Freescale Semiconductor
Technical Data

Document Number: MPC7448ECS01AD
Rev. 6, 3/2007

MPC7448 Hardware Specifications Addendum for the MC7448*xxnnnn*N*x* Series

This document describes part-number-specific changes to recommended operating conditions and revised electrical specifications, as applicable, from those described in the general *MPC7448 RISC Microprocessor Hardware Specifications*. The MPC7448, built on Power Architecture™ technology, implements the PowerPC™ instruction set architecture version 1.0.

Specifications provided in this document supersede those in the *MPC7448 RISC Microprocessor Hardware Specifications*, Rev. 3 or later, for the part numbers listed in Table A only. Specifications not addressed herein are unchanged. Because this document is frequently updated, refer to the website on the back page of this document or to your Freescale sales office for the latest version.

Note that headings and table numbers in this document are not consecutively numbered. They are intended to correspond to the heading or table affected in the general hardware specification.

Part numbers addressed in this document are listed in Table A.

Freescale Part Numbers Affected:

MC7448HX600Nx	*PPC7448HX600Nx*
MC7448VS600Nx	*PPC7448VS600Nx*
MC7448VU600Nx	*PPC7448VU600Nx*
MC7448HX667Nx	*PPC7448HX667Nx*
MC7448VS667Nx	*PPC7448VS667Nx*
MC7448VU667Nx	*PPC7448VU667Nx*
MC7448HX800Nx	*PPC7448HX800Nx*
MC7448VS800Nx	*PPC7448VS800Nx*
MC7448VU800Nx	*PPC7448VU800Nx*
MC7448HX867Nx	*PPC7448HX867Nx*
MC7448VS867Nx	*PPC7448VS867Nx*
MC7448VU867Nx	*PPC7448VU867Nx*
MC7448HX1000Nx	*PPC7448HX1000Nx*
MC7448VS1000Nx	*PPC7448VS1000Nx*
MC7448VU1000Nx	*PPC7448VU1000Nx*
MC7448HX1250Nx	*PPC7448HX1250Nx*
MC7448VS1250Nx	*PPC7448VS1250Nx*
MC7448VU1250Nx	*PPC7448VU1250Nx*
MC7448HX1267Nx	*PPC7448HX1267Nx*
MC7448VS1267Nx	*PPC7448VS1267Nx*
MC7448VU1267Nx	*PPC7448VU1267Nx*
MC7448HX1400Nx	*PPC7448HX1400Nx*
MC7448VS1400Nx	*PPC7448VS1400Nx*
MC7448VU1400Nx	*PPC7448VU1400Nx*

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Table A. Part Numbers Addressed by This Data Sheet

Freescale Part Number	Operating Conditions			Significant Differences from Hardware Specifications
	CPU Frequency (MHz)	V_{DD}	T_j (•C)	
MC7448HX600N*x*	600	1.0 V ± 50 mV	0 to 105	Modified core frequency and voltage to reduce power consumption.
MC7448HX667N*x*	667	1.0 V ± 50 mV		
MC7448HX800N*x*	800	1.0 V ± 50 mV		
MC7448HX867N*x*	867	1.0 V ± 50 mV		
MC7448HX1000N*x*	1000	1.0 V ± 50 mV		
MC7448HX1250N*x*	1250	1.1 V ± 50 mV		
MC7448HX1267NC	1267	1.1 V ± 50 mV		
MC7448HX1267ND	1267	1.05 V ± 50 mV		
MC7448HX1400N*x*	1400	1.15 V ± 50 mV [2]		
MC7448VS600N*x*	600	1.0 V ± 50 mV		
MC7448VS667N*x*	667	1.0 V ± 50 mV		
MC7448VS800N*x*	800	1.0 V ± 50 mV		
MC7448VS867N*x*	867	1.0 V ± 50 mV		
MC7448VS1000N*x*	1000	1.0 V ± 50 mV		
MC7448VS1250N*x*	1250	1.1 V ± 50 mV		
MC7448VS1267NC	1267	1.1 V ± 50 mV		
MC7448VS1267ND	1267	1.05 V ± 50 mV		
MC7448VS1400N*x*	1400	1.15 V ± 50 mV [2]		
MC7448VU600N*x*	600	1.0 V ± 50 mV		
MC7448VU667N*x*	667	1.0 V ± 50 mV		
MC7448VU800N*x*	800	1.0 V ± 50 mV		
MC7448VU867N*x*	867	1.0 V ± 50 mV		
MC7448VU1000N*x*	1000	1.0 V ± 50 mV		
MC7448VU1250N*x*	1250	1.1 V ± 50 mV		
MC7448VU1267NC	1267	1.1 V ± 50 mV		
MC7448VU1267ND	1267	1.05 V ± 50 mV		
MC7448VU1400N*x*	1400	1.15 V ± 50 mV [2]		
PPC7448HX600N*x* [1]	600	1.0 V ± 50 mV		
PPC7448HX667N*x* [1]	667	1.0 V ± 50 mV		
PPC7448HX800N*x* [1]	800	1.0 V ± 50 mV		
PPC7448HX867N*x* [1]	867	1.0 V ± 50 mV		
PPC7448HX1000N*x* [1]	1000	1.0 V ± 50 mV		
PPC7448HX1250N*x* [1]	1250	1.1 V ± 50 mV		
PPC7448HX1267NC [1]	1267	1.1 V ± 50 mV		

Table A. Part Numbers Addressed by This Data Sheet (continued)

Freescale Part Number	Operating Conditions			Significant Differences from Hardware Specifications
	CPU Frequency (MHz)	V_{DD}	T_j (•C)	
PPC7448HX1267ND [1]	1267	1.05 V ± 50 mV	0 to 105	Modified core frequency and voltage to reduce power consumption.
PPC7448HX1400N*x* [1]	1400	1.1 V ± 50 mV [2]		
PPC7448VS600N*x* [1]	600	1.0 V ± 50 mV		
PPC7448VS667N*x* [1]	667	1.0 V ± 50 mV		
PPC7448VS800N*x* [1]	800	1.0 V ± 50 mV		
PPC7448VS867N*x* [1]	867	1.0 V ± 50 mV		
PPC7448VS1000N*x* [1]	1000	1.0 V ± 50 mV		
PPC7448VS1250N*x* [1]	1250	1.1 V ± 50 mV		
PPC7448VS1267NC [1]	1267	1.1 V ± 50 mV		
PPC7448VS1267ND [1]	1267	1.05 V ± 50 mV		
PPC7448VS1400N*x* [1]	1400	1.1 V ± 50 mV [2]		
PPC7448VU600N*x* [1]	600	1.0 V ± 50 mV		
PPC7448VU667N*x* [1]	667	1.0 V ± 50 mV		
PPC7448VU800N*x* [1]	800	1.0 V ± 50 mV		
PPC7448VU867N*x* [1]	867	1.0 V ± 50 mV		
PPC7448VU1000N*x* [1]	1000	1.0 V ± 50 mV		
PPC7448VU1250N*x* [1]	1250	1.1 V ± 50 mV		
PPC7448VU1267NC [1]	1267	1.1 V ± 50 mV		
PPC7448VU1267ND [1]	1267	1.05 V ± 50 mV		
PPC7448VU1400N*x* [1]	1400	1.1 V ± 50 mV [2]		

Notes:

1. The P prefix in a Freescale part number designates a “Pilot Production Prototype” as defined by Freescale SOP 3-13. These parts have only preliminary reliability and characterization data. Before pilot production prototypes can be shipped, written authorization from the customer must be on file in the applicable sales office acknowledging the qualification status and the fact that product changes may still occur as pilot production prototypes are shipped.
2. See Section 5.1, “DC Electrical Characteristics,” for information regarding V_{DD} specifications for 1400 MHz devices.

4 General Parameters

Core power supply	1.15 V	(1400 MHz devices)
	1.1 V	(1267, 1250 MHz devices)
	1.05 V	(1267 MHz revision level D devices only, See Table 17.)
	1.0 V	(1000, 867, 800, 667, 600 MHz devices)

Note: See Section 5.1, "DC Electrical Characteristics," for information regarding V_{DD} specifications for 1400 MHz devices.

5.1 DC Electrical Characteristics

Table 4 provides the recommended operating conditions for the MPC7448 part numbers described here.

NOTE

Table 4 describes the nominal operating conditions of the device. For information on the operation of the device at supported derated core voltage conditions, see Section 5.3, "Voltage and Frequency Derating."

Table 4. Recommended Operating Conditions [1]

Characteristic	Symbol	Recommended Value				Unit	Notes
		600 MHz, 667 MHz, 800 MHz, 867 MHz, 1000 MHz	1250 MHz, 1267 MHz[3] Revision Level C for 1267 only	1267 MHz[3] Revision Level D only	1400 MHz [3, 4]		
Core supply voltage	V_{DD}	1.0 V ± 50 mV	1.1 V ± 50 mV	1.05 V ± 50 mV	1.15 V ± 50 mV	V	
PLL supply voltage	AV_{DD}	1.0 V ± 50 mV	1.1 V ± 50 mV	1.05 V ± 50 mV	1.15 V ± 50 mV	V	2

Notes:

1. These are the recommended and tested operating conditions. Some speed grades in addition support voltage derating; see Section 5.3, "Voltage and Frequency Derating." Proper device operation outside of these conditions and those specified in Section 5.3, "Voltage and Frequency Derating," is not guaranteed.
2. This voltage is the input to the filter discussed in Section 9.2.2, "PLL Power Supply Filtering," in the hardware specifications and not necessarily the voltage at the AV_{DD} pin, which may be reduced from V_{DD} by the filter.
3. V_{DD} and AV_{DD} may be reduced in order to reduce power consumption if further maximum core frequency constraints are observed. See Section 5.3, "Voltage and Frequency Derating," for specific information.
4. Effective for 1400 MHz devices with date code of 0613 and later; this includes all devices with the 'PPC' product code. V_{DD} and AV_{DD} were specified at 1.1V ± 50 mV for 1400 MHz devices with date code 0612 and prior. See Section 11, "Part Numbering and Marking," for more information.

Table 7 provides the power consumption for the MPC7448 part numbers described by this document; see Section 11.1, “Part Numbers Addressed by This Specification,” for more information. The *MPC7448 RISC Microprocessor Hardware Specifications* presents guidelines on the use of these parameters for system design. For information on power consumption when dynamic frequency switching is enabled, see Section 9.8.5, “Dynamic Frequency Switching (DFS),” in the hardware specifications.

The power consumptions provided in Table 7 represent the power consumption of each speed grade when operated at the rated maximum core frequency (see Table 8). Freescale sorts devices by power as well as by core frequency, and power limits for each speed grade are independent of each other. Each device is tested at its maximum core frequency only. (Note that Deep Sleep Mode power consumption is independent of clock frequency.) Operating a device at a frequency lower than its rated maximum is fully supported provided the clock frequencies are within the specifications given in Table 8, and a device operated at a core frequency below its rated maximum will have lower power consumption. However, inferences should not be made about a device’s power consumption based on the power specifications of another (lower) speed grade. For example, a 1267 MHz device operated at 1000 MHz may not exhibit the same power consumption as a 1000 MHz device operated at 1000 MHz.

NOTE

The power consumption information in this table applies when the device operates at the nominal core voltage indicated in Table 4. For power consumption at derated core voltage conditions, see Section 5.3, “Voltage and Frequency Derating.”

Table 7. Power Consumption for MPC7448 at Maximum Rated Frequency

	Die Junction (T_j) (•C)	Maximum Processor Core Frequency (Speed Grade, MHz)						Unit	Notes
		600, 667	800, 867	1000	1250	1267 [7]	1400		
Full-Power Mode									
Typical, Nominal	65	8.5	9.0	9.5	10.0	8.4	11.0	W	1, 2
Typical, Thermal	105	10.8	11.4	12.0	12.6	10.3	13.7	W	1, 5
Maximum	105	12.5	13.2	13.9	14.6	12.0	15.9	W	1, 3
Nap Mode									
Typical	105	6.5	6.5	6.5	8.3	6.5	8.3	W	1, 6
Sleep Mode									
Typical	105	6.3	6.3	6.3	8.0	6.3	8.0	W	1, 6
Deep Sleep Mode (PLL Disabled)									
Typical	105	6.0	6.0	6.0	7.7	6.0	7.7	W	1, 6

Notes:

1. These values specify the power consumption for the core power supply (V_{DD}) at nominal voltage and apply to all valid processor bus frequencies and configurations. The values do not include I/O supply power (OV_{DD}) or PLL supply power (AV_{DD}). OV_{DD} power is system dependent but is typically < 5% of V_{DD} power. Worst case power consumption for AV_{DD} < 13 mW.
2. Typical nominal power consumption is an average value measured at the nominal recommended V_{DD} (see Table 4) and 65°C while running the Dhrystone 2.1 benchmark and achieving 2.3 Dhrystone MIPs/MHz. This parameter is not 100% tested but periodically sampled.
3. Maximum power consumption is the average measured at nominal V_{DD} and maximum operating junction temperature (see Table 4) while running an entirely cache-resident, contrived sequence of instructions to keep all the execution units maximally busy.
4. Doze mode is not a user-definable state; it is an intermediate state between full-power and either nap or sleep mode. As a result, power consumption for this mode is not tested.
5. Typical thermal power consumption is an average value measured at the nominal recommended V_{DD} (see Table 4) and 105°C while running the Dhrystone 2.1 benchmark and achieving 2.3 Dhrystone MIPs/MHz. This parameter is not 100% tested but periodically sampled.
6. Typical power consumption for these modes is measured at the nominal recommended V_{DD} (see Table 4) and 105°C in the mode described. This parameter is not 100% tested but is periodically sampled.
7. Power consumption for the 1267 MHz device is intentionally constrained via testing and sorting to assure low power consumption for this device.

5.2.1 Clock AC Specifications

Table 8 provides the clock AC timing specifications for the MPC7448 part numbers discussed here.

NOTE

The core frequency information in this table applies when the device operates at the nominal core voltage indicated in Table 4. For core frequency specifications at derated core voltage conditions, see Section 5.3, "Voltage and Frequency Derating."

Table 8. Clock AC Timing Specifications

At recommended operating conditions. See Table 4.

Characteristic	Symbol	Maximum Processor Core Frequency (MHz)																Unit	Notes
		600		667		800		867		1000		1250		1267		1400			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Processor frequency DFS mode disabled	f_{core}	500	600	500	667	500	800	500	867	500	1000	500	1250	500	1267	500	1400	MHz	1, 8, 9
Processor frequency DFS mode enabled	f_{core_DFS}	250	300	250	333	250	400	250	433	250	500	250	625	250	633	250	700	MHz	10
VCO frequency	f_{VCO}	500	600	500	667	500	800	500	867	500	1000	500	1250	500	1267	500	1400	MHz	1, 9

Notes:

1. **Caution**: The SYSCLK frequency and PLL_CFG[0:5] settings must be chosen such that the resulting SYSCLK (bus) frequency, processor core frequency, and PLL (VCO) frequency do not exceed their respective maximum or minimum operating frequencies. Refer to the PLL_CFG[0:5] signal description in Section 9.1.1, "PLL Configuration," in the hardware specifications for valid PLL_CFG[0:5] settings.
8. This reflects the maximum and minimum core frequencies when the dynamic frequency switching feature (DFS) is disabled. f_{core_DFS} provides the maximum and minimum core frequencies in a DFS mode.
9. **Caution**: These values specify the maximum processor core and VCO frequencies when the device is operated at the nominal core voltage. If operating the device at the derated core voltage, the processor core and VCO frequencies must be reduced. See Section 5.3, "Voltage and Frequency Derating," for more information.
10. This specification supports the Dynamic Frequency Switching (DFS) feature and is applicable only when one of the DFS modes (divide-by-2 or divide-by-4) is enabled. When DFS is disabled, the core frequency must conform to the maximum and minimum frequencies stated for f_{core}.

5.3 Voltage and Frequency Derating

To reduce power consumption, these devices support voltage and frequency derating in which the core voltage (V_{DD}) may be reduced if the reduced maximum processor core frequency requirements are observed. The supported derated core voltage, resulting maximum processor core frequency (f_{core}), and power consumption are provided in Table 11. Only those parameters in Table 11 are affected; all other parameter specifications are unaffected.

Table 11. Supported Voltage, Core Frequency, and Power Consumption Derating

Maximum Rated Core Frequency (Device Marking)	Supported Derated Core Voltage (V_{DD})	Maximum Derated Core Frequency (f_{core})	Full-Power Mode Power Consumption		
			Typical	Thermal	Maximum
600	N/A				
667	N/A				
800	N/A				
867	N/A				
1000	N/A				
1250	N/A				
1267	1.0 V ± 50 mV	1000 MHz	6.0 W	7.3 W	8.5 W
1400	1.0 V ± 50 mV	1000 MHz	8.0 W	9.9 W	11.5 W

9.2 Power Supply Design and Sequencing

The power supply design and sequencing requirements of the devices described here are identical to those described in the *MPC7448 RISC Microprocessor Hardware Specifications*.

11 Part Numbering and Marking

11.1 Part Numbers Addressed by This Specification

Table 17 provides the ordering information for the MPC7448 parts described in this document.

Table 17. Part Marking Nomenclature

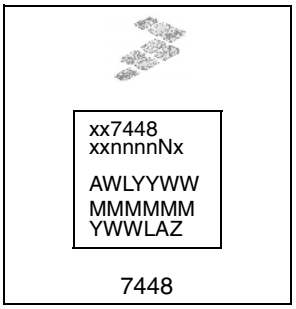
xx	**7448**	***xx***	***nnnn***	**N**	***x***
Product Code	**Part Identifier**	**Package**	**Processor Frequency**	**Application Modifier**	**Revision Level**
MC PPC [1]	7448	HX = HCTE BGA VS = RoHS LGA VU = RoHS BGA	600 667 800 867 1000	N: 1.0 V ± 50 mV 0 to 105°C	C:2.1: PVR = 0x8004_0201 D:2.2: PVR = 0x8004_0202
			1250	N: 1.1 V ± 50 mV 0 to 105°C	
MC PPC [1]			1267 Revision C only	N: 1.1 V ± 50 mV 0 to 105°C	
MC PPC [1]			1267 Revision D only	N: 1.05 V ± 50 mV 0 to 105°C	
MC			1400	N: 1.15 V ± 50 mV 0 to 105°C (date code 0613 and later) [2]	
MC PPC [1]			1400	N: 1.1 V ± 50 mV 0 to 105°C (date code 0612 and prior) [2]	

Notes:

1. The P prefix in a Freescale part number designates a “Pilot Production Prototype” as defined by Freescale SOP 3-13. These parts have only preliminary reliability and characterization data. Before pilot production prototypes can be shipped, written authorization from the customer must be on file in the applicable sales office acknowledging the qualification status and the fact that product changes may still occur as pilot production prototypes are shipped.
2. Core voltage for 1400 MHz devices currently in production (date code of 0613 and later) is 1.15 V ± 50 mV; all such devices have the MC product code. The 1400 MHz devices with date code of 0612 and prior specified core voltage of 1.1 V ± 50 mV; this includes all 1400 MHz devices with the PPC product code. See Section 11.3, “Part Marking,” for information on part marking.

11.3 Part Marking

Parts are marked as the example shown in Figure 23.



BGA/LGA

Notes:

AWLYYWW is the test code, where YYWW is the date code (YY = year, WW = work week)
MMMMMM is the M00 (mask) number.
YWWLAZ is the assembly traceability code.

Figure 23. Part Marking for BGA/LGA Device

Document Revision History

Table B provides a revision history for this part number specification.

Table B. Document Revision History

Revision	Date	Substantive Change(s)
6	3/2007	Added MC7448HX800N*x*, MC7448VS800N*x*, MC7448VU800N*x*, PPC7448HX800N*x*, PPC7448VS800N*x*, and PPC7448VU800N*x* to the first page list of Freescale Part Numbers Affected. Table A: Added MC7448HX800Nx, MC7448VS800Nx, MC7448VU800Nx, PPC7448HX800Nx, PPC7448VS800Nx, and PPC7448VU800Nx rows. Section 4, “General Parameters”: Added 800 MHz information. Table 4: Added 800 MHz to the 600 - 1000 MHz column. Table 7: Combined 600 MHz and 667 MHz columns (same specifications); added 800 MHz to 867 MHz column (same specifications). Table 8: Added 800 MHz column with associated specifications. Table 11: Added 800 MHz row. Table 17: Added 800 MHz to the 600 - 1000 MHz Processor Frequency cell.
5	10/2006	Added revision level D device information. Table A and in list of Freescale Part Numbers Affected on first page: x stands for C or D revision level. Added PPC7448HX1267N*x*, PPC7448VS1267N*x*, and PPC7448VU1267N*x* to the first page list of Freescale Part Numbers Affected. Table A: Added PPC7448HX1267NC, PPC7448HX1267ND, PPC7448VS1267NC, PPC7448VS1267ND, PPC7448VU1267NC, and PPC7448VU1267ND rows. Section 4, “General Parameters”: Added 1267 MHz revision level D information. Table 4: Added 1267 MHz revision D only column. Table 17: Removed specification modifier ‘T’ column. Table 17: Added PVR and 1267 information for revision level D. Figure 23: Removed ‘T’ from part numbering.
4	6/2006	Added support for voltage and frequency derating for 1267 MHz devices.
3	4/2006	Added 1267 MHz device.
		Increased V_{DD} and AV_{DD} specifications for 1400 MHz devices with date code 0613 and later.
2	1/2006	Table 7: Corrected processor frequency from 867 MHz to 667 MHz (867 MHz appeared twice) so that top row shows 600 MHz, 667 MHz, 867 MHz, 1000 MHz, 1250 MHz, 1400 MHz.
1	12/2005	Table 7: Added power specifications for low power modes and for Typical – Thermal condition, changed name of “Typical” power specification to “Typical – Nominal”. Table 8: Added minimum core frequency and DFS mode frequency information. Table 11: Added voltage derating information for 1400 MHz devices; this feature is not supported at this time for other speed grades. Added Section 9.3 (for clarification only). Table 17: Corrected part revision information, added “PPC” product code prefix.
0	9/2005	Initial release.

How to Reach Us:

Home Page:
www.freescale.com

email:
support@freescale.com

USA/Europe or Locations Not Listed:
Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
1-800-521-6274
480-768-2130
support@freescale.com

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku
Tokyo 153-0064, Japan
0120 191014
+81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate,
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

For Literature Requests Only:
Freescale Semiconductor
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