Solutions for the Motorola MPC 800 Embedded Power PC Microprocessor Family

Product Overview

Design, debug, and integrate real-time embedded systems

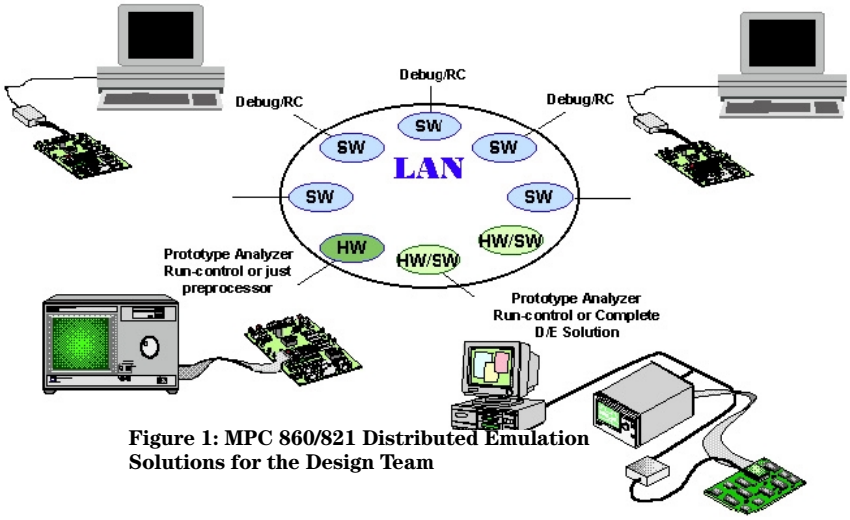

Figure 1: MPC 860/821 Distributed Emulation Solutions for the Design Team

Quickly and accurately determine the root cause of your most difficult hardware, software and system integration problems with a powerful system debug environment from Hewlett Packard.

HP offers system integrators and firmware developers scaleable powerful tools to solve today's most complex Power PC problems. With distributed emulation, design team members can customize a solution to meet their unique requirements. Many of the distributed emulation components can be used on future designs to protect your investment.

HP Distributed emulation combines the powerful tools of run control, code download, third party debugger connections, and real-time analysis for a complete scaleable system development environment. With logic analysis providing the real-time analysis of the system, you can monitor processor activity in relation to other important system signals from a PCI bus, additional processors, or other I/O devices. Unlike other MPC 860 solutions, the logic analyzer is non-intrusive to your target. You can run your target system at full speed and the analyzer simply monitors the signals in the system.

The logic analyzer also provides powerful time-correlation across all signals in the system. A system trace can be up to 1 M deep combined with a complex trigger to find the toughest communications and computing problems. The processor activity can be correlated to the high-level source code with the HP software Analyzer.

Distributed Emulation Solutions

Distributed emulation offers three types of solutions depending on the individual needs and tasks of the design team members:

Complete Distributed Emulation Solution for the System Integrator

- Processor run control
- Real-time trace with source level analysis
- Complete system development environment
- BGA probing solution
- Third party debugger connection
- Prototype analyzer run control interface

Hardware Assisted Run-Control with the HP Processor Probe for the Software Developer

- Processor run control
- Code download
- Third party debugger connection

Logic Analyzer with a Preprocessor for the Hardware Developer

- BGA probing solution
- Inverse assembled trace listing
- Real-time analysis
- Run control with prototype analyzer interface

The Motorola MPC 860/821 solutions include / one or more of the following:

HP E2476A Preprocessor
HP E3497A Processor Probe
HP B4620A Software Analyzer
HP 16500C Logic Analysis System

HP E3497A Processor Probe

The HP E3497A is designed for developers of embedded systems using the Motorola MPC 860/821 processors.

The processor probe helps you debug your code by providing run control, high-speed code download, and memory/register display and modification. You can control program execution through single-stepping, start/stop, run/break, and set/modify breakpoints, or run code at full speed in the target.

The HP E3497A is controlled over your local area network (LAN) and connects to your target through a 10-pin dedicated connector.

Unlike in-circuit emulators, the processor probe provides more stable operation by accessing only the debug pins of the microprocessor and affects no other signals.

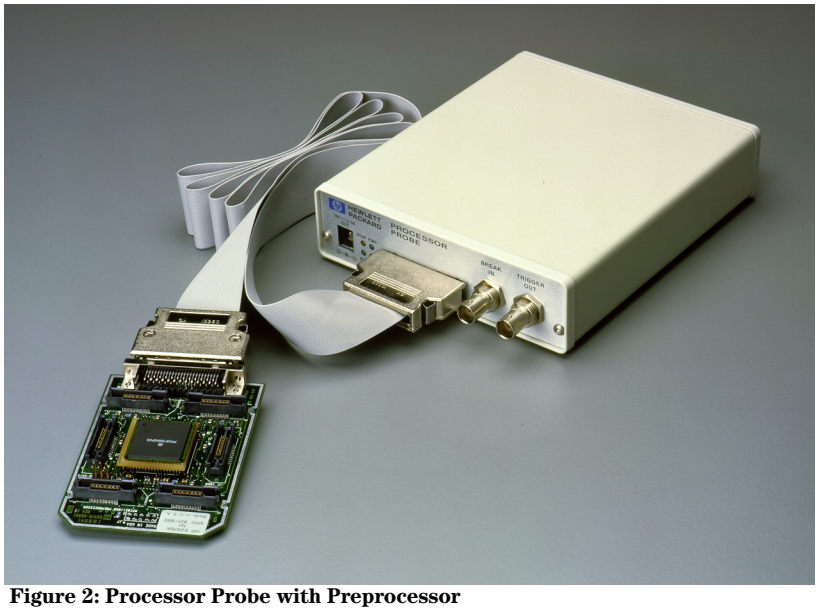

Figure 2: Processor Probe with Preprocessor

With a processor probe, you don't need a serial port on your target system to download code. The processor probe also doesn't require user memory like ROM monitors.

Debugger Interface Connection

The HP E3497A can be controlled by a third party source level debugger to provide high-level source code debug.

With a debugger connection, you can set breakpoints, single-step through code, examine variables, and modify source code variables from the debugger interface.

Using a debugger to connect the processor probe allows the entire design team to have a consistent interface from software development to hardware/software integration.

Contact your local HP representative for the latest debugger connections available. Debugger interfaces must be ordered directly from the debugger vendor.

Integration with HP Analysis Tools

The HP E3497A can be used with logic analysis equipment for a complete system debug environment.

You can stop processor execution based on conditions internal to the processor by using breakpoints in the debugger interface. In addition, you can use the powerful triggering of the HP 16500 system for events on system buses or other external events to halt the processor.

Timing measurements all around the system can be time-correlated with processor instructions and source code for a complete system debug environment.

Prototype Analyzer Run Control Interface

The HP E3497A processor probe can also be controlled by a HP 16505A Prototype Analyzer interface by using the prototype analyzer run control interface.

The prototype analyzer run control interface allows you to easily display and modify contents of processor registers, system memory, and I/O from the prototype analyzer interface. You can also view memory code segments disassembled into familiar Motorola MPC 860/821 instructions.

From the run control window, you can instruct the processor to run, break, reset, or single-step. You can also choose whether the memory, I/O, and register displays are updated for breaks and single-steps.

Writing procedures that set up registers, memory, and I/O in your system are easy with the command language. Once the procedure is written, save it on the HP 16505A hard disk. When you want to initialize your hardware system to a particular state, simply recall and execute the procedure.

The prototype analyzer run control interface does not reference back to the high-level source code like the debugger interface, but provides a simple run control interface for hardware designers and system integrators.

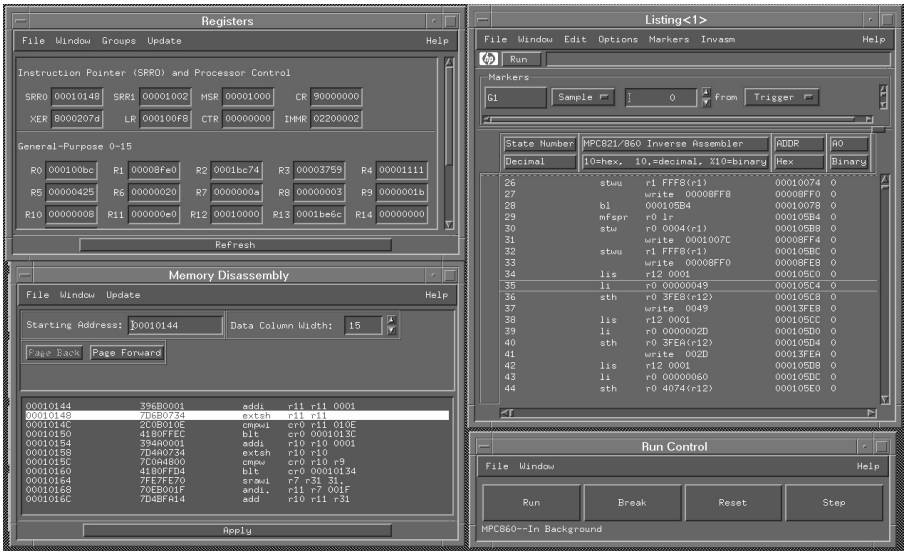

Figure 3: HP 16505A Prototype Analyzer Run Control Interface

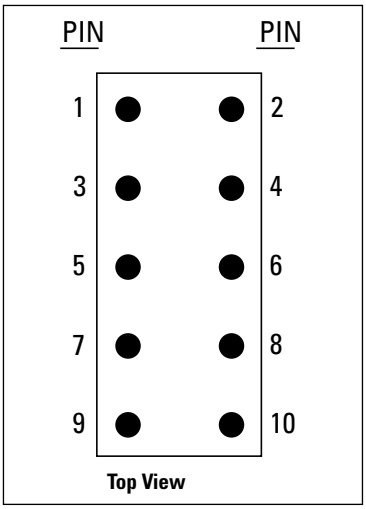

Figure 4: Header Pin Assignment

Connection to Your Target System

The HP E3497A processor probe is also used directly with the HP E2476A preprocessor as shown in figure 2. When used together, the 10-pin connector is not necessary since the debug port pins are accessed directly through the preprocessor.

Probe Pin #r	Signal	MPC860/821 Pin #
1	VFLS0	H2
2	*SRESET[3]	P2
3	GND	
4	DSCK[1]	H16
5	GND	
6	VFLS1	J3
7	*HRESET[3]	N4
8	DSD1[1]	H17
9	VDD[2]	
10	DSD0[1]	G17

[1] Do not series terminate DSCK, DSD1, or DSD0. All of the signal termination is done be the HP E3497A Processor Probe.

[2] VDD should be one of the four internal power pins : A8,M1,W8, H19

[3] *SRESET and *HRESET will be driven low at times through a 100 Ohm resistor. A conflict may arise if *SRESET and/or *HRESET are driven high by the target.

Table 1: HP E3497A Signal information

HP E2476A Preprocessor Solution

The HP E2476A preprocessor interface allows easy connection of an HP logic analyzer to your Motorola MPC 860/821 BGA target system for real-time analysis. With the preprocessor solution, you don't need to design special debug connectors into your target system.

The HP E2476A consists of a preprocessor, an HP E5355A 357-pin BGA probing kit, one HP E2476-87602 extender and three HP E5346A high density termination adapters.

Software provided with the preprocessor quickly configures the logic analyzer by labelling address, data, and status signals for the MPC 860/821. Additionally, the software includes an inverse assembler, which gives you MPC 860/821 mnemonics in the trace listing for easy correlation between captured data and target code.

With the HP 16500B/C logic analysis system and the HP 16505A prototype analyzer, you can time-correlate bus information from other processors or bus interfaces, like PCI, in your system with the MPC 860/821. Other preprocessors are available for other processors in your system. (Contact your HP Sales Representative or Field Engineer for more information).

The preprocessor is connected to the processor by a BGA probe. Mechanical dimensions are included in figure 8 (page 6). The probing adapter is soldered down in place of the processor as shown above. The processor is inserted into a BGA chip carrier socket as shown in figure 9 (page 6). The BGA chip carrier socket can also be used directly with the socket on the target board without the preprocessor.

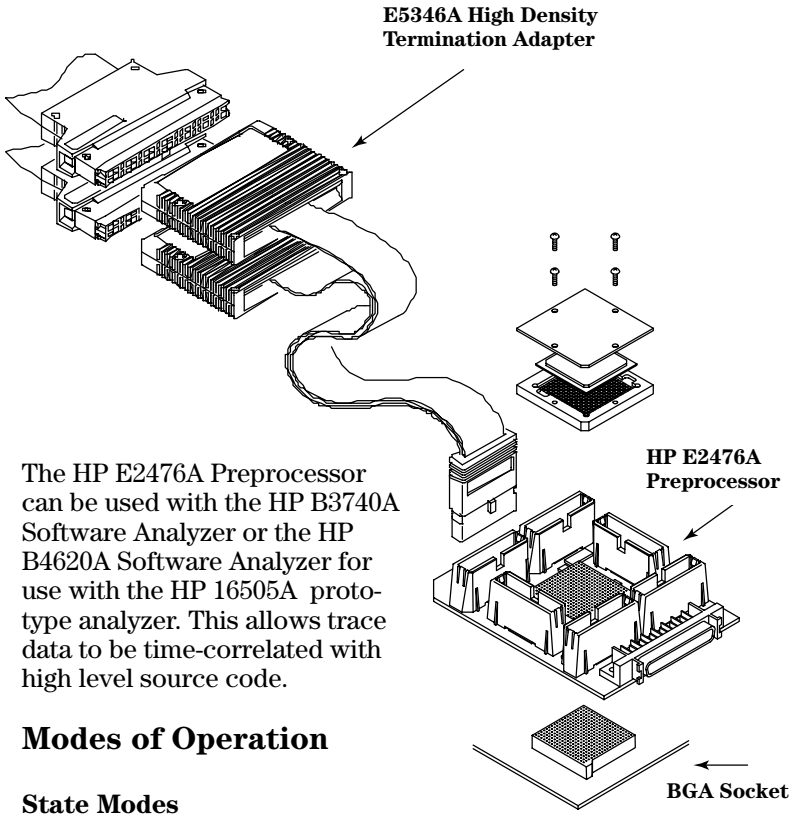

Figure 5: MPC 860/821 Preprocessor Interface

The HP E2476A Preprocessor can be used with the HP B3740A Software Analyzer or the HP B4620A Software Analyzer for use with the HP 16505A prototype analyzer. This allows trace data to be time-correlated with high level source code.

Modes of Operation

State Modes

In state-per-clock mode, the analyzer captures the processor state on every rising edge of the CPU clock.

In state-per-transfer mode, the analyzer captures only those states in which the transfer acknowledge signal (TEA) is asserted. This mode will filter out wait and idle states. The inverse assembler only works in this mode.

Timing Mode

Timing analysis is supported. All processor signals are presented to the logic analyzer unbuffered.

Target Signal Timing

Data must be valid for a 3.5 ns window with respect to the logic analyzer clock. The analyzer captures the data on the rising edge of the clock. There is a 1.25 ns propagation delay between the target and mounted preprocessor for DSDI, DSDO, and DSCK signals.

Microprocessors Supported

Microprocessor	Package	Speed
MPC 860 [4]	357-pin BGA	up to 40 MHz
MPC 821	357-pin BGA	up to 40 MHz

[4] Supports DC, DE, DH, EN, and MH Versions

Pods Required

Six 16-channel logic analyzer pods are required for inverse assembly. These six pods are connected to three HP E5346A high-density termination adapters included with the preprocessor.

Three additional HP E5346A high density termination adapters are required to probe all the signals on the processor for a total of 12 analyzer pods. Additional HP E5346A adapters must be purchased seperately.

The HP E5355A BGA Probing Kit includes the following:

- 2 surface mount BGA sockets
- Soldering kit
- Instructions

Optional Accessories

- HP E2476-87602 Extender
- HP E5346A High density Termination Adapter

BGA Probing Information

The user must solder the provided BGA socket onto the target system in place of the processor. Soldering instructions are included with the preprocessor.

"Keep Out" Area

The E2476A preprocessor requires a minimal amount of "keep out" space around the processor. The preprocessor also has an overhang as shown on page 6. The maximum height of components under the preprocessor in this area cannot exceed 19 mm or .748007 in (see figure 8)..

If components are too high for the clearance, order the HP E2476-87602 extender to add an additional .25 inches of clearance. Do not exceed two extenders for use with the HP E2476A preprocessor.

Optional Connection Method

If system constraints won't allow the preprocessor interface to be used, you may design high-density AMP Mictor connectors into your target system for connection to the processor signals. The HP E2477A offers configuration files and an inverse assembler like the preprocessor interface.

Three HP E5346A high-density termination adapters are required for inverse assembly. The AMP Mictor connectors may be located around the processor as shown in figure 7.

Refer to the *"HP E5346A High Density Termination Adapter"* Pub 5965-5475E technical specifications data sheet for more information. Contact your HP representative for signal routing information.

AMP connectors can be purchased directly from AMP or from HP. Five AMP connectors and recommended support shrouds are included in the HP E5346-68701 connector kit.

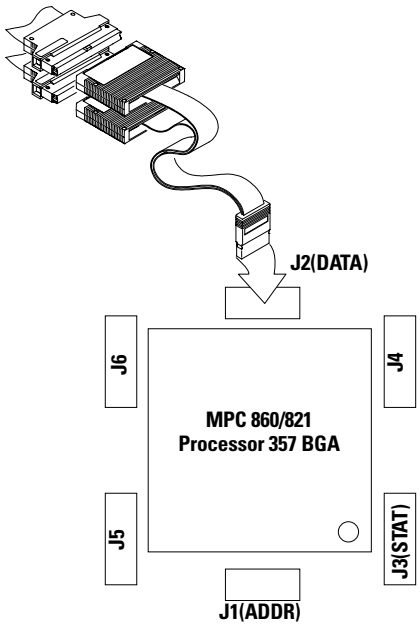

Figure 6: AMP Mictor Connector Layout

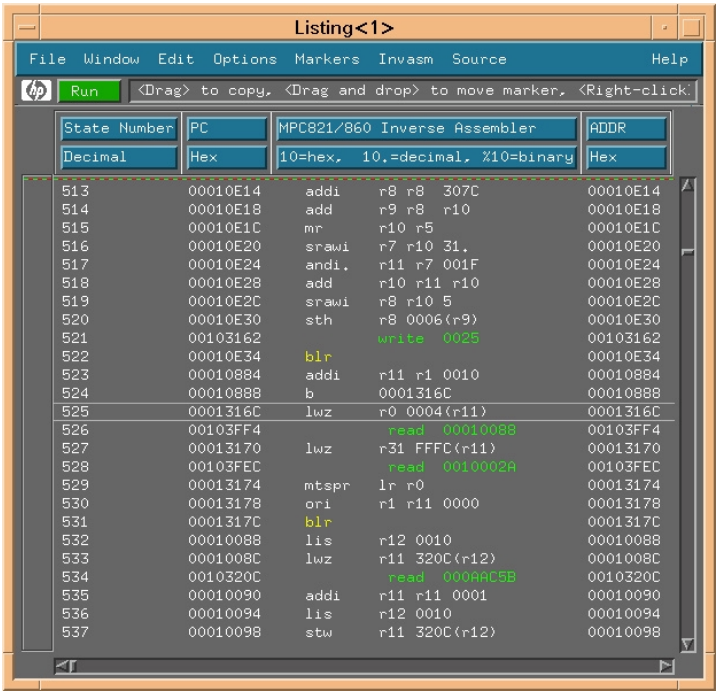

Figure 7: MPC 860/821 Real-Time Trace with Inverse Assembly

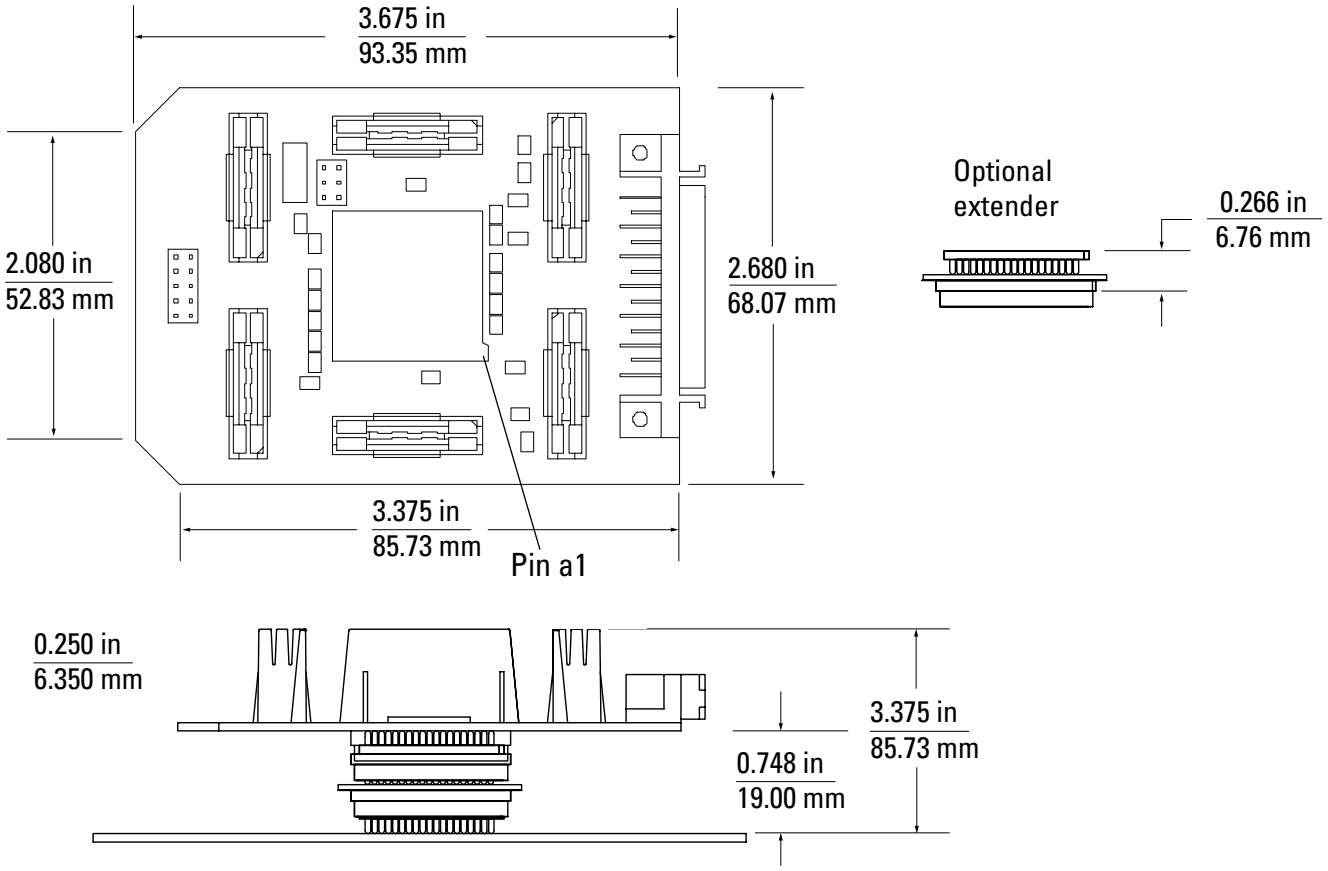

Figure 8:
Preprocessor Dimensions

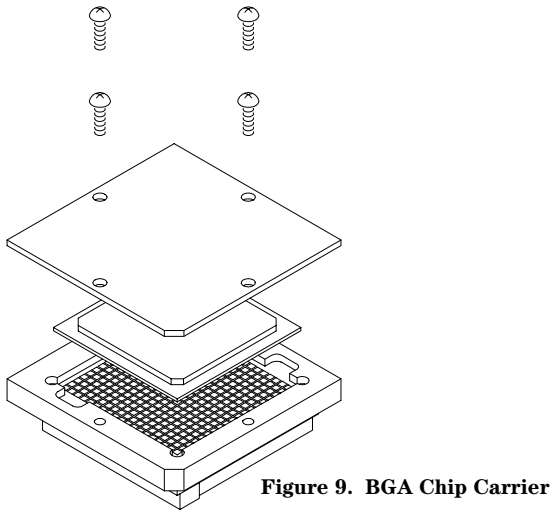

Figure 9. BGA Chip Carrier

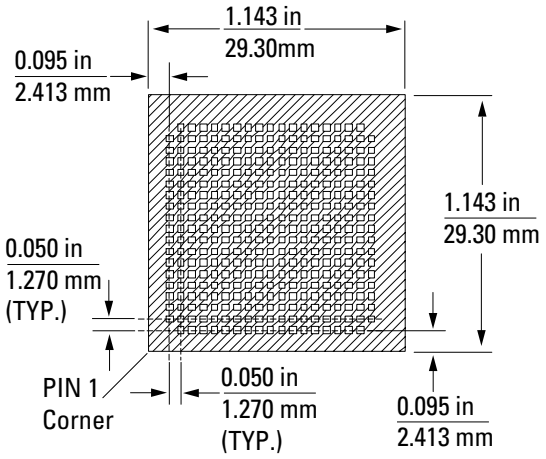

Figure 10:
BGA Socket Keep-out Area

HP E2476A Signal Line Loading

Preprocessor only:

- 25 pf on *SRESET, *HRESET, *PORESET, DSDI, DSDO, and DSCK
- 15 pf on TMS and *TRST
- <10 pf on all other signals

Logic Analyzers Supported

- HP 1660A/AS, C/CS
- HP 1661A/AS, C/CS
- HP 1670A
- HP 1671A
- HP 16550A (one card)
- HP 16554A/555A/556A (two cards)

Recommended Configurations

Software/Firmware Developer

HP E3497A Processor Probe
Third party debugger*

Hardware/Software Integrator

16500B/C System

One 16500B/C Logic Analysis Mainframe
Two 16555A 1M, 100/500 MHz, Logic Analysis Cards
One 16505A prototype analyzer
One B4620A Software Analyzer
One B4630A prototype analyzer
One E3497A Processor Probe
One E2476A Preprocessor Interface
One third party debugger*

1670A/D System

One 1670A/D Logic Analyzer
One B3740A Software Analyzer
One E3497A Processor Probe
One E2476A Preprocessor Interface
One third party debugger*

1660C/CS System

One 1660C/CS Portable Logic Analyzer with option # 015
One B3740A Software Analyzer
One E3497A Processor Probe
One E2476A Preprocessor Interface
One third party debugger*

Hardware Developer

16500B/C System

One 16500B/C Logic Analysis Mainframe
Two 16555A 1M, 100/500 MHz, Logic Analysis Cards
One 16505A prototype analyzer
One B4620A Software Analyzer
One B4630A prototype analyzer
One E3497A Processor Probe
One E2476A Preprocessor Interface

1670A/D System

One HP 1670A/D Logic Analyzer
One B3740A Software Analyzer
One E3497A Processor Probe
One E2476A Preprocessor Interface

1660C/CS System

One 1660C/CS Portable Logic Analyzer with option # 015
One B3740A Software Analyzer
One E3497A Processor Probe
One E2476A Preprocessor Interface

HP E3497A Processor Probe Specifications

Supported Processor	MPC 860/821 See page 4 for versions
Highest Clock Frequency	40 MHz
Target Power Voltage	3.3±0.3 V
RS232C	1200-115200 baud
LAN	10BASE-T or 10BASE2 Ethernet Connections TCP/IP Protocol
Physical	142 mm (W) x200 mm (D) x42 mm (H)
Physical (AC adapter)	126 mm IW) x73 mm (D) x33 mm (H)
Environmental	
Temperature	Operating 0'C to +40'C (+32'F to + I 04'F) Nonoperating -40'C to +70'C (-40'F to +1 58'F)
Altitude	Operating, 4,600 m (15,000 ft); Nonoperating 15,300 m, (50,000 ft)
Humidity	15% to 95% relative
Regulatory Compliance	
EMC	CISPR 11:1990/EN 55011:1991 Group 1, Class A IEC 801-2:1991/EN 50082-1:1992 4 kV CD, 8 kV AD IEC 801-3: 1984/EN 50082-1:1992 3 V/M, (1 KHZ 80% AM, 27-1000 MHz) IEC 801-4: 1988/EN 50082-1:1992 0.5 kV Signal Lines, 1 kV Power Lines
Safety Compliance	IEC 1010-1 (1990) + Amendment + (1992) CSA-C22.2 No. 1010.1-92

* Debug interfaces must be ordered directly from the debugger vendor

Ordering Information

Product	Description
E3497A	MPC 860/821 Processor Probe
E2476A	MPC 860/821 Preprocessor
B4620A	Software Analyzer for the HP 16505A
B4630A	Prototype Analyzer Run Control Interface
B3740A	Software Analyzer
E5346A	High-Density Termination Adapter
E5346-68701	Mictor Connectors with Support Shrouds
E2476-87602	BGA Probing Extender
E5355A	Two BGA Sockets and soldering accessories

Warranty Information

These Hewlett-Packard products have a warranty against defects in material and workmanship for a period of one year from date of shipment. During this warranty period, Hewlett-Packard Company will, at its option, either repair or replace products that prove to be defective. BGA sockets are covered under this warranty against defects in material only. They are not designed for re-use on the target system.

For more information on Hewlett-Packard Test & Measurement products, applications or services please call your local Hewlett-Packard sales offices. A current listing is available via Web through Access HP at http://www.hp.com. If you do not have access to the internet, please contact one of the HP centers listed below and they will direct you to your nearest HP representative.

United States:
Hewlett-Packard Company
Test and Measurement Organization
5301 Stevens Creek Blvd.
Bldg. 51L-SC
Santa Clara, CA 95052-8059
1 800 452 4844

Canada:
Hewlett-Packard Canada Ltd.
5150 Spectrum Way
Mississauga, Ontario
L4W 5G1
(905) 206 4725

Europe:
Hewlett-Packard
European Marketing Centre
P.O. Box 999
1180 AZ Amstelveen
The Netherlands

Japan:
Hewlett-Packard Japan Ltd.
Measurement Assistance Center
9-1, Takakura-Cho, Hachioji-Shi,
Tokyo 192, Japan
(81) 426 48 3860

Latin America:
Hewlett-Packard
Latin American Region Headquarters
5200 Blue Lagoon Drive
9th Floor
Miami, Florida 33126
U.S.A.
(305) 267 4245/4220

Australia/New Zealand:
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
Australia
131 347 ext. 2902

Asia Pacific:
Hewlett-Packard Asia Pacific Ltd
17-21/F Shell Tower, Time Square,
1 Matheson Street, Causeway Bay,
Hong Kong
(852) 2599 7070

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