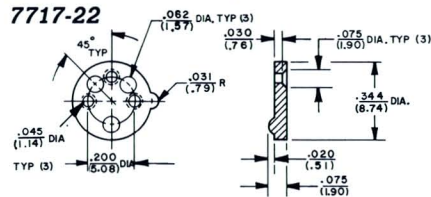
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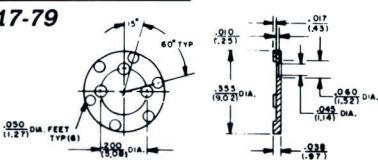
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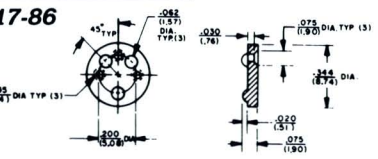
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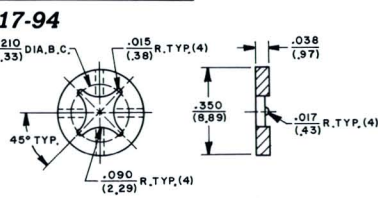
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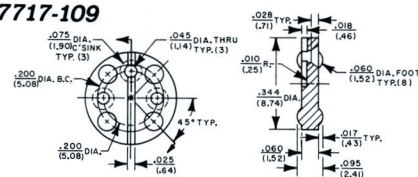
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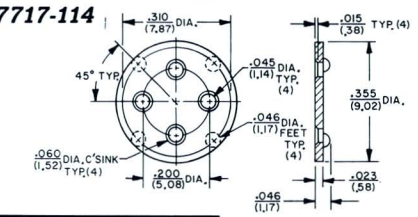
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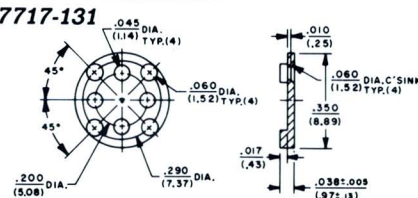
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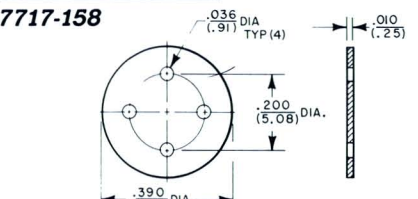
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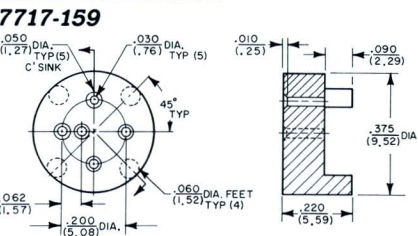
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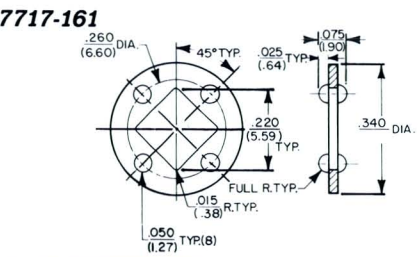
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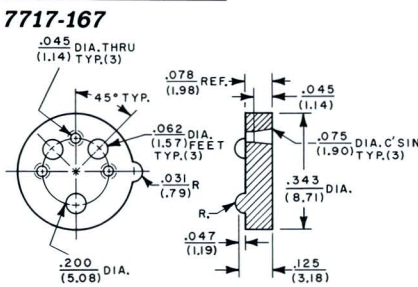
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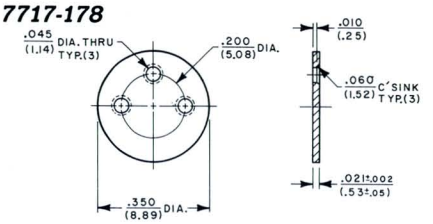
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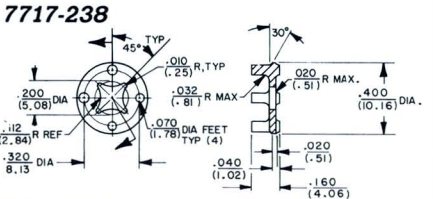
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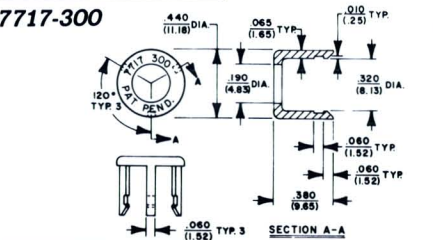
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7717-238

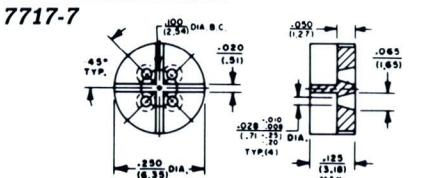


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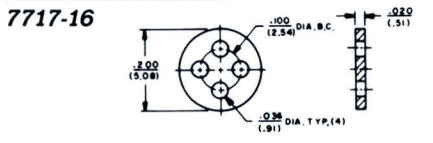


TO-18 Mounting Pads

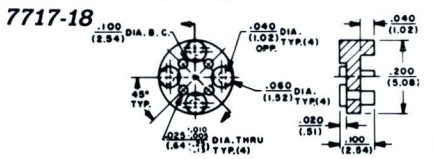
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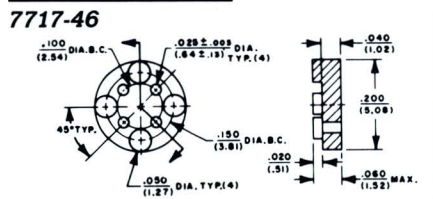
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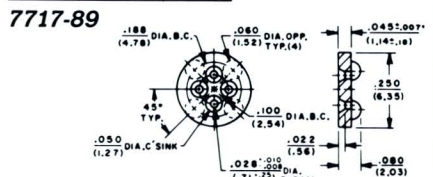
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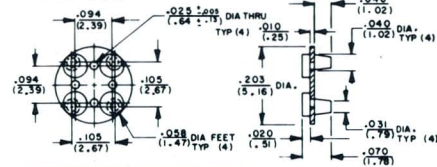
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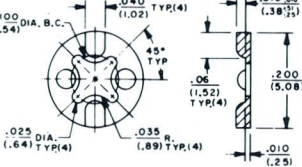
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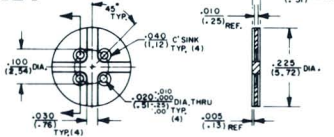
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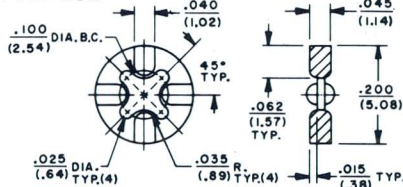
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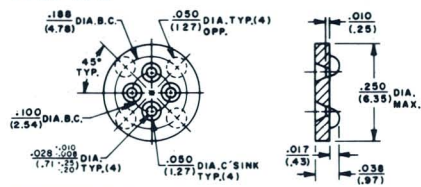
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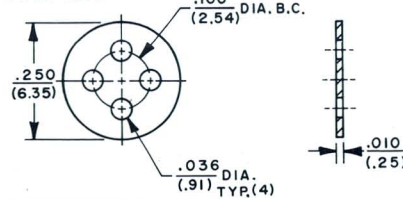
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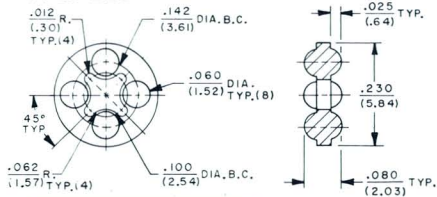
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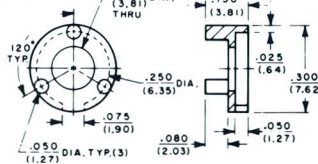
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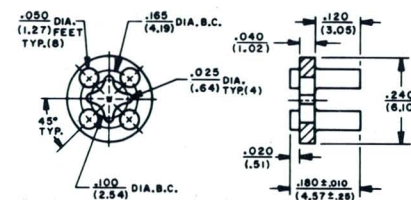
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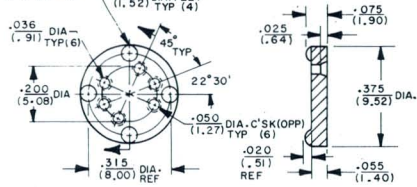


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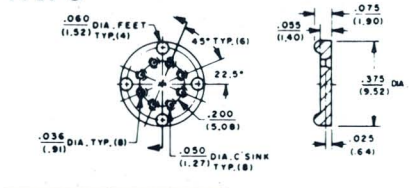


IC Mounting Pads

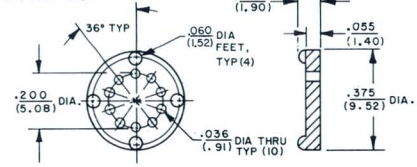
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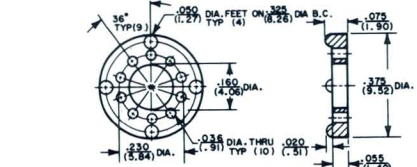
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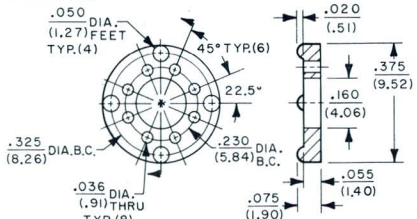
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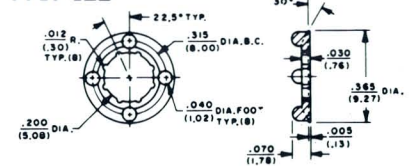
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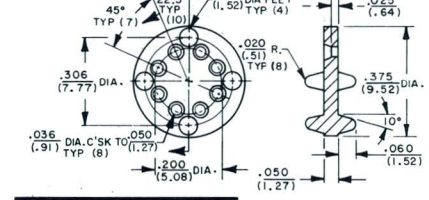
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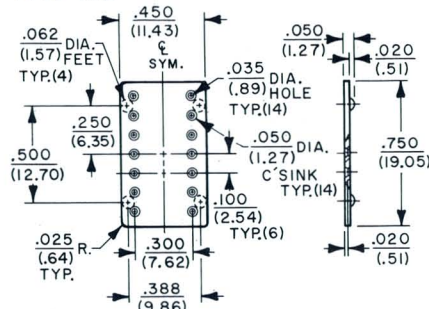
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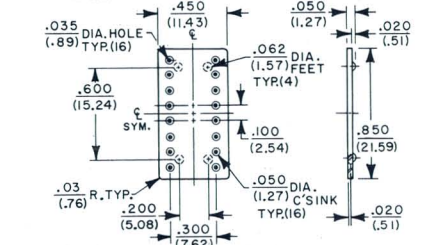
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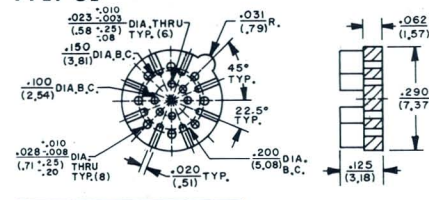


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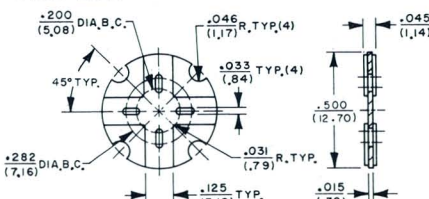


Universal Mounting Pads

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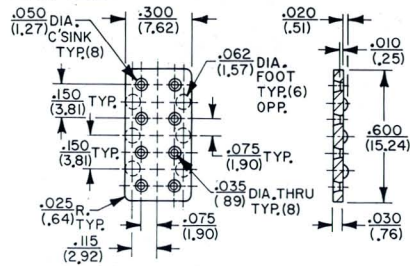


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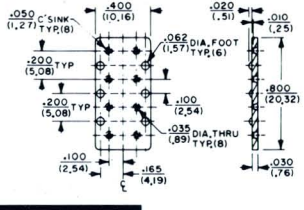


Miscellaneous Mounting Pads

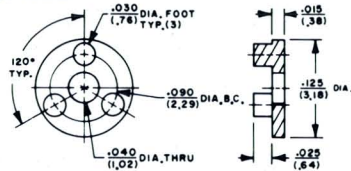
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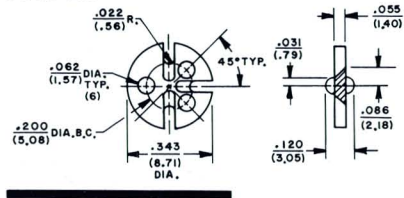


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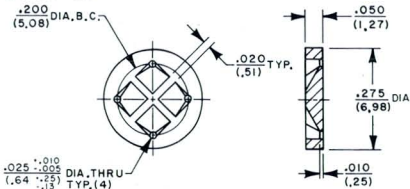


TO-18 Lead Conversion Pads

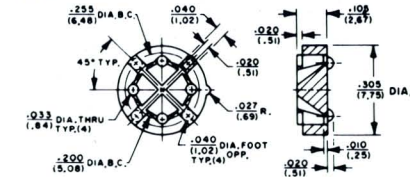
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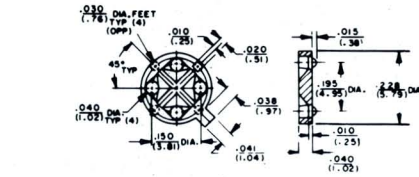
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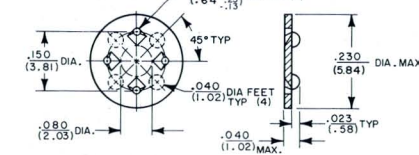
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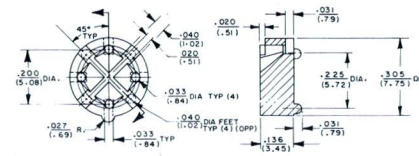
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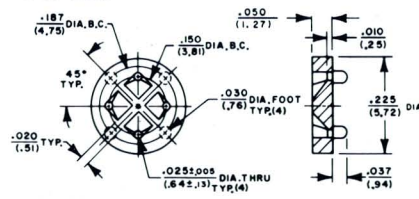
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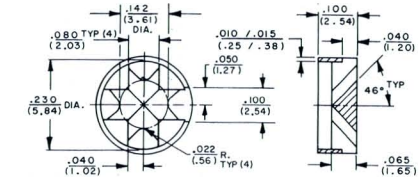
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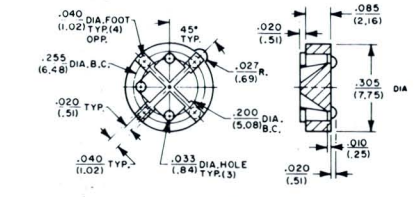
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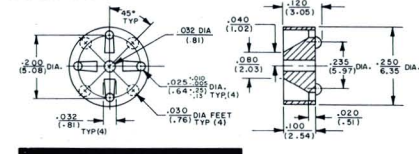
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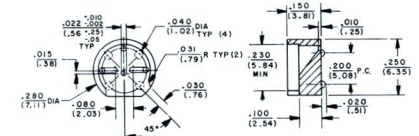
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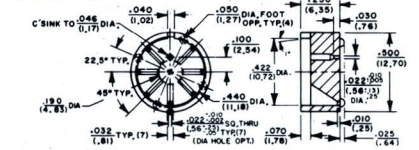


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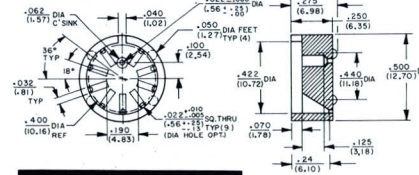


IC Lead Conversion Pads

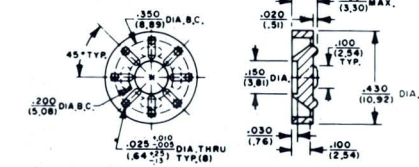
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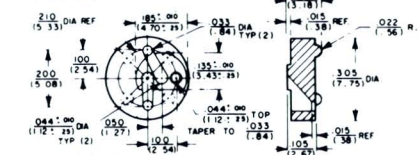


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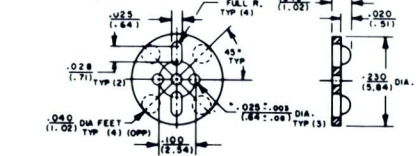


Epoxy Lead Conversion Pads

7717-2



7717-130





Thermalloy Inc.

The Innovator in semiconductor accessories

Manufacturing Plant Locations:

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TELEX: 203965 • FAX: 214-241-4656

Baird House, Manton Road • Earlstrees Industrial Estate
Corby, Northamptonshire NN17 2LJ • England
TEL: 011-44-0536-60041 • TELEX: 341533

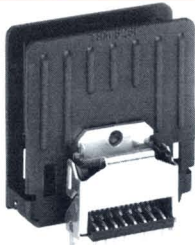
Tuen Mun Industrial Centre • B1 Ground Floor
Pui to Road T.M.T.L. 76, Tuen Mun, N.T.
Kowloon, Hong Kong • TEL: 0-847312 • TELEX:
49200 THMYL HX

6260B, 6261B: HIGH PERFORMANCE UNIVERSAL PLASTIC POWER HEAT SINKS

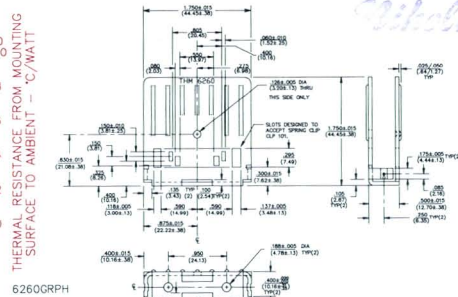
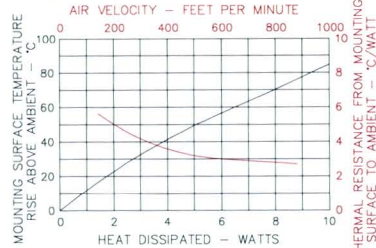
- Two new high performance heat sinks cool plastic power devices efficiently for surface area.
- Universal for plastic power devices--may be used with TO-220, TO-218, or Multiwatt® (15 lead) devices*.
- Accepts one or two plastic power devices (one on each side of the heat sink).
- Use of MT5 mounting tab or S5S stud assures positive PC board retention; MT5 mounting tab provides additional security for retention in PC board prior to wave soldering.
- Cut heat sink/transistor assembly time using spring clips (available for both heat sinks) or alignment pads (available for 6260 only).

* ('Multiwatt' is a registered trademark of SGS.)

6260B with 8261-CL21
alignment pad and
Multiwatt® device

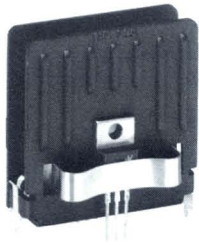


6260 Data

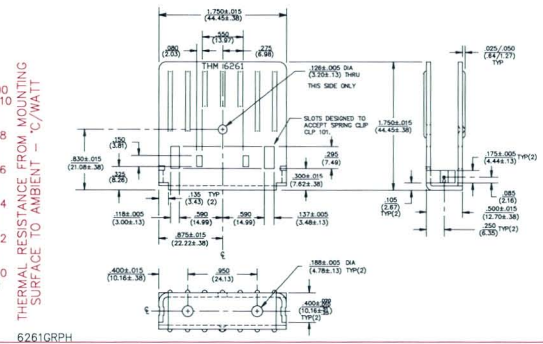
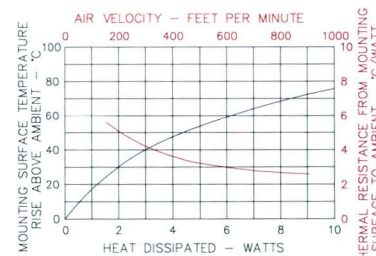


Nikola V. Vidic
JUL 21 1989

6261B-MT5 with CLP-101
and TO-220



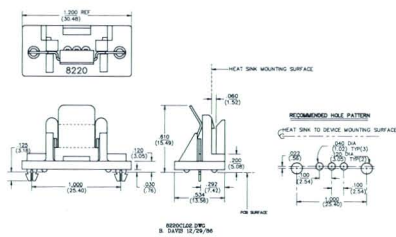
6261 Data



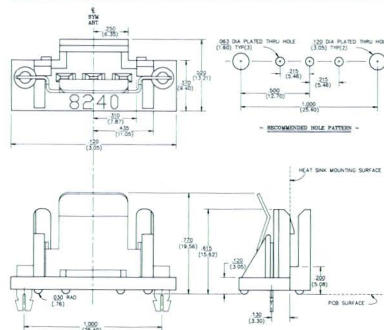
Labor-Saving Assembly
Options
(Ordered Separately)

- The alignment pad snaps onto the heat sink, and the transistor leads slide through the pad. The alignment pad easily attaches the transistor to the heat sink, aligns the leads, and provides solderability.
- For a complete brochure on the alignment pads, please request 87-AP/DS-10.

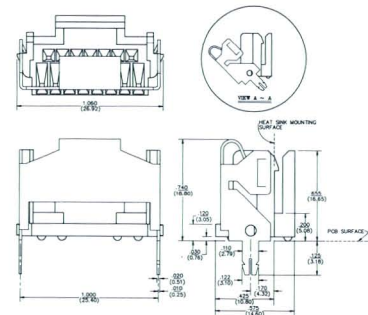
8220-CL02: Alignment Pad for TO-220



8240-CL11 Alignment Pad for TO-218



8261-CL21: Alignment Pad
for Multiwatt (15 lead) device



ORDERING INFORMATION

Heat Sinks

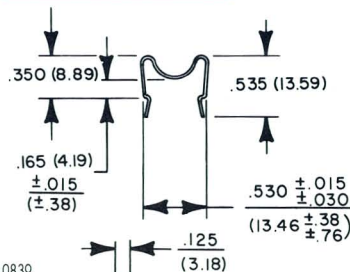
Model	Weight (lbs./grams)
6260B-MT5	.040 (18.14)
6261B-MT5	.040 (18.14)
6261B-SS5	.046 (20.87)

Heat sinks and alignment pads can be preassembled at Thermalloy.

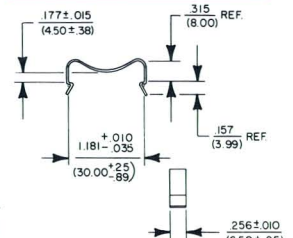
Labor Saving Assembly Options

Model	Weight (lbs./grams)
8220-CL02	.0065 (2.94)
8240-CL11	.0048 (2.17)
8261-CL21	.0096 (4.36)
CLP-101	.0027 (1.22)
CLP-201	.0008 (0.36)

CLP-201: Spring
Clip for TO-220



CLP-101: Spring Clip
for TO-218 or TO-220



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Solderable Studs

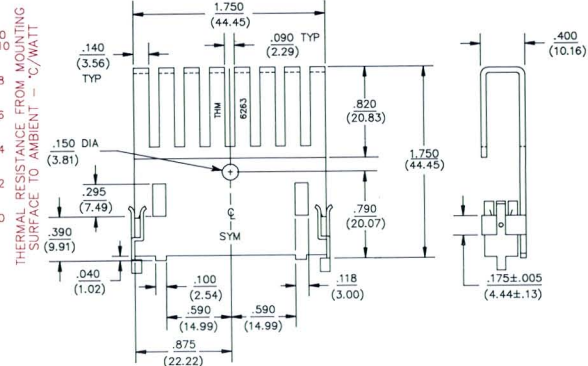
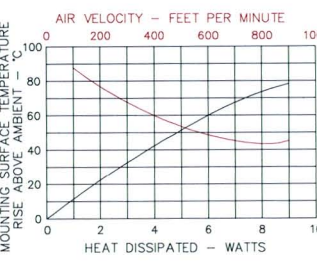
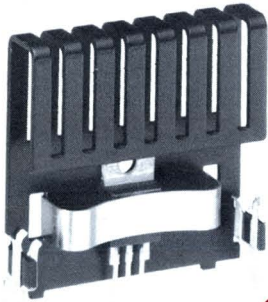


Solderable Mounting Tabs

6263B: HIGH PERFORMANCE UNIVERSAL PLASTIC POWER HEAT SINK

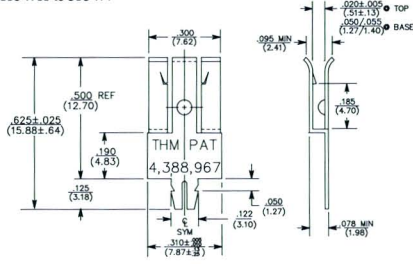
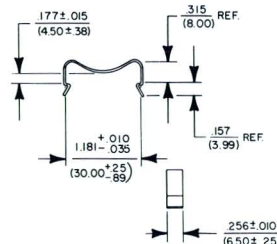
- High performance vertical mount heat sink.
- Designed for all plastic power devices--T0-220, T0-218, or Multiwatt® (15 lead) devices.
- High power heat sink with extremely small footprint.
- Bifurcated mounting tabs (MT5) assure positive retention in PC board prior to wave soldering.
- CLP-101 spring clip may be used to cut heat sink/transistor assembly time.
- Available in lower cost pre-black anodized finish.

6263B-MT5 with CLP-101 and T0-220



Labor Saving Assembly Option : CLP-101

Dimension drawing above shown with MT mounting tabs. Dimension drawing for bifurcated mounting tabs (MT5) shown below.



ORDERING INFORMATION

Heat Sinks		Labor Saving Assembly Options	
Model	Weight (lbs./grams)	Model	Weight (lbs./grams)
6263B-MT5	.020 (9.07)	CLP-101	.0027 (1.22)
6263PB-MT5	.020 (9.07)		

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Represented by:

Solderable Mounting Tabs

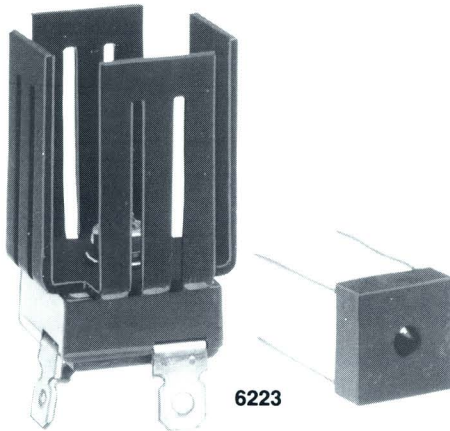
Solderable Studs U.S. Patent: 4,403,102 and 4,521,827
Canadian Patent : 1,162,324 and 1,130,466 and 1,244, 683
U.K. Patent: 2,042,260 German Patent: P3067404.5-08
EPC Patent: 0014558 French Patent: 8001955
Other Foreign Patents Pending

Mounting Tabs U.S. Patent: 4,388,967

6222 Series Bridge Rectifier Heat Sinks

JUL 2 1 1989

Nikola V. Vidovic

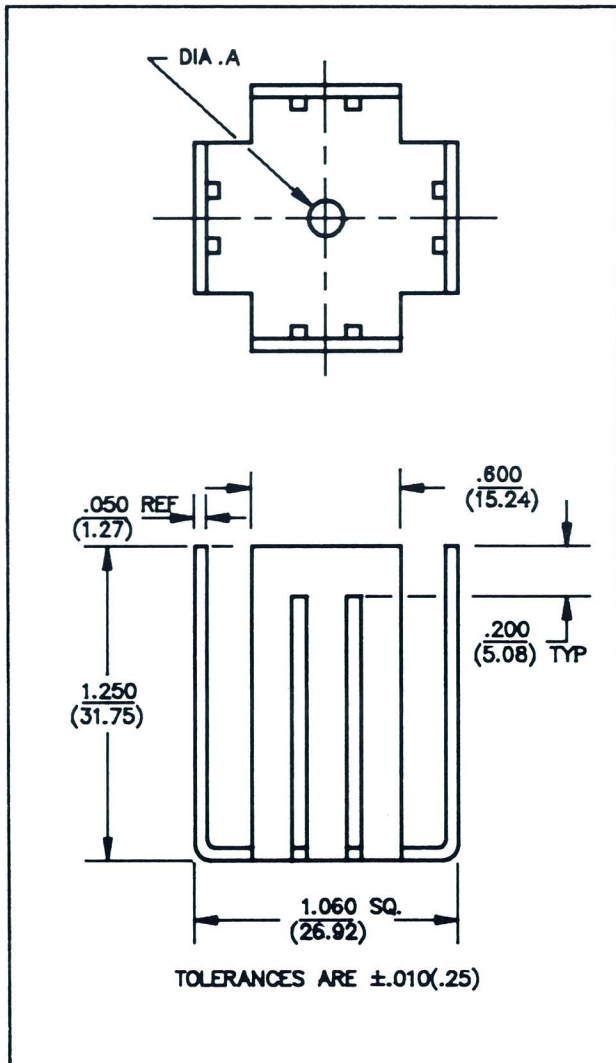


- Designed for use with bridge rectifiers.
- Three mounting hole diameters.
- Small PC board footprint.

The 6222 series is specifically designed for optimal heat dissipation of bridge rectifiers. The square shape duplicates the top of the rectifier so that no extra board space is used.

The three part numbers reflect different mounting hole sizes. The 6222 has a center hole diameter of .142-inch, the 6223 hole diameter is .163-inch and the 6224 hole diameter is .188-inch. The thermal resistance of all three parts is 9.4°C/watt at 75°C temperature rise. Parts can be ordered with optional threaded studs or nuts for easy assembly.

Dimensions

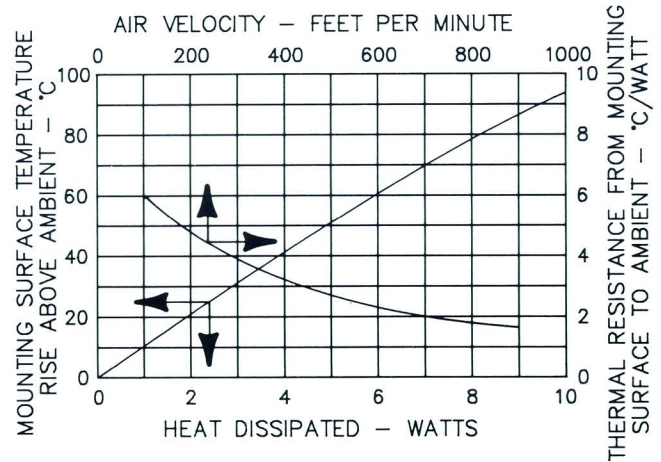


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Ordering Information

Model	Dia. A	Weight (lbs./grams)
6222 B	.142 (3.61)	.016 (7.26)
6223 B	.163 (4.14)	.016 (7.26)
6224 B	.188 (4.78)	.016 (7.26)

Thermal Performance



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6380 Series Cools Single and Zig-Zag In-Line Packages

- Designed for SIP and ZIP packages.
- Heat dissipation up to 10-15 watts.
- Standard with solderable roll pins.
- Three labor-saving device mounting options.

The new 6380 extruded heat sink series is designed specifically for efficient cooling of integrated circuits in plastic case single and zig-zag in-line packages (SIP, ZIP).

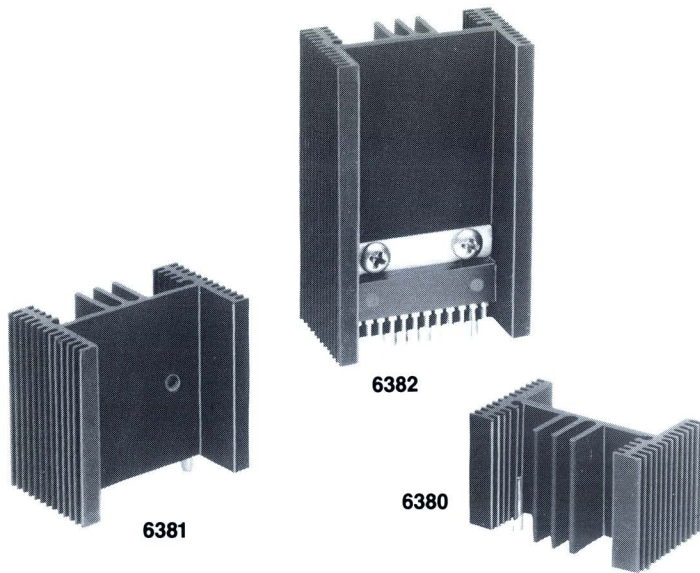
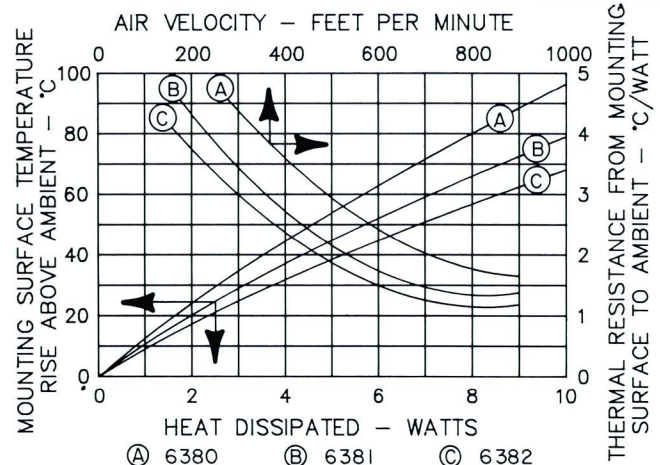
The 6380 series dissipates heat up to the 10 to 15 watt range and features standard solderable roll pins. Optional solderable roll pins with standoff shoulders are also available. Thermal resistance is 10°C/watt for the 1-inch 6380B, 7.9°C/watt for the 1½-inch 6381B, and 6.5°C/watt for the 2-inch 6382B at 75°C mounting surface temperature rise.

The device is screw-mounted through two mounting holes on .780-inch centers in the device tab. Heat sinks may also be ordered with optional self-clinching fasteners or threaded studs. The 6380 series is also available with a slotted hole pattern for mounting the TO-220 case style device using a secondary clip (part number CLP-201). Simply add a "-2" suffix to the part number.

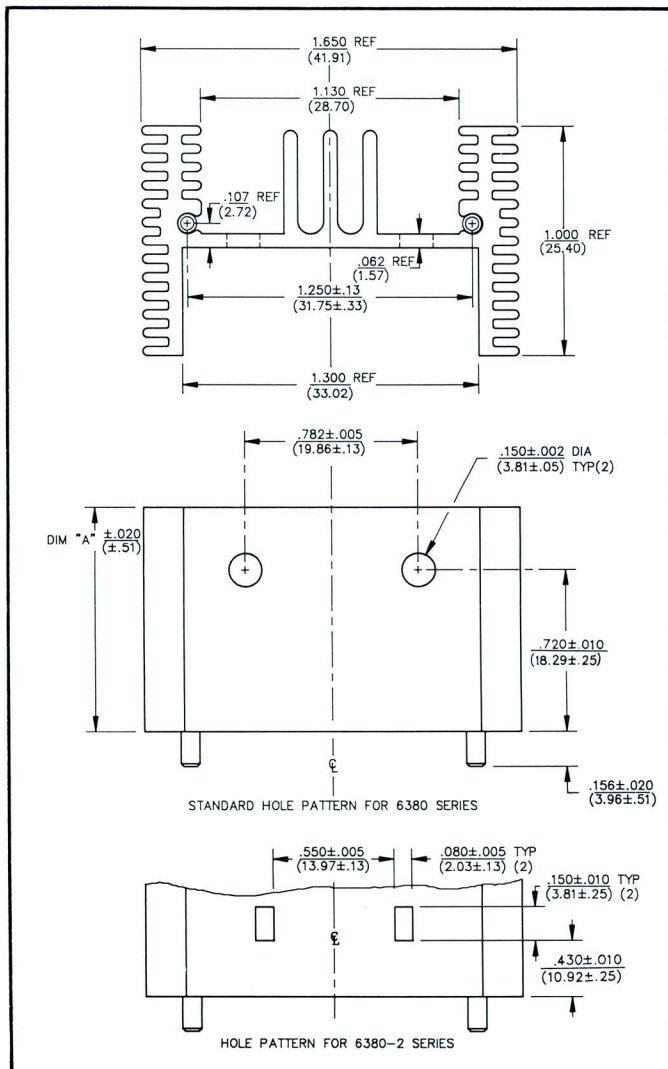
Ordering Information

Model	Dim. A	Weight (lbs./grams)
6380 B	1.000 (25.40)	.040 (18.14)
6381 B	1.500 (38.10)	.060 (27.22)
6382 B	2.000 (50.80)	.080 (36.29)

Thermal Performance



Dimensions



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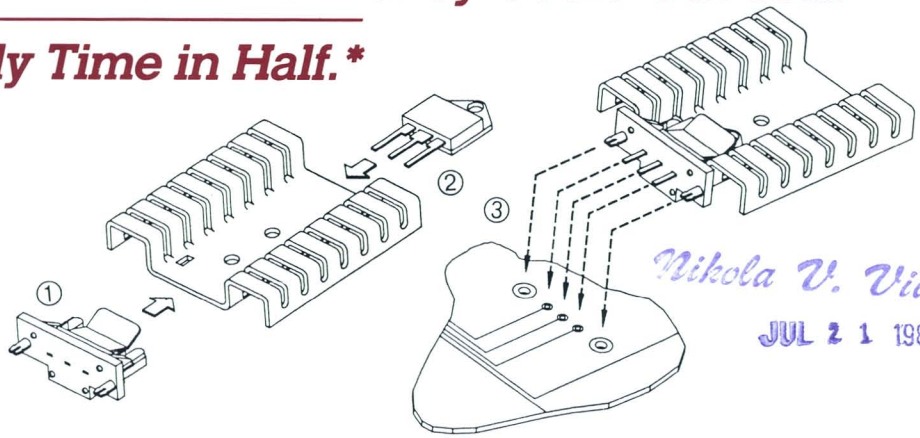
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The Newest Innovation From Thermalloy Could Cut Your

Heat Sink Assembly Time in Half.*

Thermalloy's new alignment pads reduce assembly to three easy steps.

- Step 1:** Snap the alignment pad into the base of the heat sink.
- Step 2:** Slide the transistor leads into funnel-entry guides on alignment pad for easy transistor insertion.
- Step 3:** Insert the transistor/heat sink assembly into the printed circuit board.



Nikola V. Vidovic
JUL 21 1989

*This is a conservative estimate. Thermalloy's time and motion studies indicate an average of 80% reduction in assembly time.

It's as simple as that. Tolerances and dimensions of the alignment pad are so precise that board insertion can be performed by robotic machines. Manual insertion is a snap.

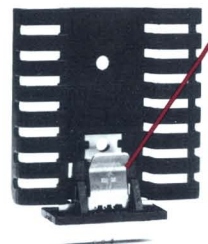
Other alignment pad features improve and simplify heat sink assembly and board insertion:

- Accurately positions leads, tabs/pins for quick insertion into PC board lead holes. Drops right into place.
- Funnel-shaped lead entry straightens device leads and facilitates assembly.
- Ideally suited to preassembly.

- Prevents the device from rotating out of alignment when screw mounting.
- Integral clips eliminate mounting hardware.
- Clips provide uniform contact pressure on device reducing the danger of cracking the chip by over-torquing.
- Pad base provides stable platform for vertically-mounted heat sinks.
- Thermally isolates heat sink to prevent drawing away heat during wave soldering. Ensures a fast, strong solder joint.

- Bifurcated solder tabs press into PC board holes to hold heat sink assembly upright and in-place prior to wave soldering.
- Stand-offs (.030") facilitate board washing.
- Device, alignment pad, and heat sink can be preassembled at Thermalloy.

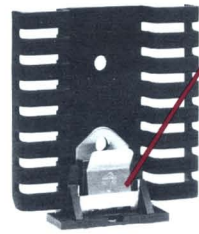
TO-220 Alignment Pad



8220-CL02 The 8220-CL02 is designed for TO-220 transistors. The alignment pad slides onto the heat sink and plastic retention barbs lock into locating holes. The device slides into assembly, engaging integral clip. Bifurcated tabs press into PC board holes to hold heat sink assembly upright and in-place prior to wave soldering. Thermally isolated tabs

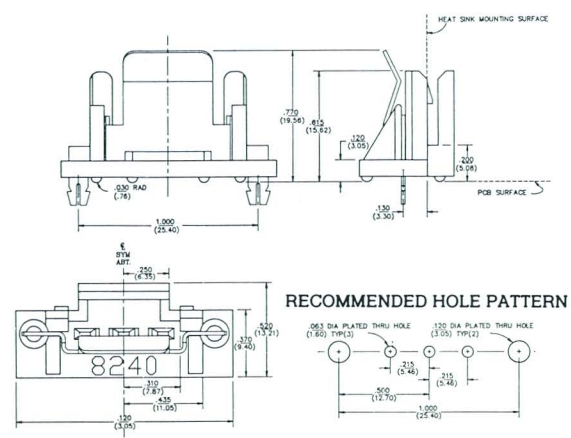
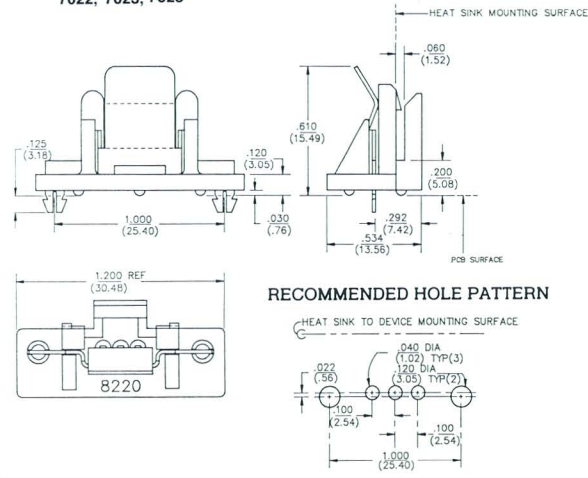
assure strong solder joint. This alignment pad can be used with the following heat sinks: 6070, 6072, 6106, 6107, 6260, 6385, 6386, 6387, 6388, 7020, 7021, 7022, 7023, 7025

TO-218 Alignment Pad



8240-CL11 The 8240-CL11 is designed for TO-218 transistors. The alignment pad slides onto the heat sink and plastic retention barbs lock into locating holes. The device slides into assembly, engaging integral clip. Bifurcated tabs press into PC board holes to hold heat sink assembly upright and in-place prior to wave soldering. Thermally isolated tabs

assure strong solder joint. Compatible heat sinks include: 6106, 6107, 6260, 6385, 6386, 6387, 6388, 7022, 7023, 7025

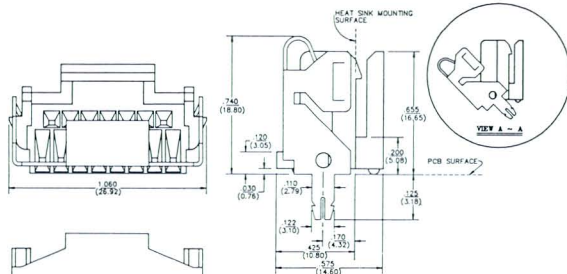


Multiwatt® (15-lead) Alignment Pads

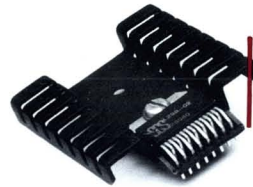
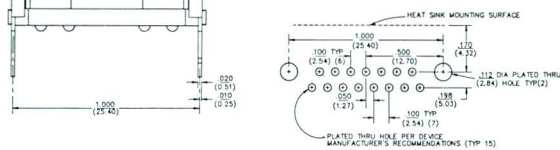


8261-CL21 The 8261-CL21 alignment pad is specially designed for the Multiwatt® (15-lead) linear integrated circuit package. The front clip is hinged so that the device can be inserted without bending the leads. With the device in place, the clip is snapped-on over the device case. No assembly hardware is required. Tabs on either side of the clip latch the spring clip in place over the device. The clip provides a uniform pressure for enhanced thermal conductivity and protects the epoxy case of the device from chipping or cracking. Bifurcated tabs assure positive PC board retention prior to wave soldering. This alignment pad fits the 6260 vertical-mount heat sink.

required. Tabs on either side of the clip latch the spring clip in place over the device. The clip provides a uniform pressure for enhanced thermal conductivity and protects the epoxy case of the device from chipping or cracking. Bifurcated tabs assure positive PC board retention prior to wave soldering. This alignment pad fits the 6260 vertical-mount heat sink.



RECOMMENDED HOLE PATTERN

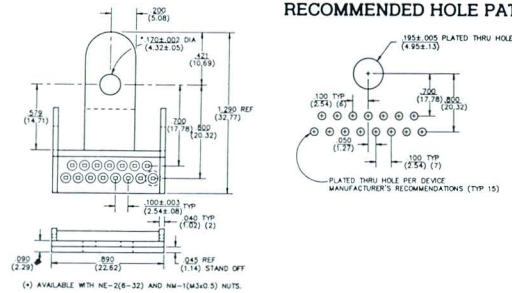


8260-NE2 The 8260-NE2 is designed for the Multiwatt® (15-lead) linear I.C. package using a horizontally-mounted heat sink and integral solderable nut. This alignment pad can be used with the following heat sinks:

7022, 7023, 7024, 7025

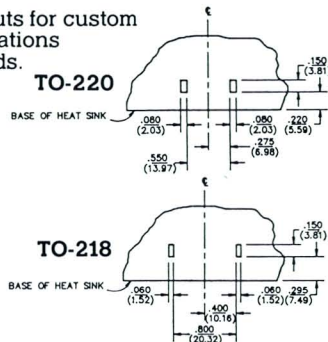
"Multiwatt" is a registered trademark of SGS.

RECOMMENDED HOLE PATTERN



Ordering Information. Heat sink/alignment pad assemblies are ordered using the heat sink part number followed by a hyphen and the alignment pad part number. Example: 7022B-8220-CL02. Alignment pads may also be ordered separately. Example: 8220-CL02. For custom heat sinks or alignment pads supplied already assembled with the transistor device, contact the factory.

Suggested layouts for custom heat sink applications of alignment pads.



Device	Alignment Pad Part Number	Weight (lb./grams)	Device Fastening Method	Board Mounting	Compatible Heat Sinks
TO-220	8220-CL02	.0065/2.94	Integral Clip	Bifurcated Solder Tabs	6070, 6072, 6106, 6107, 6260, 6385, 6386, 6387, 6388, 7020, 7021, 7022, 7023, 7025
TO-218	8240-CL11	.0048/2.17	Integral Clip	Bifurcated Solder Tabs	6106, 6107, 6260, 6385, 6386, 6387, 6388, 7022, 7023, 7025
15-lead Multiwatt®	8261-CL21	.0096/4.36	Integral Clip	Bifurcated Solder Tabs	6260
	8260-NE2	.0039/1.75	Solderable Nut	Solderable Nut	7022, 7023, 7024, 7025



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TEL: 011-44-0536-60041 • TELEX: 341533

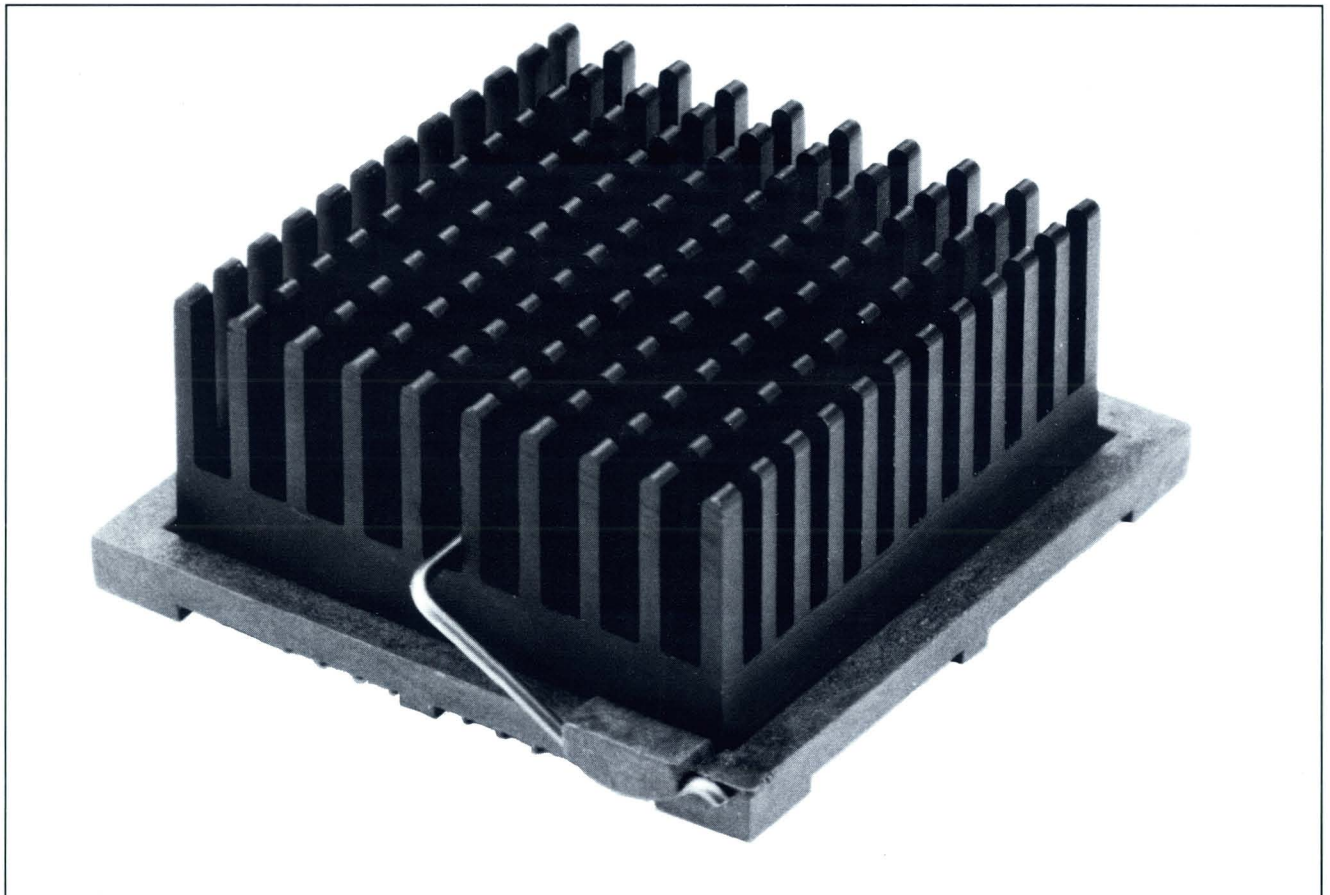
Tuen Mun Industrial Centre • B1 Ground Floor
Pui to Road T.M.T.L. 76, Tuen Mun, N.T.
Kowloon, Hong Kong • TEL: 0-847312 • TELEX: 49200 THMYL HX



Nikola V. Vidovic

JUL 2 1 1990

**New Product
Catalog**



Represented By:

Heat Sinks

***for ECL and CMOS
ASICs
Gate Arrays
Microprocessors
in PGA and LCC
packages***

New Products from Thermalloy

ASIC's, Gate Arrays, and Microprocessors are being introduced with increasingly higher power dissipation. Initially, only the ECL devices required heat sinks, but newly announced CMOS devices are reaching power levels which require heat sinks. Thermalloy was the first heat sink manufacturer to develop a line of standard, commercially available heat sinks for these applications. Many have been previously announced and can be found in the Thermalloy Semiconductor Accessories Catalog.

New Heat Sink Types

Heat sinks in this catalog are designed for 11x11, 14x14, 15x15, 18x18, and 21x21 Pin Grid Array (PGA) packages as well as for the 3M Textool socket. Types of configurations available are:

Round - Horizontal Fins - Air flow is parallel to the fins but multidirectional; close fin spacing.

Square - High Fin Ratio - Vertical fins; unidirectional air flow; closest fin spacing available.

Square - Fabricated Fins - Horizontal fins; air flow is parallel to the fins but multidirectional; very thin stamped fins for very high efficiency.

Square - Pin Fins - Vertical pin fins; air flow multidirectional; impingement cooling optional.

Materials Available

All but the 2433 are aluminum with a black anodize finish. The 2433 is copper for improved thermal conductivity. All heat sinks in this catalog are available in copper on special order. Consult the factory for specifics.

Attachment Methods

Heat sinks may be bonded directly to the PGA package using Thermalloy Thermalbond™ thermally conductive epoxy. Heat sinks designed for the 3M Textool socket may be attached by you after board assembly. Additionally, you can now choose the PGA E-Z Mount® Assembly method described below.

PGA E-Z Mount™ Assembly

Thermalloy has developed a new method for attaching the heat sink to the PGA package. The PGA E-Z Mount Assembly lets you eliminate the problems in bonding heat sinks to your pin grid array packages. No longer will you have to select an epoxy or set up additional manufacturing processes. No worrying about handling - mixing - applying or post-application curing. No more problems with surface preparation of the heat sink and the PGA. No longer will you need to worry about thermal or mechanical reliability of the bond.

Thermalloy's frame and spring clip assembly reliably and securely attach the heat sink to your PGA package. Simply place your PGA in the plastic frame, snap the spring clip on the heat sink and attach the assembly to the frame and wave solder the assembly to the board, or, if you prefer, attach the heat sink assembly after wave soldering. If the board space is tight, you can use the plastic shoes instead of the frame. These shoes fit under the four outer pins of the PGA and provide a means for spring attachment.

When used with Thermalcote™, silicone grease, or grafoil, the PGA E-Z Mount Assembly will give you comparable performance to an epoxy bond. You will also eliminate the thermal expansion mismatch associated with adhesive bonding that could result in cracking or damaging the PGA chip.

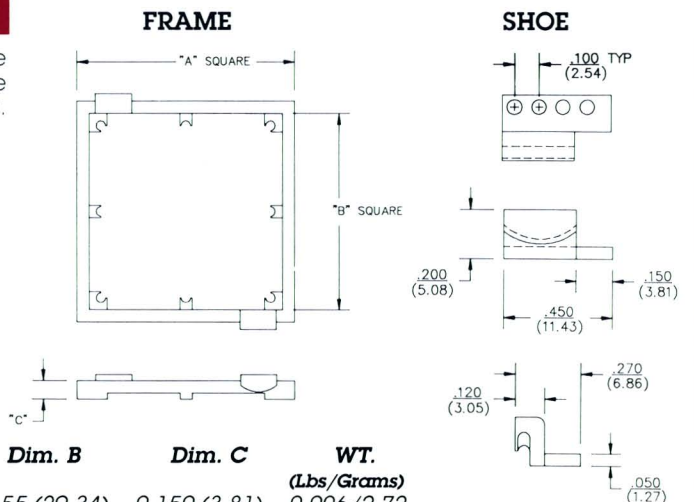
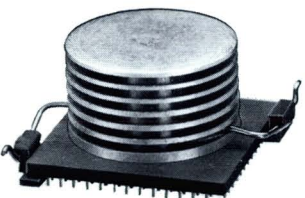
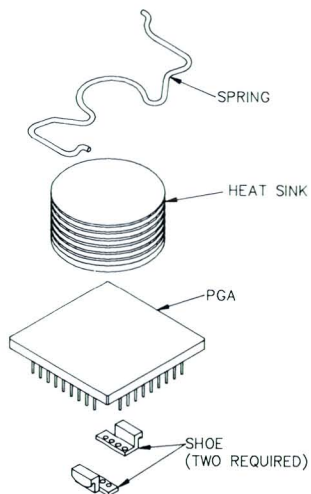
How To Order

Step #1: Select the heat sink that you wish to use. If you choose to epoxy bond to the PGA package, simply order the heat sink by catalog number; EX: 2361B.

Step #2: If you wish to order the PGA E-Z Mount Assembly, simply specify the heat sink with the appropriate assembly number; EX: 2361B with 8315-SP15 assembly. You will receive the heat sink, frame, and spring packaged separately for your assembly.

ASSEMBLY VIEW USING SHOE ATTACHMENT

The spring attachment shoes slip over the 4 outer pins on the PGA prior to wave soldering. The spring clip snaps onto the heat sink, then snaps over the shoe after wave soldering. Shoes can be used in place of frames where noted.



Frame	Dim. A	Dim. B	Dim. C	WT. (Lbs/Grams)
8300 ...	1.440 (36.58)...	1.155 (29.34)...	0.150 (3.81)...	0.006/2.72
8311 ...	1.350 (34.29)...	1.150 (29.21)...	0.150 (3.81)...	0.005/2.27
8314 ...	1.700 (43.18)...	1.442 (36.63)...	0.150 (3.81)...	0.007/3.18
8315 ...	1.800 (45.72)...	1.542 (39.17)...	0.150 (3.81)...	0.007/3.18
8321 ...	2.400 (60.96)...	2.200 (55.88)...	0.150 (3.81)...	0.010/4.54

U.S. Patent #4,745,456

Shoe
8301... For dimensions see profile above..... 0.001/0.45
Patent Pending

Materials and Finish

Shoe and Frame - Polyphenylene Sulfide (PPS) per ASTM D4067-84-PPS 000G40A43443 - Annealed after Molding - Flammability UL 94V-0 and 5V - no finish.

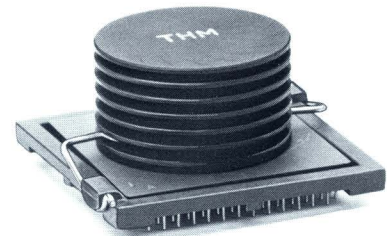
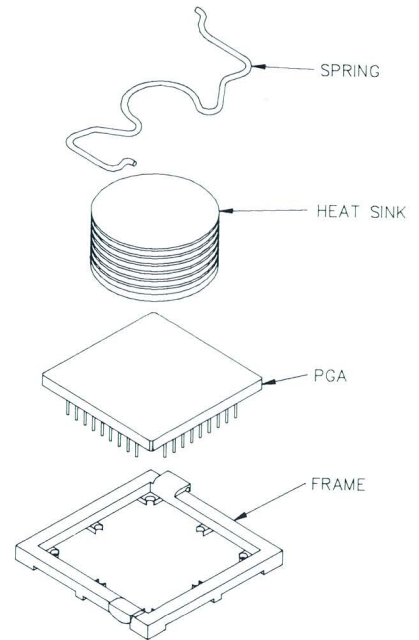
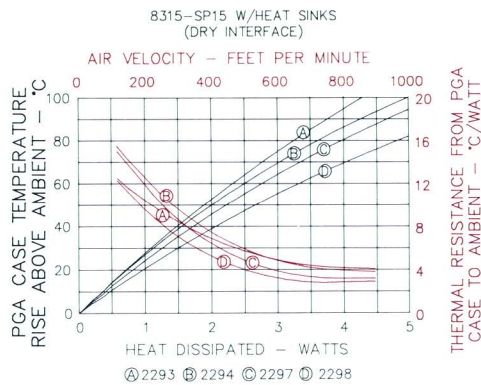
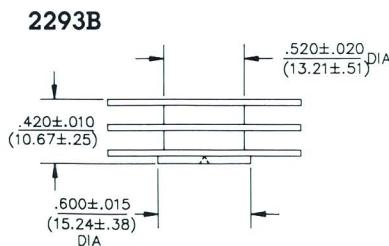
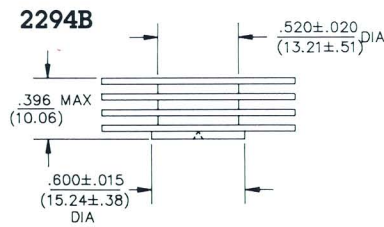
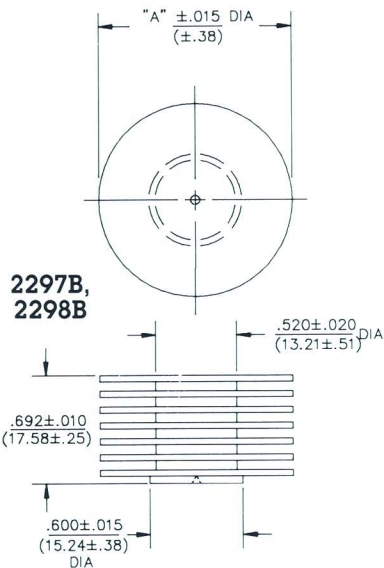
Springs - SAE 1085 Spring Steel-- Pre-tinned Finish.

2293, 2294, 2297, 2298

- For 15 X 15 pin PGA Packages - 149 Pins.
- Round horizontal fins.
- Epoxy bonding or PGA E-Z Mount Assembly with shoe or frame.
- 3, 4, or 7 fins.
- 5.6° to 7.9° C/watt in forced convection.

Model	Dim. A	No. Fins	R θ Natural Convection	R θ Forced Air (400 fpm)**	Weight (Lbs./Grams)
2293B ..	1.250 (31.75) ...	3	25.0° C/W ...	7.1° C/W ...	0.023/10.43
2294B ..	1.250 (31.75) ...	4	22.3° C/W ...	7.9° C/W ...	0.024/10.90
2297B ..	1.250 (31.75) ...	7	20.5° C/W ...	6.9° C/W ...	0.040/18.16
2298B ..	1.500 (38.10) ...	7	17.0° C/W ...	5.6° C/W ...	0.050/22.70

**feet per minute



2293B, 2294B, 2297B, 2298B

How To Order

For Epoxy Bonding Attachment: Order by heat sink part number only.

For PGA E-Z-Mount Assembly: Add assembly number to the heat sink part number. Options available for this Series are:

Assembly No. Frame No.* Shoe No.* Spring No.*

8315-SP15 8315 - SP15

8301-SP15 - 8301 SP15

Example: 2293B with 8315-SP15 Assembly (Using Frame)

2293B with 8301-SP15 Assembly (Using Shoes - 2 Per

Assembly)

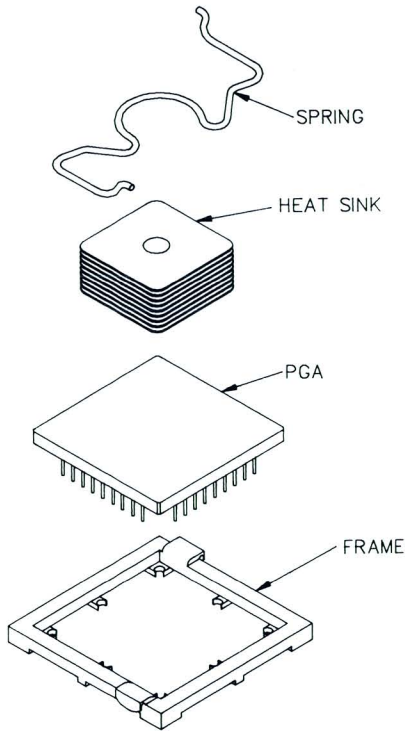
* See page 2 for frame dimensions.

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2361, 2365

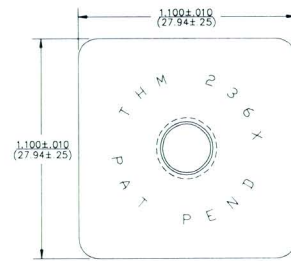
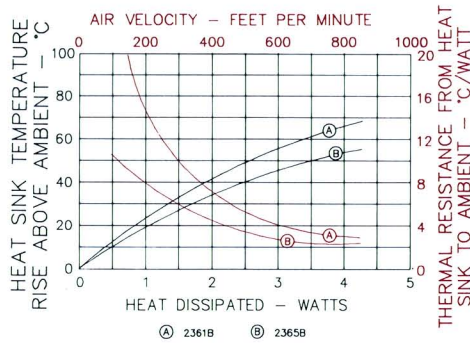
- For 15 x 15 pin PGA Packages - 149 pins.
- Square horizontal fins.
- 0.020 (0.51) thick fins for maximum surface area per unit volume.
- 3 or 9 fins.
- 4.6° to 7.0° C/watt in forced convection.



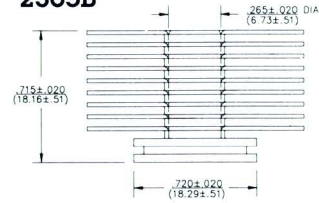
Part Shown is unfinished 2365.

Model	No. Fins	R θ Natural Convection	R θ Forced Air (400 fpm)	Weight (Lbs./Grams)
2361B	3	15.0°C/W	7.0°C/W	0.008 / 3.63
2365B	9	10.7°C/W	4.6°C/W	0.024 / 10.89

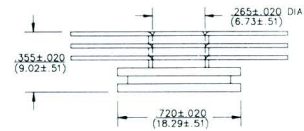
Patents Pending



2365B



2361B



2361B, 2365B **

How To Order

For Epoxy Bonding Attachment: Order by heat sink part number only.

For PGA EZ-Mount Assembly: Add assembly number to the heat sink part number. Options available for this Series are:

Assembly No.	Frame No.*	Shoe No.*	Spring No.*
8315-SP15	8315	-	SP15
8301-SP15	-	8301	SP15

Example: 2361B with 8315-SP15 Assembly (Using Frame)
 2361B with 8301-SP15 Assembly (Using Shoes - 2 per Assembly)

* See page 2 for frame dimensions.

**The 2361B and 2365B will also bond on an 11 x 11 pin PGA.

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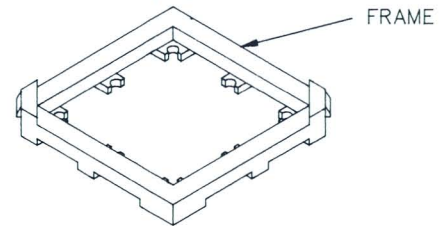
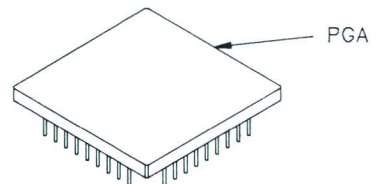
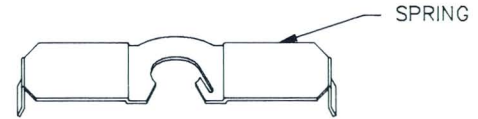
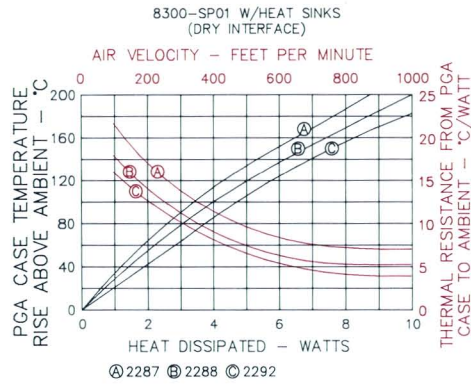
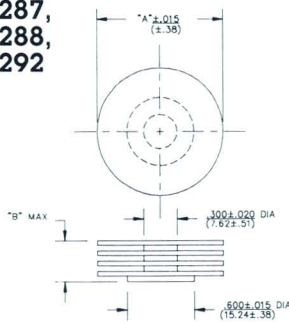
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2287, 2288, 2292

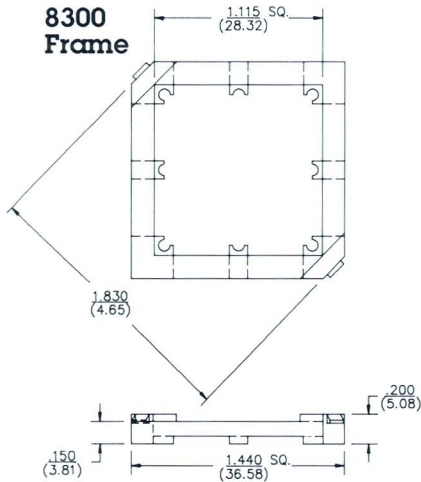
- For 11 x 11 pin PGA Packages - 72 pins.
- Round horizontal fins.
- Spring yoke snaps on corners of frame. Spring increases surface area for improved performance.
- 2 or 4 fins.
- 8° to 12° C/watt in forced convection.

Model	Dim. A	Dim. B	No. Fins	R θ Natural Convection	R θ Forced Air (400 fpm)	Weight (Lbs./Grams)
2287B..	1.000 (25.40)....	0.255 (6.48)...	2.....	31.3°C/W.....	12.0°C/W	0.008/3.63
2288B..	1.000 (25.40)....	0.360 (9.14)...	4.....	26.8°C/W.....	8.0°C/W	0.014/6.35
2292B..	1.125 (28.58)....	0.360 (9.14)...	4.....	21.4°C/W.....	7.0°C/W	0.210/9.52

**2287,
2288,
2292**



**8300
Frame**



2287B, 2288B, 2292B

How To Order

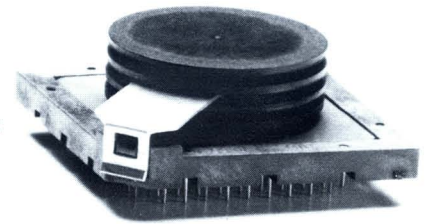
For Epoxy Bonding Attachment: Order by heat sink part number only.

For PGA EZ-Mount Assembly: Add assembly number to the heat sink part number. Option available for this Series is:

Assembly No. Frame No. Spring No.

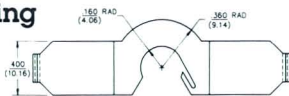
8300-SP01 8300 SP01

Example: 2287B with 8300-SP01



Patent Pending

**SP01
Spring**



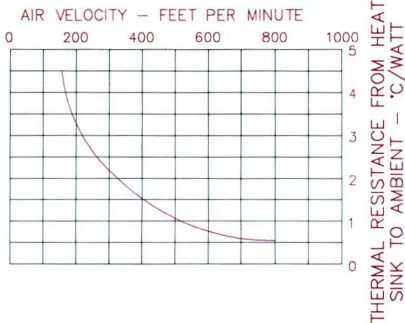
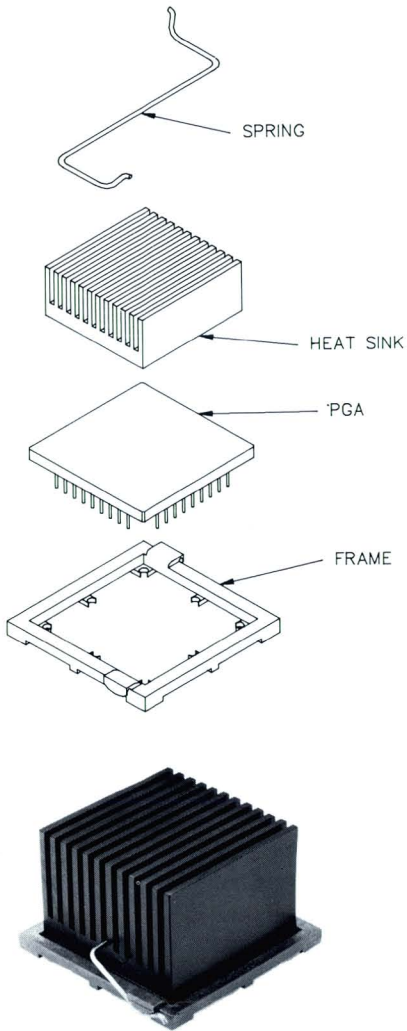
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2380

- For 15 x 15 pin PGA Packages - 149 pins.
- 12 vertical fins.
- High fin ratio, 12:1, for maximum surface area.
- 100% more surface area than conventional extrusion.
- 1.3°C/watt in forced convection.

No. *Rθ* Forced Weight
 Model Fins Convection (Lbs./Grams)
 2380B.... 12... 1.3°C/W..... 0.138/62.60
 Patent Pending



The following information is provided to reference all parts in this catalog.

Interface thermal resistance using 8315-SP15 frame and spring in comparison to bond-on adhesives. Tests performed with 2297B heat sink.

TYPE JOINT	THERMAL RESISTANCE (°C/W)
Dry	1.97
Grafoil	1.66
Thermal Grease	0.89
Anaerobic Adhesive	0.90
Epoxy Preform	0.59

2380B

How To Order

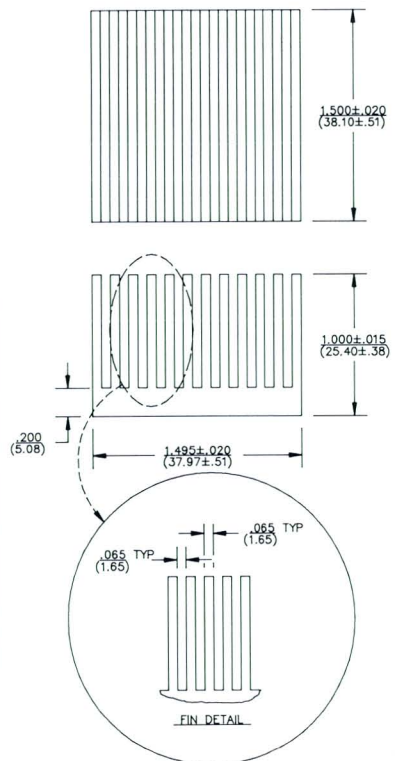
For Epoxy Bonding Attachment: Order by heat sink part number only.

For PGA EZ-Mount Assembly: Add assembly number to the heat sink part number. Options available for this Series are:

Assembly No.	Frame No.*	Shoe No.*	Spring No.*
8315-PF15	8315	-	PF15
8301-PF15	-	8301	PF15

Example: 2380B with 8315-PF15 (Using Frame)
 2380B with 8301-PF15 (Using Shoes - 2 Per Assembly)

* See page 2 for frame dimensions.



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2328, 2329, 2330, 2334, 2433

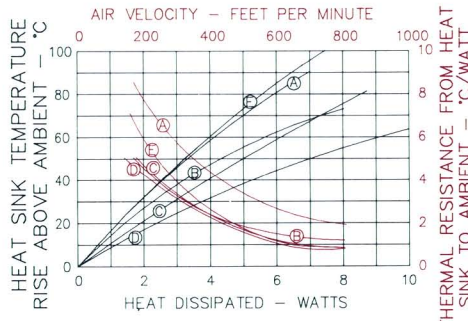
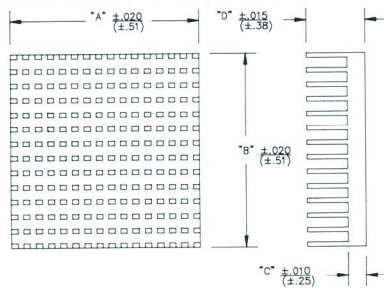
- For 11 x 11, 14 x 14, 15 x 15, 18 x 18, 21 x 21 pin PGA packages.
- Pin fin design.
- Utilizes cooling airflow from any direction.
- Ideally suited to impingement cooling.
- 20% performance improvement over extruded equivalents.
- 2433 - copper for improved thermal conductivity.

Model	PGA Size	Dim. A	Dim. B	Dim. C	Dim. D	Pin Fin Configuration	R θ Natural Convection	R θ Forced Air (400 fpm)	Weight (Lbs./Grams)
2328B	11 x 11	.975(24.76)	1.100(27.94)	0.150(3.81)	0.600(15.24)	7 x 9	13.6°C/W	4.2°C/W	0.028/12.70
2329B	14 x 14	1.235(31.37)	1.358(34.49)	0.200(5.08)	0.650(16.51)	9 x 10	10.0°C/W	2.4°C/W	0.048/21.77
2330B	15 x 15	1.495(37.92)	1.500(38.10)	0.200(5.08)	0.650(16.51)	10 x 12	9.4°C/W	2.3°C/W	0.066/29.93
2334B	21 x 21	2.015(51.18)	2.100(53.34)	0.200(5.08)	0.650(16.51)	16 x 14	6.5°C/W	2.1°C/W	0.116/52.61
2433	18 x 18	See specific plan and profile for dimensions.				14 x 14	13.9°C/W	2.6°C/W	0.216/97.95

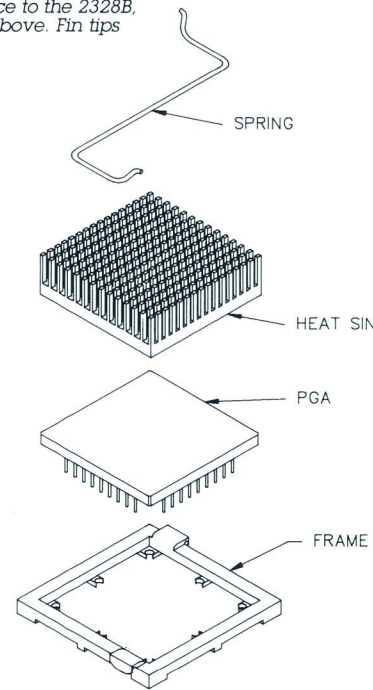
Patents Pending on parts listed above.

Note: Profile and plan shown below is the 2334B with 16 x 14 pin fin configuration. Profile and plan in reference to the 2328B, 2329B and 2330B is for perspective only. For specific dimensions and pin fin configuration refer to part table above. Fin tips may be radiused at Thermalloy's option.

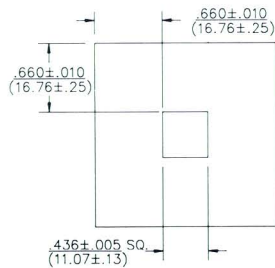
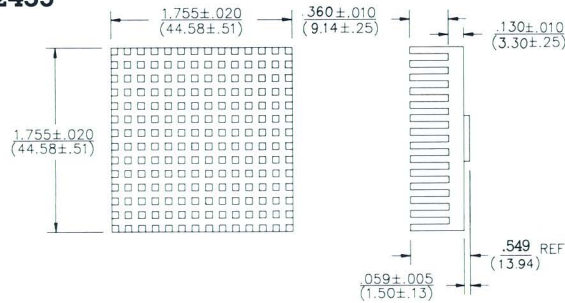
2328, 2329, 2330, 2334



Ⓐ 2328 Ⓑ 2329 Ⓒ 2330 Ⓓ 2334 Ⓔ 2433



2433



2328B, 2329B, 2330B, 2334B, 2433

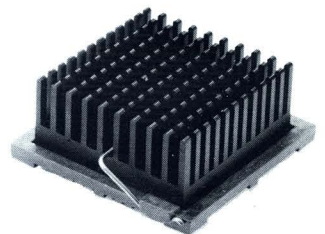
How To Order

For Epoxy Bonding Attachment: Order by heat sink part number only.

For PGA EZ-Mount Assembly: Add assembly number to the heat sink part number. Options available for this Series are:

Model No.	Assembly No.	Frame No.*	Shoe No.*	Spring No.*
2328B	8311-PF11	8311	-	PF11
2328B	8301-PF11	-	8301	PF11
2329B	8314-PF14	8314	-	PF14
2329B	8301-PF14	-	8301	PF14
2330B	8315-PF15	8315	-	PF15
2330B	8301-PF15	-	8301	PF15
2334B	8321-PF21	8321	-	PF21
2334B	8301-PF21	-	8301	PF21
2433	N/A	-	-	-

* See page 2 for frame dimensions.



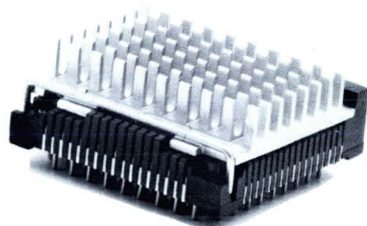
2305, 2306, 2307

- For 68 pin leadless chip carrier 3M-Textool socket.
- Pin fin or standard extrusion design.
- Pin fin utilizes cooling airflow from any direction.
- Pin fin suitable for impingement cooling.
- Thermal grease or epoxy not required.

Model	Dim.A	Dim.B	Dim.C	Dim.D	R θ Natural Convection	R θ Forced Air (400 fpm)	Weight (Lbs./Grams)
2305B.....	1.185 (30.10)....	1.095 (27.81)....	0.500 (12.70)....	N/A.....	16.3°C/W.....	5.0°C/W.....	0.014/6.35
2306B.....	1.185 (30.10)....	1.095 (27.81)....	0.260 (6.60)....	N/A.....	22.0°C/W.....	8.0°C/W.....	0.008/3.63
2307B.....	1.185 (30.10)....	1.095 (27.81)....	0.265 (6.73)....	1.520 (38.61)..	18.7°C/W.....	7.0°C/W.....	0.016/7.26

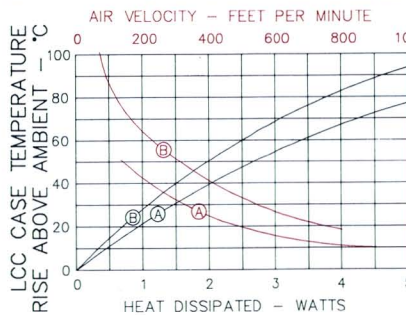
Note: 2305 profile has 5 x 10 pin configuration. 2306 profile shown with 8 x 10 pin configuration.

2305, 2306

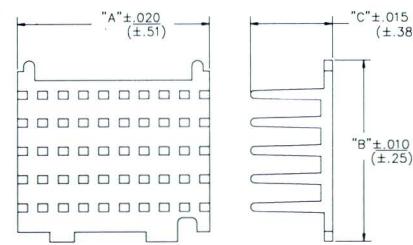


Patents Pending

Part shown is gold chromate 2306 on 3M Textool socket.

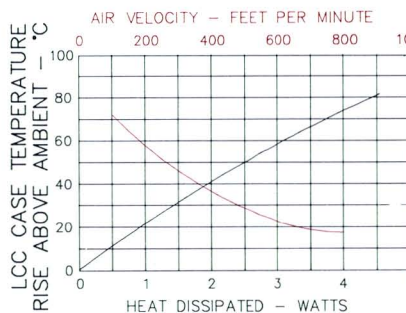
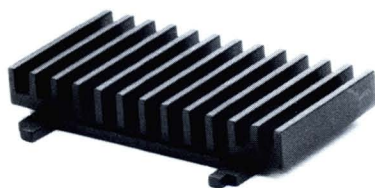


THERMAL RESISTANCE FROM LCC CASE TO AMBIENT - °C/WATT

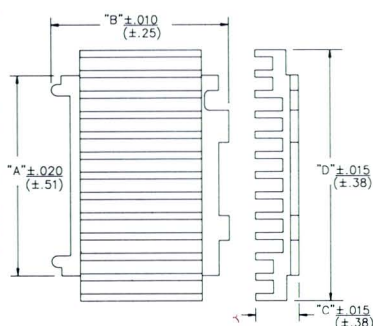


(A) 2305 (B) 2306

2307



THERMAL RESISTANCE FROM LCC CASE TO AMBIENT - °C/WATT



Engineering Information Releases (EIR's)

Many tests and evaluations have been conducted on PGA heat sinks by Thermalloy's Engineering Department. These reports are shown below and are available to you upon request. Just call Thermalloy direct or call your local Thermalloy representative.

INTRODUCTION

EIR 87-1012 Heat Sinks for Gate Arrays
EIR 87-1035 ADHESIVE ATTACHMENT AND INTERFACE DATA

EIR 87-1021 Adhesives for Heat Sink Attachment

EIR 87-1035 An Abbreviated Analysis of the Thermal Expansion Mismatch Substrate-to-Heat Sink ASIC Applications

EIR 87-1022 Interface Thermal Resistance (R θ CS) Data for Gate Array Heat Sink Applications

HEAT SINKS FOR LEADLESS CHIP CARRIERS

EIR 87-1041 Heat Sinking Ceramic Leadless Chip Carriers (AMP, Inc.)

EIR 84-1002 Thermal Test Data for Leadless

Chip Carrier Heat Sinks Including the Snap-On Heat Sink for the AMP Chip Carrier Socket

EIR 87-1003 Thermal Test Data on Leadless Chip Carriers

EIR 87-1007 Simulated R θ CA Data of a Leadless Chip Carrier in a 3M-Textool Socket with Heat Sinks 2300, 2304, 2305, 2306, and 2307

PRESS-ON FIN HEAT SINKS

EIR 86-1022 Thermal Comparison of an Aluminum Heat Sink with Press-On Fins vs. an Integral One Piece Version with Similar Dimensions

EIR 87-1024 Thermal Comparison of 2288B vs. 2361-4 Press-On Fin Specials

EIR 87-1025 Thermal Performance of Various Press-On Fin Heat Sinks

TWO PIECE HEAT SINKS AND SPRING CLIP ATTACHMENT

EIR 87-1023 Simulated PGA Thermal Performance Using the 8300-SP01 Frame and Spring with Various Heat Sinks

PIN FIN AND HIGH FIN RATIO HEAT SINKS

EIR 86-1023 Thermal Performance of Small Pin Fin Heat Sinks 2305, 2306, and 2330

EIR 87-1026 Thermal Performance of Pin Fin and High Fin Ratio (HFR) Heat Sinks 2328B, 2330B, 2334B, and 2384B

EIR 87-1027 Thermal Comparison of the 2330B vs. a 4/10 Inch Tall 2330B

EIR 87-1040 Simulated PGA Performance Using the 8315-SP15 Frame and Spring with Various Heat Sinks



Thermalloy Inc.

The Innovator in semiconductor accessories.

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B1 G/F Tuen Mun Industrial Centre
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 Kowloon, Hong Kong / TEL: 0-847312-3 / TELEX: 49200
 THMYL HX / FAX: 0-828100