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Agilent Technologies E5904B Option 060 Trace Port Analyzer for IBM Power PC Series 400 Microprocessors

Data Sheet



Figure 1. Agilent E5904B option 060 trace port analyzer for IBM Power PC Series 400.

- **Real-time debug of IBM PowerPC Series 400 ASIC and SOC systems**
- **Single box solution with both trace port and JTAG run-control**
- **200 MHz maximum clock**
- **4 M maximum memory depth**
- **Self powered**
- **Trigger in/out for use with another Agilent logic analyzer or oscilloscope**
- **Supported by Green Hills Multi and IBM RISCWatch RISCTrace features**

Quickly and accurately determine the root cause of your team's most difficult hardware and software integration problems with Agilent Technologies' powerful trace port analysis and JTAG run-control emulation.

Agilent's emulation and analysis solution for IBM Power PC 400 Series processors combines the powerful tools of run control, code download, debugger connections, and real-time execution trace for a complete debug environment in a small single box device. Combine the industry's leading debuggers to emulation with real-time trace to solve today's most complex design problems.

Complete System Analysis

The E5904B is an integrated JTAG emulator and Trace Port Analyzer (TPA). This tool supports IBM's Real Time Trace (RTT) for full speed real-time system debug of ASICs with the 401x2, 405 and 440 processors incorporating the Trace Status Port in their debug logic.

The self-powered Agilent trace port analyzer is compatible with low power and battery-powered applications.

Trace Port Analyzer

IBM PowerPC series 400 processors with Trace Status Ports contain a dedicated trace port used for real time execution tracing. During code execution, the CPU sends branch destination addresses, pipeline status, and optional read/write data from inside the processor core to the Trace Status Port debug logic. This information is encoded, serialized, and reduced to a small port width.

Agilent's trace port analyzer links this data to the debugger software, which interprets the trace data and reconstructs the instruction code flow. This tool provides a cost-effective, nonintrusive, real-time view of code execution. It is not necessary to run any special debug code on the target.

Because the information on code execution is broadcast from inside the microprocessor, real-time execution trace is available even when the instruction cache is enabled or when the processor is running code in on-chip memory. Real-time execution trace provides a window into the processor's cache that is unavailable by analyzing the controller's external bus.

Agilent's trace port analyzer is controlled by the debugger software via the LAN.

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ETM/JTAG Support

The E5904B supports all the IBM Power PC Series 400 implementations of debug logic. The JTAG emulator can support raw JTAG TCK rates up to 40 MHz and includes support for synchronized RTCK-based target systems.

Supported Processors and ASIC Cores

Processor	Trace Status Port
MPe405	Clock + 8 Trace status
440GP	Clock + 15 Trace status
405CR	Clock + 8 Trace status
405GP	Clock + 8 Trace status
403GCX	Clock + 7 Trace status
403GA	Clock + 7 Trace status
403GC	Clock + 7 Trace status
401x2	Clock + 6 Trace status

A System Integration Tool

Coupling an oscilloscope and/or logic analyzer to the trace port analyzer via its trigger input/output ports lets you view system operation as related to CPU status. For example, the oscilloscope's trigger output could be used to trigger the CPU's Trace Status Port when a control line is at a specified state.

Debugger Interface

A debugger must be used with the trace port analyzer. Industry-leading debuggers can control the Agilent trace port analyzer. The debugger user interface will let you:

- Download code, start/stop processor execution, single-step through a program, set breakpoints, and display/modify registers and memory.
- Set triggers, trigger sequences, etc., in the Trace Status Port debug logic by means of the JTAG run control functions of the trace port analyzer.
- Collect trace information.
- Display execution flow and captured trace data.

Debugger interfaces must be ordered directly from the debugger vendor.

Debugger Connections

IBM Microelectronics Division
1580 Route 52
Hopewell Junction, NY 12533-6351
USA
1 800 POWERPC (1 800 779-3772)
http://www.chips.ibm.com

GreenHills Software, Inc.
30 West Sola Street
Santa Barbara, CA 93101 USA
805 965-6044
http://www.ghs.com

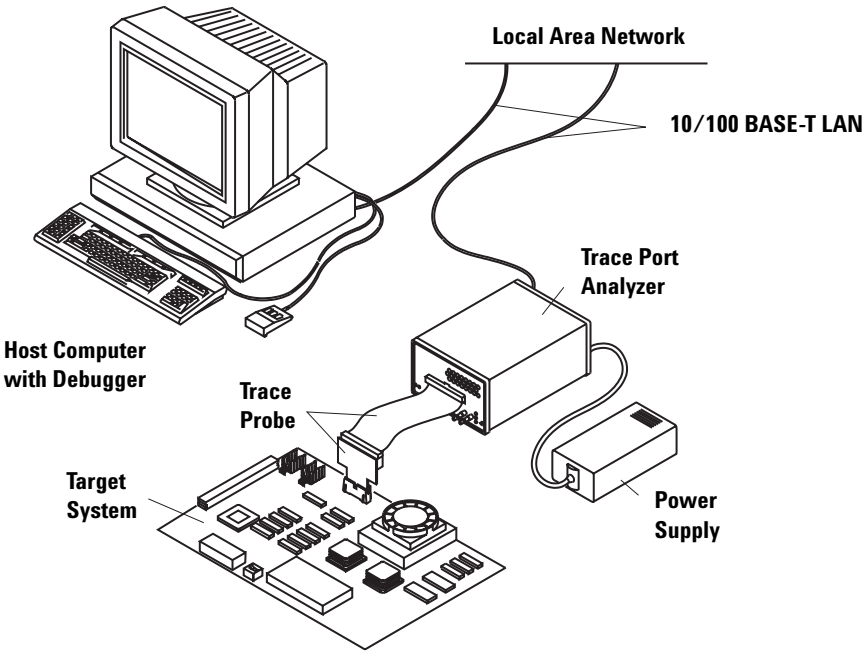


Figure 2. Typical trace port analyzer system.

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Performance Characteristics

JTAG Probe Input Characteristics

Target Connection	38 pin Mictor connector contains both JTAG and trace Status Port signals. Connector pin outs for specific processors can be obtained from http://www.agilent.com
JTAG Configuration	As per IEEE 1149.1 specification
JTAG Clock Frequency	40 MHz maximum, user selectable rate
Download Speed	194 kbytes/sec max

JTAG Input Characteristics

TDO, DBGACK, and RTCK	R_{in} = 4.7 kΩ pull up to V_{ref} C_{in}: TDO = 75 pF, BDGACK = 95 pF, DTCK = 80 pF
TDO Sampling with Respect to TCK	Selectable: falling or rising TCK Minimum required setup and hold window = 7.0 ns t_{su} = 7.5 ns, t_h = -0.5 ns
V_{ref} [1]	R_{in} = 25 kΩ pull down to ground
SRST [2]	R_{in} (inactive) = 4.7 kΩ pull up to V_{ref} R_{in} (active) = 12 Ω pull down to ground C_{out} = 200 pF

JTAG Output Characteristics

TDI, TCK, TMS, TRST, and DBGRQ	Voh/Ioh = 66 ± 15 Ω to V_{ref} Vol/Iol = 66 ± 15 Ω to 0.2 V
Delay	TDI and TMS delay from TCK falling edge to TDI and TMS valid: min 1 ns, max 2.5 ns

Trace Status Port Input Characteristics

Maximum Clock Frequency	200 MHz
Data Setup/Hold Times	1.5/1.0 ns
Trace Depth	4 M maximum, 2 M with time tags
Time Tags	50 bit time tag counter with 9.6 ns resolution
Input Impedance	10 kΩ ± 5% data = 4.0 pF, clock = 6.5 pF
Hot Plugging	Yes

[1] V_{ref} is used to determine the target power status and the reference for input threshold and output voltage swings. The Agilent Emulation probes do not draw power from the target system.

[2] Open collector output. Pulled up to generated voltage equivalent to the V_{ref} voltage with a 2.61 kΩ pull-up resistor.

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Performance Characteristics (continued)

Communications

LAN	RJ-45 connector IEEE 802.3 auto sensing 10/100 BASE-T Ethernet Maximum download speed [3]: 1 Mbyte/sec
Trigger Out	SMB (m) 2 V into 50 Ω load
Break In	SMB (m) input RC = 2 kΩ and 20 pF Edge triggered, TTL level Maximum input = 5 V above VCC

Power

Power	12 V dc, maximum current = 1 A
Power Supply	External module, 100 - 240 V input auto sensing 50/60 Hz, IEC 320 Connector
Operating Voltage	1.8 V to 5.5 V Agilent P/N E5903-66503 buffer board operated from 1.8 V to 3.3 V and Agilent P/N E5903-66502 operates from 3.3 V to 5.5 V

Dimensions

Physical Size	105 mm (4.13 in.) wide x 151 mm (5.94 in.) deep x 62 mm (2.50 in.) high

Environmental

Temperature	Operating: 0° C to +40° C (+32° F to +104° F); Non-operating: -40° C to +60° C (-40° F to +140° F)
Altitude	Operating and non-operating: 4,600 meters (15,000 ft.)
Relative Humidity	80% @ 40° C for 24 hours
Regularity 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 801-3:1994/EN 50082:1993 3 V/m (1 kHz 80% AM, 27-1 kMz); IEC 801-4:1998/EN 50082-1:1992 0.5 kV Sig lines, 1 kV power lines
Safety Approvals	IEC 1010-1:1990; AMD 1:1992; UL 1244; CSA-C22.2 No. 231

[3] Maximum download speed can be limited in specific processor.

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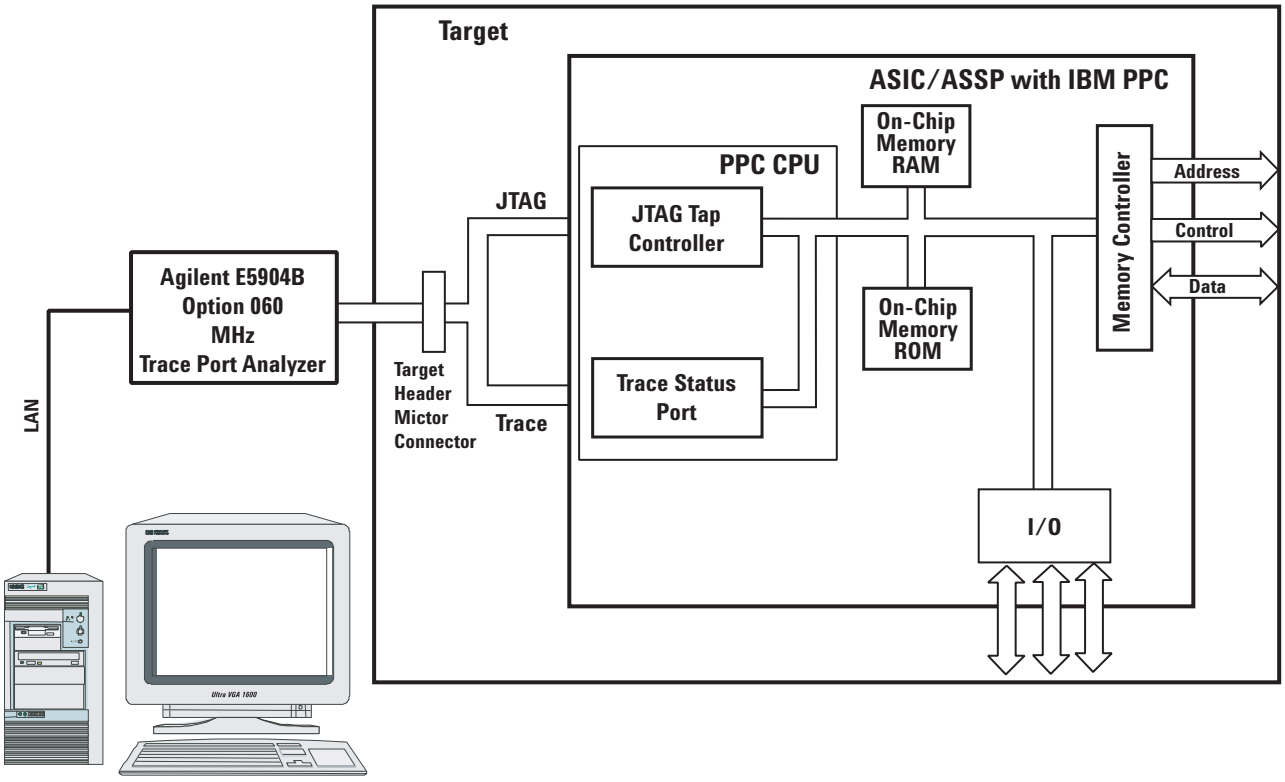


Figure 3. Real-time trace and JTAG emulation with the Agilent trace port analyzer.

Target Requirements and Design Considerations

The Agilent Technologies trace port analyzer connects to the target Mictor header with a probe. If a vertical orientation is used, refer to the user's guide for detail of required height and keep-out distance.

The Mictor connector can be modeled, if needed, as a transmission line with Z = 68 Ω and T pd = 47 pS.

Ordering Information

Part #	Description
E5904B Option 060	200 MHz IBM PowerPC Series 400 Trace Port Analyzer. Includes user's guide, power supply, ac line cord, cable, 1.8 - 3.3 V buffer board, 3.3 - 5.5 V buffer board, and RG-9 LAN cable.

Recommended Accessories

Part #	Description
E5346-68701	5 vertical Mictor headers (AMP part number 2-767004-2) and support shrouds
E5346-44701	Mictor support shroud
8120-5048	SMB (f) to BNC (m) 50 Ω trigger cable 1.22 m (48 in.)

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Related Literature

Publication Title	Publication Type	Publication Number
Agilent Technologies 16700 Series Logic Analysis System	Product overview	5968-9661E

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Other Asia Pacific Countries:
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