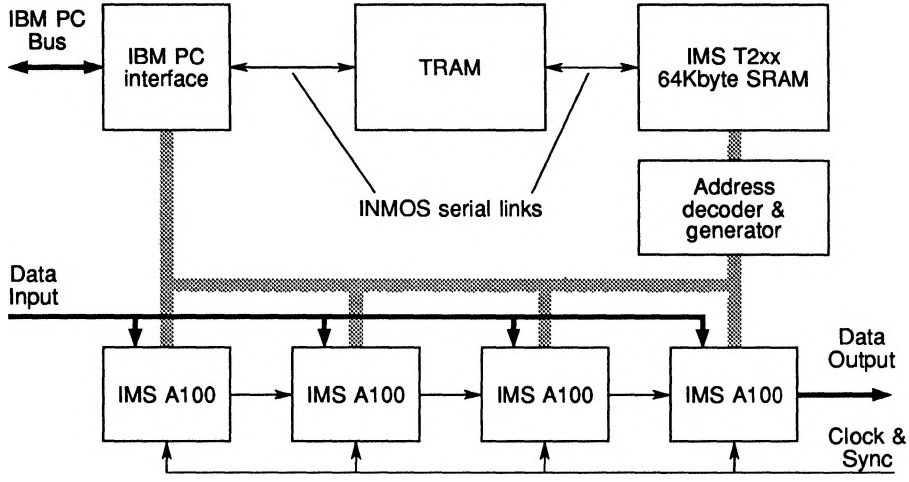
# IMS B009

## IMS A100 DSP System Evaluation Board

## Product Overview




**Features**

- High performance Digital Signal Processing development board for both real-time and non-real time compute-intensive applications
- Cascade of four IMS A100s
- Up to 1280 Million Operations Per Second (MOPS) capability
- Up to 10MSamples/sec continuous data throughput
- Fully programmable using an IMS T2xx 16 bit transputer with 64Kbyte SRAM
- Option to install TRAM
- Transputers arrayable for high performance pipelined systems
- General purpose address mapper (Look Up Table) for data sequencing
- Data supplied from internal (i.e. software/file) or external sources
- Controllable from IBM PC applications under MS-DOS or other transputer systems
- IMS A100 cascade accessible directly from IBM PC bus
- Complete DSP development environment available, including IMS A100 and IMS B009 software simulators
- Compatible with full transputer board family

## 6.1 The IMS B009 Evaluation Board

The IMS B009 can be used to evaluate and implement a wide range of high performance DSP techniques. It can also be used by OEMs as a component for building high performance, flexible, DSP systems, where the production quantities do not justify development of a specific DSP board.

The IMS B009 is an IBM PC (XT or AT) add-in board containing 4 IMS A100 signal processors controlled by an IMS T2xx. The 4 IMS A100s can be used to implement 128 tap FIR filters, convolvers or correlators, on 16 bit data, with 16 bit coefficients at rates up to 2.5 M samples/second, or at up to 10M samples/second with 4 bit coefficients.

The IMS A100s can be controlled and configured either directly from the IBM PC or, for much greater performance, by the IMS T2xx. Data flow through the IMS A100s can be controlled by the IBM PC, the IMS T2xx or directly from an external digital signal source, via a DIN 41612 edge connector. This last option allows the IMS A100s to process data at rates up to 10MHz.

The IMS T2xx has 64Kbytes of fast SRAM. The interface between the IMS T2xx, the SRAM, and the IMS A100s is designed to allow the IMS T2xx to move data through the IMS A100s at speeds up to 1.25 M samples/second. An address mapping table allows the IMS T2xx to perform complex data sequencing tasks at high speeds. Each of the 4 transputer links on the IMS T2xx can be used to transfer data between the IMS B009 and other transputer systems at up to 0.8 Mbytes/second simultaneously. using more than one link for data I/O can provide data transfer rates of several Mbytes/second.

The IMS B009 is a Transputer Module (TRAM) motherboard. A single TRAM, up to size 4, can be installed. For example, an IMS B404 TRAM can be used to provide 2 Mbytes of data storage and additional (possibly floating point) data processing. This same TRAM could be used to run software packages such as the IMS D700 Transputer Development System and the IMS D703 DSP Development System. The IMS B009 (with a suitable TRAM) thus provides the basis for both a Transputer and a DSP development workstation.

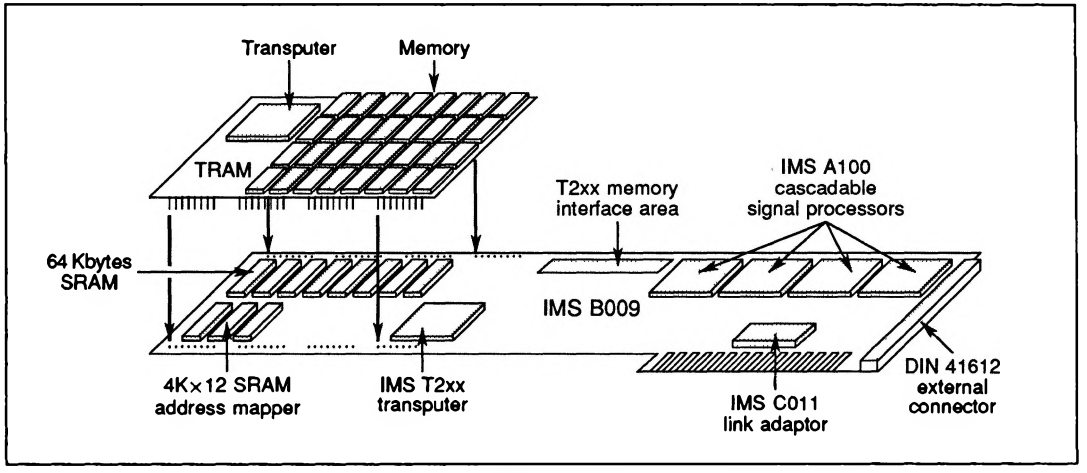



Figure 6.1 IMS B009 key components

## 6.2 Board Description

The IMS B009-1 contains a cascade of four IMS A100s, an IMS T2xx 16 bit transputer with 64Kbyte SRAM, and a socket for a standard TRAM.

An INMOS TRAM (e.g. IMS B404) provides a general purpose host processor, capable of supporting the full INMOS occam 2 Transputer Development System, and the IMS D703 DSP Development System. The IMS T2xx is used as a high performance controller for the IMS A100 cascade. Figure 2 shows the board with the optional TRAM, and the configuration of the IMS A100 cascade.

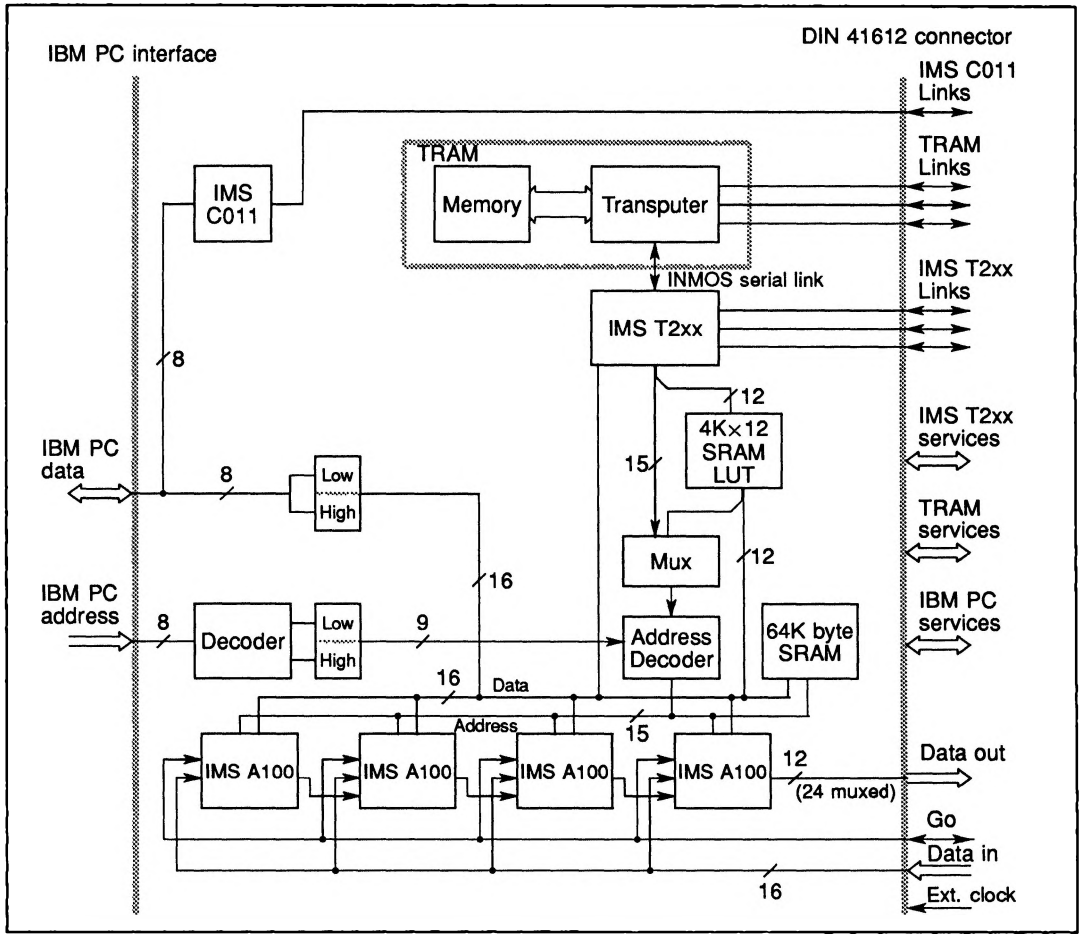



Figure 6.2 IMS B009 Detailed Block Diagram

A 4K×12 'address mapper' is provided for high speed generation of arbitrary address sequences. This mapper can be applied at any time to any addresses generated in the positive address space of the IMS T2xx, without any performance degradation. Thus, arbitrary data sequences can be preloaded, and applied at the appropriate point during data processing.

The IMS T2xx can be connected to any other transputer with one or more standard INMOS serial links, each link being capable of approx. 0.8MBytes/sec in each direction, and operation in full duplex. The transputer links can also be used to connect to other transputer evaluation boards, or for arraying IMS B009s to form a high bandwidth signal processing pipeline.

The TRAM/B009-1 combination offers a powerful concurrent processing environment, with preprocessing operations such as data pre/post ordering handled by the TRAM, whilst the IMS T2xx drives the IMS A100s. For highest performance, external ports are provided, enabling users to supply real time data to the A100 cascade, and output processed data at full speed. Thus, real time processing can be implemented with a minimum of additional hardware.

In order to maximise the range of applications of the IMS B009, most of the key control and data signals are brought to either the 96 way DIN 41612 connector, or to an internal connection area. This enables users to construct DMA interfaces to all devices on the IMS T2xx memory interface bus. Thus, a wide range of real time interfaces can be realised, making the IMS B009 ideal for general laboratory use or for prototyping final systems.

Input data can thus be supplied from one of four sources:

- External data port (10MSamples/sec continuous)
- IMS T2xx memory interface (approx. 5MBytes/sec burst)
- Transputer link (approx. 0.8MBytes/sec x 4 burst)
- IBM PC bus (approx. 0.2MBytes/sec burst)

Due to the relatively small power supplies provided with some IBM PC compatibles, special links have been provided to isolate the $V_{cc}$ plane from the IBM PC power pins, and to provide external power directly via the DIN 41612 connector. This enables several IMS B009s to be used in a standard IBM PC chassis without danger of exceeding either power supply or backplane ratings.

### 6.3 Programming

The IMS B009 enables users to exploit the flexibility of the IMS A100 under a standard occam 2 environment, by running the IBM PC Transputer Development System (IMS D700) on the TRAM located on the board itself. In this way, high performance DSP systems can be realised, using high level languages throughout. The IMS D703 DSP Development System, supplied in both source code and binary form, demonstrates how to make best use of the various addressing modes and facilities of the board.

The board can also be treated as a peripheral to the IBM PC, responding to commands sent to it on the PC bus. This mode of operation disables the transputers and limits data rates to those attainable on the standard IBM PC bus, but does enable users to evaluate the potential of attaching IMS A100s directly to an IBM PC, controlled by a normal PC based program.

Alternatively, using the IMS B009 driver program supplied with the IMS D703, the IBM PC application can boot the IMS T2xx directly. It can then use the driver program in exactly the same way as any transputer application, communicating with the IMS T2xx via the link adaptor. This approach provides far higher performance for IBM PC hosted applications than controlling the IMS A100s directly via the PC bus.

### 6.4 Product summary

The IMS B009-1 comprises four IMS A100s, one IMS T2xx 16-bit transputer with 64Kbyte SRAM, and the 4K×12 address mapper. It also contains an unpopulated socket for a TRAM (up to size 4).

A comprehensive suite of documentation is supplied with each system, including full descriptions of the board design, software users and reference manuals, and a set of application notes. Test software is also provided, which performs extensive diagnostics of all functional components of the board.

## 6.5 Technical summary

Board ready for installation in a single IBM PC XT or AT system unit expansion slot

Four IMS A100-G21S cascadable signal processors

One IMS T2xx 16 bit transputer with 64 kbytes SRAM

10 or 20 MBit/sec INMOS link transmission speeds

DIN 41612 96 pin I/O connector

**A100 signals:**
Data in/out
Clock/Go/OutRdy

**Transputer signals:**
TRAM, T2xx Reset/Analyse/Error
1 INMOS link from IMS C011
3 INMOS links from IMS T2xx
3 INMOS links from TRAM

+5V, ground

Cables (suitable for connection to all INMOS evaluation boards)

INMOS links
Up/Down Reset/Analyse/Error cables
Standard Jumpers

Power supply required (from IBM PC or externally)

+5V (approx. 4 amps with TRAM)
Ground

**Note:** *the IMS B009-1 can operate with external power supplies if required.*

## 6.6 Ordering details

| Product | Part number |
|---|---|
| B009 Evaluation board | IMS B009-1 |

**Available Documentation**

IMS A100 Data Sheet
IMS A100 Application Note 1: Digital Filtering with the IMS A100
IMS A100 Application Note 2: Discrete Fourier Transforms with the IMS A100
IMS A100 Application Note 3: Correlation and Convolution with the IMS A100
IMS A100 Application Note 4: Complex (I & Q) Processing with the IMS A100
IMS A100 Application Note 5: Hardware considerations with the IMS A100
IMS A100 Application Note 6: Image processing with the IMS A100