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THE DEVELOPMENT SYSTEMS COMPANY

Ashling Product Brief APB162

NEXUS and BDM Debug Ports on Freescale's MPC5500/5xx PowerPC Microprocessors

1 Introduction

Motorola's MPC565 "Spanish Oak" microprocessor for powertrain applications was the first device to incorporate an on-chip debug and trace port in accordance with the NEXUS standard [Ref. 1]. The Nexus 5001 Forum™, which developed the standard, began work in 1998 with the aim of defining a common set of microcontroller on-chip debug features, protocols and interfaces for the development and debugging tools that are used by embedded systems developers [Ref. 2].

Freescale (Motorola) has added to its family of microprocessors with NEXUS debug ports with the introduction of the MPC5554 ("Copperhead") device, and has extended the MPC565 device family with the addition of MPC561 and MPC563.

MPC5554 contains a NEXUS port for debug and trace. The MPC56x devices incorporate both NEXUS and BDM debug ports; they can be debugged using either NEXUS or BDM emulators. With the appropriate probe-cables, Ashling Vitra-MPC56x, Genia-MPC56x and Opella-MPC56x Emulators can debug MPC56x in either mode.

2 Comparison table

NEXUS and BDM Features-Summary			
Behavior	*NEXUS*	*BDM*	*Notes*
Industry standardization	NEXUS standard is defined and maintained by an industry consortium comprising semiconductor vendors, users and tool vendors.	BDM is a de-facto practice defined by Freescale.	
Cross-platform support	NEXUS standard is independent of the target processor (although it allows for implementation-specific cases), and may be applied to any target architecture.	BDM applies to certain Freescale processors only.	
Run-time control debugging	Program-download, run, halt, set breakpoints, set watchpoints, view and change registers and memory.		1
On-the-Fly Memory Read/write	Supported (NEXUS Class 3)	Not supported	2
Code Trace	Supported (NEXUS Class 2)	Not supported	3
Data Trace	Supported (NEXUS Class 3)	Not supported	4
Task Trace	Supported (NEXUS Class 2)	Not supported	5
Debug port physical protocol	JTAG scan-chain	Pseudo-JTAG	6
Connectors	NEXUS standard specifies several connector options	There is no 'official' BDM connector standard, but Freescale has established a de-facto standard 10-pin connector for BDM on MPC555 (and MPC56x).	7

3 Notes

1. Basic debug feature-sets offered by NEXUS Class 1 and BDM are similar.
2. NEXUS Class 3 supports on-the-fly (real-time, while the program executes) non-intrusive reads from and writes to registers and (at least part of) target memory.
3. NEXUS Class 2 supports non-intrusive Code Execution Trace by capturing all changes in sequential program flow (Branch Trace). Ashling's PathFinder Source Debugger interpolates the NEXUS branch-trace execution data to provide a full Program Execution Trace, annotated with the source code.
4. NEXUS Class 3 supports non-intrusive tracing of register and memory reads and writes.
5. NEXUS Class 2 provides the ability to non-intrusively trace and monitor Task execution and profiling. Ashling's products provide real-time, non-intrusive trace and measurement of RTOS Task Mapping, Task Profiling, Event Profiling and Performance Analysis using NEXUS.
6. NEXUS standard specifies a true JTAG (IEEE-1149) scan-chain, that can be extended to test or to debug additional resources on-chip or on-board. Most BDM implementations comply with JTAG physical protocol, but they address one JTAG node only; they do not allow extension of the scan-chain.
7. NEXUS standard offers a choice of connector definitions, to be selected based on size, debug feature-set (for example, inclusion or exclusion of Program or Data tracing), pin-multiplexing and environmental ruggedness.

4 Ashling NEXUS connector options

Ashling supplies a range of Emulator Probe Cable Assemblies that comply with the (updated) NEXUS standard. Probe Cable Assemblies are available for the 50-pin standard (suitable for Axiom's MPC56x evaluation boards with 50-pin NEXUS connector) and for the 51-pin NEXUS Robust connector standard. (A Probe Cable Assembly is also available for Motorola's initial 8MDO/2MDI NEXUS connector, as used on the earlier Axiom MPC565 evaluation board with a 40-pin connector).

In addition, Ashling supplies a BDM (10-pin) probe cable for BDM debugging on MPC555 or MPC565 targets.

5 References

1. "IEEE-ISTO 5001™-2003, The Nexus 5001™ Forum Standard for a Global Embedded Processor Debug Interface". 23rd. Dec 2003. Available at www.Nexus5001.org
2. "The NEXUS Debug Standard: Gateway to the Embedded Systems of the Future", Ashling Microsystems, Aug. 28 2001, available at www.ashling.com/technicalarticles/technicalarticles.html

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