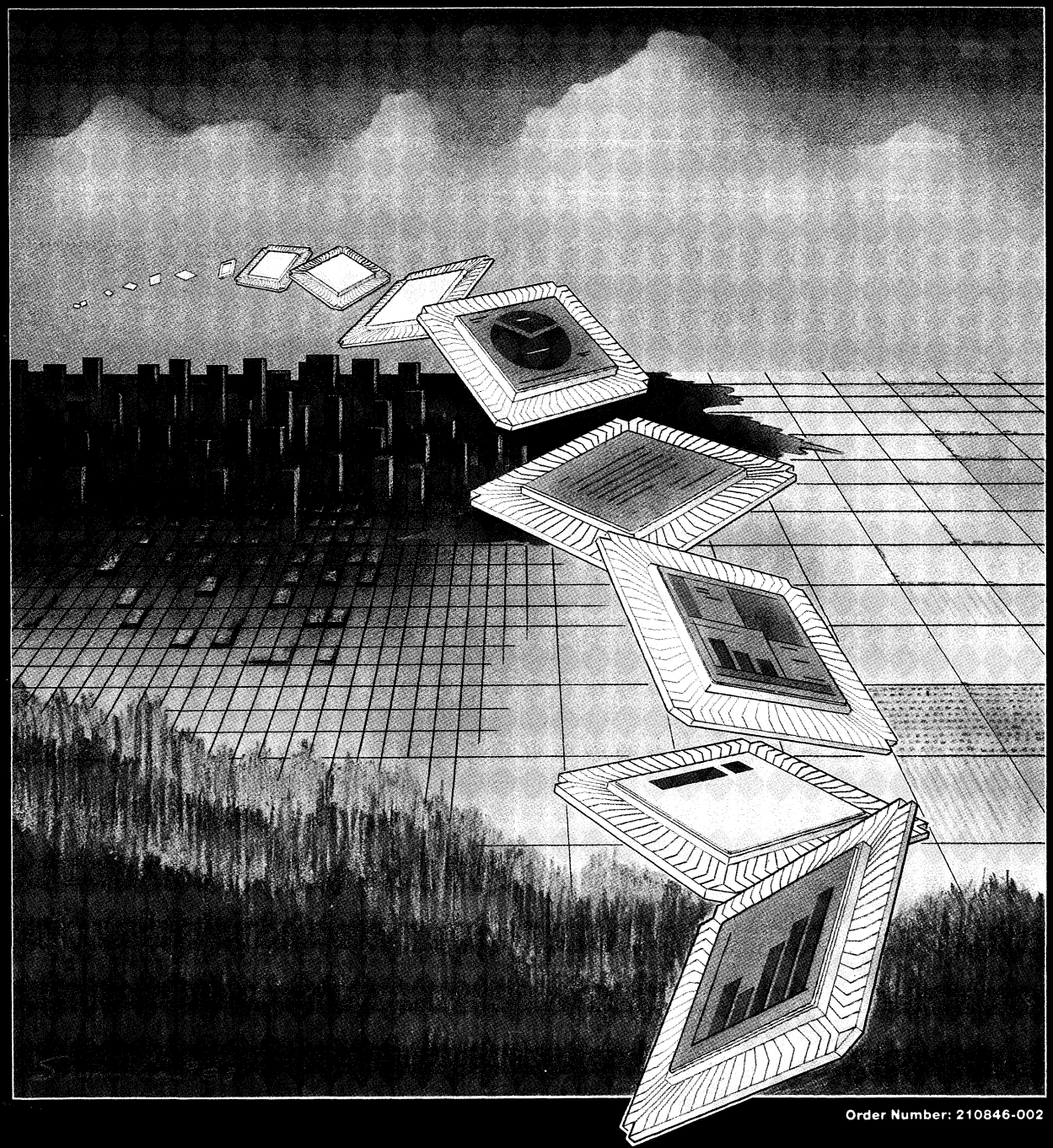
intel

Product Guide



Order Number: 210846-002

LITERATURE

In addition to the product line Handbooks listed below, the INTEL PRODUCT GUIDE (no charge, Order No. 210846) provides an overview of Intel's complete product line and customer services.

Consult the INTEL LITERATURE GUIDE for a complete listing of Intel literature. TO ORDER literature in the United States, write or call the Intel Literature Department, 3065 Bowers Avenue, Santa Clara, CA 95051, (800) 538-1876, or (800) 672-1833 (California only). TO ORDER literature from international locations, contact the nearest Intel sales office or distributor (see listings in the back of most any Intel literature).

1984 HANDBOOKS	U.S. PRICE*
Memory Components Handbook (Order No. 210830) Contains all application notes, article reprints, data sheets, and other design information on RAMs, DRAMs, EPROMs, E^2PROMs, Bubble Memories.	**$15.00**
Telecommunication Products Handbook (Order No. 230730) Contains all application notes, article reprints, and data sheets for telecommunication products.	**7.50**
Microcontroller Handbook (Order No. 210918) Contains all application notes, article reprints, data sheets, and design information for the MCS-48, MCS-51 and MCS-96 families.	**15.00**
Microsystem Components Handbook (Order No. 230843) Contains application notes, article reprints, data sheets, technical papers for microprocessors and peripherals. (2 Volumes) (Individual User Manuals are also available on the 8085, 8086, 8088, 186, 286, etc. Consult the Literature Guide for prices and order numbers.)	**20.00**
Military Handbook (Order No. 210461) Contains complete data sheets for all military products. Information on Leadless Chip Carriers and on Quality Assurance is also included.	**10.00**
Development Systems Handbook (Order No. 210940) Contains data sheets on development systems and software, support options, and design kits.	**10.00**
OEM Systems Handbook (Order No. 210941) Contains all data sheets, application notes, and article reprints for OEM boards and systems.	**15.00**
Software Handbook (Order No. 230786) Contains all data sheets, applications notes, and article reprints available directly from Intel, as well as 3rd Party software.	**10.00**

*** Prices are for the U.S. only.**

ON THE COVER: The application of microprocessors encompasses the world from cities, to factories, to the fields and beyond; unleashing productivity and creativity in all facets of human endeavor. The Intel 80286 microprocessor, depicted with some of today's most familiar applications on its chip carrier package, brings powerful multitasking capability to the world of solutions. In personal computing, multiuser office automation, and real-time factory control, the 80286 delivers the future of multitasking while carrying with it upward compatibility for the world's largest base of microprocessor software. From components to systems to software, Intel's Product Guide offers total solutions for your world.

intel®

PRODUCT GUIDE

1984

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Intel retains the right to make changes to these specifications at any time, without notice.

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* MULTIBUS is a patented Intel bus.

Additional copies of this manual or other Intel literature may be obtained from:

Intel Corporation
Literature Department
3065 Bowers Avenue
Santa Clara, CA 95051

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+XENIX is a trademark of Microsoft Corp.

ALPHANUMERIC INDEX

This is not an all-inclusive part number listing of all Intel products but merely an index to those products mentioned in this Guide. Dash numbers, military, and EXPRESS parts are not designated separately but are included under the generic product number.

INTRODUCTION

Intel introduced the first microprocessor in 1971. Today, microprocessors touch all of our lives from the factories to the fields, and from our offices to our homes. The microelectronic revolution has already brought greater productivity to industry, spawned new markets and businesses, and contributed to higher quality products and a better life. As we approach the mid-1980's, microprocessors are triggering a worldwide information revolution. Personal computers, communications networks, software standards, and system standards are allowing us to directly support individual creativity for the first time and to share those contributions using the emerging information networks. It is important to realize that these revolutionary effects on the world are possible because processing power is being distributed instead of centralized through the application of the microprocessor.

Intel is dedicated to the concept of distributed processing. In 1982 we introduced over 100 new products ranging from microprocessor and memory components, to systems and software. We develop, produce, and support a product line based on "Open Standards" and "Open Systems" that allow you to use our components, systems, and software to meet your goals for creativity and enterprise in your markets. This PRODUCT GUIDE summarizes Intel's complete offering of products and services with this in mind.

HOW TO USE THIS GUIDE

Intel offers this Product Guide as a ready reference "tool" to make it easy for you to select the set of products you'll need to meet your design objectives. You won't find every performance parameter for every device here, but you will find key features, and more importantly cross references to products required for the "total solution" design. The products are arranged into family groupings and are shown in tabular form so that you can find what you need fast. There are footnotes to guide you to related products. An Alphanumeric Index is located on Page iv which will point you directly to the page each product is listed on. In the Product Highlights we've provided a few examples of how particular designs can be executed using Intel products. Military and EXPRESS program (extended reliability) components are recapped in special sections. Customer Support Services are also contained in this Guide. These services include Customer Training, Software Support and Hardware Product Service.

WHERE TO FIND MORE INFORMATION

For complete product line data sheets, application notes, etc., refer to the appropriate Intel handbooks listed on the inside front cover of this Guide or consult the *Intel Literature Guide.* For additional assistance, call your local Intel Sales Office or franchised distributor listed in the last section of this Guide.

Your comments and suggestions on improving this Product Guide are welcomed.

Please call or write to: Sherrie Zirkle
M/S SC6-711
Intel Corporation
3065 Bowers Avenue
Santa Clara, CA 95051
(408) 496-9435

PRODUCT HIGHLIGHTS

The application of electronics is advancing rapidly, driven by advances across all fronts of VLSI technology, systems technology, and software technology.

Intel Corporation is contributing to the leading edge of technology by developing and producing products in all three areas. And to address the ever-increasing diversity of applications, Intel endeavors to develop standard, compatible building blocks in VLSI, systems, and software that can be used to formulate solutions for unique applications.

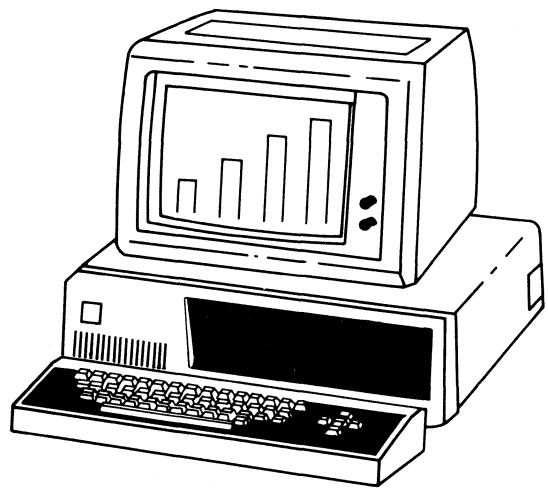
The Product Highlights that follow serve not only as an introduction to over 30 of Intel's most important products, but also demonstrate the role these products play as building blocks in the solution of some of today's most important applications.

Personal Computers Are Contributing to Nearly Every Aspect of Business Enterprise

Underlying the growth in the use of personal computers is the profusion of user friendly software written for the PC. Today a majority of desk top PC's and portable PC products are based on the Intel 8086/8088 microprocessor architecture and supported by the largest base of compatible software for PC's.

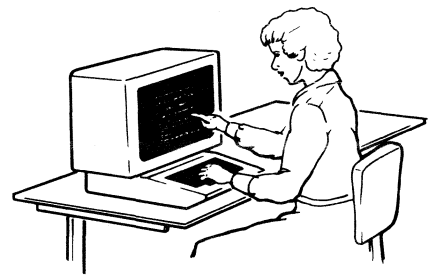
8086/8088 16-Bit Microprocessor Architecture

- 8086 full 16-bit architecture and bus
- 8088 full 16-bit architecture and 8-bit bus
- Supported by the most complete family of peripheral and memory components
- Supported by the largest compatible base of personal computer software and third party software.



The Office Is Witnessing Great Gains in Productivity with User Friendly Systems

Whether your system is a personal computer or an intelligent terminal, it must address the common issues of performance, flexibility, user friendly software and low cost. Intel has the building blocks for you. The entire design can fit on a single printed circuit board.



80186 Highly Integrated 16-Bit Microprocessor

- The heart of a powerful 16-bit office system replaces 15 to 20 ICs
- Particularly suited for individual, dedicated task workstations

82586 LAN Coprocessor

- Provides talker/listener capability on your Ethernet local area network
- Programmable protocol for easy interfacing
- Allows network to transfer data rather than using removeable floppy

iSBC® 186/51 COMMputer™ MULTIBUS® Board

- Powerful, quick to market solution for office systems
- 80186 CPU for task execution
- 82586 on board for communications capability

80150 CP/M* Operating System Coprocessor

- Software on silicon—system comes up user friendly without loading a disk
- Includes the full CP/M operating system software, basic I/O timers and interrupt controllers for a complete operating system
- Speeds system design, improves reliability, can eliminate need for a disk

82730 Alpha Numeric Text Coprocessor

- High quality text includes super and subscript
- Flexible display formats and manipulation
- High performance off-loads CPU

27256A 256K Bit EPROM

- 32K bytes of user friendly applications, software available at the touch of a button
- Standard 28 pin socket site

2186 8K x 8-bit RAM

- Simple design fits in the same 28 pin site as the 27256

*CP/M is a trademark of Digital Research, Inc.

Powerful Sophisticated Graphics Capability Is Available for Both Business and Engineering Applications

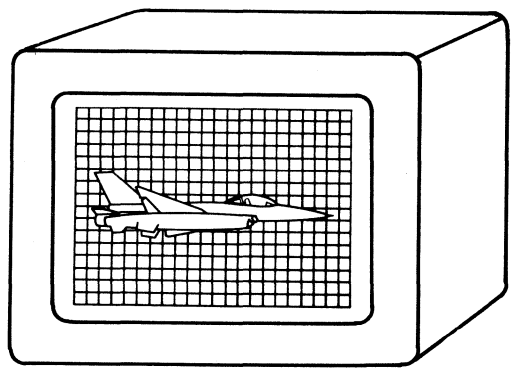
Engineering wordstations and sophisticated business systems are offering more graphics capability to meet the needs for visual interaction with complex objects and concepts.

80286 Advanced 16-Bit Microprocessor

- Designed to handle the multitasking environment in multiuser graphics systems
- Integrated layers of security to protect data and software from corruption or unauthorized access
- Extensive family of coprocessors and peripherals to configure a system to special needs

80287 Numeric Coprocessor

- IEEE floating point standard implimentation
- Up to 100X performance of software routines
- Accuracy extended to 80 bits



82720 Graphics Display Controller

- Sophisticated graphics display and bit map graphics capability
- Off loads host processor to improve system performance
- Accepts high level commands from CPU

51C64 CHMOS Dynamic RAM

- High speed low power CHMOS 64K dynamic RAM
- Ripplemode™ or Static Column Decode
- Delivers high performance graphics bit stream, 50ns per bit for a 256 bit string.

Office Systems Are Serving the Needs of Multiple Users and Linking Them Into Networks.

A family of Intel Open Systems supports the need for multiuser and networked system solutions.

XENIX[+] Operating System

- Licensed version of Unix[++] Operating System
- Highest performance Unix for microprocessors
- Supports sophisticated multiuser, multitasking capability

286/310 Supermicro System

- 80286 based supermicro system
- Supports XENIX for office applications
- Open System supports standard hardware and software interfaces for OEM's

iDIS™ Database Information System

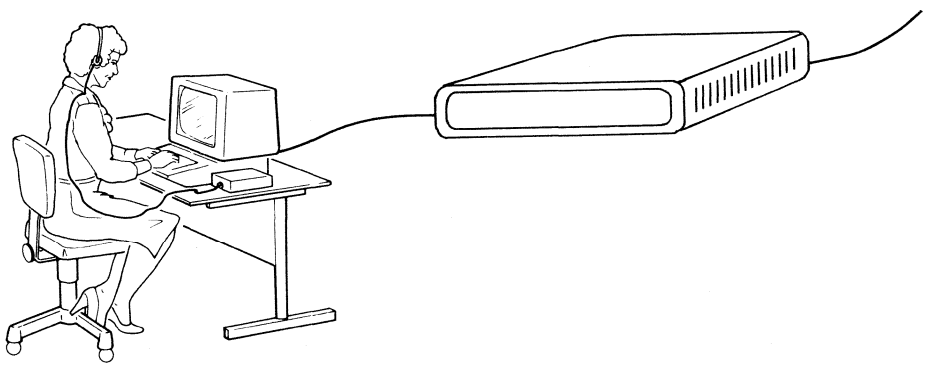
- Links personal computers to mainframe database
- Hardware/software solution optimizes interface
- Provides access to and protection of database

iTPS 445 Transaction Processor

- A complete transaction processing system controlling up to 16 user terminals
- Operates in standalone basis or up-links to larger business systems

iSBC 576 Speech Transaction Board

- Improves the accuracy and efficiency of routine transaction processing by combining voice recognition and transaction software
- Full development support allows easy tailoring to transaction vocabulary and formats



[+]XENIX is a trademark of Microsoft Corp.
[++]Unix is a trademark of Bell Laboratories

Factory Systems are Delivering Improved Productivity and Product Quality

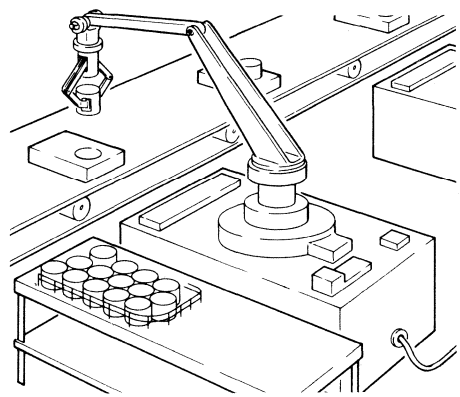
Intel's systems and components support a comprehensive automation strategy, allowing industrial control functions to reach from the central system level all the way to the most remote microcontroller.

iRMX™ Operating System

- Real-time operating system
- Ideal for interrupt driven multitasking factory control systems
- Supports high level language and standard software driver interfaces

286/310 Supermicro System

- 80286 based supermicro system
- Supports iRMX operating system for factory applications
- Open System supports system configurations using the full line of iSBC single board computers.



iSBC 254 Bubble Memory MULTIBUS Board

- Operating system, diagnostics and learned applications programs stored in non-volatile bubble memory
- Bubble memory eliminates need for batteries, enhances reliability and up time

MCS®-96 Advanced 16-Bit Microcontrollers

- Elbows and hands controlled in each axis with precision and grace by powerful 16-bit CPU
- Sensors and actuators interfaced easily to on-chip A/D inputs, pulse width modulated outputs, and digital I/O channels
- Highly integrated support functions on-chip elimate a board full of components
- Simple communication between MCS-96 devices and higher level microprocessors

Telecommunications Capability is the Key to Keeping in Touch with the Modern World, whether you Tie Into a Worldwide Network or You Just Need to Phone Home.

Digital PABXs and their closely associated feature phones are experiencing rapid advances in capabilities in an increasingly competitive environment. Intel is continuing its contribution to this evolution of digital communications.

80C51 CMOS Advanced 8-Bit Microcontroller

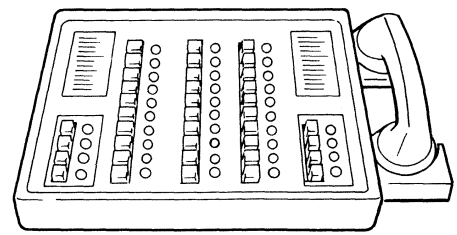
- Powerful 8-bit computing capability is packed into a single low power chip perfectly suited for the feature phone environment
- With a single design approach, the phone can be easily upgraded and additional features added

2817A 16K Bit E²PROM

- Stores the entire dialing repertoire and remembers the status of every feature
- Can be remotely updated with the latest toll rates
- Eliminates the need for batteries or maintenance, uses a 5V only supply

80286 Advanced 16-Bit Microprocessor

- Designed to handle the multitasking environment in systems like a PABX
- Integrated layers of security to protect data and software from corruption or unauthorized access. A must if your PABX is switching voice and business data
- Extensive family of coprocessors and peripherals to configure a system to special needs



2914 Combo Codec/Filter

- Reduced cost and improved line card density with the standard combo codec/filter
- Exceeds D3 and CCITT transmission specifications in the u/law and A/law versions

And of Equal Importance To Your Application is Getting Your Product to the Market on Time, on Budget, and on your Performance Target.

Intel is an innovator here, too. From microcomputer development systems and customer support services.

NDS-II Network Development System

- Powerful, networked distributed processing environment for microprocessor development
- High speed Ethernet based communication links resources and workstations.

Intellec® Series IV Development System

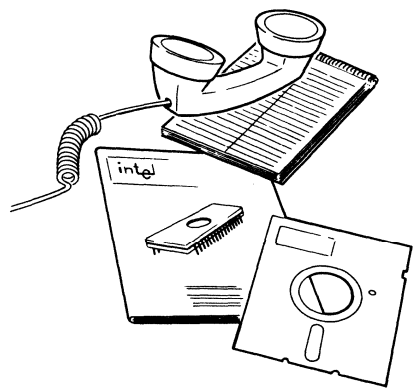
- Stand alone or support of NDS II network
- Supports 8086, 8088, 80186, 80286 microprocessors
- Advanced Program Management Tools track and manage complex software development projects

iPDS™ Personal Development System

- Portable Personal Development System—Can travel to your system on the factory floor or at a remote site
- Advanced split screen capability and ICE™ module support

Product Service Provides Maintenance Services

- Supports board and system level products
- Capability includes warranty, field, contract services as well as installation



Software Support Services

- Supports and maintains software packages
- Hotline phone support and consulting available

Customer Training Courses

- Workshops on components, systems, and software
- Available at Intel Training Centers and at customer sites

CUSTOMER SUPPORT

Customer Support is Intel's complete support service that provides Intel customers with Customer Training, Software Support Services, and Hardware Product Service.

After a customer purchases any system hardware or software product, service and support become major factors in determining whether that product will continue to meet customer expectations. Such support requires an international service organization and a breadth of programs to meet a variety of customer needs. As you might expect, Intel's customer support is quite extensive. It includes factory repair services and worldwide field service offices providing hardware repair services, software support services and customer training classes.

Product Service provides maintenance services on Intel supportable products at the board and system level. Both field and factory services are offered. Services include several types of field maintenance agreements, installation and warranty services, hourly contracted services, specially negotiated support agreements for OEM's, system integrators and large volume end users having unique service requirements, and factory return for repair.

Software Support Services provides maintenance services on software packages via subscription services, hotline phone support, consulting services, and Insite library. Consulting services are arranged for on site assistance at the customer's location.

Customer Training provides workshops by agreement at customer sites and on a regularly scheduled basis at Intel's facilities.

HARDWARE PRODUCT SERVICE

Today, it's essential to have dependable data processing and information storage equipment. To insure trouble-free performance, every Intel product is engineered and manufactured to exacting standards. But sometimes, even the finest components may malfunction. It's then that Intel Product Service delivers fast, economical, quality hardware maintenance and service support to keep vital projects on schedule.

Intel is commited to providing an international service support package through a wide variety of service offerings available from Intel Product Service. Services include:

Table 1. Standard Service Offerings

SERVICE	HIGHLIGHTS
Standard Maintenance Agreement	Full level service covering parts, labor, preventive maintenance and engineering change installations at the customer site. Customer selects hours of coverage. Applies to standard Intel product.
Carry-in Maintenance Agreement	Economical Same services as standard contract, but the customer delivers the equipment to an Intel facility.
Installation and Warranty	Installation is included on many Intel system products. Product Service installs, services and verifies correct operation before turning the system over to the customer. Warranty service is provided either via factory returns or at the customer site, depending on the warranty associated with that particular product.
Per Call Services	Purchase on an as-needed basis labor and materials for installations, repairs, preventive maintenance, and other services.
"Family" Maintenance Agreement	Individually tailored contracts to meet unique equipment configurations and customer support needs. Can include support for non-Intel product as part of the total support agreement Provides the international service capabilities of Intel's Product Service organization to the end user customer of System Integrators and OEM's.
Factory Direct Return Authorization Service (DRA)	Economical 30 day turnaround Applies to board level products in all areas and system customers in non-serviceable areas.
Factory Return Replacement Authorization Service (RRA)	Expedited service 48 hour turnaround Applies to board level products in all areas and system customers in non-serviceable areas.

Not all services provided for all product lines. Contact your local Intel service office for more specific information on the right service to meet your needs.

SOFTWARE SUPPORT SERVICES

Intel's Software Support Services is a comprehensive range of post sales support programs for your software and systems purchased from Intel. Its objectives are to maximize your system's performance and minimize unnecessary downtime for greater productivity. These services are provided for all Intel developed and most Intel marketed third-party software.

System Support Services include six programs—Initial Support. Contract Services, Updates for licensed products, Support Packages, Consulting Services and Insite™ User's Program Library.

Initial Support

Initial support provides each Intel system and licensed product with 90-day support after product delivery. It includes automatic updates and new releases, Software Performance Reporting (SPR) Service, technical reports and monthly technical bulletin. Also available on designated products will be telephone assistance for product specific technical information and assistance with work-arounds, patches, and other solutions for Intel defined product deficiencies.

Contract Services

Two levels of Contract Services are available for extended services beyond 90 days, enabling you to tailor the level of service for each part of your Intel system that satisfies your software/system support requirements.

The term of Contract Services is for 12 months, with a fixed one-time charge for the level of service you choose. No additional cost for multiple units of the same product within the same location. The annual fee allows for two designated contacts or callers. Additional callers can be added on a per caller basis.

Updates

Updates and new releases for licensed products are offered on a per update basis. Each update will be separately priced for any registered Intel customer to purchase. Notification of updates and who requires which updates, will be provided through the monthly technical bulletin, ;COMMENTS, and each product specific technical report.

Support Packages

Support Packages are available to provide an additional level of support for complex systems. This service provides you with software installation, system generation and orientation—to make you and your Intel system fully productive as soon as possible.

Contract Services and Support Packages are provided on standard Intel systems.

Consulting Services

Consulting Services provides customized support for board and component level customers. Consulting Services provide a wide range of support—from system designs to solving difficult development problems to complete project management and project implementation.

Insite™ User's Program Library

Insite User's Program Library provides user supplied and non-licensed software products and modules for a nominal fee. A wide variety of products are available to be used on or in conjunction with Intel hardware, software and system products.

Table 2. Software Support Services

PRODUCT NAME	PART NUMBER	OPERATING SYSTEM				
		ISIS	iNDX	iRMX™	XENIX+	CP/M*-80
INITIAL SUPPORT	Included in license fee or price of each product	SYS	SYS	SYS BRD	SYS BRD	SYS
CONTRACT SERVICE Subscription Service	SPR-TECH-REP	SYS	SYS	SYS BRD	SYS BRD	SYS
Hotline Service	HOTLINE	SYS	SYS	SYS BRD	SYS BRD	SYS
UPDATES	Each update has a unique part number	SYS	SYS	SYS BRD	SYS BRD	SYS
SUPPORT PACKAGES						
NDS-II	SPNDS2INSTALL		SYS			
NDS-II	SPNDS2RECON		SYS			
RMX-86	SPRMX86INSTALL			SYS, BRD		
RMX Systems	SP86330RINSTALL			SYS		
XENIX Sys.	SP86330XINSTALL				SYS	
I²ICE™	SPIII520INSTALL	SYS	SYS			
CONSULTING SERVICES Phone Consulting	CONSULT-PHONE	SYS	SYS	SYS, BRD COMP	SYS, BRD COMP	SYS
Field Consulting	CONSULT-FIELD	SYS	SYS	SYS, BRD COMP	SYS, BRD COMP	SYS COMP
Long-term Consulting	CONSULT-LT	SYS	SYS	SYS, BRD COMP	SYS, BRD COMP	SYS COMP
Expenses	CONSULT-EXP	Travel and living expenses incurred for delivering Consulting and Support Package.				
INSITE USER'S PROGRAM LIBRARY	N/A	User submitted and non-licensed software products and programs used on or in conjunction with Intel Components, Boards and Systems.				

KEY: SYS = All Intel standard system hardware, languages and software packages designed to operate on or within the particular Operating System.
BRD = Service provided for this Operating System and associated language and software designed to operate on standard Intel Single Board Computer configurations.
COMP = Support during the development of a user's system based on an Intel microprocessor component and using an Intel operating system and its associated languages and software.

*CP/M is a trademark of Digital Research, Inc.
+XENIX is a trademark of Microsoft Corp.

System Support Services is Intel's commitment to providing you, the customer, with consistent, high-quality, post-sales software and system support. It is our way of delivering guaranteed support which you can rely on. To tailor a full service software/system support program that addresses your specific needs, contact you local Intel sales or service office for more information.

CUSTOMER TRAINING

Intel offers intensive training workshops on a wide range of microcomputer products and System 2000® database management products. The workshops are held at 17 Intel Training Centers across the United States, Canada, Europe, and Japan, or at customer sites upon request. The workshops range in length from three to five days and feature "hands-on" laboratory exercises.

Workshop Attendees

The microcomputer workshops are designed primarily for design engineers who need to become familiar with Intel products. Engineering managers, those who are evaluating products, field service engineers, technical writers, and other service personnel who want to get an in-depth look at the architecture and systems also attend.

System 2000 workshops are designed for analysts and programmers, as well as database designers and administrators.

Training Center Locations

Please call the nearest Training Center for our complete workshops catalog (Order No. 980100) or write/call the Intel Literature Department to order a copy.

Boston	(617) 256-1374	London	(0793) 488-388
Chicago	(312) 981-7250	Munich	(089) 5389-1
San Francisco	(415) 940-7800	Paris	(01) 687-22-21
Dallas	(214) 241-8087	Stockholm	(08) 98.53.85
Los Angeles	(415) 940-7800	Milan	39-2-8240006
Washington, D.C.	(301) 474-2878	Tokyo	03-437-6611
Toronto	(416) 494-6831	Osaka (Call Tokyo)	03-437-6611
Israel	(972) 452-4261	Benelux	(10) 21.23.77
		Copenhagen	(1) 182-000

Table 3. Customer Training Courses

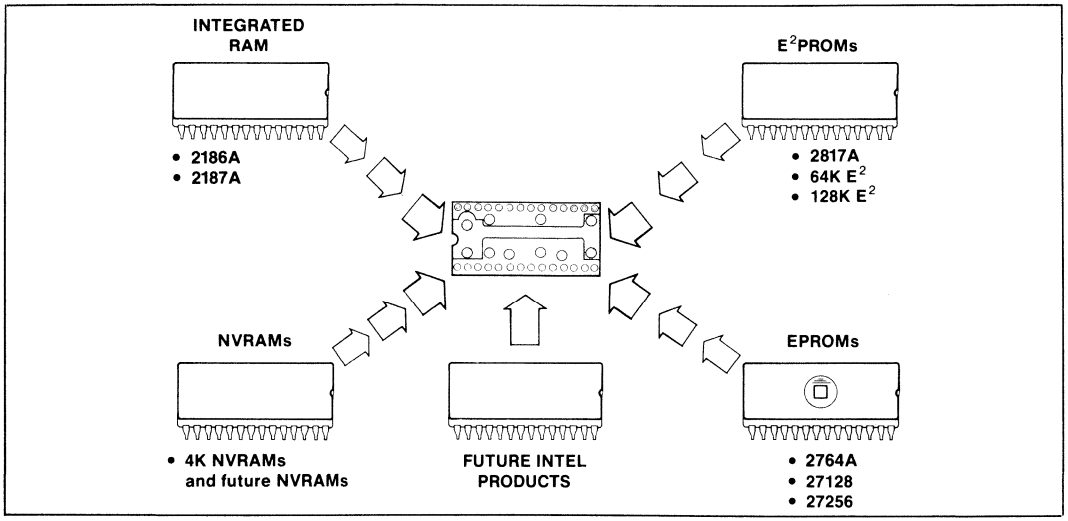
Course Title	Description
INTRODUCTORY	
Self Study Introduction to Microprocessors	Contains an 8085-based kit, audio cassettes, workbook, and manuals.
Introduction to Microprocessors	Covers fundamental computer concepts using the SDK-85 design kit.
MICROCONTROLLERS	
MCS®-48/49 Microcontrollers	Architecture, assembly language programming, in-circuit emulation, and peripheral chips.
MCS-51 Microcontrollers	Architecture, assembly language programming, in-circuit emulation, and communication chips.
MCS-96 16-Bit Microcontrollers	Architecture, assembler, linkage software, peripherals and single board emulator.
MICROPROCESSORS	
MCS-80/85 Microprocessors	Architecture, assembly language programming, system design, interfacing, and in-circuit emulation.
iAPX 86, 88, 186 Microprocessors (Part I)	ASM 86, 86, 88, 186-systems design, debugging tools, multiple-module programming.
iAPX 86, 88, 186 Microprocessors (Part II)	Large-system programming, iAPX 86 utilities, high-level language interfacing, 8087, 8089 coprocessors.
iAPX 286 Microprocessors	Architecture, operating modes, 286 protection model.
MICROCOMPUTER PROGRAMMING LANGUAGES	
Beginning Programming using Pascal	Introduction to high-level language programming using Pascal. Software terminology explained.
PL/M Programming	Structured Programming, linking, locating, and loading with multiple compilation modules. Also covers development and debug tools.
XENIX/C Programming	XENIX operating usage, C Programming, software installation and basic configuration, supported peripherals.
Ada Programming	Detailed description of the Ada language, Ada compilations on host minicomputer.
iRMX OPERATING SYSTEMS	
iRMX 86 Operating System	A two-week course covering multitasking, asynchronous events, resource sharing, intertask communications, and error handling.
	I/O topics for system programmers, loaders, I/O system extensions, and custom device drivers.
iRMX 88, 80 Operating System	Multitasking concurrency, inter-task communication, in-circuit emulation.
System 86/300 Applications Programming	Applications Programming using 86/300 Systems & iRMX 86 Operating System. Language extensions specific to PL/M-86, Pascal-86, and FORTRAN-86, OS support, 8087 Support Library, creating a custom application shell.

Table 3. Customer Training Courses (Cont.)

TRANSACTION AND DATABASE SYSTEMS	
Database Information System (iDIS)™	Explains iDIS hardware and software using iDIS menu-driven software subsystems, and system customization and application.
Transaction Processing System (iTPS)	Evaluation of iTPS and iTAPS hardware and software.
SYSTEM 2000 DATABASE MANAGEMENT WORKSHOPS	
System 2000 for Non-Programmers	Introduces System 2000 terminology, database schema, and writing System 2000 commands.
Technical Fundamentals	System 2000 Concepts and use of the QUEST languages for more experienced users.
Report Writing	Definition and generation of reports using system 2000's REPORT language and use of the Genius prompting facility for report and chart generation.
Application Programming	Survey for System 2000 tools available to the application programmer; retrieving and updating through a high-level language such as COBOL, FORTRAN, and PL/M.
Database Design and Implementation	Techniques for schema definition, data security, data archiving.

MEMORY COMPONENTS

Intel supplies a broad line of memory products to meet your application needs. Intel offers industry standard dynamic and highspeed static RAMs. To fit the needs of smaller microprocessor based systems, the byte-wide family of memories offer flexibility and upgradeability that tailors the memory to the exact requirements of the application.



Byte-Wide Family
(JEDEC-Approved Universal Socket)

RAMs

Intel offers a wide range of RAMs, all fabricated with Intel's production-proven HMOS* technology for high system performance and reliability. Ranging from the traditional high speed Static RAMs and the high-density Dynamic RAMs to the innovative iRAM, each is optimized to best satisfy system design objectives. From microprocessor memory to mainframe memory, Intel RAMs form an integral part of the system solution from Intel.

Table 4. RAMs

	STATIC RAMS					DYNAMIC RAMS			INTEGRATED RAMS	
Part Number	**2114A**	**2115/ 2125A**	**2147H**	**2148H**	**2149H**	**2164A**	**51C64**	**51C65**	**2186A**	**2187A**
SIZE (BITS)	4K	1K	4K	4K	4K	64K	64K	64K	64K	64K
ORGANIZATION	1K x 4	1K x 1	4K x 1	1K x 4	1K x 1	64K x 1	64K x 1	64K x 1	8K x 8	8K x 8
# OF PINS	18	16	18	18	18	16	16	16	28	28
READ ACCESS (ns)	100-250	45-70	35-70	45-70	45-70	150-200	100-120	100-120	250-300	250-300
MAXIMUM CURRENT dis (mA) (OPERATING/ STANDBY)	40-70	75-125	140-180/ 10-30	125-180/ 20-30	125-180	60-55/5	40/0.1	40/0.1	70/20	70/20
EXPRESS AVAILABLE	YES	YES	YES	YES	YES	YES	H2/84	H2/84	Q2/84	Q2/84
MILITARY AVAILABLE	YES	NO	YES	YES	NO	YES	H2/84	H2/84	NO	NO
FAILURE RATE/ 1000 HRS. @ 55° (60% UCL)	0.007%	0.017%	0.009%	0.009%	0.009%	0.009%	TBD	TBD	0.03%	0.03%
RELIABILITY DATA LITERATURE #	—	—	RR-26	RR-26	RR-26	RR-37	—	—	RR-37 ER-08	RR-37 ER-08

*HMOS is a patented process of intel Corporation.

EPROMS

An EPROM, or erasable, programmable read only memory, is a non-volatile memory component for program storage and prototyping applications. Intel offers a wide range of EPROM densities from 16K to 256K bits which use Intel's JEDEC-approved pin sites, allowing easy upgrade. EPROMs are available in either CERDIP or windowless plastic packages. The plastic packaged EPROMs are one-time programmable and ideal for high-volume production environments. Intel's new EPROMs—the 27256 and the 2764A—are based on the HMOS II-E technology, which scales down cell size and offers advanced produce specifications such as improved performance and power dissipation. An important feature is the two-line control which eliminates bus contention in microprocessor systems. Access times are compatible with high performance microprocessor systems.

Intel EPROMs also feature the int$_e$ligent Programming™ Algorithm, which ensures faster and more reliable programming, improving throughput by a factor of 6 and assuring data retention. Intel EPROMs are also the most reliable in the industry and the only ones with regularly published reliability data. Extended temperature and burn-in (EXPRESS Program) as well as a full line of military parts are also available for most densities.

E²PROMS

As part of its non-volatile memory family, Intel produces a family of electrically erasable programmable read-only-memories (E²PROMs). These devices embody all of the functional benefits of EPROMs plus the added features of in-circuit erasability and programmability.

E²PROMs are furnished in JEDEC-approved DIP and chip carrier packages for commercial and military applications. These devices are characterized by their fast read times, high reliability, and long data retention. Extended temperature and burn-in (EXPRESS Program) versions are also available.

Typical uses for E²PROMs include changeable system parameters, soft keys in terminals, user-configuration tables, remote firmware updates, and error logs, Intel E²PROMs offer a choice of functionality: the 2816A is the 5 volt only upgrade for users of the past generation 2816, and the 2817A for complete ease-of-design and mobility to higher E²PROM densities in the future.

NVRAMS

The Intel 2004 Non-Volatile Random Access Memory (NVRAM) is a 4K device organized 512 x 8 byte-wide architecture. It provides the real-time read/write functions of a static RAM together with the reliable non-volatile storage capability of an E²PROM. Internally, the 2004 NVRAM consists of a high speed static RAM array backed up, bit-for-bit, by an E²PROM array for non-volatile storage. The transfer of memory data between the static RAM and the E²PROM array occurs in parallel for fast storage and recall as well as minimal system support. The RAM operating characteristics of the 2004 NVRAM provides high speed microprocessor performance with unlimited endurance. In the non-volatile storage mode, data retention is specified at over 10 years for each STORE operation. Over 10,000 STORE operations can be performed reliably. The 2004 NVRAM is furnished in the JEDEC-approved 28-pin byte wide universal package.

Table 5. EPROMs/E²PROMs/NVRAMs

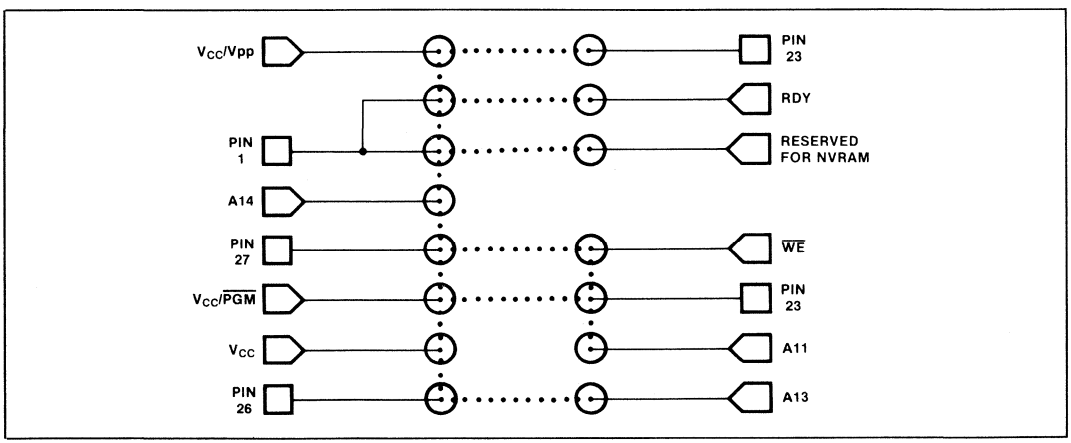
	EPROMS				E²PROMS		NVRAMS
	2732A	**2764A**	**27128**	**27256**	**2816A**	**2817A**	**2004**
SIZE (BITS)	32K	64K	128K	256K	16K	16K	4K
ORGANIZATION	4Kx8	8Kx8	16Kx8	32Kx8	2Kx8	2Kx8	512Kx8
# OF PINS	24	28	28	28	24	28	28
READ ACCESS (ns)	200-450	180-450	250-450	250-450	250-450	200-450	200-300
PROGRAMMING TIME (TYPICAL)*	3.5 min.	1.5 min.	3 min.	6 min.	9 ms	10 ms	10 ms
CURRENT (mA)	Active 125	Active 60/75	Active 100	Active 100	Active 100	Active 150	Active 100
	Standby 35	Standby 20/35	Standby 40	Standby 40	Standby 50	Standby 55	Standby 55
EXPRESS AVAILABLE	YES	YES	YES	YES	YES	YES	YES
MILITARY AVAILABLE	YES	YES	YES	YES	—	—	NO
FAILURE RATE/1000 HRS. @ 55°C (60% UCL)	0.009%	0.009%	0.009%	0.02%	—	—	—
RELIABILITY DATA LITERATURE #	RR-35	—	RR-35	—	ER-9	ER-9	—

*EPROMs per device, E²PROMs per byte

THE UNIVERSAL CONFIGURATOR

The Universal Configurator is a printed circuit layout for the JEDEC-approved universal socket. It takes advantage of the broad pinout compatibility of the byte-wide memories. The socket layout has been designed to accomodate devices of various product families, RAMs, EPROMs, E²PROMS, and NVRAMs.

The Universal Configurator places the necessary control signals for all product families in close proximity to traces for the few pins that differ between the families. To "design in" any Universal Site-compatible product, the system designer merely connects (using wire jumpers or by cutting existing traces) the appropriate control signals for the desired devices. The dotted lines on the Universal Configurator show where these connections are made.



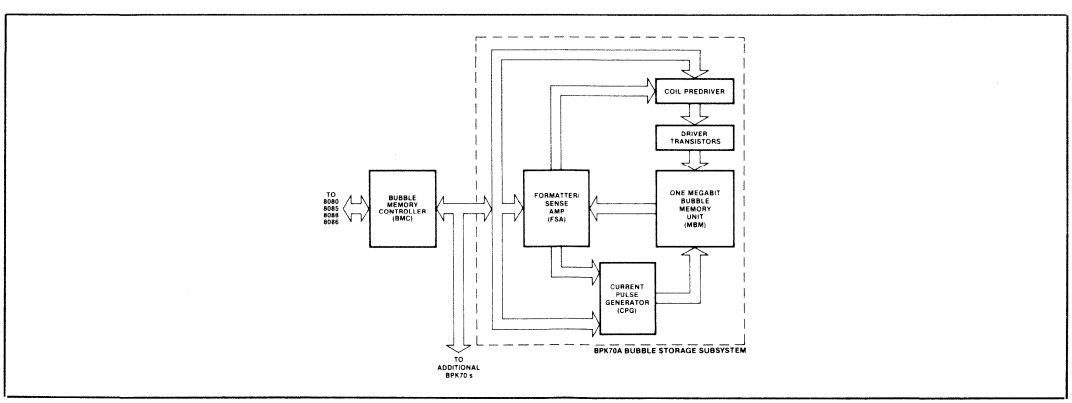
Universal Configurator For 24-Pin and 28-Pin Sites

BUBBLE MEMORY

Magnetic bubble memory is a solid state, read-write, non-volatile technology that features high density, ruggedness, small size, light weight, and limited power dissipation. A magnetic bubble memory stores data in magnetic domains or "bubbles" in a thin film on a garnet chip. The Intel bubble storage subsystem includes the bubble memory chip and five support chips (formatter/sense amplifier, current pulse generator, coil pre-driver and two drive transistors) which serve to support read and write operations between the bubble and the controller. The bubble memory controller has a software command set and is the interface between the bubble storage subsystem and microprocessor bus. Interfacing with a bubble memory controller is similar to interfacing with a disk drive controller. The controller does data conversion between serial storage in the bubble and parallel data from the system bus. The controller generates all timing signals required by the bubble storage subsystem. The Intel bubble memory product line includes interchangeable component kits for prototyping or production and fully-tested MULTIBUS® and multimodule board.

Table 6. Bubble Components (1 Mbit)

	DESCRIPTION	POWER SUPPLY	OPERATING TEMP. 10-55° 0-75° =20-85°	PACKAGE TYPE	RELIABILITY % PER 1000 HRS./55°C	RELIABILITY DATA LITERATURE #
7254	Coil Driver	+12V	— yes yes	16 pin DIP	0.043	RR-36
7250	Coil Predriver	+12V	— yes yes	16 pin DIP	0.058	RR-36
7242	1 Mbit Formatter/ Sense Amplifier	+5V, +12V	— yes yes	20 pin DIP	0.027	RR-36
7230	1 Mbit Current Pulse Generator	+5V, +12V	yes yes yes	22 pin DIP	0.017	RR-36
7220	1 Mbit Controller	+5V	— yes yes	40 pin DIP	0.030	RR-36
7110	1 Mbit Bubble Memory	+12V	yes yes yes	20 pin leaded	0.072	RR-36



Bubble Configuration 1 Mbit System

Table 7. Bubble Components (4 Mbit)

	DESCRIPTION	POWER SUPPLY	OPERATING TEMP. 10-55° 0-75° =20-85°	PACKAGE TYPE	RELIABILITY % PER 1000 HRS./55°C	RELIABILITY DATA LITERATURE #
7264	Coil Driver	+12V	— yes —	Discrete 3 pin	—	—
7250	Coil Predriver	+12V	— yes yes	16 pin DIP	—	—
7244*	4 Mbit Formatter/ Sense Amplifier	+5V, +12V	— yes —	20 pin DIP	—	—
7234*	4 Mbit Current Pulse Generator	+5V, +12V	— yes —	22 pin DIP	—	—
7224*	4 Mbit Controller	+5V	— yes —	40 pin DIP	—	—
7114*	4 Mbit Bubble Memory	+12V	yes — —	20 pin leaded	—	—

*Available 1st half, 1984

Table 8. Bubble Memory Kits‡

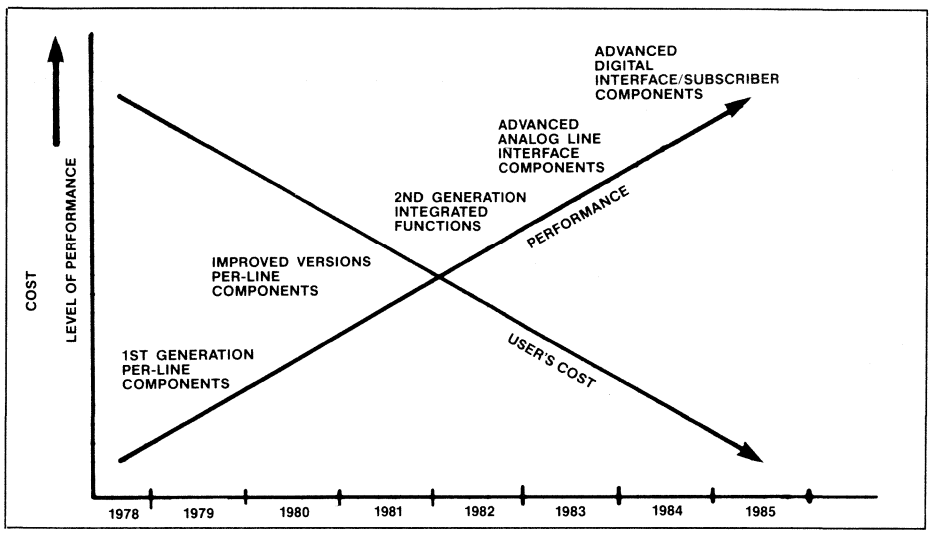
	BPK70A	BPK72A	BPK74*
DESCRIPTION	1 Mbit Production Kit	1 Mbit Prototype Board Assembled & Tested	4 Mbit Production Kit
AVERAGE ACCESS TIME	40 ms	40 ms	80 ms
DATA RATE	100k bit/sec.	100k bit/sec.	200k bit/sec.
POWER SUPPLIES	+5V, +12V	+5V, +12V	+5V, +12V
OPERATING TEMPERATURE **10-55°** **0-75°** **−20-85°**	 yes yes yes	 yes yes yes	 yes — —
TYPICAL POWER CONSUMPTION (W)	3.4	3.9	5.0
RELIABILITY % PER 1000 HRS./55°C	0.260	0.290	—
RELIABILITY DATA LITERATURE #	RR-36	RR-36	—
KIT CONTENT	7110A 7220 7230 7242 7250 7254 (2)	7110A 7220 7230 7242 7250 7254 (2) Literature Pre-Fabricated Printed Circuit Board	7114 7224 7234 7244 7250 7264(8)

*Available 1st half, 1984

‡See Table 45, Page 70 for Bubble Memory Boards

TELEPHONY COMPONENTS

The Intel telecommunication product line consists of three generations of telecom voice/data conversion products; the first generation codecs and filter; the second generation combo family; and the third generation advanced telecom components group. Two arrows are indicated on the chart below which illustrate Intel's philosophy of increasing performance levels while reducing user's costs, with each succeeding generation of telecom product.



CODECS/FILTER/COMBOS

Intel's PCM Codecs, Line Filters and Combo Chips are special purpose A/D and D/A converters and filters for use in PCM Line Circuits in telephony switching and transmission systems. The wide dynamic range (78 dB) and minimal conversion time (80 μsec) also make them ideal for such other applications as voice store and forward, digital echo cancellers, secure communications systems, and satellite earth stations.

The 2910A/11A PCM Codecs and 2912A PCM Line Filter are industry standard components which have been in production for over four years. We have shipped more than 10,000,000 Codec/Filter sets to date.

The new industry standard telephony line circuits are the 2913 and 2914 Codec/Filter Combo Chips. These devices have a fully differential internal architecture to improve crosstalk, idle channel noise, and power supply rejection. In addition, the transmit and receive channels are totally separate to further reduce crosstalk, and to improve performance in asynchronous operation. The charge-redistribution DAC has essentially eliminated gain tracking error. This superior transmission performance is combined with surprisingly low power dissipation through the use of our advanced HMOS-E technology; a proven technology which has supported the production of millions of 2764 EPROMs. For applications requiring especially low power levels (e.g., telephone handsets), CMOS combo chips are available.

Table 9. Performance Comparison

FEATURES	2913 CODEC/FILTER COMBO CHIP	2914 CODEC/FILTER COMBO CHIP	2910A PCM CODEC μ-LAW	2911A PCM CODEC A-LAW	2912A PCM LINE FILTER
Fixed Data Rate Mode	1.536, 1.544, 2.048 MHz	1.536, 1.544, 2.048 MHz	1.536, 1.544, 2.048 MHz	1.536, 1.544, 2.048 MHz	Compatible
Variable Data Rate Mode	64 kHz to 4.096 MHz	64 kHz to 4.096 MHz	No	No	Compatible
μ/A-Law Select	Yes	Yes	μ-Law Only	A-Law Only	N/A
Asynchronous Operation	No	Yes	Yes	Yes	Yes
Analog Loop Back	No	Yes	No	No	No
Power Down Mode	Yes	Yes	Yes	Yes	Yes
On-Chip Timeslot Assignment	No	No	Yes	Yes	N/A
Cross Talk	−80 dB	−80 dB	−80 dB	−80 dB	−70 dB
Idle Channel Noise Transmit/Receive	15/11 dBrnc0	15/11 dBrnc0	10 dBrnc0	−78 dBm0p	6/2 dBrnc0
Power Supply Rejection	40 dB	40 dB	50 dB	50 dB	30 dB
Gain Tracking, S/D, Frequency Response	Exceeds D3/D4 & CCITT G.712	Exceeds D3/D4 & CCITT G.712	Meets D3/D4	Meets CCITT G.712	Meets D3/D4 & CCITT G.712
Line Group Controller	See 80C51, Table 12, Page 27				
Line Card Controller	See 80186, Table 12, Page 32				

ANALOG SIGNAL PROCESSORS

Intel's single chip analog signal processors combine on board A/D and D/A conversion with digital signal processing to perform analog signal processing functions. The 2920 has on board user programmable/erasable EPROM program memory and the 2921 has mask programmable ROM program memory. Both devices offer the benefits of digital signal processing to analog applications.

- Multiple Analog Inputs and Outputs
- On-Chip A/D and D/A Conversion
- Accuracy and Stability of Digital Signal Processing
- Supports Digital I/O
- Flexible Instruction Set—Parallel Processing

The 2920/21 can easily implement many of the functions commonly found in analog circuits, including:

- Modulation/Demodulation
- Filtering
- Waveform Generation
- Rectification
- Limiting
- Threshold Detection

Using these basic functions, the 2920/21 can implement up to 40 poles or zeroes of filtering, or up to 20 triangle wave generators. This allows the user to implement in a single chip such applications as:

- Bell 212 Modem Filters Including Line Equalizers
- Complete Videotext or Videodata Modem
- Daisy Wheel Printer Servo Control
- Disk Drive Head Positioning
- Tone Signaling—DTMF,SF,R2MF

The SP20 Support Package for the 2920/21 is a package of design tools to assist the designer in efficiently implementing systems with the 2920. It consists of an assembler, a software simulator, and a powerful applications compiler. The simulator allows testing and symbolic debugging of 2920 programs.

The SPAS-20 Compiler has a MACRO facility and simplifies:

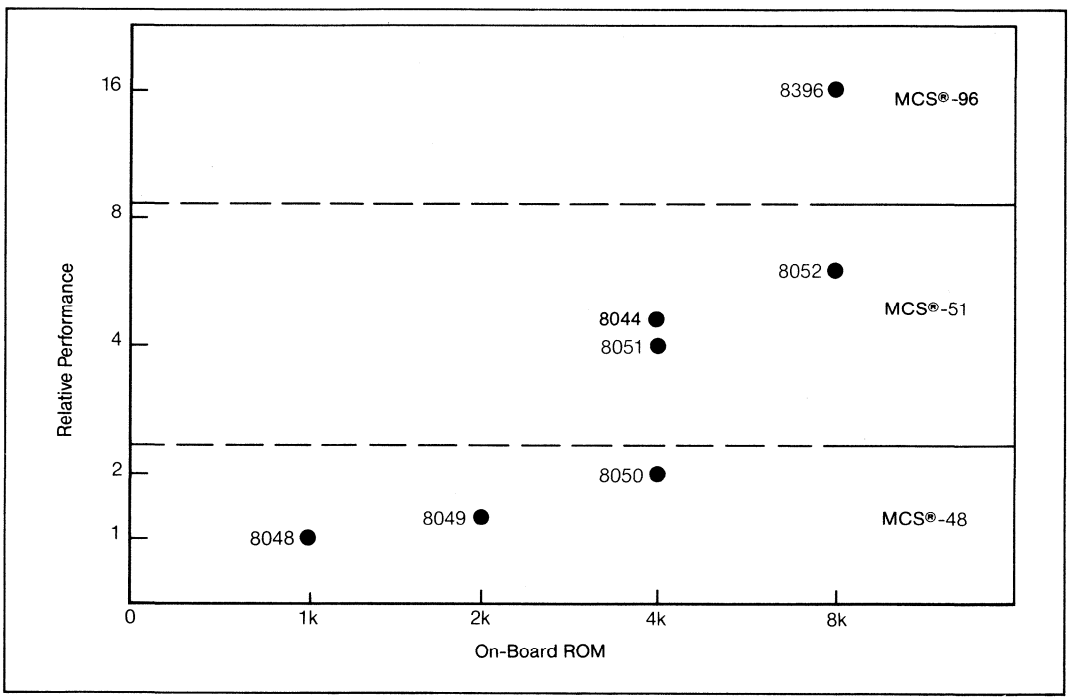
- Generation of assembly language code directly from specifications of basic analog functions or simple algebraic expressions;
- Time and Frequency domain response calculations for filter sections specified by poles and zeroes;
- Generation of piecewise linear approximations of complex functions.

Table 10. Analog Signal Processors

PRODUCT	DESCRIPTION	
2920	Analog Signal Processor with User Programmable/Eraseable EPROM Program Memory	
2921	Analog Signal Processor with Mask Programmable ROM Program Memory	
SP20	Support Package including an assembler, software stimulator and applications compiler.	
Development Support	See Development Systems Section, Page 57, and Software, Page 61.	
Literature Support	Data Sheet AP Notes Article Reprints 2920 Design Handbook	2920, 2921 AP-92, 111, 117, 124 AR-79, 81, 114, 117 (Order No. 210475)

MICROCONTROLLERS

Intel offers three basic families of single chip microcontrollers; general purpose 8-bit, advanced 8-bit, and advanced 16-bit devices. The relative range of application performance is indicated in the diagram below.



Microcontroller Performance

BASIC FAMILY CHARACTERISTICS

MCS®48: Designed for general purpose 8-bit control applications.
Average instruction time — 2.0 μs
Maximum addressable code — 4 Kbytes

MCS-51: Designed for advanced 8-bit control applications.
- Typical instruction cycle time — 1.0 μs (byte operations)
- Hardware multiply and divide (4 μs — byte by byte multiply)
- Full duplex asynchronous serial port
- On-chip Boolean Processor
- Maximum addressable code — 64 Kbytes

MCS-96: Designed with 16-bit processing power for complex algorithms.
- Average instruction time — 1.25 μs (word operations)
- Hardware multiply and divide (6.5 μs — word by word multiply)
- Analog and high speed programmable digital I/O
- Full duplex asynchronous serial port
- Maximum addressable code — 64 Kbytes

GENERAL PURPOSE 8-BIT MICROCONTROLLERS

Intel's MCS-48 family of 8-bit microcontrollers has become the world standard. They are available in several versions; with on board ROM, on board EPROM, or CPU only, to better fit your specific application needs. MCS-48 products are now fabricated either on Intel's advanced HMOS II or CHMOS processes offering higher performance and reliability while using less power.

Table 11. General Purpose 8-Bit Microcontrollers

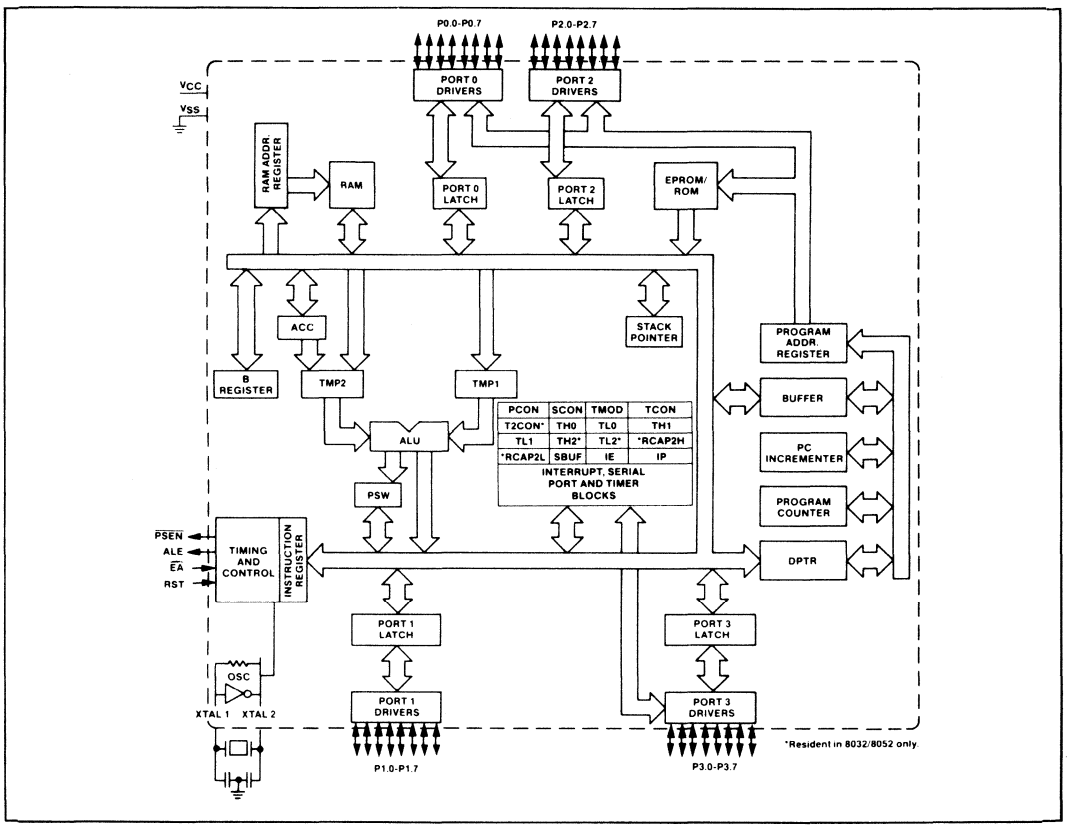
ROM Version	8048AH	8049AH 80C49-7*	8050AH
EPROM Version	8748H 8748**	8749H	—
CPU/RAM/I/O	8035AHL	8039AHL 80C39-7	8040AHL
Cycle Time	1.36 μs	1.36 μs	1.36 μs
RAM Memory (Bytes)	64	128	256
Program Memory (Bytes)	1K	2K	4K
I/O Lines	27	27	27
SYNC Mode	Yes	Yes	Yes
Timer-Counter	1	1	1
A/D	—	—	—
Interrupts	2	2	2
Program Limit	4K	4K	4K
Ext Data Limit	256 × 8	256 × 8	256 × 8
Development Support	See Development Systems, Page 57, and Software, Page 61.		

*Products designated with a "C" (i.e., 80C49) are CHMOS devices.
**Note: 8748 NMOS version has a 2.5 μs instruction cycle.

ADVANCED 8-BIT MICROCONTROLLERS

Intel's MCS-51 family members are 8-bit microcomputer systems on a single chip. The architecture is optimized for control oriented and real-time processing applications.

One of the newest MCS-51 family members is the 80C51 which combines the low power consumption of CMOS with the high performance of HMOS.



MCS®-51 Block Diagram

Table 12. Advanced 8-Bit Microcontrollers

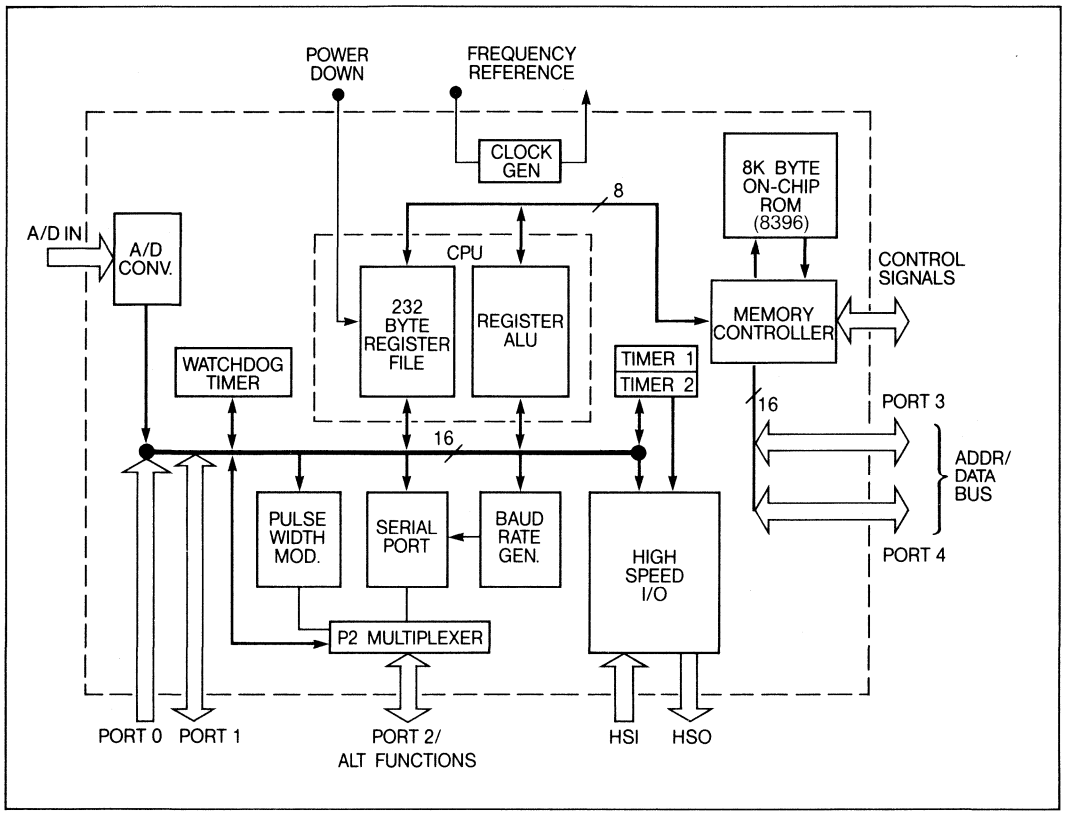
FEATURE	8051AH	80C51	8751H	8031AH	80C31	8052	8032	8044‡
Program Memory (Bytes)	4K	4K	4K EPROM	–	–	8K	–	4K
RAM Memory (Bytes)	128	128	128	128	128	256	256	192
Program Memory Expansion (Off Chip) (Bytes)	64K	64K	64K	64K	64K	64K	64K	64K
Data Memory Expansion (Off Chip) (Bytes)	64K	64K	64K	64K	64K	64K	64K	64K
Max. Clock Frequency (MHz)	12	12	12	12	12	12	12	12
Typical Instruction Time (μs)	1	1	1	1	1	1	1	1
16-Bit Timer/Counters	2	2	2	2	2	3	3	2
Serial Communications	Synchronous Mode Asynchronous Modes, 9 or 10-Bit Programmable							HDLC/SDLC
No. of I/O Lines	32	32	32	16	16	32	16	32
Interrupt Sources (Two Priority Levels)	5	5	5	5	5	6	6	5
Power Requirements (ICC MAX mA)	125	24	250	125	24	160	160	200
Programmable Power Modes Auto/Exit Idle (mA) Full Power Down (mA)	– 10	3.0 50 μA	– 20	– 10	3.0 50 μA	– 10	– 10	– 30
Development Support	See Development Systems, Page 57, and Software, Page 61.							

*Products designated with a "C" (i.e., 80C51) are CHMOS devices.
‡For details refer to Page 44, Table 27.

ADVANCED 16-BIT MICROCONTROLLERS

Intel's MCS-96 family is based on the state-of-the-art 8096 device. This 16-bit microcontroller offers the highest level of integration ever achieved on a single chip controller. The 8096 provides board level performance through a wide range of sophisticated I/O facilities and peripherals integrated onto the same piece of silicon with a powerful 16-bit CPU. The integration of these subsystems offers a single chip solution to many control problems which have previously required multiple chip solutions. The list of main features includes:

- 16-Bit CPU
- 8K Byte Mask Programmable ROM
- 232 Bytes RAM (16 Bytes Power Down)
- 16-Bit Timer/Event Counters
- High Speed Inputs/Outputs
- Pulse Width Modulated Output
- 40 Digital I/O Lines
- Watch Dog Timer
- Full Duplex Serial Port
- Flexible, 8 Source Interrupt System
- 16-Bit Multiplexed Bus



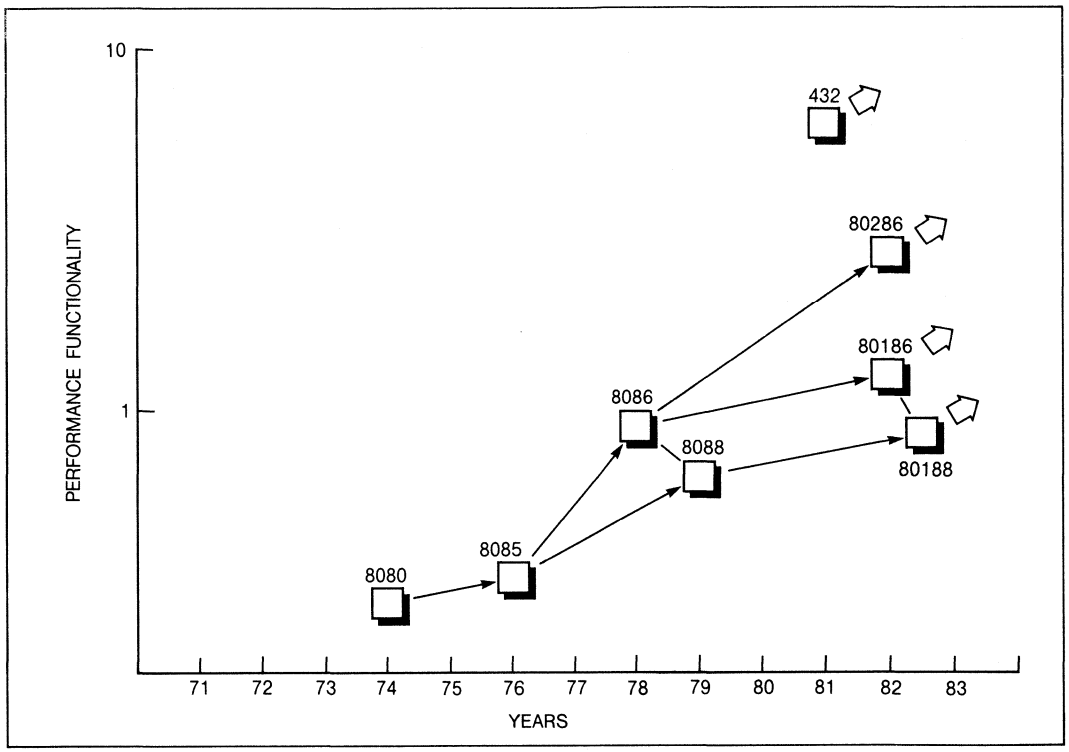
8096 Block Diagram

Table 13. Advanced 16-Bit Microcontrollers

FEATURES	8095	8097	8395	8397	8094	8096	8394	8396
Program Memory	–	–	8K	8K	–	–	8K	8K
Digital I/O	29	40	29	40	33	48	33	48
Analog I/C Inputs	4	8	4	8	–	–	–	–
Package	48 Pin Dip	68 Pin Flatpack	48 Pin Dip	68 Pin Flatpack	48 Pin Dip	68 Pin Flatpack	48 Pin Dip	68 Pin Flatpack

MICROPROCESSORS

The Intel microprocessor product line consists of three families of microprocessors: the MCS®-85 family containing the 8080 and 8085 microprocessors; the iAPX 88, 86, 186, and 286 family of 8- and 16-bit microprocessors; and the iAPX 432 micromainframe.



Microprocessor Families

MCS®-80/85 8-BIT MICROPROCESSORS

The MCS-80/85 product line is the industry standard for first generaton 8-bit computing with five second sources and an 8-year track record of production and availability. The 8085A has kept up with advances in silicon technology and is now manufactured as the 8085AH on Intel's state-of-the-art HMOS process.

iAPX 16-BIT/8-BIT MICROPROCESSORS

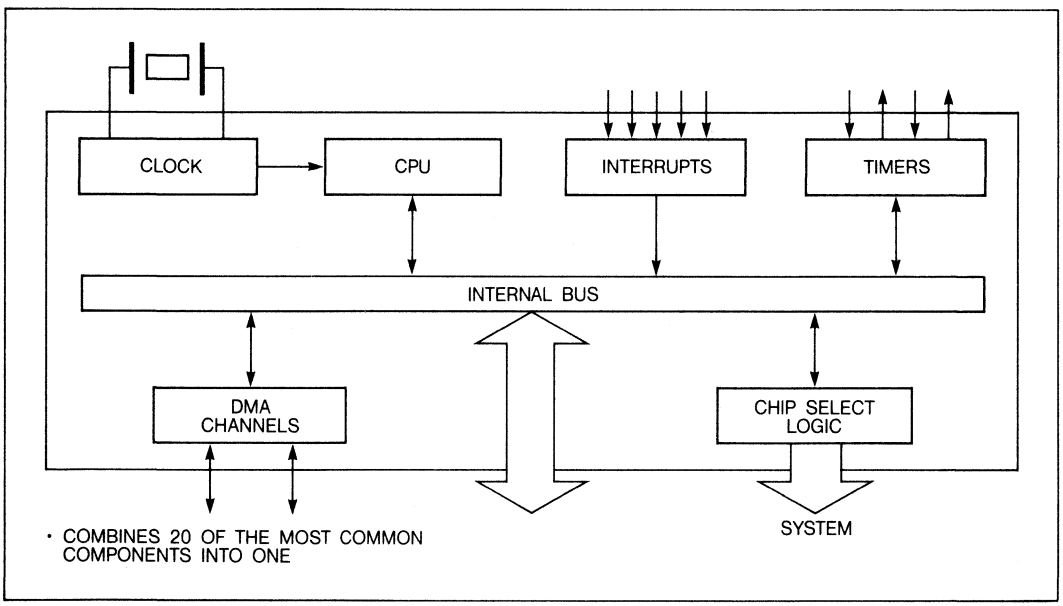
These product lines offer a complete 16-bit architecture and programming environment with both 8-bit (8088, 80188) and 16-bit (8086, 80186, 80286) bus interfaces.

iAPX 86,88

(Includes the 8086 (16-bit bus) and the 8088 (8-bit bus) CPUs plus a complete set of supporting devices.) Because the 8086 and the 8088 share the same 16-bit internal architecture, they are completely software-compatible and can use the same support components. This allows complete and full migration of software from 8- to 16-bit, and 16- to 8-bit systems. The iAPX 86, 88 have also achieved industry standard status with a 4-year track record of production and availability and numerous second sources. This family is also fully compatible with Intel's complete line of coprocessors, a unique set of VLSI devices that allow system level architecture and performance customization.

iAPX 186, 188

The Intel iAPX 186/188 (80186/80188 part number) is a highly integrated 16/8-bit microprocessor. The iAPX 186/188 effectively combines 15 to 20 of the most common iAPX 86/88 system components onto one device. The 80186/80188 provides two times greater throughput than the standard 5 MHz iAPX 86/88. The iAPX 186/188 is upward compatible with iAPX 86 and 88 software and adds 10 new instruction types to the existing set.

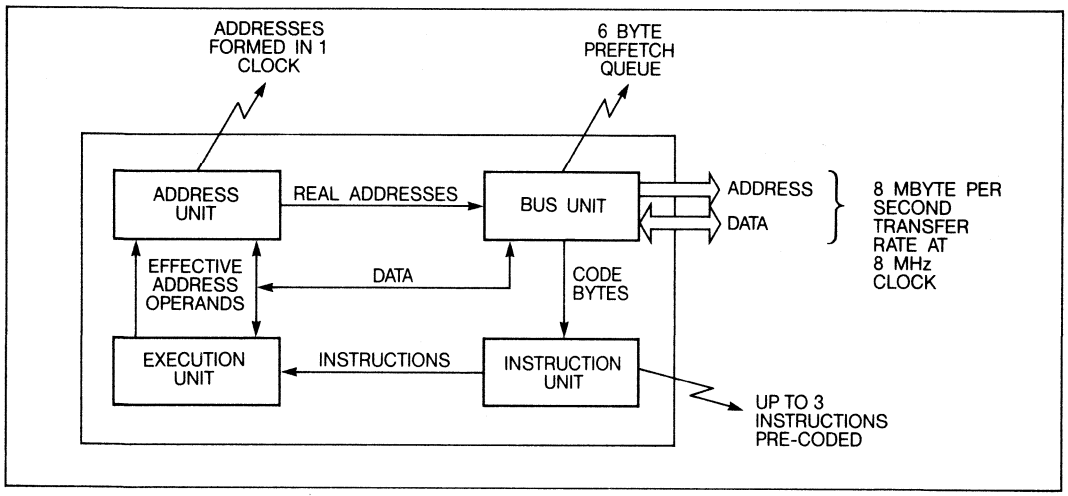


iAPX 186/188 Block Diagram
A CPU Board On A Single Silicon Chip

These highly integrated microprocessors offer higher reliability, save board space and provide cost effective solutions for very cost sensitive applications. They share the same coprocessor family as the 8086 and 8088.

iAPX 286

The iAPX 286 (80286 CPU) is an advanced high performance 16-bit microprocessor with on-chip memory management and protection and hardware support for multiuser, multitasking systems. The pipelined architecture of the iAPX 286, an 8 Mb/sec bus and a 3.5 μs interrupt response time, gives it six times the performance of a standard 5 MHz iAPX 86. The on-chip memory management and protection scheme is flexible, sophisticated and easy to use. It supports virtual memory of up to 1000 M Bytes/user. The four-level protection model provides task/task and user/operating system protection. The iAPX 286 is also upward compatible with the iAPX 86/88 and the 186/188 and has a numeric processor extension (80287) that is compatible with the 8087.



iAPX 286 Pipelined Microarchitecture

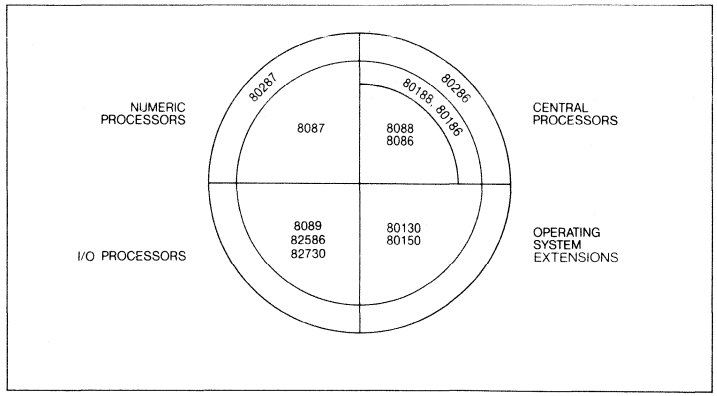
The iAPX 286 is binary compatible with the iAPX 86/88, iAPX 186/188 to allow simple migration of the large base of software for those machines to the iAPX 286. The 80286 also has its own complete line of coprocessors for system architecture and performance optimization.

Table 14. Microprocessors

FEATURES		MICROPROCESSORS						
		8080A (MCS-80)	8085AH (MCS-85)	8086 (iAPX 86)	8088 (iAPX 88)	80186 (iAPX 186)	80188 (iAPX 188)	80286 (iAPX 286)
A. ARCHITECTURE								
Bus Interface (Bits)		8	8	16	8	16	8	16
Internal Data Path (Bits)		8	8	16	16	16	16	16
Clock Frequency (Speed Selection)		2, 2.6, 3 MHz	3, 5, 6 MHz	5, 8, 10 MHz	5, 8 MHz	6, 8 MHz	6, 8 MHz	4, 6, 8, 10 MHz
Bus Band Width (Max)		.75M bytes/s	1.5M bytes/s	5M bytes/s	2M bytes/s	4M bytes/s	2M bytes/s	10M bytes/s
Register to Register (Min) Add Time (μsec/data word)		1.3 μs	0.67 μs	0.3 μs	0.38 μs	0.3 μs	0.3 μs	.2 μs
Interrupt Response Time (Min)		7.3 μs	2 μs	6.1 μs	8.6 μs	5.25 μs	8.3 μs	3.5 μs
Memory Addressability		64KB	64KB	1MB	1MB	1MB	1MB	16MB
Virtual Memory		No	No	No	No	No	No	Yes 1G byte/ task
On-Chip Memory Management and Protection		No	No	No	No	No	No	Yes
I/O Addressability		256 Bytes	256 Bytes	64KB	64KB	64KB	64KB	64KB
Addressing Modes		5	5	24	24	24	24	24
Coprocessor Interface		No	No	Yes	Yes	Yes	Yes	Yes
No. of Registers	Arithmetic	1	1	8	8	8	8	8
	Index	1	1	4	4	4	4	4
	Segment	0	0	4	4	4	4	4
	General Purpose	6	6	8	8	8	8	8
Code Compatibility		8080A Code		8086 Code				
B. SOFTWARE SUPPORT								
High Level Languages		See Page 66						
Operating Systems		See Page 64						
C. DEVELOPMENT SUPPORT		:See Development Systems, Page 57, and Software Section, Page 61						
D. KEY PERIPHERAL SUPPORT CHIPS		:See Peripherals Section, Page 36						
Clock Generator		8224	On-Chip	8284A	8284A	On-Chip	On-Chip	82284
System Controller		8228	On-Chip	8288	8288	On-Chip	On-Chip	82288
Interrupt Controller		8259A	8259A	8259A	8259A	On-Chip	On-Chip	8259A
DMA Controller		8257	8237A	8089	8237/8089	On-Chip	On-Chip	8089
Timer/Counters		8253	8253/8254	8253/8254	8253/8254	On-Chip	On-Chip	8253/8254
Data Bus Transceiver		8216/8226	8286/8287	8286/8287	8286/8287	On-Chip	On-Chip	8286/8287
Chip Select/Wait State Logic		TTL	TTL	TTL	TTL	On-Chip	On-Chip	TTL
Math Processor		See Table 26, Page 43		8087	8087	8087	8087	80287
Operating System Software on Silicon		See Table 15, Page 34						
E. GENERAL								
Package	Pins	40	40	40	40	68	68	68
	Type	DIP (P&D)	DIP (P&D)	DIP (P&D)	DIP (P&D)	Leadless JEDEC Type A	Leadless JEDEC Type A	Leadless JEDEC Type A
Power Supply		±5V, 12V	5V	5V	5V	5V	5V	5V
Military/EXPRESS		See Military Section, Page 54, EXPRESS Section Page 50						

COPROCESSING—A NEW ARCHITECTURAL CONCEPT

The iAPX 86 family brought with it a new architectural concept called "coprocessing." Basically, the task to be handled is partitioned into functional areas such as central processing, I/O processing, numerics and operating system (O.S.) support. For each functional area there is a device that extends the CPU's register and instruction sets. In this way, the cost of the specialized hardware is incurred only when required, and the chip-set is optimized for specific applications.



Processing—Function Partitioning

For numeric intensive applications, the 8087 and 80287 numeric coprocessors extend the base architecture by adding 8 eighty-bit registers and about 70 instructions. By executing floating point routines in hardware, performance is improved up to 100X. Eighty-bit precision maximizes accuracy while conforming to the proposed IEEE standard for floating point execution.

I/O intensive applications are supported by the 8089 I/O coprocessor. This 16-bit device provides two channels of flexible DMA control and I/O execution.

The 82586 LAN Coprocessor is an I/O coprocessor that concurrently processes the ISO open system interconnect model levels 1 and 2 for local area networks with various topologies, framing techniques, contention detection schemes and carrier methods.

The 82730 Text Coprocessor is an I/O coprocessor that concurrently processes text manipulation tasks. It interprets pointer table linked list data structures, allowing high resolution text displays to be modified "instantaneously" without loading the microprocessor. Display formats are very flexible, allowing system designers to program displays to satisfy their unique requirements.

iAPX 86/88 and iAPX 186/188 applications requiring an operating system are supported by the 80130 (iRMX 86 kernel) and the 80150 (CP/M*-86) Operating System Software components. These software on silicon devices integrate industry-standard operating systems with key peripheral functions on a single chip, offering a highly integrated easy-to-use system building block. The major benefits are reduced software development, simpler end-user operation, higher system reliabilty and integrity, and no licensing requirements, leading to a more compact and inexpensive system. Software drivers are included, either on-chip or as additional products for common disk controllers, CRT controllers, and serial and parallel interfaces. With all this software on the chip itself, additional memory and often disk drives can be eliminated.

*CP/M is a trademark of Digital Research, Inc.

Table 15. Numeric Processors

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	SPEED	PACKAGE TYPE/ NO. OF PINS
8087	Numeric Processing	Performs arithmetic, logical and transcendental operations on 32-, 64-, 80- bit floating point operands, 32- and 64- bit integers and 18-digit BCD operands to greatly enhance speed of system. Floating point operations are approximately 100x faster than equivalent CPU/software routines. Accuracy is extended to 80 bits. Meets proposed IEEE standard (#754).	8086/8088 80186/80188	With 5 MHz clock 14/18 μs 32 Bit Multiply: 19 μs 64 Bit Multiply: 27 μs Divide 39 μs With 8 MHz clock 32 Bit Multiply: 11.9 μs 64 Bit Multiply: 16.9 μs	Ceramic 40
80287	Numeric Processing	Performs arithmetic, logical and transcendental operations on 32-, 64-, 80- bit floating point operands, 32- and 64- bit integers and 18-digit BCD operands to greatly enhance speed of system. Floating point operations are approximately 100x faster than equivalent CPU/software routines. Accuracy is extended to 80 bits. Meets proposed IEEE standard (#754).	80286	With 5 MHz clock 14/18 μs 32 Bit Multiply: 19 μs 64 Bit Multiply: 27 μs Divide 39 μs With 8 MHz clock 32 Bit Multiply: 11.9 μs 64 Bit Multiply: 16.9 μs	LCC/40

Table 16. I/O Processors

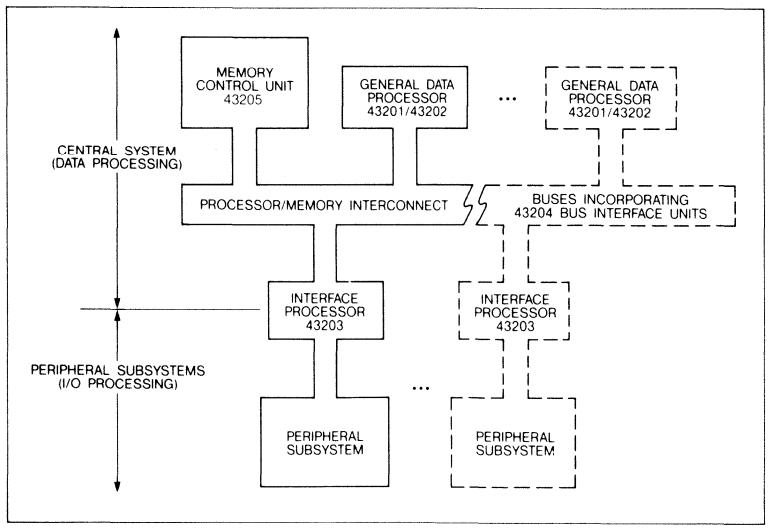
DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	SPEED	PACKAGE TYPE/ NO. OF PINS
8089	2-Channel Intelligent I/O Processor with DMA	Two I/O channels offer flexible, intelligent DMA operations and I/O program execution. In "local mode," the 8089 is closely coupled with an 8088 or 8086 CPU to add DMA capabilities with minimum chip count. In "remote mode," the 8089 serves as an I/O subsystem to maximize performance and flexibility.	8086 } Local 8088 } Mode ALL } Remote } Mode	1.25 Mbytes (5 MHz)	D/40
82586	Local Area Network Coprocessor	Implements Ethernet† and IEEE 802.3 specifications, manages transmission/ reception processes w/o CPU intervention including command and data buffer chaining network management and diagnostic functions.	8085AH 8086/8088 80186/80188	8 MHz	CC/48
82730	Text Coprocessor	Provides high quality text display, proportional spacing, superscript/subscript, etc. High performance text manipulation-onboard DMA, high-level commands and table driven linked list data structure. Programmable bus interface—8 or 16 bit data and 16 or 32 bit addressing. Flexible display formats programmable at screen and row level. Simultaneous desplay of independent data bases.	ALL	8MHz-Bus 10MHz-Character	C/68

Table 17. Operating System Software Extensions

DEVICE NUMBER	CHIP	CPU	BASE OPERATING SYSTEM	SOFTWARE DESCRIPTION
80130	16 K-Byte ROM, 3 Timers, 8-Line Programmable Interrupt Controller	8086 8088 80186 80188	iRMX™-86	• 35 Multitasking Real-Time Operating System Primitives • Includes Task Management, Interrupt Management, Message Passing, Synchronization, and Memory Allocation Commands • Supports Five Operating System Data Types: Jobs, Tasks, Segments, Mailboxes, Regions • Fully Extendable to, and compatible with, iRMX-86 • iOSP™-86 Development Support Package
80150	16 K-Byte ROM, 3 Timers, 8-Line Programmable Interrupt Controller	8086 8088 80186 80188	CP/M-86	• Contains the complete CP/M-86 Operating System • Standard on-chip BIOS (Basic Input/Output System). Contains drivers for 8272A, 8275, 8274, 8255A, 8251A, 8237A, 8089 • BIOS Extensible with User-Supplied Peripheral Drivers

iAPX 432 MICROMAINFRAME™

The iAPX 432 micromainframe is a new level of computing capability that offers the designer functions like transparent microprocessing to accommodate designs with varying workloads and fault tolerance for designs requiring high system availability.



432 systems can be built from combinations of 5 VLSI components: a 2-chip general data processor (43201+43202), a 1-chip interface processor (43203), a bus interface unit (43204) and memory control unit (43205). Data processing is separated and protected from I/O processing. Its object based architecture is optimized for software reliability and productivity and its transparent multi-processing provides a range of performance without software change. It is offered for information management and high availability systems. *(See page 75 for board level iAPX 432 products and software.)*

PERIPHERALS

Intel offers an extensive set of peripheral devices to augment microprocessor capabilities. The six major families of peripherals include: support peripherals, memory controllers, CRT display controllers, slave processors, math processors, and data communication controllers.

SUPPORT PERIPHERALS

Intel's support peripherals are designed with a consistent bus interface that makes them compatible with the entire Intel microprocessor line, from 8 to 16 bits. As a result, the user can leverage previous design and learning investments with each microprocessor upgrade. This support includes the following products.

Timer-Counters, Parallel I/O, Keyboard Controllers

These devices are used for baud rate generation, event counting, motor controls and real-time clock functions.

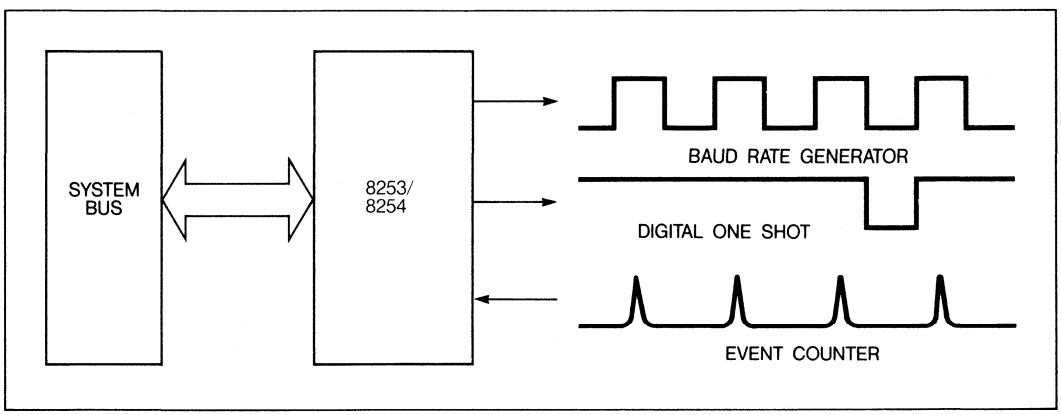


Table 18. Timer-Counters, Parallel I/O, Keyboard Controllers

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	SPEED	PACKAGE TYPE/ NO. OF PINS
8253	Timer/Counter	3 Independent 16-Bit Counters	ALL	2.6 MHz Count Rate	P,D/24
8254	Timer/Counter	3 16-Bit Counters—Superset of the 8253	ALL	10 MHz Count Rate	P,D/24
8255A	Parallel I/O	24 TTL—Compatible I/O Lines	ALL	—	P,D/40
8256	All Basic Support Functions	Serial I/O + Parallel I/O + Timer/ Counters + Interrupt Control (8251A + 8253 + 8255A + 8259A)	ALL	UART: 1 MB/s Counters: 0.5 MHz	P,D/40
8279	Keyboard Controller	64-key keyboard and display scan control	ALL	—	P,D/40

DMA Controllers

These devices are designed to offload the CPU while speeding up data transfers in the system by allowing external devices to directly transfer data to or from system memory.

Table 19. DMA Controllers

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	SPEED	PACKAGE TYPE/ NO. OF PINS
8089	2-channel Intelligent I/O Processor with DMA	Two I/O channels offer flexible, intelligent DMA operations and I/O program execution. In "local mode," the 8089 is closely coupled with an 8088 or 8086 CPU to add DMA capabilities with minimum chip count. In "remote mode," the 8089 serves as an I/O subsystem to maximize performance and flexibility.	8086 Local 8088 Mode ALL Remote Mode	1.25 Mbytes/ sec (5 MHz)	D/40
8237A	High Performance DMA Controller	4 independent DMA channels, can be cascaded to support any number of channels, additional feature of memory-to-memory transfer.	ALL	1.6 Mbytes/ sec	P,D/40
8257	DMA Controller	4 channel DMA controller	8080A 8085AH	960 Kbytes/sec (3 MHz)	P,D/40

Interrupt Controllers

These provide faster response to real-time events in a large system without requiring the processor to poll for the source of peripheral service requests.

Table 20. Interrupt Controllers

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	PACKAGE TYPE/ NO. OF PINS
8259A	Programmable Interrupt Controller	8 Vectored Interrupts, Cascadable to 64	ALL	P,D/28

Multiplexed Memory Components

These components can communicate over the multiplexed address/data bus of the MCS®-85, iAPX 88 or iAPX 188 processors eliminating the need for address latching.

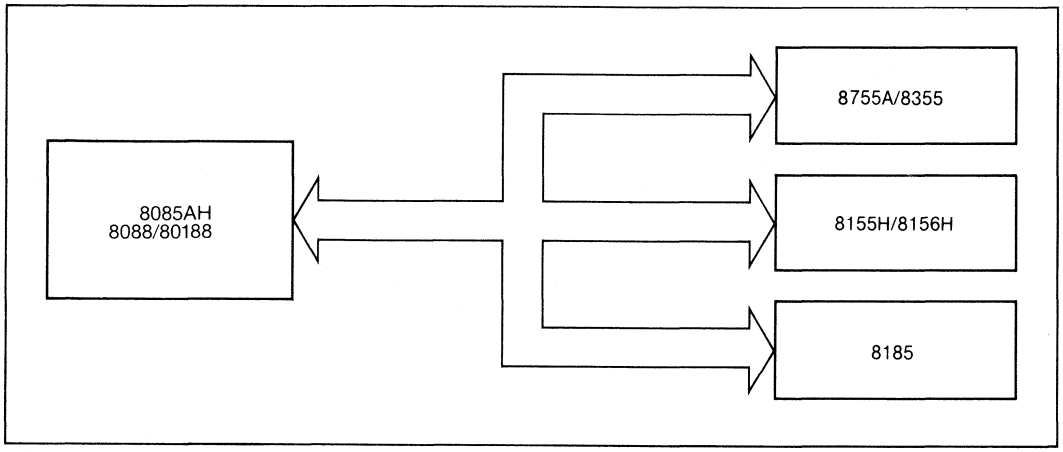


Table 21. Multiplexed Memory Components

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	ACCESS TIME	PACKAGE TYPE/ NO. OF PINS
8155H/ 8156H	Static RAM, I/O and Timer	256 bytes RAM; 14-bit counter/ timer, 22 parallel I/O ports; internal address latch	8085AH 8088 80188	330 ns (−2) 400 ns (Std)	PD/40
8185	Static RAM	1K × 8 RAM; internal address latch; low standby power requirements	8085AH 8088 80188	250 ns (−2) 350 (Std)	PC/18
8355	ROM and I/O	2K × 8-bit Masked ROM; Two bidirectional 8-bit ports; internal address latch	8085AH 8088 80188	300 ns (−2) 450 ns (Std)	PD/40
8755A	EPROM and I/O	2K × 8-bit Eraseable PROM and I/O; Eraseable with UV Light; Electrically reprogrammable; interchangeable with 8355	8085AH 8088 80188	300 ns (−2) 450 ns (Std)	DB/40

Clock Generators and Bus Controllers

These devices include: clock generators, bus drivers, bus transceivers, bus controllers, bus arbiters and latches. They provide the drive, control signals and timing to directly support interfacing to the industry-standard MULTIBUS®.

Table 22. Clock Generators and Bus Controllers

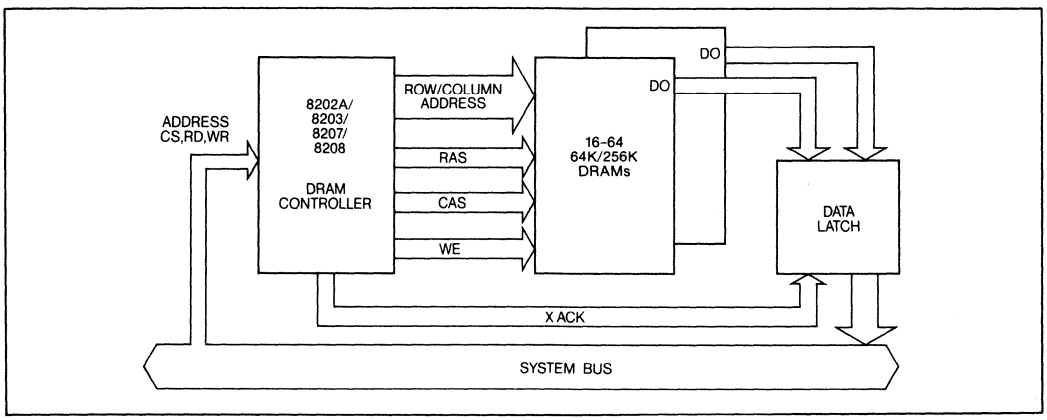
DEVICE NUMBER	FUNCTION AND DESCRIPTION	CPU	PACKAGE TYPE/ NO. OF PINS	SPEED SELECTIONS
For MCS-80/85 Processors				
8212	8-Bit Latch	8085AH	P,D/24	–
8216/8226	Bus Driver	8080A	P,D/16	–
8218	Bus Controller and Arbiter	8080A	D/28	3 MHz
8219	Bus Controller and Arbiter	8085AH	D/28	3 MHz
8224	Clock Generator	8080A	P,D/16	3 MHz
8228/8238	System Controller and Bus Driver	8080A	P,D/28	3 MHz
For iAPX 86/88 Processors				
8282/8283	Octal Latch	8086 8088	P,D/20	–
8284A	Clock Generator and Driver	8086 8087 8088 8089	P,D/18	8 MHz 10 MHz
8286/8287	Bus Transceiver	8086 8088	P,D/20	–
8288	Bus Controller	8086/8088 80186/80188 8087 8089	D/20	8 MHz
8289	Bus Arbiter	8086/8088 80186/80188 8087 8089	P,D/20	8 MHz
For iAPX 286				
82284	Clock Generator	80286	D/18	8 MHz
82288	Bus Controller	80286	D/20	8 MHz
For I/O Coprocessors				
82285	Clock Generator	82586 82730	D/18	8 MHz

MEMORY CONTROLLERS

The memory controller family of peripherals integrates the logic required to interface dynamic RAM, floppy disks and Winchester disks to microprocessors.

The dynamic RAM controllers supply all three functions necessary in any dynamic RAM design: row/column address multiplexing, refresh and arbitration. A single device replaces 10-15 TTL packs and the delay line. The 8207 extends the level of integration to include support for a dual-port interface, bank interleaving and complete ECC control with the 8206.

Three other memory controllers interface a microprocessor to mass storage devices. The 8271 and 8272A control single and double density floppy disk or mini floppy disk drives, while the 82062 controls Winchester disk drives using the ST506/SA1000 standard interface.



Dynamic RAM Subsystem

Table 23. Memory Controllers

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	SPEED	MEMORY SIZE	PACKAGE TYPE/ NO. OF PINS
8202A	16K DRAM Controller	Provides all logic to interface 16K DRAMs to any microprocessor	ALL	0-3 Wait states	128K Bytes	D/40
8203	16K/64K DRAM Controller	Provides all logic to interface 64K DRAMs to any microprocessor	ALL	0-3 Wait states	256K Bytes	D/40
82C03	16K/64K DRAM Controller	Low Power CMOS 8203	ALL	0 - 3 Wait States	256K Bytes	P/40
8206	Error Detection and Correction	Single-bit Correction, Double-bit Detection	ALL	67 ns	8 bit to 80 bit words	CC/68
8207	64K/256K DRAM Controller	Interfaces 64K/256K DRAMs while providing a dual-port interface, bank interleaving and ECC control	ALL	0 Wait state	2M Bytes	CC/68
8208	64K/256K DRAM Controller	Interfaces 64/256K DRAMs while providing bank interleaving and a high performance interface to any microprocessor	iAPX 186, 86, 88	0 Wait states	1M Bytes	C,P/48
8271	Single-Density Floppy Disk	Programmable Single-Density Controller for up to 4 drives	ALL	250 KB/s	8" Floppy or 5¼" Mini Floppy	PD/40
8272A	Single/Double Density Floppy Disk	Programmable Single or Double Density Controller for up to 4 drives	ALL	500 KB/s	8" Floppy or 5¼" Mini Floppy	PD/40
82062	Winchester Disk Controller	Programmable Winchester Disk Controller for ST506	ALL	5 MB/s	5¼" or 8" Winchester Disk	PD/40

CRT DISPLAY CONTROLLERS

Intel's CRT controllers are designed to display information on a CRT screen with a wide variety of screen formats. They are also the only chips designed to reduce the display manipulation task for the system microprocessor, improving overall system quality and performance.

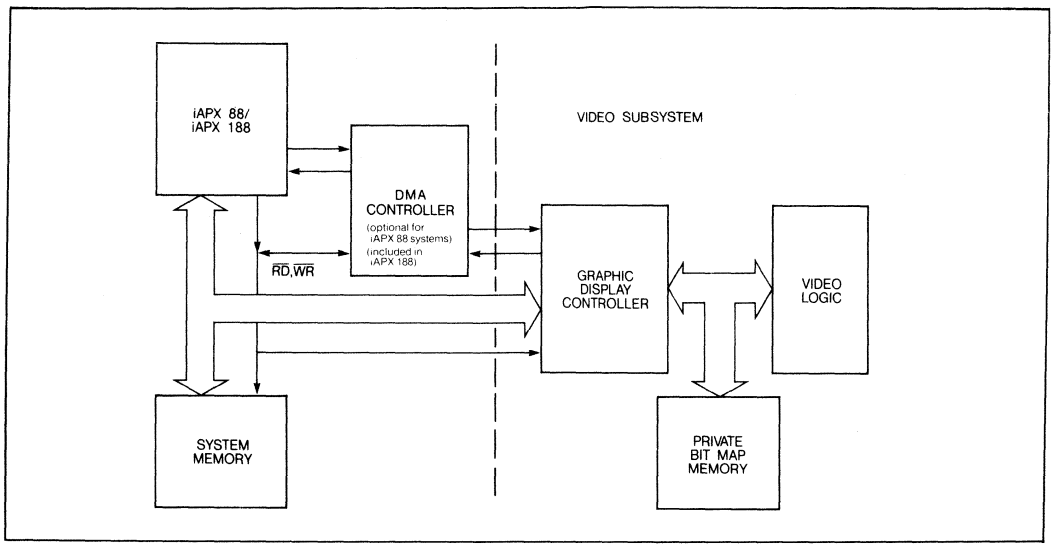


Table 24. CRT Display Controllers

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	SCREEN FORMATS	DISPLAY TYPES	SPEED SELECTIONS	PACKAGE TYPE/ NO. OF PINS
8275	Programmable CRT Controller	Programmable screen and character format, 6 independent field attributes, 11 visual character attributes, cursor control, light pen capability, programmable DMA mode.	MCS 80/85 iAPX 86/88 iAPX 186/188 MCS-51	80 char/ row 64 rows/ frame	Alpha-Numeric	2 MHz (Std) 3 MHz (−2)	PD/40
8276	Small System CRT Controller	Programmable screen and character format, 6 independent field attributes, cursor control, on-chip dual row buffers, cascadable up to 4 controllers.	MCS 80/85 iAPX 86/88 iAPX 186/188 MCS-51	80 char/ row 64 rows/ frame	Alpha-Numeric	2 MHz (Std) 3 MHz (−2)	PD/40
82720	Graphics Display Controller	Provides microcomputer system with bit map graphics capabilities. Refreshes screen from a bit map RAM. Accepts high level commands which causes GDC to draw graphics figures into bit map memory concurrently with CPU operations.	ALL	Up to one mega pixel resolution	Alpha-Numeric; Graphic; Vector; Arc; Rectangle; Slant	4 MHz (Std) 5 MHz (−1)	C/40
82730	Text Coprocessor	Provides high quality text display, proportional spacing, superscript/ subscript, etc. High performance text manipulation-onboard DMA, high-level commands and table driven linked list data structure. Programmable bus interface—8 or 16 bit data and 16 or 32 bit addressing. Flexible display formats programmable at screen and row level. Simultaneous display of independent data bases.	ALL	Up to 200 chars/ row 2048 scan lines/frame	Alpha-Numeric Alpha-mosaic, mixed text and graphics with 82720	Separate system and video clocks, maximize overall system performance	C/68
82731	Video Interface Controller	Parallel to serial data conversion, on-chip dot clock generator, dot rates up to 50 MHz 16 dot wide character. Proportional spacing and attribute generation support. Works with the 82730 text coprocessor.	–	–	–	50 MHz dot rate	PD/40

SLAVE PROCESSORS

Slave processors consist of two major groups of peripheral components. The first are programmable peripherals. "Universal Peripheral Interfaces" (UPI™), for control functions where no standard controller exists. These UPI devices are flexible single chip microcomputers with on-chip CPU, ROM or EPROM, RAM, I/O ports and a slave interface to the master system CPU. They allow the designer to integrate random control logic and to add custom control interfaces to a system.

UPI products include pin-compatible ROM and EPROM versions to allow prototyping/debugging or rapid feature upgrades in production. The instruction set is based upon industry-standard 8048.

The second group of slave processors are functionally dedicated like 8278, 8294A and 8295. They are a UPI programmed for specific applications.

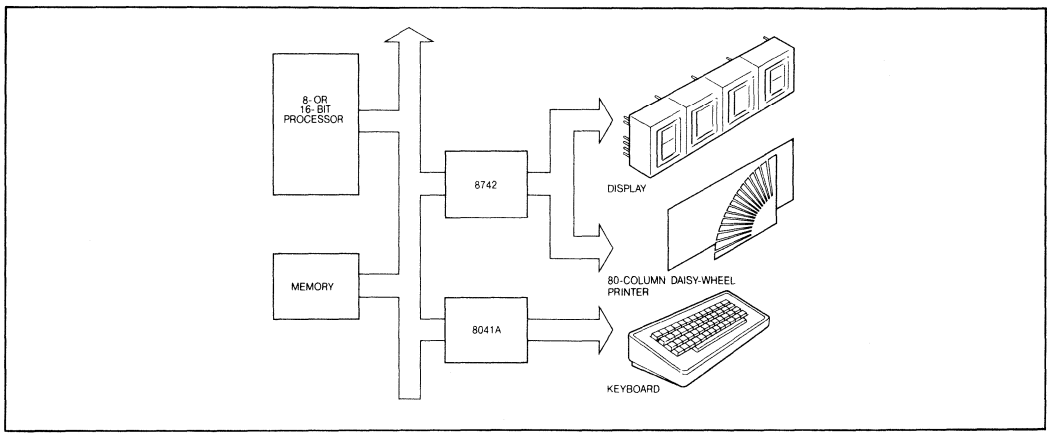


Table 25. Slave Processors

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	SPEED	RAM	I/O LINES	PACKAGE TYPE/ NO. OF PINS
8041A	UPI 1K ROM	Programmable Peripheral	ALL	6 MHz	64 Bytes	18	P,D/40
8741A	UPI 1K EPROM	Programmable Peripheral	ALL	6 MHz	64 Bytes	18	P,D/40
8042	UPI 2K ROM	Programmable Peripheral	ALL	12 MHz	128 Bytes	18	P,D/40
8742	UPI 2K EPROM	Programmable Peripheral	ALL	12 MHz	128 Bytes	18	P,D/40
8243	I/O Expansion	UPI I/O Expander adds 16 lines to UPI controller	8041A 8042 8048 8049 8050	–	–	16	P,D/40
8278	Keyboard Control	128 key contact/capacitive keyboard controller	ALL	10.7 ms keyboard scan time	–	–	P,D/40
8294A	Data Encryption/ Decryption	Implements National Bureau of Standards DES algorithm	ALL	400 Bytes/sec	–	–	P,D/40
8295	Dot Matrix Printer Control	Controller for LRC 7040 Dot Matrix Printer	ALL	–	–	–	P,D/40

MATH PROCESSORS

These devices process the data sent by the host CPU. Math and IEEE floating point calculations are implemented in hardware. This increases performance, reduces software overhead, and frees up the processor for other tasks.

Table 26. Math Processors

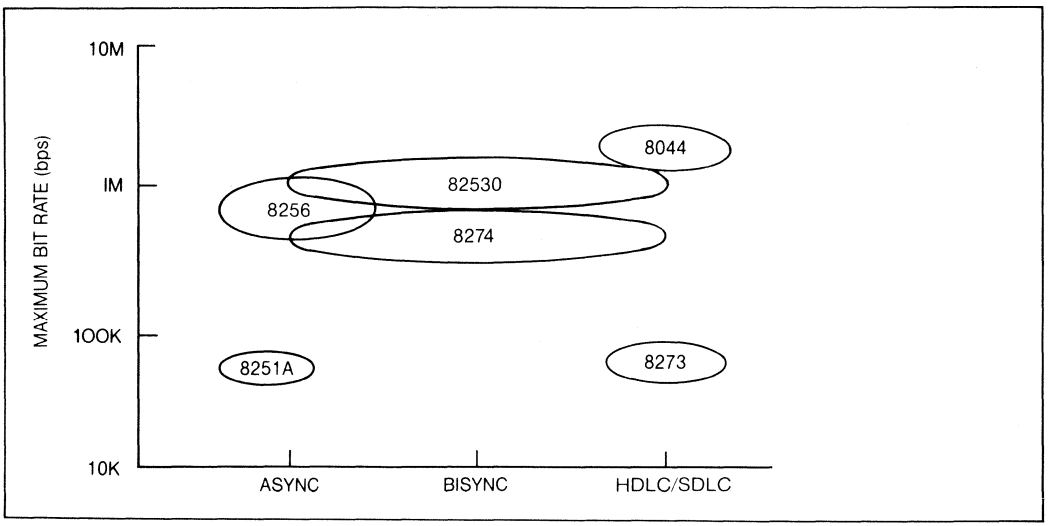
DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	SPEED	PACKAGE TYPE/ NO. OF PINS
8087	Numeric Processing	Performs arithmetic, logical and transcendental operations on 32-, 64-, 80-bit floating point operands, 32- and 64-bit integers and 18-digit BCD operands to greatly enhance speed of system. Floating point operations are approximately 100 x faster than equivalent CPU/software routines. Acuracy is extended to 80 bits. Meets proposed IEEE standard (#754).	8086/8088 80186/80188	With 5 MHz clock 32 Bit Multiply: 19 μs 64 Bit Multiply: 27 μs Divide 39 μs	CC/40
80287	Numeric Processing	See 8087	80286	See 8087	
8231A	Arithmetic Processing	16/32 Bit Integer and Floating Point Arithmetic	ALL	32 Bit Integer Multiply: 50 μs 32 Bit Floating Point Sine: 1·1 μs	

DATA COMMUNICATION CONTROLLERS

This group of integrated circuits provides support for the routine range of standard communications protocols. These devices should be used to interface the system microcomputer bus to a communications channel which is the means of sending data to other pieces of equipment.

Serial Data Communication Controllers

The five serial communication devices support all the serial standard protocols; asynchronous, byte synchronous and bit synchronous protocols. The interconnection can be local or remote. For remote channels, modem control lines are provided.



Intel Data Comm Family

Table 27. Serial Data Communication Controllers

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	MODEM CONTROL LINES	SERIAL CHANNELS	ASYNC	BISYNC	HDLC/ SDLC	MAX DATA RATE	PACKAGE TYPE/ NO. OF PINS
8251A	USART	Industry standard synchronous and asynchronous full duplex transmitter/receiver. Programmable parity bit, sampling rates, break generation and detection.	8080A 8085AH 8086/8088 80186/80188 8048AH/49AH 8051/8096	4	1	X	X		19.2K bps (Async) 64K bps (Bisync)	D,P/28
8256	Multifunction UART (MUART)	Full duplex asynchronous receiver/transmitter. Programmable baud rate generator. 16 parallel I/O lines. 8 level interrupt controller.	All	1	1	X			1M bps	D,P/40
8273	SDLC/HDLC Communications Controller	Interfaces μP to SDLC/HDLC communication lines. Implements first level driver software in hardware. On-chip DPLL. Loop mode support.	8085AH 8086/8088 80186/80188 8048AH/49AH 8051/8096	3	1			X	64K bps	D,P/40
8274	Multiprotocol Serial Controller (MPSC)	Multiprotocol device with several μP interface options. 4 independent DMA channels on-chip.	8085AH 8086/8088 80186/80188 8048AH/49AH 8051/8096	4 per channel	2	X	X	X	880K bps	D,P/40
82530	Serial Communications Controller (SCC)	Dual channel multiprotocol controller with on-chip baud rate generators, digital phase locked loops, various data encoding/decoding schemes and extensive diagnostic capabilities.	8085AH 8086/8088 80186/80188 8048AH/49AH 8051/8096	per channel	2	X	X	X	1M bps	D,P/40
8344	High Performance 8-bit Microcontroller with On-chip Serial Communication Processor	8051 microcontroller core with high performance serial communication controller that can automatically respond to SDLC primary station commands. On-chip DPLL supports loop and non-loop.	—	2	1			X	2.4M bps	P/40
8044		8344 with 4K bytes of on-chip ROM	—	2	1			X	2.4M bps	P/40
8744		8344 with 4K bytes of on-chip EPROM.	—	2	1			X	2.4M bps	C/40

GPIB Controllers

The 8291A/8292/8293 are all the building blocks needed to implement the different types of nodes used on the GPIB (IEEE-488) parallel instrumentation bus.

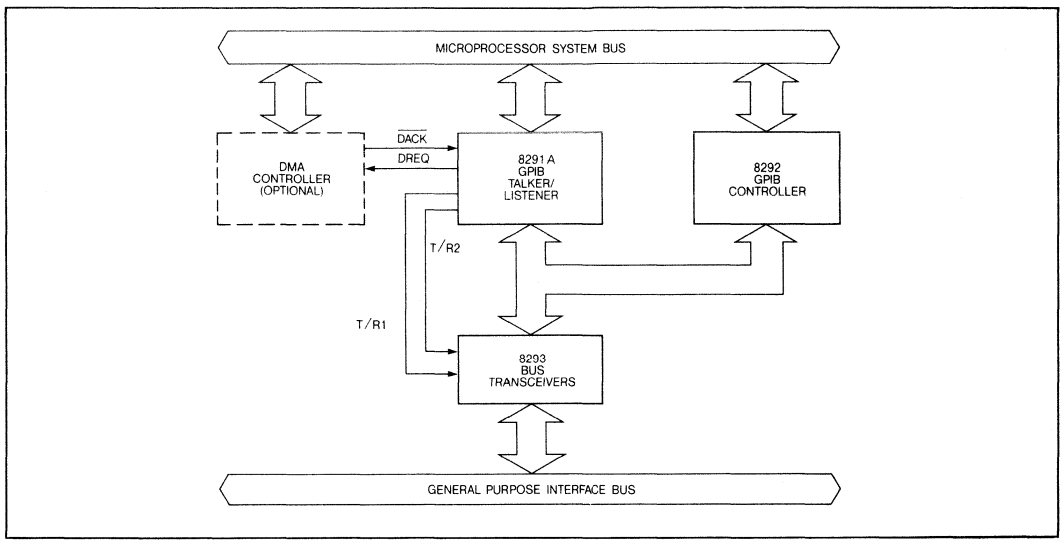


Table 28. GPIB Controllers

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	DATA RATE	PACKAGE TYPE/ NO. OF PINS
8291A	GPIB Talker/Listener	Complete talker/listener device that adheres to IEEE-488 standard. Implements all 9 talker/listener functions, on-chip programmable end of sequence register for automatic end of message.	8085AH 8086/8088 80186/80188 8048AH/8049AH 8051/8096	350K bps max	P,D/40
8292	GPIB Controller	Connects with the 8291A to form a complete IEEE-488 standard interface talker/ listener/controller. Built in bus lock-up timers for high system reliability.	8085AH 8086/8088 80186/80188 8048AH/8049AH 8051/8096	N/A	P/40
8293	GPIB Transceiver	High current (48 mA), non-inverting buffer for use between 8291A/8292 and GPIB bus. Can be used as a general purpose buffer.	N/A	N/A	D/28

Local Area Network Controllers

For equipment connected in a local area network, the 82586/82501 devices provide the most complete VLSI solution available. These support a range of LAN protocols using the CSMA/CD access method, including Ethernet and IEEE 802.3 standards.

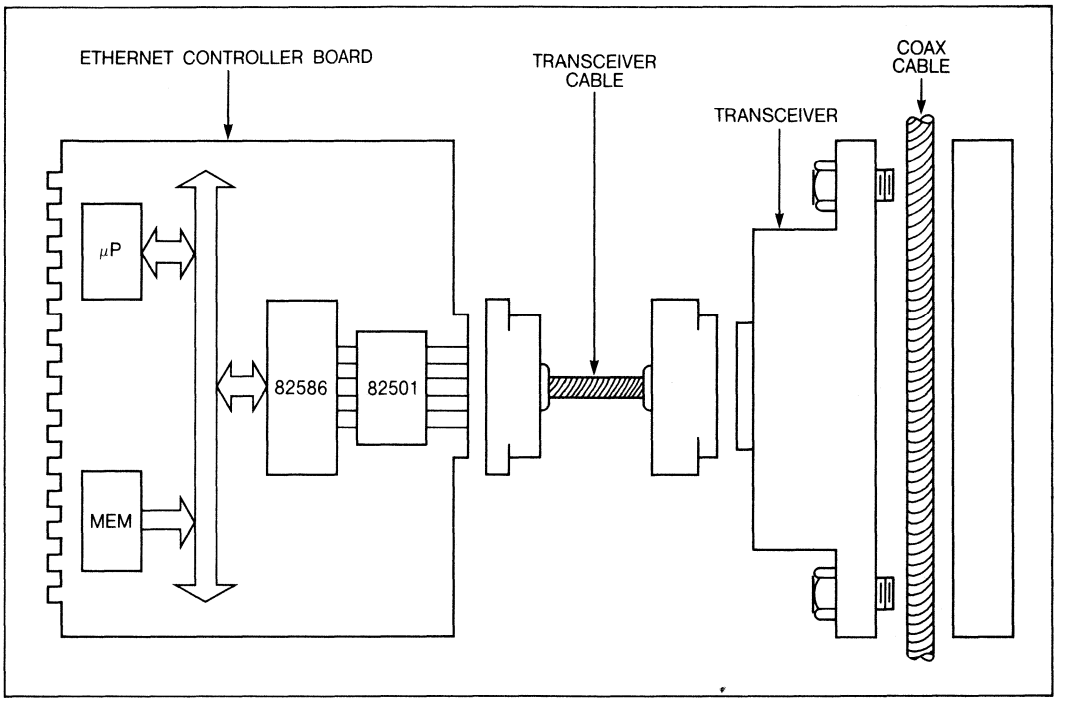


Table 29. Local Area Network Interface

DEVICE NUMBER	FUNCTION	DESCRIPTION	CPU	ENCODING/ DECODING	PROTO-COLS	DATA RATE	PACKAGE TYPE/ NO. OF PINS
82501	Ethernet Serial Interface	Generate 10 MHz transmit clock for the 82586, perform Manchester encoding/decoding of transmitted/ receiver frames and provide the electrical interface to the Ethernet transceiver cable. Utilized with the 82586 LAN ocprocessor.	N/A	Manchester	Ethernet	10M bps	D/20
82586	Local Area Network Coprocessor	Implements Ethernet and IEEE 802.3 specifications manages transmission/ reception processes w/o CPU intervention including command and data buffer chaining network management and diagnostic functions	8085AH 8086/8088 80186/80188	N/A	Ethernet IEEE 802.3	8 MHz-Bus 10 MHz-LAN	CC/48

CUSTOM COMPONENTS

Functional Description

The iCEL SuperCEL Design System provides users without silicon expertise the capability to design their own custom semiconductor components. All interaction with the system is accomplished through a single input file, (Net-List file) and the system is accessable from the user's facility.

The user designs his component by selecting functional blocks from a standard cell library, iLIB-II. Each CEL is a well characterized circuit structure. Using the iCEL software the user verifies his logic. iCEL software then translates the design into VLSI through the automated interconnection of these CELs. Each CEL has a corresponding data sheet. As such, an engineer designs with CELs much as with standard SSI, MSI, and LSI components. In turn, the iLIB-II library contains a model for each CEL that describes the CEL's functionality and performance to the iSIM logic and timing (circuit) simulator. iSIM is the software "breadboard" that the designer uses to debug his design.

Through a series of software modules, the iCEL SuperCEL Design System supports the user in performing logic design, verification of component performance, and generation of test programs. Intel uses additional software modules to automatically place the CELs, route the interconnect and produce a layout data-base tape which is used to create photolithographic masks for semiconductor processing.

iLIB-II- Standard CEL Library

The iLIB-II library contains two classes of CELs. StandardCELs are basic logic functions such as AND gates, FLIP-FLOPS, and COUNTERS, while SuperCELs are LSI cores of standard Intel PROCESSORS, PERIPHERALS, and CONTROLLERS. Two types of SuperCELs are currently available. Array SuperCELs are memory elements such as ROM, RAM, and PLAs. Processor SuperCELs currently include microcomputer cores of the 80C49 and 80C51. The capability to combine StandardCELs and SuperCELs will allow the user to create application-specific microprocessors and systems-on-a-chip. Both StandardCELs and SuperCELs are designed in Intel's high performance, silicon gate CHMOS-II (Complementary High Performance MOS) technology.

iSIM- Logic and Timing Simulator

The iSIM logic and timing simulator is the user's interface to the iCEL system. Simulation of the user's network is the primary design verification tool for iCEL designs. Accurate simulation of a network of CELs guarantees circuit functionality and establishes the circuit's dynamic performance capability. The input to iSIM, the NET-LIST file, is also used as the input data file for artwork generation.

iTEST- Test Pattern Generation

iTEST is an iCEL software module that uses the iSIM Net-List input file to generate a test program for a user's custom device. The test program is organized to run on an industry standard Sentry-VII tester.

iPAR- Artwork Generation

The "place and route" software (iPAR) is used internally by Intel to interconnect the user's selected CELs to form the semiconductor layout artwork. iPAR uses each CEL's geometric artwork from the iLIB-II computer database. The output of iPAR is used to create photolithographic masks for semiconductor processing.

iCEL Manufacturing

All iCEL components are manufactured with Intel's industry standard CHMOS-II wafer process. iCEL wafers are run side by side with such high-volume standard products as the 80C49 and 80C51. iCEL components benefit from this economy of scale (high volumes=lower cost). Each iCEL component has the attention of the U.S.'s largest non-captive producer of MOS.

Packaging

Intel provides the iCEL user with virtually every available standard IC package. Dual In-line Packages up to 48 pins are available. Leadless Chip Carriers up to 68 pins can be specified. For applications requiring greater than 68 pins. Pin grid arays are provided.

iCEL Training

Learning the iCEL SuperCEL Design System is made easy through a "hands-on" workshop and a comprehensive User's Manual. The Workshop serves as a complete preparation for design, simulation, and verification of custom circuits using the iCEL system. Experienced instructors focus on how to define networks, select Standard CELs from the library, simulate logic, verify timing, and examine critical pathes. users learn to design with testing as consideration, perform worst case analysis and estimate artwork capacitance.

Table 30. iLIB-II Controller SuperCELs

TYPE	DESCRIPTION
Controller SuperCELs	Processor Core, 80C49 Processor Core, 80C51

Table 31. iLIB-II Array SuperCELs

TYPE	DESCRIPTION
ROM Elements	512 x 1 or x 4 or x 8 Bit Assembled Static ROM 1024 x 1 or x 4 or x 8 Bit Assembled Static ROM 2048 x 1 or x 4 or x 8 Bit Assembled Static ROM
RAM Elements	32 x 1 or x 4 or x 8 Bit Assembled Static RAM 64 x 1 or x 4 or x 8 Bit Assembled Static RAM 128 x 1 or x 4 or x 8 Bit Assembled Static RAM
PLA	10 Input/8 Output; 12 Input/6 Output; 14 Input/4 Output 16 Input/2 Output; 16 Input/48 Output

Table 32. iLIB-II Standard CEL List

TYPE	DESCRIPTION
Gates	2, 3, or 4 input NAND, NOR, AND, OR 2 wide 2 input AND-NOR 5, 6, 7, 8 input NAND 6, 7, 8 input NOR Exclusive NOR Exclusive OR
Inverters	Seven performance selections
Buffers	Non-inverting, four performance selections 3-State non-inverting, four performance selections
Flip-Flops	D Master/Slave: SET; RESET; SET/RESET; D Master/Slave: RESET, D=VSS; SET, D=VDD D Master/Slave: 3-State output: SET; RESET; SET/RESET Fast D Master/Slave: with SET; with RESET Toggle Flip-Flop: with RESET; with RESET/SET Fast Toggle Flip-Flop: with RESET; with SET J-K Flip-Flop: with RESET; with SET/RESET
Counters	Control cell, positive clock with RESET Body cell, telescoping toggle with RESET Fast ripple toggle Syncronous up with RESET Syncronous up with PARALLEL LOAD Syncronous up/down with RESET
Latches	Set/Reset NOR & NAND latches; with/without buffered outputs D Latch: with RESET Expandable D latch control cell Expandable D latch body cell Expandable D latch body cell, 3-state outputs
Shift Registers	Body cell with RESET Control cell (POS CLK) Static parallel in/parallel out PSEUDO-static serial in/parallel out
Input Pads	Inverting & non-inverting CMOS buffer, 3 selections Inverting & non-inverting TTL buffer, 3 selections Inverting & non-inverting SCHMITT buffer, 2 selections
Output Pads	CMOS inverting and non-inverting buffer, 3 selections TTL inverting buffer, 3 selections 3-state non-inverting buffer, 5 selections
Input/Output Pads	Inverting CMOS/TTL/SCHMITT inputs Non-inverting TTL outputs Inverting CMOS/TTL/SCHMITT inputs Non-inverting CMOS outputs
Other Pads	VSS Pad, VDD Pad

EXPRESS PRODUCT FAMILY

EXPRESS is a new service program that allows users of Intel IC components to tailor the products' electrical test flow to their specific application requirements. The test flows are designed to suit a broad range of system and production requirements.

The EXPRESS program offers users of Intel microcomputers, RAMs, EPROMs, and peripheral component families, products that are screened to operate within two industry-standard temperature ranges, each with the option of 168±8 hours of dynamic burn-in (equivalent to MIL-STD-883B, Method 1015). All Intel processing technologies are included. New products will enter the program as they become available.

The key to using EXPRESS is the generic matrix. You can, by specifying a two-letter prefix, select the test flow your product requires including its operating temperature range and package type. The two operating temperature ranges are: Commercial (0°C to 70°C) and Extended (−40°C to 85°C). Products are available in both hermetic ceramic and molded plastic packages, that meet these temperature specifications. Adding the option of burn-in creates the versatile EXPRESS matrix.

TEMPERATURE RANGE	BURN-IN HOURS	
	(NONE)	(168±8)
Commercial 0°C to 70°C	Standard	Q
Extended −40°C to 85°C	T	L

EXPRESS Prefix Definitions

Standard	High quality standard products
Q	Standard product with burn-in and 100% unit post burn-in electrical screening to COMMERCIAL temperature range
T	Standard product with EXTENDED temperature screening
L	Standard product with burn-in and 100% unit post burn-in electrical screening to EXTENDED temperature range

The EXPRESS test flow first subjects 100% of all products to a stringent class electrical examination. Complete DC, AC and functional parameters are tested at operating guard band temperature(s) for compliance to published specifications. Then, at your option, the product undergoes 168±8 hours of dynamic burn-in at 125°C. Post burn-in screening features a 100% unit electrical retest of DC, AC and functional parameters to guarantee the product's performance over its designated operating temperature range.

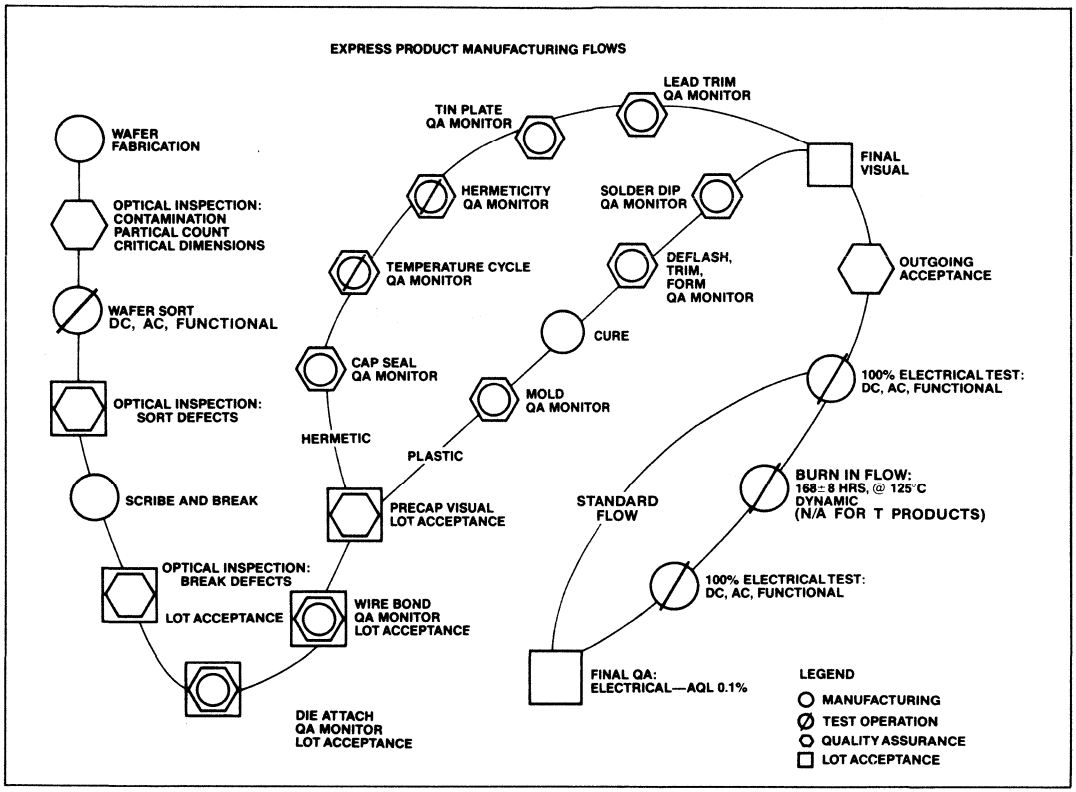
Both these product flows, independent of package type, then receive sample screening for electrical and visual parameters by Final Quality Assurance to 0.1% AQL. These standards are periodically reviewed, and tightened according to Intel's Corporate quality goals.

Table 33. EXPRESS Products

TYPE	PRODUCT	DESCRIPTION	Q	T	L
Microcontroller	8031AH	8-Bit Single Chip Computer, without ROM, Boolean Processor	X	X	X
	8035AHL	8-Bit Single Chip Computer, without ROM, 64 × 8-Bit RAM	X	X	X
	8039AHL	8-Bit Single Chip Computer, without ROM, 128 × 8-Bit RAM	X	X	X
	8040AHL	8-Bit Single Chip Computer, without ROM, 256 × 8-Bit RAM	X	X	X
	8048AH	8-Bit Single Chip Computer, 1K × 8-Bit ROM, 64 × 8-Bit RAM	X	X	X
	8049AH	8-Bit Single Chip Computer, 2K × 8-Bit ROM, 128 × 8-Bit RAM	X	X	X
	8050AH	8-Bit Single Chip Computer, 4K × 8-Bit ROM, 256 × 8-Bit RAM	X	X	X
	8051AH	8-Bit Single Chip Computer, 4K × 8-Bit ROM, 128 × 8-Bit RAM, Boolean Processor	X	X	X
	8748	8-Bit Single Chip Computer, 1K × 8-Bit EPROM, 64 × 8-Bit RAM	X	X	X
	8749H	8-Bit Single Chip Computer, 2K × 8-Bit EPROM, 128 × 8-Bit RAM	X	X	X
	8243	I/O Expander for Microcontrollers	X	X	X
Microprocessor	8085AH	8-Bit HMOS CPU	X	X	X
	8086	16-Bit HMOS CPU	X	X	X
	8087	Numeric Data Processor	X	X	X
	8088	8-Bit HMOS CPU, 16-Bit Internal Architecture	X	X	X
	8089	8/16-Bit I/O Processor	X		
	8185	1K × 8-Bit Static RAM	X	X	X
Support Product	8282	Parallel Bus Latch	X	X	X
	8283	Parallel Bus Latch	X	X	X
	8284A	Clock Generator for 8086, 8088	X	X	X
	8286	Parallel Bus Transceiver	X	X	X
	8287	Parallel Bus Transceiver	X	X	X
	8288	Bus Controller for 8086, 8088	X	X	X
	8289	Bus Arbiter for 8086, 8088	X	X	X
Controller	8237A	High Performance Programmable DMA Controller	X		
	8257	Programmable DMA Controller	X		
	8259A	Programmable Interrupt Controller	X	X	X

Table 33. EXPRESS Products (Con't.)

TYPE	PRODUCT	DESCRIPTION	Q	T	L
Peripheral	8155H	256 × 8-Bit RAM, I/O Ports, Counter	X	X	X
	8156H	256 × 8-Bit RAM, I/O Ports, Counter	X		
	8251A	Programmable Communication Interface	X	X	X
	8253	Programmable Interval Timer, 3 MHz	X	X	X
	8254	Programmable Interval Timer, 8 MHz	X	X	X
	8255A	Programmable Peripheral Interface	X	X	X
	8272A	Single/Double Density Floppy Disk Controller	X		
	8274	Multi-Protocol Serial Controller	X	X	X
	8279	Programmable Keyboard/Display Interface	X		
	8291A	GPIB Talker/Listener	X		
	8292	GPIB Controller	X		
	8741A	Universal Peripheral Interface, 64 × 8-Bit RAM	X	X	X
	8755A	2K × 8-Bit EPROM with I/O Ports	X	X	X
EPROM	2732A	4K × 8-Bit	X	X	X
	2764	8K × 8-Bit	X	X	X
	27128	16K × 8-Bit	X	X	X
	27256	32K × 8-Bit	X	X	X
E²PROM	2816A	2K × 8-Bit	X		
	2817A	2K × 8-Bit	X		
NVRAM	2004	512 × 8-Bit	X		
Static RAM	2114A	1K × 4-Bit, Three State	X	X	X
	2114AL	1K × 4-Bit, Low Power, Three State	X	X	X
	2115A	1K × 1-Bit, Open Collector	X		
	2115AL	1K × 1-Bit, Low Power, Open Controller	X		
	2125A	1K × 1-Bit, Three State	X		
	2125AL	1K × 1-Bit, Low Power, Three State	X		
	2147H	4K × 1-Bit, Three State	X	X	X
	2147HL	4K × 1-Bit, Low Power, Three State	X	X	X
	2148H	1K × 4-Bit, Three State	X	X	X
	2148HL	1K × 4-Bit, Low Power, Three State	X	X	X
	2149H	1K × 4-Bit, Three State	X		
	2149HL	1K × 4-Bit, Low Power, Three State	X		


EXPRESS PRODUCT MANUFACTURING FLOWS
WAFER FABRICATION
OPTICAL INSPECTION: CONTAMINATION PARTICAL COUNT CRITICAL DIMENSIONS
WAFER SORT DC, AC, FUNCTIONAL
OPTICAL INSPECTION: SORT DEFECTS
SCRIBE AND BREAK
OPTICAL INSPECTION: BREAK DEFECTS
LOT ACCEPTANCE
DIE ATTACH QA MONITOR LOT ACCEPTANCE
WIRE BOND QA MONITOR LOT ACCEPTANCE
HERMETIC
CAP SEAL QA MONITOR
TEMPERATURE CYCLE QA MONITOR
HERMETICITY QA MONITOR
TIN PLATE QA MONITOR
LEAD TRIM QA MONITOR
PLASTIC
PRECAP VISUAL LOT ACCEPTANCE
MOLD QA MONITOR
CURE
SOLDER DIP QA MONITOR
DEFLASH, TRIM, FORM QA MONITOR
FINAL VISUAL
OUTGOING ACCEPTANCE
100% ELECTRICAL TEST: DC, AC, FUNCTIONAL
BURN IN FLOW: 168±8 HRS, @ 125°C DYNAMIC (N/A FOR T PRODUCTS)
100% ELECTRICAL TEST: DC, AC, FUNCTIONAL
STANDARD FLOW
FINAL QA: ELECTRICAL—AQL 0.1%
LEGEND
MANUFACTURING
TEST OPERATION
QUALITY ASSURANCE
LOT ACCEPTANCE

MILITARY PRODUCTS

The components included in Intel's Military product family are summarized in the table below. A more complete description of each generic device can be found in this Guide by referring to the appropriate component section or by using the alphanumeric index located on Page iv.

Table 34. Military Products

TYPE	PRODUCT	DESCRIPTION	MAXIMUM CLOCK SPEED	PACKAGE TYPE		
				DIP	LCC	PGA
Microcontroller	M8031AH	High-Performance 8-Bit Single-Chip Computer without ROM, 128 × 8-bit RAM, Boolean Processor	12 MHz	X		
	M80C31	High-Performance 8-Bit Single-Chip Computer without ROM. Low power, power-down and idle modes	12 MHz	X	X	
	M8035HL	8-Bit Single-Chip Computer without ROM. 64 × 8-bit RAM, power-down mode	8 MHz	X		
	M8039HL	8-Bit Single-Chip Computer without ROM. 128 × 8-bit RAM, power down mode	8 MHz	X		
	M80C39	8-Bit Single-Chip Computer without ROM. 128 × 8-bit RAM, low power, power-down and idle modes	11 MHz	X	X	
	M8048H	8-Bit Single-Chip Computer, 1K × 8-Bit Mask Programmable ROM, 64 × 8-Bit RAM	8 MHz	X		
	M8049H	8-Bit Single-Chip Computer, 2K × 8-Bit Mask Programmable ROM, 128 × 8-Bit RAM	8 MHz	X		
	M80C49	8-Bit Single-Chip Computer, 2K × 8-Bit Mask Programmable ROM, 128 × 8-Bit RAM, low power, power-down idle modes	11 MHz	X	X	
	M8051AH	High-Performance 8-Bit Single-Chip Computer, 4K × 8-bit Mask Programmable ROM, 128 × 8-Bit RAM, Boolean Processor.	12 MHz	X		
	M80C51	High-Performance 8-Bit Single-Chip Computer, 4K × 8-Bit Mask Programmable ROM, 128 × 8-Bit RAM, low power, power-down and idle modes	12 MHz	X	X	
	M8748	8-Bit Single-Chip Computer with 1K × 8-Bit EPROM, 64 × 8-Bit RAM	6 MHz	X		
	M8749H	8-Bit Single-Chip Computer with 2K × 8-Bit EPROM, 128 × 8-Bit RAM	11 MHz	X	X	
	M8751H	High-Performance 8-Bit Single-Chip Computer with 4K × 8-Bit EPROM, 128 × 8-Bit RAM, Boolean Processor	11 MHz	X	X	

Table 34. Military Products (con't.)

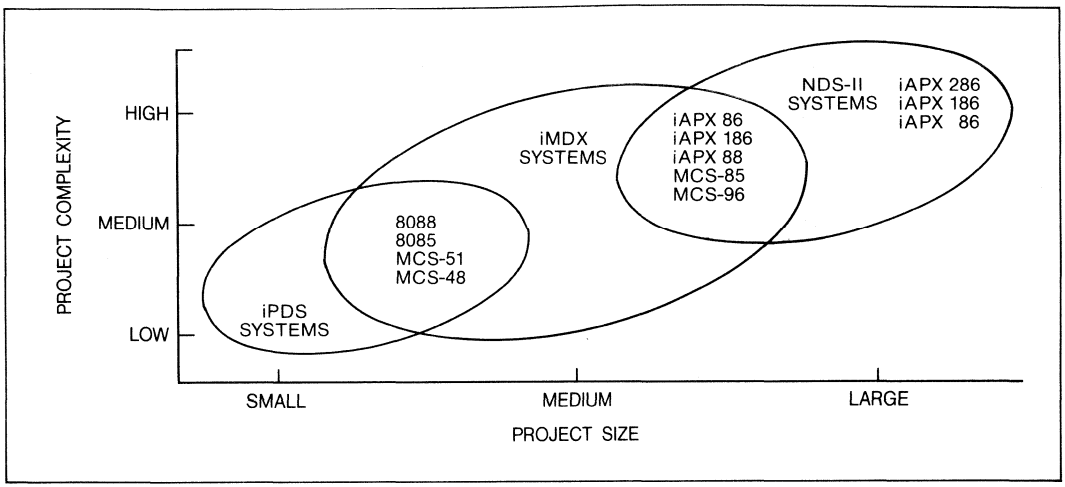
TYPE	PRODUCT	DESCRIPTION	MAXIMUM CLOCK SPEED	PACKAGE TYPE		
				DIP	LCC	PGA
Microprocessor	J8080A	8-Bit Parallel CPU, 2 μsec instruction cycle, M38510/42001BQX	2 MHz	X		
	M8080A	8-Bit Parallel CPU, 2 μsec instruction cycle	2 MHz	X		
	M8085AH	8-Bit Parallel CPU, 1.3 μsec instruction cycle, on-chip clock generator and system controller, DESC SID 7901001QX	3 MHz	X		
	J8086	16-Bit Microprocessor, M38510/53001BQX	5 MHz	X		
	M8086	16-Bit Microprocessor	5 MHz, 8 MHz	X	X	
	M8087	Numeric Data Processor, Math and floating point hardware for host M8086 and M8088	5 MHz	X	X	
	M8088	High-Performance 8-Bit Microprocessor, 16-Bit internal architecture	5 MHz	X	X	
	M8089	8/16-Bit I/O Processor, High speed DMA with I/O hardware	4 MHz	X		
	M80186	High Integration 16-Bit Microprocessor	8 MHz		X	X
Support Product	M8212	I/O Port, 8-Bit Latch		X		
	M8214	8-Level Priority Interrupt Control Unit		X		
	M8216	4-Bit Parallel Bidirectional Data Bus Driver/Receiver		X		
	M8224	Single-Chip Clock Generator and Driver for M8080A		X		
	M8226	4-Bit Parallel Bidirectional Data Bus Driver/Receiver		X		
	M8228	Single-Chip System Controller and Driver for M8080A		X		
	M8243	I/O Expander for M8035HL/M8048H/ M8748/M8039HL/M8049H/M8749H and M8741		X		
	M8282	8-Bit Parallel Address/Data Latch		X	X	
	M8283	8-Bit Parallel Address/Data Latch		X	X	
	M8284A	Single-Chip Clock Generator and Driver for M8086, M8088 and M8089	8 MHz	X	X	
	M8286	8-Bit Parallel Address/Data Bus Transceiver		X	X	
	M8287	8-Bit Parallel Address/Data Bus Transceiver		X	X	
	M8288	Bus Controller for M8086, M8088 and M8089, provides command and control timing generation	8 MHz	X	X	
	M8289	Bus Arbiter for M8086, M8088 and M8089 system busses	8 MHz	X	X	

Table 34. Military Products (con't.)

TYPE	PRODUCT	DESCRIPTION	MAXIMUM CLOCK SPEED	PACKAGE TYPE		
				DIP	LCC	PGA
Controller	M8257	4-Channel Programmable DMA (Direct Memory Access) controller for M8080A and M8085AH	3 MHz	X		
	M8259A	Programmable Interrupt Controller, handles up to 8-vectored priority interrupts	8 MHz	X	X	
Peripheral	M8155	256 × 8-Bit Static RAM with 22 programmable I/O ports, binary timer/counter		X		
	M8185	1K × 8-Bit Static RAM with internal address latch		X		
	M8231A	Arithmetic Processing Unit, High-Performance Fixed and Floating Point Arithmetic and Floating Pointing Trigonometric Operation	4 MHz	X	X	
	M8251A	Programmable Communication Interface, (USART)	3 MHz	X	X	
	M8253	Programmable Interval Timer, 3 independent 16-bit counters	DC to 2 MHz	X		
	M8254	Programmable Interval Timer, 3 independent 16-Bit counters	DC to 8 MHz	X	X	
	M8255A	Programmable Peripheral Interface, 24 programmable I/O ports		X	X	
	M8741A	General Purpose 8-Bit Microcomputer with 1K × 8-Bit EPROM	3.6 MHz	X		
	M8755A	2K × 8-Bit EPROM with 16 programmable I/O ports, Ta = −55°C to +100°C		X		
EPROM	M2716	2K × 8-Bit, DESC SID 7802201JB	tCE = 450ns	X		
	M2732A	4K × 8-Bit				
		DESC SID 8001203JB	tCE = 250ns	X		
		DESC SID 8001204JB	tCE = 450ns	X		
	M2764	8K × 8-Bit				
		DESC SID 8200502YB	tCE = 250ns	X	X	
		DESC SID 8200501YB	tCE = 450ns	X	X	
	M2764A-25	8K × 8-Bit	tCE = 250ns	X		
	M2764A-35	8K × 8-Bit	tCE = 350ns	X		
	M27128	16K × 8-Bit DESC SID 8202501YB	tCE = 450ns	X	X	
	M27256	32K × 8-Bit	tCE = 250ns	X	X	
E²PROM	M2816	2K × 8-Bit, Byte Erase/Write, Block Erase. Erase/Write at Ta = −40°C to +85°C	tCE = 350ns tWP = 10ms	X	X	
	M2817A	2K × 8-Bit	tCE = 250ns	X	X	
			tWP = 100ns	X	X	
	M2817A-3	2K × 8-Bit	tCE = 350ns	X	X	
			tWP = 100ns	X	X	
Static RAM	M2114A	1K × 4-Bit	tA = 150ns	X		
	J2147H	4K × 1-Bit,				
		M38510/23801BVX	tAA = 85ns	X		
		M38510/23803BVX	tAA = 70ns	X		
		M38510/23805BVX	tAA = 55ns	X		
		M38510/23807BVX	tAA = 45ns	X		
	M2147H	4K × 1-Bit	tAA = 45ns	X	X	
	J2148H	1K × 4-Bit,				
		M38510/23806BVX	tAA = 70ns	X		
	M2148H	1K × 4-Bit	tAA = 70ns	X	X	
Dynamic RAM	M2164A	65K × 1-Bit	tRAC = 150ns	X	X	

DEVELOPMENT SYSTEMS

Intel offers the optimal development system environment for every Intel microcomputer, from the low cost Personal Development System (iPDS™) for small projects using the 8051, to the NDS-II for the large project teams doing iAPX 286 designs. A complete line of assemblers, languages, debuggers and in-circuit emulators are available to support design efforts. *(See Software section immediately following (Page 61) for complete information on development software.)*



Range of Development Support for Microprocessors

PERSONAL DEVELOPMENT SYSTEM (iPDS™)

iPDS offers the user an integrated development system for Intel's 8-bit microcomputer line, at a low cost. The portable unit is based on the Intel 8085 microprocessor and comes with 64K of RAM. Mass storage is provided by a 5¼" 640 Kb integral disk drive (expandable to 2.5M Bytes).

The iPDS offers productivity enhancing tools through new products full development cycle. With optional CP/M*-80, users can use software tools like Multiplan**, Wordstar***, and others to plan their project. Use the standard ISIS operating system and full set of ISIS based software to speed development, with FORTRAN, BASIC, PL/M-80, PASCAL, and assembly level programming available.

Use convenient plug-in PROM programming and hardware development and integration. The iPDS combination of ease-of-use and portability makes it ideal for transporting your designs into manufacturing and field service. The iPDS even offers optional bubble memory for testing in harsh environments.

INTELLEC® DEVELOPMENT SYSTEM

The Intellec family of development systems are engineered to function as standalone system or network workstations. These systems are especially suited for users planning a variety of Intel microprocessor-based

*CP/M is a trademark of Digital Research, Inc.
**Multiplan is a trademark of Microsoft Corp.
***Wordstar is a trademark of MicroPro International

products. A key feature of the Intellec line is flexibility of support. The Intellec Development System provides the lowest cost solution for a user who needs to support an 8051 microcontroller design as well as an iAPX 286 design.

Table 35. Intellec® Development System

PRODUCT	DESCRIPTION
Series IIE iMDX-225	Intellec® Series IIE, Microcomputer Development System provides the 8-bit user with a complete development system that can be easily upgraded to support future 16-bit designs. The iMDX-225 includes an Intel 8085 CPU with 64K RAM, a 24 X 80 green CRT, and an integral 225K byte flexible disk drive. The Series IIE also features function keys, auto repeat keys and command line recall, thus making it easier to use. The iMDX-225 has five slots available for options.
iMDX-557 (Upgrades Series IIE to Series IIIE)	An 8 MHz, iAPX Resident Processor Card Package is an enhancement package for Intellec Series IIE and Model 800 Development Systems. It is specifically designed for iAPX microprocessor product development. It includes an iAPX-86 based CPU board with 256K RAM, CRT-based menu-driven editor (AEDIT), and software applications debugger (DEBUG-86).
Series IIIE DX-286	Intellec Series IIIE Microcomputer Development System is designed to support iAPX-86 family design projects. Combining the features of the Series IIE and the 557 upgrade, the Series IIIE gives a user access to Intel's broad line of iAPX-86 high level languages such as PLM, PASCAL, FORTRAN and C. Series IIIE is the host for Intel's latest debug tools, PSCOPE and I²ICE™, system.
Peripherals for Series IIE, IIIE iMDX-750	Intellec Winchester Subsystem provides 20 MB (formatted) of on line storage that improves system throughput. It includes a Winchester disk controller board.
iMDX-720	Intellec Double Density Flexible Disk System, provides an additional 1 MB mass storage for use with the Intellec Microcomputer Development System. The iMDX-720 includes a flexible disk controller and two flexible disk drives.
iMDX-201	Intellec Series IIE/IIIE Expansion Chassis provides four additional slots for use with the Intellec Series IIE or IIIE systems. The iMDX-201 chassis comes with its own power supply, fans and cable assemblies.
iUP 200/201	New PROM programmer is available in two versions: iUP200, an Intellec system peripheral; and iUP-201, a standalone system. These products allow fast programming of all Intel programmable memories and microcontrollers. A single iUP personality module can support an entire family of parts. These low cost modules are also compatible with the iPDS system.
Series IV iMDX 430/431 iMDX 440/441	The Intellec Series IV is a new generation development system specifically designed for supporting the iAPX family of advanced microprocessors. It also provides complete support for 8-bit microprocessors. Series IV models include the 8088 and 8085 CPUs with 384K RAM or the optional 8086 CPU high performance board with an additional 128K RAM. Series IV features an advanced, friendly interface, foreground/background processing, and a protected hierarchical file system. Intel's latest debug tools, I²ICE, iLTA, and PSCOPE, can be hosted on the Series IV. Program Management Tools, the advanced text editor (AEDIT), and the software applications debugger (DEBUG-86) are provided with Series IV.

NETWORK DEVELOPMENT SYSTEM

NDS-II

NDS-II is a powerful, networked distributed processing environment for microprocessor development. Utilizing Intellec development systems as workstations (Series IV, Series III, Series II, Model 800), the NDS-II provides high-speed Ethernet†-based communication and allows users to share all network resources.

Designed to improve engineering productivity, the NDS-II simplifies project organization. The hierarchical file system, archival utilities, software version control system, and automatic system generation program all reduce administrative overhead and aid project management.

NRM

At the heart of the NDS-II is the Network Resource Manager (NRM) which controls all NDS-II resources. The shared mass storage back-up devices, and spooled line printer which reside at the NRM are available to all network workstations. In addition, all Intellec Development System workstations are available as network resources to batch process jobs created by any user.

ISIS Cluster

ISIS Cluster puts more software engineers on line with the low-cost workstation. An extension of the distributed processing environment, the ISIS Cluster processor board resides in an Intellec development system host, and requires a user-supplied terminal to communicate with the user. The Cluster station has complete access to network resources.

DEVELOPMENT DEBUG SUPPORT

As part of a total solution, Intel has developed debug tools that aid design engineers in debugging and integrating hardware and software. These tools include PSCOPE, a high level language software debugger, and ICE™ (in-circuit emulators) for Intel microcomputers. The newest member of the emulator family is the I²ICE system which integrates logic analysis, high-level language debug and in-circuit emulation for the entire iAPX 86 family.

PSCOPE

PSCOPE, a high level program debugger, gives users a window into program execution at the high level language source level. A user can trace execution at the statement or procedure level. Advanced features include the ability to make source patches using a HLL-like syntax.

EMV Emulation Modules

The EMV modules provide the complete hardware and software debug capability for Intel's iPDS. It offers the design engineer many standard in-circuit emulation features in a compact and lightweight package. The most comprehensive debug capabilities are provided by Intel's ICE products.

ICE™ Emulation Modules

Intel pioneered the development and use of in-circuit emulators (ICE). ICE modules have become a standard design tool for microcomputer engineers. They can cut months off schedules by shortening the hardware/software debug and integration Phases of projects. Intel provides a complete line of emulator products to support Intel microcomputers.

I²ICE™ System

The I²ICE system is an advanced instrumentation product for the entire iAPX 86 family. Users can now use in-circuit emulation to debug at the same high level language level that the software was written in. The engineer does not have to match assembly level mneumonics with PASCAL statements.

iLTA, the I²ICE system's optional logic timing analyzer, integrates wave form analysis with in-circuit emulation into a common system. In addition, the I²ICE system uses the same command syntax as PSCOPE, thus allowing the user to learn one set of debug commands for the entire design cycle.

Table 36. Microprocessor and Microcontroller Debug Support.

	MCS®-48	MCS-51	MCS-80/85	iAPX 86, 88	iAPX 186,188	iAPX 286 (PROTECTED MODE)
ICE	X	X	X	X		
I²ICE				X	X	X
PSCOPE				X	X	
EMV		X				
iLTA				X	X	X

SOFTWARE

Intel offers an extensive selection of operating systems, high level languages, development and debug support that is specifically tuned for microprocessors and microprocessor-based boards and system. Intel also offers applications software and maintains the INSITE™ Library of user software. Intel publishes a Software Handbook, a comprehensive directory of software available directly from Intel, as well as the Intel Yellow Pages, which is a directory of software and services available for Intel's microprocessors, boards, and systems.

DEVELOPMENT SOFTWARE

(For information on development systems and debuggers see the Development Systems section immediately preceding.)

Intel provides a range of microprocessor development software, from assembly to high level languages. This software is available for a wide range of development environments.

Table 37. Development Languages and Utilities

PRODUCT	DESCRIPTION
Assemblers	All Intel assemblers provide full macro support.
Utilities	Linkage utilities allow independent assembly/compilation of modules. Library managers allow the management of standard modules and routines. In the case of the iAPX 286 (protected mode) a system builder is provided to allow easy configuration of a complex protected/memory managed systems.
PL/M	PL/M was the first high level language expressly designed for microprocessors. PL/M is a procedure oriented language with data structuring facilities and gives the engineer full control over microprocessor-dependent architecture features. It is one of the most widely used tools in the microprocessor world. These advantages are also available to the 8051 microcontroller user.
PASCAL	PASCAL-86 is a superset of ISO-PASCAL. Extensions include independent compilation and port I/O. In addition, PASCAL-86 embodies the most advanced code optimization techniques to achieve extremely efficient programs.
FORTRAN	FORTRAN-86 is an ANSI-77 standard compiler. Among its features are full 8087 support and the ability to handle very large arrays.
C	C-86 is a true implementation of the "C" programming language as defined by Keringhan and Ritchie. C is a high level language offering flexibility and portability of programs.

The following table shows the software tools available for specific Intel microprocessors on Intel host systems and non-Intel computers.

Table 38. Intel Language/Host Summary

LANGUAGE	COMPONENT FAMILY	HOST CODE[1]
Macro Assembler + Utilities	2920 MCS®-85 Family MCS-48 Family MCS-51 Family MCS-96 Family iAPX-86 Family iAPX-286 (Protected Mode)	1,2 2 1 1 2 1,2,3 2,3
PL/M	MCS-85 MCS-51 Family MCS-96 Family iAPX-86 Family iAPX-286 (Protected Mode)	1 1 2* 1, 2, 3 2, 3*
PASCAL	MCS-85 iAPX-86 Family iAPX-286 (Protected Mode)	1 2, 3*
FORTRAN	MCS-85 Family iAPX-86 Family iAPX-286 (Protected Mode)	1 2 4*
"C"	iAPX-86 Family iAPX-286 (Protected Mode)	2, 3* 2; 3*
Ada	iAPX-86 Family iAPX-86 (Protected Mode)	3; 4* 3; 4*

[1]See Development Systems Section Page 57

NOTE: * = Planned

Host Codes

1 = Intel 8085 Basic Development System (iPDS™, MDX Series IIE)

2 = Intel iAPX-86 Family Basic System (e.g., MDX Series IIIE, RMX™-86)

3 = VAX††/VMS Minicomputer

4 = Intel iAPX-286 (Protected) Basic System

APPLICATIONS SOFTWARE

An iMDX/Series IIE, IIIE or iPDS can be used as a personal computer with the addition of the CP/M*-80 operating system. Multiplan.** and Wordstar.*** Multiplan is an advanced spreadsheet program that allows users to do project planning, budget analysis, and what-if scenarios. With Wordstar, a development system can be used as a word processor.

* CP/M is a trademark of Digital Research, Inc.
** Multiplan is a trademark of Microsoft Corp.
*** Wordstar is a trademark of MicroPro International
†† VAX is a trademark of Digital Equipment Corp.

INSITE™ User's Library

INSITE is a collection of programs that have been written by users of Intel microcomputers, single board computers, and development systems. These programs are available on paper tapes, diskettes or source listings and includes monitors, conversion routines, peripheral drivers, translators, math packages, and even games. The library can also serve as a learning tool for users unfamiliar with assembly or high level languages associated with Intel's microprocessors.

Table 39. Applications Software and Languages

APPLICATIONS SOFTWARE AND LANGUAGES	OPERATING SYSTEM REQUIRED
Multiplan	CP/M-80
WordStar	CP/M-80
Personal Software Kit (WordStar, Multiplan, and CP/M 80)	CP/M-80
INSITE User's Library	Intel Customer Developed Software

OEM SOFTWARE

INTEL offers a broad range of OEM operating systems and languages. For real-time and dedicated commercial applications there is iRMX-86. iRMX-86 is the world standard for 16-bit applications requiring fast response times to real time events. Intel also supports XENIX+-86, a fully licensed version of Unix++ tuned especially for microcomputers. XENIX is well suited to development and many business applications. A full complement of languages are available for both RMX-86, and XENIX including FORTRAN, C, Cobol, and PASCAL, iRMX-88 and iRMX-80 are 8-bit operating systems for real time applications.

iRMX™ Operating System

The iRMX 86 Operating System is an easy-to-use, real-time, multi-tasking and multi-programming software system designed to manage and extend the resources of iSBC 86 and iSBC 88 Single Board Computers, as well as other iAPX 86- and iAPX 88-based microcomputers. iRMX 86 functions are available in silicon with the iAPX 86/30 and 88/30 Operating System Processors, in a user configurable software package, and fully integrated into the SYSTEM 86/300 Family of Microcomputer Systems. The Operating System provides a number of standard interfaces that allow iRMX 86 applications to take advantage of industry standard device controllers, hardware components, and a multitude of software packages developed by Independent Software Vendors (ISVs).

+ XENIX is a trademark of Microsoft Corp.
++ Unix is a trademark of Bell Laboratories

Many high-performance features extend the utility of iRMX 86 Systems into applications such as data collection, transaction processing, and process control where immediate access to advances in VLSI technology is paramount. The configurable layers of the System provide services ranging from interrupt management and standard device drivers for many sophisticated controllers, to data-file maintenance commands provided by a comprehensive multi-user human interface. By providing access to the standard Universal Development Interface (UDI) for each user terminal, Original Equipment Manufacturers (OEMs) can pass program development and target application customization capabilities to their users.

XENIX+Operating System

Intel offers the Microsoft XENIX Operating System. XENIX-86 is a fully licensed and enhanced derivative of the Unix Operating System. This a multi-user, multi-tasking, memory protected software system. It provides a coalition of operating system, program development, text processing, information handling and communication utilities. The XENIX system comes configured to the System 86/330X and 86/380X. Intel's product engineering and support insure that the software has been thoroughly tested for reliability and integrity.

Table 40. Operating Systems

FEATURE	iRMX-80	iRMX-88	iRMX-86	iRMX-286R	XENIX-86
PRIMARY FEATURES					
Multitasking Support	Yes	Yes	Yes	Yes	Yes
Device Driver Support	Yes	Yes	Yes	Yes	Yes
File System Support	Yes	Yes	Yes	Yes	Yes
Optional Multiprocessing Support	Yes	Yes	Yes	Yes	No
Any Combination of PROM and RAM residency	Yes	Yes	Yes	Yes	No
Building-block approach	Yes	Yes	Yes	Yes	Yes
Multiprogramming Support	No	No	Yes	Yes	Yes
Interactive Support	No	No	Yes	Yes	Yes
On-target Development	No	No	Yes	Yes	Yes
ADVANCED FEATURES					
Hierarchical directories	No	No	Yes	Yes	Yes
Custom device drivers	No	Yes	Yes	Yes	Yes
Low-overhead random access support	No	Yes	Yes	Yes	Yes
File access control	No	No	Yes	Yes	Yes
Automatic buffering	No	No	Yes	Yes	Yes
Load-time location	No	No	Yes	Yes	Yes
Utility commands	Some	No	Extensive	Extensive	Extensive
Interactive debugger	Yes	No	Yes	Yes	Yes
Interactive configuration	Yes	Yes	Yes	Yes	Yes
Communications/Networking	Yes	Yes	Yes	Yes	Yes
Text Processing	No	No	Yes	Yes	Yes—Extensive
Computer Aided Instruction	No	No	No	No	Yes
Source Code Control System	No	No	No	No	Yes

+ XENIX is a trademark of Microsoft Corp.

iRMX™ Languages And Utilities

The Intel iRMX languages and utilities provide full "on-the-target-system" software development capability for the 86/300 family of microcomputer systems and iSBC 86/88 or iAPX 86,88 based systems. This facility allows OEMs to allow their end users to make on-the-spot modifications and add additional capability to their applications. All languages are compatible with Intel's Universal Development Interface (UDI) "software bus."

The iRMX languages run only on iRMX 86 but are fully compatible with Intel's software development languages allowing users to develop programs on Intel's Series IIE, IIIE Development Systems and then easily move it to an RMX 86 system.

The iRMX languages allow OEMs to select the correct language for their application. For technical applications FORTRAN or PASCAL can be used, for systems programming use PL/M; commercial—PASCAL; and for size optimization—Macro Assembler can be used. Several languages are also available from independent software vendors (Cobol from Microfocus, BASIC from Microsoft, "C" from Mark Williams).

The iRMX utilities provide all necessary software for development including LINK, LOCATE, LIB, and both screen and line oriented editors.

Table 41. iRMX™ Languages and Utilities

PRODUCT	DESCRIPTION	APPLICABLE STANDARD	8087 SUPPORT (SEE KEY BELOW)
iRMX 86 UTILITIES (iRMX 860)	EDIT is a powerful line oriented editing facility. LINK connects object modules which have been individually compiled into a single, relocatable object module. LOCATE maps the relocatable object code into the iAPX 86/88 memory segments. LIBRARIAN allows creation of object module libraries.	N/A	SP,DP,(ASK1)
iRMX 86 PASCAL (iRMX 861)	PASCAL compiler which strictly implements ISO language standard. Many extensions to the language are available which allow programs to be written specifically for microcomputers, e.g., separate module compilation, and 8087 Numeric Data Processor support.	ISO	SP,TRANS
iRMX 86 FORTRAN (iRMX 862)	FORTRAN compiler which provides users total compatibility with existing FORTRAN 66 language generated code, plus many new language features provided by the FORTRAN 77 standard including "IF-THEN-ELSE," random access I/O, 8087 support, character variables.	ANSI 77	SP,DP,TRANS
iRMX 86 PL/M (iRMX 863)	PL/M compiler which provides users with a powerful, microcomputer oriented system programming language. iRMX 86 PL/M is a compatible superset of PL/M80 offering easy portability of software.	Intel PL/M	SP,DP,TRANS*
iRMX 86 SCREEN EDITOR (iRMX 864)	A screen editor which provides users with a menu driven text-editor. By keeping the menu of commands always in view, even infrequent users of the editor are able to edit text quickly.	N/A	N/A

SP=Single Precision
DP=Double Precision
TRANS=Transcendentals
*=Via Subroutine 1005F

Table 42. OEM Operating Systems and High Level Languages

OPERATING SYSTEMS	LANGUAGES SUPPORTED	COMPONENTS[1]	MULTIBUS® [2] BOARDS	SYSTEMS[3]
iRMX 80	*	MCS-80,85	iSBC 80/10B /16 /20-4 /24 /30	
iRMX 88	*	iAPX 86,88 Family	iSBC 86/05 /12 /14 /30 iSBC 88/25 /40 /45	
iRMX 86	Assembler PASCAL 86/88 FORTRAN 86/88 Microfocus Cobol BASIC-86 Interpreter (Microsoft) C-86 (Mark Williams) PL/M 86	iAPX 86, 88, 186, 286 Family	iSBC 86/05 /12A /14 /30 iSBC 88/25 /40 iSBC 286/10 iRMX 286	86/330 86/380 iTPS
iRMX 286R	Assembler PASCAL 86 FORTRAN 86 PL/M 86 Microfocus Cobol C-86 (Mark Williams) Basic	iAPX 286	iSBC 286/10	286/310
XENIX, licensed version of Unix V7	C language FORTRAN Cobol PASCAL (planned BASIC-86 Interpreter	iAPX 86, 286 Family	iSBC 86/12 /14 /30 iSBC 286/10	86/330 86/380

*The same languages supported by iRMX 86 can be used in a cross host environment to generate code that runs with iRMX 80 and iRMX 88.

[1]See Microprocessor Section on Page 29.
[2]See MULTIBUS Single Board Computer Section, Page 67
[3]See OEM Systems Section, Page 76

SINGLE BOARD COMPUTERS

The components that make the 'Open System' a reality . . .

It all begins with MULTIBUS System Architecture: the industry standard architecture.

The Foundation of Intel's microcomputer systems architecture was laid in 1976 with the introduction of the MULTIBUS system bus, and Intel's first single board computer product, the iSBC® 80/10. It was a solution the microcomputer industry needed to make microprocessor technology easier to use and more readily available for new product design and development. It's widespread use and popularity made it a defacto industry and IEEE standard (IEEE 796).

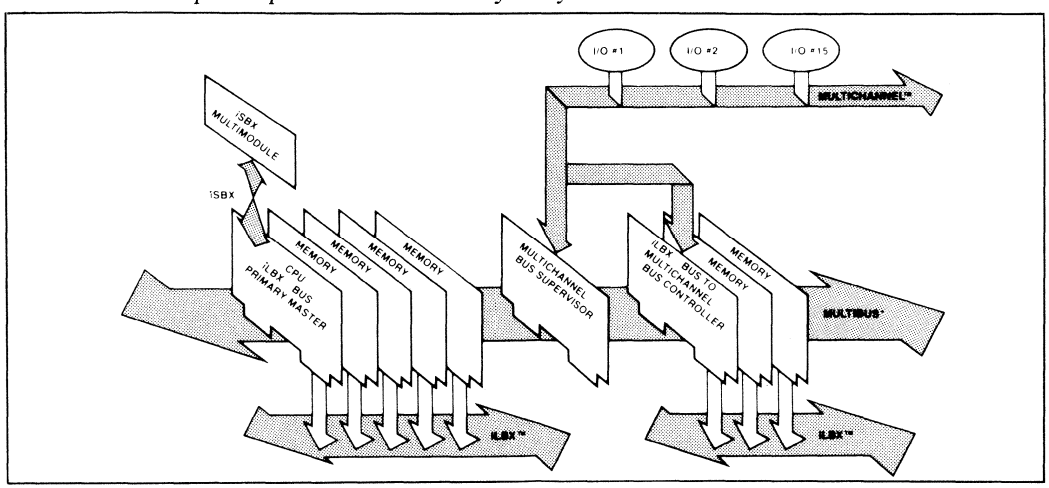
The bus architecture is the conceptual foundation and physical framework for interfacing the various pieces of the microcomputer system into a family of system solutions. This family now includes single board computers, memory expansion boards, a board array of I/O expansion product, packaging products, microsystem software and integrated microsystems.

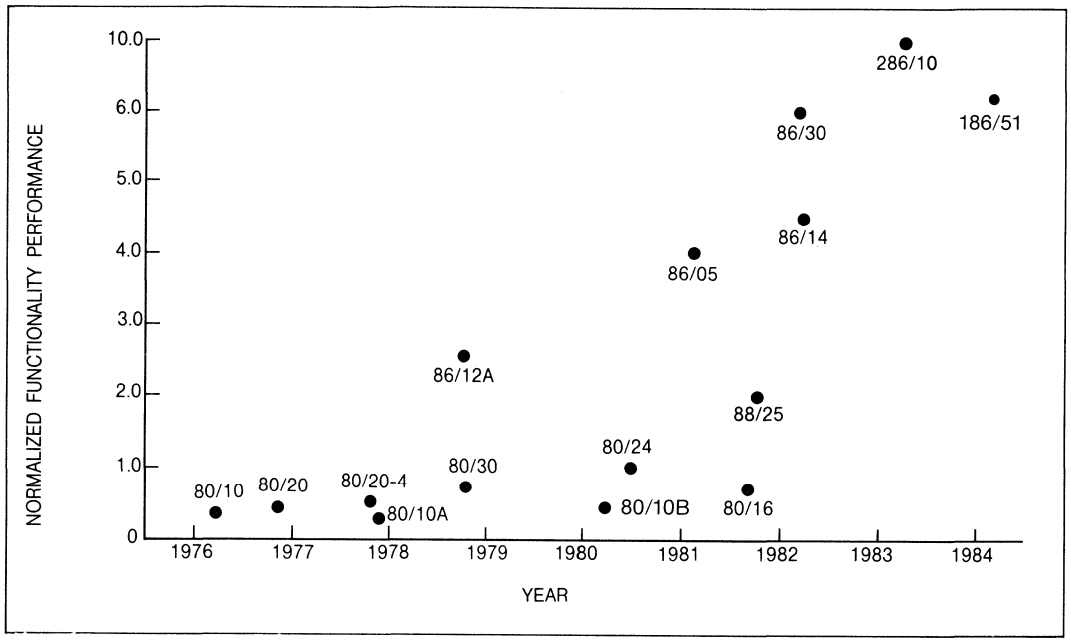
Support for multiple levels of expansion and design flexibility

The five levels of iSBC expansion supported by Intel's MULTIBUS provide OEMs with the widest range of cost/performance solutions and open system flexibility in the industry.

- The Multibus System Bus—system communication and interconnection
- The iLBX™ Execution Bus—large amounts of high speed memory
- The MULTICHANNEL™ I/O Bus—very high speed, high performance I/O
- The iSBX™ I/O Expansion Bus—low cost modular I/O
- iSBC MULTIMODULE™ Add-ons—on-board memory and math expansion

Intel continues to develop new iSBC products to meet the industry's need for powerful, cost-effective, single board computer products. There are now more than 65 MULTIBUS expansion boards. There are also over 200 MULTIBUS vendors providing more than 1000 MULTIBUS compatible products, the largest assortment of compatible products in the industry today.





iSBC® CPU Boards—Relative Performance

Table 43. MULTIMODULE™ Expansion Options

iSBC MULTIMODULE™s		Single Board Computers (iSBC)								
Expansion	**Product**	**86/30**	**86/14**	**86/12A**	**86/05**	**88/45**	**88/40**	**88/25**	**80/30**	**80/24**
64K EPROM	iSBC 341				•	•	•	•		
16K EPROM	iSBC 340			•						
H.S. Math	iSBC 337	•	•	•	•	•	•	•		
Memory Mgmt.	iSBC 309	•	•							
Memory Mgmt.	iSBC 308			•						
128K RAM	iSBC 304	•								
RAM Parity	iSBC 303		•	•						
8K RAM	iSBC 302				•			•		
4K RAM	iSBC 301						•			•
32K RAM	iSBC 300A		•							
32K RAM	iSBC 300			•						

Table 44. MULTIBUS® CPU Boards

PRODUCT	CPU[1]	RAM	EPROM E²PROM	ISBX™[2] EXPANSION CONNECTORS	MULTIMODULE™[2] EXPANSION	OPERATING[3] SYSTEM SOFTWARE
iSBC 286/10	80286	0-112Kb	0-384Kb	2	iSBC 341	iRMX™ 286 XENIX+ 286 CP/M* 286
iSBC 186/51	80186	128Kb	6, 28-pin JEDEC sites	2	iSBC 304	iNA 960 iRMX 86
iSBC 86/30	8086-2	128Kb	8-64Kb	2	iSBC 304 iSBC 337	iRMX 86 iRMX 86PC CP/M 86 XENIX iRMX 88
iSBC 86/14	8086-2	32Kb	8-64KB	2	iSBC 300 iSBC 337	iRMX 86 iRMX 86PC CP/M 86 XENIX iRMX 88
iSBC 86/12A	8086	32Kb	4-16Kb	0	iSBC 300 iSBC 340 iSBC 337	iRMX 86 iRMX 86PC iRMX 88 CP/M 86 XENIX
iSBC 86/05	8086-2	8KB	8-16Kb	2	iSBC 302 iSBC 341 iSBC 337	iRMX 86 iRMX 88 iRMX 86PC CP/M 86 XENIX
iSBC 88/45	8088 (8/16-bit)	16K	64K-128K	2	iSBC 341	iRMX 86 iRMX 88 CP/M 86 XENIX iMMX 880
iSBC 88/40	8088 (8/16-bit)	4Kb	16-32Kb	3	iSBC 301 iSBC 341 iSBC 377	iRMX 86 iRMX 88 XENIX
iSBC 88/25	8088 (8/16-bit)	4Kb	4-64Kb	2	iSBC 302 iSBC 341 iSBC 377	iRMX 88 iRMX 86 CP/M 86 XENIX
iSBC 80/30	8085A (8-bit)	16KB	8-8KB	0	iSBC 304 iSBC 337	iRMX 80 CP/M 80
iSBC 80/24	8085A (8-bit)	4K	4-32Kb	2	iSBC 301	iRMX 80 CP/M 80
iSBC 80/20-4	8080A (8-bit)	4K	4-8Kb	0		iRMX 80 CP/M 80
iSBC 80/16	8080A	2K-32K	8-64K	2		iRMX 80
iSBC 80/10B	8080A	1K-4K	4-16Kb	1		iRMX 80
iSBC 80/05	8085A	512Kb	2K-4Kb	0		

[1]See Microprocessor Section, Page 29.
[2]See Tables 45-51 on following pages.
[3]See Software Section starting on Page 63.

* CP/M is a trademark of Digital Research, Inc.
+ XENIX is a trademark of Microsoft Corp.

Table 45. MULTIBUS® Memory Expansion Boards

PRODUCT	MEMORY TYPE	MEMORY SIZE (Bytes)	PARITY	iLBX INTERFACE
iSBC 016A	Dynamic RAM	16K	No	No
iSBC 032A	Dynamic RAM	32K	Yes	No
iSBC 064	Dynamic RAM	64K	No	No
iSBC 064A	Dynamic RAM	64K	Yes	No
iSBC 28A	Dynamic RAM	128K	Yes	No
iSBC 056A	Dynamic RAM	256K	Yes	No
iSBC 012B	Dynamic RAM	512K	Yes	No
iSBC 028C	Dynamic RAM	128K	Yes	No
iSBC 056C	Dynamic RAM	256K	Yes	No
iSBC 012C	Dynamic RAM	512K	Yes	No
iSBC 028CX	Dynamic RAM	128K	Yes	Yes
iSBC 056CX	Dynamic RAM	256K	Yes	Yes
iSBC 012CX	Dynamic RAM	512K	Yes	Yes
iSBC 464	EPROM	0-64K	No	No
iSBC 428	28-Pin Universal Site	0-1M	No	Yes
iSBC 300	Dynamic RAM	32K	No	No
iSBC 300A	Dynamic RAM	32K	No	No
iSBC 301	Static RAM	4K	No	No
iSBC 302	Static RAM	8K	No	No
iSBC 304	Dynamic RAM	128K	No	No
iSBC 340	24 Pin EPROM	128K	No	No
iSBC 341	24/28 Pin EPROM	32K-64K	No	No
iSBC 254	Bubble Memory	128K-512K	Yes (Auto)	No
iSBX 251	Bubble Memory	128K	Yes (Auto)	No

Table 46. MULTIBUS® Memory and I/O Expansion Boards

PRODUCT	RAM	EPROM	SERIAL I/O	PARALLEL I/O	
				LINES	CONNECTORS
iSBC 108A	8K	4-32K	1 (RS232C)	48	2
iSBC 116A	16K	4-32K	1 (RS232C)	48	2

Table 47. MULTIBUS® Analog I/O Expansion Boards

PRODUCT	INPUT CHANNELS	OUTPUT CHANNELS	MULTIMODULE TYPE
iSBX 311	8-16		iSBX Single Wide
iSBX 328		8	iSBX Single Wide

Table 48. MULTIBUS® Digital Interface and I/O Expansion Boards

PRODUCT	DESCRIPTION	I/O CAPACITY	TYPE
iSBC 569	Intelligent 8085-driven Digital I/O Slave	48 I/O Lines	MULTIBUS
iSBC 519	Gen'l Purpose Digital I/O	72 I/O Lines	MULTIBUS
iSBC 556	Optically-Isolated Digital I/O	48 I/O Lines	MULTIBUS
iSBC 350	Programmable I/O iSBX MULTIMODULE	24 I/O Lines	Single-Wide iSBX MULTIMODULE
iSBX 488	IEEE 488 GPIB/HPIB	16 I/O Lines 16 Control	Single-Wide iSBX MULTIMODULE
iSBX 351	Programmable serial I/O MULTIMODULE Board	1—I/O Port RS232C RS422	Single-Wide iSBX MULTIMODULE
iSBC 589	Intelligent DMA Controller	8/16-bit 1—MULTICHANNEL Port 2—iSBX Connectors	MULTIBUS
iSBC 580	MULTICHANNEL Bus	1—16-bit MULTICHANNEL 1—16-bit iLBX Interface	MULTIBUS

Table 49. MULTIBUS® High Speed Math Boards

	CHIP	SPEED	FIXED	FLOATING	TRANSCENDENTAL	SOFTWARE SUPPORT[1]
iSBX 331	8231	4MHz	Yes	Yes	Yes	iRMX 88
iSBX 332	8232 8087	4MHz 5MHz	No Yes	Yes Yes	No Yes	iRMX 86

			Multiply	Divide	Add	Subtract
iSBC 337	Execution Time (Microseconds)	Fixed Point	28	48	20	20
		Floating Point	29	40	29	37

[1]See Software Section, Page 63.

Table 50. Disk/Diskette Controllers

PRODUCT	NO. OF BOARDS	TYPICAL RECORDING DENSITY	NO. OF DRIVERS SUPPORTED	SOFTWARE[1] SUPPORT	MAXIMUM CAPACITY DISK/DISKETTE DRIVE
iSBC 204	1	Single	4 Single-Sided 2 Dual-Sided	iRMX 80 iRMX 86	256K (std. size single-sided) 512K (std. size dual-sided) 80K (mini-size)
iSBC 208	1	Single/Double 48-96 TPI	4	iRMX 88 iRMX 86	1 MByte
iSBC 215G	1	960 TPI	4	iRMX 88 iRMX 86	150 MByte
iSBX 217B	1 Double/Wide MULTIMODULE	8000 BPI	4	iRMX 88 iRMX 86	60 MByte
iSBX 218	1 Double/Wide MULTIMODULE	Single/Double 48-96	4	iRMX 88 iRMX 86	1 MByte
iSBC 220	1	600 TPI	4	iRMX 88	600 MByte
iSBC 254	1	Bubble Memory	–	iRMX 86 iRMX 86	512K Byte

[1]See Software Section, Page 63.

Table 51. MULTIBUS® Video Controllers[1]

PRODUCT	NUMBER OF BOARDS	SCREEN RESOLUTION	CHARACTER SIZE	COLOR OR B.W.	FRAME RATE
iSBX 270	Double/Single	24/80	5×7, 7×9 6×8	8 color or B&W	50 Hz or 6 Hz
iSBX 275	Double/Wide	512×512×1 256×256×3	Up to 8×8	8 color or B&W	50 Hz or 60 Hz

[1]See Peripheral Section, Page 44 for VLSI Video Controller Components

LOCAL AREA NETWORK PRODUCTS

Intel's family of LAN system building blocks allows users to achieve early market entry with MULTIBUS-compatible Ethernet controllers, network software, and Ethernet cluster modules. Using these building blocks, an Ethernet local area network connecting MULTIBUS-based stations can be quickly implemented, including the Physical, Data Link, and Transport Software (layer 4 of the ISO Open Systems model). These products provide quick-to-market building blocks based on Ethernet and MULTIBUS.

Table 52. Communications Controllers

PRODUCT	DESCRIPTION
iSBC 186/51 COMMputer™	• Integrates a programmable processor and communications capability onto one board to serve as both computational and communications extensive environments • Powerful 80186 microprocessor • Two iSBX bus connectors for low cost expansion
iSBC 88/45 ADCP (Advanced Data Communications Processor)	• Intelligent communications controller can function as single board multimaster CPU or slave data comm gateway • 8 MHz iAPX 88/10 (8088-2) Microprocessor • Three half/full duplex communication channels support HDLC/SDLC/ASYNCH/SYNCH operation • Two iSBX bus connectors to expand to 6 communication channels with iSBX 351 or iSBX 352 serial expansion multimodule boards
iSBC 550/550 Kit (Ethernet controller for MULTIBUS Systems)	• Supports data link layer and physical link layer with (CSMA/CD) Carrier Sense Multiple Access/Collision Detect Implementation • Transport layer software for local area networks available with iNA 950-1 LAN software • Implements Ethernet IEEE P802 communications • iSBC 550 Kit offers software interface compatibility with 82586 VLSI local communication controller
iSBC 544 Intelligent Communications Controller	• Acts as a single board communications controller or an intelligent slave for multi-terminal communications expansion • On-board dedicated 8085A CPU provides communications control and buffer management for 4 programmable synchronous/asynchronous channels • 10 programmable parallel I/O wires compatible with Bell 801 Automatic Calling Unit (ACU)
iSBC 534 Four-Channel Communications Board	• Four fully programmable synchronous and asynchronous serial communications channels • 16-bit parallel I/O interface compatible with the Bell 801 Automatic Calling Unit (ACU)
iSBC 352 Programmable Communications MULTIMODULE Board	• Lowest cost building block for X.25 and iBM SNA software network implementations • Single HDLC/SDLC half/full duplex communications channel • Software programmable baud rate generator
iSBC 351 Programmable Serial I/O MULTIMODULE Board	• Provides serial communications capability using 8251A USART • Serial interface RS232C or RS422/449 buffered • Software programmable baud rate generator
Intellink™	• Connects up to nine Ethernet-compatible workstations without the need for transceivers or coaxial cable • Connects directly to Ethernet coaxial cable through a standard transceiver and transceiver cable
iNA 960 Network Software	• Provides reliable "virtual circuit" process-to-process massage delivery service • IEEE 802.3 Data Link Protocol (CSMA/CD) supported • ISO transport (8073) class 4 services and Comprehensive Network Management functions on 8086, 8088. 80186 microprocessors and 82586 communications co-processor

SPEECH TRANSACTION PRODUCTS

The Intel Speech Transaction Family, iSBC 570, iSBC 576 and iSBC 577, is a set of products that provides a minimal risk path to adding speech Input/Output (I/O) to your product line. The Speech Transaction Family will allow you to move from evaluation to integral speech driven products without major redesigns. Depending on your stage of product development, whether it is an evaluation, a product simulation, an add-on speech option, or a fully integrated speech product, the Speech Transaction Family's flexibility allows your speech I/O application to grow with a minimal amount of engineering effort.

The iSBC 570, Speech Transaction Development Set will plug directly into your Intellec® Microcomputer Development System. The iSBC 576, Speech Transaction Board is compatible with Intel Multibus single board computers, peripherals, card cages, and power supplies. If you desire, the iSBC 576 can be used with any non-MULTIBUS host system by communication via a RS232C serial link.

Table 53. Speech Transaction Products

PRODUCT	DESCRIPTION
iSBC 570 (Speech Transaction Development Set)	Complete Development Support Set for Intel Speech Product Family. The set includes: • Speech Transaction Generator • iSBC 576 Speech Transaction Board • iSBC 575 Operator Control Unit • Microphone • Demo Program This package is intended to provide the ability for technology evaluation, application development and application simulation.
iSBC 576 (Speech Transaction Board)	The iSBC 576 Speech Transaction Board is the heart of a speech I/O system. Besides providing Automatic Speech Recognition (ASR), a ROM-resident Speech Transaction Manager is included on the board. This provides a flexible operating structure for the system designer with a fully buffered speech generated input–transaction handling capability.
iSBC 577 (Speech Transaction Recognition Chip Set)	The iSBC 577 Speech Recognition Chip Set is a solution for high volume/maximum value-added speech I/O solutions. The chip set contains the Intel-developed proprietary components from the iSBC 576 Speech Transaction Board.
Development Support	See Development Systems Section, Page 57

iAPX 432 MICROMAINFRAME™

The iAPX 432 Micromainframe is a sophisticated 32-bit multiprocessor system designed for those specialized applications which demand absolute software reliability or hardware fault tolerance. Software for the machine is developed using the 432 Cross Development System. Source code, written in the high-level language Ada, is first compiled on a DEC VAX†† family computer then downloaded to a debug workstation for execution and testing. The debug workstation combines an Intellec Series III development system with a System 432/670 integrated computer system as the execution vehicle. The 432 processors run under iMAX, a state-of-the-art multitasking, multiuser operating system offering virtual memory and available in three upward-compatible configurations. OEMs can choose to base their 432 system on the System 432/600 family of modular computer products or develop a proprietary design from components.

Table 54. MICROMAINFRAME™ Systems

PRODUCT	DESCRIPTION
	Software
Ada-432	Compiler System
LINK-432	Version-checking linker
DEBUG-432	Symbolic, system-level debugger
UPDATE-432	Revision utility
iMAX 432	Multitasking, multiuser operating system
DSP-432	Diagnostic programs
	Hardware
	Logic Boards:
iSBC 432/601	General Data Processor Board
iSBC 432/602	Interface Processor Board
iSBC 432/603	Interface Processor Link Board
iSBC 432/604	Memory Controller Board
iSBC 432/607	Storage Array Board (256K bytes ECC memory)
	Chassis:
iSBC 432/630	Powered and cooled chassis
iSBC 432/632	Rack Mount Kit
	Integrated Systems:
System 432/670	Including: Two General Data Processors, one Interface Processor, and ½-Megabyte memory in a powered and cooled chassis
iAPX 432 VLSI Component	See Microprocessor Section, Page 35

††VAX is a trademark of Digital Equipment Corp.

OEM SYSTEMS

OPEN SUPERMICRO SYSTEMS DESIGNED FOR THE OEM

The System 300 family of microcomputer systems now includes the latest VLSI supermicro in the System 286/310 and System 286/380. These systems are designed to meet the OEM systems market's requirement for "open systems":

- Open to future VLSI through use of standards
- Open to multiple levels of integration by the OEM
- Open to aftermarket suppliers of hardware and software
- Open to the OEM's special requirements

This growing family uses both the new 80286 supermicro processor and the 8086 industry-standard processor, giving the OEM a choice of the highest performance available in a microsystem or a new low cost in integrated systems operating under today's dominant 16-bit architecture. Both are implemented in the System 300 family using established hardware and software standards to ensure that they continue to meet the OEM's open systems needs.

Available with these hardware systems are Intel's iRMX™ 86/iRMX 286R real-time operating system and the XENIX[+] 86/XENIX 286 Interactive Multiuser Operating Systems (fully-licensed versions of Bell Laboratories' Unix[++] system). Intel's software systems are available with a wide range of languages and support software, both from Intel and from independent vendors of quality software products.

[+]XENIX is a trademark of Microsoft Corp.
[++]Unix is a trademark of Bell Laboratories

Table 55. System 300 Family Product Features

FEATURES	SYSTEM 86/310-1	SYSTEM 86/310-2	SYSTEM 86/310-3	SYSTEM 286/310-5	SYSTEM 86/330	SYSTEM 86/380	SYSTEM 286/380
CPU	8086	8086/8087	8086/8087	80286/80287	8086/8087	8086/8087	80286/80287
RAM Memory	128KB	256KB	640KB	512KB w/ECC	384KB	384KB	512KB w/ECC
RAM May Be Expanded to:	896KB	896KB	896KB	1.5MB	896KB	896KB	6.0MB
Winchester Disk	—	10MB	10MB	10MB	35MB	35MB	35MB
Flexible Disk	320KB	320KB	320KB	320KB	1MB	1MB	1MB
Peripheral Expansion	One Additional 5.25-inch Drive	—	—	—	—	One Additional 8-inch Drive	One Additional 8-inch Drive
Serial I/O	1 RS232	1 RS232	1 RS232	2 RS232	1 RS232	1 RS232	2 RS232
Parallel I/O	1 Centronics Printer Port	1 Centronics Printer Port	1 Centronics Printer Port	1 Centronics Printer Port	1 Centronics-Compatible Printer Port	1 Centronics-Compatible Printer Port	1 Centronics-Compatible Printer Port
MULTIBUS® Board Slots Available For Expansion	6	5	4	4	2	11	11
Operating Systems			iRMX 86(1)	iRMX 286R(1) XENIX+++ 286(1)	iRMX 86(1) XENIX 86(1)	iRMX 86(1) XENIX 86(1)	iRMX 286(1) XENIX 286(1)
Available Languages **(Unless noted otherwise, languages run on 8086/ 80286, iRMX and XENIX)**			ASM(2) FORTRAN COBOL C PL/M(2) PASCAL BASIC	ASM(2, 3) FORTRAN COBOL C(3) PL/M(2, 4) PASCAL(4) BASIC(4) Multiplan+++(5) Word Proc(5) Menus(5)	ASM(2, 3) FORTRAN COBOL C(3) PL/M(2) PASCAL(6) BASIC(6)	ASM(2, 3) FORTRAN COBOL C(3) PL/M(2) PASCAL(6) BASIC(6)	ASM(2, 3) FORTRAN COBOL C(3) PL/M(2, 4) PASCAL(4) BASIC(4) Multiplan(5) Word Proc(5) Menus(5)
Size - Width	17 in./43.2 cm	17 in./43.2 cm	17 in./43.2 cm	17 in./43.2 cem	16.8 in/42.5 cm	16.8 in./42.5 cm	2 Units, Each is 16.8 in./42.5 cm
Depth	20 in./50.8 cm	20 in./50.8 cm	20 in./50.8 cm	20 in./50.8 cm	21 in./53.4 cm	21 in./53.4 cm	21 in./53.4 cm
Height	6.5 in./16.5 cm	6.5 in./16.5 cm	6.5 in./16.5 cm	6.5 in./16.5 cm	12.3 in./31.1 cm	12.3 in./31.1 cm	12.3 in./31.1 cm

NOTES

(1) Available in System Kits bundled with these configurations of Integrated Systems hardware; other hardware configurations are intended to support OEM run-time applications systems. XENIX 86 also requires iSXM™ 101 Memory Management Unit hardware installed in System 86/300

(2) Shipped as part of iRMX System Software Kits

(3) Shipped as part of XENIX System Software Kits

(4) XENIX 286 versions available 2H'84.

(5) Multiplan, Word Processing, and Menu Development Package will be available only on XENIX 286 (1H'84).

(6) Not available on XENIX 86.

+++ Multiplan and XENIX are trademarks of Microsoft Corp.

OEM PACKAGING PRODUCTS

Intel's MULTIBUS packaging product line consists of card cages, power supplies, and chassis which function to house, power, and cool single board computers and their peripherals. They provide the optimum operating environment for MULTIBUS applications. System power, rack and backwall-mounting, safety and emissions specifications, system cooling, and peripheral housing are just a few of the details to which Intel's packaging systems pay attention.

Table 56. Packaging Product Features

	CHASSIS						CARDCAGES	
FEATURES	**iSBC 680**	**iSBC 661-1**	**iSBC 660**	**iSBC 665**	**iSBC 655**	**iCS 80/640**	**iSBC 608/68**	**iSBC 604/614**
No. of Slots	6	8, 2 iSBX 6 iSBC	8	4	4	4, expands to 12	8, expands to 16	4, expands to 16
Power	300W	230W	230W	110W	108W	230W	N/A	N/A
Current Supplied +5V	30A	30A	30A	15A	15A	30A	N/A	N/A
+12V	2.9A	4.5A	4.5A	3A	2.0A	0.5A	N/A	N/A
−12V	3A	1.75A	1.75A	1A	0.8A	0.75A	N/A	N/A
−5V	2A	1.75A	1.75A	1A	0.9A	0.75A	N/A	N/A
+24V −24V	7.8A 1.6A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Input VAC	100, 120, 220, 240 VAC ±10%	100, 120, 220, 240 VAC ±10%	100, 120, 220, 240 VAC ±10%	100, 120, 220, 240 VAC ±10%	100, 120, 220, 240 VAC ±10%	100, 120, 220, 240 VAC ±10%		
Input Frequency	47-63 Hz	47-63 Hz	47-63 Hz	47-63 Hz	47-63 Hz	47-63 Hz	N/A	N/A
Rack-mount	Yes	Yes	No	Yes	Yes	Yes	Yes	N/A
Slide Rack-mount	Yes	Yes	Yes	No	Yes	No	No	N/A
Table Top	Yes	Yes	No	No	No	No	N/A	N/A
UL Certified	Yes	Yes	No	Yes	No	No	N/A	N/A
CSA Certified	Yes	Yes	No	Yes	No	No	N/A	N/A
FCC Certified	Yes	Yes	No	Yes	No	No	N/A	N/A
VDE Certified	Yes	Yes	No	Yes	No	No	N/A	N/A
Peripherals Supported	Two 8"	No	No	No	No	No	N/A	N/A
Size Width Height Depth	 16.8" 12.3" 21.5"	 16.95" 8.75" 19"	 19" 7" 19"	 19" 3.5" 16.25"	 16.9" 3.5" 19.4"	 17.4" 17.5" 11.25"	 13.2" 8.4" 7.0"	 14.2" 3.4" 8.5"

DATABASE PRODUCTS

Intel offers database management systems for a variety of users. The Data Pipeline™ products are an integrated series of mainframe and microprocessor products that are designed to distribute data and data processing in today's modern office environments. The SYSTEM 2000® DBMS and the iDIS™ System are the primary Data Pipeline products. Intel also offers the iDBP™ database processor for offloading DBMS functions to a cluster controller, backend, or file server.

DATABASE MANAGEMENT SYSTEMS

Intel's SYSTEM 2000 Database Management System and related database family products provide complete and integrated database facilities for the mainframe data processing environment. Facilities are provided to fulfill requirements spanning the DP department to end-user departments. The rest of the system is a DBMS kernel controlled by an integrated data dictionary, which provides security and integrity while offering flexibility and isolation of physical structures. Complete data manipulation facilities are available via a procedural language interface, interactive report generators, graphics, relational query/update and structured query/update access. Production performance and shared access in batch and online environments are assured through Intel's unique multiuser capability. SYSTEM 2000 DBMS supports operating systems on the mainframes of three major manufacturers: IBM, CDC, and Sperry (UNIVAC).

The SYSTEM 2000 system packaging includes three configuration options designed for different types of users: Entry System, End-User System, and Development System. The major facilities included in each of those packages are listed below:

Table 57. System 2000® Configuration Options

PACKAGE	FACILITIES
ENTRY	Database Manager Basic Data Dictionary Queue 1 PLEX Save/Restore USI Multi-User Multi-Thread TSO Interface CICS Interface Accounting Log Recovery Concurrent Update
END-USER	ENTRY SYSTEM QUEST Report Writer Genius w/Graphics QueX RDBA CREATE
DEVELOPMENT	END-USER Remaining PLEXs iDIS 735 XDD Dual Write TAPS/80 Screen Writer

Table 58. SYSTEM 2000® Database Management System

FEATURES	CDC SERIES	SPERRY UNIVAC SERIES	IBM/OS SERIES	IBM/CMS SERIES	IBM/DOS SERIES
Supported Mainframes	CDC 6000 Cyber 70/80/170 Series Cyber 700 Cyber 800	UNIVAC 1100	370 303x 308x 43xx	370 303x 308x 43xx	370 303x 308x 43xx
Supported Operating Systems	Kronox, scope NOS,NOS/BE	OS 1100	MVS, SVS VSI,OS/MVT OS/MFT	VM/CMS	DOS/VS DOS/VS (E)
Batch/On-Line (Interactive)	BOTH	BOTH	BOTH	BOTH	BOTH
Teleprocessing Interfaces	Interactive Control Program	Will Run Under CMS	CICS TSO/TONE	CMS	CICS
Programming Language Interfaces (PLEX)	COBOL FORTRAN	COBOL FORTRAN	COBOL FORTRAN PL/1 ASM	COBOL FORTRAN PL/1 ASM	COBOL FORTRAN PL/1 ASM
Dictionary Support **Integrated** **Extended**	 Yes No	 Yes No	 Yes Yes	 Yes Yes	 Yes Yes
Report Writer	GENIUS™	GENIUS	GENIUS	GENIUS	Yes
Relational Query	Yes	Yes	Yes	Yes	Yes
Conversational Facility	CREATE	QueX Screen Writer	QueX TAPS/80	SOLO w/ QueX	TAPS/80
Concurrent Access	Yes	Yes	Yes	Yes	Yes
Concurrent Update	No	Yes	Yes	Yes	Yes
Recovery	Journal Roll Forward	Journal Roll Forward	Journal Rollback/ Roll Forward Transaction	Journal Rollback/ Roll Forward Transaction	Journal Rollback/ Roll Forward
Dual Write	No	No	Yes	Yes	No
Graphics	GENIUS	GENIUS	GENIUS	GENIUS	No
iDIS Supported	Yes	Yes	Yes	Yes	Yes

DATABASE INFORMATION SYSTEMS

The Intel Database Information System (iDIS) is a complete, fully-integrated hardware/software microcomputer-based system that provides user-friendly access to mainframe databases and application data files. The iDIS system serves as a gateway between personal computer/terminal end-users and mainframe data. Access to the mainframe databases is gained via menu-driven extract facilities. iDIS databases can be populated via a direct extract (i.e., from a specific DBMS, such as SYSTEM 2000) or via the generic extract (that allows data down-load from any application file system).

As an Information Center tool, the iDIS system provides a full range of information processing functions to multiple concurrent users at all levels of technical skills. The iDIS operating system is provided by XENIX+, an enhanced version of Unix++. Electronic mail and electronic calendar are included.

The iDIS Seamless™ Software provides a local relational DBMS facility, a word processor, and a spreadsheet. The relational DBMS supports an interactive query/update language similar to that of IBM's SQL Data System. It also includes programmatic interfaces and bulk loading/unloading of data. The word processing system allows a full range of document preparation functions for both technical and non-technical users. The Multiplan** spreadsheet system supports 'what if' decision-modeling with a two-dimensional matrix, or 'spreadsheet'. Interrelationships among the data are automatically maintained and data can be entered from the keyboard, the iDIS DBMS, a down-loaded SYSTEM 2000 database, or XENIX file.

Application development is facilitated by a screen menu/form development package, an on-line HELP processor, C programming language, and a full-screen editor. Other programming languages are also available.

Table 59. iDIS™ Database Information System

Standard Hardware	8086-based, 768Kb RAM, 1Mb floppy storage, 35Mb Winchester storage, support for 5 terminals or PCs, TTY pass-through communications.
Standard Software	XENIX, C programming language, iQ (relational DBMS), iHELP (interactive user assist), iMENU shell, generic iXTRACT, electronic mail, electronic calendar, IBM PC networking software.
Hardware Options	Winchester disk storage (extra 35Mb or 70Mb) Display terminal (up to 9) Printer (character, 200 cps) Communications: RJE (MASP or 3780/2780) or 3270 BISYNC
Software Options	iMENU (menu/forms development) iWORD (word processing) iPLAN (spreadsheet) iXTRACT, direct (from SYSTEM 2000) COBOL programming language

+ XENIX is a trademark of Microsoft Corp.
++ Unix is a trademark of Bell Laboratories
** Multiplan is a trademark of Microsoft Corp.

DATABASE PROCESSORS

The Intel Database Processor (iDBP) is a microprocessor-based, relational database management engine that functions as a very intelligent mass-storage controller for one or more host computers. It combines general purpose database management system software with specialized hardware to provide an integrated, systems-level solution. The iDBP system sits between its hosts and a set of disks dedicated to the database management function, performing file and database management services for applications that are executed in these hosts, thereby freeing them for other tasks.

The iDBP system is offered in two basic configurations:

iDBP Development System for the development of value-added applications.

iDBP Runtime System for low-cost production usage.

Table 60. iDBP™ Database Processor

Feature	iDBP Development System	iDBP Runtime System
Relational Kernel with Hierarchical and Network Capabilities	Standard	Standard
Structured and Unstructured Data Information	Standard	Standard
Integrity Constraints and Controls	Standard	Standard
Development Assistance	Standard	No
Hard-disk Storage	Optional 35Mb Winchester Optional 70Mb External Winchester	Optional 35Mb Winchester Optional 70Mb External Winchester
Hard-disk Interfaces	Winchester or SMD	Winchester or SMD
Communications	Standard Terminal Custom Link Interface Optional Ethernet	Optional Terminal Custom Link Interface Optional Ethernet

TRANSACTION PROCESSING SYSTEMS

The Intel Transaction Processing System (iTPS) product family is a family of fully integrated multi-user commercial computer systems. These systems are based on the Intel 8086 microprocessor and support an extensive array of communications, languages, and application development software.

A key option in the system's powerful software offering is the Intel Terminal Application Processing System (iTAPS). iTAPS provides a fully integrated transaction processing environment complete with an interactive application development facility, screen definition and management, integrated relational database manager, and a transaction execution monitor. The menu driven iTAPS also contains interactive utility routines and supports an on-line query facility allowing non-technical users to access databases and format their own custom reports.

The iTPS product family brings powerful on-line processing capabilities and an attractive price-performance ratio to OEM systems integrators, software houses, and large end-user organizations. The product family is designed for applications in such areas as manufacturing, retail, financial, inventory, and legal.

Table 61. Transaction Processing Systems

	iTPS-86/445	iTPS-86/435
Number of Users	1-16	1-4
Processor	8086	8086
Memory	Up To 1 MB	768 Kb
Number of Disk Drives **Capacity**	1-4 84 MB	1 35 MB
Maximum Disk Storage	336 MB	35 MB
Floppy Disk **Size** **Capacity**	 5¼" 0.6 MB	 8" 1 MB
Tape	¼" Cartridge	User Supplied
Printer	200 CPS Matrix	200 CPS Matrix
Operating System	RMX 86 With Commercial Extensions	RMX 86 With Commercial Extensions
Communications Supported	RS232 2780/3780 3270 BSC 3270 SNA X.25 HASP	RS232 2780/3780 3270 BSC 3270 SNA X.25 HASP
Application Development Software	iTAPS	iTAPS
Languages Supported	Cobol Pascal C Fortran PL/M 86 ASM	Cobol Pascal C Fortran PL/M 86 ASM
Other Options	iTPS to IBM PC-link • Terminal Emulation • File Transfer	iTPS to IBM PC-link • Terminal Emulation • File Transfer

QUALITY/RELIABILITY

Quality Assurance Operations, Corporate Policy

It is the policy of Intel Corporation to design, manufacture, and deliver products that not only meet our specified standards, but also satisfy our customer standards, and perform reliably in their applications. To this end, Quality Assurance at Intel has the authority to exercise control of quality over every phase of the design and manufacturing process.

Quality Assurance Overview

Since 1969 Intel has been recognized as an innovator and a leader in product quality and reliability—from silicon solutions to system products. This leadership was not achieved by accident. It resulted from a combination of clearly defined objectives, careful planning and thorough execution. At Intel, Quality is a commitment, a philosophy, and a goal: a commitment to satisfy our customer's needs; a philosophy practiced as "do it right the first time"; and a goal of excellence in the world marketplace.

Organization, a Unique Matrix

All product-related Q.A. organizations come under a uniform policy, while still maintaining the flexibility to service the specific needs of a product area. To perform in this manner, a unique matrix organization was developed. All quality and reliability functions report directly through Q.A. operations or site managers to the Director of Quality Assurance. The flexibility is obtained by the Q.A. managers associated with product areas (such as EPROMs, memories, OEM boards, and development systems) also reporting indirectly to (i.e., matrixing to) the operation or division general manager.

Additionally, each product area has both a quality and reliability group under a single Q.A. manager. This involvement on a product-specific level provides both the customer and Intel with the timely response necessary to maintain a problem-free product flow. When problems arise, they are handled quickly on a local level. This results in a "team" approach between quality, reliability, development, and manufacturing—making state-of-the-art technology available in a usable form for our customers.

COMPONENT RELIABILITY

The key to establishing a new product, process or package, or to changing an existing one, is meeting the rigid qualification requirements. Qualification must be run and approved by the appropriate reliability department before any revenue shipment may be made. The reliability goals which have been set during the concept stage must be demonstrated by the qualification. Consider one example, the qualification of a new wafer fab technology for EPROMs. The first 5 wafer lots face the following tests during qualification:

125°C burn-in	168 hours
125°C lifetest	2000 hours
150°C HTRB	1000 hours
Low-temperature lifetest	1000 hours
250°C storage	1000 hours
Temperature cycle	−65°C to +150°C
Thermal shock	−65°C to +150°C
Test pattern study	
Program/erase cycling	
System verification	

This sequence of tests determines infant mortality, random failure rates, and associated failure mechanisms. This data also becomes the basis of reliability reports made available to our customers.

While successful completion of qualification is the key to product introduction, it would be meaningless if the device were not sampled throughout its product life. On a rotating product basis, 125°C dynamic burn-in and lifetests are performed continuously to monitor all technologies. Fifty thousand devices each month are allocated for the Reliability Monitor Program by the Components Division. In this manner, all generic technology families are continuously scrutinized to assure that reliability goals are met.

In the same manner, Intel Package Reliability performs an extensive package monitor program to assure the mechanical integrity of every package type produced by every assembly facility.

Special Component Quality Programs

The need for an Intel-customer correlation effort has grown with device complexity. In response to this need, a FACR (Failure Analysis Correlation Request) system has been established within each division or operation. Operating through the Field Sales Engineers, the object of the program is to eliminate electrical test discrepancies between Intel and its customers in a timely manner. The system provides direct contact with a product-oriented Quality Engineer to eliminate test program or equipment discrepancies between the customer and Intel without returning all products shipped. The success of the program may be measured by the number of lots that have been shipped to customers and been questioned and accepted after utilizing the FACR system. The obvious by-product of this system is to build customer confidence to the point where Intel's final test and FQA data becomes the customer's incoming inspection data.

Military

The Military Quality Assurance program, operated out of the Phoenix site, attends to customers within the aerospace or military industry, or in some cases, to customers that have special documentation requirements. To perform in this product area, the Military Q.A. acts as an overlay on all sites and operations, defining the Q.A. program requirements in that particular area. The success of this program may be gauged by the acceptance of selected high-technology products by the Federal Government, and the product processing areas certified by an agency of the Federal Government. This department also performs process audits on a regular basis of applicable Intel manufacturing facilities to assure compliance to rigid military traceability and process requirements.

EXPRESS Program

The EXPRESS burn-in program provides additional testing of components to meet specific customer application requirements. A 168-hour dynamic burn-in at 125°C enables microprocessors, RAMs, EPROMs, and peripheral components to meet high reliability, harsh environment requirements. Customers can also specify testing over two operating ranges—0° to 70°C or −40° to 85°C. The EXPRESS service is available at either temperature range, with or without the extended burn-in. The service applies to products sold in molded plastic packages and hermetic ceramic packages.

SYSTEM QUALITY ASSURANCE

The Systems Quality Assurance Organization is a centralized function with operational entities at each System Site. The Site Quality Assurance Managers have accountability to product General Managers, but report to the Group Quality Assurance Director.

This structure provides unique leverage and significant synergy from a variety of prospectives: most significant is that Product Quality is assured and never compromised.

Operationally the organizations are integrally involved in all phases of product life cycle, and in the control of all internal practices and disciplines.

Organizationally the function at all Sites is composed of 4 entities, each responsible for distinct and measurable tasks, specifically:

1. *Advanced Reliability and Quality Assurance*—responsible for the design reliability of new products, including reliability and environmental qualification, and field reliability performance.

2. *Material Quality Assurance*—responsible for the quality of all procured items, comprising supplier and part qualification, and incoming material testing and control.

3. *Product Quality Assurance*—responsible for the control of all processes during the manufacturing cycle and the quality levels of all outgoing products.

4. *Components Engineering*—responsible for the qualification and selections of electronic parts used in the design of all system products.

Controlling product quality and reliability is a complex task requiring a high degree of integration, organizational involvement and use of specialized disciplines, notably:

Design control through part selection and application, design rules, circuit analysis, derating requirements and assiduous environmental and reliability qualification testing.

Procured material quality through a rigorous supplier selection, qualification and monitoring process. Our computerized control system automatically assures procurement only from selected and approved sources. The right for any supplier to be on the approved list must be earned!

Product quality level monitoring and control through our automated reporting and analysis systems, and improvement through a corrective action system including impositions of extensive product failure free burn-in requirements. But the final measure of outgoing quality is our continuous product sampling program, where a significant percentage of finished products is subjected to a "customer audit". Only products which meet the stipulated quality levels may ship.

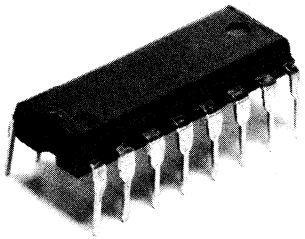
To complete the cycle, a full field reliability reporting system provides timely feedback on our ability to control the product design and manufacturing processes.

Our approach to quality is based on a very fundamental premise: DO IT RIGHT THE FIRST TIME, while our quality philosophy is structured on two basic precepts: *OUR PRODUCT MUST MEET THE CUSTOMERS NEEDS AND BE IN ABSOLUTE COMPLIANCE TO SPECIFICATIONS.*

To provide you with additional insight on how the Intel Systems Group operates and assures quality of all products and services a video tape presentation has been made available. The name of this production is "INTEL SYSTEMS – SUCCESS BY DESIGN", and can be readily obtained from your Distributor or Intel Salesperson.

PLASTIC DUAL IN-LINE PACKAGE TYPE P

16-LEAD PLASTIC DUAL IN-LINE PACKAGE TYPE P



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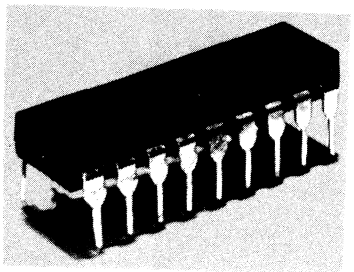

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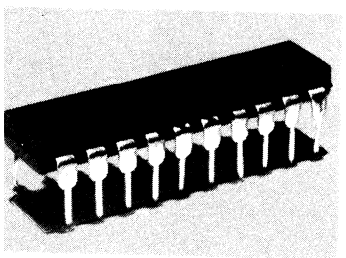

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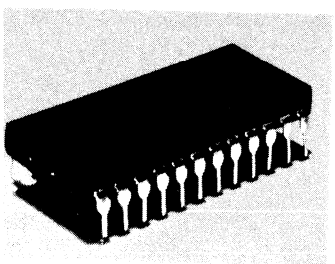

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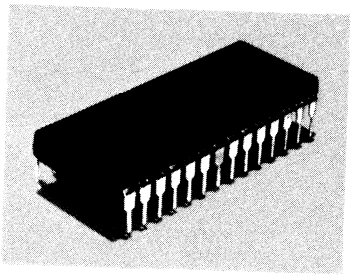

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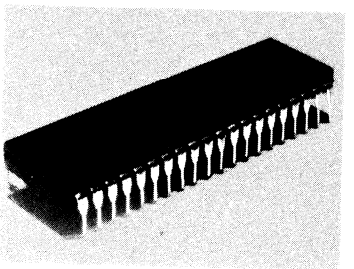

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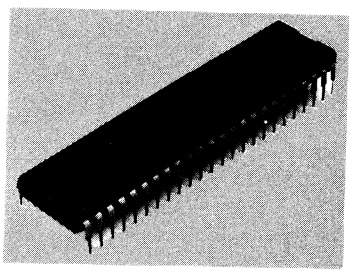

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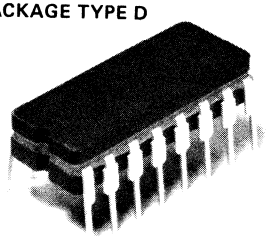

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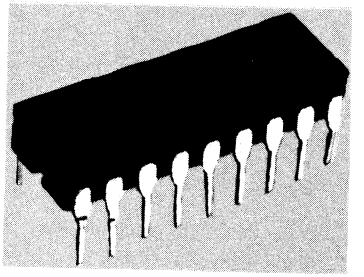

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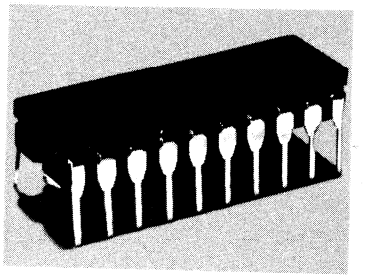

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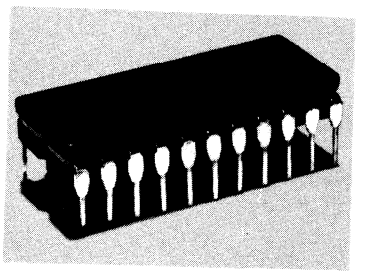

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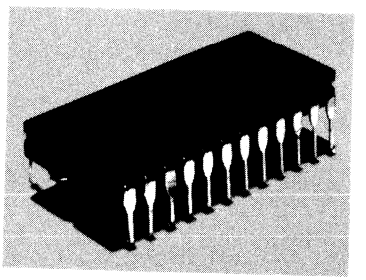

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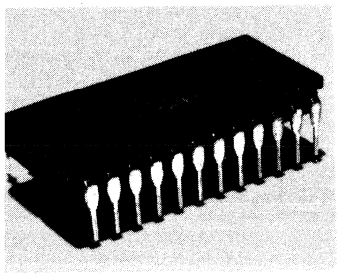

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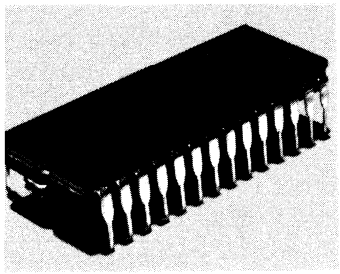

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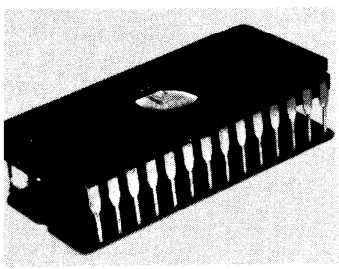

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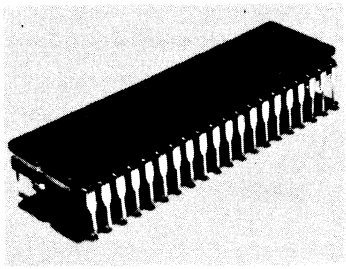

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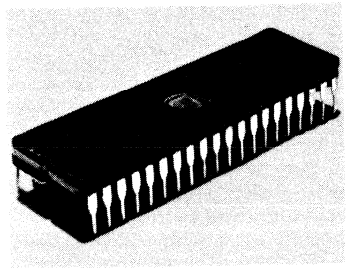

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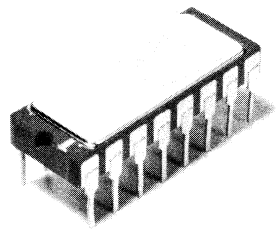

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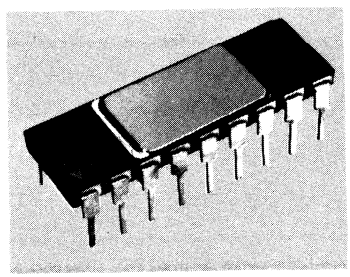

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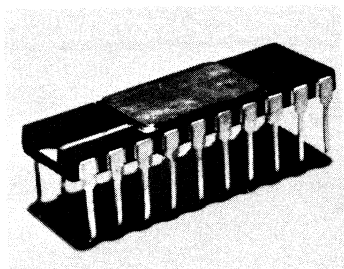

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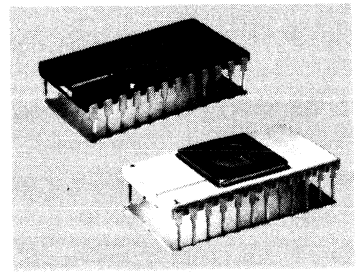

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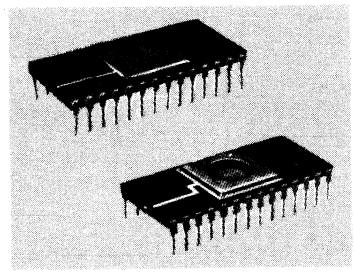

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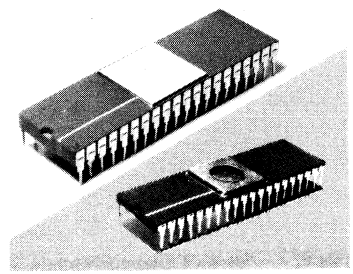

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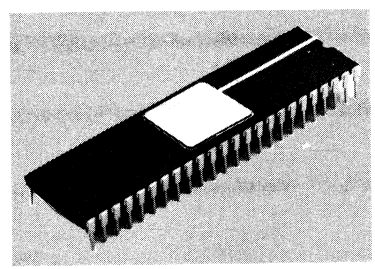

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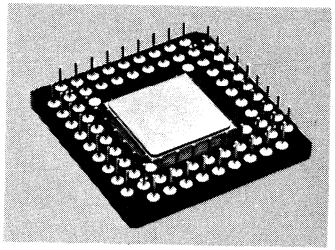

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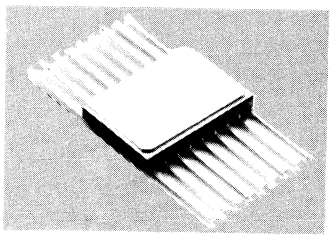

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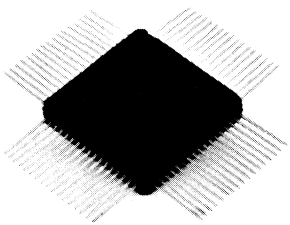

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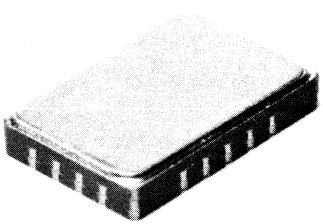

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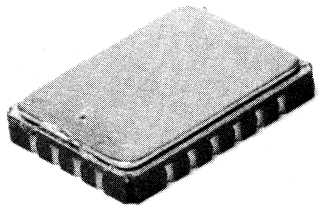

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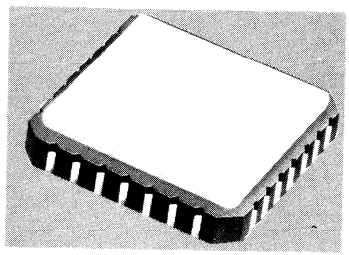

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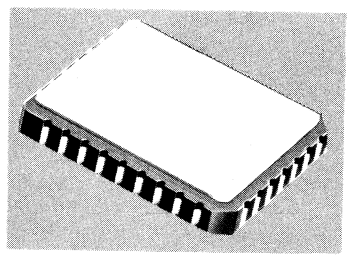

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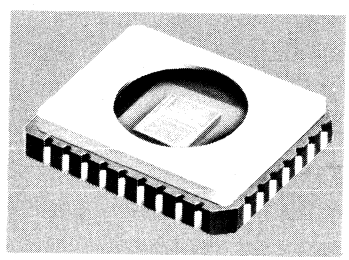

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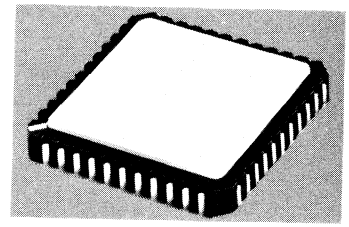

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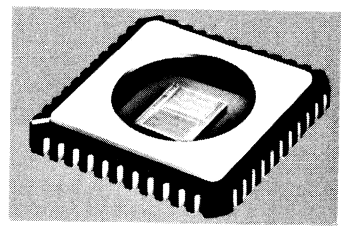

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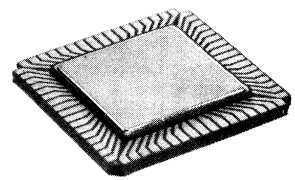
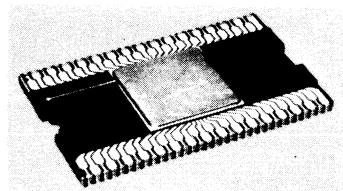
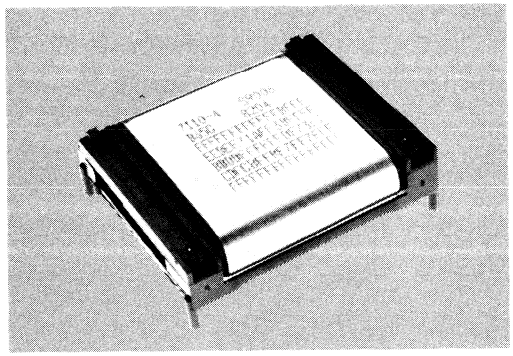


CERAMIC LEADLESS QUAD IN-LINE HERMETIC TYPE C

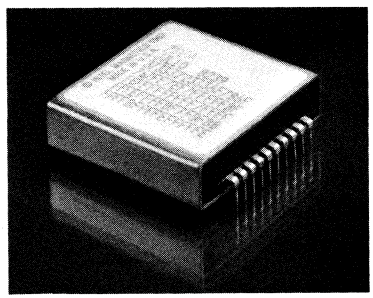
64 PINS-REQUIRES A SOCKET



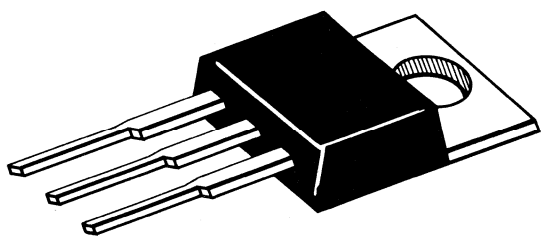
BUBBLE LEAD-LESS PACKAGE AND SOCKET



1 MBIT LEADED BUBBLE MEMORY PACKAGE



7264 (PART OF 4 MBIT BUBBLE MEMORY SYSTEM)



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