# intel®

iSBX™ 488
GPIB MULTIMODULE™ BOARD

- Complete IEEE 488-1978 Talker/Listener Functions Including:
  — Addressing, Handshake Protocol, Service Request, Serial and Parallel Polling Schemes
- Complete IEEE 488-1978 Controller Functions Including:
  — Transfer Control, Service Requests and Remote Enable
- Simple Read/Write Programming

- Software Functions Built into VLSI Hardware for High Performance, Low Cost and Small Size
- Standard iSBX Bus Interface for Easy Connection to Intel iSBC™ Boards
- IEEE 488-1978 Standard Electrical Interface Transceivers
- Five Volt Only Operation

The Intel iSBX 488 GPIB Talker/Listener/Controller MULTIMODULE board provides a standard interface from any Intel iSBC board equipped with an iSBX connector to over 600 instruments and computer peripherals that use the IEEE 488-1978 General Purpose Interface Bus. By taking full advantage of Intel's VLSI technology the single-wide iSBX 488 MULTIMODULE board implements the complete IEEE 488-1978 Standard Digital Interface for Programmable Instrumentation on a single low cost board. The iSBX 488 MULTIMODULE board includes the 8291A GPIB Talker/Listener, 8292 GPIB Controller and two 8293 GPIB Transceiver devices. This board represents a significant step forward in joining microcomputers and instrumentation using industry standards such as the MULTIBUS® system bus, iSBX bus and IEEE 488-1978. The high performance iSBX 488 MULTIMODULE board mounts easily on Intel iSBX bus compatible single board computers.

A simple user programming interface for easy reading, writing and monitoring of all GPIB functions is provided. This intelligent interface minimizes the impact on host processor bandwidth.
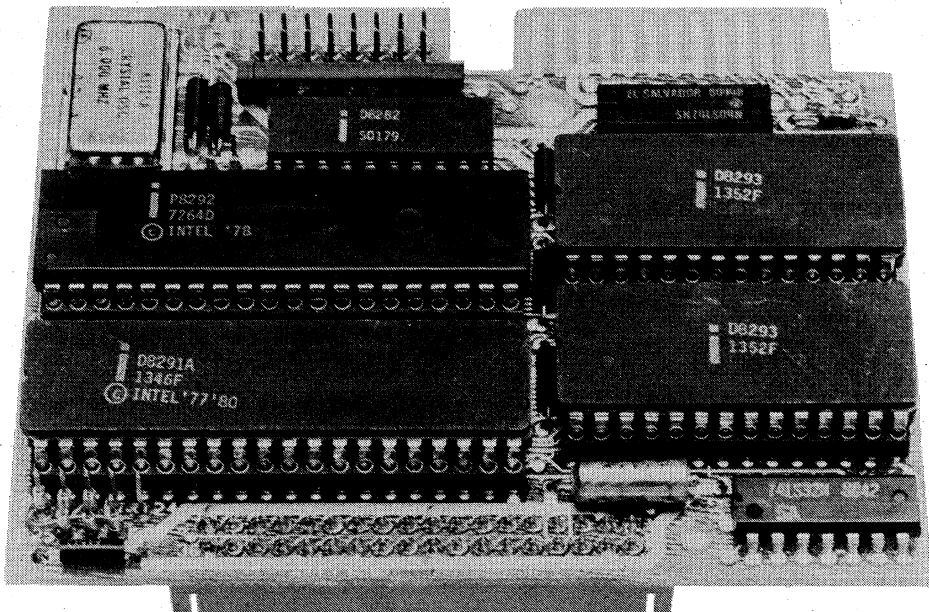
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FUNCTIONAL DESCRIPTION

The iSBX 488 MULTIMODULE board is a single-wide iSBX bus compatible I/O expansion board that provides a complete implementation of the IEEE 488-1978 Standard Digital Interface for Programmable Instrumentation. The iSBX 488 MULTIMODULE board may be configured to be a GPIB controller, talker, listener or talker/listener. The hardware implementation of the iSBX 488 board takes full advantage of Intel's VLSI capability by using the Intel 8292 GPIB controller, 8291A talker/listener and two (2) 8293 bus transceivers. All communication between the host iSBC board and the iSBX 488 MULTIMODULE board is executed via the Intel standard iSBX connector. Many of the functions that previously were performed by user software have been incorporated into VLSI hardware for high performance and simple programming. Both the Intel 8291A GPIB Talker/Listener device and the 8292 device can each communicate independently with the host processor on the iSBC board depending on configuration. Communication from the host iSBC board to either device on the iSBX 488 board is flexible and may be either interrupt or poll driven depending on user requirements. Data transfers to or from the GPIB may be executed by the host processor's I/O Read and I/O Write commands or with DMA handshaking techniques for very high speed transfers.

GPIB Talker/Listener Capabilities

The Intel 8291A device on the iSBX 488 MULTIMODULE board handles all talker/listener communications between the host iSBC processor board and the GPIB. Its capabilities include data transfer, bus handshake protocol, talker/listener addressing procedures, device clearing and triggering, service requests, and both serial and parallel polling schemes. In executing most procedures the iSBX 488 board does not interrupt the microprocessor on the iSBC processor board unless a byte of data is waiting on input or a byte is sent to an empty output buffer, thus offloading the host CPU of GPIB overhead chores.

SIMPLE PROGRAMMING INTERFACE

The GPIB talker/listener functions can be easily programmed using the high level commands made available by the Intel 8291A on the iSBX 488 MULTIMODULE board. The 8291A device architecture includes eight registers for input and eight registers for output. One each of these read and write registers is used for direct data transfers. The remaining write registers are used by the programmer to control the various interface features of the Intel 8291A device. The remaining read registers provide the user with a monitor of GPIB states, bus conditions and device status.
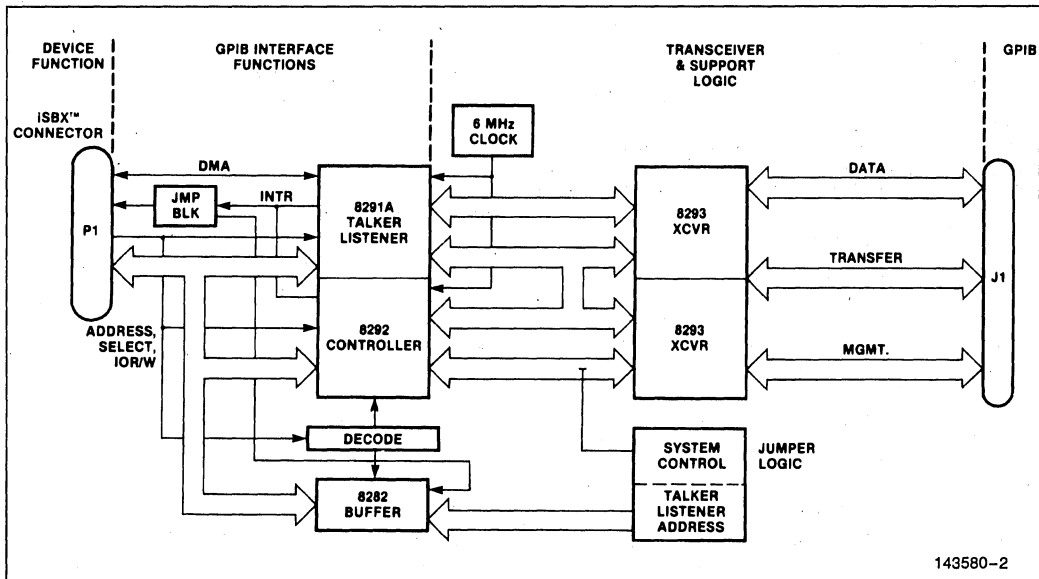

Figure 1. iSBX™ 488 MULTIMODULE™ Board Block Diagram

SOFTWARE FUNCTIONS BUILT INTO VLSI HARDWARE

Additional features that have migrated from discrete logic and software into Intel VLSI include programmable data transfer rate and three addressing modes that allow the iSBX board to be addressed as either a major or a minor talker/listener with primary or secondary addressing. The iSBX 488 MULTIMODULE board can be programmatically configured into almost any bus talker, listener, or talker/listener configuration. Writing software to control these and other iSBX 488 board functions is simply a matter of reading or writing the control registers.

IEEE 488-1978 Functions[1]

Function	ISBX™ 488 Supported IEEE Subsets
Source Handshake (SH)	SH0, SH1
Acceptor Handshake (AH)	AH0, AH1
Talker (T)	T0 through T8
Extended Talker (TE)	TE0 through TE8
Listener (L)	L0 through L4
Extended Listener (LE)	LE0 through LE9
Service Request (SR)	SR0, SR1
Remote Local (RL)	RL0, RL1
Parallel Poll (PP)	PP0, PP1, PP2
Device Clear (DC)	DC0 through DC2
Device Trigger (DT)	DT0, DT1
Controller (C)	C0 through C28

NOTE:
1. For detailed information refer to IEEE Standard Digital Interface for Programmable Instrumentation published by The Institute of Electrical and Electronics Engineers, Inc. 1978.

Controller Capabilities

The GPIB controller functions supplied by the iSBX 488 board are provided by the Intel 8292 GPIB controller device. The 8292 is actually an Intel 8041A eight bit microcomputer that has been preprogrammed to implement all IEEE 488-1978 controller functions. The internal RAM in the 8041A is used as a special purpose register bank for the 8292 GPIB Controller. Just as with the 8291A GPIB Talker/Listener device, these registers are used by the programmer to implement controller monitor, read and write commands on the GPIB.

When configured as a bus controller the iSBX 488 board will respond to Service Requests (SRQ) and will issue Serial Polls. Parallel Polls are also issued to multiple GPIB instrument devices for receiving

simultaneous responses. In applications requiring multiple bus controllers, several iSBX 488 boards may each be configured as a controller and pass the active control amongst each other. An iSBX 488 board configured for a System Controller has the capability to send Remote Enable (REN) and Interface Clear (IFC) for initializing the bus to a known state.

GPIB Physical Interface

The iSBX 488 MULTIMODULE board interfaces to the GPIB using two Intel 8293 bidirectional transceivers. The iSBX 488 board meets or exceeds all of the electrical specifications defined in IEEE 488-1978 including bus termination specifications. In addition, for direct connection to the GPIB, the iSBC 988 cable, a 26 conductor 0.5 meter GPIB interface cable is also available from Intel. The cable is terminated with a 26-pin edge connector at the iSBX end and a 24-pin GPIB connector at the other. The cable is also supplied with shield lines for simple grounding in electrically noisy environments.

Installation

The iSBX 488 MULTIMODULE board plugs directly onto the female iSBX connector available on many Intel iSBC boards. The MULTIMODULE board is then secured at one additional point with nylon hardware (supplied) to insure the mechanical security of the assembly.

SPECIFICATIONS

Interface Information

iSBX™ Bus—All signals TTL compatible

26-pin Edge Connector—Electrical levels compatible with IEEE 488-1978.

Physical Characteristics

Width: 3.70 in (0.94 cm)

Length: 2.85 in (7.24 cm)

Height: 0.8 in (2.04 cm)

Weight: 3.1 oz (87.8 gm)

GPIB Data Rate*

300K bytes/sec transfer rate with DMA host iSBC board

50K bytes/s transfer rate using programmed I/O
730 ns Data Accept Time

*Data rates are iSBX board maximum. Data rates
will vary and can be slower depending on host
iSBC board and user software driver.

Electrical Characteristics

DC Power Requirements: $V_{CC} = +5$ VDC $\pm 5\%$

$I_{CC} = 600$ milliamps maximum

GPIB Electrical and Mechanical Specifications

Conforms to IEEE 488-1978 standard electrical lev-
els and mechanical connector standard when pur-
chased with the iSBC 988 GPIB cable.

Environmental Characteristics

Operating Temperature: 0° to 60°C (32° to 140°F)

Relative Humidity: Up to 90% R.H. without
condensation.

Reference Manual

143154-001— iSBX 488 GPIB MULTIMODULE
Board Hardware Reference Manual
(not supplied).

ORDERING INFORMATION

Part Number   **Description**

SBX488   GPIB MULTIMODULE

SBC988   0.5 meter GPIB cable for iSBX 488
MULTIMODULE Board