MPC755 RISC Microprocessor Hardware Specifications Addendum for the XPC755B*xxnnn*T*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 *MPC755 RISC Microprocessor Hardware Specifications*. The MPC755 and MPC745 are reduced instruction set computing (RISC) microprocessors that implement the PowerPC™ instruction set architecture.

Specifications provided in this document supersede those in the *MPC755 RISC Microprocessor Hardware Specifications*, Rev. 4 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 listed on the back cover of this addendum or contact 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.

Freescale Part Numbers Affected:

XPC755BRX350TD
XPC755BRX400TD
XPC755BRX350TE
XPC755BRX400TE

freescale™
semiconductor

Part numbers addressed in this document are listed in Table A. For more detailed ordering information see Section 10, "Ordering Information." Note that significant differences exist between Rev. 2.7 (Rev. D) and Rev. 2.8 (Rev. E) devices. All such differences are detailed in this specification.

Table A. Significant Differences from Hardware Specifications by Part Number

| Freescale Part Number[1] | Operating Conditions | | | Significant Differences from Hardware Specification |
	CPU Frequency (MHz)	V_{DD}[2]	T_J (°C)	
XPC755BRX350TD	350	2.0 V ±100 mV	−40 to 105	Extended operating temperature; 2.0 V/1.8 V I/O voltage supported, 2.5 V I/O not supported; all nominal core voltages are 2.0 V ± 100 mV; AC timing different for processor bus and L2 bus interfaces; L2 bus interface AC timing not guaranteed in 1.8 V/2.0 V mode.
XPC755BRX400TD	400			
XPC755BRX350TE	350			Extended operating temperature
XPC755BRX400TE	400			

Notes:
1. The X prefix in a Freescale PowerPC part number designates a "Pilot Production Prototype" as defined by Freescale SOP 3-13. These are from a limited production volume of prototypes manufactured, tested, and Q.A. inspected on a qualified technology to simulate normal production. These parts have only preliminary reliability and characterization data. Before pilot production prototypes may 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 while shipping pilot production prototypes.
2. Nominal. See Table 3 for recommended operating conditions

There are currently no known errata for the part numbers addressed by this document.

3 General Parameters

The general parameters that follow apply to the part numbers described herein:

Core power supply   2.0 V ±100 mV DC (nominal; see Table 3 for recommended operating conditions)

I/O power supply   1.8 V ±100 mV DC (processor bus interface only; not supported on L2 interface; XPC755BRX350TD and XPC755BRX400TD only), or

2.0 V ±100 mV DC (processor bus interface only; not supported on L2 interface; XPC755BRX350TD and XPC755BRX400TD only), or

2.5 V ±125 mV DC (XPC755BRX350TE and XPC755BRX400TE only), or

3.3 V ±165 mV DC

4.1 DC Electrical Characteristics

The Rev. D devices support 3.3 V and 1.8 V/2.0 V I/O voltages, but do not support the 2.5 V I/O voltages supported by Rev. E devices. Note that Rev. E devices do not support 1.8 V/2.0 V I/O. Table 2 describes

the input threshold voltage settings. Though unchanged from the *MPC755 RISC Microprocessor Hardware Specifications*, input threshold voltage settings for Rev. E devices are also included for clarity.

Table 2. Input Threshold Voltage Setting

BVSEL Signal	Processor Bus Interface Voltage		L2VSEL Signal	L2 Bus Interface Voltage	
	XPC755RX350TD XPC755RX400TD	XPC755RX350TE XPC755RX400TE		XPC755RX350TD XPC755RX400TD	XPC755RX350TE XPC755RX400TE
0	1.8 V or 2.0 V	N/A	0	1.8 V or 2.0 V	N/A
1	3.3 V	2.5 V or 3.3 V	1	3.3 V	2.5 V or 3.3 V

Caution: The input threshold selection must agree with the OV_{DD}/$L2OV_{DD}$ voltages supplied.

Table Table 3 provides the recommended operating conditions for Rev. D devices. Though unchanged from the *MPC755 RISC Microprocessor Hardware Specifications*, recommended operating conditions for Rev. E devices are also included for clarity.

Table 3. Recommended Operating Conditions[1]

Characteristic		Symbol	Recommended Value			Unit	Notes
			XPC755RX350TD XPC755RX400TD	XPC755RX350TE	XPC755RX400TE		
Core supply voltage		V_{DD}	2.0 ±100 mV	1.9-2.0 ±100 mV	2.0 ±100 mV	V	2
PLL supply voltage		AV_{DD}	2.0 ±100 mV	1.9-2.0 ±100 mV	2.0 ±100 mV	V	2
L2 DLL supply voltage		$L2AV_{DD}$	2.0 ±100 mV	1.9-2.0 ±100 mV	2.0 ±100 mV	V	2
Processor bus supply voltage	BVSEL = 0	OV_{DD}	1.8 ±100 mV or 2.0 ±100 mV	N/A		V	
	BVSEL = 1	OV_{DD}	3.3 ±165 mV	3.3 ±165 mV or 2.5V ±125 mV		V	
L2 bus supply voltage	L2VSEL = 0	$L2OV_{DD}$	1.8 ±100 mV or 2.0 ±100 mV	N/A		V	
	L2VSEL = 1	$L2OV_{DD}$	3.3 ±165 mV	3.3 ±165 mV or 2.5V ±125 mV		V	
Die junction temperature		T_j	−40 to 105			°C	

Notes:

1. These are the recommended and tested operating conditions. Proper device operation outside of these conditions is not guaranteed.
2. 2.0 V nominal.

Table 6 provides the DC electrical specifications for Rev. D devices. Though unchanged from the *MPC755 RISC Microprocessor Hardware Specifications*, the DC electrical specifications for Rev. E devices are also included for clarity. Also note that the AC timing specifications given for Rev. E devices are guaranteed for both 2.5 V and 3.3 V operation.

Table 6. DC Electrical Specifications

At recommended operating conditions (see Table 3)

Characteristic	Nominal Bus Voltage[1]	Symbol	Min	Max	Unit	Notes
Input high voltage (all inputs except SYSCLK)	1.8/2.0	V_{IH}	$0.65 \times (L2)OV_{DD}$	$(L2)OV_{DD} + 0.3$	V	2,3,4
	2.5		1.6	$(L2)OV_{DD} + 0.3$		5
	3.3		2.0	$(L2)OV_{DD} + 0.3$		2,3
Input low voltage (all inputs except SYSCLK)	1.8/2.0	V_{IL}	−0.3	$0.35 \times (L2)OV_{DD}$	V	2,4
	2.5		−0.3	0.6		5
	3.3		−0.3	0.8		
SYSCLK input high voltage	1.8/2.0	KV_{IH}	1.5	$OV_{DD} + 0.3$	V	4
	2.5		1.8	$OV_{DD} + 0.3$		5
	3.3		2.4	$OV_{DD} + 0.3$		
SYSCLK input low voltage	1.8/2.0	KV_{IL}	−0.3	0.2	V	4
	2.5		−0.3	0.4		5
	3.3		−0.3	0.4		
Output high voltage, $I_{OH} = -6$ mA	1.8/2.0	V_{OH}	$(L2)OV_{DD} - 0.45$	—	V	4
	2.5		1.7	—		5
	3.3		2.4	—		
Output low voltage, $I_{OL} = 6$ mA	1.8/2.0	V_{OL}	—	0.45	V	4
	2.5		—	0.45		5
	3.3		—	0.4		

Notes:

1. Nominal voltages; see Table 3 for recommended operating conditions.

2. For processor bus signals, the reference is OV_{DD}. $L2OV_{DD}$ is the reference for the L2 bus signals.

3. Excludes test signals (LSSD_MODE, L1_TSTCLK, L2_TSTCLK) and IEEE 1149.1 boundary scan (JTAG) signals.

4. XPC755BRX350TD and XPC755BRX400TD only.

5. XPC755BRX350TE and XPC755BRX400TE only.

4.2.2 Processor Bus AC Specifications

All Rev. D part numbers have slower AC timing characteristics than later revisions of the part. The affected processor bus AC timing specifications are given in Table 10. Though unchanged from the *MPC755 RISC Microprocessor Hardware Specifications*, the AC timing characteristics for Rev. E devices are also included for clarity.

Table 10. Processor Bus AC Timing Specifications

At recommended operating conditions (see Table 3)

Parameter	Symbol	XPC755BRX350TD XPC755BRX400TD		XPC755BRX350TE XPC755BRX400TE		Unit
		Min	Max	Min	Max	
Input Hold Times: $\overline{TLBISYNC}$, $\overline{MCP}$, $\overline{SMI}$	t_{IXKH}	0.6	—	0.6	—	ns
Input Hold Times: All Inputs except $\overline{TLBISYNC}$, $\overline{MCP}$, $\overline{SMI}$		0.6	—	0.2	—	
Valid Times: All Outputs	t_{KHOV}	—	4.5	—	4.1	ns

4.2.4 L2 Bus AC Specifications

The AC timing characteristics of the L2 bus interface in 3.3 V mode are slower for Rev. D than for Rev. E devices. Additionally, the AC timing of the L2 interface is not guaranteed or tested in 1.8 V/2.0 V mode for Rev. D devices and does not meet these specifications. The L2 interface output drivers may display a non-linear, stepped behavior when switching that prolongs the rise and fall times in this mode. This behavior is dependent on $L2OV_{DD}$, the impedance of the circuit board, and operating conditions of the processor. In a worst-case device, at $L2OV_{DD} = 1.8$ V and $T_j = 105°C$, the driver output impedance is 55 Ω; at $L2OV_{DD} = 2.0$ V and $T_j = 105°C$, the driver output impedance is 47 Ω. The non-linear behavior results when the driver output impedance is greater than the board impedance and can cause reflected wave switching instead of incident wave switching. The voltage level at which the step will occur is $V_{step} = L2OV_{DD} \times [Z_{board}/(Z_{out} + Z_{board})]$. If V_{step} is less than the input high threshold voltage of the SRAM, the SRAM will not recognize a logical high on a given signal until the reflected wave arrives. The time delay between the arrival of the incident wave and the reflected wave is determined solely by the propagation delay of the signal. Because of these issues, Freescale does not recommend or support the use of the L2 bus interface of Rev. D devices in 1.8 V/2.0 V mode. Table Table 12 provides the L2 bus interface AC timing specifications for the Rev. D devices described in this document when the L2 bus interface is in 3.3 V mode only; note Rev. D devices do not support 2.5 V I/O. Though unchanged from the *MPC755 RISC Microprocessor Hardware Specifications*, the L2 Bus AC timing characteristics for Rev. E devices are also included for clarity. Also note that the L2 bus AC timing specifications given for Rev. E devices are guaranteed for both 2.5 V and 3.3 V operation and that Rev. E devices do not support 1.8 V/2.0 V mode.

Table 12. L2 Bus Interface AC Timing Specifications

At recommended operating conditions (see Table 3)

Parameter	Symbol	XPC755BRX350TD XPC755BRX400TD		XPC755BRX350TE XPC755BRX400TE		Unit	Notes
		Min	Max	Min	Max		
Setup Times: Data and parity	t_{DVL2CH}	1.5	—	1.2	—	ns	2
Input Hold Times: Data and parity	t_{DXL2CH}	0.5	—	0	—	ns	2

Valid Times:
    All outputs when L2CR[14–15] = 00
    All outputs when L2CR[14–15] = 01
    All outputs when L2CR[14–15] = 10
    All outputs when L2CR[14–15] = 11
	t_{L2CHOV}	
		—
		—
		—
		—
			
			3.6
			3.8
			4.0
			4.2
				
				—
				—
				—
				—
					
					3.1
					3.2
					3.3
					3.7
						ns	3, 4

L2SYNC_IN to high impedance:
    All outputs when L2CR[14–15] = 00
    All outputs when L2CR[14–15] = 01
    All outputs when L2CR[14–15] = 10
    All outputs when L2CR[14–15] = 11
	t_{L2CHOZ}	
		—
		—
		—
		—
			
			3.5
			4.0
			4.2
			4.5
				
				—
				—
				—
				—
					
					2.4
					2.6
					2.8
					3.0
						ns	3, 5

Notes:

2. All input specifications are measured from the midpoint of the signal in question to the midpoint voltage of the rising edge of the input L2SYNC_IN. Input timings are measured at the pins.
3. All output specifications are measured from the midpoint voltage of the rising edge of L2SYNC_IN to the midpoint of the signal in question. The output timings are measured at the pins. All output timings assume a purely resistive 50-Ω load.
4. The outputs are valid for both single-ended and differential L2CLK modes. For pipelined registered synchronous BurstRAMs, L2CR[14–15] = 01 or 10 is recommended. For pipelined late write synchronous BurstRAMs, L2CR[14–15] = 11 is recommended.
5. Guaranteed by design and characterization.

10 Ordering Information

10.1 Part Numbers Addressed by This Specification

Table 20 provides the ordering information for the MPC755 parts described in this specification.

Table 20. Part Numbering Nomenclature

XPC	755	B	*xx*	*nnn*	*x*	*x*
Product Code	Part Identifier	Process Descriptor	Package	Processor Frequency [1]	Application Modifier	Revision Level
XPC [2]	755	B = HiP4DP	RX = CBGA	350 400	T: 2.0 V ±100 mV −40° to 105°C	D: 2.7; PVR = 0008 3203 E: 2.8; PVR = 0008 3203

Notes:

1. Processor core frequencies supported by parts addressed by this specification only. Parts addressed by other specifications may support other maximum core frequencies.
2. The X prefix in a Freescale part number designates a "Pilot Production Prototype" as defined by Freescale SOP 3-13. These are from a limited production volume of prototypes manufactured, tested, and Q.A. inspected on a qualified technology to simulate normal production. These parts have only preliminary reliability and characterization data. Before pilot production prototypes may 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 while shipping pilot production prototypes.

10.3　Part Marking

Parts are marked as the example shown in Figure 29.


```
MPC755B
RX400TD

MMMMMM
ATWLYYWWA
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755

BGA
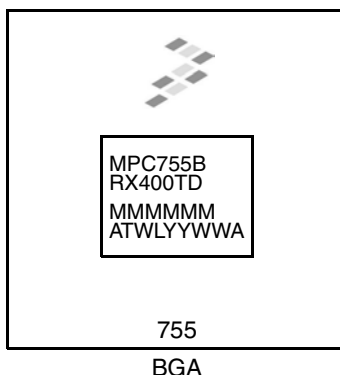
Notes:

MMMMMM is the 6-digit mask number.
ATWLYYWWA is the traceability code.
CCCCC is the country of assembly. This space is left blank if parts are
assembled in the United States.

Figure 29. Part Marking for BGA Device

Document Revision History

Table B provides a revision history for this hardware specifications addendum.

Table B. Document Revision History

Rev. No.	Date	Editor/ Writer	Substantive Change(s)
0.1	02/15/2006	BM/NB	Changed document order number (was MPC755BTXPNS, Rev. 0). Updated to Freescale template. Updated section numbers to match the hardware specifications document.
0			Initial release.

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