AT&T
Microelectronics

Microelectronic Products
Selection Guide

Expanding people's capabilities through innovation . . .

AT&T Microelectronics Product Selection Guide/Fall 1993

AT&T Microelectronics Product Selection Guide Fall 1993

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Using This Guide

The AT&T Microelectronic Product Selection Guide provides an overview of our integrated circuit and component offerings. It is organized to assist you in making a first order determination of additional information or application solutions you may need to apply to your product. There are several ways to learn more about AT&T Microelectronics and our products using this Guide:

1. Introduction (Section 1): our vision, capabilities, and customer focus.

2. Applications (Section 2): component-level solutions supported by block diagrams, product listings, and cross-references to specific product information in the product listing section.

3. Product Listing (Sections 3—13): product family overviews, detailed product descriptions of new/feature products, and product reference charts with features, characteristics, codes, and literature availability.

4. Literature Selection Index (Section 14): listing of available application notes, data books, and manuals.

5. Customer Support (Section 15): listing of locations and contact numbers for sales offices, manufacturers representatives, and distributors organized by region.

Literature Code Legend:
AP — Application Note
BC — Brochure
CA — Catalog
DB — Data Book
DS — Data Sheet
IM — Information Manual
MN — Manual
PN — Product Brief
TN — Technical Note

To order literature or request additional information, call your AT&T Account Manager (see customer support section) or call 1-800-372-2447.

Introduction

Expanding People's Capabilities Through Innovation...

For over a hundred years people have been communicating by voice-only telephony made significantly possible by the technology and products of AT&T Microelectronics. Through the 1990s advanced technology will be expanding people's communication possibilities through innovative methods. People have the opportunities to exchange thoughts, messages, and information via speech, signals, and writing. Visual images and pictures will enhance people's communication between one another and the world around them, while stretching beyond the limits of strictly words. As technology advances, people will understand their need to communicate is no longer determined by their location, by the time zone in which they live, or by the communication instrument available to them at a given time. Today, their ability to communicate or access information is aided by a wider choice of media and a greater accessibility range. People now have the opportunity to communicate sitting at a desk, traveling in an airplane or car, or even lounging on the beach. These communication capabilities are emerging from a convergence of the traditional communication, computing, and entertainment markets. From this merger come opportunities in new markets, with new products, and between new customers. AT&T Microelectronics, working together with the key players in these markets, is creating the vision of anytime, anywhere communications.

Customer-Driven Solutions

AT&T Microelectronics applies the world-renowned research of AT&T Bell Laboratories, our integrated technology platforms, and our customers' needs and insights to create focused applications in line with our vision. Our efforts result in leading products and application solutions which give our customers an advantage and bring an added value to their own customers. Today we're delivering industry-leading solutions for networked computing, wireless communications, and telecommunications. Soon we'll deliver solutions for personal communicators, desktop video conferencing, and advanced consumer electronic products like HDTV and interactive multiplayers. And with our state-of-the-art production facilities and design centers located throughout North America, Europe, and Asia, we can deliver these solutions on a worldwide scale (see Figure 1).

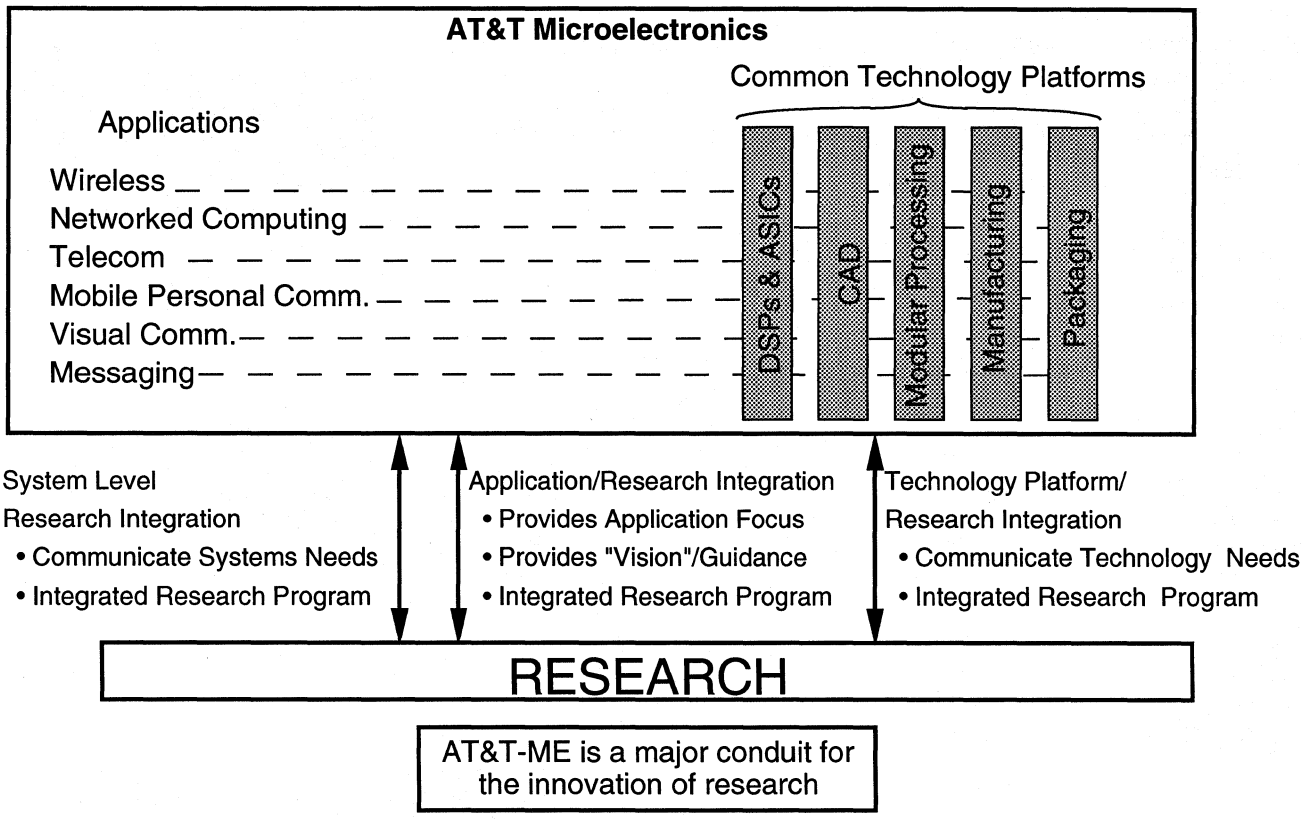


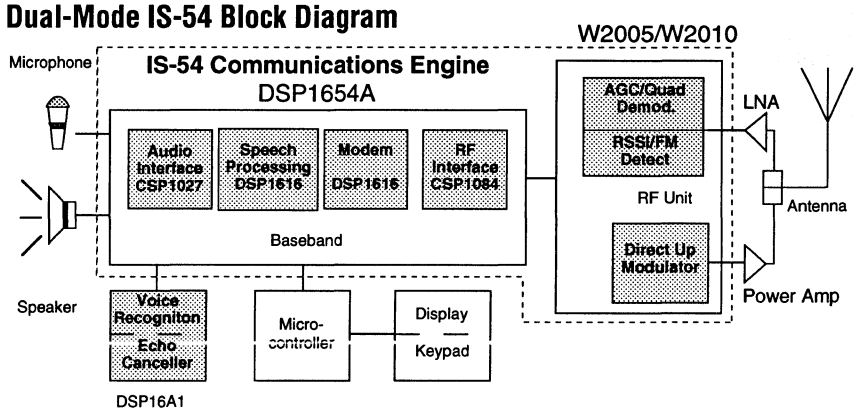
Figure 1. Focusing AT&T Microelectronic's Resources on Meeting the Critical Needs of Customers

Applications

Rapidly advancing technology, coupled with user needs and expectations, is driving the cellular, mobile data, and ultimately, the personal communications markets. This Wireless Revolution is demanding portable communication products that are smaller and lighter, and provide longer talk time and more features than thought imaginable. For designers and manufacturers of these products, component vendor selection is critical. High integration, advanced packaging, low power, and low supply voltages are key component selection criteria. AT&T Microelectronics has the solutions.

We've leveraged our leading-edge CMOS and bipolar process technologies and our low-power/low-voltage and high-performance design technologies to deliver cellular-specific DSPs and RF/IF components. We took this a step further by offering a total dual-mode IS-54 communications engine solution. In addition, we provide complete modem chip sets that support *MOBITEX*, a wireless packet radio network, and analog cellular networks. Our unmatched competence in DSP, voice coding, and radio technologies with our unrivaled commitment to this market will help you meet the challenges of the Wireless Revolution.

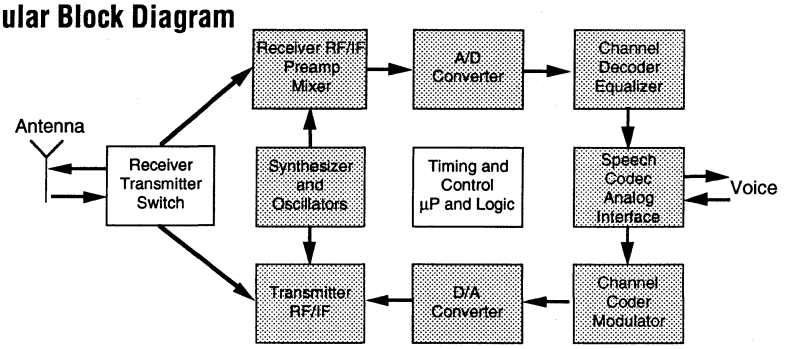
Dual-Mode IS-54 Block Diagram



IS-54 Communications Engine Features and Benefits

- DSP1654A Baseband Chip set
  - — Complete baseband solution for pocket, handheld, mobile dual-mode IS-54 terminals
  - — Low power consumption with low-voltage options for extended talk and standby times
  - — Compact form factor solutions with four chips in TQFP packages
  - — Expandable architecture for adding user features (voice recognition, speakerphone, encryption)
- 900 MHz RF Transceiver Chip set (W2005 Receiver/W2010 Transmitter)
  - — Specifically designed for the IS-54 cellular standard
  - — W2005 receiver performs both analog and digital modulation on one chip
  - — Also suited to GSM and JDC (W2010 only) digital cellular standards
  - — High level of integration and powerdown features

Digital Cellular Block Diagram



Cellular Components
RF/IF Functions

Part No.	Description	Page No.
W1452	69 dB IF Amplifier/Quadrature Demodulator	—
W1466	100 MHz, 45 dB IF Amplifier	—
W1575	69 dB IF Amplifier/Quadrature Demodulator	—
W2005	1 GHz to Baseband FM & DQPSK Cellular Receiver	—
W2009	IF Quadrature Modulator	—
W2010	1 GHz Direct-Up Quadrature Modulator	—
W2012	1.9 GHz Indirect-Up Quadrature Modulator	—
—	Crystal Oscillators	3-21

Note: Data sheets available.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Codecs

Part No.	Description	Page No.
T7582	Baseband Codec	3-13
CSP1027	Voiceband Codec	3-13
CSP1084	Baseband Radio Interface	3-13

Signal Processing Functions

Part No.	Description	Page No.
DSP16A	Fixed-Point, 16-bit, Digital Signal Processor	3-11
DSP16A1-STVR	Speaker-Trained Voice Recognizer—HVP Family (Hands-Free Voice Processor)	3-12
DSP16C	Fixed-Point, 16-bit, Digital Signal Processor with Voiceband Sigma-Delta Codec	3-12
DSP1610	Fixed-Point, 16-bit, Digital Signal Processor with 8K Downloadable Dual-Port RAM and 512K Boot ROM or 4K RAM and 512K Boot ROM	3-12
DSP1616	Fixed-Point, 16-bit, Digital Signal Processor with 2K RAM and 12K ROM	3-12
—	CMOS ASICs—High-Performance and Low-Power Libraries with Industry-Standard Macrocells	4-4

Base Station Receiver and Transmit Amplifier Components

Part No.	Description	Page No.
1098E	Complex Vector Attenuator, 810 MHz to 830 MHz and 869 MHz to 894 MHz	—
—	GSM Low-Noise Amplifier, 890 MHz to 915 MHz	—

Note: Data sheets available.

Power

Part No.	Description	Page No.
—	Board-Mounted Power Modules	12-1
—	dc-dc Converters	12-8
—	Transformers	13-1

Interconnection

Part No.	Description	Page No.
—	*Metral*™ Interconnection System	8-1
—	Multilayer Printed-Circuit Boards	7-1

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Wireless Modem Applications

For a complete listing of components suited to wireless modem applications, refer to the Data Communications section on page 2-3.

Networking will be a key opportunity for advanced PCs and workstations in the 90s. By the close of the decade, two out of three PCs and workstations will be part of a LAN. Most sites will use modem-accessed communications and information services. And ISDN-based services integrating still and animated video images will stimulate new business and personal computer applications.

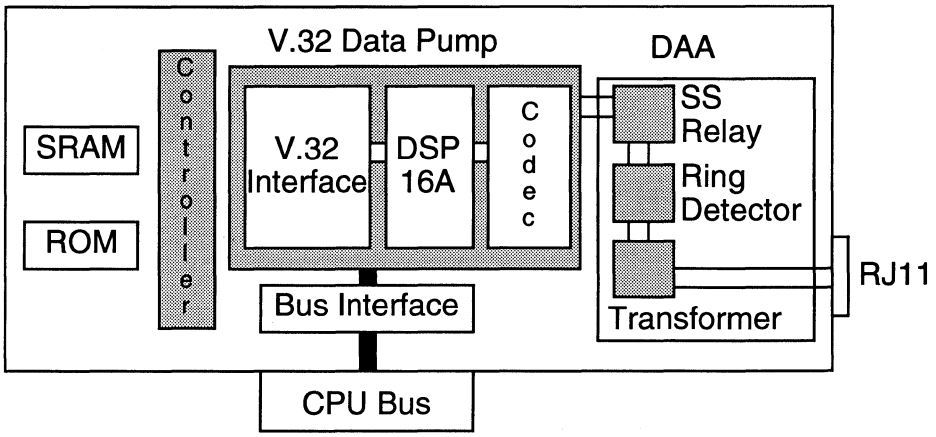
AT&T Microelectronics is perfectly positioned to help you capture a significant share of this market with unequalled applications experience in all areas of data communications and telecommunications; with components designed specifically for information-exchange applications; and with all of the technologies needed to provide complete solutions, not just isolated parts.

V.32 Modems

AT&T Microelectronics manufactures high-speed (19,200 bits/s, 14,400 bits/s, 9,600 bits/s) DATA/FAX/VOICE modem chip sets based on the AT&T DSP16A. At the heart of virtually every modem produced today is a modem chip set. At the highest level, there are two flavors of modem chip sets: data pump chip sets and complete modem chip sets. A data pump is the portion of the modem which pumps bits of data onto a telephone line. In addition to a data pump, a complete modem chip set contains a microcontroller and firmware which performs error correction and data compression and provides an AT command interface to a PC or terminal.

The AT&T DSP16A Data Pump and Complete Modem Chip Sets are suited for a wide variety of applications and feature requirements. In addition to data rates of 19,200 bits/s, 14,400 bits/s, and all fallbacks, the chip sets provide FAX (14,400 bits/s and all fallbacks), as well as voice compression algorithms (for answering machine type features). The chip sets are packaged in either PLCC (D for desktop PC 1/2 cards and external box modems), PQFP (L for ultralow power notebook internal modems and pocket modems), and TQFP packaging (P for PCMCIA cards and other applications with severely limited space requirements). The HSM prefix in the part numbers refers to high-speed modems (9600 bits/s and above). V.32MX refers to chip sets that include support for *MOBITEX*, a wireless packet radio network. V.32 Cell refers to chip sets that include options to operate the modem over the analog cellular network.

V.32/V.32bis/FAX Modem Cards



V.32 Modems — Data Pumps

Part No.*	Package Options	Highest Speed†	Standard Features	Optional Features	Page No.
HSM96xD	D, L, P	9,600 bits/s	9,600 bits/s Data/FAX	—	3-13
HSM144xD	D, L, P	14,400 bits/s	14,400 bits/s Data/FAX	—	3-13
HSM144xD-V	D, L, P	14,400 bits/s	GSM Voice Coder	3.3 V vers.	3-13
HSM144xD-P	D, L, P	14,400 bits/s	Parallel Data Transfer Mode	3.3 V vers.	3-13
HSM144xD-X	L, P	14,400 bits/s	*MOBITEX* Packet Radio Network Support	3.3 V vers.	3-13
HSM144xD-C	L, P	14,400 bits/s	Analog Cellular Data/FAX Support	3.3 V vers.	3-13
HSM192xD	D, L, P	19,200 bits/s	V.32terbo data support	3.3 V vers.	3-13

* Replace the x in the part number with the character corresponding to the package option. The choices are D-desktop, L-laptop, P-PCMCIA.

† Highest speed implies that all fallbacks below that rate are supported, i.e.:
Data supports V.32terbo, V.32bis, V.32, V.22bis, V.22, V.21, V.23, Bell 212/103
FAX supports V.17, V.29, V.27ter, V.21 (ch2)
GSM is 13 kbits/s; voice thru also supports 54 kbits/s μ-law & A-law and linear modes

V.32 Modems — Complete Modem Chip Sets

Part No.*	Package Options	Highest Speed†	Feature Set‡	Standard Features	Optional Features§	Page No.
HSM96xC	D ,L, P	9,600 bits/s	Classic	9,600 bits/s Data/FAX	PID	3-14
HSM144xC	D, L, P	14,400 bits/s	Classic	14,400 bits/s Data/FAX	PID	3-14
HSM144xC+	D, L, P	14,400 bits/s	Gold	GSM Voice Coder	3.3 V, PID	3-14
HSM144xC-X	L, P	14,400 bits/s	Classic	*MOBITEX* Packet Radio Network Support	3.3 V, PID	3-14
HSM144xC-C	L, P	14,400 bits/s	Classic	Analog Cellular Data/FAX support	3.3 V, PID	3-14
HSM192xC	D, L, P	19,200 bits/s	Classic	V.32terbo Support	3.3 V, PID	3-14
HSM192xC+	D, L, P	19,200 bits/s	Gold	V.32terbo Support	3.3 V, PID	3-14

* Replace the x in the part number with the character corresponding to the package option. The choices are D-desktop, L-laptop, P-PCMCIA.

† Highest speed implies that all fallbacks below that rate are supported, i.e.:
Data supports V.32terbo, V.32bis, V.32, V.22bis, V.22, V.21, V.23, Bell 212/103
FAX supports V.17, V.29, V.27ter, V.21 (ch2)
GSM is 13 kbits/s; voice thru also supports 54 kbits/s μ-law & A-law and linear modes

‡ Feature Sets:
- Classic feature set includes data and FAX modulations and their fallbacks, AT command set, V.42/V.42bis, *MNP* 4 and 5 EIA/TIA 579 Class 1 FAX Hayes *AutoSync* or Class 2 FAX, integrated UART, low-power, zero glue logic.
- Gold feature set includes data and FAX modulations and their fallbacks, AT command set, V.42/V.42bis, *MNP* 4 and 5 EIA/TIA 576 Class 1 FAX. Hayes *AutoSync* and Class 2 FAX, integrated UART, low-power, zero glue logic voice command set including answering machine features, *MNP* 10, V.42 Appendix III, V.25bis, V.32Cell option.

§ PID refers to an optional PCMCIA interface device which incorporates PCMCIA interface logic into one chip.

V.32 Modems — Data Access Arrangement (DAA)

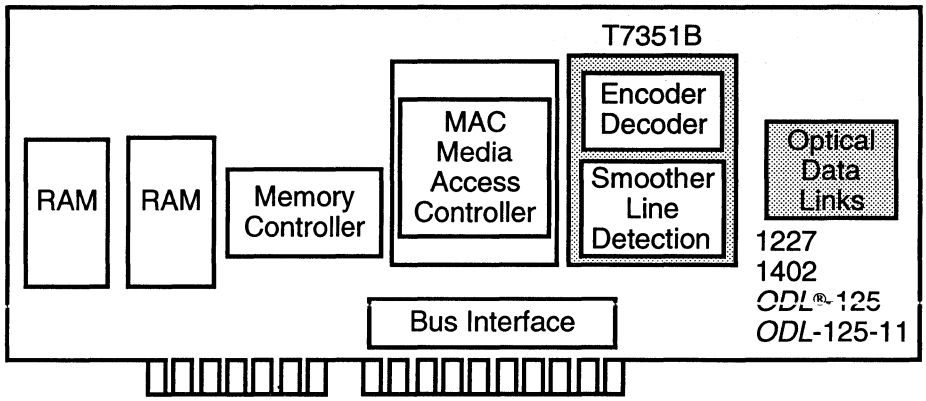
Part No.	Description	Page No.
LB1006AB	Telephone Ringing Detector IC	3-3
2769A	V.32 Low-Profile Transformer	13-1
2770A	V.32 Low-Profile Transformer, Surface Mount	13-1
LH1540AT	Solid-State Relay	3-32

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

FDDI Products

FDDI (Fiber Distributed Data Interface) is an ANSI standard, high-performance, fiber-optic local area network. Essentially, FDDI is made up of two counter-rotating token rings with a throughput of 100 Mbits/s each. In case of interruption, the rings are reconfigured automatically to continue to provide service. Stations on the network can be dual or single attachment. A dual-attachment station connects directly to both rings via a dual-attachment adapter card, while a single-attachment station is linked by optical cable to a concentrator, itself a dual-attachment device. The T7351B is targeted as the physical interface for the single-attachment and dual-attachment adapter card and for the concentrator. It will work with all popular FDDI MAC devices and, being a single-chip device implemented in CMOS, it offers space and power advantages.

FDDI Adapter Card



FDDI Adapter Card

Part No.	Description	Page No.
1227	Single-Mode FDDI Transmitter	10-3
1402	FDDI Compliant Transceiver	10-7
ODL-125	FDDI Compliant Data Link	10-6
ODL-125-II	Low-Cost FDDI Compliant Data Link	10-6
T7351B-FC	FDDI Physical Layer Interface	3-5

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

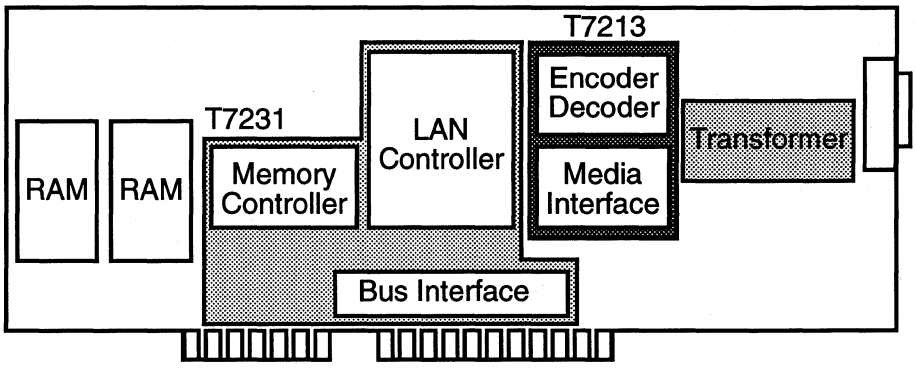
Optical Data Communications

Part No.	Description	Page No.
1227-Type	SM FDDI Laser Transmitter	10-3
1237-Type	SM FDDI Laser Transmitter	10-3
1238-Type	Fiber Channel Laser Transmitter	10-3
1318A	Fiber Channel Laser Receiver	10-4
1402-Type	FDDI Transceiver	10-7
1408A/B	Low-Cost FDDI Transceiver	10-7
1409A	*ODL*-200 Fiber Channel Board	10-7
T7032	Clock Data Recovery with Descrambler (1 MHz to 52 MHz)	3-6
T7035	Clock Data Recovery Chip (47.7 MHz to 210.5 MHz)	3-6
1401-Type	*IBM-ESCON* Architecture Compatible Transceiver	10-7
ODL-50-II	10Base-F Fiber Ethernet Data Link	10-6
ODL-125-II	Low-Cost FDDI Data Link (Lightweight Package)	10-6
ODL-200	FCO-266 Mbits/s Data Link for Fiber Channel	10-6
TRU200	*ESCON* and Fiber Channel Compatible/Clock and Data Recovery	3-20

Ethernet Network Interface Card (NIC)

The Ethernet NIC provides the physical connection to the network. In most cases, the card fits into the expansion slot of the networked computer. In portable computers, it is anticipated that the PCMCIA format will be the favorite NIC implementation. Other computers, like most workstations, have the NIC function integrated directly on the motherboard. The T7213 and T7231 together provide the Ethernet NIC function. The T7213 includes the transceivers, clock recovery circuit, and Manchester encoder/decoder. It provides an AUI or TP interface. The T7231 implements the media access controller, buffer management, and system bus interface (ISA). The T7213 and T7231 are targeted at adapter card and motherboard applications (excluding PCMCIA).

Ethernet Adapter Card



Ethernet Adapter Card

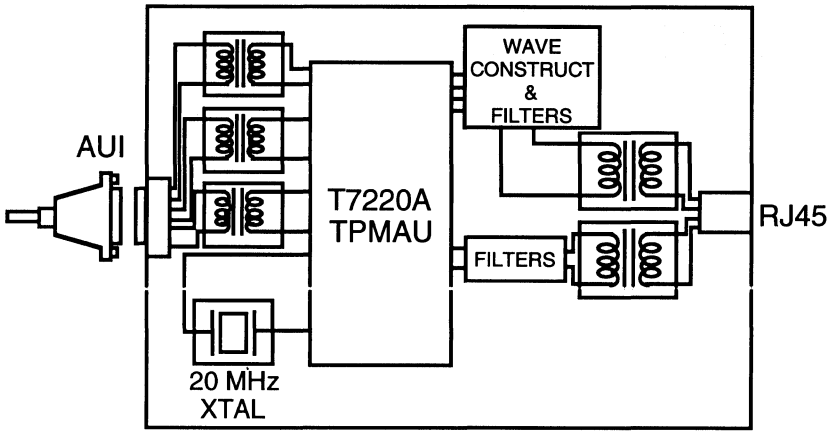
Part No.	Description	Page No.
T7213	Dual Interface Station Chip	3-5
T7231	LAN Controller	3-5

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

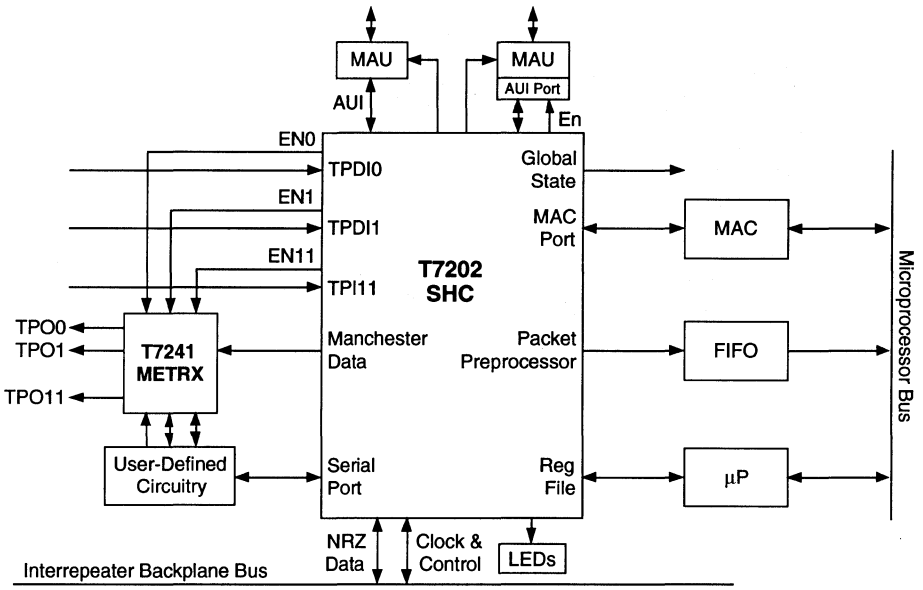
Intelligent 10Base-T Hub Product

As Ethernet evolved, the breakthrough in the ability to run a 10 Mbits/s data stream on existing wiring led to the development and implementation of wiring concentrators or hubs. These concentrators provide configuration and security management benefits which give network managers more control over their networks. Today's intelligent hub represents the next generation in this continuing hub evolution. These new hubs use industry-standard network management protocols, such as SNMP and CMIP, to enable the network manager to monitor and actively manage the network. The network management protocols provide fault, security, configuration, and performance information to the system administrator. The T7202 and its companion device, the T7241, are targeted at the intelligent hub applications and offer system design simplicity together with efficient network management information handling. The T7202 and T7241 also offer a unique hardware implemented network security feature.

T7220 Twisted-Pair Medium Attachment Unit (TPMAU)



Smart Hub Controller



Ethernet Repeaters

Part No.	Description	Page No.
T7202	Smart Hub Controller	3-4
T7220A	Twisted-Pair Medium Attachment Unit	3-5
T7241	Multiple Ethernet Transmitter	3-4

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

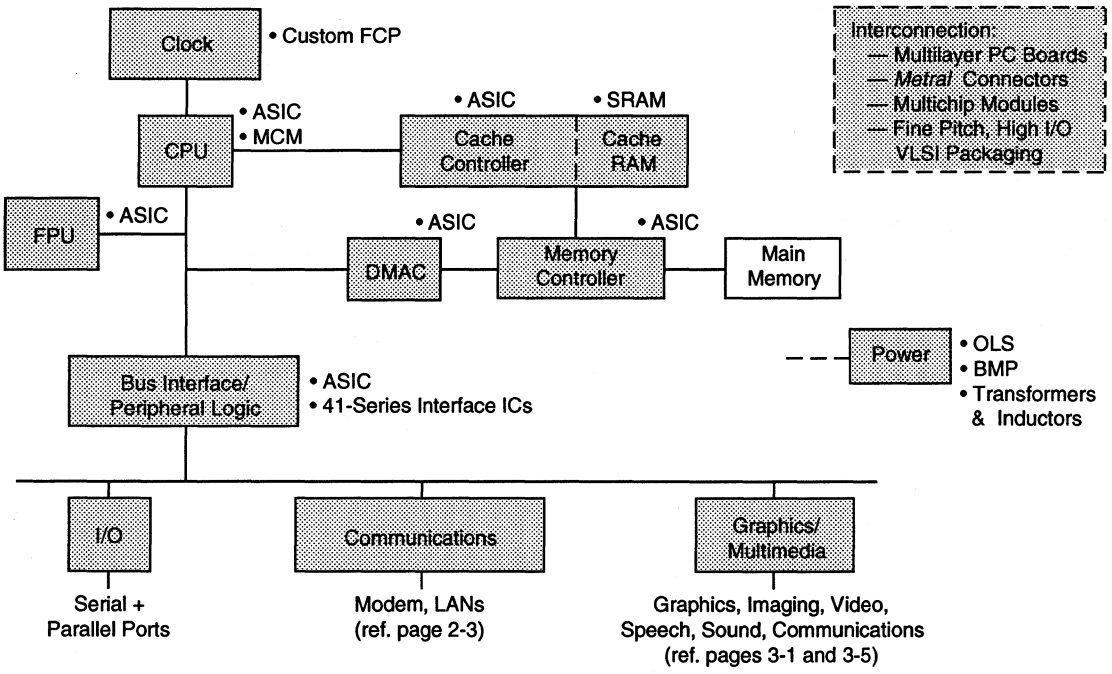
HIGH-PERFORMANCE PCs AND WORKSTATIONS

Today, it takes more to stay right on the leading edge in personal computers and workstations. The issues of system design are more numerous and far more complex.

Now you face processor speeds to 50 MHz and beyond: multitasking architectures, emerging standards in local and wide area networking, new capabilities in graphics and multimedia, more power for easier-to-use applications, never-ending pressure for greater functional density and better price-performance, and relentless competition from clones.

You can meet these challenges head-on at the component level with AT&T Microelectronics. Whether your system is designed for personal productivity, workgroup computing, or technical applications, your system will have more to offer with AT&T Microelectronics components. We have an extremely broad offering of the components you need. And our components offer the high performance and advanced capabilities the market demands.

High-Performance PC/Workstation Block Diagram



CPU/ Logic/ I/O

Part No.	Description	Page No.
—	Custom Frequency Control Products	3-20
—	41-Series High-Performance Line Drivers, Receivers, and Transceivers	3-28
—	Memory ICs	3-30
—	Semicustom and Custom ICs	4-1—4-7
—	Custom Multichip Modules	6-1
—	Electronic Power Transformers	13-1

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Multimedia – AT&T's DSP/*VCOS*™ Solution

The AT&T DSP vision of multimedia transcends conventional views of video and audio. AT&T has started with baseline functions that are critical to end users today, like FAX and data modems. Algorithms for speech coding, image processing, and audio coding were a natural follow-on for near-term application enhancements. For the future, AT&T also provides speech recognition, text-to-speech, low bit-rate coders, speakerphone, and other sophisticated DSP functions. AT&T's DSP Multimedia strategy is to be compatible with MPC and other evolving industry modules, carrying applications developers to new levels of breakthrough multimedia solutions. Using AT&T's strategy, developers have a no-risk path from today's necessary functions to tomorrow's open-ended possibilities.

An efficient, cost-effective multimedia solution must include three basic components, and AT&T's DSP Multimedia solution addresses each of these needs:

- Real-Time Operating System
  AT&T *VCOS* Operating System
- Multimedia Library
  AT&T *VCOS* Multimedia Module Library
- Low-cost, 32-bit, floating-point IC
  AT&T DSP32xx Digital Signal Processor

Functions

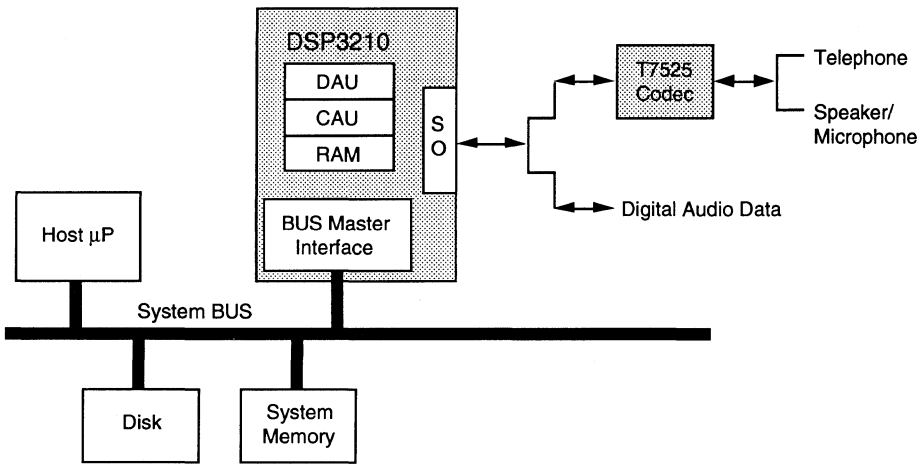
Audio
- PC desktop standards
  - — MPC/MIDI
  - — SoundBlaster
  - — Business audio
- Video standards
  - — MPEG Audio
  - — G.728 and G.722 speech
- Future standards

Communications
- 19.2 to 2.4 kbits/s data and FAX modems
- Caller ID
- Speakerphone AEC

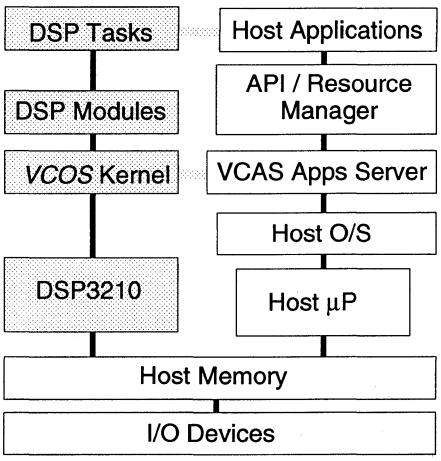
Speech
- Voice recognition
- Text-to-speech
- Speaker verification

Imaging
- JPEG still image

PC/Workstation Multimedia System Configuration



VCOS Layers

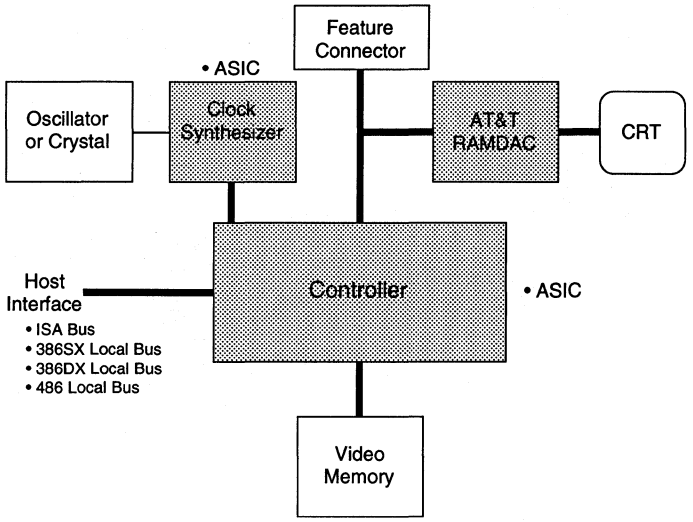


Multimedia

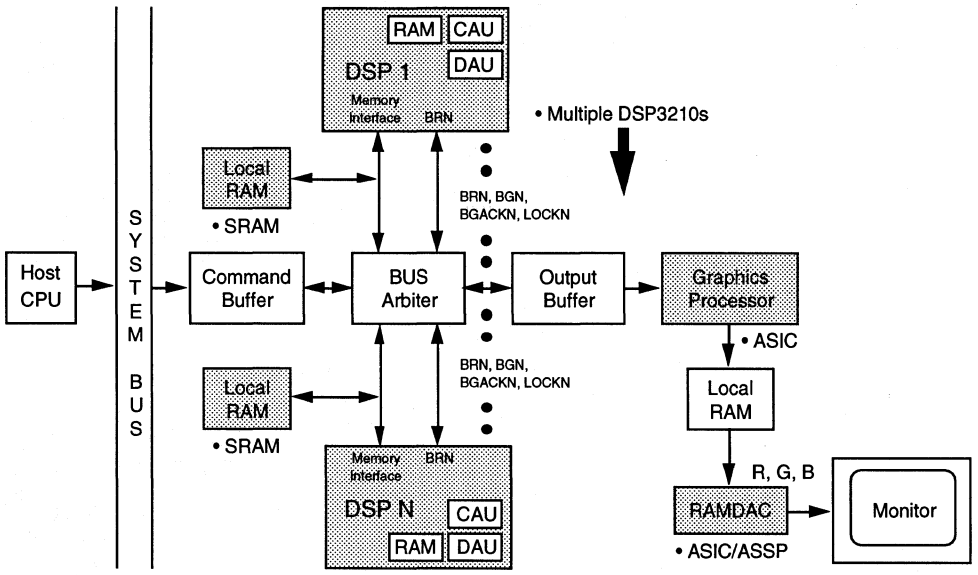
Part No.	Description	Page No.
DSP3210 & DSP3207	Floating-Point, 32-bit, Multimedia Digital Signal Processors	3-10
MP3210	DSP3210 Development Board	3-11
VCOS—VMDE	*VCOS* Multimedia Development Environment	3-11
—	Semicustom and Custom ICs	4-1—4-7

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

PC Graphics Block Diagram



PC/Workstation 3-D Graphics Block Diagram

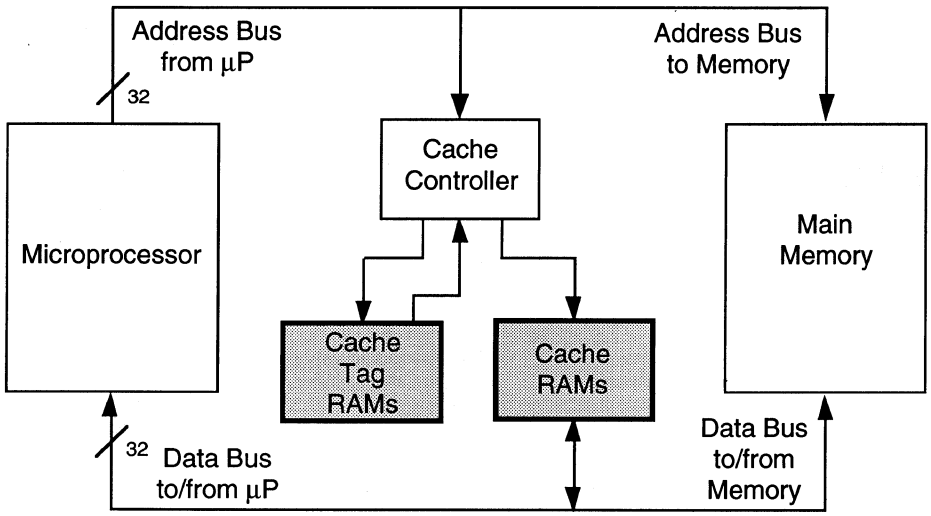


Graphics

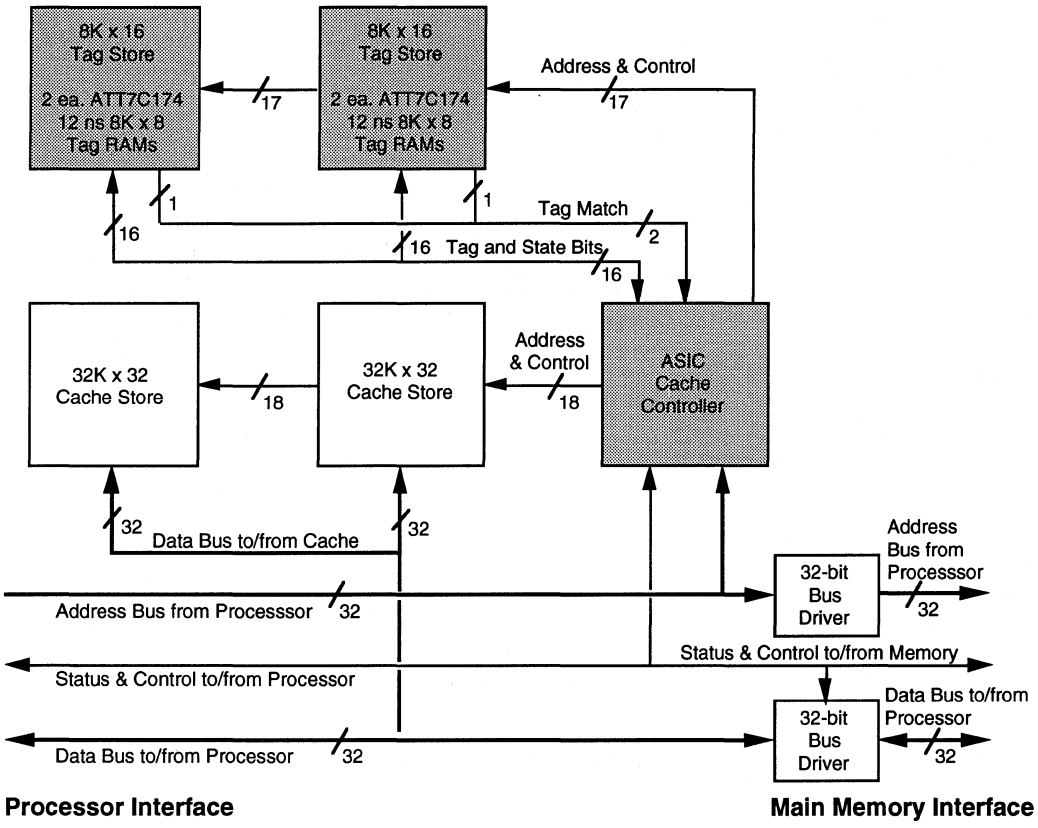
Part No.	Description	Page No.
RAMDACs for PC and Workstation Graphics		
ATT20C505	PC, 24-bit True-Color, 32-bit Pixel-Port VRAM 110/135/170 MHz	3-1
ATT20C504	PC, 24-bit True-Color, 32-bit Pixel-Port VRAM 85/100 MHz	3-1
ATT20C498	PC, 24-bit True-Color, 16-bit Pixel-Port 80/110/135 MHz	3-1
ATT20C491	PC, 24-bit True-Color with Gamma Correction 80/100/110 MHz	3-1
ATT20C492	PC, 18-bit Hi-Color with Gamma Correction 80/100/110 MHz	3-1
ATT20C490	PC, 24-bit True-Color 80/100/110 MHz	3-1
ATT20C493	PC, 18-bit True-Color 80/100/110 MHz	3-1
ATT20C497	Portable PC, 8-bit Pseudocolor, 50/80/100/110 MHz	3-1
ATT20C475A	Portable PC, 6-bit Pseudocolor, 50/66/80/100 MHz	3-1
ATT20C458	Workstation, 8-bit 110/135/170/200/220 MHz	3-1
DSP32C	32-bit CMOS DSP (3-D Graphics Floating-Point Accelerator with Graphics Application Library)	3-10
—	Semicustom and Custom ICs	4-1—4-7

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

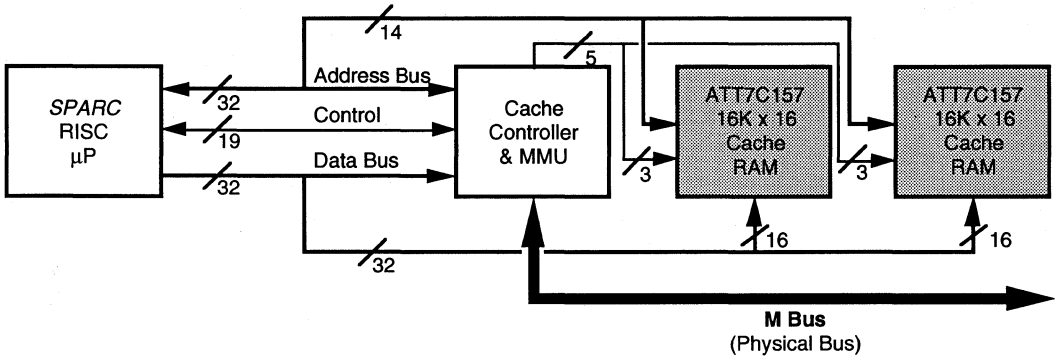
PC Cache Memory Block Diagram



Two-Way Set Associative 256 Kbyte Cache Block Diagram



SPARC RISC µP and Cache RAM Block Diagram



Cache RAM Solutions

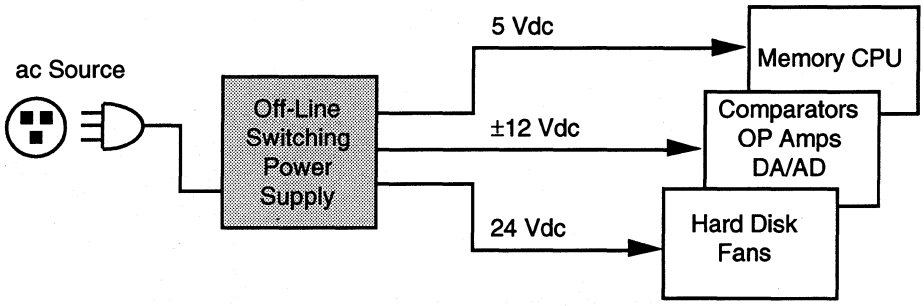
Processor	Clock Rate (MHz)	SRAM Speed (ns)	Devices	Organization		Page No.
SPARC	33	24	ATT7C157	16K x 16	Sync, Self-timed	3-30
(601)	40	20	ATT7C157	16K x 16	Sync, Self-timed	3-30

Cache Tag Solutions

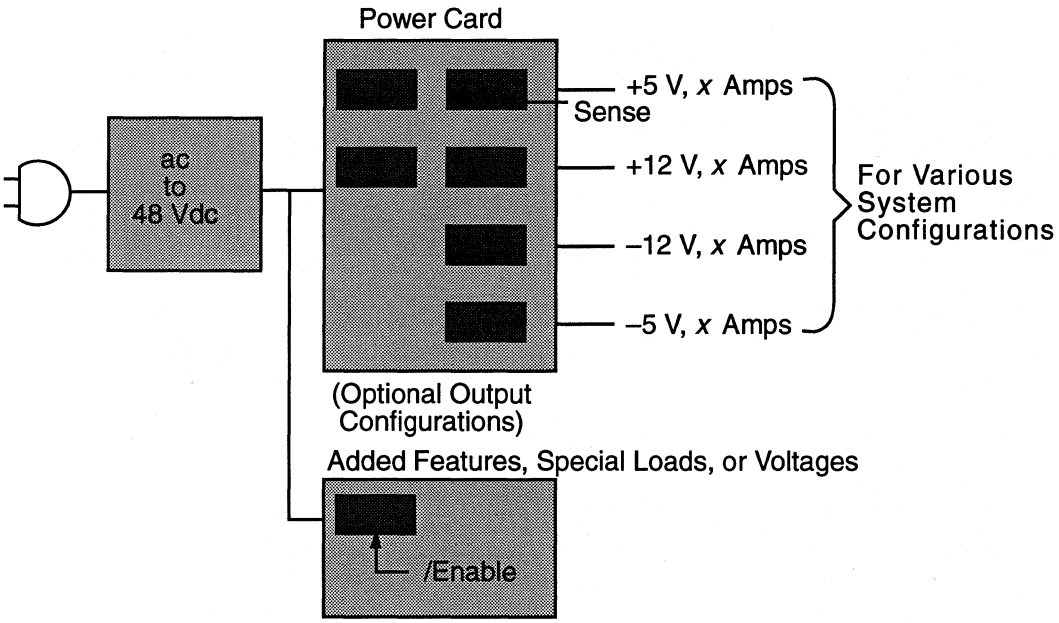
Processor	Clock Rate (MHz)	SRAM Speed (ns)	Devices	Organization		Page No.
386 SX	20	20	ATT7C181	4K x 4	Flash Clear	3-30
		20	ATT7C174	8K x 8	Flash Clear	3-30
	25	15—20	ATT7C181	4K x 4	Flash Clear	3-30
		15—20	ATT7C174	8K x 8	Flash Clear	3-30
386 DX	33	12—15	ATT7C181	4K x 4	Flash Clear	3-30
	50	12—15	ATT7C174	8K x 8	Flash Clear	3-30
486	33	12—15	ATT7C174	8K x 8	Flash Clear	3-30
	50	12	ATT7C174	8K x 8	Flash Clear	3-30

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Off-Line Switching Power



Board-Mounted Power



Power

Part No.	Description	Page No.
LBR022BS	Regulation Control Circuits	3-3
—	Board-Mounted Power Modules	12-1
—	Off-Line Switching Power Supplies	12-2

Interconnection Products

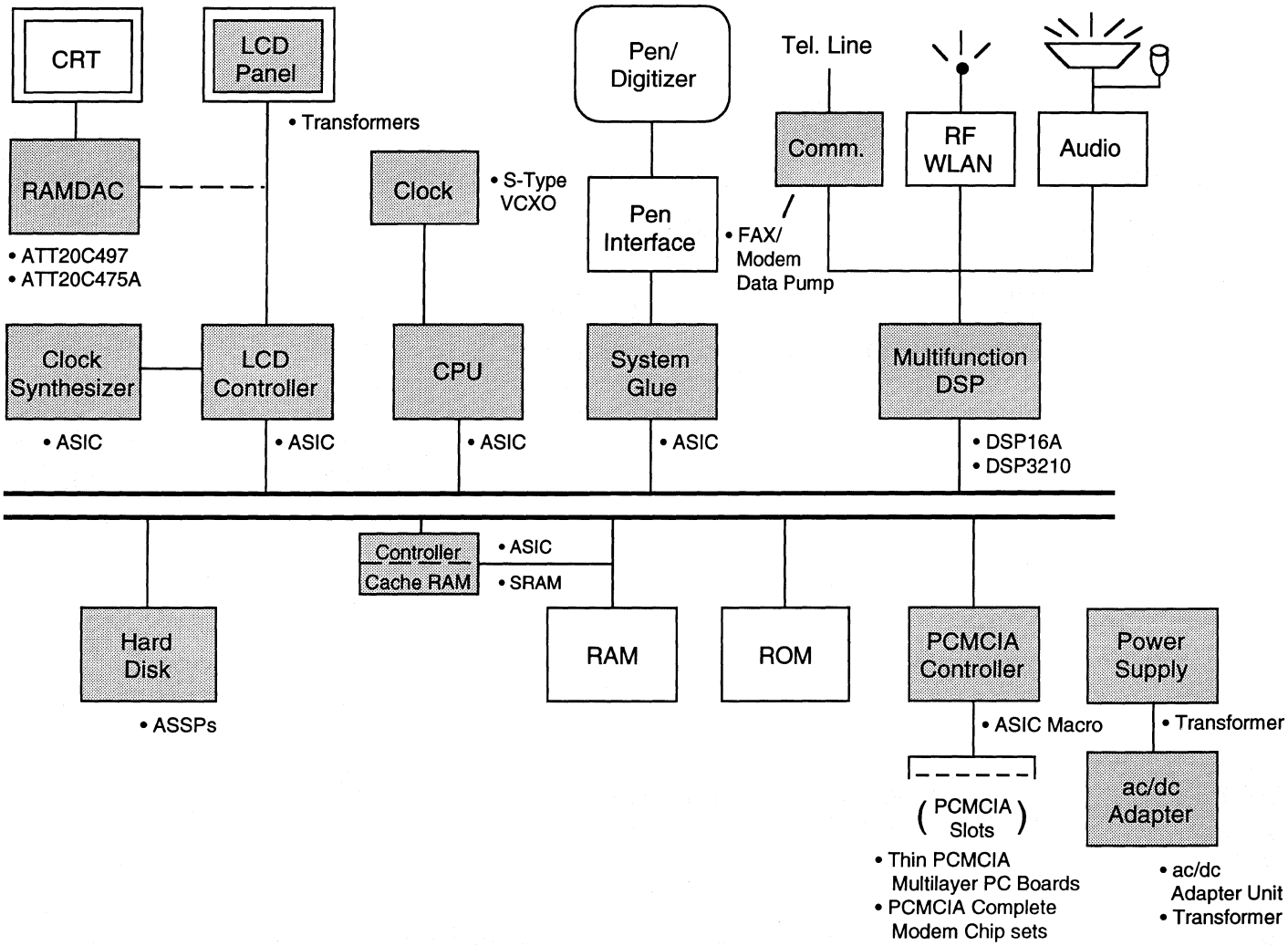
Part No.	Description	Page No.
—	Custom Multichip Modules	6-1
—	Custom Multilayer Printed-Circuit Boards	7-1
—	*Metral* Interconnection System	8-1

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Evolutionary advances in VLSI, CPUs, memory, mass storage, and displays have enabled desktop functionality in a portable form factor. Today's sophisticated mobile computer users not only require small, light-weight systems with long operating life but high performance and useful I/O and connectivity as well, i.e., maximum utility.

AT&T Microelectronics has the components you need to deliver the new generation of truly mobile computers: low-power 3 V CMOS standard-cell ASICs for system and I/O control logic; highly integrated hard disk drive ASSPs for small form factor mass storage; the industry-leading V.32/V.32bis FAX/modem chip set; and small ac/dc adapter units. We're also a leading supplier of PCMCIA I/O solutions. And this is just a sample of the products we're offering that will help drive the mobile computing revolution.

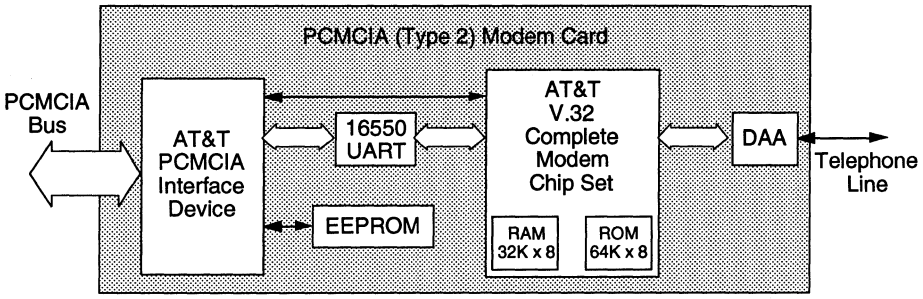
Mobile Computer Block Diagram



CPU/System and I/O Control Logic

Part No.	Description	Page No.
—	CMOS ASICs, High-Performance and Low-Power Libraries with Industry-Standard Macrocells	4-4
—	Cache RAM	2-11 & 3-30
—	S-Type Crystal Oscillator	3-21

PCMCIA (Type 2) Modem Card



The figure above shows a typical block diagram for a PCMCIA application of the AT&T modem chip set. There is a variety of modem chip sets to accommodate various portable computers. For instance, the chip set comes in a laptop form factor for low-power pocket modems and notebook internal modems as well as a PCMCIA form factor for PCMCIA modems. In addition, the complete controller solution offers options for communicating over wireless networks such as V.32Cell (analog cellular network) or V.32MX (*MOBITEX* packet data network).

Refer to page 2-3 for additional information on AT&T DSP16A modem chip sets. Refer to page 3-8 for AT&T DSP16A modem chip sets product listing.

Data Communications/Networking

Part No.	Description	Page No.
—	V.32/V.32bis FAX/Data Pump	2-4
—	Local Area Network Solutions	2-6 & 3-4

Graphics/Multimedia

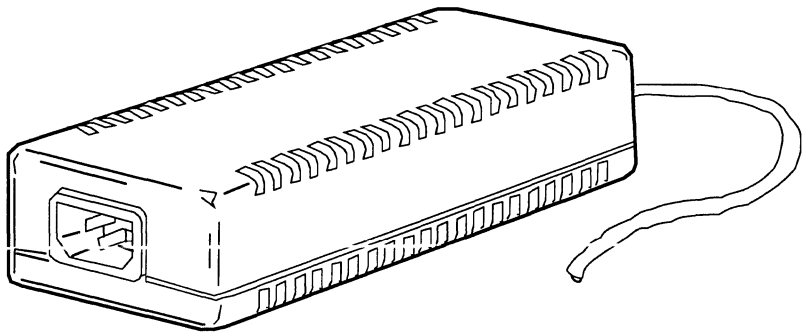
Part No.	Description	Page No.
DSP16A	Fixed-Point, 16-bit Digital Signal Processor	3-11
DSP3210	Floating-Point, 32-bit, Multimedia DSP	3-11
ATT20C497	Portable PC, 8-bit Pseudocolor RAMDAC	3-1
ATT20C475A	Portable PC, 6-bit Pseudocolor RAMDAC	3-1

Mass Storage

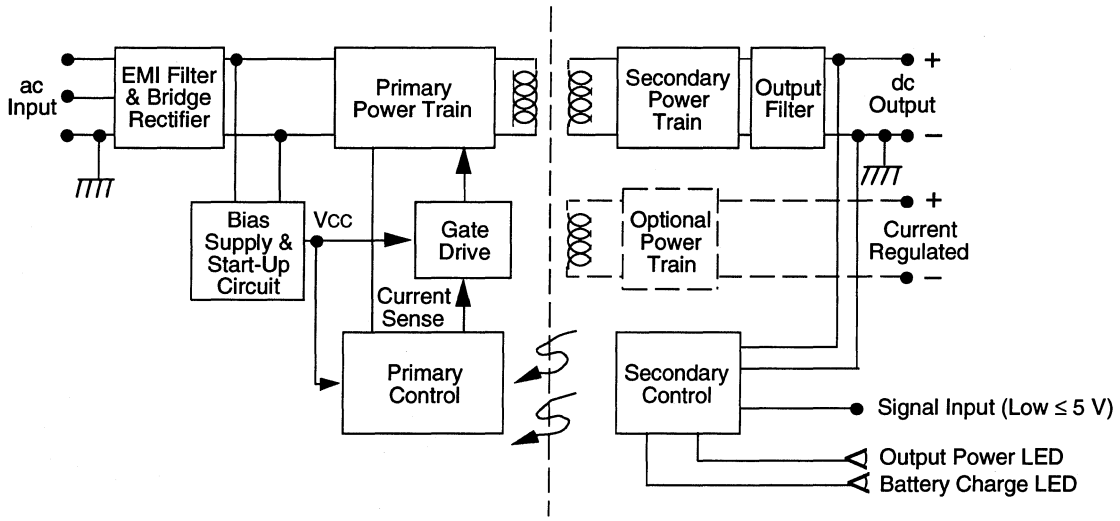
Part No.	Description	Page No.
—	Hard Disk Drive ASSPs	3-2

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

AT&T Notebook Power Supplies



Typical Block Diagram



Power

Part No.	Description	Page No.
—	Notebook Power Supplies	12-13
—	Transformers	13-1

Interconnection Products

Part No.	Description	Page No.
—	Custom Multilayer Printed-Circuit Boards	7-1
—	Thin PCMCIA Printed-Circuit Boards	7-1

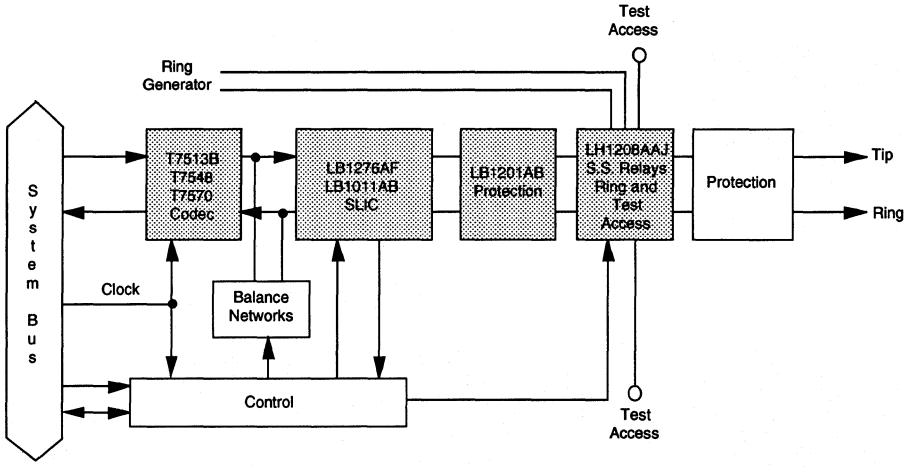
For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

AT&T Microelectronics is a world leader in the design and manufacture of components for the telecommunications industry—CMOS and high-performance bipolar ICs, high-frequency gallium arsenide ICs, transformers, solid-state relays, lightwave devices and subsystems, and new multilayer printed-circuit boards and interconnection systems.

There are four subapplications focus areas within telecommunications. These include analog line cards, digital line cards, digital pair-gain systems, and transmission interfaces. AT&T Microelectronics offers a variety of components that can be used together to create system solutions for analog line cards, codecs, battery feed circuits, and ring and test access components.

For the listing of components suited to modem applications, refer to the Data Communications, V.32 Modem section on page 2-3.

Analog Line Card Block Diagram



Analog Line Cards

Part No.	Description	Page No.
LB1011AB	Battery Feed	3-3
LB1013AD	Dual 85 V Op Amp	3-3
LB1201AB	Subscriber Line Interface Circuit Protector	3-3
LB1276AF	SLIC (w/out Teletax)	3-3
LB1276CF	SLIC (Teletax)	3-4
LH1208AAJ	PBX Switch Set	3-3
LH1263AE	E&M Signaling Circuit	3-3
LH1192AT	High-Voltage Solid-State Relay	3-32
LH1500AT	Solid-State Relay	3-32
LH1504AT	Solid-State Relay	3-32
LH1527AB	Solid-State Relay	3-32
T7513B	μ-Law, A-Law Codec with Filters	3-8
T7517A	A-Law PCM Codec with Filters	3-8
T7548	μ-Law, A-Law Programmable Gain PCM Codec	3-8
T7570	μ-Law, A-Law Programmable Gain Programmable Hybrid PCM Codec	3-8
—	Custom Multichip Modules	6-1
—	Multilayer Printed-Circuit Boards	7-1
—	*Metral* Interconnection System	8-1

Digital Line Cards

Part No.	Description	Page No.
2718AM	ISDN U-Interface Electronic Circuit Transformer	13-2
2754H	ISDN U-Interface Electronic Circuit Transformer	13-3

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Digital Pair Gain

Part No.	Description	Page No.
2754H2	ISDN U-Interface Electronic Circuit Transformer	13-3
T7513B	μ-Law, A-Law Codec with Filters	3-8
LB1276AF	SLIC	3-3

Transmission

Part No.	Description	Page No.
2741G	Miniature Pulse Transformer	13-2
2741H	Miniature Pulse Transformer	13-2
2745AE	Low-Power Pulse Transformer	13-2
2745AF	Low-Power Pulse Transformer	13-2
2745AG	Low-Power Pulse Transformer	13-2
2745B	Low-Power Pulse, DS1, DS1C, Interface Transformer	13-2
2745C	Audio/Voice, DS1, DS1C, Interface Transformer	13-2
T7032	Clock/Data Recovery with Descrambler (1 MHz to 52 MHz)	3-6
T7035	Clock/Data Recovery (47.7 MHz to 210.5 MHz)	3-6
126/127	InGaAs Avalanche Photodiode	10-1
1306 Type	Lightwave Receiver 2.5 Gbits/s (OC-48)	10-4
1227 Type	Lightwave Transmitter	10-3
1230 Type	Lightwave Transmitter (OC-12) 622 Mbits/s	10-3
1310 Type	Lightwave Receiver 52 Mbits & 155 Mbits/s (OC-1, 3)	10-6, 10-4
1313 Type	Lightwave (OC-12) 622 Mbits/s w/Clock Recovery	10-6, 10-4
237	1300 nm Laser in Receptacle	10-2
245	Pigtailed 1300 nm Laser	10-2
246	Digital DFB w/Internal Isolator for 2.5 Gbits/s	10-2
131	InGaAs PIN Pigtailed Detector	10-2
137	InGaAs PIN Detector in Receptacle	10-2
HG1210AxA	GaAs Transimpedance Amplifier Hybrid	11-1
LG1602AxB	GaAs Decision Circuit IC	11-1
LG1605BxB	GaAs Limiting Amplifier IC	11-1
LG1606AxB	GaAs Transition Detector IC	11-1
LG1608AxB/C	GaAs Laser Driver IC	11-1
TF1001A	Test Fixture for LG1606AXB, LG1602AXB	11-1
TF1002A	Test Fixture for LG1608AXA, LG1608AXC	11-1
TF1003B	Test Fixture for LG1605BXB	11-1
TF1005A	Test Fixture for HG1210AXA	11-1
TRU050	Clock and Data Recovery to 51.84 MHz	3-20
TRU200	Clock and Data Recovery Device from 44 MHz to 315 MHz	3-20
TRU600	Clock and Data Recovery Device from 155.520 to 622.080 MHz	3-20
—	S-Type Voltage Controlled Crystal Oscillator	3-21

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Basic Terminals

Part No.	Description	Page No.
LB1005 Type	General-Purpose Telephone Tone Ringer	3-3
LB1006AB	Telephone Ringing Detector IC	3-3
LB1008AE	Keyboard-Controlled, Touch-Tone, Single-Chip Telephone IC	3-3
LB1009AE	Microprocessor-Controlled, Single-Chip Telephone IC	3-3
LB1013AD	High-Voltage Dual Operational Amplifier	3-3
LB1026AB	Voice Frequency Level Expanders	3-3
LB1068BC/BW	Universal Voice-Signal Conditioner	3-3
LB1071AC	Speech Network IC	3-3
LH1500AT	Solid-State Relay	3-32
2718AM	ISDN S/T-Interface Electronic Circuit Transformer	13-2

CPE MUX/PBX

Part No.	Description	Page No.
2718AM	ISDN S/T-Interface Electronic Circuit Transformer	13-2
2741G	Miniature Pulse Transformer	13-2
2741H	Miniature Pulse Transformer	13-2
2745AE	Low-Power Pulse Transformer	13-2
2745AF	Low-Power Pulse Transformer	13-2
2745AG	Low-Power Pulse Transformer	13-2
2758A	Miniature Pulse Transformer	13-2
LBR022BS	Regulation Control Circuits	3-3
T7032	Clock/Data Recovery with Descrambler (1 MHz to 52 MHz)	3-6
T7035	Clock Recovery Chip (47.7 MHz to 210.5 MHz)	3-6
T7513B	μ-Law, A-Law Codec with Filters	3-8
T7517A	PCM Codec with Filters	3-8
T7548	μ-Law, A-Law Programmable Gain PCM Codec	3-8
T7570	μ-Law, A-Law Programmable PCM Codec with Hybrid-Balance Filter	3-8

Power

Part No.	Description	Page No.
—	Board-Mounted Power Modules	12-1
—	dc-dc Converters	12-8
—	Off-Line Switching Power Supplies	12-12

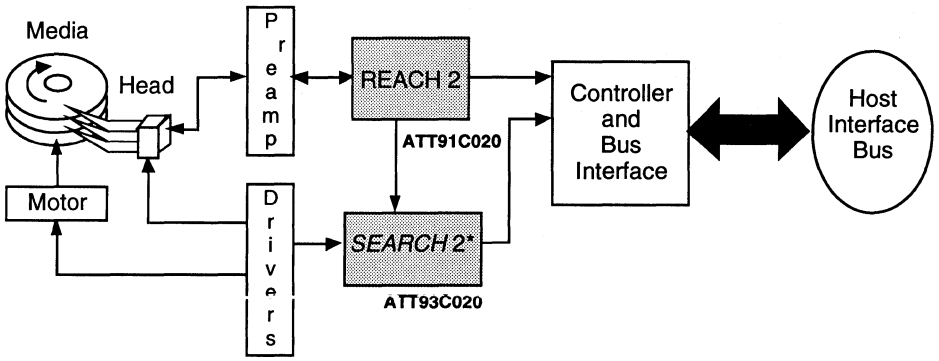
For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

The AT&T Microelectronics CMOS Mass Storage devices are designed for small form-factor winchester disk drives. The circuits are fabricated in 0.9 µm CMOS technology and include a series of all-CMOS read channel devices that will evolve to higher levels of integration.

By implementing the read channel in all-CMOS (a technological alternative to BiCMOS or traditional bipolar technology), the technology barrier to higher levels of integration has been removed, and lower power consumption and lower cost are provided.

AT&T Microelectronics 41-series line drivers and receivers have become the standard for all ESDI compatible disk drives. For closed-loop high-performance servo systems, AT&T Microelectronics has a full line of DSP products which allow core DSP functions to be integrated onto advanced servo controller devices. AT&T Microelectronics offers a full line of custom switching power supplies and standard board-mounted power modules for disk drives.

Winchester Disk Drive Block Diagram



* This function can also be implemented with *SEARCH™* 1 (ATT93C010) and *SPIN™* 1 (ATT91C611).

Read Channel

Part No.	Description	Page No.
ATT91C020	REACH 2, Low-Power CMOS Read Channel with AGC, Pulse Detector, Read PLL, Frequency Synthesizer, Quad Integrating Servo Demodulator, Filter, and ENDEC	3-2
ATT91C012	Enhanced REACH 1, Low-Power CMOS Read Channel Device with Separate AGC Loops for Data and Servo, Peak Detector, Read PLL, Precision Averaging Peak Detect, Servo Demodulator	3-2
ATT91C011	REACH 1, Low-Power CMOS Read Channel Device with AGC, Peak Detector, Pulse Detector, Write Precompensation, Read PLL, Servo Demodulator	3-2
Evaluation Board	Printed-Circuit Board Including ATT91C011 Test Points for Device Evaluation	—

Controller/Host Interface

Part No.	Description	
—	CMOS ASIC, High-Performance, and Low-Power Libraries with Industry-Standard Macrocells	4-4

Drive/Receive

Part No.	Description	
—	ESDI-Compatible 41-Series Quad Line Drivers and Receivers	3-28

Servo/Motor Control

Part No.	Description	
ATT93C020	*SEARCH* 2, Integrated *SEARCH* 1 and *SPIN* 1	3-2
ATT93C010	*SEARCH* 1, Servo Multiprocessor with 16-bit DSP, 8031µC, and Servo Timing Generator	3-2
ATT91C611	*SPIN* 1, Servo Interface with 6-input 10-bit A/D and 10-bit D/A Converters	3-2
ATT93C010EK	*SEARCH* 1, Evaluation Kit	—
DSP16A	Fixed-Point, 16-bit Digital Signal Processor	3-11
DSP32C	Floating-Point, 32-bit Digital Signal Processor	3-10

Power

Part No.	Description	
—	Board-Mounted Power Modules	12-1
—	Off-Line Switching Power Supplies	12-12

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Product Listing

Graphics ICs

The AT&T Microelectronics Graphics IC family consists of RAMDAC products supporting industry-standard color graphics for personal computers and workstations. These CMOS products take advantage of the latest AT&T technology to offer additional features over the competition and the highest performance in the industry.

- 16 million color specialists
- Pixel rates up to 220 MHz
- Photographic video quality
- Pixel ports up to 32 bits wide
- On-chip V_{REF} accurate to ±3%
- Mid-end/high-end PC, workstation applications
- DRAM and VRAM based solutions

RAMDACs for PC and Workstation Graphics

Part No.	Description	Package Type	Temp. Ranges	Literature
ATT20C505	PC, 24-bit True-Color, 32-bit Pixel-Port VRAM 110, 135, 170 MHz	84-pin PLCC	0 °C to 50 °C 0 °C to 70 °C	DS
ATT20C504	PC, 24-bit True-Color, 32-bit Pixel-Port VRAM 85, 110 MHz	84-pin PLCC	0 °C to 70 °C	DS
ATT20C498	PC, 24-bit True-Color, 16-bit Pixel-Port 80, 110, 135 MHz	44-pin PLCC	0 °C to 70 °C	—
ATT20C491	PC, 24-bit True-Color with Gamma Correction 80, 100, 110 MHz	44-pin PLCC	0 °C to 70 °C	DS
ATT20C492	PC, 18-bit Hi-Color with Gamma Correction 80, 100, 110 MHz	44-pin PLCC	0 °C to 70 °C	DS
ATT20C490	PC, 24-bit True-Color 80, 100, 110 MHz	44-pin PLCC	0 °C to 70 °C	DS
ATT20C493	PC, 18-bit True-Color 80, 100, 110 MHz	44-pin PLCC	0 °C to 70 °C	DS
ATT20C497	Portable PC, 8-bit Pseudocolor 50, 80, 100, 110 MHz	44-pin PLCC	0 °C to 70 °C	DS
ATT20C475A	Portable PC, 6-bit Pseudocolor 50, 66, 80, 100 MHz	44-pin PLCC	0 °C to 70 °C	DS
ATT20C458	Workstation, 8-bit 110, 135, 170, 200, 220 MHz	84-pin PLCC	0 °C to 70 °C	DS

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Storage ICs

Features

ATT91C011 REACH 1

- Fully integrated single-chip read channel
- 5 V all-CMOS design
- Low-power operation: 230 mW max read mode/225 mW max write mode
- Standby mode power = 35 mW max
- Data rates from 6.67 Mbits/s to 30 Mbits/s
- Internal embedded servo demodulator
- On-chip pulse detector & AGC circuitry
- Fully integrated multiple-zone constant density recording support
- On-chip DAC for PLL center frequency control
- Fast-acquisition zero-phase start PLL
- On-chip write precompensation circuitry
- µP programmable via serial interface
- Available in both 44-pin PLCC and EIAJ QFP package

ATT91C012 Enhanced REACH 1

- REACH 1 performance and features

In addition:

- Separate AGC loops for data and servo
- Precision averaging peak detect servo demodulator

ATT91C020 REACH 2

- Fully integrated all-CMOS single-chip read channel
- 5 V only low-power operation with multiple powerdown modes:
  - — Under 500 mW in operating
  - — Under 195 mW in servo tracking
  - — Under 1 mW in sleep mode
- Supports power cycling via I/O pin:
  - — Wake-up from sleep in under 1 ms
  - — Fast wake-up from track following in under 30 µs
- Data rates from 6.67 Mbits/s to 30 Mbits/s
- Full multizone constant density recording support
- Integrates the following read/write and servo functions on one IC:
  - — Data AGC circuit
  - — Pulse detector with two programmable qualification thresholds
  - — 7th-order 0.05° equiripple data filter with programmable boost
  - — Data synchronizer with programmable window shift and zero phase start PLL
  - — Bypassable RLL (1, 7) ENDEC
  - — Two-level write data precompensation
  - — 3rd-order bessel servo filter
  - — Quad integrating servo demodulator with PES outputs
  - — Frequency synthesizer
- Typically requires 11 external passive components
- 64-pin EIAJ SQFP package

ATT93C010 *SEARCH* 1

- On-chip 30 MHz 80C31 microcontroller with 256 bytes of internal RAM
- On-chip digital signal processor:
  - — DSP is optimized for mass storage
  - — Accumulation self-limits to significantly reduce DSP overhead
  - — Selectable 2s complement and unsigned arithmetic
  - — Performs 16- by 16-bit multiply in one clock
  - — Accumulates to 32-bit precision
  - — Includes 32- by 16-bit division instruction
- On-chip programmable timing processor generates and detects servo timing signals
- On-chip burst-mode DMA controller
- On-chip programmable clock generator:
  - — Crystal oscillator accepts crystal or CMOS-level inputs
  - — Supplies five internal and two external clock references
  - — External clock reference provides four programmable divisors
- CMOS design requires single 5 V or 3 V supply
- Versatile power management: internal and external clock references can be individually enabled or disabled
- 100-pin EIAJ SQFP

ATT93C020 *SEARCH* 2

- Integrated *SEARCH* 1 and *SPIN* 1

ATT91C611 *SPIN* 1

- Six-channel A/D converter
- Performs 10-bit A/D conversion in 1.8 µs
- Performs 10-bit D/A conversion in 3.6 µs
- Interfaces to 8- or 16-bit multiplexed µP bus
- Sleep and power-saving modes
- Internal or external reference voltage
- 6 ADC output storage registers
- +5 V single power supply
- 48-pin EIAJ SQFP package

Product Matrix

Part Number	Description	Package Type	Literature
ATT91C011-30M44	REACH 1 Integrated Read Channel	44-pin PLCC	—
ATT91C011-30J44	REACH 1 Integrated Read Channel	44-pin EIAJ QFP	—
ATT91C012-30M44	Enhanced REACH 1 Integrated Read Channel	44-pin PLCC	—
ATT91C020-30Q64	REACH 2 Fully Integrated Read Channel	44-pin EIAJ SQFP	—
ATT93C010-30Q10	*SEARCH* 1 Servo DSP Multiprocessor	100-pin EIAJ SQFP	—
ATT93C020-30Q10	*SEARCH* 2 Integrated *SEARCH* 1 and *SPIN* 1	100-pin EIAJ SQFP	—
ATT91C611-06Q48	*SPIN* 1 Servo Data Converter	48-pin EIAJ SQFP	—

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Linear Telecom Product Matrix

Part Number	Description	Package Type	Temp. Ranges	Literature
LB1005 Type	General-Purpose Tone Ringers	8-pin DIP	–20 °C to +75 °C	DS
LB1006AB	Ringing Signal/High-Voltage ac Detector	8-pin DIP	–40 °C to +75 °C	DS
LB1008AE	Keypad-Controlled Single-Chip Telephone	20-pin DIP	0 °C to 60 °C	DS
LB1009AE	Microprocessor-Controlled Single-Chip Telephone, 600 Ω Receiver Output	20-pin DIP	0 °C to 60 °C	DS
LB1009BE	Microprocessor-Controlled Single-Chip Telephone, Adjustable Receiver Output	20-pin DIP	0 °C to 60 °C	DS
LB1026AB	Voice Frequency Level Expander	8-pin DIP	0 °C to 50 °C	DS
LB1068BC	Universal Voice-Signal Conditioner	16-pin DIP	–20 °C to +55 °C	DS
LB1068BW	Universal Voice-Signal Conditioner	16-pin SOIC	–20 °C to +55 °C	DS
LB1071AC	Speech Network	16-pin DIP	–20 °C to +70 °C	DS
LBR022BS	Regulation Control Circuits	8-pin DIP	–40 °C to +100 °C	DS

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Line Card ICs PBX Switch Set

The LH1208 PBX Switch Set combines analog and digital circuitry with high-voltage switches to provide a very cost-effective solution for control, supervision, and signaling in subscriber loop circuits for PBX and key systems. The LH1208 IC packs five high-voltage switches, ring trip circuitry, comprehensive logic, and an auxiliary latch into a single monolithic integrated circuit. This device is packaged in a 28-pin SOG surface-mount plastic package.

With the addition of simple battery-feed circuitry, a very cost-effective, power-saving, and space-efficient microprocessor-controlled subscriber loop circuit can be implemented. Further, the LH1208 IC allows the designer to implement an entirely solid-state PBX line circuit, thereby eliminating the reliability, environmental, and noise problems typically associated with traditional mechanical relays.

E&M Signaling Circuit

The LH1263 E&M Signaling Circuit replaces electromechanical relays and discrete components that are utilized in line signaling interface circuits such as E&M signaling and FX ground start applications.

The LH1263 is comprised of three logic-programmable, latched switched controlled high-voltage switches, a ground-reference comparator, and a driver for external relays and is packaged in a 20-pin, plastic DIP.

Using relatively few external components and TTL compatible inputs, an E&M lead trunk side or signaling side circuit that can be configured as a Type I-V interface using the LH1263 can be achieved. This circuit requires relatively few components and space versus its electromechanical counterpart.

Line Interface Product Matrix

Part Number	Description	Package Type	Temp. Ranges	Literature
LH1208AAJ	PBX Switch Set	28-pin SOG	0 °C to 70 °C	DS, AP
LH1263AE	E&M Signaling Circuit	20-pin DIP	0 °C to 70 °C	DS, AP
LB1011AB	General-Purpose Battery Feed	8-pin DIP	–20 °C to +70 °C	DS
LB1013AD	High-Voltage Dual Op Amp	18-pin DIP	–25 °C to +70 °C	DS
LB1060AB	Dual Bilateral Switch Maintenance Termination Unit (MTU)	8-pin DIP	–40 °C to +65 °C	AP, DS
LB1201AB	Subscriber Line Interface Circuit Protector	8-pin DIP	–40 °C to +85 °C	DS
LB1276AF	Battery Feed	24-pin DIP	–40 °C to +125 °C	DS

Line Interface Product Matrix (continued)

Part Number	Description	Package Type	Temp. Ranges	Literature
LB1276AP	Battery Feed	44-pin PLCC	–40 °C to +125 °C	DS
LB1276CF	Battery Feed with Teletax	24-pin DIP	–40 °C to +125 °C	DS
LB1356CF	Battery Feed with Reverse Battery	24-pin DIP	–40 °C to +125 °C	DS

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Intelligent 10Base-T Hub Products

The T7202 Smart Hub Controller (SHC) and T7241 Multiple Ethernet Transmitter (METRX) represent AT&T's third-generation multiport repeater controller ICs for use in IEEE 802.3 10Base-T networks. The chip set provides a two-chip solution for implementation of a central network hub with extensive network management capabilities. This chip set also provides a low-cost, easy-to-design, feature-rich solution for PC-based 10Base-T repeaters.

Features

- High level of integration
  - — Twelve 10Base-T ports
  - — Two AUI ports
  - — Dedicated MAC port
  - — Dedicated expansion port
  - — Security
- Dedicated MAC port
- Dedicated expansion port
- Preprocessed network management statistics
- Per-port statistics
- Per-port collision counters
- Dedicated management report FIFO

Benefits

- Reduce system cost and improve reliability
- Address size-sensitive markets such as PC hubs
- Provide superior system performance
- Provide superior network management features in your system

Part No.	Description	Package Type	Temp. Ranges	Application	Literature
Intelligent 10Base-T Hub Products					
T7202	Smart Hub Controller	132-pin PQFP	0 °C to +70 °C	TP Ethernet	DS, AP, TN, PN
T7241	Multiple Ethernet Transmitter	84-pin PLCC	0 °C to +70 °C	TP Ethernet	DS, PN

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Ethernet Network Interface Card (NIC) Products

The T7231 Local Area Network Protocol Assist Communications Engine with ROM Controller (*LANPACER*™ Controller) and the T7213 Dual Interface Station Chip (DISC) provide a two-chip solution for the implementation of IEEE 802.3 for an Ethernet attachment unit interface (AUI) and twisted-pair wire (10Base-T) media. These two devices provide the complete solution for the *PC/XT/AT* bus interface to the network media.

Features

- High level of integration
  - — Integrated bus interface
  - — Software medium selection
  - — Software link-integrity control
- 82586 software compatibility
- Certified Novell and NDIS drivers
- Flexible data structure
- Support EEPROM/Flash
- Printer error monitor

Benefits

- Minimal components
- High reliability
- Low manufacturing cost
- Small card applications
- Laptop applications
- Early to market
- Low development cost
- Easy to upgrade

Ethernet Network Interface Card (NIC) Products

The T7220A Twisted-Pair Medium Attachment Unit (TPMAU2) simplifies the design and implementation of a minimal-part-count, cost effective medium attachment unit (MAU) between an ethernet attachment unit interface (AUI) and the twisted-pair wire media. The T7220A TPMAU2 can also be used to implement the twisted-pair wire interface on an ethernet computer network interface card.

Standard features of the T7220A include level-shifted data pass-through, collision detection, and internal predistortion generation. Additional features include selectable signal quality error (SQE) test generation, LED control for IC status, link-integrity strapping option, autopolarity detection and correction, and a squelch function.

The T7220A TPMAU2 device requires a standard 5 V supply and consumes a maximum of 600 mW.

T7220A Features

- Integrated TP and AUI drivers and receivers
- All functions integrated on a single device
- Integrated LED drivers
- Autopolarity detection/correction extended wire length
- Over 1.5 million sold
- Low jitter robust smart squelch accurate predistortion

Benefits

- Small adapter and transceiver applications
- Early to market
- Low development cost
- Special features for product differentiation
- Proven performance, early to market
- Superior network performance

Part No.	Description	Package Type	Temp. Ranges	Application	Literature
Ethernet Network Interface Card (NIC) Products					
T7220A	Twisted-Pair Medium Attachment Unit	28-pin SOJ 28-pin DIP	0 °C to +70 °C	TP Ethernet	DS
T7213	Dual Interface Station Chip	28-pin, plastic DIP 28-pin, plastic SOJ	0 °C to +70 °C	TP Ethernet	DS, PN
T7231	IEEE 802.3 *LANPACER* Controller	132-pin, PQFP	0 °C to + 85 °C	TP Ethernet	DS, MN, PN

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

FDDI Products

The T7351B FDDI Physical Layer Device is a single-chip CMOS device which implements the complete fiber distributed data interface (FDDI) physical layer protocol as defined by ANSI X3T9.5 FDDI Committee. The T7351B provides the connection among the physical media dependent (PMD) interface, the media access control (MAC) unit, and the station management (SMT) portion of the node controller. The T7351B device monitors and controls the media line state, exchanging this information with the MAC and SMT layers.

The T7351B device requires a standard 5 V supply and consumes a maximum of 800 mW.

The T7351B implements the PHY layer protocol in an FDDI node. These nodes can be found in backbone applications such as bridges, routers, and gateways, or in station applications such as PCs, workstations, concentrators, servers, minicomputers, and mainframes. In PCs and workstations, the node can be implemented either as an add-on card or directly on the motherboard.

Features

- Single-chip device (on-chip clock recovery)
- Low power
- Extended CMT support

Benefits

- Board space saving (84-pin PQFP package)
- Board cost saving
- No need to run 125 MHz clock on the board
- Reduced cooling requirements
- Multiport concentrator possible
- No external logic
- No additional components
- Provides additional ring management features

Part No.	Description	Package Type	Temp. Ranges	Application	Literature
FDDI Products					
T7351B	FDDI Physical Layer Device	84-pin PQFP	0 °C to +70 °C	FDDI	DS, AP, PN

Clock Recovery Circuits

When transmitting digital signals, it is very important to determine the beginning and end of each bit position. One rather expensive approach is to provide a separate clock lead to synchronize transmitter and receiver. A more cost-effective approach is to provide synchronization by recovering the clock from the suitability encoded transmitted signal itself. The data is then synchronized to this recovered clock. The T7032 and T7035 perform this clock recovery and data retiming function. These two devices offer a broad range of application flexibility, with the T7032 up to 52 MHz, and the T7035 between 47.7 MHz and 210.5 MHz.

Features

- Pin-programmable for 1 MHz to 210.5 MHz
- Only one inexpensive 3.58 MHz crystal needed
- Programmable frequency
- Single 5 V supply
- 100K ECL compatible
- Extended temperature range available: –40 °C to + 85 °C

Benefits

- Flexibility, suitable for numerous applications
  - — SONET
  - — ATM
  - — Fiber channel
  - — *ESCON*
  - — FDDI
  - — Fiber or copper wire
- Ease of design
- Rugged

Part No.	Description	Package Type	Temp. Ranges	Application	Literature
Clock Recovery					
T7032	Clock Recovery and Data Retiming Circuit (1 MHz to 52 MHz)	20-pin, plastic DIP	–40 °C to +85 °C	Transmission	DS, AP, TN
T7035	Clock Recovery and Data Retiming Circuit (47.7 MHz to 210.5 MHz)	44-pin PLCC	–40 °C to +85 °C	Transmission	DS, PN, TN

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Support Tools —T7202/T7241 Smart Hub Chip Set Evaluation Board

The T7202/T7241 is a development and evaluation tool for the T7202/T7241 Smart Hub Chip Set. It consists of a PC/*AT* plug-in evaluation board, a port and display board, a utilities diskette, and a user manual.

A block diagram of the evaluation board is shown on the next page. The evaluation board demonstrates utilization of 12 twisted-pair ports, one of two AUI ports, and a MAC port. Port expansion is implemented with a second evaluation board. The hardware also provides a daughter-board connector that allows designers to connect a microprocessor of their choice. This allows for development/test work outside the PC environment. The on-board FPGA is designed to demonstrate how to use the serial port data to implement security. If desired, users can reprogram the FPGA to test their own designs. Use of the evaluation board allows for evaluation of all hardware aspects of the T7202/T7241 chip set (except the TTL AUI port).

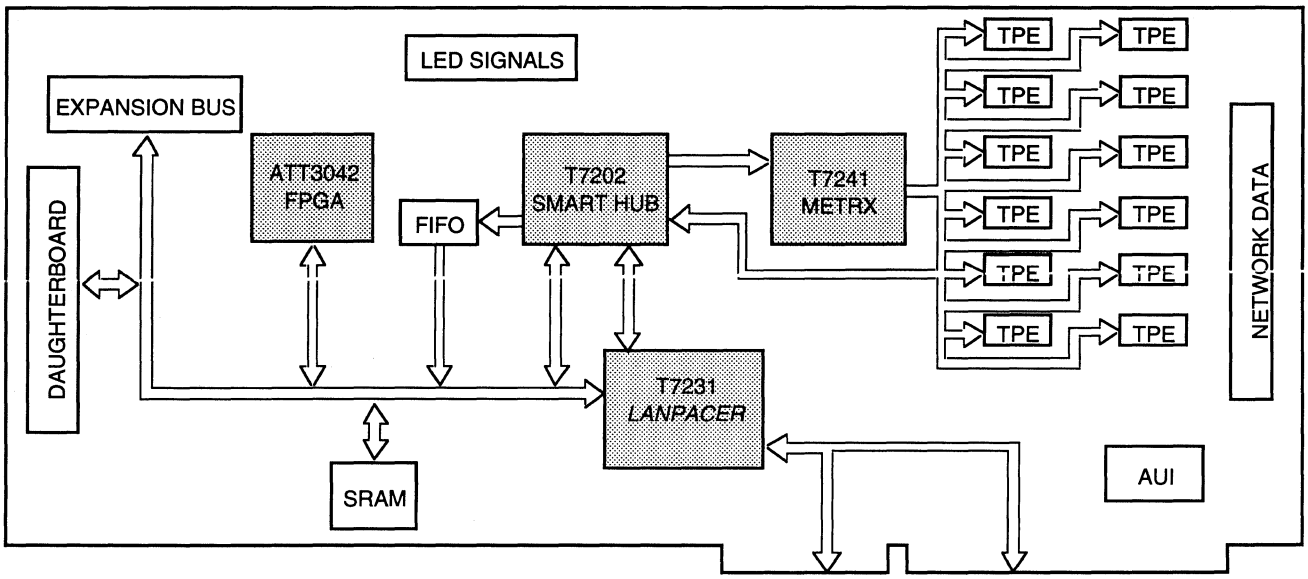
A port and display board is provided with all evaluation boards. This board demonstrates all possible LEDs (except for the TTL AUI port) and provides the port connections.

The utilities diskette provides sample software that demonstrates the network statistics capabilities of the T7202. Generic network control and statistics software and hardware diagnostic software are included in Novell's LAN and HMI drivers. Source code can be made available.

Features and Benefits

- Single PC/*AT* plug-in board
- Port and display board demonstrates LEDs
- 14-port capability
  - — 12 twisted-pair ports
  - — One AUI port
  - — MAC port
- Expandable with second board
- Hardware-based security
- Hardware diagnostic software
- Repeater statistics collection/display
- HMI software demonstration
- AT&T FPGA allows for customization
- Daughterboard connector for connecting alternate processors

Evaluation Board



Part No.	Description	Package Type	Temp. Ranges	Application	Literature
Support Tools					
T7202/41	Evaluation Board	—	—	TP Ethernet	PN

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Coding Information

T 7351B – F C

- Telecommunications
- Generation
- Processing/Speed
- Package
- Temperature

Generation

A Second
B Third, etc.

Package Options

B Nonhermetic, ceramic DIP
C Hermetic, ceramic DIP
D Cerdip
E Small-outline J-lead
F Plastic quad flat pack (PQFP)
G Small-outline gull wing
J Nonhermetic, leadless chip carrier
K Hermetic, leadless chip carrier
L Hermetic, ceramic leaded chip carrier
M Plastic, leaded chip carrier
N Nonhermetic, ceramic pin array
P Plastic DIP
R Hermetic, ceramic pin array
S Plastic pin array
T Plastic, leadless chip carrier
U Nonhermetic, ceramic, leaded chip carrier
W Chip in wafer form

Temperature Options

C 0 °C to 70 °C
E 0 °C to 85 °C
M Military
L –40 °C to +85 °C

Analog Line Cards

The line card codec is where the analog world meets the digital network. The codec provides A/D and D/A conversion, anti-alias filtering, and reconstruction filtering for the line card. In addition, programmable codecs may offer gain and/or hybrid balance adjustment. AT&T offers a wide range of single-chip codecs for line card applications. Since the early 1980s, AT&T has been making codecs of the highest performance, quality, and reliability.

AT&T codecs meet exacting transmission requirements, offer low noise and power dissipation, and have excellent latch-up immunity and power-supply-noise rejection.

In addition to the devices in this catalog, AT&T also offers a variety of custom codecs. Some are used in digital and wireless telephone applications.

Codec Feature Comparison

	T7513B	T7517A	T7548	T7570
Power Supply	±5 V	±5 V	±5 V	+5 V
Companding (μ-/A-law)	Selectable	A-law	Selectable	Selectable
Programmable Gain	Ext Resistors	Ext Resistors	Yes	Yes
Programmable Hybrid Balance	No	No	Int. Switches	Yes
Latches	No	No	No	6
Second Source	*TI* 29C13	*TI* 29C17	*Intel* 29C48	*National* TP3070
Models Available	Now	Now	Now	Now
Production Available	Now	Now	Now	Now

Part No.	Description	Package Type	Temp. Ranges	Application	Literature
Telecom ICs					
T7513B	PCM Codec with Filters	20-pin, plastic SOJ 20-pin, plastic DIP	–40 °C to +85 °C	Analog Line Card	DS
T7517A	PCM Codec with Filters	16-pin, plastic DIP 16-pin, plastic SOJ	–40 °C to +85 °C	Analog Line Card	DS
T7548	Feature-Control Codec with Filters	28-pin PLCC	0 °C to +85 °C	Analog Line Card	DS
T7570	Programmable PCM Codec with Hybrid-Balance Filter	28-pin PLCC	–40 °C to +85 °C	Analog Line Card	DS, AP

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

ISDN Desktop ICs

SBus Dual Basic Rate ISDN (DBRI) Transceiver

The AT&T SBus Dual Basic Rate ISDN (DBRI) Transceiver provides simultaneous ISDN Basic Rate Interface connections as an ISDN terminal endpoint (TE) and network termination (NT). The device allows flexible routing between four interfaces: ISDN TE for connection to the network, ISDN NT to support ISDN CPE on the desktop, concentration highway interface (CHI) to connect to external ICs, and a microprocessor (SBus) interface to system memory. The DBRI allows flexible configuration of channels: two ISDN B channels can be concatenated to allow 128 kbits/s operation, or B channels can be subdivided into multiple subchannels. HDLC formatting to and from memory is provided on both D channels and can be used on up to six other channels or subchannels. In addition, the NT and TE functions can be bypassed, allowing operation as a 16-channel DMA controller.

The DBRI uses a single +5 V power supply and is available in a 132-pin JEDEC plastic quad flat pack (PQFP) package. The DBRI DMA interface uses the *Sun* SBus to interface with virtual memory.

Enhanced User-Network Interface for ISDN and Proprietary Terminal Endpoints

The T7250C is the next-generation 4-wire user-to-network digital interface device that supports the S/T Basic Rate ISDN standards. Its flexibility and programmability provide for both standardized interfaces as well as proprietary applications.

Features:

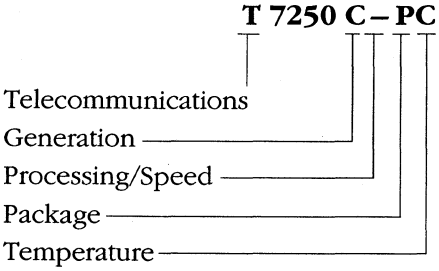
- Powerdown mode of operation (less than 7 mW)
- D-channel address recognition
- Parallel readout of selected B-channel via microprocessor bus interface
- Automatic activation/deactivation
- Flexible clocking options
- Supports CCITT 1.430/ANS/T1.605 Standard for ISDN 2B+D basic access at the SIT reference point

Part No.	Description	Package Type	Temp. Ranges	Application	Literature
ISDN Desktop ICs					
T7250C	Enhanced user-network interface for ISDN and proprietary terminal endpoints	44-pin PLCC	0 °C to 70 °C	ISDN Desktop	PN
T7259	SBus Dual Basic Rate (DBRI) Transceiver	132-pin, JEDEC PQFP	0 °C to 70 °C	ISDN Desktop	*

* For more information on this product, contact CoSystems at 408-748-2190.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Coding Information



Generation
A Second
B Third, etc.

Package Options
B Nonhermetic, ceramic DIP
C Hermetic, ceramic DIP
D Cerdip
E Small-outline J-lead
F Plastic quad flat pack (PQFP)
G Small-outline gull wing
J Nonhermetic, leadless chip carrier
K Hermetic, leadless chip carrier
L Hermetic, ceramic leaded chip carrier
M Plastic, leaded chip carrier
N Nonhermetic, ceramic pin array
P Plastic DIP
R Hermetic, ceramic pin array
S Plastic pin array
T Plastic, leadless chip carrier
U Nonhermetic, ceramic, leaded chip carrier
W Chip in wafer form

Temperature Options
C 0 °C to 70 °C
E 0 °C to 85 °C
M Military
L –40 °C to +85 °C

AT&T's DSP Multimedia Solutions

Next-generation computers need to include multimedia applications integrating audio, video, graphics, and telecommunications. These capabilities require that sophisticated digital signal processing algorithms be easily integrated into both the hardware computer systems and the applications programs created by independent software developers. Computer manufacturers demand high performance, low cost, and compatibility with industry standards. Their application developers require that the signal processing technology be accessible via familiar application program interfaces. Both insist on open software systems. Only AT&T provides an integrated solution that meets the needs of computer manufacturers **and** application developers.

AT&T's DSP3210 Digital Signal Processor is the world's first DSP designed specifically for PCs and workstations in multimedia applications. It offers 32-bit floating-point power, compatibility with *Intel* and *Motorola* microprocessor buses, and low system integration costs.

AT&T's *VCOS* Operating System is a powerful development and execution environment tailored to the needs of the application programmer. The *VCOS* Multimedia Module Library offers speech processing, telecommunications, image processing, FAX/data modem, and 3-D graphics algorithms for application developers to use in creating exciting, new multimedia applications as well as adding powerful multimedia capabilities to existing applications.

Floating-Point DSP Products - Product Matrix

Part Number	Description	Package Type	Speed (ns)	Temp. Ranges	Literature
DSP32C	32-bit CMOS Digital Signal Processor 1.5K RAM/0 ROM	133-pin, ceramic PGA 164-pin PQFP	80, 100	0 °C to 70 °C –40 °C to +85 °C* (I)	AP, DS, IM
DSP32C w/o External Memory Interface	2K RAM/0 ROM	68-pin PLCC	80	0 °C to 70 °C	AP, DS, IM
DSP3210	32-bit CMOS Digital Signal Processor 2K RAM/256 ROM	132-pin PQFP	60, 72 100 at 3.3 V	0 °C to 70 °C	AP, DS, IM

* Industrial temperature only available at 100 ns.

DSP32C Development Tools - Product Matrix

Part Number	Host	Description
DSP32C-SL-*SUN4*-C	*SunOS* 4.1	(*Sun-4* Series)
DSP32C-SL-*MSDOS*-F	*MSDOS*	(PC6300 and compatibles)
DSP32C-AL-BKSUN-C	*UNIX* Berkeley 4.2	(*Sun-3* Series)
DSP32C-AL-*SUN4*-C	*SunOS* 4.1	(*Sun-4* Series)
DSP32C-AL-*MSDOS*-F	*MSDOS*	(PC6300 and compatibles)
DSP32C-CC-BKSUN-C	*UNIX* Berkeley 4.2	(*Sun-3* Series)
DSP32C-CC-*SUN4*-C	*SunOS* 4.1	(*Sun-4* Series)
DSP32C-CC-*MSDOS*-F	*MSDOS*	(PC6300 and compatibles)
DSP32C-DS-DEV-16	PC Board — Development Board (w/16K)	
DSP32C-DS-DEV-64	PC Board — Development Board (w/64K)	

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

DSP32C Development Tools - Product Matrix (continued)

Part Number	Host	Description
DSP32C-DS-*ICE*	PC Board — In-Circuit Emulator	Half-Card
DSP32C-DS-PBS	PC Board — PC Bus Interface Half-Card	
DSP32C-DS-MII	Multi-*ICE* Interface Box	
DSP32C-DS-EXM	PC Board — Extended Memory Board	

DSP3210 Development Tools - Product Matrix

DSP3210 Software Tools		
DSP3210-ST-*SUN3*-C	*UNIX* Berkeley 4.2	(*Sun-3* Series)
DSP3210-ST-*SUN4*-C	*SunOS* 4.1	(*Sun-4* Series)
DSP3210-ST-MCMPW-D	*MAC* OS	(*Macintosh* II Series)
DSP3210-ST-*MSDOS*	*MSDOS*	(PC6300 and compatibles)
DSP3210 Application Software Libraries		
DSP3210-AL-*SUN3*-C	*UNIX* Berkeley 4.2	(*Sun-3* Series)
DSP3210-AL-*SUN4*-C	*SunOS* 4.1	(*Sun-4* Series)
DSP3210-AL-*MAC*-D	*MAC* OS	(*Macintosh* II Series)
DSP3210-AL-*MSDOS*	*MSDOS*	(PC6300 and compatibles)
DSP3210 Hardware		
MP3210	DSP3210 PC/*AT* Board	
Multimedia Tools		
DSP3210-VMDE-MSW kit	*VCOS* Multimedia Development Environment (Includes *VCOS* tools, VMD, DSP3210-ST, AL)	
Multimedia Software		
DSP3210-VMD-MSW	*VCOS* Multimedia Desktop	(PC6300 and compatibles)
DSP3210 Compilers (Including CC, ST, Special Version of AL)		
DSP3210-CC-*SUN3*-C	*UNIX* Berkeley 4.2	(*Sun-3* Series)
DSP3210-CC-*SUN4*-C	*SunOS* 4.1	(*Sun-4* Series)
DSP3210-CC-MCMPW-D	*MAC* OS	(*Macintosh* II Series)
DSP3210-CC-*MSDOS*	*MSDOS*	(PC6300 and compatibles)

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Fixed-Point DSP Products - Product Matrix

Part Number	Description	Package Type	Speed (ns)	Temp. Ranges	Literature
DSP16A	2K RAM/12K ROM 16-bit CMOS Digital Signal Processor	84-pin PLCC 84-pin PQFP	25, 33, 55	0 °C to 70 °C –40 °C to +85 °C*	AP, DS, IM
	1K RAM/8K ROM 16-bit CMOS Digital Signal Processor	84-pin PLCC	33, 55	0 °C to 70 °C –40 °C to +85 °C*	AP, DS, IM
	2K RAM/24K ROM 6-bit CMOS Digital Signal Processor	84-pin PLCC 84-pin PQFP 100-pin TQFP	25, 33, 55	0 °C to 70 °C –40 °C to +85 °C*	AP, DS, IM

* Industrial temperature for 25/33/55 ns in 84 PLCC and 33/55 ns in 84 PQFP only.

Fixed-Point DSP Products - Product Matrix (continued)

Part Number	Description	Package Type	Speed (ns)	Temp. Ranges	Literature
DSP16A1-STVR	Speaker-Trained Voice Recognizer 8K x 16 ROM 1K x 16 ROM	84 PLCC	55	—	PN
DSP16C	16-bit CMOS Digital Signal Processor (DSP16A) and a Voice-Band Sigma-Delta Codec on One Chip	100-pin PQFP	25, 33† 28, 38‡	–40 °C to +85 °C	PN
DSP1610	16-bit CMOS Digital Signal Processor with 8K Downloadable Dual-Port RAM and 512K Boot ROM or 4K RAM and 512K Boot ROM	132-pin PQFP	25, 33	0 °C to 70 °C –40 °C to +85 °C	AP, BC, DS, IM
DSP1616	16-bit CMOS Digital Signal Processor with 2K RAM and 12K ROM	100-pin PQFP 100-pin TQFP	25, 33, 38	–40 °C to +85 °C	AP, BC, DS

* Industrial temperature for 25, 33, 55 ns in 84 PLCC and 33, 55 ns in 84 PQFP only.
† 2x clock.
‡ 1x clock.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

DSP16, DSP16A, and DSP16C Development Tools - Product Matrix

Part Number	Host	Description
DSP16A-SL-*MSDOS*-F	*MSDOS*	(PC6300 and compatibles)
DSP16A-SL-*SUN4*-C	*SunOS* 4.1	(*Sun-4* Series)
DSP16A-AL-*MSDOS*-F	*MSDOS*	(PC6300 and compatibles)
DSP16A-AL-*SUN4*-C	*SunOS* 4.1	(*Sun-4* Series)
DSP16A-DS	Stand-Alone Development System	(55 ns & 75 ns DSP16As)
DSP16A-BD-EVAL	PC Board — Development Board	(33 ns DSP16As)
DSP16A-BD-EV/25	PC Board — Development Board	(25 ns DSP16As)
DSP16C-DS	Development System for DSP16C	
DSP1610-ST-*VMS*-T	*VMS*	(VAX 11/780 Series)
DSP1610-ST-*SUN4*-C	*SunOS* 4.1	(*Sun-4* Series)
DSP1610-ST-*MSDOS*-F	*MSDOS*	(PC6300 and compatibles)
DSP1610-HDS	Hardware Development System	
DSP1610-EVAL	PC Board — DSP1610 Evaluation Board	
1027 Add-On Card	Adds CSP1027 Functionality to DSP1610-EVAL	

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

DSP16, DSP16A, and DSP16C Development Tools - Product Matrix (continued)

Part Number	Host	Description
DSP1616-ST-*MSDOS*-F	*MSDOS*	(PC6300 and compatibles)
DSP1616-POD	DSP1616 In-Circuit Emulation Pad	
DSP1616/27-DEMO	Demo Board w/CSP1027, Memory & 510 Port Connectors	
DSP16A-BD-VR	Voice Recognition Module	
DSP16A-AT-VR	PC Evaluation Adapter Board & PC Control Software	
DSP16A-SYS-VR	Voice Recognition Development System (16A-BD-VR & 16A-AT-VR)	

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Codecs

Part Number	Description	Package Type	Temp. Ranges	Literature
T7582	Baseband Codec for Digital Cellular Applications	44-pin PLCC	–40 °C to +85 °C	DS
CSP1027	Voiceband Codec for Cellular Handset and Modem Applications	44-pin EIAJ QFP 48-pin TQFP	–40 °C to +120 °C	—
CSP1084	Baseband Radio Interface for IS-54 Dual-Mode Cellular Telephone Applications	80-pin EIAJ QFP 100-pin TQFP	–40 °C to +85 °C	—

Data Pump Chip Sets

	Package Types					
Part Number	**DSP16A**	**V32-INTFC**	**Codec***	**Controller**	**Options†**	**Literature**
HSM96DD	84-pin PLCC	68-pin PLCC	28-pin SOJ	NA	—	DB, BC
HSM144DD	84-pin PLCC	68-pin PLCC	28-pin SOJ	NA	—	DB, BC
HSM144DD-V	84-pin PLCC	68-pin PLCC	28-pin SOJ	NA	—	DB, BC
HSM144DD-V	84-pin PLCC	68-pin PLCC	28-pin SOJ	NA	—	DB, BC
HSM192DD	84-pin PLCC	68-pin PLCC	28-pin SOJ	NA	—	DB, BC
HSM96LD	84-pin PQFP	84-pin PQFP	28-pin SOJ	NA	—	DB, BC
HSM144LD	84-pin PQFP	84-pin PQFP	28-pin SOJ	NA	—	DB, BC
HSM144LD-V	84-pin PQFP	84-pin PQFP	28-pin SOJ	NA	3.3 V	DB, BC
HSM144LD-P	84-pin PQFP	84-pin PQFP	28-pin SOJ	NA	3.3 V	DB, BC
HSM144LD-X	84-pin PQFP	84-pin PQFP	28-pin SOJ	NA	3.3 V	DB, BC
HSM144LD-C	84-pin PQFP	84-pin PQFP	28-pin SOJ	NA	3.3 V	DB, BC
BCHSM192LD	84-pin PQFP	84-pin PQFP	28-pin SOJ	NA	3.3 V	DB, BC
HSM96PD	100-pin TQFP	100-pin TQFP	48-pin TQFP	NA	—	DB, BC
HSM144PD	100-pin TQFP	100-pin TQFP	48-pin TQFP	NA	—	DB, BC
HSM144PD-V	100-pin TQFP	100-pin TQFP	48-pin TQFP	NA	3.3 V	DB, BC
HSM144PD-P	100-pin TQFP	100-pin TQFP	48-pin TQFP	NA	3.3 V	DB, BC
HSM144PD-X	100-pin TQFP	100-pin TQFP	48-pin TQFP	NA	3.3 V	DB, BC
HSM144PD-C	100-pin TQFP	100-pin TQFP	48-pin TQFP	NA	3.3 V	DB, BC
HSM192PD	100-pin TQFP	100-pin TQFP	48-pin TQFP	NA	3.3 V	DB, BC

* In Laptop version 3.3 V chip sets, the T7525 codec is replaced with CSP1027 codec in a 44-pin PQFP package. All PCMCIA version chip sets include the CSP1027 codec in a 48-pin TQFP package.

† To specify the 3.3 V version, add the suffix "3" to the part number shown in the left-hand column.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Complete Modem Chip Sets

	Package Types					
Part Number	**DSP16A**	**V32-INTFC**	**Codec***	**Controller**	**Options†**	**Literature**
HSM96DC	84-pin PLCC	68-pin PLCC	28-pin SOJ	100-pin QFP	—	DB, BC
HSM144DC	84-pin PLCC	68-pin PLCC	28-pin SOJ	100-pin QFP	—	DB, BC
HSM144DC+	84-pin PLCC	68-pin PLCC	28-pin SOJ	100-pin QFP	—	DB, BC
HSM192DC	84-pin PLCC	68-pin PLCC	28-pin SOJ	100-pin QFP	—	DB, BC
HSM192DC+	84-pin PLCC	68-pin PLCC	28-pin SOJ	100-pin QFP	—	DB, BC
HSM96LC	84-pin PQFP	84-pin PQFP	28-pin SOJ	100-pin QFP	—	DB, BC
HSM144LC	84-pin PQFP	84-pin PQFP	28-pin SOJ	100-pin QFP	—	DB, BC
HSM144LC+	84-pin PQFP	84-pin PQFP	28-pin SOJ	100-pin QFP	3.3 V	DB, BC
HSM144LC-X	84-pin PQFP	84-pin PQFP	28-pin SOJ	100-pin QFP	3.3 V	DB, BC
HSM144LC-C	84-pin PQFP	84-pin PQFP	28-pin SOJ	100-pin QFP	3.3 V	DB, BC
HSM192LC	84-pin PQFP	84-pin PQFP	28-pin SOJ	100-pin QFP	3.3 V	DB, BC
HSM192LC+	84-pin PQFP	84-pin PQFP	28-pin SOJ	100-pin QFP	3.3 V	DB, BC
HSM96PC	100-pin TQFP	100-pin TQFP	48-pin TQFP	100-pin VQFP	PID	DB, BC
HSM144PC	100-pin TQFP	100-pin TQFP	48-pin TQFP	100-pin VQFP	PID	DB, BC
HSM144PC+	100-pin TQFP	100-pin TQFP	48-pin TQFP	100-pin VQFP	3.3 V, PID	DB, BC
HSM144PC-X	100-pin TQFP	100-pin TQFP	48-pin TQFP	100-pin VQFP	3.3 V, PID	DB, BC
HSM144PC-C	100-pin TQFP	100-pin TQFP	48-pin TQFP	100-pin VQFP	3.3 V, PID	DB, BC
HSM192PC	100-pin TQFP	100-pin TQFP	48-pin TQFP	100-pin VQFP	3.3 V, PID	DB, BC
HSM192PC+	100-pin TQFP	100-pin TQFP	48-pin TQFP	100-pin VQFP	3.3 V, PID	DB, BC

* In Laptop version 3.3 V chip sets, the T7525 codec is replaced with CSP1027 codec in a 44-pin PQFP package. All PCMCIA version chip sets include the CSP1027 codec in a 48-pin TQFP package.

† Key to options column:

3.3 V — To specify the 3.3 V version, add the suffix "3" to the part number shown in the left-hand column.

PID — Refers to an optional PCMCIA interface device (V32PID) that incorporates PCMCIA interface logic into a single additional device. To specify this option, add the suffix "P" to the part number shown in the left-hand column.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

ATT3000 Series Field-Programmable Gate Arrays (FPGAs)

The ATT3000 Series field-programmable gate arrays (FPGAs) are second-generation, high-performance, static memory-based, submicron, CMOS integrated circuits. The FPGA's extendable, user-programmable array architecture is composed of a configuration program store, plus three types of configurable elements: a perimeter of I/O blocks, a core array of logic blocks, and an interleaved interconnect.

The *XACT* development system allows the user to define the logic functions of the device. Schematic capture and auto place-and-route are available for design entry, while logic and timing simulation and in-circuit debugging are available for design verification. *XACT* compiles the data pattern which represents the configuration program. This data then can be converted to a PROM programmer format file to create the configuration program storage.

The FPGA's user logic functions and interconnections are determined by the configuration program data stored in internal static-memory cells. The program can be loaded in any of several modes to accommodate various system requirements. The AT&T Microelectronics 3000 Series is programmed to form networks carrying logic signals among blocks, similar to traces on a printed-circuit board connecting MSI/SSI packages.

There are presently five 3000 Series FPGAs in production:

	ATT3020	ATT3030	ATT3042	ATT3064	ATT3090
CLB Matrix	8 x 8	10 x 10	12 x 12	14 x 16	16 x 20
Functions	128	200	288	448	640
Flip-Flops	256	360	480	688	928
Equivalent Gates	2000	3000	4200	6400	9000
Maximum User I/Os	64	80	96	120	144

ATT3000 Series FPGA Device Matrix

Part Number & Speed (MHz)	44-pin PLCC M44	68-pin PLCC M68	84-pin PLCC M84	84-pin Cer. PLCC R84	100-pin EIAJ PGA J100	100-pin TQFP T100	100-pin Cer. QFP N100	132-pin Plast. PGA H132	132-pin Cer. PGA R132	160-pin EIAJ QFP J160	164-pin Cer. QFP N164	175-pin Plast. PGA H175	175-pin Cer. PGA R175	208-pin Plast. SQFP S208	Lit.
ATT3020															
50				CIM			CIM								DS
70		CI	CI	CIM	CI		CIM								DS
100		CI	CI	CIM	CI		CIM								DS
125		CI	CI	CIM	CI		CIM								DS
150		C	C	C	C		C								DS
200		C	C	C	C		C								DS
230		C	C	C	C		C								DS
ATT3030															
70	CI	CI	CI	CI	CI										DS
100	CI	CI	CI	CI	CI										DS
125	CI	CI	CI	CI	CI										DS
150	C	C	C	C	C	C									DS
200	C	C	C	C	C	C									DS
230	C	C	C	C	C	C									DS
ATT3042															
50				CIM			CIM		CIM						DS
70			CI	CIM	CI		CIM	CI	CIM						DS
100			CI	CIM	CI		CIM	CI	CIM						DS
125			CI	CIM	CI		CIM	CI	CIM						DS
150			C	C	C	C		C	C						DS
200			C	C	C	C	C	C	C						DS
230			C	C	C	C	C	C	C						DS

Notes:
C = commercial temperature option, I = industrial temperature option, and M = military temperature option.
For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

ATT3000 Series FPGA Device Matrix (continued)

Part Number & Speed (MHz)	44-pin PLCC M44	68-pin PLCC M68	84-pin PLCC M84	84-pin Cer. PLCC R84	100-pin EIAJ PGA J100	100-pin TQFP T100	100-pin Cer. QFP N100	132-pin Plast. PGA H132	132-pin Cer. PGA R132	160-pin EIAJ QFP J160	164-pin Cer. QFP N164	175-pin Plast. PGA H175	175-pin Cer. PGA R175	208-pin Plast. SQFP Q208	Lit.
ATT3064															
70			CI					CI	CI	CI					DS
100			CI					CI	CI	CI					DS
125			CI					CI	CI	CI					DS
150			C					C	C	C					DS
200			C					C	C	C					DS
230			C					C	C	C					DS
ATT3090															
50											CIM		CIM		DS
70			CI							CI	CIM	CI	CIM	CI	DS
100			CI							CI	CIM	CI	CIM	CI	DS
125			CI							CI	CI	CI	CI	CI	DS
150			C							C	C	C	C	C	DS
200			C							C	C	C	C	C	DS
230			C							C	C	C	C	C	DS

Notes:
C = commercial temperature option, I = industrial temperature option, M = military temperature option.
For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

FPGA Software Tools and Description

Part Number	Description
ATT-DS35	*XNF* Interface and Library for *OrCAD SDT* Schematic Editor
ATT-DS390/290-PC2	*Viewlogic Viewdraw*-LCA Schematic Editor, *XNF* Interface, & Library for *Viewlogic Viewdraw* and *Viewsim*
ATT-DS501-PC1	PC *XACT* Design Implementation System for ATT3000 Series
ATT-DS501-AP1	*Apollo XACT* Design Implementation System for ATT3000 Series
ATT-DS501-SN2	*Sun-4 XACT* Design Implementation System for ATT3000 Series

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Optimized Reconfigurable Cell Array (ORCA) Series FPGAs & Development System

Description

The AT&T ORCA series is the second generation of SRAM (static random access memory) based FPGAs produced in AT&T Microelectronics' advanced submicron CMOS (complementary metal oxide semiconductor) process technologies. ORCA is a revolutionary new FPGA architecture that draws upon advanced routing concepts from AT&T's telecommunications research. ORCA FPGAs provide system designers with high-performance, high-density, high I/O, user-programmable logic. ORCA FPGAs range in size from 3,500 to 22,000 equivalent masked gate-array gates. For more information, refer to the *Optimized Reconfigurable Cell Array (ORCA) Series Field-Programmable Gate Arrays* Data Sheet.

ORCA Series FPGAs

Features

- 0.6 µm CMOS process technology
- High-density 3,500 to 22,000 usable gates
- Up to 288 usable I/O
- High-performance (system) operating frequency (33 MHz—80 MHz)
- Low power consumption
- In-circuit reprogrammable
- Built-in boundary scan (IEEE 1149.1)
- Multiple device and package types
- Configurable large-/medium-grain structure optimizes logic utilization
- TTL or CMOS input thresholds
- Nibble-wide input structure for ease of implementing 4-, 8-, 16-, or 32-bit bus interface
- Identical and symmetrical programmable logic cells (PLCs)
- Four programmable latches/FFs per PLC
- Fast on-chip user-programmable SRAM memory
- Multiple user-defined low-skew clocks
- Global or local set and reset
- Selectable output sink/source current capability per I/O (12 mA/6 mA sink, 6 mA/3 mA source)
- Expandable fast-carry overflow for arithmetic functions and counters

Part Number	Usable Gates	Registers	Max User RAM Bits	User I/Os	Array Size	Literature
ATT1C03	3,500	400	6,400	160	10 x 10	DS, PN
ATT1C05	5,000	576	9,216	192	12 x 12	DS, PN
ATT1C07	7,000	784	12,544	224	14 x 14	DS, PN
ATT1C12	12,000	1296	20,736	216	18 x 18	DS, PN
ATT1C15	15,000	1600	25,600	240	20 x 20	DS, PN
ATT1C22	22,000	2304	36,864	288	24 x 24	DS, PN

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

ORCA Series Development System

Features

- *Windows* 3.1 interface on PCs
- *X-Windows* (*Open Look*) interface on *Sun Workstations*
- Design flow integrated with pull-down menus
- Supports popular third-party design entry tools
- Over 350 ORCA library logic elements
- 100% automatic map, place, and route
- Logic optimization option
- Postlayout static timing analysis
- Interactive design editor

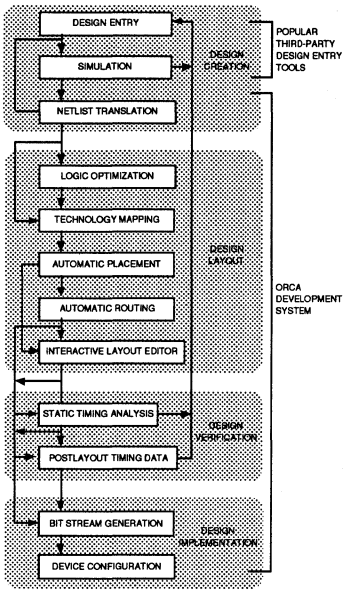


Figure 1. ORCA Development System Design Flow

ORCA Series FPGA Device Matrix

Part Number	84-pin PLCC M84	100-pin TQFP T100	132-pin JEDEC PQFP F132	208-pin EIAJ SQFP S208	240-pin EIAJ SQFP S240	304-pin EIAJ SQFP G304	225-pin Plastic PGA H225	225-pin Ceramic PGA R225	280-pin Ceramic PGA R280	364-pin Ceramic PGA R364	Literature
ATT1C03	C	C	C	C			C	C			DS, PN
ATT1C05	C	C	C	C	C		C	C			DS, PN
ATT1C07				C	C	C			C		DS, PN
ATT1C12				C		C			C		DS, PN
ATT1C15				C		C			C		DS, PN
ATT1C22				C		C				C	DS, PN

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

ORCA Development System

Part Number	Version	Description	Literature
ATT-ODSIDS-PC1	1.0	ORCA Development System for *Windows*	DS, PN
ATT-ODSVL-PC1	1.0	ORCA *Viewlogic* Interface and Library for PCs	DS, PN
ATT-ODSDEMO	1.0	ORCA Hardware Demonstration Board and Download Cable	DS, PN
ATT-ODSCABLE	1.0	ORCA Serial Download Cable	DS, PN
ATT-ODSIDS-SN1	1.0	ORCA Development System for *Sun Workstations*	DS, PN
ATT-ODSVL-SN1	1.0	ORCA *Viewlogic* Interface and Library for *Sun Workstations*	DS, PN
ATT-ODSDEMO	1.0	ORCA Hardware Demonstration Board and Download Cable	DS, PN
ATT-ODSCABLE	1.0	ORCA Serial Download Cable	DS, PN

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

NeoCAD FPGA Development System

Description

The NeoCAD Development System is a set of CAE software tools used to design FPGAs for the ATT3000 and ORCA FPGA product families. Coupled with third-party CAE design entry and simulation tools, the NeoCAD Development System provides a complete design system for FPGA designers with advanced capabilities such as timing- and frequency-driven place and route, FPGA-specific analysis, industry leading algorithmic technology, and a consistent design environment for all current and future AT&T FPGAs.

Features

- Supports ATT3000 Series FPGAs
- Advanced mapping, optimization, and routing capabilities
- Interactive graphical layout and logic editor
- Static timing analyzer
- Timing- and frequency-driven module option
- Supported on 386/486 PCs, *Sun SPARCstation*, and *HP700*
- *MS Windows* user interface on PC
- *X-Windows* and *OSF/MOTIF* user interface on workstations
- *Viewlogic* and *Mentor Graphics* third-party CAE integration kits
- Upgrade module supports ORCA FPGAs (4Q93) in addition to ATT3000 series

The ATT3000 Series development system, which was specifically developed by NeoCAD Inc. for AT&T, is an alternative solution to the *Xilinx XACT* system for *XC3000* and ATT3000 Series FPGAs. This system provides technology mapping, placement, and routing of FPGA designs created with third-party CAE tools. The ATT3000 Series development system improves circuit performance when used with the optional *Timing Wizard* module. This improvement can provide two benefits to FPGA users: one is the ability to use less expensive, lower-speed grade devices, and the other is higher performance from 100 MHz to 200 MHz ATT3000 Series FPGAs for high-speed system designs. Timing- and frequency-driven capabilities eliminate the need for architectural expertise, thereby eliminating barriers to using FPGAs.

NeoCAD *Timing Wizard* Module

Timing Wizard is an optional module that is fully integrated with the ATT3000 Development System. *Timing Wizard* automatically ensures that FPGA designs meet user-specified operating frequencies. It accepts high-level timing requirements, such as frequency, skew, and offset for synchronous designs and maximum path delays for combinational circuits. *Timing Wizard* uses true static timing analysis and actual device delay characteristics to implement user timing specifications. Benefits to designers are reduction of design iterations and faster overall designs —20% to 60% on average.

ORCA Upgrade Kit

The ORCA upgrade kit, also developed for AT&T by NeoCAD, will be available in 4Q93, and is used in conjunction with the ATT3000 development system to provide technology mapping, placement, and routing for AT&T's innovative new ORCA series of FPGAs. The kit is fully compatible with *Timing Wizard* and all NeoCAD third-party integration kits and also provides an additional ORCA-specific library with elements unique to ORCA's architecture, such as SRAM memory blocks.

Table 1. PC Version

Part Number	Description
ATT-NEO3000-PC1	NeoCAD ATT3000 Development System
ATT-NEOVL-PC1	NeoCAD Integration Kit for *Viewlogic*
ATT-NEOWIZ-PC1	NeoCAD *Timing Wizard* Module
ATT-NEOORCA-PC1	NeoCAD ORCA Upgrade Kit (to ATT-NEO3000)

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Table 2. *SPARCstation* Version

Part Number	Description
ATT-NEO3000-SN2	NeoCAD ATT3000 Development System
ATT-NEOVL-SN2	NeoCAD Integration Kit for *Viewlogic*
ATT-NEOMN-SN2	NeoCAD Integration Kit for *Mentor Graphics*
ATT-NEOWIZ-SN2	NeoCAD *Timing Wizard* Module
ATT-NEOORCA-SN2	NeoCAD ORCA Upgrade Kit (to ATT-NEO3000)

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Table 2. *HP700* Version

Part Number	Description
ATT-NEO3000-HP7	NeoCAD ATT3000 Development System
ATT-NEOVL-HP7	NeoCAD *Viewlogic* Integration Kit
ATT-NEOMN-HP7	NeoCAD *Mentor Graphics* Integration Kit
ATT-NEOWIZ-HP7	NeoCAD *Timing Wizard* Module
ATT-NEOORCA-HP7	NeoCAD ORCA Upgrade Kit (to ATT-NEO3000)

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Clock Recovery and Data Retiming Modules

Features:

TRU600
- Miniature, ceramic 28-pin surface-mount package
- 100K ECL inputs and outputs
- SONET compatible
- Low power consumption

TRU200
- Ceramic 28-pin DIP package
- 100K ECL inputs and outputs
- SONET compatible

TRU050
- Ceramic 16-pin DIP package
- TTL compatible output
- Superior jitter performance

Model	Data Rate Range	Power Consumption	Jitter Generation	Operating Temperature	Literature
TRU600	155.520 MHz to 622.080 MHz	325 mW	10 ps rms typical	–40 °C to +85 °C	DS
TRU200	44 MHz to 315 MHz	325 mW	10 ps rms typical	–40 °C to +85 °C	DS
TRU050	up to 52 MHz	250 mW	1 ns p-p typical	–40 °C to +85 °C	DS

Electrical Specifications

Parameter	Symbol	Min.	Max.
Supply Voltage			
TRU050	V_{DD}	4.5 V	5.5 V
TRU200	V_{CC}–V_{EE}	4.5 V	5.5 V
TRU600	V_{CC}	4.5 V	5.5 V
Supply Current			
TRU050	I_{DD}	25 mA	60 mA
TRU200	I_{CC}	50 mA	75 mA
TRU600	I_{CC}	50 mA	75 mA

Voltage-Controlled SAW Oscillator VCO-600

Features:

- Low-profile, ceramic 28-pin surface-mount package
- 10K ECL logic levels with fast transition times
- Low phase jitter

Model	Frequency Range	Operating Temperature	Frequency Stability	Pull Range	Literature
VCO-600	155 MHz to 1.1 GHz	–40 °C to +85 °C	±150 ppm	±800 ppm	DS

Electrical Specifications

Parameter	Symbol	Min.	Max.
Supply Voltage	V_{EE}	–4.5 V	–5.5 V
Supply Current	I_{EE}	36 mA	48 mA
Symmetry	SYM	45%	55%
Transition Times			
Rise Time	tR	0.10 ns	0.40 ns
Fall Time	tF	0.10 ns	0.40 ns

Voltage-Controlled S-Type Crystal Oscillator

Features:

- Miniature, ceramic, 6-pin surface-mount or DIP package
- TTL or CMOS selectable
- 3-state output
- VCXO or fixed frequency

Model	Frequency Range	Operating Temperature	Frequency Stability	Pull Range	Literature
S-Type	200 Hz to 52 MHz	–40 °C to +85 °C	±100 ppm	±150 ppm	DS

Electrical Specifications

Parameter	Symbol	Min.	Max.
Supply Voltage	V_{DD}	4.5 V	5.5 V
Supply Current	I_{DD}	12 mA	32 mA
Symmetry	SYM (CMOS)	45%	55%
Transition Times			
Rise Time	tR	1.0 ns	5.0 ns
Fall Time	tF	1.0 ns	5.0 ns

AT&T Bipolar Foundry

The AT&T Bipolar Foundry organization is one in which customer input can be anything from an idea to ready masks. Our foundry is a recognized major supplier of a wide variety of high-performance bipolar technologies that span a broad analog/mixed signal application base including products designed for interface circuitry, network computing, telecom, instrumentation/ATE, and video/RF. The proven manufacturability of our foundry technologies is complemented nicely by a full range of development and manufacturing services (summarized in Table 1) performed by our technical and management staff. Additionally, AT&T utilizes their design ingenuity to offer versatile design solutions that result in highly integrated customer solutions leading to substantial cost savings and higher system performance. Also, we support commercially available PC and workstation based design tools.

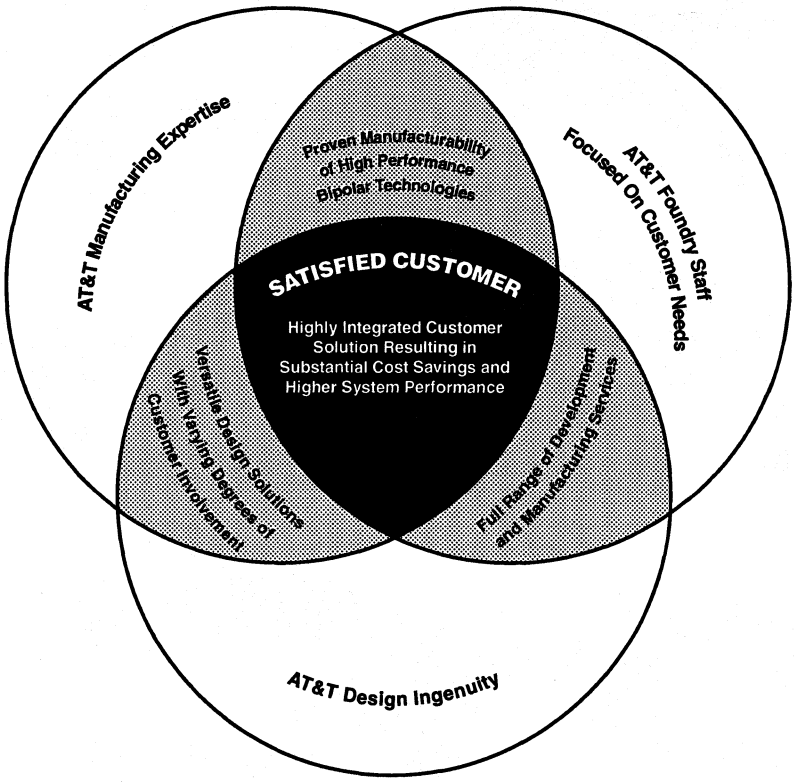


Table 1. Bipolar Foundry Services

Development Services	Production Services
Customer Training	Wafer Fabrication
IC Electrical Design	Wafer Probe
Test Development	Product Packaging and Test
IC Layout and Mask Tooling	Product Engineering
Prototype Wafer Fabrication	
Prototype Packaging and Test	
Prototype Evaluation	

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Technology Offerings

AT&T provides a diverse offering of high-performance bipolar technologies that can be utilized to provide system solutions to our customers. Several of AT&T's bipolar technologies are offered in both custom or semicustom design options in which either the customer or AT&T can provide the design and layout. The foundry technologies, manufactured in world-class cleanroom facilities, fall into two major groups. First, there is the Complementary Bipolar Integrated Circuit (CBIC) consisting of CBIC-R, CBIC-U2, and CBIC-V2 technologies. They provide vertical PNPs as well as vertical NPNs having f_T/BVceos ranging from 250 MHz/33 V to 10 GHz/10 V, respectively.

The second group of foundry technologies, ideal for data conversion products, was designed for ultrafast NPN, ECL-type digital and analog UHF/VHF communications. This is our Bipolar Enhanced Super Self-Aligned Technology (BEST1) which offers a typical f_T of 14 GHz and a minimum BVceo of 5.5 V. This technology has evolved to BEST-2, a high-performance BiCMOS technology. In addition to adding PMOS and NMOS transistors, a significant improvement in bipolar performance has also been obtained. BEST-2 will be available for design activity 1Q94. A technology overview is shown in Table 2 and a summary of dc and ac device characteristics is shown in Table 3.

Table 2. Analog/Mixed Signal Bipolar Technology Overview

Technology	Overview
CBIC-R	General-purpose 33 V, 250 MHz, moderate-speed complementary bipolar technology for analog/mixed signal applications. CBIC-R is the most mature junction-isolated complementary bipolar technology available with over ten years of manufacturing experience. CBIC-R technology is also offered through the ALA-400 family of semicustom linear arrays.
CBIC-U/U2	High-performance 12 V, 4 GHz, high-speed complementary bipolar technologies for wideband or low-power analog/mixed signal applications. Since CBIC-U's introduction to the marketplace four years ago, and most recently, CBIC-U2's introduction in 1992, many customers have used these technologies to introduce leading-edge products targeted in video/consumer, industrial, instrumentation, and data/telecommunications markets. CBIC-U's semicustom products are available in the ALA-200 family of arrays.
CBIC-V/V2	Very high-performance 6 V/10 V, 10.2 GHz, complementary bipolar technologies that can be utilized for very high-speed or ultralow-power analog/mixed signal applications. CBIC-V/V2 are the highest-speed side wall oxide isolated complementary bipolar technologies in manufacture. CBIC-V was introduced into manufacture in 1989, and CBIC-V2 in 1993, and they have already been used in numerous military and commercial applications. The ALA-100 family supports semicustom designs in CBIC-V.
BEST-1	Offers a nonoverlapping, super self-aligned, oxide isolated NPN transistor capable of a 5.5 V minimum BVceo, and a typicalf_T of 14 GHz. BEST-1 has been in production since 1989, and is ideal for ultrahigh-speed lower power consumption mixed signal applications. BEST-1 is utilized for applications such as video driver distribution circuitry, high-speed data communications, and high-speed data conversion. ECL prop delays of 87 ps at a power level of 2 mW per gate have been obtained. BEST-1 semicustom solutions are available in the BE1000, BE2000, and BE4000 gate arrays.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Table 3. Technology Characteristics

Parameter	CBIC-R	CBIC-U2	CBIC-V2	BEST-1	Unit
BVceo (min)					
NPN	33	12	10	5.5	V
PNP	33	11	10	6*	V
f_T (typ)					
NPN	250 MHz	3.5 GHz	10.2 GHz	14 GHz	—
PNP	250 MHz	2.7 GHz	4.3 GHz	—	—
hFE (typ)					
NPN	85	125	118	100	—
PNP	110	35	45	4*	—
CJC (1 x typ)					
NPN	220	40	30	9	fF
PNP	340	60	50	—	fF
Interconnect	2 LM Ti-Pt Ti-Pt-Au	2 LM Ti-Pt-Au Ti-Pt-Au	2 LM Ti-Pt-Au Ti-Pt-Au	3 LM + Poly Ti-TiN-Al-TiN —	— — —
Resistors	200 & 2000 (implanted)	50 & 1080 (implanted)	80 & 1880 (implanted)	565 (Poly)	Ω/sq.
Trimmed Resistors	300	300	300	—	Ω/sq.
Capacitors	0.4	0.34	0.22	1.62 (MOS)	fF/μm² (MNOS)
Min. Feature Size	5.0	1.5	1.5	1.5	μm

*Lateral PNP.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Flexible Design Options

Table 4 covers the range of customer/AT&T partnership arrangements that might be followed once masks and wafers have been produced. Development begins, given customer specified product performance requirements, with AT&T serving as technology consultants. As development commences, the division of customer/AT&T responsibility depends upon customer choice. For example, the customer might finish design through layout and finish with option 1 in Table 4, leaving AT&T only responsible for mask and wafer fabrication. Or the customer may require a turnkey solution, finished as option 6. Deliverables in options 1, 2, and 3 are either wafers or die.

Furthermore, the product may be either a custom or semicustom IC. The semicustom product offerings and component summaries are summarized in Tables 5–7. The essential feature of this supported IC development procedure is that it is flexible in meeting customer needs.

Table 4. Customer/AT&T IC Product Development (Custom or Semicustom)

Foundry Options						
Manufacturing Steps	**Customer Options***					
	1	**2**	**3**	**4**	**5**	**6**
Mask Fab Wafer Fab Visual Inspection	A	A	A	A	A	A
Wafer Probe	C	A	A	A	A	A
Dicing	C	C	A	A	A	A
Package Assembly	C	C	C	A	A	A
Package Test	C	C	C	C	A	A
Qualification	C	C	C	C	C	A

* Symbol key: C → Customer
A → AT&T

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Analog/Mixed Signal Design Options

AT&T design capabilities offer highly integrated solutions resulting in substantial savings in costs along with higher system performance. This is achieved by utilizing either AT&T full-custom or semicustom design alternatives.

Full Custom

Full custom is the customizing of component types, values placement, and interconnect and requires a complete mask set. An extensive, characterized library of transistors, resistors, and capacitors is provided which enables the designer to optimize the performance for a given application at minimal risk.

Semicustom

Semicustom is dies consisting of a standardized set of prepositioned components. Wafers are held in inventory prior to metallization. The interconnection is customized for each design, resulting in fewer masks, lower NRE, and a shorter processing interval than a full-custom design. Deliverables can be either tested or untested die, packages, or wafers.

Table 5. Analog/Mixed Signal Product Offering

			Technology			
Product	**CBIC-R**	**CBIC-U**	**CBIC-U2**	**CBIC-V**	**CBIC-V2**	**BEST-1**
Semicustom	ALA-401	ALA-201	—	ALA-110	ALA-110	BE1000
	ALA-402	ALA-202	—	—	—	BE2000
		ALA-210	—			BE4000
Full Custom	√	√	√	√	√	√

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

The following is a general summary of the number and type of components available on the various linear array products. For more detailed information, please request the appropriate data sheet.

Table 6. Semicustom Product Component Summary

Product	Voltage (V)	Complementary Transistors NPN	Complementary Transistors PNP	Resistors	Capacitors	Bonding Pads
ALA-110	10	51	41	282	14	16
ALA-201	12	68	43	480	21	36
ALA-202	12	136	86	960	38	48
ALA-210	12	37	37	104	6	16
ALA-401	33	61	61	434	7	38
ALA-402	33	104	104	744	12	46

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

The following is a summary of the BEST-1 gate-array complexities available. The number of equivalent gates is calculated based on a gate multiplier of four transistors per gate.

Table 7. Semicustom Gate-Array Complexity Options

Product	Voltage	Equivalent Gates	Internal Cells	I/O Buffer Cells	Fixed Power & GND Pads	Equivalent Gates (D Flip-Flop with Clear)	Equivalent Gates (1-Bit Full Adder)
BE1000	5.5 V	1048	182	48	32	728	1001
BE2000	5.5 V	2780	484	92	38	1936	2660
BE4000	5.5 V	4196	728	108	38	2912	4004

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

CAD SUPPORT

As circuits become more complex, computer-aided design (CAD) tools become more important to the successful completion of a design. AT&T Microelectronics supports a variety of commercially available PC and workstation based design tools. A description of the supported tools is offered below.

Training in the use of any of these tools will be provided at a nominal fee.

SCHEMATIC CAPTURE

AT&T Microelectronics provides a library and software support for *Viewdraw* from Viewlogic Corporation and the schematic capture tool in the Cadence Design Systems' Analog Artist environment.

CIRCUIT SIMULATION

SPICE

SPICE is the primary circuit analysis tool used by analog designers. There are several versions available. AT&T Microelectronics provides transistor models compatible with SPICE 2G6. The resistor and capacitor models supplied are compatible with any simulator which allows models to be specified. In addition, some enhanced subcircuit models are available for use with MicroSim's *PSPICE*, version 4.01 or later.

ADVICE

AT&T's own circuit simulator, ADVICE (a SPICE derivative), is available for use on *Sun Workstation.* It features an extended four-terminal bipolar transistors model which covers parasitic transistor behavior, operation in the quasi-saturation region, both interactive and batch execution, parameterized subcircuits, design centering, user-definable models, and procedural simulation. AT&T Microelectronics licenses the ADVICE simulation tool and will provide training for a fee.

Layout

AT&T Microelectronics supports cell-based layout libraries for a number of layout editors available for both PC and *Sun Workstation* platforms. A library of CBIC primitive cells is available in *GDS II Stream* format.

Analog Artist Layout

The polygon layout editor in Analog Artist is supported with CBIC cell libraries written in Analog Artist database format. Also supplied are parameterized cells for generating valid resistor cells with desired values.

Verification

Layout verification using both AT&T and other commercial tools is supported on PC and *Sun Workstation* platforms.

Analog Artist

The verification tools PDcheck, PDextract, ERC, and PDcompare are fully supported for design rule checking, layout connectivity and parasitic capacitor extraction, electrical rule checking, and layout versus schematic checking, respectively.

Dracula

A library of command files for Cadence Design Systems' *Dracula* is available to enable design rule checking, layout connectivity and parasitic capacitor extraction, electrical rule checking, and layout versus schematic checking for layouts.

Dielectrically Isolated Wafers

AT&T also provides a wafer foundry service wherein we prepare dielectrically isolated (DI) wafers for customers to finish processing in their own fab lines. In this mode, we are currently fabricating DI wafers for a variety of high-voltage and high-performance bipolar technologies.

Bonded Silicon on Insulator (SOI) Wafer

Features

- Handles like bulk silicon
- High bond strength

Specifications

- Diameter:
  - — 100 mm and 125 mm
  - — 150 mm available Nov. 1993
- Orientation: <100> or <111>

Description

AT&T Microelectronics provides high-performance silicon materials to OEM customers. Process enhancements are made possible by the substrate properties which can be achieved through wafer bonding. High-volume processes are used to meet your production needs. AT&T-ME's bonding process was developed in conjunction with AT&T Bell Laboratories.

Customized Bonded Wafer Process

Silicon wafer bonding enables two wafers with different properties to be united by an attractive force. Sophisticated substrates are created with specific properties for a given process.

The bonded wafer process consists of the following steps:

1. Two wafers are matted together at room temperature.
2. Bond integrity is verified by infrared interference inspection. This step ensures that no voids are present following the initial bonding process.
3. The bonded wafers are annealed at high temperature to increase bonding strength.
4. The device layer is thinned to the appropriate thickness by grinding and polishing.

SOI Wafer Physical Characteristics

Wafer Type	Device Layer Thickness	Device Layer Thickness Variation	Insulating Oxide Thickness	Total Wafer TTV
Thickness SOI	10 µm—150 µm	±15%	0.4 µm—4 µm	<10 µm
Thin SOI	2 µm—10 µm	±0.5 µm	0.4 µm—4 µm	3 µm
Ultrathin SOI	0.07 µm—2 µm	±0.02 µm	0.1 µm—2 µm	3 µm

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

The 41 Series of High-Performance Line Drivers, Receivers, and Transceivers

AT&T's 41 Series consists of a family of general-purpose interface devices capable of driving backplane mediums or for use as translators (TTL to Pseudo ECL [PECL] and vice versa). The devices are pin and functionally equivalent to common 26LS31/26LS32 TTL to TTL interface devices but feature a PECL line interface that allows the device to transmit data at data rates as high as 400 Mbits/s with device propagation delays as low as 1.0 ns (typical). Utilizing 41 Series devices in data bus and backplane applications can significantly reduce system EMI generation. Systems employing only 41 Series devices for the backplane interface were shown to have EMI emissions 20 dB to 30 dB less than the same system employing standard TTL to TTL type devices.

AT&T offers two speed ranges of the 41 Series for various EDP, telecommunication, LAN, disk drive, and other applications. The 41L Series can output data at data rates up to 200 Mbits/s while the 41M Series supports data rates to 400 Mbits/s. All devices are packaged in 16-pin DIP and surface-mount packages (SOJ and SOIC). Surface-mount packages are available in tape and reel.

Other features include:

- 0 °C to 85 °C ambient operating temperature range
- Integrated impedance matching and pull-down resistors in select devices
- Wide common mode range: –1.2 V to +7.2 V
- Low output skew

High-Speed Interface Devices Product Matrix - 41L Series (200 Mbits/s)

Category	Part No.	Functional* Equivalent	Built-In Termination Resistor		Package Type	Literature
			Driver	Receiver		
Quad, Differential Line Drivers	41LG	—	None	NA	DIP	DB
	1041LG	—	None	NA	SOJ	DB
	1141LG	—	None	NA	SOIC	DB
	41LP	26LS31	220 Ω to GND	NA	DIP	DB
	1041LP	26LS31	220 Ω to GND	NA	SOJ	DB
	1141LP	26LS31	220 Ω to GND	NA	SOIC	DB
Quad, Differential Line Receivers	41LF	26LS32	NA	None	DIP	DB
	1041LF	26LS32	NA	None	SOJ	DB
	1141LF	26LS32	NA	None	SOIC	DB
	41LR	—	NA	See Figure 1.	DIP	DB
	1041LR	—	NA	See Figure 1.	SOJ	DB
	1141LR	—	NA	See Figure 1.	SOIC	DB
	41LS	26LS32	NA	None	DIP	DB
	1041LS	26LS32	NA	None	SOJ	DB
	1141LS	26LS32	NA	None	SOIC	DB
	41LT	—	NA	See Figure 2.	DIP	DB
	1041LT	—	NA	See Figure 2.	SOJ	DB
	1141LT	—	NA	See Figure 2.	SOIC	DB
Dual, Differential Transceivers	41LK	—	None	None	DIP	DB
	1041LK	—	None	None	SOJ	DB
	1141LK	—	None	None	SOIC	DB
	41LL	8923/8923A	220 Ω to GND	None	DIP	DB
	1041LL	8923/8923A	220 Ω to GND	None	SOJ	DB
	1141LL	8923/8923A	220 Ω to GND	None	SOIC	DB
	41LM	—	220 Ω to GND	See Figure 1.	DIP	DB
	1041LM	—	220 Ω to GND	See Figure 1.	SOJ	DB
	1141LM	—	220 Ω to GND	See Figure 1.	SOIC	DB

* Identical in pinout and function but with improved electrical characteristics.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Advanced High-Speed Interface Devices Product Matrix - 41M Series (400 Mbits/s)

Category	Part No.	Functional* Equivalent	Built-In Termination Resistor		Package Type	Literature
			Driver	Receiver		
Quad, Differential Line Drivers	41MGA	—	None	NA	DIP	DS
	1041MGA	—	None	NA	SOJ	DS
	1141MGA	—	None	NA	SOIC	DS
	41MPA	26LS31	220 Ω to GND	NA	DIP	DS
	1041MPA	26LS31	220 Ω to GND	NA	SOJ	DS
	1141MPA	26LS31	220 Ω to GND	NA	SOIC	DS
Quad, Differential Line Receivers	41MF	26LS32	NA	None	DIP	DB
	1041MF	26LS32	NA	None	SOJ	DB
	1141MF	26LS32	NA	None	SOIC	DB
	41MR	—	NA	See Figure 1.	DIP	DB
	1041MR	—	NA	See Figure 1.	SOJ	DB
	1141MR	—	NA	See Figure 1.	SOIC	DB
	41MT	—	NA	See Figure 2.	DIP	DB
	1041MT	—	NA	See Figure 2.	SOJ	DB
	1141MT	—	NA	See Figure 2.	SOIC	DB
Dual, Differential Transceivers	41MK	—	None	None	DIP	DB
	1041MK	—	None	None	SOJ	DB
	1141MK	—	None	None	SOIC	DB
	41ML	8923/8923A	220 Ω to GND	None	DIP	DB
	1041ML	8923/8923A	220 Ω to GND	None	SOJ	DB
	1141ML	8923/8923A	220 Ω to GND	None	SOIC	DB
	41MM	—	220 Ω to GND	See Figure 1.	DIP	DB
	1041MM	—	220 Ω to GND	See Figure 1.	SOJ	DB
	1141MM	—	220 Ω to GND	See Figure 1.	SOIC	DB

* Identical in pinout and function but with improved electrical characteristics.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Termination/Impedance Matching Resistor Diagrams

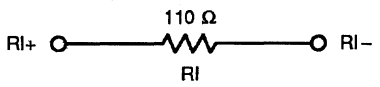


Figure 1.

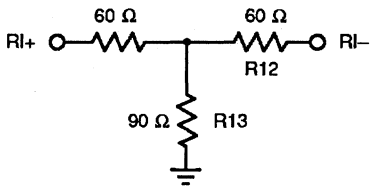


Figure 2.

Features

- High-performance 10 ns cache tag SRAM
  ATT7C180/181 — 4K x 4 tag SRAM
- Fastest 64K cache tag SRAM available
  ATT7C174 — 10 ns, 8K x 8 tag SRAM
- High-performance 64K cache data SRAM
  ATT7C185 — 10 ns, 8K x 8 data SRAM
- Synchronous cache data SRAM with wide bus architecture
  AT17C157 — 15 ns, 16K x 16, self-timed data SRAM

Benefits

- Accelerates PC architecture beyond 40 MHz
- Streamlines custom cache controllers for 40 MHz, 486 designs
- Accelerates primary and secondary RISC caches
- Speed enhanced 128 Kbyte caches with minimal chip count
- Efficient two-chip solution with no glue logic required for the *SPARC* architecture
- Direct fit with the 82385 cache controller and popular chip set cache controllers

High-Speed CMOS Cache RAMs

Part No.	Org.	Speeds (ns)	Features	Packaging		Literature
16 Kbits						
ATT7C167	16K x 1	10, 12, 15, 20, 25	S I/O	20-pin DIP	20-pin SOJ	DS
ATT7C168	4K x 4	10, 12, 15, 20, 25	C I/O	20-pin DIP	20-pin SOJ	DS
ATT7C170	4K x 4	10, 12, 15, 20, 25	C I/O, OE	22-pin DIP	24-pin SOJ	DS
ATT7C171	4K x 4	10, 12, 15, 20, 25	S I/O, T W	24-pin DIP	24-pin SOJ	DS
ATT7C172	4K x 4	10, 12, 15, 20, 25	S I/O, HI Z W	24-pin DIP	24-pin SOJ	DS
ATT7C180	4K x 4	10, 12, 15, 20, 25	Tag RAM: Flash Clear Comparator (Totem-Pole Match)	22-pin DIP	24-pin SOJ	DS
ATT7C181	4K x 4	10, 12, 15, 20, 25	Tag RAM: Flash Clear Comparator (Open-Drain Match)	22-pin DIP	24-pin SOJ	DS
ATT7C116	2K x 8	10, 12, 15, 20, 25	C I/O, OE	24-pin DIP	24-pin SOJ	DS
64 Kbits						
ATT7C187	64K x 1	10, 12	S I/O	22-pin DIP	24-pin SOJ	DS
ATT7C164	16K x 4	10, 12	C I/O	22-pin DIP	24-pin SOJ	DS
ATT7C165	16K x 4	10, 12	C I/O, 2CE, OE	24-pin DIP	24-pin SOJ	DS
ATT7C166	16K x 4	10, 12	C I/O, OE	24-pin DIP	24-pin SOJ	DS
ATT7C161	16K x 4	10, 12	S I/O, T W	28-pin DIP	28-pin SOJ	DS
ATT7C162	16K x 4	10, 12	S I/O, HI Z W	28-pin DIP	28-pin SOJ	DS
ATT7C185	8K x 8	10, 12	C I/O	28-pin DIP	28-pin SOJ	DS
ATT7C174	8K x 8	10, 12, 15, 20, 25	Tag RAM: Flash Clear Comparator (Open-Drain Match)	28-pin DIP	28-pin SOJ	DS
ATT7C186	8K x 8	12, 15, 20, 25	Flash Clear	28-pin DIP	28-pin SOJ	DS
128 Kbits						
ATT7C183	8K x 16, 2 x 4K x 16	25	Cache RAM for 386 Systems	48-pin DIP	52-pin PLCC	DS
256 Kbits						
ATT7C157	16K x 16	18, 20	Cache RAM for *SPARC* Systems	52-pin PLCC		DS

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Solid-State Relays

AT&T offers a full line of solid-state relays (SSRs) for use in telecommunication, industrial control, and instrumentation applications. AT&T SSRs are currently being used in PBX and central office switches, modems, answering machines, printers, test and service equipment, thermostats, programmable controllers, and control panels. Some typical applications include on/off hook, ring and test access, ring generator, dial pulse, transducer drivers, automatic tuning, ac switch, flying capacitor, and others.

Solid-state construction and current-limiting circuitry ensure a device with the characteristics of clean bounce-free switching, no EMI, low power consumption, and high-surge capability. Featuring low ON-resistance and high linearity, small signal switching is viable, and signal losses and distortion are virtually nonexistent.

Applications

Telecom	Modems FAX PBX Equipment T1 Equipment
Industrial	Remote Sensors Control Panels
Consumer	Home Security Systems Ans. Machines
Instrumentation	Remote Meters Circuit Board Testing Data Acquisition

Self-Protecting Feature

AT&T integrates current limiting into most of its Form A SSRs. Current limiting protects the switch from excessive currents, unlike electromechanical relays (EMRs) and standard solid-state relays where contacts and switch elements can easily be damaged by high current surges. Not only does current limiting protect the relay, it can also be utilized to protect power supplies and minimize power dissipation during ground fault or other undesirable conditions.

Features

- 3750 V input-to-output isolation on LH1500 Series
- New, more robust package design (LH1500 series)
- Low ON-resistance
- Low operating current
- Integrated current limiting (self-protecting)
- Monolithic IC reliability
- Small size (6- or 8-pin)
- Surface mount available (in sticks or tape & reel)

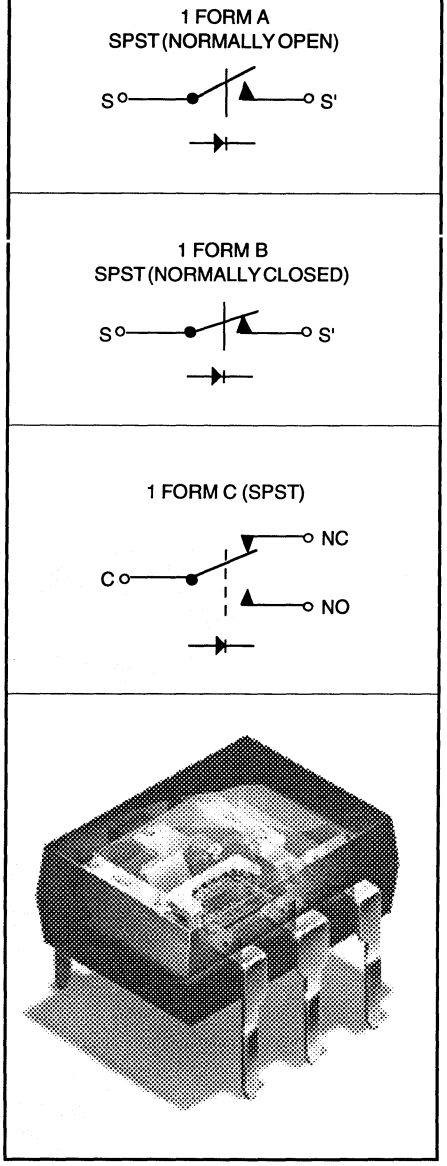
Agency Recognitions

UL Recognized
CSA Certified
BABT Certified

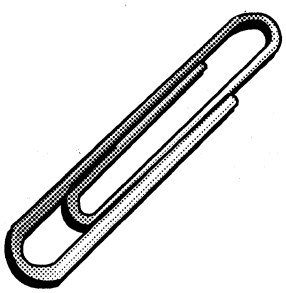
Available Documents

Data Sheets
Quick Reference
Cross Reference
Designers Guide
Blister Pack Sample Cards

Relay "Forms"



"Perhaps there is something almost as reliable as our Solid-State Relays, after all."



Solid-State Relay Selection Chart

			Output Characteristics				
Product Group	Contact Form	DIP Part Number	Load Voltage (Max.) (V)	Load Current (Max. Recommended) (mA) ac/dc	dc	ON-Resistance (Max. at 25 °C) (Ω) ac/dc	dc
Optically Coupled SSRs	**1 Form A**	LH1517AT	150	400	800	3	0.85
		LH1510AT	200	200	350	15	3.75
		LH1541AT[1]	250	55		160	
		LH1518AT	250	130	300	20	5.00
		LH1519AT	250	225	450	10	2.50
		LH1191AT	280	120		33	
		LH1056AT	350	100		50	
		LH1540AT	350	120	250	25	6.25
		LH1500AT	350	150	250	25	6.25
		LH1530AT	350	150	250	25	6.25
		LH1504AT[2]	400	95		34	
		LH1516AT	400	200	450	10	2.50
		LH1192AT	440	80		83	
	1 Form B	LH1511AT	200	200	350	15	3.75
		LH1536AT	250	300	600	6	1.50
		LH1501AT	350	150	250	25	6.25
	1 Form A/B,C	LH1512AB	200	200		15	
		LH1502AB[3]	350	150		25	
	1 Form C	LH1537AB/AT[3]	250	150		16	
		LH1527AB/AT[3]	400	125		33	
	2 Form A	LH1514AB[4]	15	150		8	
		LH1061AB	200	110		15	
		LH1513AB	200	140		15	
		LH1193AB	280	100		33	
		LH1204AB	280	110		31	
		LH1503AB	350	110		25	
	Dual 1 Form A	LH1522AB	200	140		15	
		LH1544AB[1]	250	55		160	
		LH1505AB	250	120		20	
		LH1520AB	350	110		25	
		LH1531AB	350	110		25	
		LH1532AB	350	110		25	
		LH1524AB[2]	400	70		34	
	Dual 1 Form B	LH1523AB	200	140		15	
		LH1521AB	350	110		25	
MOSFET Driver	**Dual Channel**	LH1262BB[5]	NA	NA		NA	
Monolithic SSRs	**1 Form A**	LH1571AB[2,6]	250		250		5.0
	1 Form C	LH1296AB[7]	350	100		50	
Specialty Relays							
Telecom Switch	**1 Form A +Opto Coupler**	LH1529AB1	350	120		25	
High-Frequency Relay (T1 Applications)	**2 Form A**	LH1514AB	15	150		8	
Protected Power Feed Relay (ISDN/PBX Applications)	**1 Form A**	LH1571AB	250		250		5.0
Instrumentation Relays	**1 Form A**	LH1541AT[1]	250	55		160	
	Dual 1 Form A	LH1544AB[1]	250	55		160	

1. Low-capacitance SSR (3.5 pF).
2. Diode offset in I/V characteristics.
3. Break-before-make operation.
4. High-frequency SSR (<50 MHz).
5. At 10 mA LED drive, open-circuit voltage = 13 V; short-circuit current = 9μA.
6. Protected power feed SSR, requires +5 V and between –20 V to –60 V (telephone battery voltage) to operate.
7. Also configurable as a 1 Form K and a 1 Form A/1 Form B relay. Requires +12 V or +15 V to operate.

	Input Characteristics						
Current Limit (Typical at 25 °C) (mA) ac/dc / dc	**Operate Time ton / toff (Max.) IF = 5 mA, *IF = 10 mA (ms)**		**LED Operate Current (minimum mA)** 25 °C Test Specifications	Recommended Current for 85 °C Operation	**I/O Isolation (Minimum) (Vrms)**	**Package**	**Lit.**
	3.0*	3.0*	2.0	6.0	3750	6-Pin	DS, MN
360 / 720	2.0*	2.0*	2.0	5.0	3750	6-Pin	DS, MN
	0.25	0.25	1.0	3.0	3750	6-Pin	DS
200	3.0	3.0	2.0	5.0	3750	6-Pin	DS, MN
380	3.0	3.0	2.0	5.0	3750	6-Pin	DS, MN
210	2.0	2.0	2.5	6.0	1500	6-Pin	DS
150	2.0	2.0	2.5	6.0	1500	6-Pin	DS
210	2.0	2.0	2.0	5.0	3750	6-Pin	DS, MN
270	2.0	2.0	2.0	5.0	3750	6-Pin	DS, MN
	1.0*	1.0*	2.0	5.0	3750	6-Pin	DS, MN
210	5.0	5.0	2.0	5.0	3750	6-Pin	DS, MN
375	3.0*	3.0*	2.0	5.0	3750	6-Pin	DS, MN
170	2.0	2.0	2.5	6.0	1500	6-Pin	DS
	3.0*	3.0*	2.0	5.0	3750	6-Pin	DS, MN
—	3.0*	3.0*	2.0	5.0	3750	6-Pin	DS
	3.0	3.0	2.0	5.0	3750	6-Pin	DS, MN
360	3.0*	3.0*	2.0	5.0	3750	8-Pin	DS, MN
270	6.0*	3.0*	2.0	5.0	3750	8-Pin	DS, MN
	4.0*	4.0*	3.0	7.0	3750	6- or 8-Pin	DS, AP
	4.0*	4.0*	3.0	7.0	3750	6- or 8-Pin	DS, AP
	1.0*	1.0*	3.0	8.0	3750	8-Pin	DS, AP
250	3.0	3.0	2.5	6.0	1500	8-Pin	DS
360	2.5*	2.5*	3.0	8.0	3750	8-Pin	DS, MN
250	3.0	3.0	2.5	6.0	1500	8-Pin	DS
	3.0	3.0	2.5	6.0	1500	8-Pin	DS
270	2.5*	2.5*	3.0	8.0	3750	8-Pin	DS, MN
360	2.0*	2.0*	2.0	5.0	3750	8-Pin	DS, MN
	250 µs	250 µs	2.0	5.0	3750	8-Pin	DS
200	4.0	4.0	2.0	5.0	3750	8-Pin	DS, MN
270	2.0	2.0	2.0	5.0	3750	8-Pin	DS, MN
—	1.0*	1.0*	2.0	5.0	3750	8-Pin	DS
210	2.0	2.0	2.0	5.0	3750	8-Pin	DS
210	5.0	5.0	2.0	5.0	3750	8-Pin	DS, MN
	3.0*	3.0*	2.0	5.0	3750	8-Pin	DS, MN
	3.0	3.0	2.0	5.0	3750	8-Pin	DS, MN
NA	0.07*	0.4*	NA		1500	8-Pin	DS, AP
500	10.0	3.0	CMOS Input		—	8-Pin	DS, AP
150	0.9	0.2	CMOS Input		500	8-Pin	DS
210	2.0	2.0	1.0		3750	8-Pin	DS, AP
	1.0*	1.0*	3.0	8.0	3750	8-Pin	DS AP
500	10.0	3.0	CMOS Input		200	8-Pin	DS, AP
	250 µs	250 µs	2.0	5.0	3750	6-Pin	DS
	250 µs	250 µs	2.0	5.0	3750	8-Pin	DS

Optically Coupled ac/dc Switches

LH1000/1100/1200 Series
UL Recognized
CSA Certified

LH1500 Series
BABT Certified
UL Recognized
CSA Certified

Package Types

LH1527AT/AAB

- T = 6-pin DIP
- B = 8-pin DIP
- AB = 6-pin Gull Wing
- AC = 8-pin Gull Wing

AT&T HVC Technology: Power ICs for Today

AT&T is proud of the new HVC technology series. Both the HVC-400 and HVC-800 technologies offer significant advantages to customers needing analog/digital control circuitry with high-voltage, power MOSFET devices on a single chip. The HVC-800 technology offers high-voltage NMOS (Vds = 800 V) devices with varying ON-resistance values (1 Ω to 100 Ω) to meet your specific system needs. Combined with efficient low-voltage, 3μm geometry CMOS, capable of supporting 5 V, 12 V, or 15 V supplies, the HVC technology addresses all of your "smart" power needs. The HVC-400 (Vds = 400 V) technology offers the same advantages for customers who do not require the high-voltage range supported by HVC-800.

Using world-class wafer fabrication facilities located in Reading, PA, AT&T Microelectronics uses advanced processing techniques, materials, and equipment to develop cost-effective integrated circuits for a variety of applications and customers. The HVC technology implements a double resurf technique, which results in very high-voltage NMOS transistors that are comparable to discrete MOSFETs in both size and performance. The double resurf concept allows the electric field to be distributed over a large concentrated area (drift region), allowing the NMOS to sustain very high voltages (up to 1200 V) before reaching avalanche breakdown.

Another benefit of the resurf technology is the ability to maintain low ON-resistance versus area (commonly referred to as R x A); the HVC NMOS transistor is significantly smaller than competitive high-voltage technologies (see chart on next page). The combination of an area-effective high-voltage NMOS transistor with 3 μm CMOS devices allows one to merge low-voltage control with high-voltage power transistors on a single die, while providing a cost-effective integrated solution. The HVC technology reduces device count and board space without compromising on system performance.

Power ICs Product Matrix

The ATT2101 Low Side Gate Driver IC is designed to provide the gate drive for an external N-Channel power MOSFET or IGBT. The ATT2101 provides the high-voltage level shifting, at 600 V or 800 V, required to interface with a high side MOS-gate driver. Designed to be used with the ATT2102 High Side Gate Driver, the ATT2101 provides a cost-effective interface between low-voltage logic and high-voltage loads. Both high-side and low-side gate drivers can be controlled independently from ground-referenced 5 V logic. Internal protection circuitry prevents the simultaneous conduction of the low-side and high-side gate drivers. The undervoltage lockout circuitry ensures that adequate gate-drive voltage is available before the output is enabled.

The ATT2405AVI is a single-chip power supply designed to convert ac line power to a constant 5 V to 24 V dc output at 50 mA. Fabricated in AT&T's proprietary dielectrically isolated BCDMOS technology, the device integrates the functions of a transformer, rectifier bridge, and voltage regulator, all on a single monolithic chip. A compact, lightweight, cost-effective power supply can be realized with just a few external components. The ATT2405ABI can be operated over an ac input voltage range of 15 Vrms to 275 Vrms. The circuit can be configured to provide a regulated dc output voltage of 5 V to 24 V with a guaranteed output of 50 mA.

The ATT2406ABI is identical to the ATT2405ABI except it converts ac line power to a constant 5 V to 70 Vdc output at 100 mA.

The ATT2131 3-Phase Gate Driver IC is designed to drive the gates of discrete N-channel MOSFETs or IGBTs. The ATT2131 features three high-current totem-pole outputs for driving the gates of low-side discrete devices. The ATT2131 also has three high-voltage level shifters to interface with high-side gate drivers. Designed to be used with ATT2132 High-Side Gate Driver ICs, the AT2131 provides a cost-effective interface between low-voltage logic and high-voltage, high-current discretes in 3-phase motor applications. Both the low-side and high-side power discretes can be controlled with 5 V ground referenced logic.

The ATT2131 also features a selectable overcurrent shutdown circuit and an operational amplifier that can provide analog feedback of load current. The undervoltage lockout circuit ensures that adequate gate drive voltage is available before the output drivers are enabled. The fault output indicates if a fault condition exists.

The ATT2132 is designed to drive the gates of a high-side N-channel power MOSFET or IGBT. A floating supply is derived by using a simple bootstrap technique. The ATT2132 is designed to be used with the ATT2131 3-Phase Gate Driver IC, which provides the high-voltage level shifting. A cost-effective interface between low-voltage logic and high-voltage, high-current discretes in 3-phase motor applications can be realized with three ATT2132 High-Side Gate Drivers and one ATT2131 3-Phase Gate Driver.

The ATT2131ABA is offered in an 8-pin plastic DIP.

The LH1465ISDN dc Termination IC is used on U-interface digital subscriber lines (U-DSL) and provides a polarity-insensitive dc termination for the loop-sealing current and a recognizable signature for mechanized loop testing (MLT) systems. The LH1465 passes dc signaling information to the NT1 circuitry through a 6N139 opto-isolator (or equivalent). The LH1465 IC consists of two functional blocks. The first provides the electronic inductor and silicon-controlled rectifier portion of the termination, while the second drives the LED of the 6N139 opto-isolator.

The LH1497AY Telephone Interface IC is a high-voltage interface circuit specifically designed for use in telephone circuits for the European market. It provides line and tone ringer interface functions for a telephone set when used with additional external circuitry. The LH1497AY has an on-hook dial function that allows line seizure in an on-hook condition, and it can be configured to actuate an external speaker. The LH1497AY uses AT&T's proprietary dielectrically isolated BCDMOS process to integrate low-voltage bipolar and CMOS devices along with high-voltage DMOS and PMOS structures on a monolithic die.

Power ICs Product Matrix

Part Number	Description	Packages	Temp. Ranges	Literature
ATT2101	Low-Side Gate Driver IC	8-pin DIP/SON	–40 °C to +85 °C	DS
ATT2102	High-Side Gate Driver IC	8-pin DIP/SONB	–40 °C to +85 °C	DS
ATT2405	Off-Line Power IC	8-pin DIP	–40 °C to +85 °C	DS
ATT2406	Off-Line Power IC	8-pin DIP	–40 °C to +85 °C	DS
ATT2131	3-Phase Gate IC	20-pin DIP	–40 °C to +85 °C	DS
LH1465	ISDN dc Termination IC	8-pin DIP, 16-pin SOG	–40 °C to +85 °C	DS
LH1497AY	Telephone Interface IC	20-pin SOG	–5 °C to +45 °C	DS

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

High-Voltage Octal Arrays

AT&T Microelectronics manufactures a revolutionary family of high-voltage solid-state switches designed for bare printed-circuit board test applications.

Compared to the bulky glass-encapsulated reed switches that have traditionally been used in PC board test sets, our three-chip set (ONA-OPA-OLT) offers reduced cost, higher switching speed, smaller size, simplified design, and a 6X increase in integration level.

Our devices offer high reliability by providing built-in ESD protection for all transistor gates and using a tightly controlled, fully characterized, high-yield process.

Pin-for-pin compatible with industry-standard solid-state devices, our chip set measures PCB continuity and isolation by forcing a voltage or current and sensing the associated resistance. The chip set includes three devices. The ONA (octal N-channel array) and OPA (octal P-channel array) switch the FORCE and SENSE circuits to the appropriate test points. The OLT (octal level translator) provides the logic level-to-high voltage translation required for PMOS gate control.

In addition to our catalog devices, we provide a custom ASIC service that enables us to achieve higher levels of integration. For example, we can combine the switches and control circuitry needed for up to eight test points on a single die.

Our products are fabricated by using a dielectrically isolated, high-voltage, mixed-mode process known as BCDMOS (bipolar-CMOS-DMOS). A direct result of more than 10 years' industry experience in the design and manufacture of high-voltage linear devices, this high-voltage process not only maximizes yields (<100 ppm defect rates), but provides tightly controlled ON-resistance distributions and extremely low leakage (250 pA typical).

High-Voltage Octal Arrays Product Matrix

Part Number	Description	Packages	Temp. Ranges	Literature
AN0132NAR	Octal N-Channel DMOS Array	16-pin DIP	–40 °C to +85 °C	DS
APO130NA	Octal P-Channel DMOS Array	16-pin DIP	–40 °C to +85 °C	DS
HT013OP	Octal Level Translator	18-pin DIP	–40 °C to +85 °C	DS

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Digital Bipolar Gate Arrays, Standard-Cell and Full-Custom ASICs

High-Performance ECL ASIC Products

	BEST-1 Typical (fr = 14 GHz)	SFOXIL Typical (fr = 5 GHz)	Literature
Gate Array	1K, 2K, 4K	1K, 2K, 6K	MN
Standard Cell	to 20K Gates	to 6K Gates	MN
Full Custom/Mixed Signal	✓	✓	

High-Performance BEST-1 ECL Gate Arrays

The BEST-1 Series digital bipolar gate arrays are the newest addition to the AT&T Microelectronics family of ECL gate arrays.

The BEST-1 Series high-performance ECL gate arrays use AT&T's new bipolar-enhanced, super-self-aligned technology (BEST), which yields a typical fr of 14 GHz at a highly manufacturable minimum geometry of 1.5 µm. At modest power levels, BEST-1 gate arrays achieve greater than 1 GHz operating frequency. The BEST-1 ECL array family combines advanced process technology with innovative design and high-performance packaging.

Features

- 1,000 to 4,000 equivalent logic gates
- Four programmable speed/power levels (2-input OR/NOR):
  - — 0.25 mW/gate at 700 ps unloaded
  - — 0.5 mW/gate at 350 ps unloaded
  - — 1.0 mW/gate at 250 ps unloaded
  - — 2.0 mW/gate at 200 ps unloaded
- Single supply voltage of either 5.2 V± 10% or –4.5 V± 0.3 V (5.0 V± 10% for TTL I/O)
- 10KH and 100K ECL and TTL logic family I/O interface
- 130-member function library
- Frequency response:
  - — 2.0 GHz toggle frequency
  - — 1.0 GHz ECL output buffer
  - — 2.0 GHz ECL input buffer
- Operating junction temperature of 0 °C to 125 °C for three levels of series gating and –55 °C to +125 °C for two levels of series gating

The BEST-1 Gate Arrays Product Matrix

Parameter	BE1000	BE2000	BE4000	Literature
Equivalent Gates	1,048	2,780	4,196	MN
Internal Cells	182	484	728	MN
I/O Buffer Cells (I/O bond pads)	48	92	108	MN
Fixed Power and Ground Pads	8	38	24	MN
Equivalent Gates Using D Flip-Flops W/Clear	637	1,936	2,548	MN
Equivalent Gates Using 3-Input XORs	1,820	4,840	7,280	MN
Packaging	44 PLCC	84 PLCC	132 CPGA	MN
	68 PLCC			MN
	71 PPGA	119 CPGA	153 CPGA	MN

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

SFOXIL ECL/TTL Gate Arrays

The ATE-Series SFOXIL gate arrays offer high-performance, low-cost, and quick-turnaround solutions. These high-speed, TTL-ECL gate arrays are implemented by using scaled-fast oxide-isolated logic (SFOXIL) bipolar technology, which offers high operating speeds at moderate power.

Features

- Several internal speed and power options:

Speed	Power
500 ps	1.25 mW/gate
300 ps	2.5 mW/gate
200 ps	5.0 mW/gate

- FF toggle frequency of 500 MHz to 800 MHz
- Fast ECL and TTL buffer options:

ECL buffer input	300 ps
ECL buffer output	600 ps
TTL buffer input	500 ps
TTL buffer output	2400 ps

- ECL outputs that drive 50 Ω loads
- Fast turnaround time of six weeks
- 150-member SSI/MSI macro library

SFOXIL Gate Arrays Product Matrix

Array	Gates	Equivalent Sites	Internal Sites	I/O & Packages	Literature
ATE6000	6600	2200	120	153-pin PGA	CA
ATE2000	2200	800	72	119-pin PGA	CA
ATE1000	1100	360	36	44-pin PLCC	CA

Process and Transistor Characteristics

Process Description		BEST-1 (Self-aligned, oxide-isolated, double-poly process)	SFOXIL (Oxide-isolated)
Introduction		1989	1987
f_T (typ)		14 GHz	5 GHz
Ring Osc. Delay		80 ps @ 2 mW	200 ps @ 5 mW
Speed x Power		0.16 pJ	1.0 pJ
Gain (h_{FE})		70—160	80
No. Mask Levels		16	13
Capacitance:	E-B	11 fF	39 fF
	C-B	9 fF	55 fF
	C-S	28 fF	95 fF
Resistance:	Re	64 Ω	13 Ω
	Rb	420 Ω	1000 Ω
Min. Emitter Size		1.5 µm x 1.5 µm	1.5 µm x 6.5 µm
Transistor Size		280 μm^2	600 μm^2
Interconnect		3 LM + local poly	3 LM
Gate Density in 400 mil^2		20K	6K

For additional information, call your AT&T Account Manager, or call 1-800-372-2774.

High-Performance ECL Standard-Cell ASICs

In addition to the BEST-1 gate-array series, AT&T Microelectronics also offers BEST-1 standard-cell ASIC design solutions. The BEST-1 standard-cell product line provides the designer with the flexibility to implement high-speed, low-power ASICs while optimizing IC performance and die size. A common gate-array/standard-cell library consists of 67 fully characterized function blocks and 63 TTL and ECL buffers. The function blocks in the BEST-1 library feature a speed/power tradeoff scheme with each function available in four performance levels. The library includes the basic digital functions necessary for implementing any high-performance, complex logic function.

Standard-cell ASIC products are also available designed in the SFOXIL technology. The SFOXIL library contains 150 fully characterized function blocks. There are four different speed-versus-power levels available in addition to other design techniques to adjust the speed/power ratio.

Designs can initially be captured in SFOXIL and migrate into BEST-1 as the performance requirements increase through system life.

The common gate-array/standard-cell library can be made available to customers for schematic capture with *Viewlogic*. AT&T can also perform the entire design on a turnkey basis. The placement and interconnect layout are optimized by AT&T with the customer's input and die-size requirements. This interaction results in a minimum die size and optimum performance consistent with customer objectives.

The standard-cell design approach offers performance and cost advantages similar to a full-custom design, but without the extensive development and characterization typical of full-custom circuits. Standard-cell designs also provide faster turnaround time, excellent design flexibility, and a more competitive NRE investment than full-custom designs.

Standard-Cell Benefits

- Device size versatility. Die layout is customized to minimize chip size.
- Optimum device performance. Placement, layout, and signal routing are designed to generate optimum die performance.
- Cost-effectiveness. A standard-cell design can be smaller and therefore lower cost than the same function implemented as a gate array.
- Customized signal count. Standard-cell designs use the buffer area for exactly the num ber of I/Os needed, whereas gate arrays can underuse buffer sites.
- Customized gate count. The BEST-1 gate-array series includes fixed 1K, 2K, and 4K gate counts. Designs requiring any other number of gates up to approximately 20K can be more efficiently implemented as standard-cell designs.
- Package versatility. The standard-cell ASIC layout can be tailored to fit customer-specific package requirements.

High-Performance ECL Full-Custom ASICs

AT&T Microelectronics also supports full-custom design solutions based on both BEST-1 and SFOXIL. Unspecified functions currently not contained in the cell library can be created and inserted in any standard-cell design.

Once fabricated and characterized, any new function block can be added to the library for future use. The complete design can, of course, be full custom. To facilitate this approach, the transistor and discrete component models are available in a *PSPICE* format on a 5 in. floppy disk. A design can be captured based on these *PSPICE* models. Mask generation information can be accepted in a *GDSII Stream* format. This approach takes full advantage of the high-performance transistors in these leading-edge technologies.

Mixed Signal Standard-Cell ASICs

The BEST-1 standard-cell library is being expanded to include function blocks for RF and IF analog signal processing for cordless and cellular telephone applications.

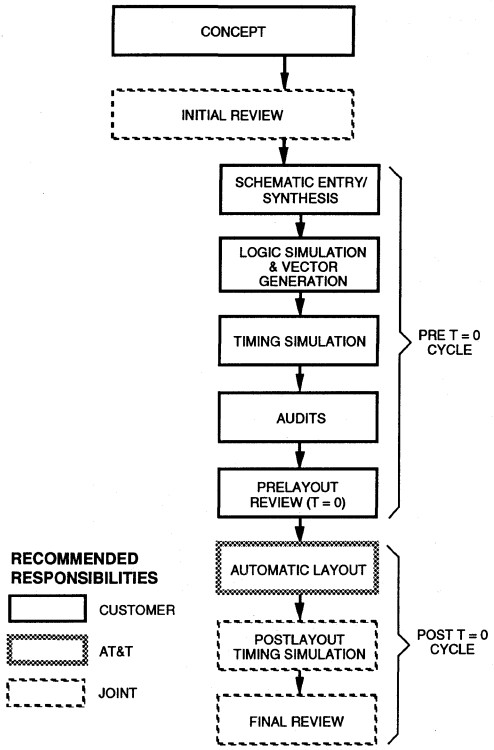
AT&T Microelectronics' cell-based, submicron CMOS technologies offer space-efficient, high-density, semicustom ICs—designs with the flexibility of full-custom circuits at significantly increased performance levels. Our capabilities include 3 V/5 V CMOS libraries of standard cells, synthesized combination cells, automatically compiled digital and memory macroblocks, analog cells, and industry-standard macrocells.

With a solid foundation of technological innovation and the resources of AT&T Bell Laboratories, it's no wonder that we are one of the world's leading producers of cell-based ASICs. But there's more to our success than high production levels. Our cell-based ASIC designs achieve greater than 120 MHz clock speed with exceptionally high first-time success rates and fast ramp-up to full production.

The AT&T Microelectronics commitment to design success continues through manufacturing. Prototypes are built and ac-tested on the same high-volume manufacturing lines that ultimately support production quantities. The same rigorous tests used to verify the design in simulation are used to guarantee the performance of every manufactured part, both at the system and chip level.

Sophisticated designs and state-of-the-art software development tools, coupled with high-volume manufacturing capabilities and high first-time success rates, have made AT&T Microelectronics the leader in the industry. We'd like to put our experience to work for you. Together we can design successful products that deliver performance for your business.

ASIC Design Cycle



Design kit support for AT&T Design Tools, *Mentor Graphics, Verilog/Amadeus, Viewlogic, IKOS, Synopsys,* and Quad Motive.

Industry-Standard Macrocells

Device*	Description	Literature
80C31	8-Bit Controller	DS
16C550A	UART with FIFO	DS
16C450A	UART	DS
82C37	DMA Controller	DS
82C59	Interrupt Controller	DS
146818	Real-Time Clock	DS
74LS612	Memory Mapper	DS
82C54	Programmable Timer	DS
82C55A	Programmable Peripheral Interface	DS
85C30	Serial Comm. Controller	DS
C25	16-Bit DSP	DS
C15	16-Bit Fixed-Point DSP	DS
196KB/KB+	16-Bit Microcontroller	DS
83C90	Ethernet Controller	DS
82365	PCMCIA Host Controller	DS
PCIU	PCMCIA Card Interface Unit (card side)	DS
53C94	SCSI Disk Controller	DS

*Functional equivalent.

HL400C: 3 V Optimized High-Performance, Low-Power, CMOS Standard-Cell Library

AT&T's leading-edge CMOS HL400C Standard-Cell Library enhances performance by 100% over the AT&T LP600C Library, offering up to 70% improvement in chip packing densities. System clock speeds up to 120 MHz are now achievable for 3 V systems, with significant power savings. AT&T's state-of-the-art 0.5 µm (drawn) gate 3LM technology is optimized specifically for 3 V applications. The typical gate delay for a two-input NAND gate is 0.33 ns (3.3 V, 25 °C, nominal processing, fan-out of two plus 2 mm of metal wiring).

Advantages:

- High-performance 3 V optimized process
- Ultralow power
- High density
- Mixed analog/digital design

Features:

- 120 MHz full chip operation achievable
- Three levels of interconnect
- 5 V interface cells
- Support of industry-standard macrocells

Specifications:

Type	CMOS standard cell
Voltage	2.7 V to 3.6 V
Geometry	0.5 µm
Performance	330 ps
Raw Gate Size	Up to 150,000
Utilization	100%
I/O	500
Power	1.0 µW/Gate/MHz (FO = 1)
Literature	DB, PN

LP600C: Low-Power CMOS Standard-Cell Library

The Low-Power LP600C Library will enhance performance by up to 30% over the previous-generation technology. Systems clock speeds up to 75 MHz are now achievable for 3 V systems, with power savings up to 60% over 5 V systems. When combined with three levels of interconnect, high-performance, compact standard-cell designs can be produced. Designers developing power-sensitive, portable systems (e.g., notebook and pen-based computers, cellular) will find their task simplified, and they will be able to keep pace with the higher-performance requirements while conserving power.

Advantages:

- Fully characterized 3 V standard-cell library
- Allows for tighter packing density
- Power savings up to 60% over 5 V solution
- Expands the use of low-cost plastic packaging

Features:

- System clock speeds 75 MHz achievable
- 3 V industry macrocells
- 3 V memories up to 256 kbits/s
- Supports mixing of 5 V/3 V logic in the core or I/O

Specifications:

Type	CMOS standard cell
Voltage	2.7 V to 3.9 V
Geometry	0.6 µm
Performance	200 ps
Raw Gate Size	Up to 150,000
Utilization	100%
I/O	500
Power	1.0 µW/Gate/MHz (FO = 1)
Literature	DB, PN

HS600C: High-Speed CMOS Standard-Cell Library

The High-Speed HS600C Library will enhance performance by 30% over the previous-generation technology. System clock speeds up to 100 MHz are now achievable. When combined with three levels of interconnect, high-performance, compact standard-cell designs can be produced. Designers developing high-performance systems such as workstations, video, and memory interfaces will find their task simplified, and they will be able to keep pace with the higher-performance requirements.

Advantages:

- High performance
- High chip density
- High I/O current drive for buses

Features:

- System clock speeds 100 MHz achievable
- Buffer drives up to 48 mA and support of ECL, TTL, and CMOS I/O
- Support of industry-standard macrocells
- Three levels of interconnect

Specifications:

Type	CMOS standard cell
Voltage	5 V ± 10%
Geometry	0.6 µm
Performance	125 ps
Raw Gate Size	Up to 150,000
Utilization	100%
I/O	500
Power	2.3 µW/Gate/MHz (FO = 1)
Literature	DB, PN

LP900C: Low-Power CMOS Standard-Cell Library

AT&T's LP900C CMOS Standard-Cell Library uses a two-level metal technology with low-resistance polysilicide as a third level of routing. The compact design with low power consumption makes this library ideal for battery-powered systems. The LP900C library offers designers the flexibility to mix 5 V and 3 V cells during the transition from 5 V technology to 3 V technology without simulation or errors.

Advantages:

- Power savings up to 60% over 5 V solutions
- Mixed analog/digital design

Features:

- Low standby current for battery operation (typical IDDQ 200 nA)
- Fully characterized 3 V library
- Support boundary scan and BIST
- Family of 3 V industry-standard macrocells
- Concurrent layout placement of 3 V/5 V cells
- Mixed 3 V/5 V core and I/O cells
- Single pass delay calculation for mixed 3 V/5 V designs

Specifications:

Type	CMOS standard cell
Voltage	2.7 V to 3.9 V
Geometry	0.9 µm
Performance	270 ps
Raw Gate Size	Up to 150,000
Utilization	100%
I/O	500
Power	1.1 µW/Gate/MHz (FO = 1)
Literature	DB, PN

HS900C: High-Speed CMOS Standard-Cell Library

AT&T's HS900C CMOS Standard-Cell Library uses a two-level metal technology with low-resistance polysilicide as a third level of routing. The combination of three routing levels and standard cells produces a compact, low-power design with high-performance.

Advantages:

- High performance
- Mixed analog/digital design
- High I/O current drive for buses

Features:

- Support of industry standard macrocells
- Buffer drives up to 48 mA and support of ECL
- Three levels of interconnect
- 75 MHz system clock designs achievable
- Up to 250K bits of fast SRAM

Specifications:

Type	CMOS standard cell
Voltage	5 V ± 10%
Geometry	0.9 µm
Performance	160 ps
Raw Gate Size	Up to 150,000
Utilization	100%
I/O	500
Power	2.5 µW/Gate/MHz (FO = 1)
Literature	DB, PN

ATT656 SERIES CMOS GATE ARRAYS

The ATT656 series of CMOS gate arrays combines the leading edge technology necessary for high-performance products with design capability, service, and high quality. This combined capability helps to increase both system performance and integration, while reducing the design cycle time.

The ATT656 series is manufactured by using a 0.75 µm channel length Si-gate CMOS triple-layer metal technology. A sea of gates architecture is used on the ten base arrays which provide a range of 5,000 to 177,000 equivalent gates and up to 448 I/Os. The typical gate delay for a two-input NAND gate is 270 ps (5.0 V, 25 °C, nominal processing, fan-out of 1). The device performance and cell libraries are compatible with the *NEC* gate array families (CMOS-6, CMOS-6A).

AT&T provides design kits containing schematic libraries, simulation libraries, application software, and documentation. ATT656 series gate array design kits are available for the AT&T Design System, *Mentor Graphics, Synopsys, Viewlogic*, and *Verilog*.

The ATT656 series is also an integral part of AT&T's product migration capability which allows the gate arrays to be used as a prototyping vehicle for the AT&T standard-cell devices or as a cost-reduction vehicle for FPGAs. This methodology also provides for fast prototyping of the ATT656 series gate arrays with FPGAs to drastically reduce a product's time to market.

Features

- CMOS Si-gate triple-layer metal process technology; 0.75 µm effective channel length.
- 270 ps typical gate delay (two-input NAND, fan-out = 1, V_{DD} = 5 V, T_A = 25 °C)
- Channelless architecture for maximum layout flexibility
- Ten array sizes from 5,000 to 177,000 available gates
- Workstation support includes the AT&T Design System, *Mentor Graphics, Synopsys, Verilog,* and *Viewlogic*
- Design synthesis supported through *Synopsys*
- Typically over 65% to 80% utilization for triple-layer metal arrays; 45% to 65% utilization for double-layer metal arrays
- Migration path offered between FPGAs, gate arrays, and standard cells
- Extensive library of macrocells, I/O buffers, macrofunctions, and standard memory configurations
- Up to 448 signal I/Os with choice of:
  - — Input, output, or bidirectional buffers
  - — Additional power pads
  - — CMOS or TTL input levels
  - — Schmitt trigger inputs
  - — CMOS or TTL output levels
  - — Buffer driven up to 36 mA
- Internal power dissipation <8 µW/gate/MHz
- Diversified package offering
- Licensed second source to *NEC*

ATT656 Series Gate Array Features

Part No.	Available Gates	Estimated Usable Gates 50% Memory	Estimated Usable Gates All Logic	I/O Pins	Literature
2LM					
ATT65630	5,000	3,200	2,200	84	DB, PN
ATT65636	8,000	5,200	3,600	100	DB, PN
ATT65640	11,000	7,200	5,000	120	DB, PN
ATT65646	16,000	10,400	7,200	140	DB, PN
ATT65650	21,000	13,600	9,400	160	DB, PN
ATT65654	30,000	19,500	13,500	192	DB, PN
3LM					
ATT65658	42,000	33,600	27,300	220	DB, PN
ATT65664	72,000	57,600	46,800	288	DB, PN
ATT65672	119,000	95,200	77,400	368	DB, PN
ATT65676	177,000	141,600	115,000	448	DB, PN

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

INTEGRATED CIRCUIT PACKAGING

As the industry's need for higher power ranges and tighter packing densities drives packaging requirements, AT&T Microelectronics has maintained a leading position through its research role, its input to standards-setting bodies such as JEDEC, and its compliance with evolving federal semiconductor standards and regulations.

AT&T Microelectronics has helped to formulate many standards, such as the corner bumper features in the plastic, quad flat pack family of packaging. In addition, AT&T Microelectronics offers packaging support services such as CAD and CAM systems and state-of-the-art assembly and testing procedures, plus many other IC services.

AT&T Microelectronics' ICs are available in the following technologies:

- Ceramic with multilayer metallization
- Plastic with multilayer metallization
- Postmolded plastic with single-layer metallization

Two types of packages are available in these technologies: through-hole mount and surface-mount.

Through-Hole-Mount Packages

Two of the most popular through-hole configurations are dual-in-line packages (DIPs) and pin grid arrays (PGAs). DIPs are available in postmolded plastic or ceramic; PGA packages are constructed in ceramic or in multilayer plastic. The tables that follow present complete details on the characteristics and package dimensions for each configuration AT&T supports.

Surface-Mount Packages

Today's assembly methods and higher-density packaging needs have created a new generation of surface-mount packages. They can be directly attached to metallized footprints located on the surface of the PC board, which reduces required component size and allows both sides of the board to be used.

As a result, surface-mount technology offers significant improvements in circuit densities. These packages are ideally suited for high-frequency applications and are used with automated component-placement equipment.

Among the surface-mount packages of particular interest are the quad flat pack packages with leadless chip carriers (40 and 50 mils on center), leaded chip carriers (50 mils on center), and fine-pitch leaded chip carriers (25 and 20 mils on center). In-line packages are also available in small-outline packages (50 mils on center).

Through-Hole-Mount Packages

		Number of Leads/Pins	Lead/Pin Spacing (in.)	Package Dimensions (in.) Maximum Length*	Maximum Width*	Nominal Height Above Board
Plastic Dual In-Line Package		8	0.100	0.400	0.320	0.140
		14	0.100	0.810	0.320	0.140
		16	0.100	0.810	0.320	0.140
		18	0.100	0.920	0.320	0.140
		20	0.100	1.040	0.320	0.140
		22 Skinny	0.100	1.095	0.325	0.140
		24	0.100	1.270	0.615	0.140
		24 Skinny	0.100	1.265	0.325	0.140
		28	0.100	1.470	0.615	0.140
		28 Skinny	0.100	1.355	0.325	0.140
		32	0.100	1.650	0.610	0.140
		40	0.100	2.070	0.625	0.140
		48	0.100	2.450	0.625	0.140
Ceramic Dual In-Line Package		16 Short	0.100	0.785	0.325	0.170
		16	0.100	0.815	0.325	0.170
		18	0.100	0.915	0.325	0.170
		20	0.100	1.015	0.325	0.170
		24	0.100	1.212	0.625	0.185
		28	0.100	1.412	0.625	0.185
		32	0.100	1.625	0.625	0.185
		40	0.100	2.020	0.625	0.185
		48	0.100	2.420	0.625	0.185
Ceramic Pin Grid Array Packaging	11 x 11 Array	68	0.100	1.120	1.120	0.157
	12 x 12 Array	84	0.100	1.272	1.272	0.157
	11 x 11 Array	85	0.100	1.172	1.172	0.147
	13 x 13 Array	101	0.100	1.372	1.372	0.157
		120	0.100	1.372	1.372	0.157
		125	0.100	1.372	1.372	0.165
	14 x 14 Array	132	0.100	1.475	1.475	0.135
	13 x 13 Array	133	0.100	1.372	1.372	0.165
		145	0.100	1.372	1.372	0.165
	15 x 15 Array	149	0.100	1.576	1.576	0.157
		153	0.100	1.576	1.576	0.157
		224	0.100	1.576	1.576	0.165
	16 x 16	159	0.100	1.676	1.676	0.175
		175	0.100	1.676	1.676	0.160
	17 x 17	225	0.100	1.768	1.768	0.170
	19 x 19	280	0.100	1.918	1.918	0.160

* Includes leads where applicable.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Through-Hole-Mount Packages (continued)

		Number of Leads/Pins	Lead/Pin Spacing (in.)	Package Dimensions (in.) Maximum Length*	Maximum Width*	Nominal Height Above Board
Plastic, Multilayer Pin Grid Array Package	12 x 12 Array	104	0.100	1.890	1.185	0.145
	13 x 13 Array	104	0.100	1.373	1.373	0.155
		121	0.100	1.373	1.373	0.155
	14 x 14 Array	132	0.100	1.475	1.475	0.150
	13 x 13 Array	133	0.100	1.373	1.373	0.155
	15 x 15 Array	149	0.100	1.576	1.576	0.155
	16 x 16 Array	155	0.100	1.676	1.676	0.150
		159	0.100	1.676	1.676	0.150
		175	0.100	1.676	1.676	0.150
	17 x 17 Array	225	0.100	1.778	1.778	0.180
	18 x 18 Array	223	0.100	1.879	1.879	0.150
	20 x 20 Array	299	0.100	2.079	2.079	0.150

* Includes leads where applicable.

Surface-Mount Packages

	Number of Leads/ Pins	Lead/Pin Spacing (in.)	Package Dimensions (in.) Maximum Length*	Maximum Width*	Nominal Height Above Board
Plastic, Small-Outline J-Lead	16	0.50	0.410	0.347	0.125
	20	0.50	0.510	0.347	0.125
	24	0.50	0.610	0.347	0.125
	28	0.50	0.710	0.347	0.125
Plastic, Small-Outline J-Lead — Narrow Body	8	0.50	0.200	0.243	0.070
	14	0.50	0.348	0.243	0.070
	16	0.50	0.398	0.243	0.070
Plastic, Small-Outline Thin Butt	28	0.50	0.710	0.300	0.070
Plastic, Small-Outline Gull Wing	16	0.50	0.410	0.408	0.105
	20	0.50	0.510	0.408	0.105
	28	0.50	0.710	0.408	0.105
Plastic, Leaded Chip Carrier	20	0.50	0.352	0.352	0.180
	28	0.50	0.453	0.453	0.180
	44	0.50	0.653	0.653	0.180
	52	0.50	0.753	0.753	0.180
	68	0.50	0.954	0.954	0.200
	84	0.50	1.154	1.154	0.200
	100	0.50	1.345	1.345	0.200

* Includes leads where applicable.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Surface-Mount Packages (continued)

	Number of Leads/ Pins	Lead/Pin Spacing (in.)	Package Dimensions (in.) Maximum Length*	Maximum Width*	Nominal Height Above Board
Plastic, Quad Flat Pack (JEDEC)	84	25.0	650.0†	650.0†	180.0
	100	25.0	750.0†	750.0†	180.0
	132	25.0	950.0†	950.0†	180.0
	164	25.0	1150.0†	1150.0†	180.0
Plastic, Quad Flat Pack (EIAJ)	44	0.031 (0.80)	0.393 (10.00)	0.393 (10.00)	0.092 (2.35)
QFP	80	0.031 (0.80)	0.551 (20.00)	0.551 (14.00)	0.129 (3.30)
( ) = Dimensions in millimeters	100	0.025 (0.65)	0.551 (20.00)	0.551 (14.00)	0.129 (3.30)
	120	0.031 (0.80)	1.102 (28.00)	1.102 (28.00)	0.160 (4.07)
	160	0.025 (0.65)	1.102 (28.00)	1.102 (28.00)	0.160 (3.00)
Plastic, Quad Flat Pack (EIAJ)	128	0.019 (0.50)	0.551 (20.00)	0.551 (14.00)	0.129 (3.75)
SQFP	208	0.019 (0.50)	1.102 (28.00)	1.102 (28.00)	0.160 (3.75)
( ) = Dimensions in millimeters	240	0.019 (0.50)	1.259 (32.00)	1.259 (32.00)	0.165 (3.75)
	304	0.019 (0.50)	1.574 (40.00)	1.574 (40.00)	0.177 (4.50)
Quad Flat Pack (EIAJ)	48	0.019 (0.50)	0.275 (7.00)	0.275 (7.00)	63 (1.60)
TQFP	64	0.019 (0.50)	0.393 (10.00)	0.393 (10.00)	63 (1.60)
( ) = Dimensions in millimeters	100	0.019 (0.50)	0.551 (14.00)	0.551 (14.00)	63 (1.60)
	144	0.019 (0.50)	0.787 (20.00)	0.787 (20.00)	63 (1.60)
	176	0.019 (0.50)	0.944 (24.00)	0.944 (24.00)	63 (1.60)
Leaded, Fine-Pitch, Ceramic Chip Carrier	132	0.025	1.140	1.140	0.118
	256	0.020	1.670	1.670	0.118
Leadless, Ceramic Chip Carrier	16	0.050	0.256	0.256	0.100
	18	0.050	0.775	0.350	0.083
	24	0.050	0.410	0.410	0.100
	28	0.040	0.325	0.325	0.100
	30	0.050	0.730	0.350	0.083
	32	0.040	0.425	0.425	0.100
	48	0.040	0.566	0.566	0.100
	68	0.050	0.960	0.960	0.115
	100	0.050	1.365	1.365	0.115

* Includes leads where applicable.
† PQFP dimensions do not include bumpers.
For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

CUSTOM MULTICHIP MODULES

When your design calls for fully tested, functional subassemblies, choose AT&T's custom hybrid integrated circuits. Multichip modules reduce the space needed by conventional ICs; they fit into extra-compact component designs, plus offer advantages in their ability to execute complex functions. That's like getting an ideal compromise between an ASIC and a circuit board.

These custom multichip modules contain packaged or unpackaged integrated circuits and discrete or integrated passive devices, including optical components. They are substrates, usually ceramic with thin-film conductors, integral passive components such as resistors and capacitors, and appliqued components. These integrated circuits are joined to their next higher level of interconnection with leads or pins, either through hole or surface mount.

Features and Capabilities

AT&T's multichip modules bring performance and flexibility to your design requirements. Some key features include:

Performance

- High-stability resistor and capacitor technology with tight component tolerances, ratios, and tracking capabilities
- Low parasitics and controlled impedances
- Excellent thermal performance
- High conductivity with copper or noble-metal conductor systems
- Minimum propagation delay

Flexibility

- Efficient electronic packaging via interconnecting various IC technologies, such as MOS and bipolar, on one hybrid
- Cost-effective, high-quality film components with standard or tailored values
- Quick modification with minimal production-schedule restraints
- JEDEC-standard surface-mount formats available

Modularity

- Pretuned and tested modules to meet critical functional requirements
- Pretested hybrid ICs improve system yields and reduce diagnostic and repair costs

Take Advantage of AT&T's Custom Design Services

When you have developed your circuit specifications, call our Multichip Module Design Engineers at 1-800-372-2447. They'll work with you to partition and develop a hybrid version of your circuit design to help ensure maximum benefit.

Packaging Options

Several physical packaging options exist for your hybrid IC. Standard SIPs and DIPs are often the most cost-effective solution, but options such as surface mount, leaded, and unleaded are also available.

Advantages include secure environmental, chemical, and mechanical protection with the epoxy-based molded packaging material that encapsulates these ICs and conforms to JEDEC standards. You also get the benefit of standard design dimensions compatible with standard automated handling and insertion robotics. Surface-mount applications are among the many recommended uses for these ICs.

Choose the POLYHIC for Multichip Applications

The POLYHIC is a significant advancement in multichip technology. It combines the benefits of copper thin-film with a polymer process to produce conductor layers separated by an AT&T-patented polymer film. The result is a high-performance packaging medium which can accommodate many more interconnections than single-layer hybrids—and does so within tight packaging requirements.

POLYHIC packaging is suited for digital or analog designs that require high trace densities and/or bandwidths of 2 GHz or greater. It's also ideal for data bus applications requiring conductor lengths to be minimized, controlled, and consistent to help ensure uniform delays.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

CUSTOM PRINTED-CIRCUIT BOARDS AND BACKPLANES

AT&T Microelectronics' high-density, multilayer printed-circuit boards (PC boards) offer high levels of precision and performance for applications up to 22 layers and standard line widths and spaces down to 5 mils.

Choose from conventional plated holes, or select buried microvias to conserve surface area when using surface-mount components extensively. All PC boards are UL-approved, and meet both Bellcore and IPC specifications. In addition, they're thoroughly electrically tested and inspected before being shipped to you.

AT&T Microelectronics' PC boards are custom double-sided rigid and multilayer and are available in these substrates:

- FR4
- BT (bismaleimide triazine)
- Materials for lower dielectric constant applications

Surface finishes include solder mask over bare copper with hot-air solder leveling, plus several alternative solder masks.

Standard high-density capabilities include line width and spacing to 0.005 inches and drilled hole size to 0.0135 inches with 0.025-inch lands on external layers. Most models are available in five days—quality-tested and ready for your system testing.

AT&T's backplanes are available with your choice of components. We will assemble your backplane design with connectors on standard or metric grids, with *Fastech*® or other pins, and with passive and/or active components. Large sizes up to 24 inches x 24 inches are available. All backplanes are electrically tested, including level III testing when active components are part of your design.

Total quality control (TQC) and statistical process control (SPC) programs are combined with full electrical testing to help produce reliable, defect-free boards.

Personalized service from dedicated field engineers is available to all customers who wish support in the early design phases through volume production.

Additional features include:

- Up to 22 layers for interconnection density
- Surface-mount technology
- Standard via, blind via, and buried microvia technologies

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Fastech Interconnection System

The *Fastech* Integrated Packaging System consists of proven interchangeable hardware components that can provide a variety of packaging arrangements. This provides design flexibility, cost reductions, and time savings for the user. This system is a complete shelf assembly that supports both the circuit packs and the pin populated backplane. *Fastech* compatible plug-in power units are also available. This system features a wide selection of standard circuit pack sizes, and pinouts of 50 to 400 I/Os per circuit pack connector. It also offers high reliability, simplified assembly, and computer aids that provide automatic circuit routing and computer-generated documentation. Some other specific features of the *Fastech* system are shown below

Circuit Pack Connectors

- Can be used with single- or double-sided printed-wiring boards
- Can be used with multilayered boards
- Come in a wide range of standard sizes and I/Os
- Provide keying capability

Coax and Lightguide Modules

- Permit mixing of standard pin and socket interconnections with high-performance coaxial or lightguide connections
- Have three modules available: dual-coax, dual-fiber, and multifiber
- Can have up to four modules attached to the circuit pack connector

Apparatus Mountings

- Have circuit pack mounting centers on 1/4 inch multiples with 1/2 inch minimum spacing between packs
- Come in many different size arrangements or single width shelves
- Have snap-in card guides

Backplanes

- Use a wide variety of compliant section pins compatible with *Fastech* Packaging System connectors on 0.125 inch grid
- Have either hand or automatic wire wrap capability
- Have up to three levels of sequencing available
- Have shorting contacts available
- Can use cable connectors

Metral Interconnection System

The *Metral* Interconnection System is a modular interconnection system on 2 mm (0.079") centers. The basic building block module is 12 mm long and 4 rows wide (accommodating 24 signal contacts) with 4 x 6, 4 x 12, 4 x 24, and 4 x 48 module sizes available. It is designed to be stacked end-to-end on the card edge or backplane without loss of position. In addition to the signal modules, other modules can be integrated into the same form factor. I/O possibilities include fiber-optic or coaxial ports. Eight-pin power modules fit into the same 12 mm form factor. The *Metral* Interconnection System is a reverse system with the pins on the backplane and the sockets on the circuit pack.

Benefits

- Maximum design flexibility
- Full range of customer needs, allowing for easy integration of power, coaxial, and fiber modules
- Increased density over DIN products while positioned as a true global standard
- Industry-standard product providing multiple sources of supply and lower-cost solution
- More I/Os per card
- Reduced system cost
- Compatibility with SMT and through hole
- Enhanced electrical performance (shorter stub length, more grounds, less skew, and shorter electrical length)

Features

- Complete modular system
- Complete interconnection system
  - — Backplane/circuit pack connectors
  - — Cable connectors
  - — Fiber-optic and coaxial connectors
  - — Shielded (EMC) connectors
  - — Power connectors
- End-to-end stackability with no loss of position
- Metric system based on 2 mm grid
- Accepted IEEE *Futurebus+* connector system
- Surface-mount or through-hole configurations
- 456 signal positions on a double-high (6U) Eurocard or on a 10.50" (266.7 mm) circuit pack
- Compatible with Eurocard hardware and 0.6" card-to-card spacing

Low-Profile Insulation Displacement Connectors (IDC) (963T)

Features

- 0.600" connector profile (front-to-back)
- 0.125" contact spacing
- 0.100" contact spacing in development
- Stackable (side-to-side or end-to-end)
- Field-repairable
- Qualified for 28- through 22-gauge solid conductor wire (qualification is planned for stranded wires)

Paddleboard Connectors (982)

The paddleboard backplane connectors interface with the wiring side of a backplane pinfield. These connectors provide termination to discrete wires, ribbon cable, coaxial or triaxial cable, and various discrete components.

Features

- Flexibility to terminate both cable and discrete components on a paddleboard
- Available in a wide variety of sizes
- Two connections per contact permit daisy-chaining on the backplane
- Strain-relief for wire and ribbon cable
- Stackable side to side or end to end
- Compatibility with full-body and end retainers
- Connectors are ultrasonically bonded to the printed-circuit board (paddleboard)

Coaxial Backplane Connectors (9821)

9821-type coaxial connectors are similar to 982-type paddleboard connectors but are equipped with special ferrules to permit termination of subminiature coaxial cable (approximately 0.090" or 0.120" diameter).

Features

- Terminates multiple coaxial cables to the wiring side of backplanes
- Provides for a variety of cable routing directions
- Solder and ferrules used for highly reliable coaxial termination

Edgecard Connectors

AT&T Microelectronics manufactures two types of edgecard, one-piece, printed-circuit connectors. They were developed to be used with the TRANSPAC hardware used in digital transmission systems. The edgecard connectors mate with precious metal-plated fingers on a printed-circuit board. The contacts are on either 0.125" spacing (single-density) or 0.0625" spacing (double-density). Several sizes are available with up to 198 contacts per connector.

KS-21479 Single-Density Edgecard Connectors (SDE 1203 Series)

Features

- All contacts are individually replaceable
- Cost-effective connector for I/O needs ≤100
- Shorting-contact feature
- Sequencing capability
- Terminals available for solderless wrap and connectorization
- Designed to mate with 0.062" thick printed-circuit boards with gold-plated fingers

KS-22766 Double-Density Edgecard Connector (DDS 1200 Series)

Features

- Provides for higher-density edgecard applications
- From 50 to 198 I/Os
- Shorting contacts
- All contacts are individually replaceable
- Provides for wire-wrap and connectorization applications

Optical Connectors Dual-Fiber Module Connectors (9638A/B)

The Dual-Fiber Modular Connector is attached to the printed-circuit board with two self-threading screws into mounting ears that interlock with the adjacent 963CM or other module. The optical contacts and their accompanying fibers are inserted into the 9638A after all soldering operations on the printed-circuit board and 963CM are completed. The 9638B is attached to the backplane by using the snap-fit pegs provided.

Features

- Up to two optical connections per module
- Fibers can be inserted or removed regardless of whether the connector is in its mated or unmated condition
- Built-in alignment system

Panel-Mount Multifiber Array Connector (MAC) (9630B)

Features

- Automatic alignment and connection of up to 18 fibers
- Molded from flame-retardant plastics
- Snap-fit assembly
- Protects exposed fiber ends when connectors are unmated
- Can be mounted on any wall between 0.030" and 0.100" thick
- Comes with a strain-relief/bend-radius limiter

Multifiber Array Connector (MACII) (9630)

The 9633 Multifiber Array Connector (MACII) Product Family can be used for circuit pack to backplane or panel mount interconnection. When used with circuit packs in a *Fastech* system, the minimum board spacing is 0.75 inches. These connectors allow the interconnection of between 2 and 18 optical fibers. The circuit pack version is available in two designs: one is a stand-alone connector, the other is a modular connector. The modular version interlocks with other optical or electrical modules to provide a variety of interconnection options at the board edge.

MACII connectors can be used to interconnect fiber with an outside diameter of between 120 μm minimum and 170 μm maximum. When 62.5/125 μm, multimode fiber is used with 0.87 μm wave-

length and short launch and receive conditions, average loss is less than 0.5 dB. When 8.3/125μm, single-mode fiber is used with 1.3μm wavelength, average loss is less than 0.7 dB. Index matching fluid is not used with the MACII connector.

Features

- Capable of integrating up to 18 discrete fibers
- Compact size: 0.5" x 0.6" x 2.26"
- Less than 0.6 dB average loss using 50/125 μm fiber
- Constructed by using corrosion-resistant metals and flame-retardant plastics

Smart Optical Connector (SOC)

The AT&T Smart Optical Connector (SOC) is a fiber-optic connector subsystem that provides optical driving and receiving function for cabinet-level custom applications. The device contains optical transmitter and receiver components and uses cabinet-supplied 5 V power and ground connections through the miniature ribbon connector. The transmitter and receiver are compatible with 62.5/125 μm and 50/125 μm multimode fiber. The positioning of the *ST*® Lightguide Cable Connectors can be changed for those applications requiring a different fiber routing.

Features

- Bit rate of 1 Mbit/s to 50 Mbits/s, NRZ
- LED transmitter: 875 μm or 1300 μm wavelength
- PIN receiver: 875 μm or 1300 μm wavelength
- 62.5/125 μm, multimode optical fiber as standard
- Link distances of up to 2 km
- Bit-error rate no greater than 10
- EMI/RFI-shielded package
- TTL compatible
- 25-pair, miniature ribbon electri cal connector and *ST* Lightguide Cable Connectors
- Multicabinet interface

Centronic Surface-Mount Parallel Port Connector (1204-Type)

The 1204-Type Centronic connector can solve many of the most common assembly problems and make an all-SMT possible. It mates with industry-standard 36 contact ribbon plugs. Some of the problems solved by the 1204-Type connector include: the elimination of high mating force of cables, assurance of no missing bail locks, and compatibility with badly bowed PCBs.

Features

- True surface-mount design
- Right angle, 36-contact receptacle
- Captive bail locks remain secure
- Solder-plated lead tips ensure good solderability
- Preloaded leads to accommodate PCB warp
- Compliant leads for high reliability solder joints
- Solder joints accessible for inspection
- Consistent low insertion force of cable connector
- Alignment pegs ensure accurate location
- Corrosion-resistant stainless shell
- Panel mountable
- Stand-offs (0.20 in.) for easy flux cleaning

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Microinterconnect Multichip Module (MCM) Substrates

AT&T has developed silicon MCM substrates for low-power, high-density interconnect applications. These module substrates can accommodate microsurface mount flip-chip bonded ICs and may include built-in resistors and capacitors. The substrates feature aluminum metallization of up to three layers with polyimide dielectric. The use of Al–Ti–Ni–Au top metallization allows high-quality solder bumping for flip-chip applications. The use of standard silicon wafer processing technology provides high-quality, high-density substrates at a relatively low cost. Typical specifications for AT&T silicon MCM substrates are shown in the following tables.

Table 1. Typical Silicon MCM Substrate Specifications (Other specifications can be supplied to meet customer-specific needs.)

Interconnect Only:	
Substrate:	
Material	Polished silicon
Orientation	<100> or <111>
Min. Resistivity	0.008 Ω-cm
Thickness	10 mil—25 mil
Max. No. of Conducting Layers	2
Min. Aluminum Linewidth	10 μm
Max. Substrate Size	~1 cm square
Polyimide Properties:	
Dielectric Constant	2.9
Dielectric Isolation	–200 V

Table 2. Typical Silicon MCM Substrate Specifications
(Other specifications can be supplied to meet customer-specific needs.)

Passive:	
Substrate:	
Material	Polished silicon
Orientation	<100> or <111>
Min. Resistivity	0.008 Ω-cm
Thickness	10 mil—25 mil
Max. No. of Conducting Layers	2
Min. Aluminum Linewidth	10 μm
Max. Substrate Size	~1 cm square
Polyimide Properties:	
Dielectric Constant	2.9
Dielectric Isolation	–200 V
Capacitors:	
Specific Capacitance	33 nF/cm^2
Range	10 pF—10 nF
Tolerance	±10%
Max. Voltage	40 V
Resistors:	
Range	1 Ω—500 kΩ
Tolerance	±10%

Table 3. Typical Silicon MCM Substrate Specifications
(Other specifications can be supplied to meet customer-specific needs.)

Active:	
Substrate:	
Material	Polished silicon
Orientation	<100> or <111>
Min. Resistivity	0.008 Ω-cm
Thickness	10 mil—25 mil
Max. No. of Conducting Layers	2
Min. Aluminum Linewidth	10 μm
Max. Substrate Size	~1 cm square
Polyimide Properties:	
Dielectric Constant	2.9
Dielectric Isolation	–200 V
Transistors:	
Max. Blocking Voltage	25 V
Max. Current (Ic)	200 mA
Gain—NPN	30—50
Gain—PNP	5—10
Typical Oper. Voltage	5 V
Capacitors:	
Specific Capacitance	33 nF/cm²
Range	10 pF—10 nF
Tolerance	±10%
Max. Voltage	40 V
Resistors:	
Range	1 Ω—500 kΩ
Tolerance	±10%

Custom Silicon Epitaxial Wafers

EPI

AT&T has developed silicon epitaxial processes specifically designed for discrete-power MOSFET transistor/diode technologies as well as for high-density, silicon-gate CMOS and NMOS technologies. AT&T can provide N/N+, N/P, P/P+, or P/N epitaxial wafers. These wafer designs are based on manufacturing experience that has tailored wafer properties to chip yields. Silicon epitaxial wafers are processed in a Class 10 clean room, which is equipped with a state-of-the-art, electropolished, stainless-steel gas distribution system. Wafers processed in this area are routinely supplied to established AT&T production lines and OEM customers. From substrates to epitaxial deposition and testing, special emphasis has been placed on developing a technology to enhance wafer attributes, such as micro-perfection and wafer purity. AT&T can provide complete silicon-materials technology from one source. Typical specifications for AT&T discrete epitaxial wafers are shown in Table 1.

Features

- Epitaxial processing for wafer diameters from 2 in. to 150 mm
- User-engineered silicon
- Intrinsic/extrinsic gettering

Custom Silicon Processing & Packaging

Foundry

AT&T offers silicon processing specifically designed to support customer product/process development and production.

These customer-specified designs are processed in a Class 100 clean room, with fully equipped state-of-the-art wafer fab facilities. Applications processed in this area are routinely supplied to production lines and OEM customers for niche markets and nontraditional silicon-based products in addition to our traditional business of manufacturing discrete semiconductor components for AT&T products. Our production efforts are supported by on-site advanced analytical capabilities (i.e., EBIC, SEM, Auger, X-ray, spectroscopy) in our failure mode analysis and surface analysis laboratories. AT&T can provide complete silicon processing technology.

Packaging

AT&T provides component assembly and test manufacturing for SOT-23, SOT-143, T0-18, T0-92, T0-220, D0-15, and D0-35 packages. Capabilities include die handling, bonding, encapsulation, and testing. These packages are tailored for niche applications customized to meet your specific needs.

Table 1. Typical Specifications

(Other specifications can be supplied to meet customer-specific needs.)

Epitaxial Layer:	
Type	P-type
	N-type
Resistivity	0.05 Ω-cm—100 Ω-cm
	Gradient @ 6 mm dependent upon substrate concentration, backseal, and dopant type
Layer Thickness	2 µm—150 µm
	Gradient @ 6 mm <±5%
Flatness	Tailored to meet customer needs
Surface Inspection	Laser: Estek Wafer Inspection System (WIS)
Methods	Bright-light
	Interference contrast microscope
	Selective etching
Substrate:	
Specifications	Provided per customer requirements to semistandards
Diameter	2 in. to 150 mm

LIGHTWAVE PRODUCTS

AT&T Microelectronics is the world's largest supplier of components and subsystems for fiber-optic communications. AT&T Lightwave addresses the telecommunications and data communications markets, supplying a range of lasers, light-emitting diodes (LED), PIN photodiodes, and avalanche photodetectors (APD), as well as integrated transmitters and receivers.

In the data communications market, AT&T is extremely active in leading industry standards such as Fiber Distributed Data Interface (ANSI X3T9.5), Fibre Channel (ANSI X3T9.3), and Fiber Optic Ethernet (IEEE802.3/10Base-F/FOIRL). Compact, extremely reliable data links are available for applications ranging from 10 Mbits/s to 300 Mbits/s.

AT&T has a long history of supplying state-of-the-art products for the telecommunications market. Applications range from Fiber-to-the-Home (FTTH), to SONET, to 2.5 Gbits/s long-haul transmission, to undersea.

For these applications, AT&T is offering laser and detector components, transmitters, receivers, lithium niobate modulators, and advanced technology erbium-doped fiber amplifiers.

AT&T is also a leading player in the CATV and emerging Microcellular markets. AT&T's systems-level testing allows customers to repurchase fully characterized devices. Testing includes NTSC, PAL, and cellular frequency plans.

In addition to leading-edge products, AT&T Lightwave brings years of experience to the photonics industry. Drawing on the strength of Bell Laboratories, we offer outstanding technical support. With our large commitment to fiber optics, AT&T will enable you to take advantage of leading-edge products that enable you to get to the market sooner.

Components

Device Type	Part No.	Description	Application	Features	Lit.
Modulators	2112AA	1.3 μm 4 GHz bandwidth	High-speed telecommunications, analog CATV, SONET OC-64 Analog & digital cellular communications	Uses $LiNbO_3$ technology (Z-cut), Excellent linearity for analog applications, Configurable to customer specifications	DS
	2113AA	1.3 μm 8 GHz bandwidth			DS
	2122AA	1.55 μm 4 GHz bandwidth			DS
	2123AA	1.55 μm 8 GHz bandwidth			DS
	2124AA	1.55 μm 16 GHz bandwidth			DS
	2125A	1.55 μm 8 GHz bandwidth			DS
	2126A	1.3 μm 12 GHz bandwidth			DS
	2223AA	1.3 μm 8 GHz bandwidth dual output			DS
Photodetectors					
InGaAs APDs	126A	Ceramic Carrier 1.5 Gbits/s 1.5 GHz typical bandwidth	High-speed communications, high-speed analog transmissions Submarine cable communication systems	Compatible with industry standard ceramic carriers	DS
	126B	Ceramic Carrier 2.5 Gbits/s 2.0 GHz typical bandwidth			DS
	126C	Ceramic Carrier 2.5 Gbits/s 3.0 GHz typical bandwidth			DS
	127A	Industry std. pkg. 1.5 Gbits/s 1.5 GHz Biconic Connector	High-speed communications, high-speed analog transmissions Submarine cable communication systems	Suitable for use in harsh environments High coupling stability	DS
	127A1	Industry std. pkg. 1.5 Gbits/s 1.5 GHz FC-PC Connector			DS
	127B	Industry std. pkg. 2.5 Gbits/s 2.0 GHz Biconic Connector			DS
	127B1	Industry std. pkg. 2.5 Gbits/s 2.0 GHz FC-PC Connector			DS
	127C	Industry std. pkg. 2.5 Gbits/s 2.0 GHz Biconic Connector			DS
	127C1	Industry std. pkg. 2.5 Gbits/s 3.0 GHz FC-PC Connector			DS

Components (continued)

Device Type	Part No.	Description	Application	Features	Lit.
Photodetectors (continued)					
InGaAs PIN	131A	DGTL 8-lead DIP SM Pigtail	FITL, Analog CATV	Low-cost, wide operating temperature range	DS
	131B	DGTL 8-lead DIP MM Pigtail			DS
	131D	Analog 8-lead DIP SM Rotary mechanical splice		Wide bandwidth: >1 GHz High optical coupling stability	DS
	131E	Analog 8-lead DIP no connector			DS
	131G	Analog 8-lead DIP SM Rotary mechanical splice			DS
	131H	Analog 3-lead pkg. SM Connector			DS
	131J	Analog 3-lead pkg. SM Connector			DS
	131K	Digital 3-lead pkg. SM Rotary mechanical splice			DS
	131L	Analog 8-lead DIP SM Rotary mechanical splice			DS
	131N	Digital 8-lead DIP SM Rotary mechanical splice			DS
	131P	Analog 8-lead DIP SM FC/APC Connector			DS
	131R	Analog 8-lead DIP SM FC/PC Connector			DS
	131S	Analog 8-lead DIP SM FC/APC Connector			DS
	131T	Analog 8-lead DIP SM FC/PC Connector			
InGaAs PIN	137D	FC Receptacle, 3 leads 1.1 µm—1.6 µm	MANs, LAN, SM FDDI, SONET, ISDN	High responsivity, low capacitance, low dark current	DS
	137F	*ST* Receptacle, 3 leads 1.1 µm—1.6 µm			DS
	137G	SC Receptacle, 3 leads 1.1 µm—1.6 µm			DS
Laser Modules					
Fabry-Perot multi-frequency	237C	1.3 µm, FC Receptacle SONET, ISDN	MANs, LAN, SM FDDI, SONET, ISDN	No thermoelectric cooler, compact, hermetically sealed active components	DS
	237F	1.3 µm, *ST* Receptacle			DS
	237G	1.3 µm, SC Receptacle			DS
Fabry-Perot multi-frequency	245C	1.3 µm pigtail with FC Connector	MANs, LAN, SM FDDI, SONET, ISDN	No thermoelectric cooler, compact, hermetically sealed active components	DS
	245D	1.3 µm pigtail with *ST* Connector			DS
	245F	1.3 µm pigtail with DIN Connector			DS
	245G	1.3 µm pigtail with SC Connector			DS
Digital Distributed Feedback	246M	1.3 µm 14-pin butterfly package, 2.5 Gbits/s	SONET OC-12/48, long-haul	Internal isolator, compact & lightweight, epoxy-free, hermetic package	DS
	246N	1.55 µm 14-pin butterfly package, 2.5 Gbits/s			DS

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Laser Subsystems

Device Type	Part No.	Description	Application	Features	Lit.
Transmitters					
1.3 µm Fabry-Perot	1227C	200 Mbits/s, –5 dBm, FC-PC Connector	SONET OC3 or OC-12 single-mode FDDI	20-pin DIP package with pigtail, no thermoelectric cooler required	DS
	1227D	650 Mbits/s, –5 dBm, FC-PC Connector			DS
	1227E	200 Mbits/s, –8 dBm, FC-PC Connector			DS
	1227F	200 Mbits/s, –8 dBm, FC-PC Connector			DS
	1227G	650 Mbits/s, –8 dBm, FC-PC Connector			DS
	1227H	200 Mbits/s, –11 dBm, FC-PC Connector			DS
	1227J	200 Mbits/s, –5 dBm, *ST* Connector			DS
	1227K	650 Mbits/s, –5 dBm, *ST* Connector			DS
	1227L	200 Mbits/s, –8 dBm, *ST* Connector			DS
	1227M	200 Mbits/s, –8 dBm, *ST* Connector			DS
	1227N	650 Mbits/s, –8 dBm, *ST* Connector			DS
	1227P	200 Mbits/s, –11 dBm, *ST*			DS
	1227EB	Evaluation Board for 1227 transmitter			DS
1.3 µm Fabry-Perot	1235FF	Transmitter, 650 Mbits/s with heat sink	SONET	ac-coupled	DS
1.3 µm Fabry-Perot	1237C	200 Mbits/s, –5 dBm, FC-PC Connector	SONET OC-1, OC-3, or single-mode FDDI	Receptacled, 20-pin DIP No thermoelectric cooler required	DS
	1237E	200 Mbits/s, –8 dBm, FC-PC Connector			DS
	1237H	200 Mbits/s, –11 dBm, FC-PC Connector			DS
	1237J	200 Mbits/s, –5 dBm, *ST* Connector			DS
	1237L	200 Mbits/s, –8 dBm, *ST* Connector			DS
	1237P	200 Mbits/s, –11 dBm, *ST* Connector			DS
	1237T	200 Mbits/s, –11 dBm, FC-PC Connector			DS
	1237W	200 Mbits/s, –11 dBm, *ST* Connector			DS
High-Speed 1.3 µm Fabry-Perot	1238A	1062.5 Mbits/s, –8 dBm, SM-Pigtail meets sonet mask only not Fibre channel mask	Fibre channel, SONET, Serial HIPPI	Space-saving, self-contained 20-pin DIP, No thermoelectric cooler required	DS
	1238B				DS
	1238EB	Eval. Board for 1238 transmitter			DS

Laser Subsystems (continued)

Device Type	Part No.	Description	Application	Features	Lit.
Receivers					
InGaAs APD	1306CC	1.7 Gbits/s, SM *ST* Connector	Long-haul telecommunications, SONET OC-12, OC-24, or OC-48	GaAs preamplifier, analog output	DS
InGaAs APD	1306G2	2.5 Gbits/s, SM-Pigtail FC-PC Connector	Digital telecommunications, SONET up to OC-48	GaAs preamplifier, wide dynamic range	DS
	1306G3	2.5 Gbits/s, SM-Pigtail *ST* Connector			DS
InGaAs PIN	1310C	InGaAs PIN, 155 Mbits/s, MM FC-PC Connector	SONET OC1 or OC3, medium to high-speed data communications	Pigtailed, 20-pin DIP, compact hermetic package	DS
	1310D	InGaAs PIN, 622 Mbits/s, MM FC-PC Connector			DS
	1310E	InGaAs PIN, 155 Mbits/s, MM FC-PC Connector			DS
	1310F	InGaAs PIN, 622 Mbits/s, MM FC-PC Connector			DS
	1310J	InGaAs PIN, 52 Mbits/s, MM FC-PC Connector			DS
	1310K	InGaAs PIN, 52 Mbits/s, MM FC-PC Connector			DS
	1310L	InGaAs PIN, 155 Mbits/s, MM FC-PC Connector			DS
	1310M	InGaAs PIN, 622 Mbits/s, MM FC-PC Connector			DS
	1310N	InGaAs PIN, 266 Mbits/s, MM FC-PC Connector			DS
	1310P	InGaAs PIN, 155 Mbits/s, MM FC-PC Connector			DS
	1310R	InGaAs PIN, 52 Mbits/s, MM FC-PC Connector			DS
	1310S	InGaAs PIN, 52 Mbits/s, MM *ST* Connector			DS
	1310EB	Evaluation Board for 1310 Receiver			DS
InGaAs APD	1313C	622 Mbits/s, 1.3 µm & 1.5 µm	SONET OC-12	Full regenerator	DS
Ge APD	1313K	Ge APD, 622 Mbits/s, 1.3µm FC-PC Connector	SONET OC-12	Full regenerator	DS
	1313L	Ge APD, 622 Mbits/s, 1.3µm *ST* Connector			DS
High-Speed InGaAs PIN	1318A	1062.5 Mbits/s Multimode pigtail	Fibre channel, SONET	Connectorized, 20-pin DIP	DS
	1318E	Evaluation Board			DS
InGaAs APD	1319B	2.5 Gbits/s, SM FC-PC Connector	SONET OC-48, line terminal equipment, high-speed networks	GaAs preamplifier, compact butterfly package	DS
	1319C	2.5 Gbits/s, SM *ST* Connector			DS
Optical Amplifiers & Components					
Fiber Amplifier	1702CA	Pout, 6 dBm *ST* Connector	Amplifiers for repeaters, power boosters, preamps, benchtop models available as well as thin pack, Compact, low		DS
	1702CB	Pout, 8 dBm *ST* Connector			DS
	1702CC	Pout, 10 dBm *ST* Connector			DS
	1702CD	Pout, 11 dBm *ST* Connector			DS
	1702DA	Pout, 6 dBm FC-PC Connector			DS

Laser Subsystems (continued)

Device Type	Part No.	Description	Application	Features	Lit.
Optical Amplifiers & Components (continued)					
	1702DB	Pout, 8 dBm FC-PC Connector	profile models, span distances to 180 km, microprocessor based alarm		DS
	1702DC	Pout, 10 dBm FC-PC Connector			DS
	1702DD	Pout, 11 dBm FC-PC Connector			DS
	1702FB	Pout, 8 dBm Pigtail Connector			DS
	1702FC	Pout, 10 dBm Pigtail Connector			DS
	1706CJ	Pout, 11.5 dBm *ST* Connector			DS
	1706CK	Pout, 13.5 dBm *ST* Connector			DS
	1706CQ	Pout, 15.5 dBm *ST* Connector			DS
	1706CS	Pout, 14.5 dBm *ST* Connector			DS
	1706DJ	Pout, 11.5 dBm FC-PC Connector			DS
	1706DK	Pout, 13.5 dBm FC-PC Connector			DS
	1706DQ	Pout, 15.5 dBm FC-PC Connector			DS
	1706DS	Pout, 14.5 dBm FC-PC Connector			DS
	1706FK	Pout, 13.5 dBm SM Pigtail Connector			DS
	1706FQ	Pout, 15.5 dBm Pigtail Connector			DS
	1706FS	Pout, 14.5 dBm FC Pigtail Connector			DS
	1711CH	Pout, 10.5 dBm SM *ST* Connector			DS
	1711CP	Pout, 13.5 dBm SM *ST* Connector			DS
	1711CQ	Pout, 16.5 dBm SM *ST* Connector			DS
In-Line Optical Isolators	26B	1.54 µm wavelength polarization dep. loss 0.3 dB	Fiber amplifiers, Long-distance high-bit rate systems, Test equipment, Fiber lasers	Polarization independent, small, lightweight	DS
	26B1	1.54 µm wavelength polarization dep. loss 0.2 dB			DS
	26B2	1.54 µm wavelength polarization dep. loss 0.15 dB			DS
	26B3	1.54 µm wavelength polarization dep. loss 0.1 dB			DS
Isolators	32A	1.3 µm isol. (typ) 40 dB	Digital communications, analog CATV Isolated laser packages	Small size, tilted optical surfaces, large angular acceptance	DS
	32B	1.55 µm isol. (typ) 40 dB			DS
Pump Lasers					
Constant Wave Source 1.48 µm Wavelength	250A	20 mW—30 mW output power	Erbium-doped fiber amplifier systems	Field-proven packaging technology 15-pin, hermetic, ceramic SIP IN GaAsP/InP CMBH chip	DS
	250B	30 mW—40 mW output power			DS
	250C	40 mW—50 mW output power			DS
	250D	50 mW—60 mW output power			DS
	255A	20 mW—30 mW output power	Erbium-doped fiber amplifier systems	Field-proven packaging technology 14-pin, butterfly package, GaAsP/InP CMBH chip	DS
	255B	30 mW—40 mW output power			DS
	255C	40 mW—50 mW output power			DS
	255D	50 mW—60 mW output power			DS

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

LED Subsystems

Device Type	Part No.	Description	Application	Features	Lit.
Optical Data Links					
ODL 50	1252E	Transmitter, long wavelength, 16-pin, *ST* Connector	Switching, Stereos	Industry-standard TTL input/output	TN, DS, AP
	1252P	Transmitter, short wavelength, 16-pin, *ST* Connector			TN, DS, AP
	1352E	Receiver, long wavelength, 16-pin, *ST* Connector			TN, DS, AP
	1352P	Receiver, short wavelength, 16-pin, *ST* Connector			TN, DS, AP
ODL 50 II	1261AAC	Transmitter, up to 50 Mbits/s, 16-pin, *ST* Connector	Token ring, 10Base-F	Low-cost, lightweight pkg., industry-standard TTL level interface	DS
	1361AAC	Receiver, up to 50 Mbits/s, 16-bit, *ST* Connector			DS
ODL 70 II	1261ACD	Transmitter, up to 70 Mbits/s, 16-pin, *ST* Connector	FTTH (POTs), switching	Low-cost, lightweight pkg.	DS, TN
	1361ACD	Receiver, up to 70 Mbits/s, 16-pin, *ST* Connector			DS, TN
ODL 125	1252U	Transmitter, up to 126 Mbits/s, FDDI, 16-pin, *ST* Connector	FDDI, SONET OC-3	FDDI Compatible data link	DS, TN
	1352AA	Receiver, up to 125 Mbits/s, FDDI, 16-pin, *ST* Connector			DS, TN
ODL 125 II	1261BCE	Transmitter, up to 125 Mbits/s, FDDI, 16-pin, *ST* Connector	FDDI, SONET OC-3	Low-cost FDDI data link, lightweight pkg.	DS, TN
	1361BCE	Receiver, up to 125 Mbits/s, FDDI, 16-pin, *ST* Connector			DS, TN
ODL 125 FC	1260A	Transmitter, up to 125 Mbits/s, 16-pin, FC Connector	Pt. to pt. interconnect, mainframe-peripheral, switching, SONET	High reliability MTBF >1 x 10^6 hours, 100K ECL logic cells	DS
	1360A	Receiver, up to 125 Mbits/s, 16-pin, FC Connector			DS
ODL 200	1252J	Transmitter, up to 200 Mbits/s, *ST* Connector, ±4.5 V power supply	Fibre channel, pt. to pt. interconnects, main-frame-peripheral	Multisourced package industry-standard 16-pin footprint, rugged package	DS, TN
	1252N	Transmitter, up to 200 Mbits/s, *ST* Connector, ±5 V power supply			DS, TN
	1352J	Receiver, optical sensitivity –36 dBm *ST* Connector, +5 V power supply			DS, TN
	1352N	Receiver, optical sensitivity –38 dBm *ST* Connector, –5 V power supply			DS, TN

LED Subsystems (continued)

Device Type	Part No.	Description	Application	Features	Lit.
Transceivers					
ESCON	1401BA	Pin length 0.98" improved reliability	Pt. to pt. interconnects, mainframe-peripheral, fibre channel, *ESCON* systems	*IBM-ESCON* compatible transceiver	DS
	1401BB	Pin length 1.70" improved reliability			DS
FDDI	1402UA	FDDI Transceiver A-keyed	Local area networked pt. to pt. communications channel extenders	FDDI compliant transceiver, field keyable plug, industry standard 2 x 11 pinout typical link spans of 3 km	DS
	1402UB	FDDI Transceiver B-keyed			DS
	1402UM	FDDI Transceiver M-keyed			DS
	1402US	FDDI Transceiver S-keyed			DS
	1402U	FDDI Transceiver unkeyed			DS
Low-Cost FDDI	1408A	Low-cost FDDI Transceiver link budget 11 dB	Single-attached stations	Conforms to multisourced 9-pin SIP configuration, compact lightweight package	DS
	1408B	Low-cost FDDI Transceiver link budget 7 dB			DS
Fibre Channel Board	1409A	*ODL* 200 Fibre Channel Board	High-speed data switching, proprietary point to point links	Speed selectable 266 Mbits/s or 133 Mbits/s operation Plug in compatible with with *IBM* and *HP* OLC	DS DS

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

HIGH-FREQUENCY PRODUCTS (FOR LIGHTWAVE APPLICATIONS)

The high-frequency GaAs ICs listed here, with the associated evaluation fixtures, were introduced in 1990. They were designed for SONET compatibility at the OC-48 data rate of 2.5 Gbits/s. These devices have now been in production for over two years.

Customer requests have resulted in clock and data regenerators at several standard OC rates and can be factory tuned to any data rate from 450 Mbits/s to 3.0 Gbits/s for those special needs. Fixed transimpedance amplifiers are now available at four standard OC data rates from 622 Mbits/s to 2.5 Gbits/s.

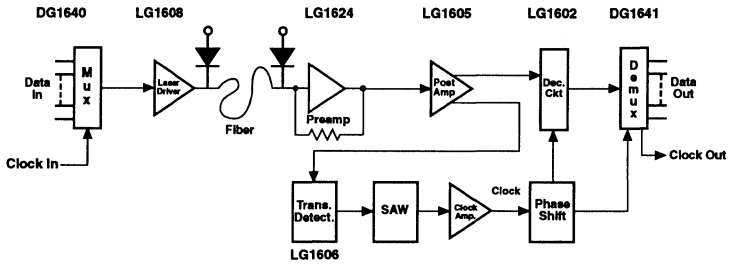
Two new products for 1993 are the 4:1 MUX and 1:4 DEMUX. These two products, added to the existing 2.5 Gbits/s products, complete the chip set for fiber-optic regeneration.

Data sheets and a color video for all products listed are available by calling (215) 939-6603.

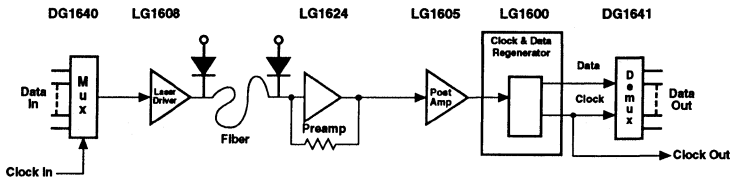
Two new products for 1994 are the Clock and Data Regenerator and Limiting Amplifier, operating at data rates up to 5 Gbits/s. The Clock and Data Regenerator is offered in the same package and has the same high functionality as the existing LG1600AXD. The Limiting Amplifier has a bandwidth of 3 GHz and a gain of 35 dB.

Block Diagram of a Fiber-Optic Regenerator

SAW-Based Solution



PLL Solution



High-Frequency Products

Part No.	Description	Type	Data Rate	Literature
DG1640ABW	4:1 Multiplexer	44-lead package	2488 Mbits/s	DS
DG1641ABW	1:4 Demultiplexer	44-lead package	2488 Mbits/s	DS
HG1210AXA	Transimpedance Amplifier	Hybrid	Var. to 2488 Mbits/s	DS
LG1600AXD2488	Clock and Data Regenerator	68-lead package	2488 Mbits/s	DS
LG1600AXD1244	Clock and Data Regenerator	68-lead package	1244 Mbits/s	DS
LG1600AXD1062	Clock and Data Regenerator	68-lead package	1062 Mbits/s	DS
LG1600AXD0622	Clock and Data Regenerator	68-lead package	622 Mbits/s	DS
LG1600AXD0565	Clock and Data Regenerator	68-lead package	565 Mbits/s	DS
LG1602AXB	Decision Circuit	16-lead package	2488 Mbits/s	DS
LG16005BXB	Limiting Amplifier	16-lead package	2488 Mbits/s	DS
LG1606AXB	Transition Detector	16-lead package	2488 Mbits/s	DS
LG1608AXB	Laser Driver	16-lead package	2488 Mbits/s	DS
LG1608AXC	Laser Driver	16-lead package	2488 Mbits/s	DS
LG1609AW	Laser Driver	SONB package	up to 1500 Mbits/s	DS
LG1621A	Transimpedance Amplifier	die	155 Mbits/s	DS
LG1622A	Transimpedance Amplifier	die	622 Mbits/s	DS
LG1623A	Transimpedance Amplifier	die	1062 Mbits/s	DS
LG1624A	Transimpedance Amplifier	die	2488 Mbits/s	DS
TF1001A	Evaluation Fixture for LG1602AXB, LG1606AXB			DS
TF1002A	Evaluation Fixture for LG1608AXB, LG1608AXC			DS
TF1003B	Evaluation Fixture for LG1605BXB			DS
TF1004A	Evaluation Fixture for LG1600AXD			DS
TF1005A	Evaluation Fixture for HG1210AXA			DS

AT&T Microelectronics offers a broad line of power conversion products and power protection systems to fulfill the needs of the telecommunications and electronic data processing markets.

AT&T board-mounted power modules, ranging from 0.5 W to 200 W, have small footprints, high efficiencies, and high-power densities. Our dc-dc converters range from 15 W to 1500 W, and the off-line switchers range from 50 W to 2,000 W. Our new line of Notebook Power Supplies range from 15 W to 55 W.

Our power systems design staff in Dallas is available to assist you in the selection of power architectures that meet your needs. Dallas is an ISO 9001 registered facility.

Board-Mounted Power Modules

AT&T board-mounted power modules offer low profiles, high-power density, off-the-shelf, dc-dc power conversions in module sizes of 0.5 W to 200 W. Known for reliability, AT&T board-mounted power modules feature a variety of design options with typical power efficiencies in excess of 80%. State-of-the-art surface-mount technology is used to achieve high performance in a small package. MTBFs of over one million hours and a three-year warranty are standard.

A system powered by board-mounted power modules offers many user benefits. In addition to the capability for developing nonstandard voltages, the power modules can reduce the cost of power distribution by decreasing distances traveled by low voltages. Moreover, they can power a system on a field-replaceable basis, thereby yielding improved system reliability.

Features

- Low profiles
- High efficiencies
- 0.5 W to 200 W
- High-power densities
- Small footprints
- Remote on/off capability
- Remote sense
- Output current limiting
- Overvoltage protection
- Isolated and nonisolated models
- Input/output filtering
- External synchronization
- Parallel operation with forced load-sharing
- Regulated output voltage
- –40 °C to +100 °C operating case temperature
- UL recognized
- 3-year warranty

Board-Mounted Power Modules
Low-Power Product Matrix (0.5 W to 50 W)

Part Number	Nominal Input (Vdc)	Input Range (Vdc)	Output Voltage (Vdc)*	Output Current (IA)	Power, Watts (W)	Length (in.)	Width (in.)	Height (in.)	Temp. (°C)	Literature
112A2	5	4.5—5.5	12	0.041	0.5	0.96	0.70	0.44	0 to +70	DS
112C2	5	4.5—5.5	15	0.100	1.5	0.96	0.70	0.44	0 to +70	DS
112D2	5	4.5—5.5	25	0.030	0.75	0.96	0.70	0.44	0 to +70	DS
112E2	5	4.5—5.5	12	0.125	1.5	0.96	0.70	0.44	0 to +70	DS
113A2	5	4.5—5.5	–5	0.100	0.5	0.96	0.70	0.44	0 to +70	DS
113AA2	5	4.5—5.5	12	0.042	0.500	0.96	0.70	0.44	0 to +70	DS
113B2	5	4.5—5.5	–12	0.063	0.75	0.96	0.70	0.44	0 to +70	DS
113B3	5	4.5—5.5	–12	0.063	0.75	0.96	0.70	0.44	0 to +70	DS
113C2	5	4.5—5.5	–15	0.050	0.75	0.96	0.70	0.44	0 to +70	DS
113E2	5	4.5—5.5	–130	0.0005	0.065	0.96	0.70	0.44	0 to +70	DS
113F2	5	4.5—5.5	–5	0.300	1.5	0.96	0.70	0.44	0 to +70	DS
113F3	5	4.5—5.5	–5	0.300	1.5	0.96	0.70	0.44	0 to +70	DS
113G2	5	4.5—5.5	–12	0.125	1.5	0.96	0.70	0.44	0 to +70	DS
RA003A	12	8.0—16.5	5	0.6	3	1.75	0.43	0.81	–10 to +50	DS
RA003B	12	8.0—16.5	12	0.25	3	1.75	0.43	0.81	–10 to +50	DS
RA003C	12	8.0—16.5	15	0.2	3	1.75	0.43	0.81	–10 to +50	DS
RA003BK	12	8.0—16.5	±12	±0.125	3	1.75	0.43	0.81	–10 to +50	DS
RA003CL	12	8.0—16.5	±15	±0.1	3	1.75	0.43	0.81	–10 to +50	DS
RC003A	28	16—32	5	0.6	3	1.75	0.43	0.81	–10 to +50	DS
RC003B	28	16—32	12	0.25	3	1.75	0.43	0.81	–10 to +50	DS
RC003C	28	16—32	15	0.2	3	1.75	0.43	0.81	–10 to +50	DS
RC003BK	28	16—32	±12	±0.125	3	1.75	0.43	0.81	–10 to +50	DS
RC003CL	28	16—32	±15	±0.1	3	1.75	0.43	0.81	–10 to +50	DS
RE003A	48	28—60	5	0.6	3	1.75	0.43	0.81	–10 to +50	DS
RE003B	48	28—60	12	0.25	3	1.75	0.43	0.81	–10 to +50	DS
RE003C	48	28—60	15	0.2	3	1.75	0.43	0.81	–10 to +50	DS
RE003BK	48	28—60	±12	±0.125	3	1.75	0.43	0.81	–10 to +50	DS
RE003CL	48	28—60	±15	±0.1	3	1.75	0.43	0.81	–10 to +50	DS
RH003A	5	4.0—7.2	5	0.6	3	1.75	0.43	0.81	–10 to +50	DS
RH003B	5	4.0—7.2	12	0.25	3	1.75	0.43	0.81	–10 to +50	DS
RH003C	5	4.0—7.2	15	0.2	3	1.75	0.43	0.81	–10 to +50	DS
RH003BK	5	4.0—7.2	±12	±0.125	3	1.75	0.43	0.81	–10 to +50	DS
RH003CL	5	4.0—7.2	±15	±0.1	3	1.75	0.43	0.81	–10 to +50	DS
MA005A	12	10—15	5	1.00	5	2.00	1.10	0.46	–10 to +70	DS
MA005B	12	10—15	12	0.42	5	2.00	1.10	0.46	–10 to +70	DS
MA005C	12	10—15	15	0.33	5	2.00	1.10	0.46	–10 to +70	DS
MA005BK	12	10—15	±12	±0.21	5	2.00	1.10	0.46	–10 to +70	DS
MA005CL	12	10—15	±15	±0.17	5	2.00	1.10	0.46	–10 to +70	DS

*Other voltages available.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Board-Mounted Power Modules (continued)
Low-Power Product Matrix (0.5 W to 50 W)

Part Number	Nominal Input (Vdc)	Input Range (Vdc)	Output Voltage (Vdc)*	Output Current (IA)	Power, Watts (W)	Length (in.)	Width (in.)	Height (in.)	Temp. (°C)	Literature
MC005A	28	18—36	5	1.0	5	2.00	1.10	0.46	–40 to +85	DS
MC005B	28	18—36	12	0.42	5	2.00	1.10	0.46	–40 to +85	DS
MC005C	28	18—36	15	0.33	5	2.00	1.10	0.46	–40 to +85	DS
MC005BK	28	18—36	±12	±0.21	5	2.00	1.10	0.46	–40 to +85	DS
MC005CL	28	18—36	±15	±0.17	5	2.00	1.10	0.46	–40 to +85	DS
ME005A	48	39.5—60	5	1.0	5	2.00	1.10	0.46	–40 to +85	DS
ME005B	48	39.5—60	12	0.42	5	2.00	1.10	0.46	–40 to +85	DS
ME005C	48	39.5—60	15	0.33	5	2.00	1.10	0.46	–40 to +85	DS
ME005N	48	39.5—60	5.2	0.96	5	2.00	1.10	0.46	–40 to +85	—
ME005BK	48	39.5—60	±12	±0.21	5	2.00	1.10	0.46	–40 to +85	DS
ME005CL	48	39.5—60	±15	0.17	5	2.00	1.10	0.46	–40 to +85	DS
MH005A	5	4.5—5.5	5	1.00	5	2.00	1.10	0.46	–10 to +70	DS
MH005B	5	4.5—5.5	12	0.42	5	2.00	1.10	0.46	–10 to +70	DS
MH005C	5	4.5—5.5	15	0.33	5	2.00	1.10	0.46	–10 to +70	DS
MH005BK	5	4.5—5.5	±12	±0.21	5	2.00	1.10	0.46	–10 to +70	DS
MH005CL	5	4.5—5.5	±15	±0.17	5	2.00	1.10	0.46	–10 to +70	DS
MW005A	48	36—72	5	1.0	5	2.00	1.10	0.46	–40 to +85	DS
MW005B	48	36—72	12	0.42	5	2.00	1.10	0.46	–40 to +85	DS
MW005C	48	36—72	15	0.33	5	2.00	1.10	0.46	–40 to +85	DS
MW005AJ	48	36—72	±5	±0.5	5	2.00	1.10	0.46	–40 to +85	DS
MW005BK	48	36—72	±12	0.21	5	2.00	1.10	0.46	–40 to +85	DS
MW005CL	48	36—72	±15	0.17	5	2.00	1.10	0.46	–40 to +85	DS
MA010A	12	10—15	5	2.00	10	2.00	1.60	0.50	–10 to +50	DS
MA010B	12	10—15	12	0.83	10	2.00	1.60	0.50	–10 to +50	DS
MA010C	12	10—15	15	0.67	10	2.00	1.60	0.50	–10 to +50	DS
MA010BK	12	10—15	±12	±0.42	10	2.00	1.60	0.50	–10 to +50	DS
MA010CL	12	10—15	±15	±0.33	10	2.00	1.60	0.50	–10 to +50	DS
MC010A	48	36—72	5	2.0	10	2.00	1.60	0.50	–40 to +85	DS
MC010B	48	36—72	12	0.83	10	2.00	1.60	0.50	–40 to +85	DS
MC010C	48	36—72	15	0.67	10	2.00	1.60	0.50	–40 to +85	DS
MC010BK	48	36—72	±12	0.43	10	2.00	1.60	0.50	–40 to +85	DS
MC010CL	48	36—72	±15	0.33	10	2.00	1.60	0.50	–40 to +85	DS
ME010A	48	40—60	5	2.0	10	2.00	1.60	0.50	–40 to +85	DS
ME010B	48	40—60	12	0.83	10	2.00	1.60	0.50	–40 to +85	DS
ME010C	48	40—60	15	0.67	10	2.00	1.60	0.50	–40 to +85	DS
ME010BK	48	40—60	±12	0.43	10	2.00	1.60	0.50	–40 to +85	DS
ME010CL	48	40—60	±15	0.33	10	2.00	1.60	0.50	–40 to +85	DS

*Other voltages available.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Board-Mounted Power Modules (continued)
Low-Power Product Matrix (0.5 W to 50 W)

Part Number	Nominal Input (Vdc)	Input Range (Vdc)	Output Voltage (Vdc)*	Output Current (IA)	Power, Watts (W)	Length (in.)	Width (in.)	Height (in.)	Temp. (°C)	Literature
MH010A	5	4.5—5.5	5	2.00	10	2.00	1.60	0.50	–10 to +50	DS
MH010B	5	4.5—5.5	12	0.83	10	2.00	1.60	0.50	–10 to +50	DS
MH010C	5	4.5—5.5	15	0.67	10	2.00	1.60	0.50	–10 to +50	DS
MH010BK	5	4.5—5.5	±12	±0.42	10	2.00	1.60	0.50	–10 to +50	DS
MH010CL	5	4.5—5.5	±15	±0.33	10	2.00	1.60	0.50	–10 to +50	DS
MW010A	48	36—72	5	2.0	10	2.00	1.60	0.50	–40 to +85	DS
MW010B	48	36—72	12	0.83	10	2.00	1.60	0.50	–40 to +85	DS
MW010C	48	36—72	15	0.67	10	2.00	1.60	0.50	–40 to +85	DS
MW010BK	48	36—72	±12	0.43	10	2.00	1.60	0.50	–40 to +85	DS
MW010CL	48	36—72	±15	0.33	10	2.00	1.60	0.50	–40 to +85	DS
FE008AJ	48	39.5—60	5	1.2	8	2.00	2.00	0.50	–40 to +85	DS
912A	48	40—60	12	1.0	12	3.00	2.20	0.61	0 to +70	DS
SE014S110	48	40—60	110	130	14	2.00	2.00	0.50	–40 to +85	DS
915AW	48	40—60	5	3.0	15	2.70	2.10	0.50	–40 to +85	DS
FC020A	28	18—36	5	4.0	20	3.64	1.90	0.50	–40 to +85	DS
FC020B	28	18—36	12	1.67	20	3.64	1.90	0.50	–40 to +85	DS
FC020C	28	18—36	15	1.33	20	3.64	1.90	0.50	–40 to +85	DS
FE020A	48	40—60	5	4.0	20	3.64	1.90	0.50	–40 to +85	DS
FE020B	48	40—60	12	1.67	20	3.64	1.90	0.50	–40 to +85	DS
FE020C	48	40—60	15	1.33	20	3.64	1.90	0.50	–40 to +85	DS
FE020E	48	40—60	2.2	4	8.8	3.64	1.90	0.50	–40 to +85	—
FE020F	48	40—60	3.3	4	13.2	3.64	1.90	0.50	–40 to +85	—
FE020N	48	40—60	5.2	3.85	20	3.64	1.90	0.50	–40 to +85	—
CC025AJ	28	18—36	±5	2.50	25	2.80	2.40	0.50	–40 to +95	DS
CC025BK	28	18—36	±12	1.04	25	2.80	2.40	0.50	–40 to +95	DS
CC025CL	28	18—36	±15	0.83	25	2.80	2.40	0.50	–40 to +95	DS
CC025ABK	28	18—36	5, ±12	5, ±1	25	2.80	2.40	0.50	–40 to +95	—
CC025ACL	28	18—36	5, ±15	5, ±0.8	25	2.80	2.40	0.50	–40 to +95	—
CW025AJ	48	36—72	±5	±2.50	25	2.80	2.40	0.50	–40 to +95	DS
CW025BK	48	36—72	±12	±1.04	25	2.80	2.40	0.50	–40 to +95	DS
CW025CL	48	36—72	±15	±0.83	25	2.80	2.40	0.50	–40 to +95	DS
CW025ABK	48	36—72	5, ±12	5, ±1	25	2.80	2.40	0.50	–40 to +95	—
CW025ACL	48	36—72	5, ±15	5, ±0.8	25	2.80	2.40	0.50	–40 to +95	—

*Other voltages available.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Board-Mounted Power Modules (continued)
Low-Power Product Matrix (0.5 W to 50 W)

Part Number	Nominal Input (Vdc)	Input Range (Vdc)	Output Voltage (Vdc)*	Output Current (IA)	Power, Watts (W)	Length (in.)	Width (in.)	Height (in.)	Temp. (°C)	Literature
DC025AA	28	18—36	5, 5	2.5, 2.5	25	2.80	2.40	0.50	–40 to +95	DS
DC025AF	28	18—36	5, 3.3	2.50, 2.50	25	2.80	2.40	0.50	–40 to +95	DS
DC025AJ	28	18—36	±5	±2.50	25	2.80	2.40	0.50	–40 to +95	DS
DC025BB	28	18—36	12, 12	1.04, 1.04	25	2.80	2.40	0.50	–40 to +95	DS
DC025BK	28	18—36	±12	±1.04	25	2.80	2.40	0.50	–40 to +95	DS
DC025CC	28	18—36	15, 15	0.83, 0.83	25	2.80	2.40	0.50	–40 to +95	DS
DC025CL	28	18—36	±15	±0.83	25	2.80	2.40	0.50	–40 to +95	DS
DC025ABK	28	18—36	5, ±12	5, ±1	25	2.80	2.40	0.50	–40 to +95	—
DC025ACL	28	18—36	5, ±15	5, ±0.8	25	2.80	2.40	0.50	–40 to +95	—
DW025AA	48	36—72	5, 5	2.50, 2.50	25	2.80	2.40	0.50	–40 to +95	DS
DW025AB	48	36—72	5, 12	5, 1	25	2.80	2.40	0.50	–40 to +95	DS
DW025AF	48	36—72	5, 3.3	2.50, 2.50	25	2.80	2.40	0.50	–40 to +95	DS
DW025AJ	48	36—72	±5	±2.50	25	2.80	2.40	0.50	–40 to +95	DS
DW025BB	48	36—72	12, 12	1.04, 1.04	25	2.80	2.40	0.50	–40 to +95	DS
DW025BK	48	36—72	±12	±1.04	25	2.80	2.40	0.50	–40 to +95	DS
DW025CC	48	36—72	15, 15	0.83, 0.83	25	2.80	2.40	0.50	–40 to +95	DS
DW025CL	48	36—72	±15	±0.83	25	2.80	2.40	0.50	–40 to +95	DS
DW025ABK	48	36—72	5, ±12	5, ±1	25	2.80	2.40	0.50	–40 to +95	—
DW025ACL	48	36—72	5, ±15	5, ±0.8	25	2.80	2.40	0.50	–40 to +95	—
SK025A	48	38—72	5	5.0	25	3.64	1.90	0.45	–40 to +85	DS
SK025B	48	38—72	12	2.0	25	3.64	1.90	0.45	–40 to +85	DS
SK025C	48	38—72	15	1.6	25	3.64	1.90	0.45	–40 to +85	DS
SK025H	48	38—72	5	10	50	3.64	1.90	0.45	–40 to +85	—
CC030A	28	18—36	5	6.0	30	2.80	2.40	0.50	–40 to +100	DS
CC030B	28	18—36	12	2.5	30	2.80	2.40	0.50	–40 to +100	DS
CC030C	28	18—36	15	2.0	30	2.80	2.40	0.50	–40 to +100	DS
CW030A	48	36—72	5	6.0	30	2.80	2.40	0.50	–40 to +95	DS
CW030B	48	36—72	12	2.5	30	2.80	2.40	0.50	–40 to +95	DS
CW030C	48	36—72	15	2.0	30	2.80	2.40	0.50	–40 to +95	DS
JC030A	24	18—36	5	6.0	30	2.40	2.28	0.50	–40 to +100	DS
JC030B	24	18—36	12	2.5	30	2.40	2.28	0.50	–40 to +100	DS
JC030C	24	18—36	15	2.0	30	2.40	2.28	0.50	–40 to +100	DS
JW030A	48	36—72	5	6.0	30	2.40	2.28	0.50	–40 to +100	DS
JW030B	48	36—72	12	2.5	30	2.40	2.28	0.50	–40 to +100	DS
JW030C	48	36—72	15	2.0	30	2.40	2.28	0.50	–40 to +100	DS
JW030D	48	36—72	2	6.5	13	2.40	2.28	0.50	–40 to +100	DS
SK050A	48	38—72	5	10.0	50	3.35	2.30	0.75	–40 to +85	DS

*Other voltages available.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

High-Power Product Matrix (50 W to 200 W)

Part Number	Nominal Input (Vdc)	Input Range (Vdc)	Output Voltage (Vdc)*	Output Current (IA)	Power, Watts (W)	Length (in.)	Width (in.)	Height (in.)	Temp. (°C)	Literature
JW050A	48	36—72	5	10	50	2.40	2.28	0.50	–40 to +100	DS
JW050B	48	36—72	12	4.2	50	2.40	2.28	0.50	–40 to +100	DS
JW050C	48	36—72	15	3.3	50	2.40	2.28	0.50	–40 to +100	DS
JW050F	48	36—72	3.3	10	33	2.40	2.28	0.50	–40 to +100	DS
JW100A	48	36—72	5	20.0	100	2.40	2.28	0.50	–40 to +100	DS
JW100B	48	36—72	12	8.3	100	2.40	2.28	0.50	–40 to +100	DS
JW100C	48	36—72	15	6.7	100	2.40	2.28	0.50	–40 to +100	DS
JW100F	48	36—72	3.3	20.0	66	2.40	2.28	0.50	–40 to +100	DS
JW150A	48	36—72	5	30	150	2.40	2.28	0.50	–40 to +100	DS
JW150B	48	36—72	12	12.5	150	2.40	2.28	0.50	–40 to +100	DS
JW150C	48	36—72	15	10.0	150	2.40	2.28	0.50	–40 to +100	DS
JW150F	48	36—72	3.3	30	99	2.40	2.28	0.50	–40 to +100	DS
FC050A	28	18—36	5	10.0	50	4.80	2.50	0.50	0 to +90	DS
FC050B	28	18—36	12	4.2	50	4.80	2.50	0.50	0 to +90	DS
FC050C	28	18—36	15	3.3	50	4.80	2.50	0.50	0 to +90	DS
FC050D	28	18—36	2	10	20	4.80	2.50	0.50	0 to +90	—
FC050F	28	18—36	3.3	10.0	33	4.80	2.50	0.50	0 to +90	DS
FC050R	28	18—36	28	1.8	50	0.50	4.80	2.50	0 to +90	—
FC100A	28	18—36	5	20.0	100	4.80	2.50	0.50	0 to +90	DS
FC100B	28	18—36	12	8.3	100	4.80	2.50	0.50	0 to +90	DS
FC100C	28	18—36	15	6.7	100	4.80	2.50	0.50	0 to +90	DS
FC100D	28	18—36	2	20.0	40	4.80	2.50	0.50	0 to +90	—
FC100F	28	18—36	3.3	20.0	66	4.80	2.50	0.50	0 to +90	DS
FC100R	28	18—36	28	5.4	150	0.50	4.80	2.50	0 to +90	—
FC150A	28	18—36	5	30.0	150	4.80	2.50	0.50	0 to +90	DS
FC150B	28	18—36	12	12.5	150	0.50	4.80	2.50	0 to +90	—
FC150C	28	18—36	15	10.0	150	4.80	2.50	0.50	0 to +90	DS
FC150D	28	18—36	2	30.0	60	4.80	2.50	0.50	0 to +90	DS
FC150F	28	18—36	3.3	30.0	100	4.80	2.50	0.50	0 to +90	DS
FC150H	28	18—36	24	6.3	150	4.80	2.50	0.50	0 to +90	—
FE050A	48	38—60	5	10.0	50	4.80	2.50	0.50	0 to +90	DS
FE050B	48	38—60	12	4.2	50	4.80	2.50	0.50	0 to +90	DS
FE050C	48	38—60	15	3.33	50	4.80	2.50	0.50	0 to +90	—
FE050D	48	38—60	2.0	10.0	20	4.80	2.50	0.50	0 to +90	DS
FE050F	48	38—60	3.3	10.0	33	4.80	2.50	0.50	0 to +90	DS
FE050H	48	38—60	24	2.1	50	4.80	2.50	0.50	0 to +90	DS
FE050N	48	38—60	5.2	9.6	50	4.80	2.50	0.50	0 to +90	DS

*Other voltages available.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

High-Power Product Matrix (50 W to 200 W) (continued)

Part Number	Nominal Input (Vdc)	Input Range (Vdc)	Output Voltage (Vdc)*	Output Current (IA)	Power, Watts (W)	Length (in.)	Width (in.)	Height (in.)	Temp. (°C)	Literature
FE100A	48	38—60	5	20.0	100	4.80	2.50	0.50	0 to +90	DS
FE100B	48	38—60	12	8.3	100	4.80	2.50	0.50	0 to +90	DS
FE100C	48	38—60	15	6.7	100	4.80	2.50	0.50	0 to +90	—
FE100D	48	38—60	2.0	20.0	40	4.80	2.50	0.50	0 to +90	DS
FE100F	48	38—60	3.3	20.0	66	4.80	2.50	0.50	0 to +90	DS
FE100H	48	38—60	24	4.2	100	4.80	2.50	0.50	0 to +90	DS
FE100N	48	38—60	5.2	19.2	100	4.80	2.50	0.50	0 to +90	DS
FE150A	48	38—60	5	30.0	150	4.80	2.50	0.50	0 to +90	DS
FE150B	48	38—60	12	12.5	150	4.80	2.50	0.50	0 to +90	DS
FE150C	48	38—60	15	10.0	150	4.80	2.50	0.50	0 to +90	—
FE150D	48	38—60	2	30.0	60	4.80	2.50	0.50	0 to +90	DS
FE150F	48	38—60	3.3	30.0	100	4.80	2.50	0.50	0 to +90	DS
FE150H	48	38—60	24	6.25	150	4.80	2.50	0.50	0 to +90	DS
FE150N	48	38—60	5.2	28.8	150	4.80	2.50	0.50	0 to +90	DS
FE150R	48	38—60	28	5.4	150	4.80	2.50	0.50	0 to +90	DS
FW050A	48	36—72	5.0	10.0	50	4.80	2.50	0.50	0 to +90	DS
FW050B	48	36—72	12	4.2	50	4.80	2.50	0.50	0 to +90	DS
FW050C	48	36—72	15	3.33	50	4.80	2.50	0.50	0 to +90	DS
FW050D	48	36—72	2	10	20	4.80	2.50	0.50	0 to +90	—
FW050F	48	36—72	3.3	10	33	4.80	2.50	0.50	0 to +90	DS
FW050H	48	36—72	24	2.1	50	4.80	2.50	0.50	0 to +90	DS
FW100A	48	36—72	5.0	20.0	100	4.80	2.50	0.50	0 to +90	DS
FW100B	48	36—72	12	8.4	100	4.80	2.50	0.50	0 to +90	DS
FW100C	48	36—72	15	6.7	100	4.80	2.50	0.50	0 to +90	DS
FW100D	48	36—72	2	20	40	4.80	2.50	0.50	0 to +90	—
FW100F	48	36—72	3.3	20	66	4.80	2.50	0.50	0 to +90	—
FW100H	48	36—72	24	4.2	100	4.80	2.50	0.50	0 to +90	—
FW150A	48	36—72	5.0	30.0	150	4.80	2.50	0.50	0 to +90	DS
FW150B	48	36—72	12	12.6	150	4.80	2.50	0.50	0 to +90	DS
FW150C	48	36—72	15	10.0	150	4.80	2.50	0.50	0 to +90	DS
FW150D	48	36—72	2	30	60	4.80	2.50	0.50	0 to +90	—
FW150F	48	36—72	3.3	30	99	4.80	2.50	0.50	0 to +90	DS
FW150H	48	36—72	24	6.3	150	4.80	2.50	0.50	0 to +90	DS
FW150R	48	36—72	28	5.4	150	4.80	2.50	0.50	0 to +90	DS
FE200A9	48	38—60	5	40	200	4.80	2.50	0.50	0 to +80	DS
FE200B9	48	38—60	12	16.6	200	4.80	2.50	0.50	0 to +80	DS
FE200F9	48	38—60	3.3	40	132	4.80	2.50	0.50	0 to +80	DS

*Other voltages available.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

dc-dc Converters

Capabilities

- AT&T has more than 50 years' experience in designing and manufacturing custom dc-dc converters typically ranging from 15 W to 1500 W with a wide variety of optional features.
- Custom design capabilities to address both United States and European requirements and standards.
- Manufacturing capabilities are available in the United States (Dallas, TX), Europe (Malmesbury, UK), and Mexico (Matamoros).
- AT&T's Dallas manufacturing site includes fully equipped product qualification facilities to meet FCC, UL, CSA, and other world regulatory and safety agency requirements.
- Surface-mount technology is available to provide high-power densities, modular packaging flexibility, and high quality.

Features

- Wide input voltage range
- Low-profile designs
- Wide operating temperature range
- Input-to-output isolation
- Inrush protection to provide hot plug-in capability
- Meets CISPR and FCC EMI and susceptibility requirements
- Externally synchronized switching frequency
- Customized alarms for input/output conditions
- Load sharing with redundancy and fault tolerance
- Programmable overcurrent shutdown
- Remote sensing
- Output current limiting/shutdown
- AT&T can provide a fully customized dc-dc converter solution using customer-specified hardware.
- AT&T offers a standard family of proven high-reliability *Fastech* and TRANSPAC dc-dc converters that can be modified if necessary to meet specific application requirements. *Fastech* and TRANSPAC dc-dc converters use AT&T connector systems and are plug-in type circuit card modules which have standardized feature sets.

The following is a representative listing of AT&T *Fastech*, TRANSPAC, and custom dc-dc converter products.

dc-dc Converters Product Matrix

Watts (W)	Input (Vdc)	Output (Vdc)	Amps (A)	Dimensions (in.) H	L	W	Part Number
***Fastech* Power Unit Packaging (Partial Listing)**							
43	48	2	17	8	8	1.5	474CA
43	140	2	17	8	8	1.5	477CA
64	48	15	1.2	12	10	0.75	551A
	—	5	2.5	—	—	—	—
	—	–5.2	3.2	—	—	—	—
	—	–4.6	2.3	—	—	—	—
	—	–2.2	2.7	—	—	—	—
65	48	24	2.7	8	8	1.5	474FA
70	48	5	13	8	10	1.5	412AA
	—	5	1	—	—	—	—
72	48	12	6	8	13	1	494MA
75	24	15	5	8	8	1.5	471DA
75	48	15	5	8	8	1.5	474DA
75	48	5	15	8	10	1.5	484BA
75	48	12	5	8	10	1.5	484GA

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

dc-dc Converters Product Matrix (continued)

Watts (W)	Input (Vdc)	Output (Vdc)	Amps (A)	Dimensions (in.) H	L	W	Part Number
***Fastech* Power Unit Packaging** (continued)							
77	24	5	12	8	13	1	491BA
	—	13	1	—	—	—	—
77	48	5	13	8	13	1	494LA
	—	12	1	—	—	—	—
84	24	5	10	8	8	1.5	471EA
	—	17	1	—	—	—	—
	—	–17	1	—	—	—	—
84	48	5	10	8	8	1.5	474EA
	—	17	1	—	—	—	—
	—	–17	1	—	—	—	—
85	48	5	15	8	13	1	494GA
	—	–5	2	—	—	—	—
85	48	5	15	8	13	1	494GB
	—	–5	2	—	—	—	—
90	24	10—12	7.5	8	8	1.5	471GA
90	24	5	18	8	13	1	491DA
90	24	15	5	8	13	1	491EA
	—	15	1	—	—	—	—
90	48	5	15	8	8	1.5	474BA
90	48	12	7.5	8	8	1.5	474GA
100	48	2	50	8	13	2	495MA
100	48	5	18	8	10	1.5	484AA
	—	–5	2	—	—	—	—
100	48	5	20	8	13	1	494RA
105	24	5	18	8	8	1.5	471AB
	—	5	0.5	—	—	—	—
	—	–15	0.1	—	—	—	—
105	48	5	18	8	8	1.5	474AB
	—	15	0.5	—	—	—	—
	—	–15	0.1	—	—	—	—
105	140	5	18	8	8	1.5	477AB
	—	15	0.5	—	—	—	—
	—	–15	0.1	—	—	—	—
106	48	5	20	8	10	1.5	411AA
112.5	48	4.5	25	8	10	2	485AA
125	48	5	25	8	10	2	485AB
140	48	2	70	8	13	1	410CA
175	24	5	35	8	13	1	415AA
	—	–5	0.1	—	—	—	—

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

dc-dc Converters Product Matrix (continued)

Watts (W)	Input (Vdc)	Output (Vdc)	Amps (A)	Dimensions (in.) H	L	W	Part Number
***Fastech* Power Unit Packaging** (continued)							
180	48	5	30	8	13	2	495NA
	—	–5	2	—	—	—	—
	—	5	4	—	—	—	—
192	24	24	8	8	10	2	490AA
212	48	5.1	14	12	10	1	557A
	—	5.2	8.3	—	—	—	—
	—	2.2	3.3	—	—	—	—
244	24	12	12	8	13	1	419AA
	—	12	2.5	—	—	—	—
	—	–12	2.5	—	—	—	—
250	48	5	50	8	13	2	495FB
250	48	5	48	8	13	2	495JC
	—	–5	2	—	—	—	—
252	48	5	48	8	13	2	495KA
	—	12	1	—	—	—	—
300	24	5	60	8	13	1.5	430AA
320	48	5	60	8	13	1	410AA
400	48	5	80	8	13	1.5	414AA
TRANSPAC Packaging (Partial Listing)							
28	48	12	1.1	8	10	1	333B
	—	24	0.6	—	—	—	—
48	48	12	4	4	10	1.5	323D
50	48	5	10	4	10	1.5	323C
50	48	5	10	4	10	2.25	323A
60	48	5	3	4.8	24	1.5	325A
	—	12	2	—	—	—	—
	—	–12	1.7	—	—	—	—
190	48	5	13	8	10	2.5	556B
	—	5	25	—	—	—	—
200	48	5.1	25	8	10	2.5	547A
	—	–5	13	—	—	—	—
200	24	5	25	8	10	2.5	547B
	—	–5	13	—	—	—	—
250	48	5	50	8	10	2.25	556C
250	48	5	30	12	1	2.25	552A
	—	5	20	—	—	—	—
273	48	5.2	40	8	10	3	549A
	—	5	13	—	—	—	—

For additional information, call your AT&T Account Manager, or call 1-800-372-2447

dc-dc Converters Product Matrix (continued)

Watts (W)	Input (Vdc)	Output (Vdc)	Amps (A)	Dimensions (in.) H	L	W	Part Number
Commercial Packaging (Partial Listing)							
15	48	5	2.7	3	7	1.5	545A
	—	5	0.2	—	—	—	—
45	48	5	9	7.4	2.6	0.7	553B
	—	5	2.5	—	—	—	—
85	48	5.1	6.2	8	9	2.5	541A
	—	24	2.2	—	—	—	—
160	48	5.1	25	8	10	2.5	555A
	—	–5.1	7	—	—	—	—
532	24	5.15	74.0	5	8	14	CS785A
728	48	28	26	9	9.6	1.9	CS793B
1350	48	35	38	9	14	3	CS870
	—	12	.2	—	—	—	—

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Features

- Meets world regulatory agency requirements, such as UL and CSA
- Meets FCC and Class A or B EMI requirements for conducted and radiated emission
- Isolated inputs/outputs
- Inputs are surge-protected for common line transient conditions
- Outputs are overvoltage protected
- Manual or autoranging for worldwide input voltage ranges
- Power factor correction
- Demonstrated high reliability designed to meet your system's needs
- Battery backup
- Remote sensing
- Current limit/shutdown
- Customized alarms for input/output conditions
- Current sharing
- Margining
- Reverse airflow/variable-speed fans
- dc input capability (limited models)
- Active or passive in rush protection
- Soft start
- Remote inhibit

Off-Line Switching Power Supplies (OLS) Product Matrix

Watts (W)	Input (Vac) Except as Noted	Output 1 (Vdc, A)	Output 2 (Vdc, A)	Output 3 (Vdc, A)	Output 4 (Vdc, A)	Dimensions (in.) L	W	H	Part Number
21	94—254	170, 0.125	—	—	—	13.94	8.40	3.10	397C
43	120—240	170, 0.250	—	—	—	14.50	7.75	3.00	610A
60	117	5, 12	12, 5	–5, 15	–48, 1.26	7.77	6.00	2.95	332C
75	100—240	5.1, 6	12, 2	–12, 0.1	24, 1.3	8.50	6.00	2.50	CS709A
80	120, 170	5, 3.5	–5, 0.5	10.0, 0.2	–48, 1.2	11.05	4.60	2.50	352D
87	120	5, 3	–4, 0.6	12, 0.17	–48, 1.4	8.00	6.00	2.90	338EMB
105	110, 224	5, 6.4	–5, 1	12, 5.4	—	8.00	5.60	2.75	CS732C
108	110	5, 5	15, 1.7	24, 0.2	–15, 1.5	9.00	4.50	2.30	CS708A
160	120	5.1, 10	–5.1, 2.5	–48, 2.05	—	11.00	8.00	2.87	391A1
215	110, 220	5, 7	–5, 6.25	–12, 0.35	24, 6	8.00	7.00	4.75	CS724C
215	110, 220, PFC	5, 7	5.1, 6.25	–12, 0.35	24, 6	8.00	7.00	4.75	CS724D
260	120/208—240	5, 40	–12, 2.9	12.0, 2.6	—	14.00	3.00	8.00	611A
260	–48 Vdc	5, 40	–12, 2.9	12.0, 2.6	—	14.00	3.00	8.00	612A
300	120	5, 60	—	—	—	14.00	3.00	8.00	631DA1
300	–48 Vdc	5, 60	—	—	—	14.00	3.00	8.00	644A
325	117	52, 6.25	—	—	—	10.21	7.15	2.06	336A1
414	120	–5, 6	–48, 8	—	—	13.00	3.00	8.00	631DB1
414	–48 Vdc	–5, 6	–48, 8	—	—	13.00	3.00	8.00	645B
450	230	34, 20	5.15, 16	—	—	15.00	8.20	3.25	CS756A
480	110—120/220—240	5, 66	12, 10.3	–12, 0.75	10.0, 0.6	9.50	7.30	6.20	CS752A
570	48 Vdc	5.1, 55	–5.1, 5.5	12, 2	–48, 6.85	19.50	8.10	7.70	676B (dc/dc)
630	200—240	2.1, 300	—	—	—	5.00	8.00	11.00	CS786A021
790	110—120/200—240	5, 105	12, 20	–12, 1	—	8.50	7.40	9.50	CS782A
1175	110, 220	5, 50	5, 35	6.35, 100	28.4, 1.5	19.80	10.00	8.00	CS792A
1500	200—240	5, 300	—	—	—	5.00	8.00	11.00	CS784A050
1500	200—240	5.23, 288	—	—	—	5.00	8.00	11.00	CS784A052
1500	200—240	54, 27.8	—	—	—	5.00	8.00	11.00	CS787B540
1800	200—240	5.2, 360	—	—	—	5.00	8.00	11.00	CS788052
2000	200—240	20, 100	—	—	—	5.00	8.00	11.00	CS788B200
2700	120—208	345, 8	—	—	—	5.00	8.00	11.00	562A

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

AT&T Microelectronics offers a new line of Notebook Power Supplies ranging from 15 W to 55 W.

Features

- Single-ended primary inductor circuit (SEPIC)
- Integrated thermal management/ isolation
- Automatic mixed mode manufacture and test
- Analytically optimized EMI suppression

Notebook Power Supplies Product Matrix

Watts (W)	Input (Vac)	Output 1 (Vdc, A)	Output 2 (Vdc, A)	Output 3 (Vdc, A)	Output 4 (Vdc, A)	Dimensions (in.) L	W	H	Part Number
16	90—265	5.2	CC*	1.8—2.4	0—6.9	5.5	2.25	1.5	CS714A
24	90—265	5	CC*	1.9—2.4	0—6	6.0	2.25	1.5	CS712A
25	90—265	12.4	—	—	—	5.0	2.25	1.5	CS719A
25	90—265	24	—	—	—	5.0	2.25	1.3	CS713A
55	90—265	22	—	2.09—2.31	4—22	5.0	2.25	1.5	CS7000A
30	90—265	—	—	2.2 max	4—13	5.5	2.25	1.5	CS7001A
25	90—265	12	—	1.2 max	18	5.5	2.25	1.5	TBD
52	90—265	22	—	2.09—2.31	12	6.0	3.0	2.0	CS708B

*CC: continuous current.

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Power Transformers

AT&T's power component product line extends to a wide variety of telecommunications and data processing network needs. These devices have met our own system design needs for power magnetics with precision quality and reliability, and we know they can adequately fit all of your power magnetic needs too. The product line offers you a broad selection of embedded and common power magnetic components that are either custom- or standard-designed, including:

- High-frequency inductors
  - — Common mode
  - — Output coupled power
  - — Output power
  - — Snubber
- High-frequency transformers
  - — Current sense
  - — Driver
  - — Flyback
  - — Unipolar and bipolar waveform
- Low-frequency inductors
  - — Alternating current (ac) power
  - — Commutating power
  - — Direct current (dc) power
- Low-frequency transformers
  - — Current sense
  - — Power line

Surface-Mount Power Magnetics

AT&T also offers a line of six low-profile surface-mount magnetic structures for high-frequency applications up to 10 W.

AT&T can design magnetics on these surface-mount structures to meet your custom circuit needs.

ISDN Transformers

AT&T offers a full line of ISDN Primary-Rate T-Carrier and CEPT, ISDN S/T-Interface, and ISDN U-Interface transformers. AT&T transformers are compatible with the components of most major communications IC manufacturers.

Features and Benefits

Along with the expertise that goes with 30 years of magnetics design and manufacturing experience, AT&T offers the following features and benefits for the majority of our LAN and ISDN transformer products:

- Low-profile packaging
- Compatibility with CCITT, ANSI, and IEEE standards
- WSF/TIC compatibility
- International safety requirement compliance
- Surface-mount designs
- Compliance with Bellcore flammability requirements

V.32 Modem Applications

Two low-profile transformers are available for V.32 modem applications. The 2769A is a through-hole ferrite core transformer. The 2770A is a surface-mount version of the 2769.

Custom-Design Capabilities

We use the outstanding engineering capabilities of AT&T Bell Laboratories for our custom-designed components. These designs, coupled with state-of-the-art manufacturing, enable us to supply a full line of magnetic components to you.

To generate a custom-designed product, AT&T uses computer-aided design (CAD) techniques. AT&T Bell Laboratories engineers work with your specifications to ensure the proper design. First, your specifications, which are expressed in terms of circuit performance, are analyzed closely. Then, they are translated into appropriate parameters, and prototypes are made. Once your requirements are met, you receive the component that you requested for your specific production needs.

ISDN Primary-Rate T-Carrier and CEPT Transformers

The 2741 Miniature Pulse Transformers are designed for DS1, DS1C, and CEPT applications. These transformers are used for digital-signaling-interface applications to DS1 or DS1C cross-connects (DSX).

The 2745 Miniature Pulse Transformers are designed for digital-signaling-interface applications to DS1 or DS1C cross-connects (DSX).

The 2758 Miniature Pulse Transformers are surface-mount versions of the 2741 and 2745 series.

The 2700A Precision Adjustable Transformer is designed for applications requiring a tunable inductance that is extremely stable over a wide temperature range.

ISDN S/T-Interface Transformers

The 2718 ISDN S/T Interface, Electronic Circuit Transformers are ferrite-core designs that operate at 192 kbits/s.

ISDN U-Interface Transformers

The 2754 ISDN U-Interface, Electronic Circuit Transformers are intended to be used with the ISDN U-Interface and those devices designed to meet the ANSI 2B1Q standard.

Electrical Characteristics

Part No.	Turns Ratio (PRI:SEC)	Minimum Primary Inductance (mH)	Maximum Primary Leakage Inductance (μH)	Maximum Interwinding Capacitance (pF)	Maximum dc Resistance Primary (Ω)	Maximum dc Resistance Secondary (Ω)	Minimum ac Breakdown (Vac)
2741G	1:2	3.15	6.5	5	1.85	4.40	850
2741H	1:1.36	0.92	2.5	5	0.83	1.43	850
2741J	1:1.37	0.92	2.0	8	0.80	1.25	850
2745B	1:2	3.5	7.0	110 (TYP)	4.9	10.2	850
2745C	1:1.37	0.680	1.2	85 (TYP)	1.0	1.4	850
2745G	1:1.14	1.75	1.4	80	0.95	1.10	850
2745AE	1:1.43	1.3	1.2	90	0.58	0.86	850
2745AF	1:2	3.15	3.0	23	1.55	3.15	850
2745AG	1:1	2.3	2.0	25	0.98	1.06	500
2745AH	1:3.76	0.43	0.64	45.0	0.35	1.45	850
2745CA	1:1.36	0.92	0.7	20	0.85	1.18	850
2745AJ	1:1.07	1.0	0.8	75 (TYP)	0.50	1.0	850
2758A	1:1.41	12.0	10.0	30	3.0	5.0	500
2758B2	1:1.14	1.75	2.0	80	0.80	0.80	850
2758C2	1:2	3.15	3.0	30	1.10	2.25	850
2758D	1:1.14	1.3	1.5	5	0.50	0.60	850
2758E	1:2	3.15	3.2	5	1.00	3.40	850
2758G2	1:1.37	0.7	1.2	50 (TYP)	0.34	0.44	850
2700A	1:2.8	0.025	–	–	–	–	–
2718AM	1:2.5	22	18	25	2.8	6.0	1000
2718AW	1:2	22	18	25	2.2	5.4	1500
2718AT	1:2.5	22	12	30	1.9	5.6	1500
2718AU	1:1.8	22	11	30	2.0	4.2	1500
2718AY	1:1.8	22	16.5	25	2.3	4.9	1500

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Electrical Characteristics (continued)

Part No.	Turns Ratio (PRI:SEC)	Minimum Primary Inductance (mH)	Maximum Primary Leakage Inductance (μH)	Maximum Interwinding Capacitance (pF)	Maximum dc Resistance Primary (Ω)	Maximum dc Resistance Secondary (Ω)	Minimum ac Breakdown (Vac)
2754B	1:2.5	11.5	23	–	2.0	9.5	1000
2754G2	1:2.5	12	25.6	–	2.5	12.2	1000
2754H2	1:1.5	12.3	27.5	–	6.8	12.4	1000

For additional information, call your AT&T Account Manager, or call 1-800-372-2447.

Appendices

LITERATURE SELECTION INDEX

AT&T Microelectronics offers a full complement of technical literature for the products featured in this book.

Application Notes are in-depth technical discussions on how a specific product should be used in a particular end-user application.

Data Books are bound collections of data sheets, with appropriate introductory material. The data books are intended as reference libraries for the design community and purchasing groups.

User Manuals are technical documents that fully describe how a specific product should be used. They are typically issued for classes of products that require extensive design-in activity.

Data Sheets provide exact definitions of a particular component by detailing its full electrical and physical specifications. The data sheet is the basic source of design information for new systems and also provides data for equipment troubleshooting, training, incoming inspection, equipment testing, and system design modification. Device data sheets can be ordered by referencing the part numbers listed throughout this book.

All documentation is available, free of charge, to qualified AT&T customers. Call your local sales office or **1-800-372-2447**.

Documentation Number	Publication Title
Application Notes	
AP90-012CMOS	CMOS ASIC Boundary-Scan and Built-In Self-Test (BIST) Implementations
AP88-05DMOS	Implementation of the CCITT Wideband Coder with the *WE*® DSP16 DSP
AP88-07DMOS	Implementation of Adaptive Differential Pulse-Code Modulation (ADPCM) Transcoder with the *WE*® DSP16 DSP
AP88-08DMOS	Dual-Tone Multifrequency Receiver Using the *WE*® DSP32 DSP
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AP88-18DMOS	Noise Generation Routines Using the AT&T *WE*® DSP16 DSP
AP88-19DMOS	*WE*® DSP16 Digital Signal Processor Demonstration Board
AP88-20DMOS	Interfacing External RAM to the *WE*® DSP16 Family of Digital Signal Processors
AP89-001DMOS	ROM Code for the *WE*® DSP32C Digital Signal Processor
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AP91-024DMOS	Cyclic Redundancy Check Coding on the DSP1610
AP91-025DMOS	Signal Coding on the DSP1610
AP91-026DMOS	Code Conversion from the DSP16A to the DSP1610/16
AP92-026DMOS	DSP3210/486 Motherboard Reference Design Application Brief

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Application Notes (continued)	
AP93-001DMOS	Algorithm Implementation Examples for Digital Cellular Communication
AP91-002HVIC	LH1208AAJ
AP91-013HVIC	Build Your Own SSR Using the LH1262
AP91-015HVIC	Using the LB127AF SLIC Battery Feed
AP92-018HVIC	T1 Switching with the LH1514 SSR
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AP88-11LWP	Using ac-Coupled *ODL*® 50 L/W Receivers for Burst-Mode and Low Data-Rate Applications
AP85-01PIZ	Voltage-Controlled Crystal Oscillators
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AP87-48XFM	2745B & 2745C Miniature Pulse Transformers
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Data Books	
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BC91-020DMOS	High-Speed Modem V.32bis/V.32/FAX Complete Modem Chipsets
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BC93-001DMOS	DSP1610 Digital Signal Processor
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CA89-03LBC	Analog Integrated Circuits
CA93-001LWP	Fiber Optic Products Lightwave Business Unit Short Form Catalog

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User Manuals	
MN91-054CMOS	High-Speed HS900C CMOS Standard-Cell Library
MN93-001ASIC	Low-Power and High-Speed LP600C/HS600C CMOS Standard-Cell Library
MN93-002ASIC	Low-Power LP900C CMOS Standard-Cell Library
MN93-003ASIC	3 V Optimized, High-Performance, Low-Power HL400C CMOS Standard-Cell Library
MN92-052DBIP	The BEST Design Manual
MN88-05DMOS	*WE*® DSP32 Digital Signal Processor Information Manual
MN88-13DMOS	*WE*® DSP32 Digital Signal Processor Application Guide
MN88-18DMOS	*WE*® DSP16 and DSP16A Digital Signal Processor Information Manual
MN88-21DMOS	*WE*® DSP16 & DSP16A Development Systems
MN89-004DMOS	*WE*® DSP 16A Evaluation Board
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MN91-002DMOS	DSP16A Digital Signal Processor Information Manual
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MN92-018DMOS	Complete Modem Chipsets Data Book
MN92-020DMOS	DSP1610 Digital Signal Processor Information Manual
MN92-058DMOS	High-Speed Modem Data Pump Chipsets Data Book
MN93-010HVIC	Solid-State Relay Designer's Guide
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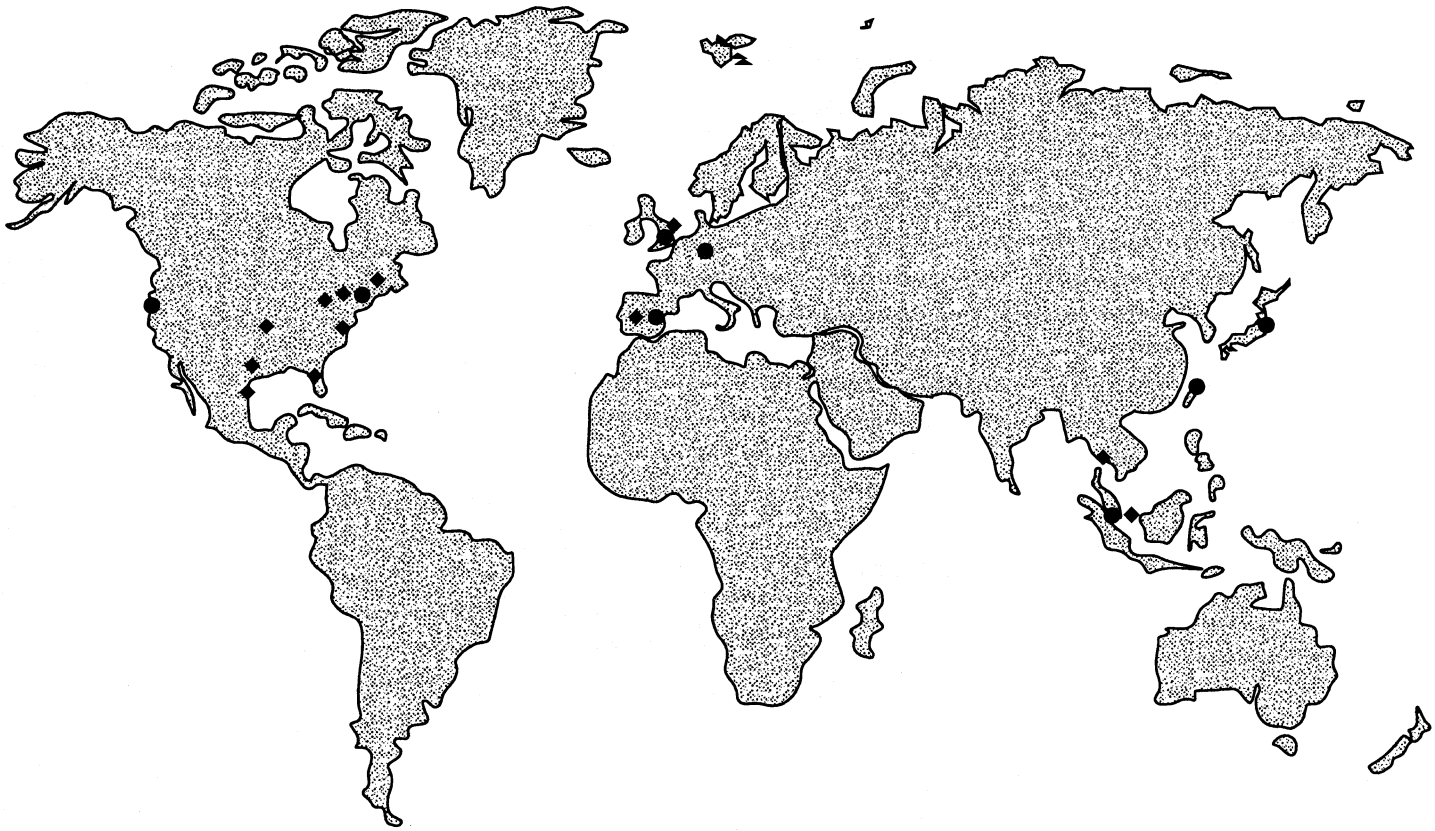

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AT&T Microelectronics
World Headquarters
2 Oak Way
Berkeley Heights, NJ 07922-2727
(908) 771-2000

For additional information:
AT&T Microelectronics
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555 Union Boulevard
Allentown, PA 18103
1-800-372-2447
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North American Sales Offices

Allentown
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Norcross, GA 30092
(404) 446-4700

Boston
Point West Place
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Framingham, MA 01701
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Itasca, IL 60143
(708) 290-3335

Dallas
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Suite 950
Irving, TX 75039
(214) 556-8800

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(303) 290-2336

Los Angeles
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Suite 101
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Minneapolis
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Portland
10220 S.W. Greenburg Rd.
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Portland, OR 97223
(503) 244-3883

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San Francisco
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(408) 980-3700

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FAX: 463-263
Int'l: +358-0-463-263

France
Tour Horizon
52 Quai de Dion Bouton
F-9280 Puteaux Cedex
Paris, France
Tel: 4767-4767
Int'l: +33-1-4767-4767
FAX: 4767-4724
Int'l: +33-1-4767-4724

Germany
Rudower Chaussee 5
0-1199 Berlin, Germany
Tel: 030-6643385
Int'l: +49-30-6643385
FAX: 030-6643225
Int'l: +49-30-6643225

Bahnhofstrasse 27A
D-8043 Unterfoehring
Munich, Germany
Tel: 089-95086-0
Int'l: +49-89-95086-0
FAX: 089-95086-333
Int'l: +49-89-95086-333

Senefelderstrasse 8
D-7302 Ostfildern 1
Stuttgart, Germany
Tel: 0711-44-20-50
Int'l: +49-711-44-20-50
FAX: 0711-44-71-59
Int'l: +49-711-44-71-59

Italy
Viale Fulvio Testi 117
I-20092 Cinisello Balsamo
Milan, Italy
Tel: 02-6601-1800
Int'l: +39-2-6601-1800
FAX: 02-6127-005
Int'l: +39-2-6127-005

Korea
Samdo Building
9th Floor
1-170 Soonhwa-Dong, Choong-ku
Seoul, 100-130, Korea
Tel: 2-751-4155
Int'l: +82-2-751-4155
FAX: 2-751-4161
Int'l: +82-2-751-4161

Japan
Crystal Tower
2-27, Shiromi 1-chome
Chuo-ku, Osaka 540, Japan
Tel: 06-945-6500
Int'l: +81-6-945-6500
FAX: 06-945-6530
Int'l: +81-6-945-6530

7-18, Higashi-Gotanda 2-chome
Shinagawa-ku, Tokyo 141, Japan
Tel: 03-5421-1600
Int'l: +81-3-5421-1600
FAX: 03-5421-1700
Int'l: +81-3-5421-1700

Singapore
14 Science Park Drive
#03-02A/04 The Maxwell
Singapore 0511
Tel: 778-8833
Int'l: +65-778-8833
FAX: 777-7495
Int'l: +65-777-7495

Spain
Poligono Industrial de
Tres Cantos (Zona Oeste)
E-28770 Colmenar Viejo
Madrid, Spain
Tel: 1-807-1700
Int'l: +34-1-807-1700
FAX: 1-807-1420
Int'l: +34-1-807-1420

Sweden
Klarabergsviadukten 70
Box 70363
S-107 24
Stockholm, Sweden
Tel: 08-700-5230
Int'l: +46-8-700-5230
FAX: 08-700-5263
Int'l: +46-8-700-5263

Taiwan
7/12/14th Floor, Overseas Trust Building
249, Sec 1, Tun Hwa South Road
Taipei, 106, Taiwan, R.O.C.
Tel: 2-711-3091
Int'l: +886-2-711-3091
FAX: 2-776-1366
Int'l: +886-2-776-1366

United Kingdom
Powell Duffryn House
London Road
Brackneil, Berkshire
RG122AQ, United Kingdom
Tel: 0344-487-111
Int'l: +44-344-487-111
FAX: -344-485-735
Int'l: +44-344-485-735

Cheshire House
164 Main Road
Goostrey, Cheshire
CW4 8JP, United Kingdom
Tel: 0477-544067
Int'l: +44-477-544067
FAX: 0477-33449
Int'l: +44-477-33449

Manufacturer Representatives

Canada/Puerto Rico/United States

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J-Squared Technologies, Inc.
300 March Road, Suite 501
Kanata, Ontario, Canada K2K 2E2
(613) 592-9540

J-Squared Technologies, Inc.
282 Belfield Rd.
Suite 201
Rexdale, Ontario, Canada M9W 1H5
(416) 674-0927

Quebec
J-Squared Technologies, Inc.
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Suite 214
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H9R 5R2
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Richardson, TX 75080
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Utah
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Virginia
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International Manufacturer Representatives

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Runfold, Farmham
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England
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FAX: 0252-781313
Int'l: +44-252-781313

Ireland
Micro Marketing Ltd.
Ellenborough House, Dublin Rd.
NAAS, Co. Kildare
Ireland
Tel: 01-2989400
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Israel
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P.O. Box 3075, 12 Irus Ha'argaman
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Israel
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Int'l: +97-2-53654368/9
FAX: 02-53653470
Int'l: +97-2-53653470

Scotland
Stuart Electronics Ltd.
Phoenix House
Bothwell Road
Castlehill
Carluke ML8 5UF, Scotland
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Int'l: +44-555-51572
FAX: 0555-51562
Int'l: +44-555-51562

Taiwan
Seraphim Engineering Co., LTD.
6th Floor, No. 34-1
Chiu Chuan Street
Taipei, Taiwan, R.O.C.
Tel: 2-593-5195
Int'l: +886-2-593-5195
FAX: 2-594-9424
Int'l: +886-2-594-9424

Exartech International Corp.
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Chung Cheng S. Rd.
San Chung
Taipei, Taiwan, R.O.C.
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(416) 670-2010

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Tel: (1) 416-670-7769

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United States

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(205) 837-6955

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Arrow/Schweber Electronics
2415 W. Erie Drive
Tempe, AZ 85282
(602) 431-0030

California

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1160 Ridder Park Drive
San Jose, CA 95131
(408) 452-2219

Anthem Electronics, Inc.
1 Oldfield Drive
Irvine, CA 92718-2809
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San Diego, CA 92121
(619) 453-9005

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(818) 775-1333

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Rocklin, CA 95677
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Arrow/Schweber Electronics
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Capstone Electronics-Orange Cty. Reg. Ctr.
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San Jose, CA 95131
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Merit Electronics
2070 Ringwood Avenue
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Colorado

Anthem Electronics, Inc.
373 Inverness Drive South
Englewood, CO 80112
(303) 790-4500

Arrow/Schweber Electronics
61 Inverness Drive East
Suite 105
Englewood, CO 80112
(303) 799-0258

Capstone Electronics (Headquarters)
3254 Fraser Street
Aurora, CO 80011
(303) 375-1300

Connecticut

Anthem Electronics, Inc.
61 Mattatuck Heights Road
Waterbury, CT 06705
(203) 575-1575

Arrow/Schweber Electronics
12 Beaumont Road
Wallingford, CT 06492
(203) 265-7741

Florida

Arrow/Schweber Electronics
400 Fairway Drive
Deerfield Beach, FL 33441
(305) 429-8200

Arrow/Schweber Electronics
37 Skyline Drive
Building D
Suites 3101, 3102, & 3103
Lake Mary, FL 32746
(407) 333-9300

Georgia

Arrow/Schweber Electronics
4250 E. River Green Parkway
Duluth, GA 30136
(404) 497-1300

Illinois

Anthem Electronics, Inc.
1300 Remington Road
Suite A
Schaumburg, IL 60173
(708) 884-0200

Arrow/Schweber Electronics
1140 W. Thorndale Avenue
Itasca, IL 60143
(708) 250-0500

Capstone Electronics – Chicago Regional Center
1100 W. Thorndale Avenue
Itasca, IL 60143
(708) 250-0300

Indiana

Arrow/Schweber Electronics
7108 Lakeview Parkway, West Drive
Indianapolis, IN 46268
(317) 299-2071

Iowa

Arrow/Schweber Electronics
375 Collins Road, N.E.
Cedar Rapids, IA 52402
(319) 395-7230

Kansas

Arrow/Schweber Electronics
9801 Legler Road
Lenexa, KS 66214
(913) 541-9542

Maryland

Anthem Electronics, Inc.
7168 Columbia Gateway Drive
Suite A
Columbia, MD 21046
(410) 995-6640

Arrow/Schweber Electronics
9800J Patuxent Woods Drive
Columbia, MD 21046
(301) 596-7800

Massachusetts
Anthem Electronics, Inc.
36 Jonspin Road
Wilmington, MA 01887
(508) 657-5170

Arrow/Schweber Electronics
25 Upton Drive
Wilmington, MA 01887
(508) 658-0900

Capstone Electronics – Boston Regional Center
25 Upton Drive
Wilmington,MA 01887
(508) 657-5874

Michigan
Arrow/Schweber Electronics
19880 Haggerty Road
Livonia, MI 48152
(313) 462-2290

Minnesota
Anthem Electronics, Inc.
7646 Golden Triangle Drive
Eden Prairie, MN 55344
(612) 944-5454

Arrow/Schweber Electronics
10100 Viking Drive
Suite 100
Eden Prairie, MN 55344
(612) 941-5280

New Jersey
Anthem Electronics, Inc.
26 Chapin Road, Unit K
Pine Brook, NJ 07058
(201) 227-7960

Arrow/Schweber Electronics
4 E. Stow Road, Unit 11
Marlton, NJ 08053
(609) 596-8000

Arrow/Schweber Electronics
43 Route 46 East
Pine Brook, NJ 07058
(201) 227-7889

Arrow/Schweber Electronics
101 Crawfords Corner Road
Room 1M511
Holmdel, NJ 07733-3030
(908) 949-4700

Capstone Electronics – Philadelphia Regional Center
4 E. Stow Road, #12
Marlton, NJ 08053
(609) 596-7500

New York
Anthem Electronics, Inc.
47 Mall Drive
Commack, NY 11725
(516) 864-6600

Arrow/Schweber Electronics
20 Oser Avenue
Hauppauge, NY 11788
(516) 231-1000

Arrow/Schweber Electronics
3375 Brighton-Henrietta
Townline Road
Rochester, NY 14623
(716) 427-0300

Arrow/Schweber Electronics
25 Hub Drive
Melville, NY 11747
(516) 391-1300

North Carolina
Arrow/Schweber Electronics
5240 Greens Dairy Road
Raleigh, NC 27604
(919) 876-3132

Capstone Electronics – Raleigh Hub
5230 Greens Dairy Road
Raleigh, NC 27604
(919) 954-0600

Ohio
Arrow/Schweber Electronics
6573 E. Cochran Road
Solon, OH 44139
(216) 248-3990

Arrow/Schweber Electronics
8200 Washington Village Drive
Suite A
Centerville, OH 45458
(513) 435-5563

Oklahoma
Arrow/Schweber Electronics
12111 E. 51st Street
Suite 101
Tulsa, OK 74146
(918) 252-7537

Oregon
Anthem Electronics, Inc.
9090 S.W. Gemini Drive
Beaverton, OR 97005
(503) 643-1114

Almac/Arrow Electronics Corp.
1885 N.W. 169th Place
Beaverton, OR 97006-7312
(503) 629-8090

Pennsylvania
Anthem Electronics, Inc.
355 Business Center Drive
Suite C
Horsham, PA 19044
(215) 443-5150

Arrow/Schweber Electronics
1000 RDIC Plaza
Suite 212
Pittsburgh, PA 15238
(412) 963-6807

Texas
Anthem Electronics, Inc.
651 N. Plano Road
Suite 429
Richardson, TX 75081
(214) 238-7100

Arrow/Schweber Electronics
3220 Commander Drive
Carrollton, TX 75006
(214) 380-6464

Arrow/Schweber Electronics
10899 Kinghurst Drive
Suite 100
Houston, TX 77099
(713) 530-4700

Arrow/Schweber Electronics
2227 W. Braker Lane
Austin, TX 78758
(512) 835-4180

Capstone Electronics – Dallas Regional Center
3220 Commander Drive
Carrollton, TX 75006
(214) 380-9049

Utah
Anthem Electronics, Inc.
1279 W. 2200 South
Salt Lake City, UT 84119
(801) 973-8555

Arrow/Schweber Electronics
1946 W. Parkway Boulevard
Salt Lake City, UT 84119
(801) 973-6913

Washington
Almac Electronics Corporation (Headquarters)
14360 S.E. Eastgate Way
Bellevue, WA 98007
(206) 643-9992

Anthem Electronics, Inc.
19107 120th Avenue, N.E.
Suite 102
Bothell, WA 98011
(206) 483-1700

Wisconsin
Arrow/Schweber Electronics
200 N. Patrick Boulevard
Brookfield, WI 53045
(414) 792-0150

International Distributors

Austria
Ing Ernst Steiner
Elektronische Bautelle
Vertriebsges Gmbh.
Hummelgasse 14
A-1130 Wien
Austria
Tel: 0222-87774740
Int'l: +43-222-87774740
FAX: 0222-8765617
Int'l: +43-222-8765617

Belgium
Inelco Electronics
Avenue des Croix de Guerre 94
B-1120 Brussels
Belgium
Tel: 02-2442811
Int'l: +32-2-2442811
FAX: 02-2-2164606
Int'l: +32-2-2164606

Brazil
Lightwave Products Only
AsGa Microelectronica
KM4-CEP 1314
Cx. P. 132
Paulina–SP
Brazil
Tel: (55192) 74-3210

Denmark
C-88 AS
101 Kokkedal Industripark
Dk-2980 Kokkedal
Denmark
Tel: 042-244888
Int'l: +45-42-244-888
FAX: 042-244-889
Int'l: +45-42-244-889

England
FPGA Products Only
Arrow
St. Martins Business Centre
Cambridge Road
Bedford
MK42 OHF
England
Tel: 02342-72733
Int'l: +44-2342-72733
FAX: 02342-10674
Int'l: +44-2342-10674

Bytech Components LTD
12A Cedarwood
Chineham Business Park
Crockford Lane
Basingstoke
Hampshire, RG24 OWD
England
Tel: 0256-707107
Int'l:+44-256-707107
FAX: 0256-707162
Int'l: +44-256-707162

Macro
Burnham Lane
Slough
SL1 6LN
England
Tel: 0628-604383
Int'l: +44-628-604383
FAX: 0628-666873
Int'l: +44-628-666873

Lightwave Products Only
Optilas
Mill Court
Wolverton Mill
Milton Keynes
MK12 5RE
England
Tel: 0908-221123
Int'l: +44-908-221123
FAX: 0908-221110
Int'l: +44-908-221110

Finland
Nordcomp Finland OY
Asemakuja 2
SF-02770 ESPOO
Finland
Int'l: +35-8-0859-3699
FAX: +35-8-0859-3644

France
A2M
5 Rue Carie Vernet
92315 Sevres Cedex
France
Int'l: +33-1-46237904/63
FAX: +33-1-46237923

Compress
30, Rue Du Morvan
94633 RUNGIS CEDEX
France
Int'l: +33-1-46878020
FAX: +33-1-46866763

Lightwave Products Only
Microscience SA
14, Rue Violet
75015 Paris
France
Int'l: +33-1-45787880
FAX: +33-145752955

Germany
API Elektronik Vertriebs GmbH
Lorenz-Braren-Str. 32
D-8062 Markt Indersdorf
Germany
Tel: 08136-7092
Int'l: +49-8136-7092
FAX: 08136-7398
Int'l: +49-8136-7398

All Products Except Modems
Astronic GmbH
Electronik-Vertrieb
Gruenwalder Weg 30
D-8024 Deisenhofen
Germany
Tel: 089-6130303
Int'l: +49-89-6130303
FAX: 089-6131668
Int'l: +49-89-6131668

Fil Electronic-Vertriebs GmbH
Hans Boeckler Str. 17
D-W7312 Kircheim/Teck
Germany
Int'l: +49-7021 98530 X13
FAX: +49-7021-9853-34

Jermyn GmbH
Im Dachsstück 9
D-6250 Limburg
Germany
Tel: 06431-5080
Int'l: +49-6431-5080
FAX: 06431-508289
Int'l: +49-6431-508289

Italy
Lasi Elettronica S.P.A.
Viale Fulvio Testi, 280
20126 Milan
Italy
Tel: 02-661431
Int'l: +39-2-661431
FAX: 02-66101385
Int'l: +399-2-6610385

Power Products Only
De Mico
Viale Vittorio Veneto 8
20061 Cassina de Pecchi (Mi)
Italy
Tel: 02-95343600
Int'l: +39-2-95343600
FAX: 02-9522227
Int'l: +39-2-9522227

Lightwave Products Only
Farnell Italia Srl
Via F. lli Cernuschi
22-22055 Merate (Como)
Italy
Tel: 039-9907612
Int'l: +39-39-9907612
FAX: 039-599213
Int'l: +39-39-599213

Japan

AT&T Japan Semiconductor Marketing Ltd.
7-18, Higashi-Gotanda 2-chome
Shinagawa-ku, Tokyo 141
Japan
Tel: 03-5421-1750
Int'l: 81-3-5421-1750
FAX: 03-5421-1755
Int'l: 81-3-5421-1755

Kanematsu Electronics Components Corp.
Shin-Ohsaki Kangyo Bldg. 11F
6-4 Ohsaki 1-chome
Shinagawa-ku, Tokyo 141
Japan
Tel: 03-3779-7811
Int'l: +81-3-3779-7811
FAX: 03-3779-7800
Int'l: +81-3-3779-7800

Mitsui & Co., Ltd.
2-1 Ohtemachi 1-chome
Chiyoda-ku, Tokyo 100
Japan
Tel: 03-3285-4067
Int'l: 81-3-3285-4067
FAX: 03-3285-9868
Int'l: 81-3-3285-9868

Sumisho Electronic Devices Corp. Eiseniwamotocho Bldg.
2-8-8 Iwamotocho
Chiyoda-ku, Tokyo 101
Japan
Tel: 03-3863-8200
Int'l: +81-3-3863-8200
FAX: 03-3863-8211
Int'l: +81-3-3863-8211

TOMEN Electronics Corp.
1- 1, Uchisaiwaicho 2-chome
Chiyoda-ku, Tokyo 100
Japan
Tel: 03-3506-3657
Int'l: +81-3-3506-3657
FAX: 03-3506-3497
Int'l: +81-3-3506-3497

Netherlands

TME Components BV
Helftheuvelweg 83
NL-52224 AS 's-Hertogenbosch
The Netherlands
Tel: 073-221010
Int'l: +31-73-221010
FAX: 073-220330
Int'l: +31-73-220330

Norway

Odin Electronics AS
P.O. Box 9376
0135 Oslo
Norway
Int'l: +47-22-67-7290
FAX: +47-22-67-7380

Portugal

ATD Electronica LDA
Edificio Altejo
Urbanizacao da Matinha
Rua 3 No. 505
1900 Lisbon
Portugal
Int'l: +351-1-8580191/2/3/4
FAX: +351-1-8587841

Spain

ATD Electronica SA
Avda. de la Industria
32-Nave 17-2B
28100 Alcobendas
Madrid
Spain
Int'l: +34-1661-6551
FAX: +34-1661-6300

FPGA Products Only
Semiconductores Investigacion y Diseno SA
Edificio "Centro de Encuentros"
Issac Newton, s/n
28760 Tres Cantos
Madrid
Spain
Int'l: +34-18035052
FAX: +34-18039557

Sweden

NC Nordcomp Sweden AB
P.O. Box 4115, Hemvärnsgaten 11
S-171 04 Solna
Sweden
Tel: 08-985140
Int'l: +46-8-985140
FAX: 08-7645451
Int'l: +46-8-765451

Switzerland

Datacomp AG
Silbernstrasse 10
CH-8953 Dietikon
Switzerland
Tel: 01-7405140
Int'l: +41-1-7405140
FAX: 01-7413423
Int'l: +41-1-7413423

Turkey

Inter Muhendislik
Danismanlik Ve Ticaret A.S.
Hasircibasi CAD. No. 55
81310 Kadikoy
Istanbul
Turkey
Tel: 013499400
Int'l: +90-1-3499400
FAX: 013499430
Int'l: +90-1-3499430

AT&T MICROELECTRONICS TERMS AND CONDITIONS

TERMS AND CONDITIONS

THE TERMS AND CONDITIONS OF SALE CONTAINED HEREIN ("THIS AGREEMENT") SHALL APPLY TO ALL QUOTATIONS AND OFFERS MADE AND PURCHASE ORDERS ACCEPTED BY SELLER. IF THESE TERMS AND CONDITIONS CONFLICT WITH TERMS AND CONDITIONS OF A PURCHASE ORDER OR PROCUREMENT DOCUMENT ISSUED BY BUYER, THE TERMS AND CONDITIONS CONTAINED HEREIN SHALL GOVERN. SELLER'S ACCEPTANCE OF BUYER'S ORDER IS CONDITIONED UPON BUYER'S ACCEPTANCE OF THESE TERMS AND CONDITIONS IRRESPECTIVE OF WHETHER THE BUYER ACCEPTS THEM IN WRITING, BY IMPLICATION, OR BY ACCEPTANCE OF AND PAYMENT FOR PRODUCT SOLD HEREUNDER, AND IRRESPECTIVE OF WHEN BUYER'S PURCHASE ORDER OR PROCUREMENT DOCUMENT IS ISSUED OR WHETHER IT PRECEDES OR FOLLOWS ISSUANCE OF THIS AGREEMENT. SELLER'S FAILURE TO OBJECT TO PROVISIONS CONTAINED IN ANY COMMUNICATION FROM BUYER SHALL NOT BE DEEMED A WAIVER OF THE PROVISIONS HEREIN.

1. DELIVERY, TITLE, AND RISK OF LOSS — Shipment will be made in a manner determined by Seller. Title (except as provided in Section 8, "RIGHTS IN INTELLECTUAL PROPERTY") and risk of loss or damage to the product shall pass to Buyer at the time Seller delivers possession of the product to a carrier at Seller's plant or warehouse or other facility without regard to notification of shipment or selection of carrier. Product held by Seller at Buyer's request beyond the scheduled delivery date shall be at Buyer's risk and expense. Freight shall be prepaid by Seller and invoiced back to Buyer. Buyer shall be responsible for expenses incurred by Seller where, at Buyer's request, Seller ships or packs product in other than its normal manner for domestic shipment.

2. LICENSED PRODUCTS — No title or other ownership rights in any licensed products or any copies thereof shall pass to Buyer under this Agreement or any performance hereunder. Buyer agrees that it will not alter any notices on, prepare derivative works based on, or reproduce, reverse engineer, disassemble or decompile any software embodied in licensed products or recorded in the purchased products furnished under this Agreement.

3. TERMINATION OR CHANGE — Buyer shall not terminate, suspend performance, reschedule or cancel delivery or issue a "hold" order under this Agreement, in whole or in part, without Seller's prior written consent and upon terms that will compensate Seller for any loss or damage resulting from such action. Buyer's liability shall include, but not be limited to, the price of product delivered or held for disposition and the price of services already performed, plus Seller's loss of profits thereon, incurred costs and a reasonable allocation of general and administrative expenses. Any such termination shall be subject to a minimum termination charge of fifteen percent (15%) of the dollar amount of the sales terminated.

4. TERMS OF PAYMENT — Buyer shall pay the invoiced amount within thirty (30) days from the date of Seller's invoice. Delinquent payments are subject to an interest charge at the rate of one and one-half percent (1-1/2%) per month, or portion thereof (but not to exceed the maximum lawful rate). Buyer hereby grants to Seller a purchase money security interest in the product to secure the purchase price of the product until the purchase price is paid in full. Buyer agrees to execute and deliver all documents requested by Seller to perfect and maintain Seller's security interest. Orders are subject to a maximum outstanding credit limit (measured counting all outstanding invoices, whether or not past due, combined with the value of all accepted orders) as reasonably determined by Seller. Seller may refuse to accept purchase orders, if such acceptance would result in Buyer exceeding such credit limit. The amount of credit or terms of payment may be changed or credit withdrawn by Seller at any time. Each shipment shall constitute an independent transaction and Buyer shall pay for same in accordance with the specified payment terms. If shipments are delayed by Buyer, Seller may invoice Buyer when Seller is prepared to ship.

5. TAXES — Any tax or related charge that Seller shall be required to pay to or collect for any government upon or with respect to services rendered or the sale, use or delivery of products shall be billed to Buyer as a separate item and paid by Buyer, unless a valid exemption certificate is furnished by Buyer to Seller.

6. PRODUCT CHANGES — Seller may at any time (i) make changes in the products that do not materially affect physical or functional interchangeability or performance or (ii) make more substantial changes or discontinue delivery of the product when required for purposes of safety.

7. WARRANTY — Seller warrants to Buyer that products of its manufacture will be, on the date of shipment of the product, free from defects in material and workmanship and will substantially conform to Seller's written specifications provided to Buyer or to the specifications, if any, identified in an order and agreed to in writing by Seller, other than specifications specifying performance for a period of time. If any defect in material or workmanship or failure to meet said published specifications (a "defect") appears in the product, Seller will, at its option, either repair or replace the defective product without charge at Seller's manufacturing or repair facility or credit or refund the purchase price of the defective product provided: (i) the defect appears within twelve (12) months from the date of shipment of the product, (ii) Buyer notifies Seller in writing of the claimed defect within thirty (30) days after Buyer knows or reasonably should know of the claimed defect, and (iii) Seller's examination of the product discloses that the claimed defect actually exists.

Buyer shall follow Seller's instructions regarding return of defective product, and no product will be accepted for repair, replacement, credit or refund without the written authorization of and in accordance with Seller's instructions. Replaced products shall become Seller's property. In no event shall Seller be responsible for deinstallation or reinstallation of defective products or for the expenses thereof. If Seller determines that the returned products are not defective, Buyer shall pay Seller all costs of handling, inspection, repairs and transportation at Seller's then prevailing rates. Repairs and replacements covered by the above warranty are warranted to be free from defects as set forth above except that the defect must appear (i) within three (3) months from the date of repair or replacement or (ii) prior to the expiration of the above twelve (12) month period, whichever is later.

With respect to products not manufactured by Seller, Seller, to the extent permitted, extends the warranties and affords the remedies to Buyer given to Seller by its vendor of said products. Seller makes no warranties with respect to experimental products or prototypes or to products which have been subjected to misuse, neglect, accident or abuse or have been improperly installed, stored, maintained, repaired or altered by anyone other than Seller, or had their serial numbers or month and year of manufacture or shipment removed, defaced or altered.

EXCEPT AS STATED IN THIS SECTION 7, SELLER, ITS SUBSIDIARIES AND AFFILIATES, SUBCONTRACTORS AND SUPPLIERS MAKE NO WARRANTIES EXPRESS OR IMPLIED, AND SPECIFICALLY DISCLAIM ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AS WELL AS OTHER IMPLIED WARRANTIES, IN LAW OR EQUITY. BUYER'S SOLE AND EXCLUSIVE REMEDY SHALL BE SELLER'S OBLIGATION TO REPAIR OR REPLACE OR CREDIT OR REFUND AS SET FORTH ABOVE.

8. RIGHTS IN INTELLECTUAL PROPERTY — Seller exclusively shall own all right, title and interest in and to any inventions, discoveries, improvements, methods, ideas, computer and other apparatus programs and related documentation, other works of authorship fixed in any tangible medium of expression, mask works or other forms of intellectual property, whether or not patentable, copyrightable or subject to mask work rights or other forms of protection, which are made, created, developed, written, conceived or first reduced to practice by Seller solely, jointly or on its behalf, in the course of, arising out of or as a result of work done under this Agreement.

9. INTELLECTUAL PROPERTY INDEMNITY — Seller shall: (i) defend or settle, at its option and expense, any claim against Buyer alleging that any product furnished hereunder, in the form in which it is furnished by Seller, infringes any United States patent, copyright or trademark; (ii) reimburse Buyer for any costs incurred at Seller's written request; and (iii) pay all damages and costs assessed by final judgment against Buyer and attributable to such claim. Seller shall have the right, at any time and at its option and expense to: (i) procure for Buyer the right to continue using such product; (ii) replace or modify any such product provided or to be provided to be free of the infringement claim and/or discontinue further deliveries of the product; or (iii) require return of such product and refund the purchase price paid less a reasonable allowance for use, damage and obsolescence. Seller's obligations hereunder are conditioned upon: (i) Buyer giving Seller prompt written notice of any such claim; (ii) Seller having complete control of the defense and settlement thereof; and (iii) Buyer cooperating fully with Seller to facilitate the defense or settlement of such claim.

Notwithstanding the foregoing, Seller shall have no obligation to defend or settle any claim for any infringement or other violation of any patent or other intellectual property right: (i) arising from compliance with Buyer's specifications, designs or instructions; or (ii) relating to use of any product furnished hereunder in combination with any other item(s), whether or not furnished by Seller, even if such use is the product's necessary or inherent use or the use for which the product is purchased.

The sale of any product by Seller shall not in any way confer upon Buyer, or upon anyone claiming under Buyer, any license (expressly or impliedly, by estoppel or otherwise) under any patent claim of Seller or others covering or relating to any combination, machine or process in which such product is or might be used, or to any process or method of making such product.

THE FOREGOING STATES THE SOLE AND EXCLUSIVE REMEDY AND OBLIGATION OF THE PARTIES HERETO FOR INFRINGEMENT OR OTHER VIOLATION OF ANY INTELLECTUAL PROPERTY RIGHT AND IS IN LIEU OF ALL WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, IN REGARD THERETO.

10. EXPORT CONTROL — Buyer acknowledges that the products sold under this Agreement and technical information transmitted in connection therewith may be subject to export restrictions under applicable law, including the U.S. Department of Commerce Export Administration Regulations ("Regulations"), and Buyer agrees to comply fully with same. Buyer assures Seller that it will not transmit, sell, transfer or convey any such products, technical information or software, or goods produced through the use of same, to any country, or citizen or resident of a country, other than the United States without first securing the written consent, if required, of the U.S. Department of Commerce.

11. EXCLUSIVE REMEDIES AND LIMITATIONS OF LIABILITY

A. FOR PURPOSES OF THE EXCLUSIVE REMEDIES AND LIMITATIONS OF LIABILITY SET FORTH IN THIS SECTION 11, SELLER SHALL BE DEEMED TO INCLUDE AMERICAN TELEPHONE AND TELEGRAPH COMPANY, ITS SUBSIDIARIES AND AFFILIATES AND THE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS, REPRESENTATIVES, SUBCONTRACTORS AND SUPPLIERS OF EACH OF THEM; AND "DAMAGES" SHALL BE DEEMED TO REFER COLLECTIVELY TO ALL INJURY, DAMAGE, LOSS OR EXPENSE INCURRED.

B. SELLER'S ENTIRE LIABILITY AND BUYERS' EXCLUSIVE REMEDIES AGAINST SELLER FOR ANY DAMAGES CAUSED BY ANY PRODUCT DEFECT OR FAILURE, OR ARISING FROM THE PERFORMANCE OR NON-PERFORMANCE OF ANY WORK, REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT, TORT INCLUDING NEGLIGENCE, STRICT LIABILITY OR OTHERWISE SHALL BE:

1. FOR INFRINGEMENT, THE REMEDIES SET FORTH IN SECTION 9.
2. FOR FAILURE OF PRODUCT OR WORK PERFORMED, THE REMEDIES STATED IN SECTION 7.
3. FOR DELAYS IN DELIVERY, NONE UNLESS THE DELIVERY IS DELAYED BY MORE THAN THIRTY (30) DAYS BY CAUSES NOT ATTRIBUTABLE EITHER TO BUYER OR TO FORCE MAJEURE CONDITIONS, IN WHICH CASE BUYER SHALL HAVE THE RIGHT, AS ITS SOLE REMEDY, TO CANCEL THE ORDER WITHOUT INCURRING TERMINATION CHARGES.
4. FOR DAMAGES TO REAL OR TANGIBLE PERSONAL PROPERTY OR FOR BODILY INJURY OR DEATH TO ANY PERSON PROXIMATELY CAUSED BY SELLER, BUYER'S RIGHT TO PROVEN DIRECT DAMAGES.
5. FOR CLAIMS OTHER THAN SET FORTH ABOVE, SELLER'S LIABILITY SHALL BE LIMITED TO DIRECT DAMAGES THAT ARE PROVEN, IN AN AMOUNT NOT TO EXCEED $100,000.

C. NOTWITHSTANDING ANY OTHER PROVISION OF THIS AGREEMENT, SELLER SHALL NOT BE LIABLE FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OR FOR LOST PROFITS, SAVINGS OR REVENUES OF ANY KIND, WHETHER OR NOT SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THIS PROVISION SHALL SURVIVE FAILURE OF AN EXCLUSIVE REMEDY.

12. MEDICAL AND LIFE SUPPORT APPLICATIONS — Seller does not recommend the use of any products for medical or life support applications wherein a failure or malfunction of the product may directly threaten life or cause injury and Seller will not knowingly sell its products for such use except pursuant to a written exception to this policy granted on a case-by-case basis. No warranty is made with respect to any such medical or life support use of any product.

13. ASSIGNMENT — Buyer shall not assign this Agreement or any rights or obligations hereunder without the prior written consent of the Seller. Any attempted assignment without the Seller's consent shall be void and ineffective.

14. NON-WAIVER — No course of dealing or failure of either party to strictly enforce any term, right or condition of this Agreement shall be construed as a waiver of such term, right or condition.

15. FORCE MAJEURE — Except with respect to Buyer's obligation to make timely payments when due, neither party shall be held responsible for any delay or failure in performance of any part of this Agreement to the extent such delay or failure is caused by fire, flood, explosion, war, strike, embargo, government requirement, civil or military authority, act of God, nature or the public enemy, inability to secure material or transportation facilities, inadequate yield of products despite Seller's reasonable efforts, act or omission of carriers or any other causes beyond its reasonable control. Seller may, in the event of any such circumstance, allocate at its sole discretion its available production output among itself and its other customers, including at Seller's option those not under contract.

16. CHOICE OF LAW — The construction, interpretation and performance of this Agreement shall be governed by the substantive laws, but not the conflicts of law, of the State of New York. The U.N. Convention on Contracts for the International Sales of Goods shall not apply to the sale of product hereunder.

17. ENTIRE AGREEMENT — Except for any written agreement between the parties relating to confidentiality of proprietary information, the terms and conditions contained in this Agreement supersede all prior oral or written understandings between the parties and shall constitute the entire Agreement between the parties with respect to the subject matter of this Agreement. This Agreement shall not be modified or amended except by a writing signed by Buyer and Seller.

For additional information, contact your AT&T Account Manager or the following:

❑ AT&T Microelectronics
Dept. AL-500404200
555 Union Boulevard
Allentown, PA 18103
1-800-372-2447
FAX 215-778-4106

In Canada, call:
1-800-553-2448
FAX 215-778-4106

❑ AT&T Microelectronics Asia/Pacific
14 Science Park Drive
#03-02A/04 The Maxwell
Singapore 0511
Tel. (65) 778-8833
FAX (65) 777-7495

❑ AT&T Microelectronics
AT&T Japan Ltd.
7-18, Higashi-Gotanda 2-chome
Shinagawa-ku, Tokyo 141
Japan
Tel. (81) 3-5421-1600
FAX (81) 3-5421-1700

For data requests in Europe:

❑ AT&T Dataline
Tel. (44) 732 742 999
FAX (44) 732 741 221

For technical inquiries in Europe:

❑ Central Europe: **(49) 89 95086 0** (Munich)
Northern Europe: **(44) 344 487 111** (Bracknell UK)
France: **(33) 1 47 67 47 67**
Southern Europe: **(39) 2 6601 1800** (Milan)
(34) 1 807 1700 (Madrid)

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CA93-004OTH (Replaces CA93-003OTH)

AT&T
Microelectronics