inmos

iq systems product overview

innovation and quality

SGS-THOMSON MICROELECTRONICS

INMOS is a member of the SGS-THOMSON Microelectronics group

iq

systems charter

To provide an extensive range of innovative modular hardware and software products to meet the high quality standards and service requirements of the OEM and system developer.

CONTENTS

1.1 INTRODUCTION AND BACKGROUND

The INMOS transputer family of microprocessors is the industry standard in the field of multi-processing. The family consists of a range of powerful VLSI devices which all adhere to the same basic architecture incorporating a processor, memory and communication links for direct connection to other transputers.

Multiprocessor systems can be constructed from a collection of transputers operating concurrently and communicating through links. Unlike all other microprocessor implementations currently commercially available, additional bus arbitration logic is not required.

1.1.1 INNOVATION AND QUALITY

INMOS provides a wide range of tools to support development on the transputer. These have been designed to enable users to easily evaluate transputers and develop systems smoothly within the shortest possible timescales. Development tools include C, FORTRAN and PASCAL compilers and development packages based on the OCCAM compiler. A wide range of software is also available from third parties, details of which are included in The Transputer White Pages Directory, available from INMOS. INMOS provides technical field support, software training courses and a comprehensive software support service.

INMOS has further exploited the power of the transputer architecture and technology by providing a range of modular hardware products for integration into end-user systems and for use as development platforms for general transputer projects. These TRAMs (TRAnsputer Modules) are part of a total INMOS strategy to fully support the systems builder in terms of innovation and quality for INMOS products and service. This strategy has driven the establishment of a new INMOS business enterprise known as *iq* systems.

Technical expertise in design and manufacturing of transputer silicon and associated software provides an excellent basis for a professional system product range. INMOS has been a successful supplier of silicon products to the electronics industry for many years and fully recognises the importance of service and quality in the high technology business sectors. In a demanding and competitive marketplace INMOS is fully aware of the critical importance to the system builder of reliable products and effective supplier support.

The experience, expertise and innovation of INMOS combined with the full support and resources of its parent multinational company, SGS-THOMSON Microelectronics, results in a stable yet efficient business foundation.

1.1.2 TRAMS (TRANSPUTER MODULES)

The INMOS TRAM concept was introduced during 1987 to exploit some of the major benefits of the transputer and parallel processing.

TRAMS are small, cost effective sub-assemblies of transputers and other circuitry (often RAM) with a very simple but efficient 16 signal interface standard profiled in modular sizes. The interface accommodates 4 serial INMOS links for inter-processor communication, power supply and system signals.
With this standard, TRAMs may be mounted onto a variety of motherboards which provide specific host interface hardware.

Each motherboard can accomodate a number of TRAMs and provides facilities for configuring a network of TRAMs to the user specified topology under software control. A software package is provided which allows this task to be undertaken with the minimum of effort.

The TRAM architecture offers many advantages over conventional system configurations. The following features are included:

An industry standard yet simple multiprocessor interface

System upgradeability at incremental cost

Maximum flexibility of cost/performance with minimal real-estate

1.1.3 STANDARD INTERFACE

The electrical interface to every TRAM product consists of 16 signal pins meeting a standard electrical and mechanical format. All TRAMs are based upon a single module profile with a defined pin layout. This single format is known as Size 1. Larger TRAMs are simply multiple sizes of this format with the same pin spacing. This published format will be maintained for future TRAM development by INMOS and has already been adopted by many third party developers to extend the range of TRAM options and hosts.

1.1.4 UPGRADEABILITY

Upgradeability has been a major attraction for customers both for development and end product applications. TRAMs are becoming known as a futureproof solution. Investment made today using TRAMs, with respect to software and hardware engineering, can also be regarded as an investment for future designs. Due to the unique ability of the transputer to distribute application data and code via the links, the same software can be written to run on one, two or many processors. Hence, TRAMs permit exploitation of current hardware technology, but at the same time liberate software development

from hardware constraints of cost, real-time performance and compute power. For example, a system designed today by the system integrator may be very efficiently enhanced at some time in the future as a result of a change in his end market demand. This can be achieved in two ways:

By replacing existing TRAMs with faster TRAMS as they become available (eg, IMS B401-2 to IMS B401-5

By adding additional TRAMs to the existing hardware

In either case the system cost is incremental and it is possible to operate with the same original application software by simply reconfiguring and booting the new network. Using traditional sequential multiprocessor solutions the second approach would inevitably result in a complete system hardware and software re-design, significant expansion in board area and a drawn out time to market.

1.1.5 FLEXIBILITY

Many system designers exploit the modularity of TRAMs to provide a range of products meeting varieties of performance/cost demand mix. For example, due to the modularity of the hardware and software, a customer may develop a low budget product and a high performance product from the same range of components. In addition, the same design can be used across the INMOS range of motherboards or specific customer designed motherboards which conform to the TRAM specification. This results in a single design being able to exploit a wide range of host environments and markets.

Unlike other architectural implementations, the preceding flexibility can be achieved utilising just one application software package. A further advantage of this approach is the commonality of TRAM components within each end product type. This offers the system builder significant savings by minimising inventory holding.

1.1.6 EVALUATION

Customer investing in the TRAM architecture for transputer evaluation purposes have the opportunity to immediately investigate the performance and characteristics of new transputer silicon as it becomes available. INMOS is committed to provide a standard TRAM interface for each new member of the transputer family.

1.1.7 QUALITY AND RELIABILITY

All INMOS systems products are manufactured and tested to strict quality standards. For example Every product undergoes extensive soak testing at temperature before final test. This procedure includes the completion of test logs which are documented and retained for product traceability.

More detailed information describing INMOS Quality and Reliability is included later in this publication.

INMOS is constantly enhancing its range of products. If a particular function is not available, please contact your local INMOS sales outlet for the latest product information

STANDARD INTERFACE BOARDS (3)

Bus interface	Interface method	Memory	No.of TRAM slots	Reconfig-urable?	Format	Order number	Page No.
Motherboards							
PC XT/AT	C012	-	10	Yes	Long PC card	B008-1	6
VMEbus	Dual port DRAM	2M	2	Yes	6U VME	B011-2	6
VMEbus	C012	-	8	Yes	6U VME	B014-1	7
NEC PC9801	C012	-	5	Yes	NEC board	B015-1	7
INMOS link	-	-	16	Yes	Double extended Eurocard	B012-1	6
Fixed boards							
SA400 ST 506	2x CO12	2M	-	-	Double extended Eurocard	B005-1	8
VMEbus	Dual port DRAM	4M	-	-	6U VME	B016-1	8

TRANSPUTER MODULES (TRAMS) (4)

COMPUTE ONLY TRAMS

Total Memory size	Transputer	SRAM/ cycles	DRAM/ cycles	TRAM size	Sub-system	Order number	Page No.
8 Kbytes	T222-20	8K/2	-	1	No	IMS B402-10	9
32 Kbytes	T414-20	32K/3	-	1	No	IMS B401-2	9
32 Kbytes	T425-25	32K/3	-	1	No	IMS B401-8	9
32 Kbytes	T800-20	32K/3	-	1	No	IMS B401-3	9
32 Kbytes	T800-25	32K/3	-	1	No	IMS B401-5	9
64 Kbytes	T222-20	64K/2	-	1	No	IMS B416-10	11
160 Kbytes	T801-20	160K/2	-	2	No	IMS B410-11	10
1 Mbyte	T414-20	-	1M/3	4	Yes	IMS B403-2	9
1 Mbyte	T425-20	-	1 M/3	4	Yes	IMS B403-7	9
1 Mbyte	T800-20	-	1 M/3	4	Yes	IMS B403-3	9
1 Mbyte	T425-20	-	1 M/3	1	No	IMS B411-7	11
1 Mbyte	T800-20	-	1 M/3	1	No	IMS B411-3	11
2 Mbytes	T425-25	32K/3	2 M/4	2	Yes	IMS B404-8	10
2 Mbytes	T800-17	32K/3	2 M/4	2	Yes	IMS B404-4	10
2 Mbytes	T800-20	32K/3	2 M/4	2	Yes	IMS B404-3	10
2 Mbytes	T800-25	32K/3	2 M/4	2	Yes	IMS B404-5	10
4 Mbytes	T800-25	64K/3	4M/4	4	Yes	IMS B417-5	11
8 Mbytes	T800-20	-	8M/6	8	Yes	IMS B405-3	10

SPECIAL APPLICATION TRAMS

Application	Transputer	SRAM/ cycles	DRAM/ cycles	VRAM/ cycles	EPROM/ cycles	TRAM size	Sub-system	Order number	Page No.
Distributed graphics system:									
Frame store	T800-20	-	1M/4	1.25M/4	-	8	No	IMS B408-3	12
Display driver	T222-20	-	-	-	-	8	No	IMS B409-1	12
G300 TRAM	T800-20	-	2M/4	2M/4	-	6	Yes	IMS B419-1	13
Differential link TRAM	-	-	-	-	-	1	Yes	IMS B415-1	13
Ethernet interface	T222-20	64K/3	-	-	-	8	No	IMS B407-1	12
'Flash' ROM TRAM	T222-20	-	-	-	256K/ 7	2	Yes	IMS B418-1	13
Vector Processing TRAM	T800-25	256K/3	1 M/4	-	-	4	Yes	IMSB420-5 *	14
GPIB TRAM	T222-20	48K/2	-	-	-	4	Yes	IMS B421-1*	14
SCSI TRAM	T222-20	64K/2	-	-	-	2	Yes	IMS B422-1*	15

* Advance information

HARDWARE / SOFTWARE SUPPORT (5)

Description	Order number	Page No.
Cable sets	see page 16	16
Device drivers for IMS B008 (PC) and IMS B014 (SUN)	IMS S708	17
	IMS S514	17
Racks	IMS B211	17

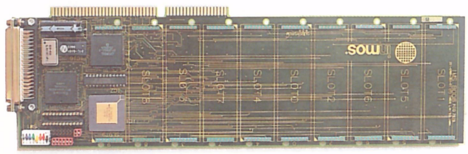
DEVEOPMENT TOOLS (6)

Description	Language	Format	Order number	Page No.
Compilers	C	SUN 3	IMS D511	18
		VAX/VMS	IMS D611	18
		NEC/IBM PC	IMS D711	18
	FORTRAN	SUN 3	IMS D513	18
		VAX/VMS	IMS D613	18
		NEC/IBM PC	IMS D713	18
	Pascal	NEC/IBM PC	IMS D712	18
	Ada	VAX/VMS	Available from Alsys*	19
		NEC/IBM PC	Available from Alsys*	19
occam 2 Toolset	occam	SUN 3	IMS D505	19
		VAX/VMS	IMS D605	19
		IBM PC XT/AT	IMS D705	19
		NEC PC 9801	IMS D705	19
Transputer development system (TDS)	occam	IBM PC XT/AT	IMS D700	20
		NEC PC 9801	IMS D700	20

* Please contact local INMOS Business Centre for further details.

PC XT/AT Mother-boards

IMS B008



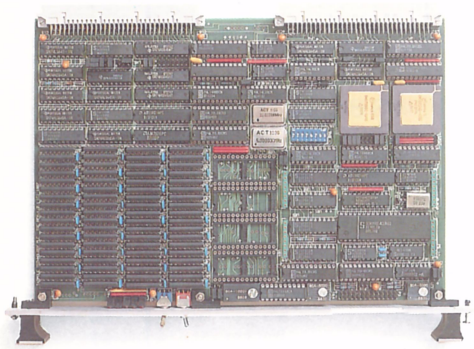
FEATURES

- 10 transputer module (TRAM) slots
- IMS T212 transputer
- IMS C004 programmable 32 way switch
- IBM PC-XT or PC-AT format

The IMS B008 is a TRAM motherboard which plugs into the IBM PC-XT or PC-AT. It has slots for up to ten TRAMs. Links 1 and 2 from each of the TRAM slots are hard wired on the IMS B008, such that the TRAMs, when plugged in, form a pipeline of processing elements. The remaining links can be "softwired" using an INMOS IMS C004 programmable link switch, incorporated on the IMS B008. This arrangement allows a large variety of networks to be created under software control.

VME MASTER

IMS B011



FEATURES

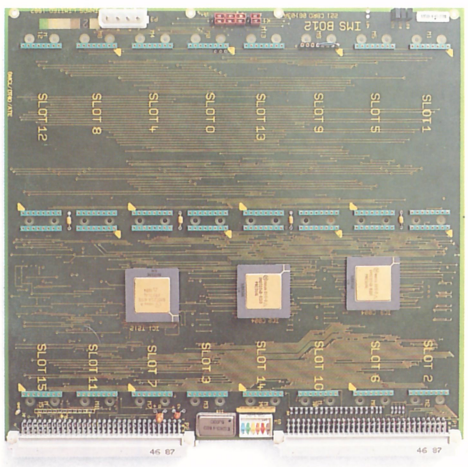
- IMS T800, 32 bit transputer
- 2 Mbytes of Dual-ported DRAM
- Acts as bus master/slave to VMEbus
- 2 transputer module (TRAMs) slots
- 2 RS232 ports
- Double Eurocard VME board
- INMOS link and system signals to P2 connectors

The IMS B011 board is suitable for applications in the system level market, and can perform all communications between a system bus and an array of transputers. The user has the option of one or more transputers on-board and is able to communicate with other transputer based VME cards (e.g. IMS B014) over the P2 connector.

The IMS B011 is suitable as a main system processor, a specialised accelerator, or as a transputer development tool in a VME bus based workstation.

Double Eurocard

IMS B012



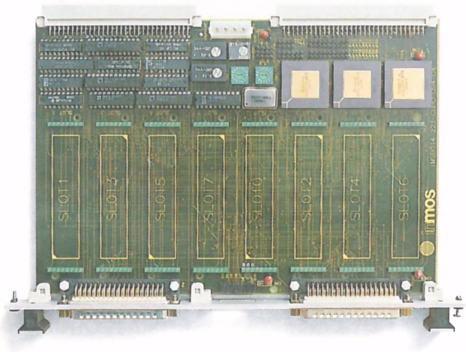
FEATURES

- 16 transputer module (TRAM) slots
- IMS T212 - 16 bit transputer
- Two IMS C004 programmable 32 way switches
- Double Extended Eurocard

The IMS B012 is a Eurocard TRAM motherboard designed to fit into standard card cages such as the INMOS ITEM. The IMS B012 provides 16 slots for TRAMs, with IMS C004s to provide a wide variety of configurations. A possible application might be an image or speech recognition system using eight IMS B401s for feature extraction and a IMS B405 running LISP or another AI language for recognition.

VME Slave

IMS B014



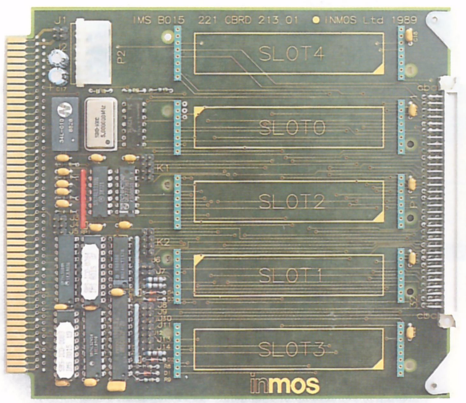
FEATURES

- Compatible with VMEbus Specification Rev. C.1
- Accommodates 8 standard transputer modules (TRAMs)
- Static or dynamic link configuration using two IMS C004 link switches
- Expandable to form arbitarily large systems
- Suitable for use as VMEbus-transputer interface with IMS D505 SUN based development system

The IMS B014 module motherboard is compatible with VMEbus Specification Rev. C.1. It is a standard depth (160mm), double height (6U) card, containing 8 TRAM slots with associated configuration circuitry and a VMEbus slave interface. Two IMS C004 crossbar link switches are provided to allow the user to configure the transputer link connections. This architecture allows any topology to be established on the board. Additionally, 24 links are brought to the edge connectors (8 on the P2 back connector, and 16 split between two front connectors) so that larger networks, using multiple boards may be constructed.

NEC PC

IMS B015



FEATURES

- 5 slots for INMOS TRAMs
- INMOS link adaptor interface to the NEC expansion bus
- Interrupt capability
- Choice of IO address
- Conforms to INMOS module-motherboard architecture
- Can be used as an interface to external transputer systems

The IMS B015 is a TRAM motherboard for the NEC PC-9800 series of personal computers. It allows transputer modules to be fitted to a 9800 series PC for program development, and application acceleration.

The IMS B015 has five sites for TRAMs and an interface to the 9800 series PC expansion bus. This allows the PC to communicate with and reset the TRAMs. It also has connections which allow it to connect to other transputers, TRAMs, or transputer boards (such as another IMS B015).

VME master

IMS B016

FEATURES

VMEbus MASTER/SLAVE.

IMS T801-25 transputer.

256 Kbytes private transputer RAM (80ns cycle).

4 Mbytes RAM dual-ported between IMS T801 and VMEbus.
Slave DRAM supports all VMEbus cycle types - A32/24/16, D32/16/8, RMW UAT, BLT.
Write posting supported.

Full VMEbus master -A32/24/16, D32/16/08, BLT (UAT and RMW are incompatible with IMS T801).Supports all modern request/release modes including fairness requesting.

Full VMEbus interrupter and interrupt handler.

Full VMEbus slot 1 functions.

Databus crosspoint switch between IMS T801 and DRAM / VMEbus allows fast byte re-ordering to overcome big / little endian incom-patabilities.

256 Kbytes PROM (in 32-pin JEDEC PLCC sockets).

2 serial ports using 2681 DUART.

Real-time clock for time of day, when power supply fails, the RTC is automatically switched to the VMEbus +5V standby rail.

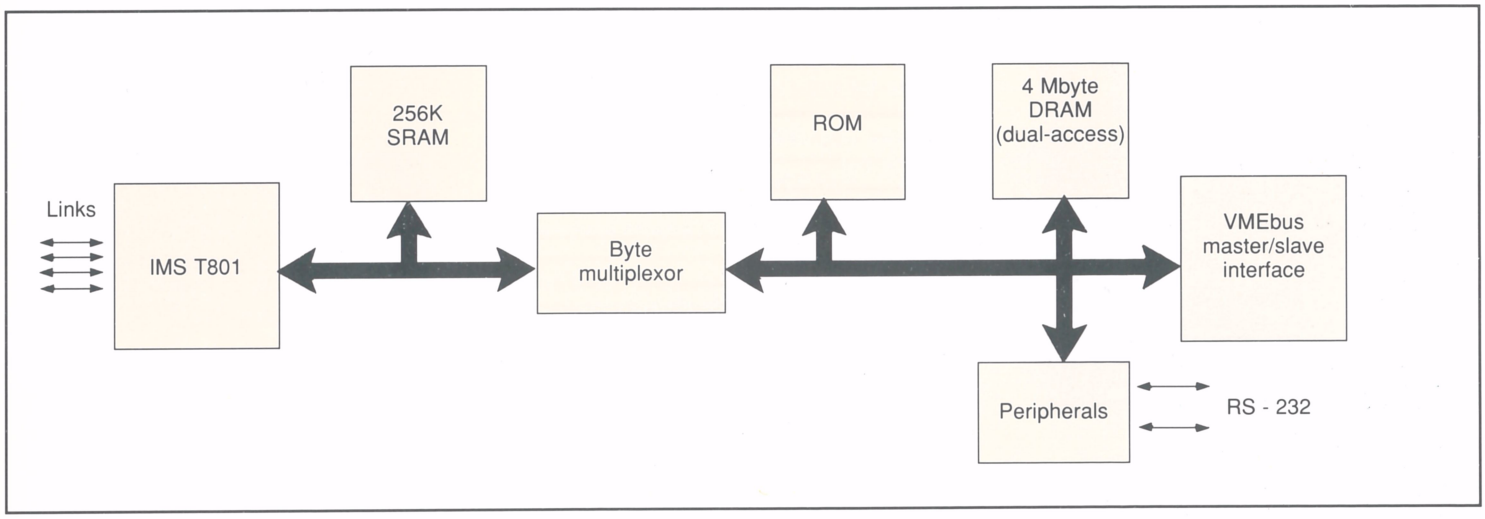
IMS T801 boots from ROM or link.

PEX I/O connector for SCSI, floppy, Parallel, GPIB or custom interfaces.

Interprocessor communication mailbox registers.

6U format board, complaint with VMEbus specification rev C.1.

The IMS B016 is a high performance VMEbus master/slave, based around the IMS T801 32 bit transputer. It is suited to all applications requiring a high performance interface between transputers and the VMEbus. The availability of fast private RAM to the IMS T801 also makes the board suitable for many processing aplications



M212 Evaluator

IMS B005

FEATURES

INS M212 transputer, with two standard links and 64 Kbyte of static RAM

SA400/ ST506 standard disc drive interface with buffering.

20 Mbyte 3.5 inch winchester disc drive

1 Mbyte 3.5 inch floppy disc drive

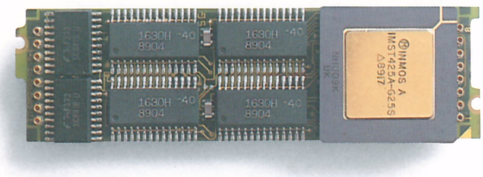
Double extended Eurocard

The IMS B005 board allows the user to evaluate and demonstrate the use of the M212 disc controller transputer.

The IMS M212 is able to control up to four disc drives via the industry standard SA400/ ST506 interfaces. Two drives are present on the IMS B005 and provision has been made for connecting other drives if the user so desires, or to change either of the drives on the board (for example use two Winchester drives). The external memory interface can address 64K of memory space; as supplied this memory is static RAM (two 32K x 8 devices), but it is possible to replace one or both with EPROM if required. The external memory interface may be switch programmed for different speeds.

32 Kbyte TRAM

IMS B401



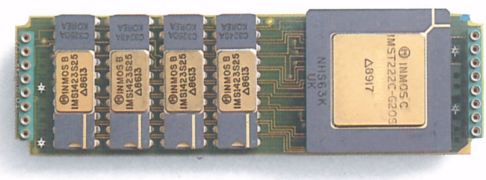
FEATURES

- Choice of either IMS T4xx-20 or 8xx-25
- 32 Kbytes of no-wait-state SRAM
- Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)
- Stackability allows other TRAMs to be 'Piggy-backed'

A low cost, high performance, 16 pin transputer, ideal for applications where 2 Kbytes or 4 Kbytes of on-chip RAM is not quite enough. The 32 Kbytes of off-chip RAM is ideal for systolic processing, signal processing, feature extraction etc. The IMS B008, fitted with ten IMS B401-3s, offers 40 MWhetstones/s in a single slot of an IBM PC, XT, AT, PS2 model 30, or clone. In the INMOS ITEM, 160 IMS B401-2s offer 1.6 GIPS (1600 MIPS) and 5 Mbytes.

8 Kbyte TRAM

IMS B402



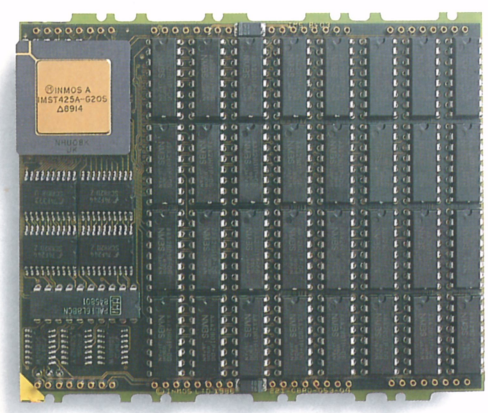
FEATURES

- IMS T222-20 transputer
- 8 Kbytes of no-wait-state SRAM
- Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)
- Stackability allows other TRAMs to be 'Piggy-backed'

The faster multiplication of the 16 bit transputer and the faster external memory interface on the IMS B402 give it a higher performance than the IMS B401, for fixed point signal processing and feature extraction. Even with programmed floating point, the IMS B402 delivers 127 KWhetstones/s, ten times the speed of the 68000. OCCAM makes it easy to program 64 bit integers on this 16 bit processor, for high precision arithmetic and operations on sets. The IMS B402 is also ideal for message switching, intelligent control of IMS C004 link switches, and for protocol conversion.

1 Mbyte TRAM

IMS B403



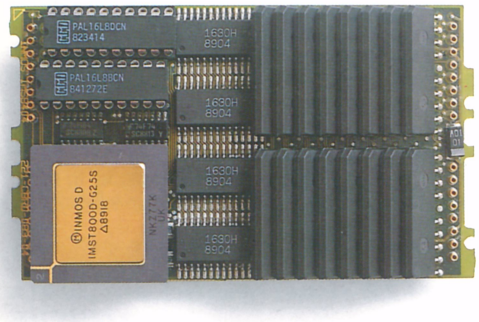
FEATURES

- Choice of either IMS T414-20 or IMS T800-20
- 1 Kbyte of no-wait-state SRAM
- Subsystem controller circuitry
- Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)
- Stackability allows other TRAMs to be 'Piggy-backed'

The IMS B403 obtains the ultimate performance from a full Mbyte of RAM; with an IMS T800-20 it offers 4MWhetstones/s. Rather than use expensive 256K SRAMs, which would take up much more board area, the IMS B403 uses 60ns access time DRAMs, designed by INMOS. The IMS B403 also incorporates subsystem control circuitry making it suitable for controlling initialisation and restarting networks of TRAMs.

2 Mbyte TRAM

IMS B404



FEATURES

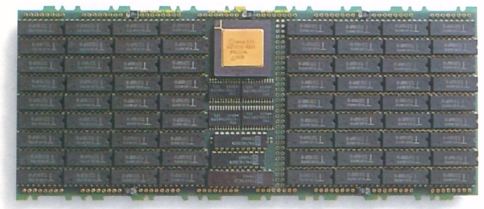
- Choice of IMS T800 or T425 transputer up to 25 MHZ
- 32 Kbytes of no-wait-state SRAM
- 2 Mbytes of one-wait-state DRAM
- Subsystem controller circuitry
- Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)
- Stackability allows other TRAMs to be 'Piggy backed'

The IMS B404 is a very compact computer module providing a full 2 Mbytes of memory and still providing maximum performance capability. This is achieved by extending the principle of fast on chip RAM to include 32 Kbytes of static RAM which cycles as fast as possible. So any technique which puts most frequently accessed memory locations near the bottom of memory will speed up the processing. This TRAM is the most popular board for running INMOS' TDS or Toolset packages.

The IMS B404 packs 11 cm^2 of silicon onto a board the size of a credit card. Four IMS B404s fit onto the IMS B008 in a single slot of the IBM PC. Fifty IMS B404s fit into an IMS B211 ITEM rack, to give 100 Mbytes, 625 MIPS, 250 MWhetstones, with space to spare for other modules.

8 Mbyte TRAM

IMS B405



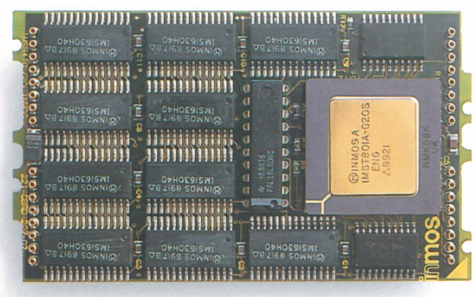
FEATURES

- IMS T800-20 transputer
- 8 Mbytes of 2-wait-state DRAM
- User selectable byte parity checking
- Subsystem controller circuitry
- Stackability allows other TRAMs to be 'Piggy backed'

The IMS B405 puts 8Mbytes, with parity, onto a module that fits comfortably on an IMS B008 in the IBM PC, considerably more volume efficient than a 20Mbyte Winchester disk. Although the IMS B405 is marginally slower than the IMS B403 and IMS B404, its large amount of external RAM makes it an ideal board for running existing large programs, such as CAD, A1, simulation, etc.

160 Kbyte TRAM

IMS B410



FEATURES

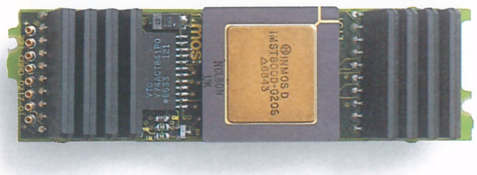
- IMS T801 transputer with de-multiplexed address and data buses
- 160 Kbyte of no-wait-state SRAM (100ns memory cycle time)
- Size 2 TRAM
- Communications via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)
- Stackability allows other TRAMs to be 'Piggy backed'

The de-multiplexed address and data busses of the IMS T801 transputer allow very high performance systems to be constructed. The IMS B410 TRAM achieves 2-cycle memory accesses with very fast SRAMs, and yet still manages to squeeze 160 Kbytes onto a size 2 TRAM.

The IMS B410 TRAM allows users to benchmark the performance of the IMS T801 transputer. The standard TRAM interface means that the processor can simply be plugged into existing development systems. However, this module is as equally at home in a very high performance system products, as it is in the evaluation environment.

1 Mbyte TRAM

IMS B411



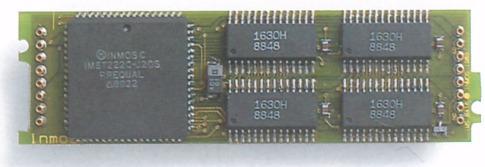
FEATURES

- Choice of either IMS T425-20 or IMS T800-20 transputer
- 1 Mbyte of no-wait-state SRAM (150ns memory cycle time)
- Size 1 TRAM
- Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

The IMS B411 TRAM is the ideal module for applications where space is at a premium. With a full Mbyte of DRAM on a size 1 TRAM, 8 transputers and 8 Mbytes of memory can be installed in a single IBM PC * slot (using the IMS B008 motherboard) or in a single 6U VMEbus slot (using the IMS B014 motherboard). The choice of an IMS T800 or T425 transputer gives the user the flexibility to tailor a system to his exact requirements in terms of cost and performance.

64 Kbyte TRAM

IMS B416



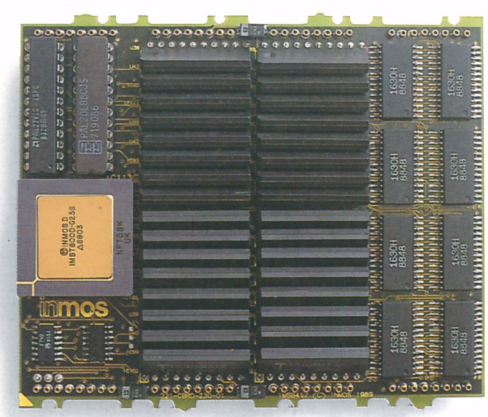
FEATURES

- IMS T222-20 Transputer
- 64 Kbytes of no-wait-state SRAM (100ns memory cycle time)
- Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

The IMS B416 utilises the full memory space of the IMS T222 transputer. It is manufactured fully from surface mount silicon components. The IMS T222's PLCC package brings low cost benefits to TRAM users.

4 Mbyte TRAM

IMS B417



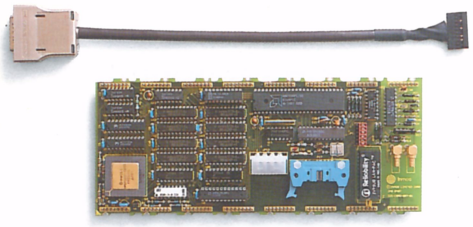
FEATURES

- IMS T800-25 Transputer
- 64 Kbytes of no-wait-state SRAM
- 4 Mbytes of single-wait-state DRAM
- Subsystem controller circuitry
- Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

The IMS B417 uses the IMS T800 25 MHz transputer. The 4 Mbytes of DRAM is sufficient to run the Ada compiler from Alsys. Also provided is 64 Kbytes of fast SRAM (3 cycle), so any technique which puts most frequently accessed memory locations near the bottom of memory will speed up the processing.

Ethernet TRAM

IMS B407



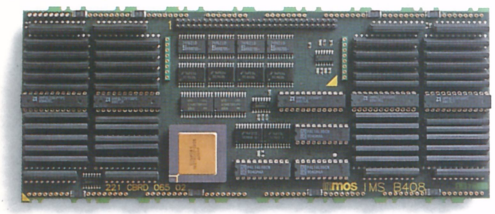
FEATURES

- Connects transputer systems to IEEE802.3 Local Area Networks (Ethernet or Cheapernet)
- IMS T222-20 transputer
- 64Kbytes SRAM, 150ns access cycle
- Uses AM 7990 (LANCE) Ethernet Controller
- Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

The IMS B407 is an INMOS link to Ethernet/ Cheapernet interface. It allows transputer systems to be connected to other computers and computer networks via IEEE802.3 Local Area Networks (LANs). The IMS B407 can be connected to other Ethernet systems (IEEE802.3 10BASE5 or Type A); or to Cheapernet systems (IEEE802.3 10BASE2 or Type B). The IMS B407 consists of an IMS T222 16 bit transputer with 64Kbytes of SRAM. The Ethernet/Cheapernet interface is implemented with the Am 7990 (LANCE), Am 7992 and Am 7996. The Cheapernet interface is isolated to 500V dc. An Attachment Unit Interface (AUI) is provided for connection to Ethernet Media Access Units.

Graphics TRAM

IMS B408



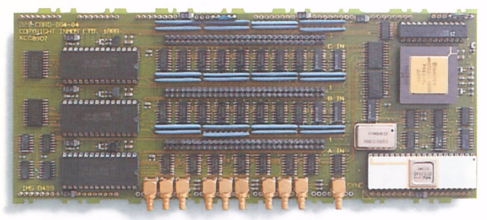
FEATURES

- IMS T800-20 transputer
- 1 Mbyte of single-wait-state DRAM
- 1.25 Mbytes of single-wait-state dual port DRAM
- Dual port supports continuous data rates up to 100Mbytes/s
- Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

The IMS B408 implements the drawing and image storage parts of a medium to high performance graphics system. It incorporates a powerful 32-bit microprocessor with on-chip floating point processor, 1 Mbyte of workspace RAM and 1.25 Mbyte of display RAM accessable to the processor and dual ported to the pixel port. The pixel port is capable of sustaining continuous data transmission at up to 100Mbytes/s, independently of the processor and under control of an autonomous address generator. The IMS B408 supports both interlaced and non-interlaced displays of arbitrary resolution up to 1024 x 768 pixels. Up to 12 IMS B408s may be used in conjunction with a single IMS B409.

Graphics TRAM

IMS B409



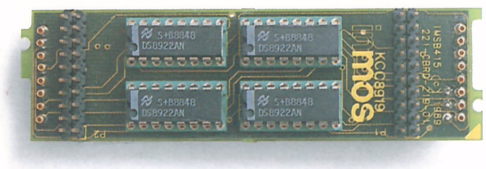
FEATURES

- IMS T222-20, transputer
- Video timing generator
- Pixel rates up to 64 MHz
- 8 or 18 bit pixels
- 3 IMS G176 colour look-up tables

The IMS B409 implements the timing generation and display driver parts of a medium to high performance graphics system. It consists of three pixel channels and a programmable video timing generator (VTG), controlled by an IMS T222. Each pixel channel consists of a 4-1 byte multiplexer and an IMS G176 colour look-up table (CLUT). Input to each pixel channel is by a separate pixel bus input and each channel generates a set of RGB outputs. The IMS B409 supports both interlaced and non-interlaced displays of arbitrary resolution up to a maximum dot rate of 64MHz. The IMS B409 may be used in conjunction with up to 12 IMS B408s.

Link i/f TRAM

IMS B415



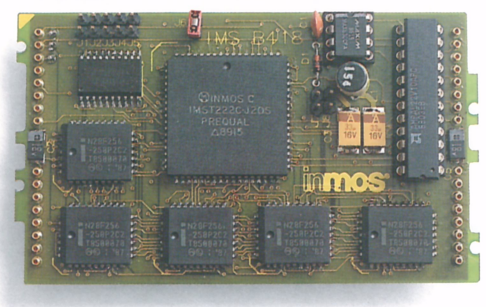
FEATURES

- Buffers all TRAM signals to RS422-compatible differential drive
- Handles 4 links reset and subsystem services signals
- Capable of 20 Mbits/s link operation
- Links go quiet when disconnected
- Designed for 100 ohm twisted pair cable
- ± 7V common-mode noise rejection
- Size 1 TRAM

The IMS B415 differential interface buffer TRAM allows connections between transputer systems which are not in the same electrical environment. No common ground connection is required, reducing earthing problems. With cable lengths up to 10m, 20 Mbit/s link speed is possible. Longer cables up to 100m support lower link speeds.

ROM TRAM

IMS B418



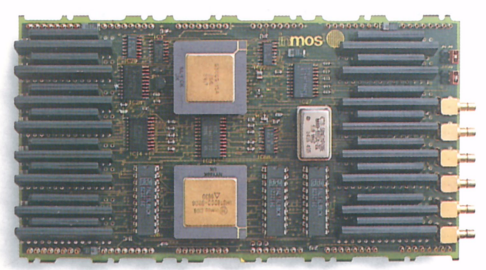
FEATURES

- IMS T222-20 transputer
- 256 Kbytes non-volatile memory (Flash ROM)
- 10 000 program/erase cycles
- Ideal for booting embedded transputer systems
- In-system reprogrammability
- ROM contents user-programmed through INMOS link
- Size 2 TRAM
- Sub-system port for resetting transputer networks
- Can be used as non-volatile backup memory

The IMS B418 is a TRAM designed primarily for configuring and boot-strapping transputer networks in embedded systems. It contains 256 kbytes of non-volatile memory: implemented with flash ROM devices (the flash ROM is an EPROM-like device with bulk electrical erasability, rather than UV erase). After reset, the IMS B418 outputs a program stored in the ROM from one of its INMOS serial links. An on-board programming voltage generator, and programming software, allows the ROM contents to be programmed without removing the ROM devices from the board and without removing the IMS B418 from an assembled system. Programming is through a simple protocol on one of the INMOS serial links. Safeguards are provided against accidental erasure/ programming. The ROM devices can be reprogrammed at least 10 000 times. The IMS B418 can also be used as a non-volatile backup memory in any microprocessor system: all that is required is an INMOS link adaptor to interface the IMS B418 to the microprocessor.

G 300 Graphics TRAM

IMS B419



FEATURES

- IMS T800-20 transputer
- IMS G300 Colour Video Controller
- 2 Mbytes of four cycle DRAM
- 2 Mbytes of four cycle VRAM
- Pixel rates 70 to 110 MHz at 8 bit/pixel
- Communicates via 4 INMOS serial links (selectable between 10 or 20 Mbits)
- Size 6 TRAM

The IMS B419 incorporates the IMS G300 Colour Video Controller with the IMS T800 32 bit floating point transputer to form a high performance graphics system. 2 Mbytes of four cycle DRAM provides a general purpose store sufficient to run applications such as an X window system, it also allows INMOS development tools to be resident on board. 2 Mbytes of Video RAM provide arbitrary screen resolutions up to a maximum of 1280 x 1024 8 bit/pixel with unrestricted screen formats at resolutions below this.

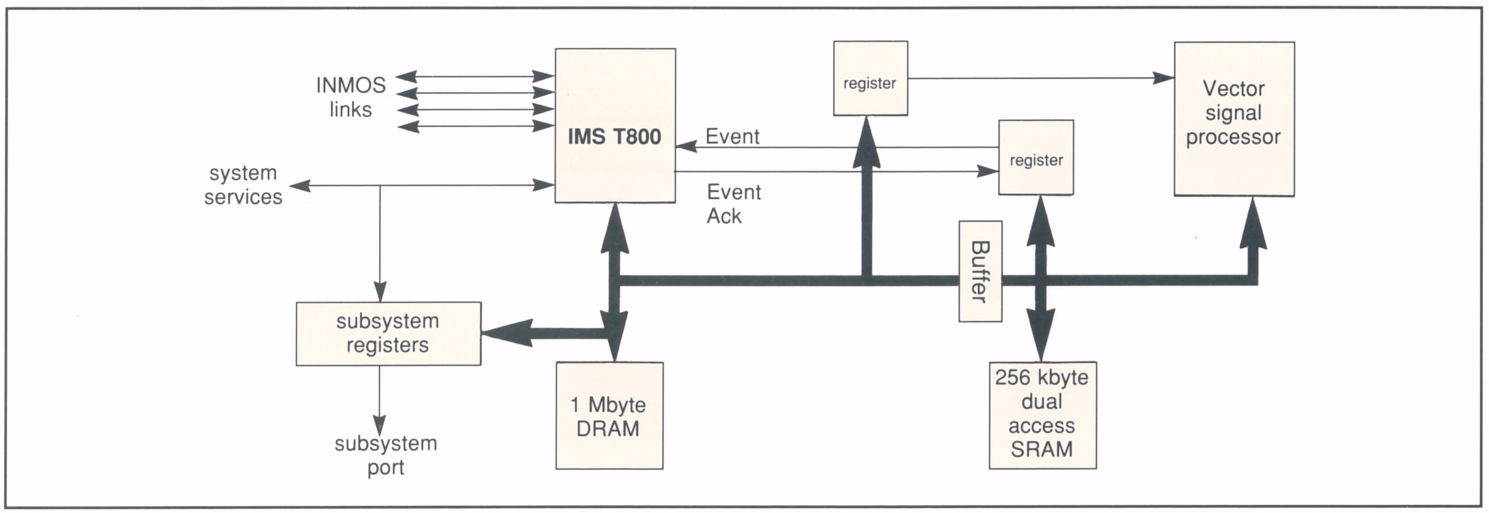
Vector Processing TRAM

IMS B420

FEATURES

- IMS T800-25 floating point transputer
- High performance vector/ signal processing co- processor - e.g. 1K complex FFT < 2ms
- Both processors support IEEE 754-1985 floating point
- 4 INMOS serial communication links allowing connection of multiple VecTRAMs
- 1 Mbyte DRAM for IMS T800
- 256 Kbyte, dual port SRAM for full speed co-processor operation
- Size 4 TRAM
- Sub-system port

The IMS B420 VecTRAM is a transputer module combining the communications ability and scalar floating point performance of the IMS T800 with a high performance vector/signal processing co- procesor. The two processors can operate concurrently, using seperate dynamic and static memory blocks. The vector/signal processor is normally operated as a slave to the IMS T800 which can read and write to the SRAM, to set up vector/DSP routines as well as to load data for processing. The two processors can handshake via interrupts, thus allowing the transputer to initiate vector routines and the co- processor to signal the termination of the requested task. Application areas include speech and image processing, graphics and numericl processing, radar, sonar and seismology.



GPIB i/f TRAM

IMS B421

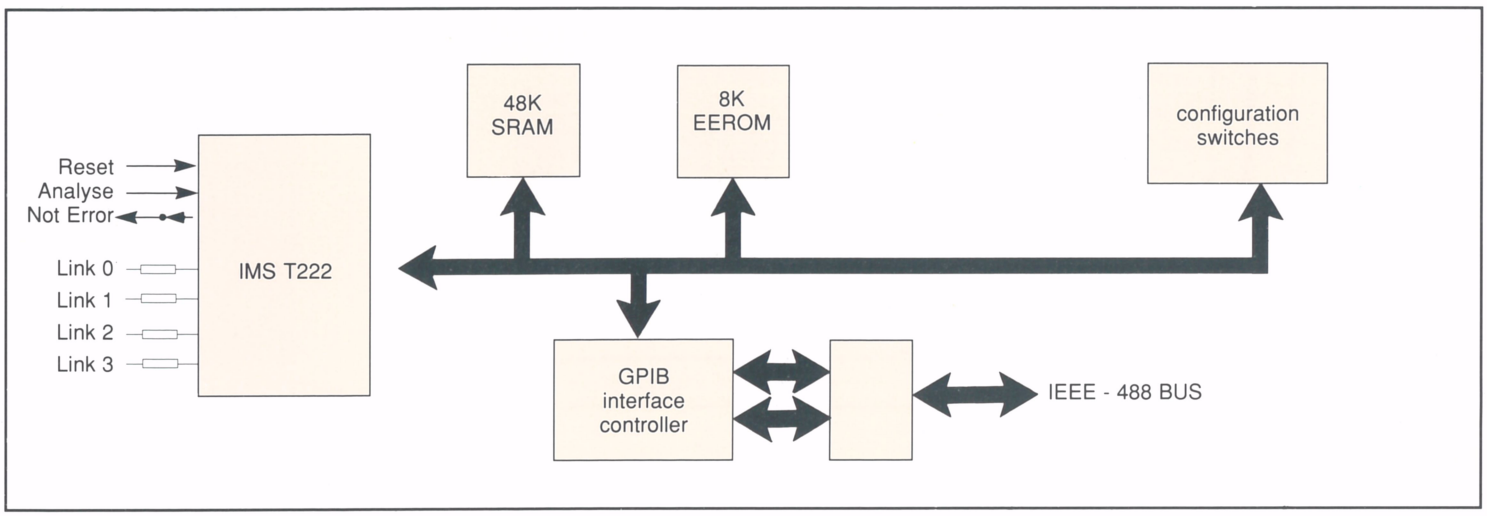
FEATURES

- IMS T222-20 transputer
- 48K of RAM
- Full electrical compliance with IEEE 754-1985
- Size 4 TRAM
- Switchable GPIB bus address
- Onboard non-volatile storage for configuration data
- Communications via 4 INMOS serial links (selectable between 10 or 20 Mbits/s)

The IMS B421 GPIB TRAM allows IEEE-488 test and instrumentation systems to be directly connected to networks of transputers. The parallel interface permits high speed communications of control and measurement information, and the power of the transputer can provide sophisticated data analysis facilities. The user can define the characteristics of the GPIB interface in terms of address etc., for maximum flexibility in system configuration.

(See diagram on next page.)

GPIB i/f TRAM



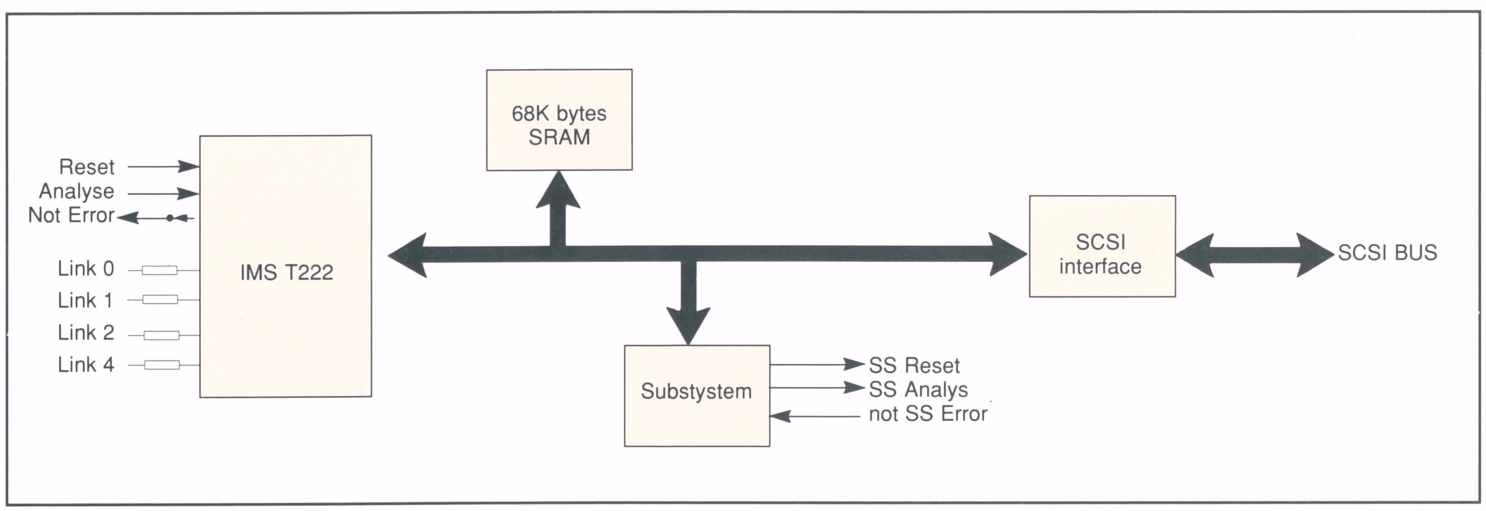
SCSI i/f TRAM

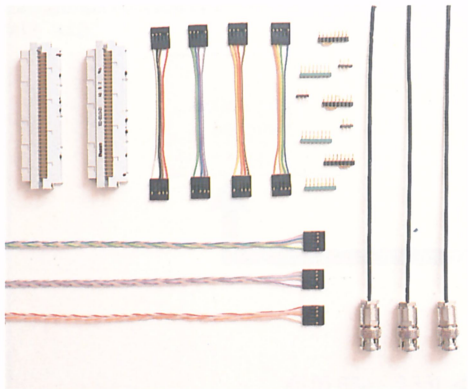
IMS B422

FEATURES

- IMS T222-20 transputer
- 64 Kbytes of two cycle memory
- SCSI bus interface (single ended drivers)
- Sustained SCSI transfer rates up to 1.5 Mbytes/s
- Target or initiator modes
- Onboard, user removable SCSI bus terminators
- Subsystem port
- Size 2 TRAM

The IMS B422 SCSI TRAM acts as an interface between an INMOS link and the SCSI bus as defined in the ANSI X3.131-1986 standard. It allows transputer systems to connect to Winchester disks, optical disks, and other peripherals via the SCSI bus. The SCSI TRAM consists of an IMS T222 16 bit transputer with 64 Kbytes of SRAM for program and data buffers. An intelligent interface device is used to implement the connection to the SCSI bus which allows common sequences to proceed without intervention from the IMS T222. Target and initiator modes are supported. Onboard removable SCSI bus terminators are provided and a standard subsystem port is implemented on the TRAM.





The following cable sets are available to complement the INMOS range of board products. Sufficient cables are included with each of the INMOS board products to build the most common configurations. However, where more sophisticated systems are required, it will sometimes be necessary to use additional cables. The table below indicates the number of each cable type included in each of the available cable sets.

Part Number	Cable Reference Code																
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
IMS CA01						10	2		1	1								
IMS CA02					8					2								
IMS CA03	10	10	1	1														
IMS CA04				3					1									
IMS CA05												3						
IMS CA06											1							
IMS CA07													1					
IMS CA08														1				
IMS CA09															3	10	10	
IMS CA10																		1

CODE	DESCRIPTION
A	Short link cable (approx. 0.1m)
B	Standard link cable (approx. 0.5m)
C	Long link cable (approx. 1.0m)
D	Very long link cable (approx. 2.0m)
E	Link jumper (yellow wires)
F	Short reset cable (approx. 0.1m)
G	Standard reset cable (approx. 0.5m)
H	Long reset cable (approx. 1.0m)
I	Very long reset cable (approx. 2.0m)
J	Reset jumper (black wires)

CODE	DESCRIPTION
K	DIN 41612 socket to wire wrap tails (with no 'row b' pins)
L	DIN 41612 socket to wire wrap tails (with 'row b' pins)
M	DIN 41612 socket to INMOS link connections
N	DIN 41612 to BNC (video) connectors
O	3-way SIL subsystem pin strip
P	8-way SIL TRAM pin extender strips
Q	8-way SIL TRAM pin slot pipe jumper
R	Pixel bus terminator module

Device drivers for IMS B014 and IMS B008

IMS S708, IMS S514

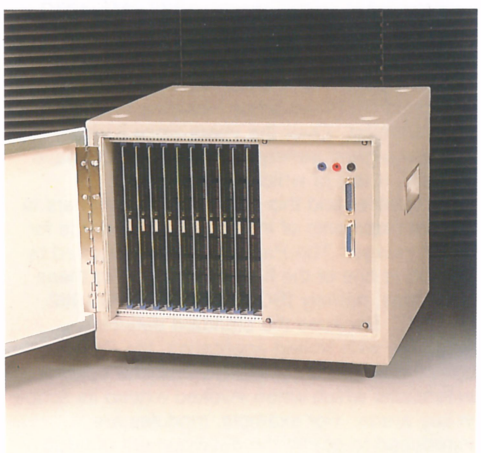
FEATURES

- Host device drivers
- INMOS server program plus sources
- Support for switch setting on INMOS motherboards
- Worm program to investigate attached transputer networks
- Support for INMOS development tools
- Support for application programs

The module motherboard software support packages provide full support for the INMOS module motherboards including device drivers, server programs and switch settling software.

ITEM Rack

IMS B211



FEATURES

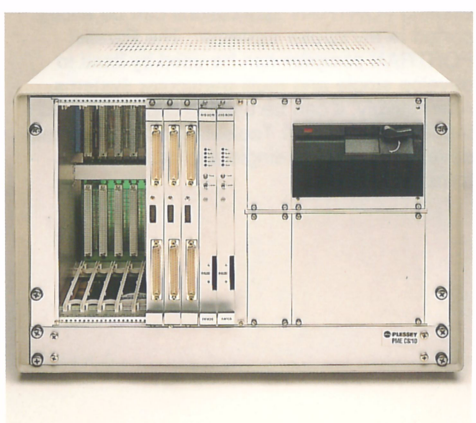
- Slots for 10 double extended Eurocards
- Configurable backplane with removable card assembly
- Built in power supply unit
- Built in forced air cooling
- Meets US FCC standards
- 19 inch rack mountable
- Overall dimensions 425mm x 330mm x 450mm

The IMS B211 INMOS ITEM is a small modular cabinet that has been designed to accomodate up to 10 INMOS boards. Ample power supply and cooling is provided. The backwiring is suitable for connecting directly to standard evaluation board connectors. The back panel is hinged to allow easy access and has two male and female RS232 connectors for connection to a terminal or a development system. The front panel is also hinged.

The requirements for current and future boards from INMOS have been accomodated in the IMS B211. The power supply unit can deliver 12 volts or 5 volts and there are four BNC plugs at the rear.

The IMS B211 provides a simple rack system for a number of transputers on boards. For portability there are carrying handles recessed into the sides. When populated with 10 x IMS B012 boards, the IMS B211 Can typically provide a low cost 500 MIPS supercomputer with 50 Mbytes of store.

VME Racks



INMOS is able to arrange a supply of a variety of VME enclosures. This is on a special order basis. Please contact your local INMOS product supplier for further details.

Parallel C Compiler SUN, VAX, PC

IMS D511, IMS D611
IMS D711

KEY FEATURES

- Kernigan and Ritchie C
- Compatible with INMOS occam 2 Toolsets (IMS D505, D605, D705)
- Produces code for IMS T414, T425, T800, T801, T805 transputers
- Transputer channel I/O with timeouts
- Concurrent tasks
- Semaphores
- Ability to allocate stack in on-chip RAM

The Parallel C compiler allows you to program single transputers and networks of transputers in C.
The Parallel C compiler supports Kernigan and Ritchie C. Consequently existing C applications can be easily ported to transputer systems. The Parallel C compiler can be used by itself to develop single and multi-transputer systems. Alternatively, it can be used in conjunction with the INMOS occam Toolsets for mixed language developments over single and multiple transputers.

Pascal Compiler on PC

IMS D712, PASCAL

EXTENSIONS INCLUDED ARE:

- Modules for separate compilation
- Import and export procedures, functions and variables
- Source file inclusion
- The use of "$" and "-" characters in identifiers Constants specified to any base between 2 and 36
- Bit vector operators (and, or, shift, etc)
- The use of "OTHERWISE" in CASE statements
- Non-printable characters in strings
- Universal parameter type
- An address function
- Full ISO 7185 Pascal
- Compatible with INMOS occam 2 Toolsets (IMS D505, D605, D705)
- Produces code for IMS T414, T425, T800, T801, T805 transputers
- Transputer channel I/O with timeouts
- Modules for separate compilation
- Import and export processes, functions and variables.
- Many other useful language extensions

The Pascal compiler allows you to program single transputers and networks of transputers in Pascal. Originally designed by N.Wirth for teaching purposes, Pascal has now found application in many areas including systems programming. Over the years since it was devised a great variety of Pascal dialects have evolved, many of which are mutually incompatible, and this has led in recent years to the developments of international standards for the language. The Pascal compiler supplied by INMOS is one of the first to be written to these standards, namely ISO 7185 (BSI 6129:1982 Level 1). Because the standard defines a language with limited application, the Pascal compiler provided by INMOS includes optional extensions which when invoked extend its scope in key areas. For example, modules are introduced to permit the development of large applications in a structured and partitioned manner.

Parallel Fortran Compiler on SUN VAX, PC

IMS D513, IMS D613
IMS D713,

KEY FEATURES

- Full ANSI standard FORTRAN X3.9-1978 language support.
- Compatible with INMOS occam 2 Toolsets (IMS D505, D605, D705).
- Produces code for IMS T414, T425, T800, T801 and T805 transputers.
- Tranputer channel I/O with timeouts
- Concurrent tasks
- Semaphores
- Ability to allocate stack in on-chip RAM

The parallel FORTRAN compiler allows you to build programs for single transputers and networks of transputers in FORTRAN.

The INMOS Parallel FORTRAN compiler is a full ANSI FORTRAN 77 compiler. Consequently existing FORTRAN applications can be easily ported to transputer systems. The Parallel FORTRAN compiler can be used by itself to develop single and multi-transputer systems. Alternatively, it can be used in conjunction with the INMOS occam Toolsets for mixed language developments over single and multiple transuputers.

Ada Compiler on VAX and PC

AVAILABLE FROM ALSYS LTD

ADA COMPILER FOR THE TRANSPUTER

Version 4 of the Alsys Ada transputer compiler offers a complete validated Ada environment suitable for the development of demanding applications on transputers. The compiler runs on an IMS T425 or IMS T800 on an IBM PC card under MS - DOS. The compiler is both self targetting and capable of generating code for the T2, T4 and T8 transputer models. Ada programs running on an IMS T222, IMS T425 or IMS T800 PC card will have access to DOS via INMOS utilities.

ADA COMPILER FOR VAX/VMS TO TRANSPUTER

Version 4 of the validated Alsys Ada VAX to transputer cross compiler offers the development of real-time embedded applications. The compiler runs on all VAX, MicroVAX, and VAXstations under VMS. The cross-compiler hosted on a Digital VAX running under VMS will target the IMS T222, IMS T425 and the IMS T800. The generated code will be capable of handling hardware interrupts and directly accessing peripherals using the physical address and bit level representation clauses provided by the Ada language.

occam 2, Toolset On SUN, VAX, PC

IMS D505, IMS 605, IMS 705

KEY FEATURES

- Complete occam 2 development system
- Targets to mixed networks of IMS T212, T222, M212, T414, T425, T800, T801, T805
- Support for machine code inserts
- Support for mixed language developments
- Tools to aid system building and ensure program consistency
- Transputer simulator
- Source level debugging tools
- Support for program loading and remote debugging
- Support for EPROM programming
- Support for teams of developers
- Easily used with project management and source control utilities
- Source and binary files directly compatible across PC, VAX and SUN hosts

APPLICATIONS

- SIngle and multi-processor embedded systems
- Scientific programming
- Framework for mixed language developments
- Framework for running existing applications (written in C, FORTRAN or Pascal) on transputer networks and accelerator boards
- Evaluation of concurrent programming and transputers.

The occam 2 toolset is a complete cross development system for building and debugging occam and mixed language programs for transputers.

The occam 2 toolsets provide complete occam 2 cross-development systems for transputer targets. They can be used to build parallel programs for single transputers and for multi-transputer networks consisting of arbitrary mixtures of transputer types. Programs developed with the toolset are both source and binary compatible across the host development machines.

The occam 2 toolset is available for three development platforms.

D705 IBM PC occam 2 toolset (transputer host)

D605 VAX occam 2 toolset (native and transputer host)

D505 SUN 3 occam 2 toolset (native and transputer host)

IMS D700

SOFTWARE FOR IBM PC AND NEC PC

Integrated software package for development of transputer-based systems

Hosted on IBM PC AT or XT, NEC PC-9801 or compatible computer

Add-in transputer board required

KEY FEATURES

- Integrated 'folding editor' user interface
- Memory-resident program development tools
- Help key, tutorial file and many introductory examples
- Full implementation of occam 2 language
- Optional machine code embedded with occam
- Automatic recompilation of program components
- Mathematical and input/output libraries
- Easy evolution from host development to stand alone or hosted target system
- Source-level debugging tool
- Tools for creating multi-processor programs in EPROM
- Targets to mixed networks of transputers (IMS T222, M212, T414, T425, T800 and compatible processors)

APPLICATIONS

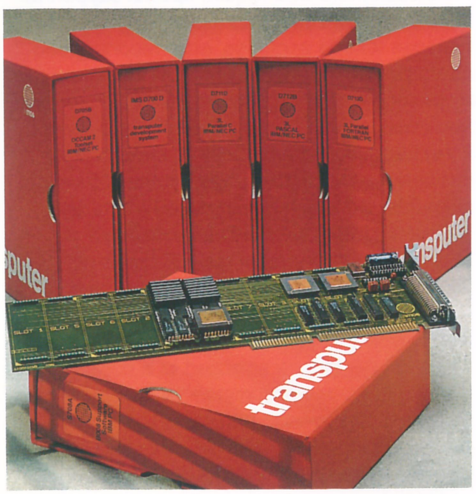
- Development of single-processor and multi-processor embedded systems
- Development of programs for application accelerator boards
- PC-based evaluation of concurrent programming and transputers

The IMS D700 Transputer development system (TDS) provides a full occam 2 development system for transputer targets. It allows the user to build concurrent programs for single transputers, and multi-transputer programs for networks consisting or arbitrary mixtures of transputer types.

The development system software is executed on a transputer board plugged into the PC. A 'server' program running on the PC provides terminal and filling system support.

PC Transputer introduction kit

TIK 1 / TIK 2



FEATURES

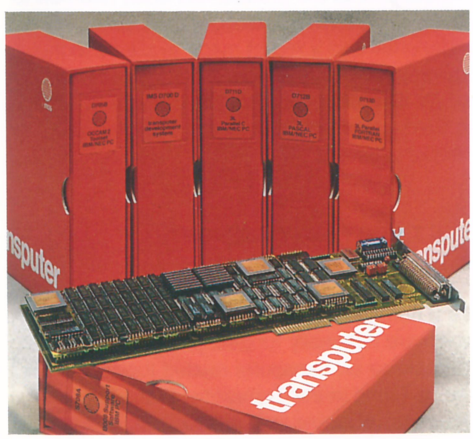
- IBM PC Motherboard (IMS B008).*
- PC device driver for the motherboard (IMS S708)*
- 2 Mbyte DRAM TRAnsputer Module (TRAM) for hosting development software (IMS B404-4)
- Choice of software from:- Parallel C, PASCAL, Parallel FORTRAN, Transputer Development System or PC Toolset

*In the TIK 2 kit these products are replaced for the Japanese market by: NEC 9800 PC Motherboard (IMS B015).

The INMOS Transputer Introduction Kit provides an inexpensive entry point for the evaluation of transputers. It provides the minimum necessary configuration for the use of any of the INMOS software products. However, the motherboard allows the addition of many more modules to create a very powerful transputer network on a single board.

PC Transputer performance evaluation kit

TPEK 1



FEATURES

- IBM PC Motherboard (IMS B008)
- PC device driver for the motherboard (IMS S708)
- IMS T800-25 + 2 Mbytes DRAM size 2 TRAM (IMS B404-5)
- IMS T801-20 + 160K SRAM size 2 TRAM (IMS B410-11)
- IMS T800-20 + 1 Mbyte size 4 TRAM (IMS B403-3)
- IMS T800-25 + 32K SRAM size 1 TRAM (IMS B401-5)
- PC Toolset (IMS D705) plus a Parallel C or PASCAL or Parallel FORTRAN compiler.

The INMOS Transputer Performance Evaluation Kit provides all the necessary hardware and software for you to evaluate the full potential of the transputer. It will typically be used for measuring real-time applications performance and benchmarking. It provides four high performance transputers each containing a Floating Point Unit and a variety of memory configurations.

PC Custom development kits

If neither of the INMOS development kit packages precisely meets your requirements, it is very straightforward to put together your own. There are a variety of motherboards available for several host platforms, and the wide range of compatible TRAMs provides you with the freedom to tailor a system to your particular needs.

To produce a custom development kit, you need a minimum hardware configuration of an IMS B008 motherboard and a TRAM with at least 2 Mbytes of memory (eg. IMS B404, IMS B405, IMS B417). Any number of other TRAMs and motherboards can be added to this minimal system, either as part of the initial system, or later as an upgrade. On this hardware you may run any PC development tools that you require from the following:

- Parallel C compiler (IMS D711)
- PASCAL compiler (IMS D712)
- Parallel FORTRAN compiler (IMS D713)
- PC Toolset (IMS D705)
- Transputer Development System (IMS D700)

The full range of modules and motherboards and development options for other hosts are described in the INMOS Transputer Development Brochure.

7.1 SYSTEMS SUPPORT

To provide a professional service to our customers, INMOS has considerably expanded its support network and service to provide timely and professional response to customer requirements at a local level.

7.1.1 DEVELOPMENT SUPPORT

To maximise the full potential of all systems products supplied by INMOS, a range of comprehensive development tools to operate on the most popular hosts are available. INMOS regard the provision of a quality development foundation as the key to the success of the transputer and associated products. This means not only providing the right development tools but also the complete support environment.

7.1.2 CUSTOMER PROJECT ANALYSIS AND SUPPORT

Once the customer has identified a market opportunity for transputer based products, the INMOS Field Application Engineering (FAE) support network is able to provide on site professional guidance regarding the use of INMOS systems products. This can extend from project definition through to the final product and includes assistance on the implementation and use of all INMOS supplied development tools.

7.1.3 REGIONAL TRANSPUTER CENTRES

Support is also available from our worldwide Regional Transputer Centres (RTCs). These are fully resourced with engineers and dedicated equipment to provide the following range of services associated with project development:

Software support

Consultancy

Training

Special project assistance

The software support function is available to those customers who require special support for INMOS software products including guaranteed response time to enquiries, error reporting and automatic software updating. With its extensive experience in multiprocessing, INMOS is ideally positioned to offer consultancy on a wide range of applications, either directly or through close involvement with third parties for specific market segments. INMOS has introduced a Strategic Alliance Program (STRAP) to encourage development in this latter area. A range of training courses is available using the latest INMOS hardware and software. Courses are held regularly in several centres worldwide and, if appropriate, can be arranged at a customer location. In certain circumstances INMOS is able to allocate engineering resources to work on specific customer projects. This can take place either on site or at an INMOS location.

7.1.4 AFTER SALES SERVICE

INMOS operates a fast failure return procedure for its systems products. In the event of an in-service product failure a replacement part will be supplied, within a guaranteed time, following notification that the product has been returned to INMOS. A full investigation into the failure will be undertaken and a report made available to the customer. This will ensure that continuity of supply is maintained at all times and is in addition to the normal warranty supplied with INMOS products.

7.1.5 THIRD PARTY SUPPORT

In addition to INMOS Transputer centres there are a number of third party groups, many of which are nationally funded, providing advice and service on transputer related topics. Details can be found in the Transputer White Pages Directory, available from INMOS.

Systems products are embraced within the INMOS Quality Policy which incorporates specific programmes in the following areas:

Design in quality

New product verification phase

Document Control

Quality control monitors

Production soak testing

Environmental stress cycle

Reliability testing

All systems products are designed in house using CAD facilities specific to PCB manufacture. These facilities incorporate design simulation and provide production data which helps to reduce design related problems later on in full production stages.

During the product verification phase, the new product is evaluated for its manufacturability and reliability. No product is allowed to progress to production build before it has passed stringent internal endorsement criteria.

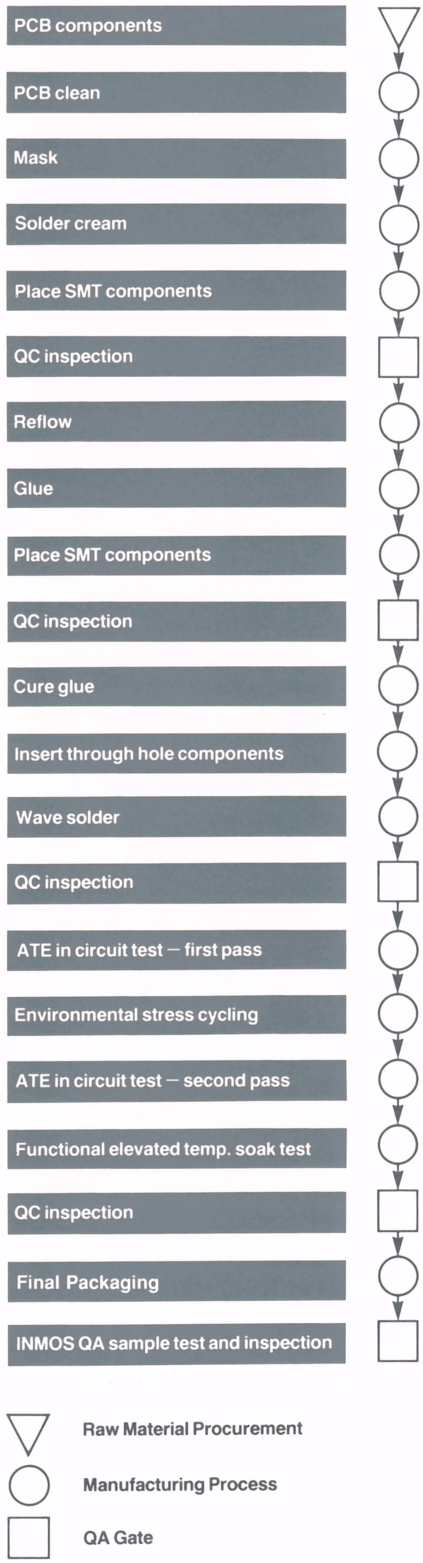
All system products are assembled and tested at INMOS approved assembly houses which conform to the INMOS Quality Program. Quality procedures detail the build specification, production testing and final product status. These procedures are all monitored and controlled by the Document Control Department (DCD).

In circuit automatic testing provides assembly and component analysis. This coupled with an environmental stress cycle and a repeated automatic test procedure provides an effective monitor to the production phase.

An INMOS Quality Assurance sample test evaluates all production batches. At this stage the conformance of the product is confirmed and the test data logged for reference.

Reliability testing is carried out on the major product lines. Samples are taken from standard stock and subjected to life testing.

PRODUCT FLOW



OTHER ASSOCIATED LITERATURE

Corporate Brochure "Inventing the future"

INMOS Approach to Quality and Reliability

Transputer Development and iq Systems Databook

Transputer Family Brochure

Transputer Development Brochure

The Transputer Databook

ADA on the INMOS Transputer

INMOS Spectrum

Reliability Update

Technology for Defence brochure

Transputer Applications Notebook: Architecture and Software

Transputer Applications Notebook: Systems and Performance

Transputer Instruction Set / Compiler Writer's Guide

Tutorial Introduction to occam Programming

Transputer Technical Notes

Transputer Architecture

Transputer White Pages (Software / Consultants)

Transputer White Pages (Hardware and Systems)

occam 2 Reference Manual

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