

MPC565 / 566 Nexus Interface Connector Options

By Randy Dees - October 05, 2000

1 INTRODUCTION

A new type of debug interface has been included on the **MPC565 / 566**. In addition to the traditional BDM (Background Debug Mode), the **MPC565 / 566** has a IEEE-ISTO 5001™-1999 Nexus Class 3 interface. The Nexus interface is a new industry standard interface that crosses CPU boundaries and allows industry standard tools to support multiple CPU architectures. The Nexus interface allows a high speed access into the core CPU of a microcontroller to allow advanced debug capability. These advanced debug capabilities include trace without having extensive external circuitry monitoring an external address bus. A Nexus compliant class 2 or greater device allows non-intrusive trace on a microcontroller in "Single Chip" mode or even a microcontroller without an external data and address busses.

Freescale Advanced Vehicle Systems Division's implementation of Nexus standard on the **MPC565 / 566** is called READI (Real-time Embedded Application Development Interface).

2 NEXUS CONNECTOR OPTIONS

The Nexus 1.0 standard defines several different standards for different speed access to a microcontroller in a target system. A 20 pin connector (Nexus connector A) provides a low end interface. On the high end there is an 80 connection (Nexus C connector) that includes a port replacement for the microcontroller signals that are used for the Nexus port. In between, the 1.0 standard has defined 3 options of a 30 pin connection (Nexus B connector option IEEE 1149.1, option 2 Auxiliary Port, and option 3 combined). A new standard 40 pin interface has been proposed for higher performance without having to go to the 80 pin C connector. The 40 pin interface removes the Port Replacement capability and is the recommended for the **MPC565 / 566** Full Port Configuration. See **Table 1 Nexus Connector Options** for a listing of the possible Nexus connector2.

NOTE:

The proposed 40-pin connector has not yet been approved by the IEEE-ISTO 5001™ Forum and is subject to change, but is being put on Freescale Evaluation boards.

Table 1 Nexus Connector Options

Connector	Number of Pins	Connector Part Number	Comments
Connector A	20	AMP, System 50, 20 pin, part #104549-2	Minimum Nexus Configuration
Connector B Option 1 - IEEE 1149.1	30	AMP, System 50, 30 pin, part #104549-5	IEEE 1149.1 configuration
Connector B Option 2 - Auxiliary Port	30	AMP, System 50, 30 pin, part #104549-5	Typical minimum MPC565 / 566 configuration
Connector B Option 3 - Combined	30	AMP, System 50, 30 pin, part #104549-5	Combined IEEE 1149.1 and Auxiliary configuration
MPC565 / 566	40	AMP, System 50, 40 pin, part # 104549-6	Recommended MPC565 / 566 Configuration (Maximum Port Configuration)
Connector C	80	Samtec MOLC Series	Maximum Nexus Port Configuration with Port Replacement

3 MPC565 / 566 NEXUS CONNECTOR OPTIONS

The **MPC565 / 566** supports two options of Nexus connectors (Connector B, option 2 or connector C), plus one option comprised of the proposed 40-pin connector. The preferred interface is the 40-pin Full Port (and high speed) configuration.

3.1 MPC565 / 566 Full Port Configuration

In its maximum configuration, the **MPC565 / 566** supports eight message data outputs with two message data inputs. This provide a maximum throughput of debug information to and from the Nexus tool. See **Table 2 MPC565 / 566 Nexus 40 Pin Definition**. In the full port configuration, this allows transfers from the microcontroller at up to 56 mega-bytes (448 mega-bits) per second (56MHz system clock speed times the 8 bit data output port). Messages into the microcontroller can be transmitted at up to 56 mega-bits per second (one-half the 56 MHz system clock times the 2 bit data input port).

Table 2 MPC565 / 566 Nexus 40 Pin Definition

MPC565 / 566 Ball	MPC565 / 566 Signal	Nexus Auxiliary Signal		Pin	Pin		Nexus Auxiliary Signal	MPC565 / 566 Signal	MPC565 / 566 Ball
AB23	$\overline{\text{HRESET}}$	/RESET	IN ¹	1	2	-	VREF	VCC2.6	VDD
M2	$\overline{\text{EVTI}}$	/EVTI	IN ¹	3	4	-	VALTREF	VSTBY2.6	_2
M3	$\overline{\text{RSTI}}$	/RSTI	IN ³	5	6	IN or OUT	VENDOR_IO1	SGPIOC7_IRQOUT_LWP0	AC14
M4	$\overline{\text{MSEI}}$	/MSEI	IN ¹	7	8	-	GND	GND	-
L4	MCKI	MCKI	IN ¹	9	10	-	GND	GND	-
L1	MDI[0]	MDI0	IN ¹	11	12	-	GND	GND	-
-	-	RESERVED	OUT	13	14	-	GND	GND	-
-	-	RESERVED	OUT	15	16	IN ¹ or OUT	VENDOR_IO2	EPEE & B0EPEE	AF21 & AD20
AF14	$\overline{\text{BG_VF0_LWP1}}$	/EVTO	OUT	17	18	-	GND	GND	-
T2	$\overline{\text{MSEO}}$	/MSEO	OUT	19	20	-	GND	GND	-
P3	MCKO	MCKO	OUT	21	22	-	GND	GND	-
P4	MDO[0]	MDO0	OUT	23	24	-	GND	GND	-
R1	MDO[1]	MDO1	OUT	25	26	-	GND	GND	-
R3	MDO[2]	MDO2	OUT	27	28	-	GND	GND	-
T1	MDO[3]	MDO3	OUT	29	30	-	GND	GND	-
N2	MDO[4]_MPIO[10]	MDO4	OUT	31	32	-	GND	GND	-
N4	MDO[5]_MPIO[9]	MDO5	OUT	33	34	-	GND	GND	-
N3	MDO[6]_MPIO[8]	MDO6	OUT	35	36	-	GND	GND	-
P1	MDO[7]_MPIO[7]	MDO7	OUT	37	38	-	GND	GND	-
L3	MDI[1]	MDI1	IN ¹	39	40	-	GND	GND	-

NOTES:

1. The Nexus standard recommends that inputs should have 10K Ω pull-up resistors to 2.6 volts.
2. These signals depend on system requirements - KAPWR (Y26), VDDSRAM1 (E3), VDDSRAM2 (D2), VDDSRAM3(G4).
3. The Nexus standard recommends that inputs should have 10K Ω pull-up resistors to 2.6 volts. The $\overline{\text{RSTI}}$ input however requires a pull-up value of less than 6.1K Ω .

3.2 MPC565 / 566 Minimum Configuration

In its reduced port configuration, the **MPC565 / 566** supports two message data outputs with one message data input. See **Table 3 MPC565 / 566 Nexus 30 Pin Definition**. In the reduced port configuration, data can be transmitted out of the **MPC565 / 566** at 112 mega-bits per second (at a 56 MHz system clock). Data from the Nexus tool into the **MPC565 / 566** can be transmitted at up to 26 mega-bits per second (at a 56 MHz system clock).

Table 3 MPC565 / 566 Nexus 30 Pin Definition

MPC565 / 566 Ball	MPC565 / 566 Signal	Nexus Auxiliary Signal		Pin	Pin		Nexus Auxiliary Signal	MPC565 / 566 Signal	MPC565 / 566 Ball
AB23	$\overline{\text{HRESET}}$	/RESET	IN ¹	1	2	-	VREF	VCC2.6	-
M2	$\overline{\text{EVTI}}$	/EVTI	IN ¹	3	4	-	GND	GND	-
M3	$\overline{\text{RSTI}}$	/RSTI	IN ²	5	6	-	GND	GND	-
-	-	RESERVED	IN	7	8	-	GND	GND	-
-	MDI[1] ³	MDI1	IN	9	10	-	GND	GND	-
L1	MDI[0]	MDI0	IN ¹	11	12	-	GND	GND	-
L4	MCKI	MCKI	IN ¹	13	14	-	GND	GND	-
M4	$\overline{\text{MSEI}}$	/MSEI	IN ¹	15	16	-	GND	GND	-
-	MDO[3] ³	MDO3	OUT	17	18	-	GND	GND	-
-	MDO[2] ³	MDO2	OUT	19	20	-	GND	GND	-
R1	MDO[1]	MDO1	OUT	21	22	-	GND	GND	-
P4	MDO[0]	MDO0	OUT	23	24	-	GND	GND	-
P3	MCKO	MCKO	OUT	25	26	-	GND	GND	-
T2	$\overline{\text{MSEO}}$	/MSEO	OUT	27	28	-	GND	GND	-
AF14	$\overline{\text{BG_VF0_LWP1}}$	/EVTO	OUT	29	30	-	Vendor Defined	$\overline{\text{SGPIOC7_IRQOUT_LWP0}}$	AC14

NOTES:

1. The Nexus standard recommends that inputs should have 10K Ω pull-up resistors to 2.6 volts.
2. The Nexus standard recommends that inputs should have 10K Ω pull-up resistors to 2.6 volts. The $\overline{\text{RSTI}}$ input however requires a pull-up value of less than 6.1K Ω .
3. This optional signal is not used in the **MPC565 / 566** reduced port configuration.

4 MPC565 / 566 NEXUS SIGNALS

4.1 Nexus Reset - $\overline{\text{HRESET}}$

$\overline{\text{HRESET}}$ is the reset signal into the **MPC565 / 566**. When asserted, it resets the **MPC565 / 566** microcontroller.

4.2 Event Input - $\overline{\text{EVTI}}$

This is the Nexus Event In signal from the Nexus tool. EVTI is level sensitive when it is configured for break-point generation.

4.3 Nexus Reset Input - $\overline{\text{RSTI}}$

$\overline{\text{RSTI}}$ is the Nexus port reset input from the Nexus tool into the **MPC565 / 566** READI module.

4.4 Message Start/End Input - $\overline{\text{MSEI}}$

The Message Start/End Input indicates when a message has started into the **MPC565 / 566** on the MDI pins. It also signals the end of the message packet.

4.5 Message Clock Input - MCKI

This is the Message Clock Input from the Nexus tool into the **MPC565 / 566**. It should be up to one-half of the system clock frequency.

4.6 Message Data Input - MDI[0:1]

The Message Data Input pins provide data input from the Nexus tool into the **MPC565 / 566**. In the reduced Port configuration, only the MDI[0] signal is used.

4.7 Nexus /EVTO - MPC565 / 566 $\overline{\text{BG_VF0_LWP1}}$

Normally this is Nexus Event Out and indicates that the processor has halted in response to a $\overline{\text{EVTI}}$ signal. On the **MPC565 / 566** an alternate use of this pin has been defined. EVTO is connected to the **MPC565 / 566** RCPU L-Bus watchpoint 1 pin. This indicates that the RCPU has reached an L-bus watchpoint.

4.8 Nexus /MSEO - MPC565 / 566 $\overline{\text{MSEO}}$

This is the Message Start/End Output that indicates that a MDO signal has started and when a MDO packet has ended.

4.9 Message Clock Output - MCKO

This is the Nexus Message Clock output from the **MPC565 / 566** to the Nexus tool that provides timing for the MDO and MSEO signals. The frequency of this clock is the same as the **MPC565 / 566** operating system frequency.

4.10 Message Data Output - MDO[0:3]

These pins are the Message Data Output signals zero through three from the **MPC565 / 566** to the Nexus device. In the reduced port configuration, only MDO[0:1] are used. In the full port configuration, MDO[0:7] are used for the message data output.

4.11 Message Data Output - Nexus MDO[4:7] - MPC565 / 566 MDO[4:7]_MPIO[7:10]

In a Nexus minimum configuration these pins are not used. In full port configuration, these pins are used as Message Data Outputs 4 through 7 to provide an eight bit output port to the Nexus tool. On the **MPC565 / 566**, these pins are shared with the MIOS14 General Purpose Parallel Port. The Nexus pins are automatically selected in the MIOS14 if the READI module is enabled and configured for the Full Port Configuration.

4.12 Nexus VENDOR_IO1 - MPC565 / 566 SGPIOC_ $\overline{\text{IRQOUT}}$ _LWP0

Vendor_IO1 has been defined to be used as the **MPC565 / 566** RCPU L-bus Watchpoint signal 0.

4.13 Nexus VENDOR_IO2 - MPC565 / 566 EPEE & B0EPEE

Vendor_IO2 has been defined to be the Flash enable signals to enable programming of the **MPC565 / 566** internal flash. This signal should drive both pins of the **MPC565 / 566**. EPEE is the internal flash enable and B0EPEE is the block 0 flash erase enable.

4.14 Voltage Reference - Nexus VREF - MPC565 / 566 VCC2.6

This pin provides the Nexus tool a reference for the signal levels of the Nexus device. All input high and low voltages should be referenced to this pin. The Nexus specification defines the input voltages as $V_{IL} = 0.3 \times V_{REF}$ and $V_{IH} = 0.7 \times V_{REF}$. For the **MPC565 / 566**, this pin should be approximately 2.6 volts. All signals in and out of the **MPC565 / 566** are 2.6 volt signals.

4.15 Nexus VALTREF - MPC565 / 566 VSTBY2.6

The Nexus VALTREF is defined to be used as the standby power for the **MPC565 / 566**. VSTBY2.6 provides a backup power supply to provide standby power for the **MPC565 / 566** SRAM.

4.16 GND

This is the ground reference point for the Nexus connectors. Many ground signals are included to provide shielding for the high speed Nexus signals.

5 MPC565 / 566 READI PORT CONFIGURATION

The READI port is enabled on the rising edge of $\overline{\text{RSTI}}$ by asserting the $\overline{\text{EVTI}}$ pin. The selection of reduced Port Configuration or Full Port Configuration is determined by the state of MDI[0] upon the negation of $\overline{\text{RSTI}}$. Note that $\overline{\text{EVTI}}$ and MDI[0] must be valid at least 4 clocks prior to the rising edge of $\overline{\text{RSTI}}$. $\overline{\text{RSTI}}$ has an internal pull-down resistor that must be overcome to enable the READI Nexus Module.

Table 4 READI Reset Configuration Options

$\overline{\text{EVTI}}$	MDI[0]	Configuration
1	X	READI Module Disabled. All outputs are three-stated.
0	1	READI Module Enabled. Default Port Configuration - 2 MDI and 8 MDO
0	0	READI Module Enabled. Reduced Port Configuration - 1 MDI and 2 MDO



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