

# Intel<sup>®</sup> Itanium<sup>®</sup> Processor 9300 Series

*Intel<sup>®</sup> Itanium<sup>®</sup> Processor Quad-Core 1.86-1.73 GHz with 24 MB L3 Cache 9350*  
*Intel<sup>®</sup> Itanium<sup>®</sup> Processor Quad-Core 1.73-1.60 GHz with 20 MB L3 Cache 9340*  
*Intel<sup>®</sup> Itanium<sup>®</sup> Processor Quad-Core 1.60-1.46 GHz with 20 MB L3 Cache 9330*  
*Intel<sup>®</sup> Itanium<sup>®</sup> Processor Quad-Core 1.46-1.33 GHz with 16 MB L3 Cache 9320*  
*Intel<sup>®</sup> Itanium<sup>®</sup> Processor Dual-Core 1.60 GHz Fixed Frequency with 10 MB L3 Cache 9310*

## Datasheet

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*February 2010*



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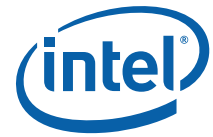
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## Revision History

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Document Number	Revision Number	Description	Date
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## Intel® Itanium® Processor 9300 Series

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*Intel® Itanium® Processor Dual-Core 1.60 GHz Fixed Frequency with 10 MB L3 Cache 9310*

### Product Features

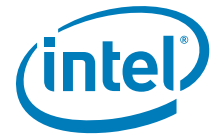
- Quad Core
  - Four complete 64-bit processing cores on one processor.
- EPIC (Explicitly Parallel Instruction Computing) Technology for current and future requirements of high-end enterprise and technical workloads
  - Provide a variety of advanced implementations of parallelism, predication, and speculation, resulting in superior Instruction-Level Parallelism (ILP).
- Hyper-Threading Technology
  - Two times the number of OS threads per core.
- Wide, parallel hardware based on Intel® Itanium® architecture for high performance:
  - Integrated on-die L3 cache of up to 24MB; cache hints for L1, L2, and L3 caches for reduced memory latency.
  - 128 general and 128 floating-point registers supporting register rotation.
  - Register stack engine for effective management of processor resources.
  - Support for predication and speculation.
- Extensive RAS features for business-critical applications, for example:
  - Machine check architecture with extensive ECC and parity protection.
  - On-chip thermal management.
  - Built-in processor information ROM (PIROM).
  - Built-in programmable EEPROM.
  - Hot Plug Socket
  - Double Device Data Correction (DDDC) for x4 DRAMs, plus correction of a single bit error.
  - Single Device Data Correction (SDDC) for x8 DRAMs, plus correction of a single bit error.
  - Intel® QuickPath Interconnect Dynamic Link Width Reduction
  - Intel® QuickPath Interconnect Clock Fail-Safe Feature
  - Intel® QuickPath Interconnect Hot Add and Removal
  - DIMM Sparing, Memory Scrubbing, Memory Mirroring, and Memory Migration
- On-die Memory Controller
  - high memory bandwidth, thus improve performance
- Intel® Virtualization Technology for virtualization for data-intensive applications.
  - Reduce virtualization complexity.
  - Improve virtualization performance.
  - Increase operating system compatibility.
- Intel® Cache Safe Technology ensure mainframe-caliber availability.
  - Minimize L3 cache errors.
  - Improve availability.
- High bandwidth Intel® QuickPath Interconnect for multiprocessor scalability:
  - 4 full and 2 half width Intel QPI Links
  - 4.8GT/s transfer rate.
  - Systems are easily scaled without sacrificing performance.
- Features to support flexible platform environments:
  - IA-32 Execution Layer supports IA-32 application binaries.
  - Bi-endian support.
  - Processor abstraction layer eliminates processor dependencies.

The Intel® Itanium® processor 9300 series delivers new levels of flexibility, reliability, performance, and cost-effective scalability for your most data-intensive business and technical applications. With double the number of cores of previous Intel Itanium processors, the Intel Itanium processor 9300 series provides more reasons than ever to migrate your business-critical applications off RISC and mainframe systems and onto cost-effective Intel architecture servers. The Intel Itanium processor 9300 series provides 24 megabytes L3 cache, Hyper-Threading Technology for increased performance, Intel® Virtualization Technology for improved virtualization, Intel® Cache Safe Technology for increased availability.



Itanium<sup>®</sup>-based systems are available from leading OEMs worldwide and run popular 64-bit operating systems such as Microsoft\* Windows Server\* 2003; Linux\* from SuSE, Red Hat, Red Flag, and other distributions; HP NonStop\*; OpenVMS\*; and HP-UX\*. More than 7,000 applications are available for Itanium-based systems, from vendors such as Microsoft, BEA, IBM, Ansys, Gaussian, Symantec/Veritas, Oracle, SAP, and SAS. And with industry support growing and future Intel Itanium processor family advances already in development, your Itanium-based server investment will continue to deliver performance advances and savings for your most demanding applications.





# 1 Introduction

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## 1.1 Overview

The Intel® Itanium® processor 9300 series employs Explicitly Parallel Instruction Computing (EPIC) design concepts for a tighter coupling between hardware and software. In this design style, the interface between hardware and software is designed to enable the software to exploit all available compile-time information, and efficiently deliver this information to the hardware. It addresses several fundamental performance bottlenecks in modern computers, such as memory latency, memory address disambiguation, and control flow dependencies. The EPIC constructs provide powerful architectural semantics, and enable the software to make global optimizations across a large scheduling scope, thereby exposing available Instruction Level Parallelism (ILP) to the hardware. The hardware takes advantage of this enhanced ILP, and provides abundant execution resources. Additionally, it focuses on dynamic run-time optimizations to enable the compiled code schedule to flow at high throughput. This strategy increases the synergy between hardware and software, and leads to greater overall performance.

The Intel Itanium processor 9300 series consists of up to 4 core processors and a system interface unit. Each processor core provides a 6-wide, 8-stage deep execution pipeline. The resources consist of six integer units, six multimedia units, two load and two store units, three branch units and two floating-point units each capable of extended, double and single precision arithmetic. The hardware employs dynamic prefetch, branch prediction, a register scoreboard, and non-blocking caches to optimize for compile-time non-determinism. Each core provides duplication of all architectural state to support hardware multithreading thus enabling greater throughput. Three levels of on-die cache minimize overall memory latency. This includes up to a 24 MB L3 cache, accessed at core speed. The system interface, with its 4 full width and 2 half width Intel® QuickPath Interconnects, enables the processor to directly connect to other system components, thus can be used as an effective building block for very large systems. The balanced core and memory subsystem provide high performance for a wide range of applications ranging from commercial workloads to high performance technical computing.

The processor will also be socket compatible with the two future Intel Itanium processors that are currently under development. Organizations will be able to scale performance and capacity for several years to come through simple and cost-effective processor upgrades.

The Intel Itanium processor 9300 series supports a range of computing needs and configurations from a 2-way to large SMP servers. This document provides the electrical, mechanical and thermal specifications that must be met when using the Intel Itanium processor 9300 series processor in your systems.

## 1.2 Processor Abstraction Layer

The Intel Itanium processor 9300 series requires implementation-specific Processor Abstraction Layer (PAL) firmware. PAL firmware supports processor initialization, error recovery, and other functionality. It provides a consistent interface to system firmware and operating systems across processor hardware implementations. The *Intel®*



*Itanium® Architecture Software Developer's Manual, Volume 2: System Architecture*, describes PAL. Platforms must provide access to the firmware address space and PAL at reset to allow the processors to initialize.

The System Abstraction Layer (SAL) firmware contains platform-specific firmware to initialize the platform, boot to an operating system, and provide runtime functionality. Further information about SAL is available in the *Intel® Itanium® Processor Family System Abstraction Layer Specification*.

### 1.3 Mixing Processors of Different Frequencies and Cache Sizes

All Intel Itanium processor 9300 series in the same system partition are required to have the same cache size (24 MB, 20 MB, 16 MB or 10 MB) and identical core frequency. Mixing components of different core frequencies and cache sizes is not supported and has not been validated by Intel. Operating system support for multiprocessing with mixed components should also be considered.

While Intel has done nothing to specifically prevent processors within a multiprocessor environment from operating at differing frequencies and differing cache sizes, there may be uncharacterized errata that exist in such configurations. Customers would be fully responsible for validation of system configurations with mixed components other than the supported configurations described above.

### 1.4 Terminology

In this document, “the processor” refers to the Intel Itanium processor 9300 series, unless otherwise indicated.

An ‘\_N’ notation after a signal name refers to an active low signal. This means that a signal is in the active state (based on the name of the signal) when driven to a low level. For example, when RESET\_N is low, a processor reset has been requested. When NMI is high, a non-maskable interrupt has occurred. In the case of lines where the name does not imply an active state but describes part of a binary sequence (such as address or data), the ‘\_N’ notation implies that the signal is inverted. For example, D[3:0] = ‘HLHL’ refers to a hex ‘A’, and D [3:0] \_N = ‘LHLH’ also refers to a hex ‘A’ (H = High logic level, L = Low logic level).

A signal name has all capitalized letters, for example, VCTERM.

A symbol referring to a voltage level, current level, or a time value carries a plain subscript, for example, Vccio, or a capitalized abbreviated subscript, for example, TCO.

### 1.5 State of Data

The data contained in this document is subject to change. It is the best information that Intel is able to provide at the publication date of this document.



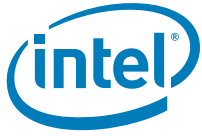
## 1.6 Reference Documents

The reader of this specification should also be familiar with material and concepts presented in the following documents:

Document Name
<i>Intel® Itanium® Processor Specification Update</i>
<i>Intel® Itanium® Architecture Software Developer's Manual, Volume 1: Application Architecture</i>
<i>Intel® Itanium® Architecture Software Developer's Manual, Volume 2: System Architecture</i>
<i>Intel® Itanium® Architecture Software Developer's Manual, Volume 3: Instruction Set Reference</i>
<i>Intel® Itanium® Processor Reference Manual for Software Development and Optimization</i>
<i>Intel® Itanium® Processor Family System Abstraction Layer Specification</i>
<i>XDP Debug Port Design Guide</i>
System Management Bus Specification

**Note:** Contact your Intel representative or check <http://developer.intel.com> for the latest revision of the reference documents.

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## 2 Electrical Specifications

This chapter describes the electrical specifications of the Intel Itanium processor 9300 series.

### 2.1 Intel® QuickPath Interconnect and Intel® Scalable Memory Interconnect Differential Signaling

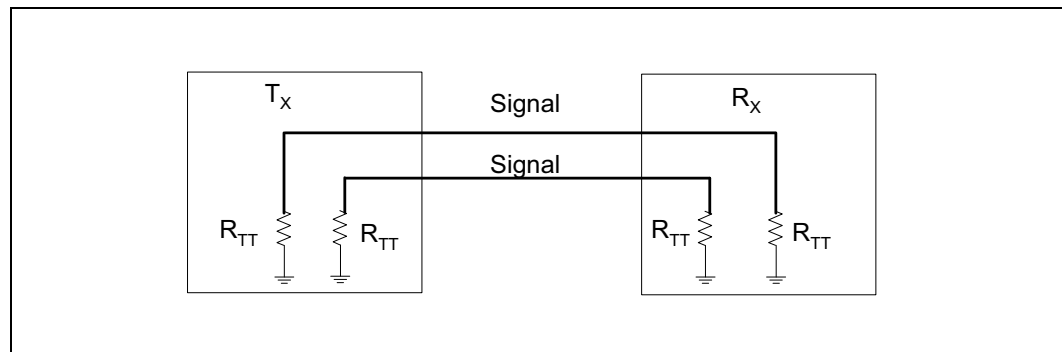
The links for Intel® QuickPath Interconnect (Intel® QPI) and Intel® Scalable Memory Interconnect (Intel® SMI) signals use differential signaling. The Intel SMI bus pins are referred to as FB-DIMM pins on the package. The termination voltage level for the processor for uni-directional serial differential links, each link consisting of a pair of opposite-polarity (D+, D-) signals, is  $V_{SS}$ .

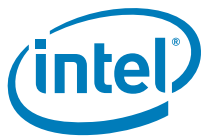
Termination resistors are provided on the processor silicon and are terminated to  $V_{SS}$ , thus eliminating the need to terminate the links on the system board for the Intel QuickPath Interconnect and FB-DIMM signals.

When designing a system, Intel strongly recommends that design teams perform analog simulations of the Intel QuickPath Interconnect and FB-DIMM pins. Please refer to the latest available revision of the *Intel® Itanium® Processor 9300 Series Platform Design Guide*.

Figure 2-1 illustrates the active on-die termination (ODT) of these differential signals. All the differential signals listed in Table 2-1 have ODT resistors. Also included in the table are the debug signals.

**Figure 2-1. Active ODT for a Differential Link Example**





**Table 2-1. Signals with R<sub>TT</sub>**

Signal	Termination
CSI[3:0]R[P/N]Dat[19:0] CSI[5:4]R[P/N]Dat[9:0] CSI[3:0]T[P/N]Dat[19:0] CSI[5:4]T[P/N]Dat[9:0] CSI[5:0]R[P/N]Clk CSI[5:0]T[P/N]Clk	VSS
FBD0NBICK[A/B][P/N]0 FBD1NBICK[C/D][P/N]0 FBD0SBOCK[A/B][P/N]0 FBD1SBOCK[C/D][P/N]0 FBD0NBI[A/B][P/N][12:0] FBD1NBI[C/D][P/N][12:0] FBD0SBO[A/B][P/N][9:0] FBD1SBO[C/D][P/N][9:0]	VSS
XDPOCPD_N[7:0] TRIGGER_N[1:0] XDPOCPFRAME_N XDPOCP_STRB_IN_N PRBMODE_REQST_N XDPOCP_STRB_OUT_N PRBMODE_RDY_N	VCCIO

## 2.2 Signal Groups

The signals are grouped by buffer type and similar characteristics as listed in [Table 2-2](#). The buffer type indicates which signaling technology and specifications apply to the signals.

**Table 2-2. Signal Groups (Sheet 1 of 3)**

Signal Group	Buffer Type	Signals 1, 2
<b>Differential System Reference Clock</b>		
Differential	CMOS In Differential Pair	SYSCLK, SYSCLK_N; SYSUTST_REFCLK_N, SYSUTST_REFCLK
<b>Intel® QuickPath Interconnect Signal Groups</b>		
Differential	Input	CSI[3:0]R[P/N]Dat[19:0], CSI[5:4]R[P/N][9:0] CSI[5:0]R[P/N]CLK
Differential	Output	CSI[3:0]T[P/N]Dat[19:0], CSI[5:4]T[P/N][9:0], CSI[5:0]T[P/N]CLK
<b>FB-DIMM Signals</b>		
Differential	Input	FBD0NBICK[A/B][P/N]0 FBD1NBICK[C/D][P/N]0
Differential	Output	FBD0SBOCK[A/B][P/N]0 FBD1SBOCK[C/D][P/N]0
Differential	Input	FBD0NBI[A/B][P/N][12:0] FBD1NBI[C/D][P/N][12:0]
Differential	Output	FBD0SBO[A/B][P/N][9:0] FBD1SBO[C/D][P/N][9:0]
<b>TAP</b>		



**Table 2-2. Signal Groups (Sheet 2 of 3)**

Signal Group	Buffer Type	Signals 1, 2
Single-ended	CMOS Inputs	TCK, TDI, TMS, TRST_N
	GTL Open Drain Output	TDO
<b>SMBus</b>		
Single-ended	GTL I/O	SMBCLK, SMBDAT
<b>SPD Bus</b>		
Single-ended	GTL I/O	SPDCLK SPDDAT
<b>Setup</b>		
Single-ended	GTL Input CMOS Input	BOOTMODE[1:0], SKTID[2:0] LRGSCLSYS
<b>Flash ROM Port</b>		
Single-ended	GTL-open Drain Input	FLASHROM_CFG[2:0], FLASHROM_DATI
	GTL-open Drain Output	FLASHROM_CS[3:0]_N, FLASHROM_CLK, FLASHROM_DATO, FLASHROM_WP_N
<b>ERROR Bus</b>		
Single-ended	GTL Open Drain Output GTL Input	ERROR[0]_N, ERROR[1]_N MEM_THROTTLE_L
<b>Power-up</b>		
Single-ended	GTL Input	PWRGOOD, RESET_N
<b>Thermal</b>		
Single-ended	GTL-Open Drain Output GTL Input	PROCHOT_N, THERMTRIP_N, THERMALERT_N FORCEPR_N
<b>VID Port<sup>3</sup></b>		
Single-ended	CMOS Output	VID_VCCCORE[6:0], VID_VCCCACHE[5:0], VID_VCCUNCORE[6:0]
<b>Voltage Regulator 3</b>		
Single-ended	CMOS Input GTL Input Open Collector/Drain Output	VROUTPUT_ENABLE0 VR_THERMALERT_N VR_THERMTRIP_N, VRPWRGD, VR_FAN_N
<b>Debug</b>		
Single-ended	GTL I/O	XDPOCPD_N[7:0], TRIGGER_N[1:0] XDPOCPFRAME_N
	GTL Input	XDPOCP_STRB_IN_N, PRBMODE_REQST_N
	GTL Output	XDPOCP_STRB_OUT_N, PRBMODE_RDY_N
<b>Power Supplies</b>		
	Core	V <sub>CC</sub> CORE
	Uncore	V <sub>CC</sub> UNCORE
	Cache	V <sub>CC</sub> CACHE
	Analog	V <sub>CC</sub> A
	I/O	V <sub>CC</sub> I/O
	Stand-by	V <sub>CC</sub> 33_SM
<b>V<sub>CC</sub>33_SM Pins</b>		



**Table 2-2. Signal Groups (Sheet 3 of 3)**

Signal Group	Buffer Type	Signals 1, 2
PIROM	Input	PIR_SCL
	I/O	PIR_SDA
	Input	PIR_A0
	Input	PIR_A1
	Input	SM_WP

**Notes:**

1. CMOS signals have a reference voltage (Vref) equal to VCCIO/2.
2. GTL signals have a reference voltage (Vref) equal to VCCIO\*(2/3).
3. These signals are connected to the Ararat voltage regulator from the topside of the processor.

## 2.3 Reference Clocking Specifications

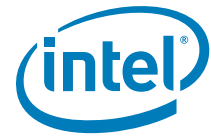
The processor has one input reference clock, SYSCLK/SYSCLK\_N for the Intel QPI interface. The processor timing specified in this section is defined at the processor pins unless otherwise noted.

**Table 2-3. Intel® QPI/Intel® SMI Reference Clock Specifications**

Symbol	Parameter	Min	Nom	Max	Units	Notes
fsysclk (ssc-off)	System clock frequency	133.31	133.33	133.34	MHz	
Fsysclk (scc-on)	System clock frequency	132.62	132.99	133.37	MHz	
ER <sub>sysclk-diff-Rise</sub> , ER <sub>sysclk-diff-Fall</sub>	Differential Rising and Falling Edge Rates	1.0		4.0	V/ns	3,4
T <sub>sysclk_dutycycle</sub>	Duty cycle of Reference clock	40		60	% period	3
C <sub>i-CK</sub>	Clock Input Capacitance	0.5		2.0	pf	
V <sub>H</sub>	Differential High Input Voltage	0.15			V	3
V <sub>L</sub>	Differential Low Input Voltage			-0.15	V	3
V <sub>Cross</sub>	Absolute crossing point	0.25	0.35	0.55	V	1,5,6
V <sub>Cross_delta</sub>	Peak-peak variation			140	mv	1,5,7
V <sub>max Overshoot</sub>	Single-ended maximum voltage			1.54	V	1,8
V <sub>min Undershoot</sub>	Single-ended minimum voltage	-0.337			V	1,9
V <sub>RB-Diff</sub>	Differential Ringback voltage threshold	-100		100	mV	3,10
T <sub>Stable</sub>	Allowed time before ringback	500			ps	3,10
T <sub>REFCLK-JITTER-RMS-ONEPLL</sub>	Accumulated rms jitter over n UI of a given PLL model output in response to the jittery reference clock input. The PLL output is generated by convolving the measured reference clock phase jitter with a given PLL transfer function. Here n=12.			0.5	ps	2,11

**Note:**

1. Measurement taken from single-ended waveform.
2. The given PLL parameters are: Underdamping (z) = 0.8 and natural frequency = fn = 7.86E6 Hz; wn = 2 \*fn. N\_minUI = 12 for Intel® QuickPath Interconnect 4.8 Gt/s channel.
3. Measurement taken from differential waveform.
4. Measured from -150 mV to +150 mV on the differential waveform (derived from SYSCLK minus SYSCLK\_N). The signal must be monotonic through the measurement region for rise and fall time. The 300 mV measurement window is centered on the differential zero crossing. See Figure 2-4.
5. Measured at crossing point where the instantaneous voltage value of the rising edge SYSCLK equals the falling edge SYSCLK\_N. See Figure 2-2.
6. Refers to the total variation from the lowest crossing point to the highest, regardless of which edge is crossing. Refers to all crossing points for this measurement. See Figure 2-3.



7. Defined as the total variation of all crossing voltages of Rising SYSCLK and falling SYSCLK\_N. This is the maximum allowed variance in Vcross for any particular system. See [Figure 2-3](#).
8. Defined as the maximum instantaneous voltage including overshoot. See [Figure 2-2](#).
9. Defined as the minimum instantaneous voltage including undershoot. See [Figure 2-2](#).
10. T<sub>Stable</sub> is the time the differential clock must maintain a minimum ±150 mV differential voltage after rising/falling edges before it is allowed to droop back into the VRB ±100 mV range. See [Figure 2-5](#).
11. See Referenced Clock Jitter Tool in Section 1.2.

## 2.4 Intel QuickPath Interconnect and Intel SMI Signaling Specifications

### 2.4.1 Intel QuickPath Interconnect and Intel SMI Specifications for 4.8 GT/s

This section contains information for QPI slow boot up speed (1/4 frequency of the reference clock) and processor’s normal operating frequency, 4.8 GT/s, for Intel QPI and Intel SMI.

For Intel QPI slow boot up speed, the signaling rate is defined as 1/4 the rate of the system reference clock. For example, a 133 MHz system reference clock would have a forwarded clock frequency of 33.33 MHz and the signaling rate would be 66.67 MT/s.

The transfer rates available for the processor are shown in [Table 2-4](#). Transmitter and receiver parameters for Intel QPI slow mode, Intel QPI and Intel SMI are shown in [Table 2-5](#).

**Table 2-4. Clock Frequency Table**

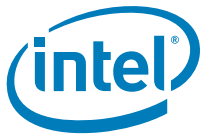
Intel® QuickPath Interconnect Forwarded Clock Frequency	Intel® QuickPath Interconnect Data Transfer Rate
33.33 MHz	66.66 MT/s (see note 1)
2.40 GHz	4.8 GT/s

**Notes:**

1. This speed is the 1/4 SysClk Frequency.

**Table 2-5. Transmitter Parameter Values for Intel QuickPath Interconnect and Intel SMI Channels @ 4.8 GT/s (Sheet 1 of 2)**

Symbol	Parameter	Min	Nom	Max	Units	Notes
UI <sub>avg</sub>	Average UI size at 4.8 GT/s		208.33		ps	
N <sub>MIN-UI-Validation</sub>	# of UI over which the eye mask voltage and timing spec needs to be validated	1E6				
T <sub>slew-rise-fall-pin</sub>	Defined as the slope of the rising or falling waveform as measured between +/-100 mV of the differential transmitter output, data or clock	6		12	V/ns	
V <sub>Tx-diff-pp-pin</sub>	Transmitter differential swing	900		1300	mV	
R <sub>TX</sub>	Transmitter termination resistance	37.4		47.6	Ω	4
Z <sub>TX_LINK_DETECT</sub>	Link Detection Resistor	500		2000	Ω	
V <sub>TX_LINK_DETECT</sub>	Link Detection Resistor Pull-up Voltage			max VCCIO	V	
T <sub>DATA_TERM_SKEW Intel QPI</sub>	Skew between first to last data termination meeting Z <sub>RX_LOW_CM_DC</sub>	600			UI	2
T <sub>DATA_TERM_SKEW Intel SMI</sub>	Skew between first to last data termination meeting Z <sub>RX_LOW_CM_DC</sub>	780			UI	2



**Table 2-5. Transmitter Parameter Values for Intel QuickPath Interconnect and Intel SMI Channels @ 4.8 GT/s (Sheet 2 of 2)**

Symbol	Parameter	Min	Nom	Max	Units	Notes
T <sub>INBAND_RESET_SENSE</sub>	Time taken by inband reset detector to sense Inband Reset	8k		256k	UI	
T <sub>CLK_DET</sub>	Time taken by clock detector to observe clock stability	8k		256k	UI	
T <sub>SYSClk-TX-VARIABILITY</sub>	Phase variability between reference Clk (at Tx input) and Tx output.			500	ps	
TXEQ-BOOST	Voltage ratio between the cursor and the post-cursor when transmitting successive ones	0		25	dB	3
V <sub>TX-CM-PIN</sub>	Transmitter data or clock common mode level	23		27	%	
V <sub>TX-CM-RIPPLE-PIN</sub>	Transmitter data or clock common mode ripple	0		14	%	8,9
TX <sub>DUTY-CYCLE-PIN</sub>	Transmitter clock or data duty cycle at the pin. Transmit duty cycle at the pin, defined as UI to UI jitter as specified by the Intel QPI Electrical Specification, Rev 1.0.	-0.076		0.076	UI-UI	6
T <sub>TX-DATA-CLK-SKEW-PIN</sub>	Delay of any data lane relative to clock lane, as measured at Tx output	-0.5		0.5	UI	1,2
TX <sub>ACC-JIT-N_UI-1E-9</sub>	Peak-to-peak accumulated jitter out of any TX data or clock over $0 < n <= N$ UI where $N=12$ , measured with 1E-9 probability.	0		0.18	UI	5
TX <sub>JITUI-UI-1E-9PIN</sub>	Transmitter clock or data UI-UI jitter at 1E-9 probability.	0		0.17	UI	5
RL <sub>TX-DIFF</sub>	Transmitter Differential return loss from 50MHz to 2GHz	-10		dB		7
RL <sub>TX-DIFF</sub>	Transmitter Differential return loss from 2GHz to 4GHz	-6		dB		7

**Notes:**

1. Parameter value at full Intel QPI Refclk
2. Stagger offset = 0xF
3. See [Figure 2-6](#)
4. The termination small signal resistance; tolerance over the entire signalling voltage range shall not exceed ±5 ohms
5. Requires Matlab script
6. Refer to Intel QuickPath Interconnect (Intel QPI) - Electrical Specifications for calculation of this value. Note that UI to UI definition is used herein, where the value of UI-UI DCD = 2\*UI DCD.
7. See [Figure 2-7](#)
8. Applies to Vtx-diff-pp-pin
9. Peak-to-peak value of the ripple

**Table 2-6. Receiver Parameter Values for Intel QuickPath Interconnect and Intel SMI Channels @ 4.8 GT/**

Symbol	Parameter	Min	Nom	Max	Units	Notes
R <sub>RX</sub>	RX termination resistance	37.4		47.6	Ω	3
T <sub>Rx-data-clk-skew-pin</sub>	Delay of any data lane relative to the clock lane, as measured at the end of Tx+ channel. This parameter is a collective sum of effects of data clock mismatches in Tx and on the medium connecting Tx and Rx.	-0.5		3.5	UI	2
T <sub>Rx-data-clk-skew-pin</sub>	Delay of any data lane relative to the clock lane, as measured at the end of Tx+ channel. This parameter is a collective sum of effects of data clock mismatches in Tx and on the medium connecting Tx and Rx.	0.48		0.52	UI	1
RL <sub>RX-DIFF</sub>	Receiver differential return loss from 50 MHz to 2 GHz	-10		dB		6
RL <sub>RX-DIFF</sub>	Receiver differential return loss from 2GHz to 4GHz	-6		dB		6



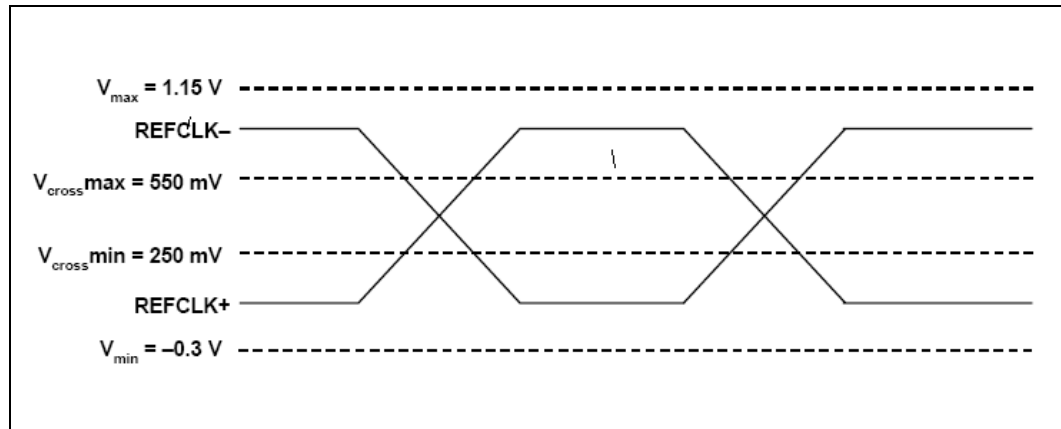
**Table 2-6. Receiver Parameter Values for Intel QuickPath Interconnect and Intel SMI Channels @ 4.8 GT/**

Symbol	Parameter	Min	Nom	Max	Units	Notes
$V_{RX-data-cm-pin}$	Receiver data common mode level	125		350	mV	2
$V_{RX-data-cm-ripple-pin}$	Receiver data common mode ripple	0		100	mV <sub>p-p</sub>	
$V_{RX-clk-cm-pin}$	Receiver clock common mode level	175		350	mV	
$V_{RX-clk-cm-ripple-pin}$	Receiver clock common mode ripple	0		100	mV <sub>p-p</sub>	
$V_{RX-eye-data-pin}$	Minimum eye height at pin for data	200			mV	4
$V_{RX-eye-clk-pin}$	Minimum eye height at pin for clk	225			mV	5
$T_{RX-eye-pin}$	Minimum eye width at pin for clk and data	0.6			UI	4
QPI BER <sub>Lane</sub>	Bit Error Rate per lane valid for 4.8 and 6.4 GT/s			1.0E-14	Events	
SMI BER <sub>Lane</sub>	Bit Error Rate per lane valid for 4.8 and 6.4 GT/s			1.0E-12	Events	

**Notes:**

1. Parameter value at 1/4 QPI Refclk
2. Parameter value at full QPI Refclk
3. The termination small signal resistance; tolerance over the entire signalling voltage range shall not exceed +/-5 ohms with regard to the average of the values measured in the high output voltage state and the low output voltage state for that pin.
4. HVM guaranteed error free value for stressed PRBS signaling across PVT. Link BER is the dominant spec of which eye dimensions are only one factor, and improving another factor could compensate for eye height or width.
5. HVM guaranteed error free value for stressed '1010 signaling across PVT. Link BER is the dominant spec of which eye dimensions are only one factor, and improving another factor could compensate for eye height or width.
6. See Figure 2.5

**Figure 2-2. Single-ended Maximum and Minimum Levels and  $V_{cross}$  Levels**



**Figure 2-3.  $V_{cross-delta}$  Definition**

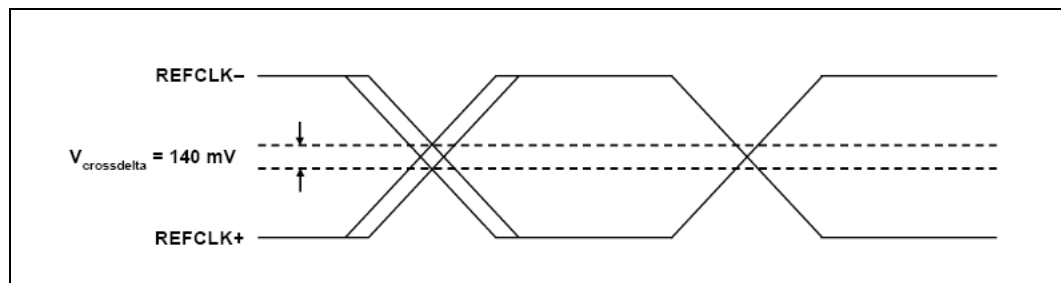


Figure 2-4. Differential Edge Rate Definition

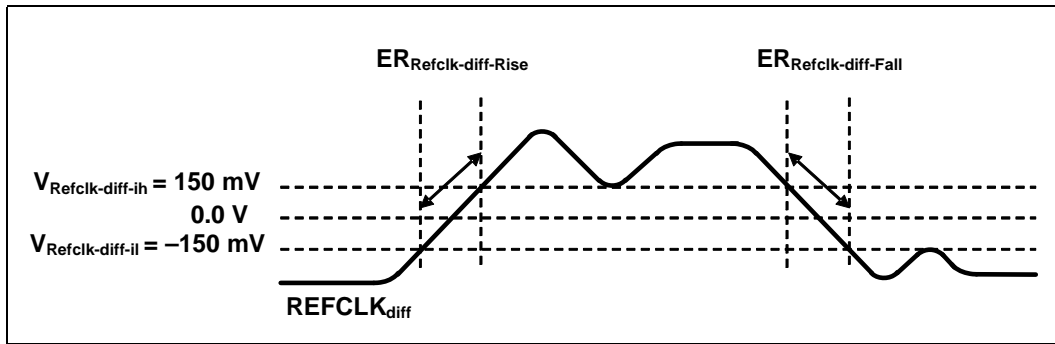


Figure 2-5.  $V_{RB}$  and  $T_{Stable}$  Definitions

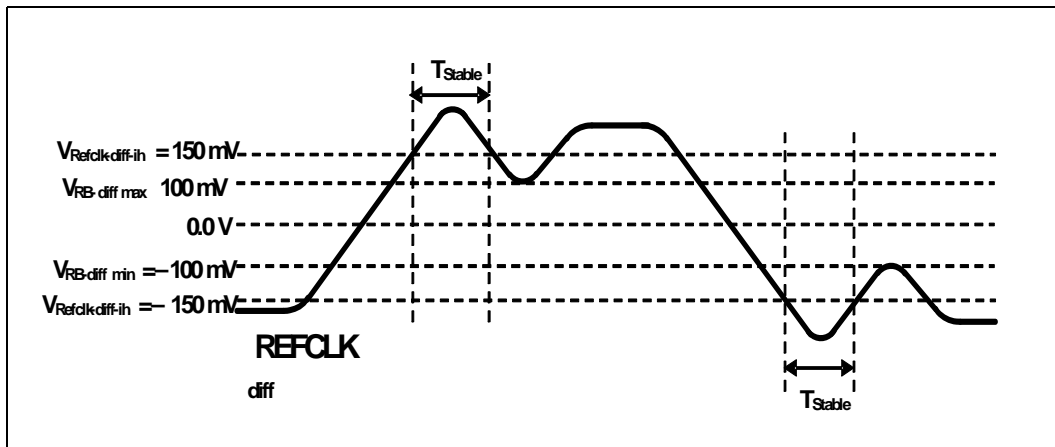




Figure 2-6. TX Equalization Diagram

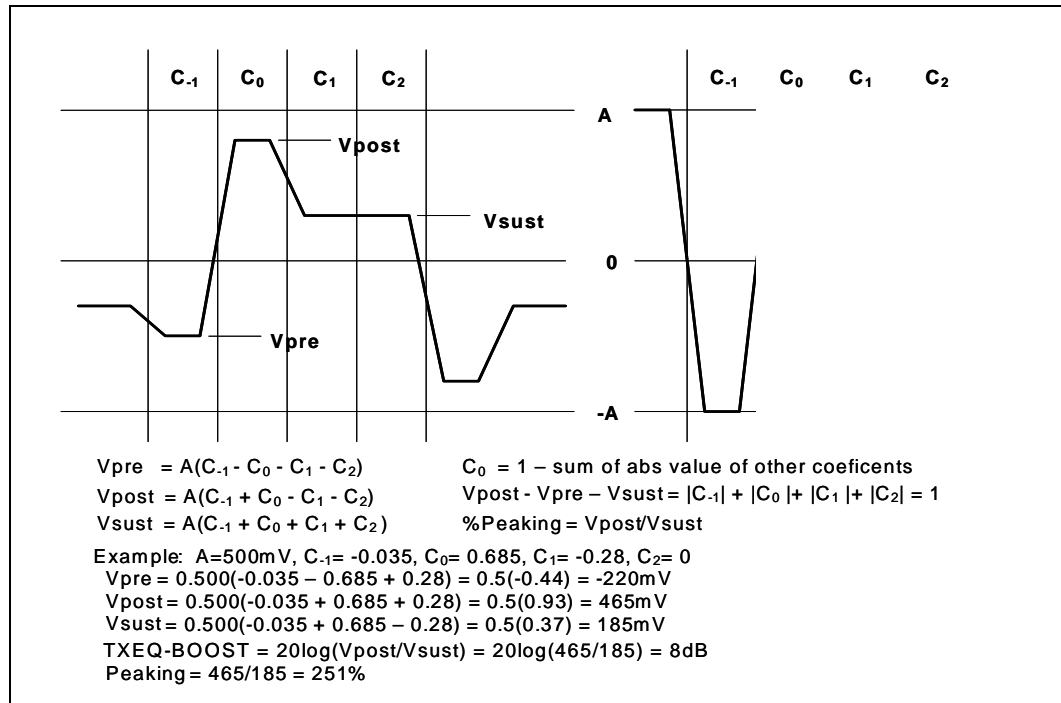


Figure 2-7. TX Return Loss

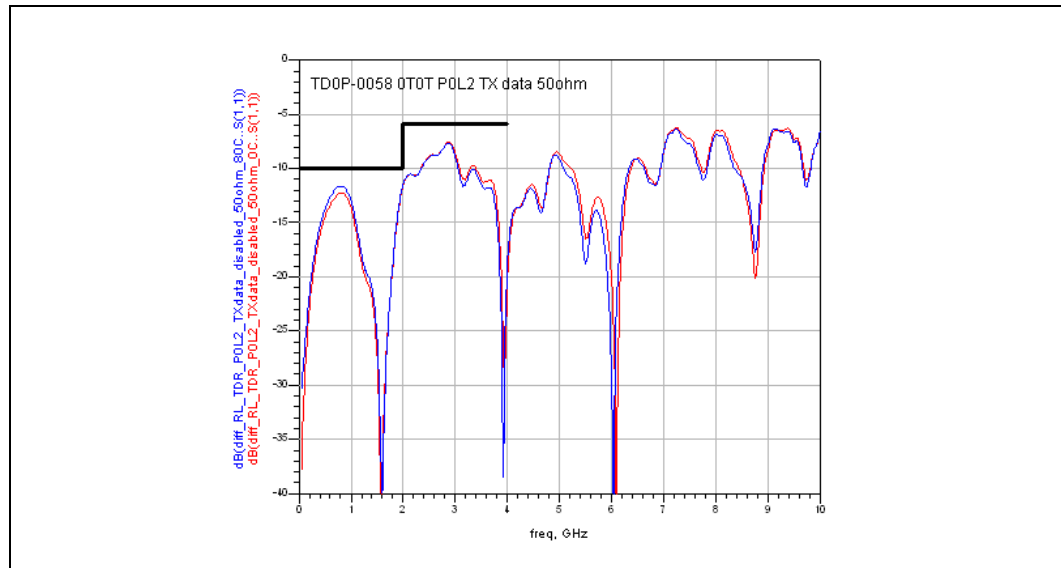
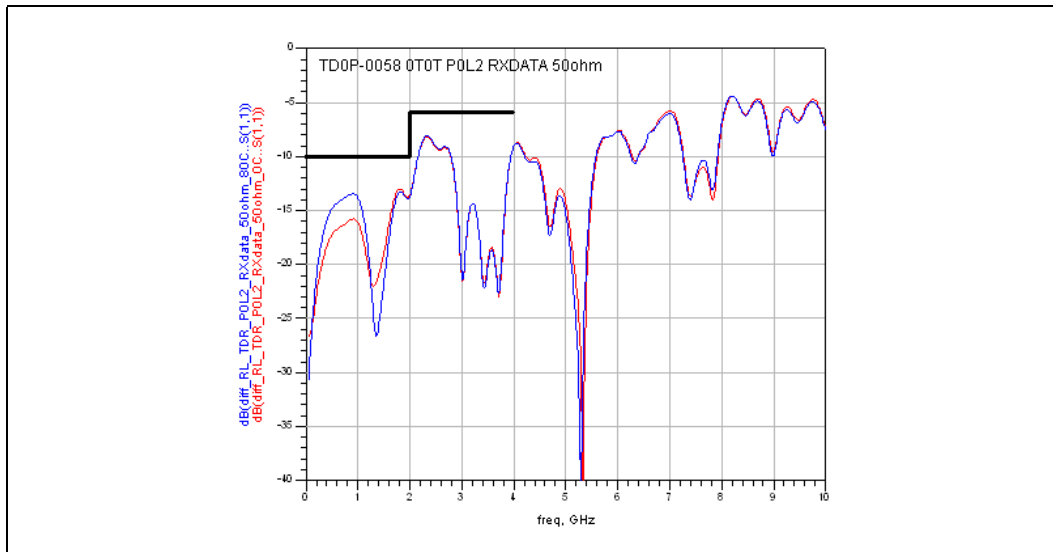


Figure 2-8. RX Return Loss



## 2.5 Processor Absolute Maximum Ratings

Table 2-7 specifies absolute maximum and minimum ratings. Within operational maximum and minimum limits, the processor functionality and long-term reliability can be expected. The processor maximum ratings listed in Table 2-7 are applicable for the 130 W, 155 W, and 185 W parts.

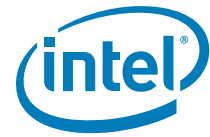
At conditions outside operational maximum ratings, but within absolute maximum and minimum ratings, neither functionality nor long-term reliability can be expected. If a device is returned to conditions within operational maximum and minimum ratings after having been subjected to conditions outside these limits, but within the absolute maximum and minimum ratings, the device may be functional, but with its lifetime degraded depending on exposure to conditions exceeding the functional operation condition limits.

At conditions exceeding absolute maximum and minimum ratings, neither functionality nor long-term reliability can be expected. Moreover, if a device is subjected to these conditions for any length of time, then, when returned to conditions within the functional operating condition limits, it will either not function, or its reliability will be severely degraded.

Although the processor contains protective circuitry to resist damage from static electric discharge, precautions should always be taken to avoid high static voltages or electric fields.

Table 2-7. Processor Absolute Maximum Ratings (Sheet 1 of 2)

Symbol	Parameter	Min	Max	Units	Notes 1,2
V <sub>CCORE</sub>	Processor core supply voltage with respect to V <sub>SS</sub>	-0.3	1.55	V	
V <sub>CCUNCORE</sub>	Processor uncore supply voltage with respect to V <sub>SS</sub>	-0.3	1.55	V	
V <sub>CACHE</sub>	Processor cache voltage with respect to V <sub>SS</sub>	-0.3	1.55	V	
V <sub>CCA</sub>	Processor Analog Supply Voltage with respect to V <sub>SS</sub>	-0.3	1.89	V	

**Table 2-7. Processor Absolute Maximum Ratings (Sheet 2 of 2)**

Symbol	Parameter	Min	Max	Units	Notes 1,2
V <sub>CCIO</sub>	Processor I/O Supply Voltage with respect to V <sub>SS</sub>	-0.3	1.55	V	
V <sub>CCIO_FBD</sub>	Processor I/O Supply Voltage for FB-DIMM with respect to V <sub>SS</sub>	-0.3	1.55	V	
V <sub>CC33_SM</sub>	Processor 3.3 V Supply Voltage with respect to V <sub>SS</sub>	-0.3	3.465	V	

**Notes:**

- For functional operation, all processor electrical, signal quality, mechanical, and thermal specifications must be satisfied.
- Overshoot and undershoot voltage guidelines for input, output, and I/O signals are outlined in [Section 2.6.3](#). Excessive overshoot or undershoot on any signal will likely result in permanent damage to the processor.

## 2.6 Processor DC Specifications

[Table 2-8](#) through [Table 2-24](#) list the DC specifications for the Intel Itanium processor 9300 series and are valid only while meeting specifications for case temperature, clock frequency, and input voltages.

The following notes apply:

- Unless otherwise noted, all specifications in the tables apply to all frequencies
- Unless otherwise noted, these specifications are based on characterized data from silicon measurements.

### 2.6.1 Flexible Motherboard Guidelines

The Flexible Motherboard (FMB) guidelines are estimates of the maximum ratings that the processor will have over certain time periods. The ratings are only estimates as actual specifications for future processors may differ. The processor may or may not have specifications equal to the FMB value in the foreseeable future. System designers should meet the FMB values to ensure that their systems will be compatible with future releases of the Intel® Itanium® processor 9300 series.

FMB Voltage Specification values apply to both the 130W and 155W/185W processor stock-keeping units (SKUs). Current specifications are identified for each processor SKU separately.

**Table 2-8. FMB Voltage Specifications (Sheet 1 of 2)**

Symbol	Parameter	Min	Typ	Max	Units	Notes
VID <sub>Range</sub>	VCCCORE VID Range	0.8	1.1	1.35	V	
UVID <sub>Range</sub>	VCCUNCORE VID Range	0.8	1.1	1.35	V	
CVID <sub>Range</sub>	VCCCACHE VID Range	0.8	1.1	1.35	V	
VCCCORE	Processor core supply voltage	See <a href="#">Table 2-13</a> and <a href="#">Figure 2-12</a>			V	1,2,3
VCCUNCORE	Processor uncore supply voltage	See <a href="#">Table 2-11</a> and <a href="#">Figure 2-10</a>			V	2,4
VCCCACHE	Processor cache supply voltage	See <a href="#">Table 2-12</a> and <a href="#">Figure 2-11</a>			V	5
VID Transition	VID step size during transition		± 12.5		mV	
VID_DCshift	Total allowable DC load line shift from VID steps.			-450	mV	6
VCCIO	Processor I/O supply voltage at die including all AC and DC	1.08	1.15	1.22	V	7
VCCIO	Processor I/O supply voltage (high frequency AC p-p noise at die)			50	mV	



**Table 2-8. FMB Voltage Specifications (Sheet 2 of 2)**

Symbol	Parameter	Min	Typ	Max	Units	Notes
VCCIO	Processor I/O supply voltage at package pin including all AC and DC	1.147	1.175	1.203	V	8
VCCA	Processor analog supply voltage (DC spec)	1.764	1.8	1.836	V	
VCCA	Processor analog supply voltage (AC tolerance for noise at scope full bandwidth)		1.8	±25	mV	9, 10
VCCA	Processor analog supply voltage (AC tolerance for noise > 1MHz)		1.8	±15	mV	9, 11
VCCA	Processor analog supply voltage (Total = DC spec + AC tolerance)	1.739	1.8	1.861	V	
VCC33_SM	3.3 V supply voltage	3.135	3.3	3.465	V	

**Notes:**

1. These voltages are target only. A variable voltage source should exist on systems in the event that a different voltage is required. See [Section 2.9](#) and *Ararat 170 Watt Voltage Regulator Design Guide* for more information.
2. Uncore, Core, and Cache voltage and Current Rating are at the Package Pad.
3. The voltage specification requirements are measured across the V<sub>CCCORESENSE</sub> and V<sub>SSCORESENSE</sub> pins using an oscilloscope set to a 100 MHz bandwidth and probes that are 1.5 pF maximum capacitance and 1 MΩ minimum impedance at the processor socket. The maximum length of ground wire on the probe should be less than 5 mm. Ensure external noise from the system is not coupled into the scope probe.
4. The voltage specification requirements are measured across the V<sub>CCUNCORESENSE</sub> and V<sub>SSUNCORESENSE</sub> pins using an oscilloscope set to a 100 MHz bandwidth and probes that are 1.5 pF maximum capacitance and 1 MΩ minimum impedance at the processor socket. The maximum length of ground wire on the probe should be less than 5 mm. Ensure external noise from the system is not coupled into the scope probe.
5. The voltage specification requirements are measured across the V<sub>CCCACHESENSE</sub> and V<sub>SSCACHESENSE</sub> pins using an oscilloscope set to a 100 MHz bandwidth and probes that are 1.5 pF maximum capacitance and 1 MΩ minimum impedance at the processor socket. The maximum length of ground wire on the probe should be less than 5 mm. Ensure external noise from the system is not coupled into the scope probe.
6. Warm boot reset, only in downward direction.
7. Min and Max range is spec at the die for both VCCIO and VCCIO\_FBD. This range includes 50 mV p-p AC noise. It also includes any DC and AC tolerances at package pin.
8. The FMB remote sense tolerance is ±2.5% for DC to 20 MHz at the package, where ±1.5% is allotted for a DC to 1 MHz range and an additional ±1% for 1 MHz to 20 MHz. Similarly, ±6.4% is allotted for DC to 20 MHz at the die. It is expected that VCCIO regulators meet ±1.5% at the remote sense location based on the general remote sense termination point location as described in [Figure 2-13](#), VR Sense Point (Representation). For future processor compatibility, it is strongly recommended that the platform query the PIROM to assure VCCIO is set to the appropriate level prior to powering up the VCCIO supply.
9. All voltage regulation measurements taken at remote sense termination points.
10. For peak-to-peak Ripple and Noise (R&N) measured with full bandwidth (BW) of the scope (Min 1 GHz BW scope is required): set scope diff probe and the scope at full BW (capture waveform A, channel 1).
11. For peak-to-peak Ripple and Noise (R&N) measured above 1 MHz:  
 Step 1 = set both: scope diff probe and/or the scope at 1 MHz BW limit (capture waveform B, channel 2)  
 Step 2 = calculate A-B (use scope Math function: subtract channel 1 - channel 2).

**Table 2-9. FMB 130 W Current Specifications (Sheet 1 of 2)**

Symbol	Parameter	Max	Units	Notes
I <sub>CC_CORE</sub>	I <sub>CC</sub> for core	151	A	
I <sub>CC_CORE_TDC</sub>	Thermal Design Current for Core	100	A	1
I <sub>CC_CORE_STEP</sub>	Max Load step for core	95	A	2
dI <sub>CC_CORE/dt</sub>	Slew rate for core at Ararat output	154	A/us	
I <sub>CC_UNCORE</sub>	I <sub>CC</sub> for uncore	50	A	
I <sub>CC_UNCORE_TDC</sub>	Thermal Design Current for Uncore	43	A	3
I <sub>CC_UNCORE_STEP</sub>	Max Load step for uncore	22	A	4
dI <sub>CC_UNCORE/dt</sub>	Slew rate for uncore at Ararat output	75	A/us	
I <sub>CC_CACHE</sub>	I <sub>CC</sub> for processor cache	50	A	
I <sub>CC_CACHE_TDC</sub>	Thermal Design Current for Cache	50	A	5
I <sub>CC_CACHE_STEP</sub>	Max Load step for cache	25	A	6



**Table 2-9. FMB 130 W Current Specifications (Sheet 2 of 2)**

Symbol	Parameter	Max	Units	Notes
$dI_{CC\_CACHE}/dt$	Slew rate for cache at Ararat output	125	A/us	
$I_{CC\_IO}$	$I_{CC}$ for processor I/O	22	A	7
$I_{CC\_Analog}$	$I_{CC}$ for processor Analog	6	A	
$I_{CC33\_SM}$	$I_{CC33}$ for main supply	200	mA	

**Notes:**

- $I_{CC\_CORE\_TDC}$  is the sustained (DC equivalent) current that the processor core is capable of drawing indefinitely and should be used for the Ararat voltage regulator temperature assessment. The Ararat voltage regulator is responsible for monitoring its temperature and asserting the VR\_FAN\_N, VR\_THERMALERT\_N, VR\_THERMTRIP\_N signals sequentially to inform the processor and platform of a thermal excursion. Of the three signals, only VR\_THERMALERT\_N is monitored by the processor. Please see the Ararat Voltage Regulator Design Guide for further details. The processor is capable of drawing  $I_{CC\_CORE\_TDC}$  indefinitely. Refer to Figure 2-9 for further details on the average processor current draw over various time durations. This parameter is based on design characterization and is not tested.
- During system power on, the pulse inrush ( $I_{CC\_CORE\_STEP}$ ) can be as high as 130A peak-to-peak.
- $I_{CC\_UNCORE\_TDC}$  is the sustained (DC equivalent) current that the processor uncore is capable of drawing indefinitely and should be used for the Ararat voltage regulator temperature assessment. The Ararat voltage regulator is responsible for monitoring its temperature and asserting the VR\_FAN\_N, VR\_THERMALERT\_N, VR\_THERMTRIP\_N signals sequentially to inform the processor and platform of a thermal excursion. Of the three signals, only VR\_THERMALERT\_N is monitored by the processor. Please see the Ararat Voltage Regulator Design Guide for further details. The processor is capable of drawing  $I_{CC\_UNCORE\_TDC}$  indefinitely. This parameter is based on design characterization and is not tested.
- During system power on, the pulse inrush ( $I_{CC\_UNCORE\_STEP}$ ) can be as high as 40A peak-to-peak.
- $I_{CC\_CACHE\_TDC}$  is the sustained (DC equivalent) current that the processor cache is capable of drawing indefinitely and should be used for the Ararat voltage regulator temperature assessment. The Ararat voltage regulator is responsible for monitoring its temperature and asserting the VR\_FAN\_N, VR\_THERMALERT\_N, VR\_THERMTRIP\_N signals sequentially to inform the processor and platform of a thermal excursion. Of the three signals, only VR\_THERMALERT\_N is monitored by the processor. Please see the Ararat Voltage Regulator Design Guide for further details. The processor is capable of drawing  $I_{CC\_CACHE\_TDC}$  indefinitely. This parameter is based on design characterization and is not tested.
- During system power on, the pulse inrush ( $I_{CC\_CACHE\_STEP}$ ) can be as high as 40A peak-to-peak.
- The  $I_{CC\_IO}$  current specification applies to the total current from VCCIO and VCCIO\_FBD pins.

**Table 2-10. FMB 155/185 W Current Specifications**

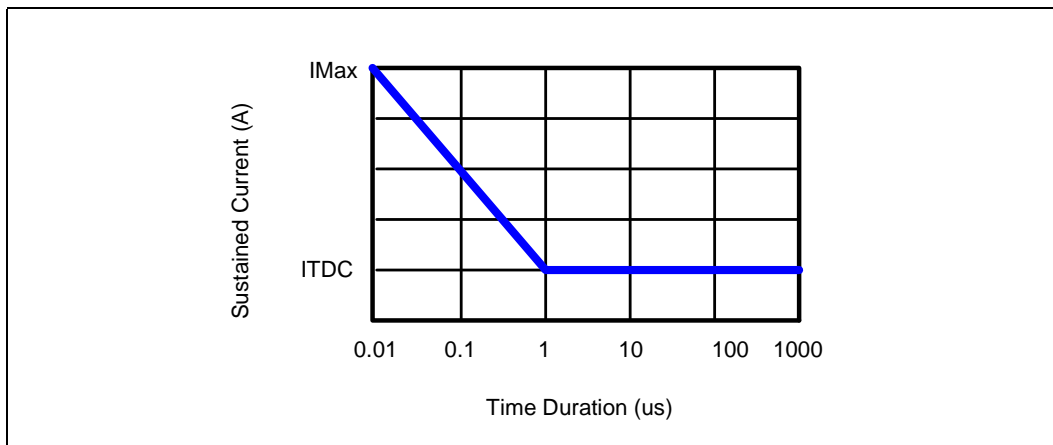
Symbol	Parameter	Max	Units	Notes
$I_{CC\_CORE}$	$I_{CC}$ for core	180	A	
$I_{CC\_CORE\_TDC}$	Thermal Design Current for Core	131	A	1
$I_{CC\_CORE\_STEP}$	Max Load step for core	95	A	2
$dI_{CC\_CORE}/dt$	Slew rate for core at Ararat output	154	A/us	
$I_{CC\_UNCORE}$	$I_{CC}$ for uncore	50	A	
$I_{CC\_UNCORE\_TDC}$	Thermal Design Current for Uncore	43	A	3
$I_{CC\_UNCORE\_STEP}$	Max Load step for uncore	22	A	4
$dI_{CC\_UNCORE}/dt$	Slew rate for uncore at Ararat output	75	A/us	
$I_{CC\_CACHE}$	$I_{CC}$ for processor cache	50	A	
$I_{CC\_CACHE\_TDC}$	Thermal Design Current for Cache	50	A	5
$I_{CC\_CACHE\_STEP}$	Max Load step for cache	25	A	6
$dI_{CC\_CACHE}/dt$	Slew rate for cache at Ararat output	125	A/us	
$I_{CC\_IO}$	$I_{CC}$ for processor I/O	22	A	7
$I_{CC\_Analog}$	$I_{CC}$ for processor Analog	6	A	
$I_{CC33\_SM}$	$I_{CC33}$ for main supply	200	mA	

**Notes:**

- $I_{CC\_CORE\_TDC}$  is the sustained (DC equivalent) current that the processor core is capable of drawing indefinitely and should be used for the Ararat voltage regulator temperature assessment. The Ararat voltage regulator is responsible for monitoring its temperature and asserting the VR\_FAN\_N, VR\_THERMALERT\_N, VR\_THERMTRIP\_N signals sequentially to inform the processor and platform of a thermal excursion. Of the three signals, only VR\_THERMALERT\_N is monitored by the processor. Please see the Ararat Voltage Regulator Design Guide for further details. The processor is capable of drawing  $I_{CC\_CORE\_TDC}$  indefinitely. Refer to Figure 2-9 for further details on the average processor current draw over various time durations. This parameter is based on design characterization and is not tested.

2. During system power on, the pulse inrush ( $I_{CC\_CORE\_STEP}$ ) can be as high as 130A peak-to-peak.
3.  $I_{CC\_UNCORE\_TDC}$  is the sustained (DC equivalent) current that the processor uncore is capable of drawing indefinitely and should be used for the Ararat voltage regulator temperature assessment. The Ararat voltage regulator is responsible for monitoring its temperature and asserting the VR\_FAN\_N, VR\_THERMALERT\_N, VR\_THERMTRIP\_N signals sequentially to inform the processor and platform of a thermal excursion. Of the three signals, only VR\_THERMALERT\_N is monitored by the processor. Please see the Ararat Voltage Regulator Design Guide for further details. The processor is capable of drawing  $I_{CC\_UNCORE\_TDC}$  indefinitely. This parameter is based on design characterization and is not tested.
4. During system power on, the pulse inrush ( $I_{CC\_UNCORE\_STEP}$ ) can be as high as 40A peak-to-peak.
5.  $I_{CC\_CACHE\_TDC}$  is the sustained (DC equivalent) current that the processor cache is capable of drawing indefinitely and should be used for the Ararat voltage regulator temperature assessment. The Ararat voltage regulator is responsible for monitoring its temperature and asserting the VR\_FAN\_N, VR\_THERMALERT\_N, VR\_THERMTRIP\_N signals sequentially to inform the processor and platform of a thermal excursion. Of the three signals, only VR\_THERMALERT\_N is monitored by the processor. Please see the Ararat Voltage Regulator Design Guide for further details. The processor is capable of drawing  $I_{CC\_CACHE\_TDC}$  indefinitely. This parameter is based on design characterization and is not tested.
6. During system power on, the pulse inrush ( $I_{CC\_CACHE\_STEP}$ ) can be as high as 40A peak-to-peak.
7. The  $I_{CC\_IO}$  current specification applies to the total current from VCCIO and VCCIO\_FBD pins.

Figure 2-9. Processor  $I_{CC\_CORE}$  Load Current versus Time



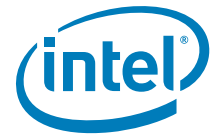
## 2.6.2 Uncore, Core and Cache Tolerances

### 2.6.2.1 Uncore Static and Transient Tolerances

Table 2-11 and Figure 2-10 specify static and transient tolerances for the uncore outputs.

Table 2-11.  $V_{CCUNCORE}$  Static and Transient Tolerance (Sheet 1 of 2)

Uncore Current (A)	Voltage Deviation from VID Setting (V) <sup>1,2,3,4</sup>		
	$V_{CC\_Max}$	$V_{CC\_Typ}$	$V_{CC\_Min}$
0	VID - 0	VID - 0.02	VID - 0.04
5	VID Intel® Itanium® Processor 9300 Series Datasheet - 0.02	VID - 0.04	VID - 0.06
10	VID - 0.04	VID - 0.06	VID - 0.08
15	VID - 0.06	VID - 0.08	VID - 0.1
20	VID - 0.08	VID - 0.1	VID - 0.12
25	VID - 0.1	VID - 0.12	VID - 0.14
30	VID - 0.12	VID - 0.14	VID - 0.16
35	VID - 0.14	VID - 0.16	VID - 0.18



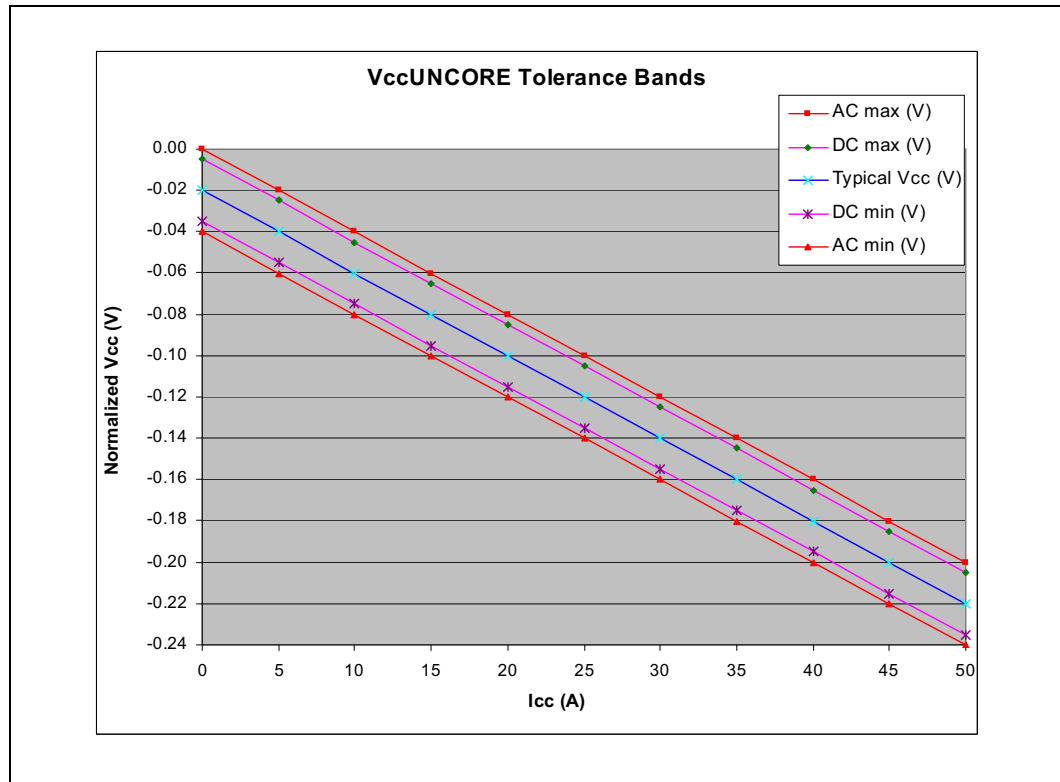
**Table 2-11. V<sub>CCUNCORE</sub> Static and Transient Tolerance (Sheet 2 of 2)**

Uncore Current (A)	Voltage Deviation from VID Setting (V) 1,2,3,4		
40	VID - 0.16	VID - 0.18	VID - 0.2
45	VID - 0.18	VID - 0.2	VID - 0.22
50	VID - 0.2	VID - 0.22	VID - 0.24

**Notes:**

1. The V<sub>CC\_MIN</sub> and V<sub>CC\_MAX</sub> load lines represent static and transient limits.
2. This table is intended to aid in reading discrete points on Figure 2-10.
3. The load lines specify voltage limits at the die measured at the V<sub>CCUNCORESENSE</sub> and V<sub>SSUNCORESENSE</sub> pins. Voltage regulation feedback for voltage regulator circuits must be taken from processor V<sub>CC</sub> and V<sub>SS</sub> pins. Refer to the *Ararat Voltage Regulator Design Guide* for socket load line guidelines and VR implementation.
4. V<sub>DC(max)</sub>=VID-R<sub>II</sub>\*I<sub>CC</sub>-5mV; V<sub>DC(min)</sub>=VID-R<sub>II</sub>\*I<sub>CC</sub>-35mV; R<sub>II</sub>=4mΩ.

**Figure 2-10. V<sub>CCUNCORE</sub> Static and Transient Tolerance**



**2.6.2.2 Cache Static and Transient Tolerances**

Table 2-12 and Figure 2-11 specify static and transient tolerances for the uncore outputs.



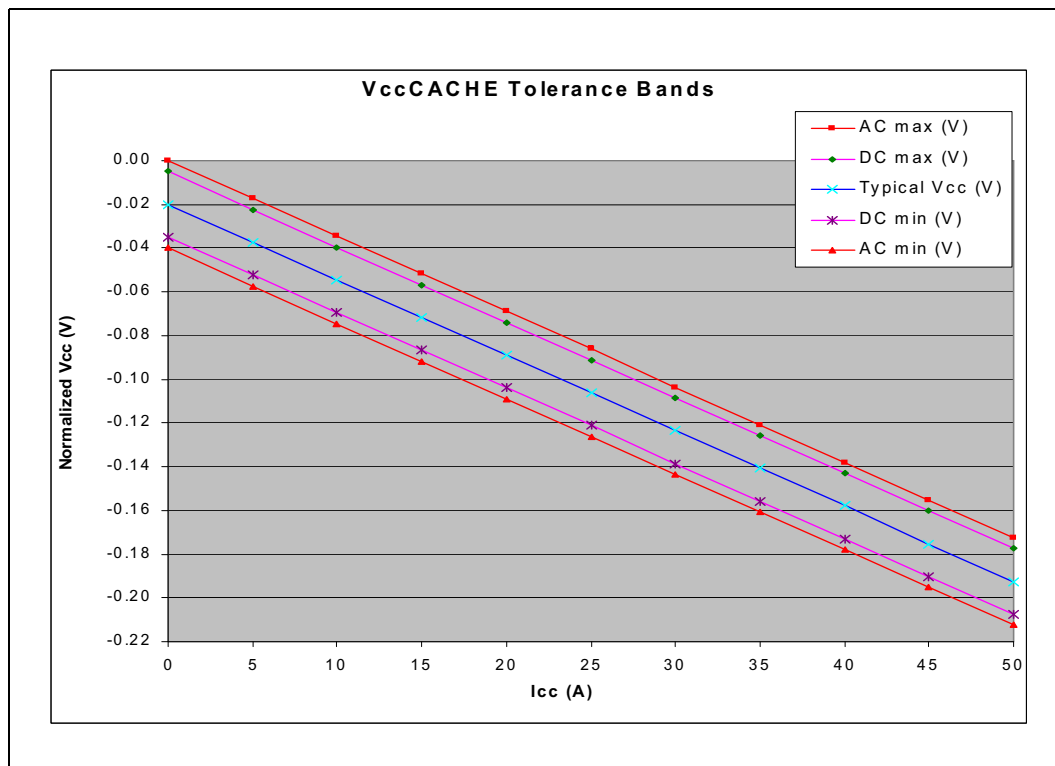
Table 2-12. VccCACHE Static and Transient Tolerance

Cache Current (A)	Voltage Deviation from VID Setting (V) 1,2,3,4		
I <sub>CC_CACHE</sub>	V <sub>CC_Max</sub>	V <sub>CC_Typ</sub>	V <sub>CC_Min</sub>
0	VID - 0	VID - 0.02	VID - 0.04
5	VID - 0.017	VID - 0.037	VID - 0.057
10	VID - 0.035	VID - 0.055	VID - 0.075
15	VID - 0.052	VID - 0.072	VID - 0.092
20	VID - 0.069	VID - 0.089	VID - 0.109
25	VID - 0.086	VID - 0.106	VID - 0.126
30	VID - 0.104	VID - 0.124	VID - 0.144
35	VID - 0.121	VID - 0.141	VID - 0.161
40	VID - 0.138	VID - 0.158	VID - 0.178
45	VID - 0.155	VID - 0.175	VID - 0.195
50	VID - 0.173	VID - 0.193	VID - 0.213
55	VID - 0.19	VID - 0.21	VID - 0.23

**Notes:**

1. The V<sub>CC\_MIN</sub> and V<sub>CC\_MAX</sub> load lines represent static and transient limits.
2. This table is intended to aid in reading discrete points on Figure 2-11.
3. The load lines specify voltage limits at the die measured at the V<sub>CCCACHESENSE</sub> and V<sub>SSCACHESENSE</sub> pins. Voltage regulation feedback for voltage regulator circuits must be taken from processor V<sub>CC</sub> and V<sub>SS</sub> pins. Refer to the *Ararat Voltage Regulator Design Guide* for socket load line guidelines and VR implementation.
4. V<sub>DC(max)</sub>=VID-R<sub>II</sub>\*I<sub>CC</sub>-5mV; V<sub>DC(min)</sub>=VID-R<sub>II</sub>\*I<sub>CC</sub>-35mV; R<sub>II</sub>=3.45mΩ

Figure 2-11. VCCACHE Static and Transient Tolerance





2.6.2.3 Core Static and Transient Tolerances

Table 2-13 and Figure 2-12 specify static and transient tolerances for the uncore outputs.

Table 2-13. VccCORE Static and Transient Tolerance (Sheet 1 of 2)

Core Current (A)	Voltage Deviation from VID Setting (V) 1,2,3,4		
I <sub>CC_CORE</sub>	V <sub>CC_Max</sub>	V <sub>CC_Typ</sub>	V <sub>CC_Min</sub>
0	VID - 0	VID - 0.02	VID - 0.04
5	VID - 0.004	VID - 0.024	VID - 0.044
10	VID - 0.009	VID - 0.029	VID - 0.049
15	VID - 0.013	VID - 0.033	VID - 0.053
20	VID - 0.017	VID - 0.037	VID - 0.057
25	VID - 0.021	VID - 0.041	VID - 0.061
30	VID - 0.026	VID - 0.046	VID - 0.066
35	VID - 0.03	VID - 0.05	VID - 0.07
40	VID - 0.034	VID - 0.054	VID - 0.074
45	VID - 0.038	VID - 0.058	VID - 0.078
50	VID - 0.043	VID - 0.063	VID - 0.083
55	VID - 0.047	VID - 0.067	VID - 0.087
60	VID - 0.051	VID - 0.071	VID - 0.091
65	VID - 0.055	VID - 0.075	VID - 0.095
70	VID - 0.06	VID - 0.08	VID - 0.1
75	VID - 0.064	VID - 0.084	VID - 0.104
80	VID - 0.068	VID - 0.088	VID - 0.108
85	VID - 0.072	VID - 0.092	VID - 0.112
90	VID - 0.077	VID - 0.097	VID - 0.117
95	VID - 0.081	VID - 0.101	VID - 0.121
100	VID - 0.085	VID - 0.105	VID - 0.125
105	VID - 0.089	VID - 0.109	VID - 0.129
110	VID - 0.094	VID - 0.114	VID - 0.134
115	VID - 0.098	VID - 0.118	VID - 0.138
120	VID - 0.102	VID - 0.122	VID - 0.142
125	VID - 0.106	VID - 0.126	VID - 0.146
130	VID - 0.111	VID - 0.131	VID - 0.151
135	VID - 0.115	VID - 0.135	VID - 0.155
140	VID - 0.119	VID - 0.139	VID - 0.159
145	VID - 0.123	VID - 0.143	VID - 0.163
150	VID - 0.128	VID - 0.148	VID - 0.168
155	VID - 0.132	VID - 0.152	VID - 0.172
160	VID - 0.136	VID - 0.156	VID - 0.176
165	VID - 0.14	VID - 0.16	VID - 0.18

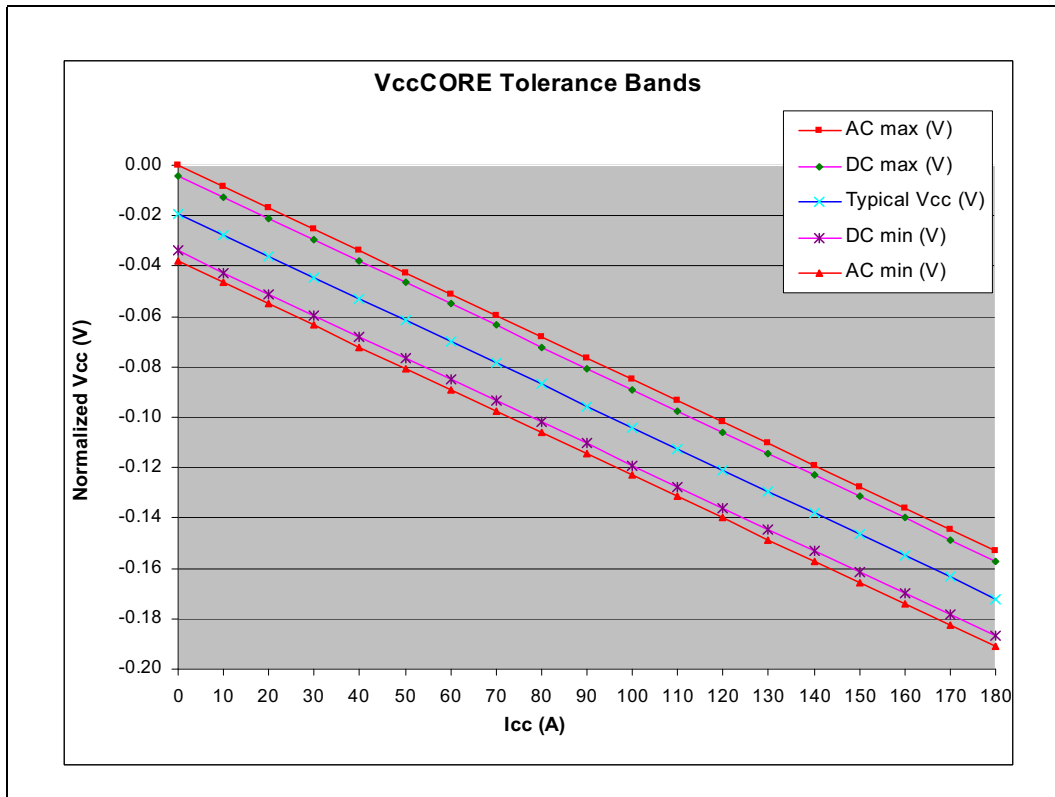
Table 2-13. VccCORE Static and Transient Tolerance (Sheet 2 of 2)

Core Current (A)	Voltage Deviation from VID Setting (V) 1,2,3,4		
	$V_{CC\_Max}$	$V_{CC\_Typ}$	$V_{CC\_Min}$
170	VID - 0.145	VID - 0.165	VID - 0.185
175	VID - 0.149	VID - 0.169	VID - 0.189
180			

**Notes:**

1. The  $V_{CC\_MIN}$  and  $V_{CC\_MAX}$  load lines represent static and transient limits.
2. This table is intended to aid in reading discrete points on Figure 2-12.
3. The load lines specify voltage limits at the die measured at the  $V_{CCCORESENSE}$  and  $V_{SSCORESENSE}$  pins. Voltage regulation feedback for voltage regulator circuits must be taken from processor  $V_{CC}$  and  $V_{SS}$  pins. Refer to the *Ararat Voltage Regulator Design Guide* for socket load line guidelines and VR implementation.
4.  $V_{DC(max)} = VID - R_{II} * I_{CC} - 4mV$ ;  $V_{DC(nom)} = VID - R_{II} * I_{CC} - 19mV$ ;  $V_{DC(min)} = VID - R_{II} * I_{CC} - 34mV$ ;  $R_{II} = 0.85m\Omega$ .

Figure 2-12. VccCORE Static and Transient Tolerance





## 2.6.3 Overshoot and Undershoot Guidelines

Overshoot (or undershoot) is the value of the maximum voltage above or below VSS. The overshoot and undershoot specifications limit transitions beyond VCCIO or VSS due to the fast signal edge rates. The processor can be damaged by single and/or repeated overshoot or undershoot events on any input, output, or I/O buffer if the charge is large enough (that is, if the overshoot or undershoot is great enough). Determining the impact of an overshoot or undershoot condition requires knowledge of the magnitude, the pulse duration, and the activity factor (AF). Permanent damage to the processor is the likely result of excessive overshoot or undershoot.

### 2.6.3.1 Overshoot/Undershoot Magnitude, Pulse Duration and Activity Factor

Magnitude describes the maximum potential difference between a signal and its voltage <sup>1</sup> = reference level. For the Intel® Itanium® processor 9300 series, both are referenced to VSS. It is important to note that overshoot and undershoot conditions are separate and their impact must be determined independently.

Pulse duration describes the total amount of time that an overshoot or undershoot event exceeds the overshoot or undershoot reference voltage. Activity factor (AF) describes the frequency of overshoot or undershoot occurrence relative to a clock. Since the highest frequency of assertion of a single-ended signal is every other clock, an AF = 1 indicates that the specific overshoot or undershoot waveform occurs every other clock cycle. Thus, an AF = 0.01 indicates that the specific overshoot or undershoot waveform occurs one time in every 200 clock cycles. The highest frequency of assertion of any differential signal is every active edge of its associated clock (not the reference clock). So, an AF = 1 indicates that the specific overshoot or undershoot waveform occurs every cycle.

### 2.6.3.2 Overshoot/Undershoot Specifications

The overshoot and undershoot specifications listed in the following table specify the allowable overshoot or undershoot for a single overshoot or undershoot event. [Table 2-14](#) specifies the maximum overshoot and undershoot for the processor for both the single ended and the differential signalling pins. The overshoot and undershoot values assume an activity factor of 100% and a pulse width of 25% over the signal pulse width. The table also includes the absolute maximum and minimum values beyond which the processor is not guaranteed to operate properly. These values assume a pulse width of 1% and an activity factor of 100%.

**Table 2-14. Overshoot and Undershoot Specifications For Differential Intel QuickPath Interconnect and Intel® SMI and Single-Ended Signals**

Symbol	Parameter	Min	Max	Unit
$V_{MAX-OS-SE}$	Overshoot for single-ended signals		1.45	V
$V_{MIN-US-SE}$	Undershoot for single-ended signals	-0.247		V
$V_{ABSMAX-OS-SE}$	Absolute Max for single-ended signals		1.6	V
$V_{ABSMIN-US-SE}$	Absolute Min for single-ended signals	-0.425		V
$V_{MAX-OS-DIFF}$	Overshoot for Intel QPI and Intel SMI signals		1.54	V
$V_{MAX-US-DIFF}$	Undershoot for Intel QPI and Intel SMI signals	-0.337		V
$V_{ABSMAX-OS-DIFF}$	Absolute Max for Intel QPI and Intel SMI signals		1.7	V
$V_{ABSMAX-US-DIFF}$	Absolute Min for Intel QPI and Intel SMI signals	-0.525		V



## 2.6.4 Signal DC Specifications

**Table 2-15. Voltage Regulator Signal Group DC Specifications**

Symbol	Parameter	Min	Max	Unit	Notes
V <sub>IL</sub>	Input Low Voltage	0	0.4	V	
V <sub>IH</sub>	Input High Voltage	0.8	3.6	V	
V <sub>OH</sub>	Output High Voltage	0.8	3.6	V	1, 2, 3, 4, 5
V <sub>OL</sub>	Output Low Voltage	0	0.4	V	1, 2, 3, 4, 5

**Notes:**

1. Open collector and drain outputs need pull-up resistors on the motherboard.
2. These outputs can be pulled up to VCCIO or VCC\_STDBY on the platform.
3. Pull-up resistance should limit current to 2 mA.
4. Actual V<sub>OH</sub> and V<sub>OL</sub> levels are determined by pull-up resistance and supply voltage values.
5. These values are based on 2.2 kΩ pull-up to 3.3 V supply.

**Table 2-16. VR\_THERMALERT\_N DC Specification**

Symbol	Parameter	Min	Max	Unit	Notes
V <sub>IL</sub>	Input Low Voltage	0	(VCCIO*0.67) - 0.2	V	
V <sub>IH</sub>	Input High Voltage	(VCCIO*0.67) + 0.2	VCCIO	V	
V <sub>OH</sub>	Output High Voltage	VCCIO-0.2	VCCIO	V	1,2,3,4,5
V <sub>OL</sub>	Output Low Voltage	0	0.25	V	1,2,3,4,5

**Notes:**

1. Open collector and drain outputs need pull-up resistors on the motherboard.
2. Pull-up resistance should limit current to 2 mA.
3. Actual V<sub>OH</sub> and V<sub>OL</sub> levels determined by pull-up resistance and supply voltage values.
4. These values are based on 1 kΩ pull-up to 1.1 V.
5. VR\_THERMALERT\_N is an input to the top of the package and an output from the bottom of the package. V<sub>IH</sub> and V<sub>IL</sub> levels are for the input at the top of the package, sensed by the processor; V<sub>OH</sub> and V<sub>OL</sub> are for the output levels on the package pins at the bottom of the package.

**Table 2-17. TAP Group DC Specifications**

Symbol	Parameter	Min	Max	Unit	Notes
V <sub>IL</sub>	Input Low Voltage	0	(VCCIO*0.5) - 0.2	V	
V <sub>IH</sub>	Input High Voltage	(VCCIO*0.5) + 0.2	VCCIO	V	
V <sub>OH</sub>	Output High Voltage	VCCIO-0.2	VCCIO	V	
V <sub>OL</sub>	Output Low Voltage	0	0.25	V	1
I <sub>OL</sub>	Output Low Current	16	23	mA	1
I <sub>ILeak</sub>	Input Leakage Current	-200	200	μA	2,3,4
I <sub>OLeak</sub>	Output Leakage Current	-1000	200	μA	

**Notes:**

1. With 50 Ω termination to VCCIO at the far end.
2. With V at the pin at 1.1 V and 0 V. System designers are advised to check the tolerance of their voltage regulator solutions to ensure V at the pin is 1.1 V.
3. Internal weak pull-up included for TCLK
4. Internal weak pull-up included for TRST\_N, TMS and TDI

**Table 2-18. Error, FLASHROM and Thermal Group DC Specifications (Sheet 1 of 2)**

Symbol	Parameter	Min	Max	Unit	Notes
V <sub>IL</sub>	Input Low Voltage	0	(VCCIO*0.67) - 0.2	V	

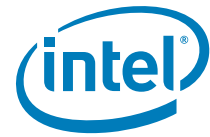


Table 2-18. Error, FLASHROM and Thermal Group DC Specifications (Sheet 2 of 2)

Symbol	Parameter	Min	Max	Unit	Notes
V <sub>IH</sub>	Input High Voltage	$(V_{CCIO} \times 0.67) + 0.2$	V <sub>CCIO</sub>	V	
V <sub>OH</sub>	Output High Voltage	V <sub>CCIO</sub> -0.2	V <sub>CCIO</sub>	V	
V <sub>OL</sub>	Output Low Voltage	0	0.25	V	1
I <sub>OL</sub>	Output Low Current	16	23	mA	1
I <sub>ILeak</sub>	Input Leakage Current	-1000	200	μA	2
I <sub>OLeak</sub>	Output Leakage Current	-1000	200	μA	

**Notes:**

1. With 50Ω termination to V<sub>CCIO</sub> at the far end.
2. With input leakage current measured at the pin with 0 V and with 1.1 V supplied to the pin. System designers are advised to check the tolerance of their voltage regulator solutions to ensure a voltage of 1.1 V at the pin.

Table 2-19. POWERUP and Setup Signal Group DC Specifications

Symbol	Parameter	Min	Max	Unit	Notes
V <sub>IH</sub>	Input High Voltage	$(V_{CCIO} \times 0.67) + 0.2$	V <sub>CCIO</sub>	V	
V <sub>IL</sub>	Input Low Voltage	0	$(V_{CCIO} \times 0.67) - 0.2$	V	
I <sub>LI</sub>	Input Leakage Current	-1000	200	μA	

Table 2-20. VID\_VCCCORE[6:0], VID\_VCCUNCORE[6:0] and VID\_VCCCACHE[5:0] DC Specifications

Symbol	Parameter	Min	Max	Unit	Notes
V <sub>OH</sub>	Output High Voltage	V <sub>CCIO</sub> -0.1	V <sub>CCIO</sub>	V	1
V <sub>OL</sub>	Output Low Voltage	0	0.1	V	1
I <sub>OLeak</sub>	Output Leakage Current	-200	200	μA	1,2

**Notes:**

1. These parameters are not tested and are based on design simulations.
2. Leakage to V<sub>SS</sub> with pin held at 1.1 V and leakage to 1.1 V with pin held at V<sub>SS</sub>.

Table 2-21. SMBus and Serial Presence Detect (SPD) Bus Signal Group DC Specifications

Symbol	Parameter	Min	Max	Unit	Notes
V <sub>IL</sub>	Input Low Voltage	0	$(V_{CCIO} \times 0.67) - 0.2$	V	1
V <sub>IH</sub>	Input High Voltage	$(V_{CCIO} \times 0.67) + 0.2$	V <sub>CCIO</sub>	V	1
V <sub>OL</sub>	Output Low Voltage	0	0.25	V	1
I <sub>OL</sub>	Output Low Current	16	23	mA	1,2
I <sub>ILeak</sub>	Input Leakage Current	-1000	200	μA	1
I <sub>LO</sub>	Output Leakage Current	-1000	200	μA	1

**Notes:**

1. These parameters are based on design characterization and are not tested.
2. With 50Ω termination to V<sub>CCIO</sub> at the far end.

**Table 2-22. Debug Signal Group DC Specifications**

Symbol	Parameter	Min	Max	Unit	Notes
V <sub>IL</sub>	Input Low Voltage	0	(VCCIO*0.67) - 0.2	V	
V <sub>IH</sub>	Input High Voltage	(VCCIO*0.67) + 0.2	VCCIO	V	
V <sub>OH</sub>	Output High Voltage	VCCIO-0.2	VCCIO	V	
V <sub>OL</sub>	Output Low Voltage	0	0.35	V	1
I <sub>OL</sub>	Output Low Current	13	23	mA	1
I <sub>ILeak</sub>	Input Leakage Current	-1000	200	μA	2
I <sub>OLeak</sub>	Output Leakage Current	-1000	200	μA	

**Notes:**

1. With 2 parallel 50Ω termination to VCCIO at the far end.
2. With input leakage current measured at the pin with 0V and with 1.1V supplied to the pin. System designers are advised to check the tolerance of their voltage regulator solutions to ensure V<sub>pin</sub> of 1.1 V.

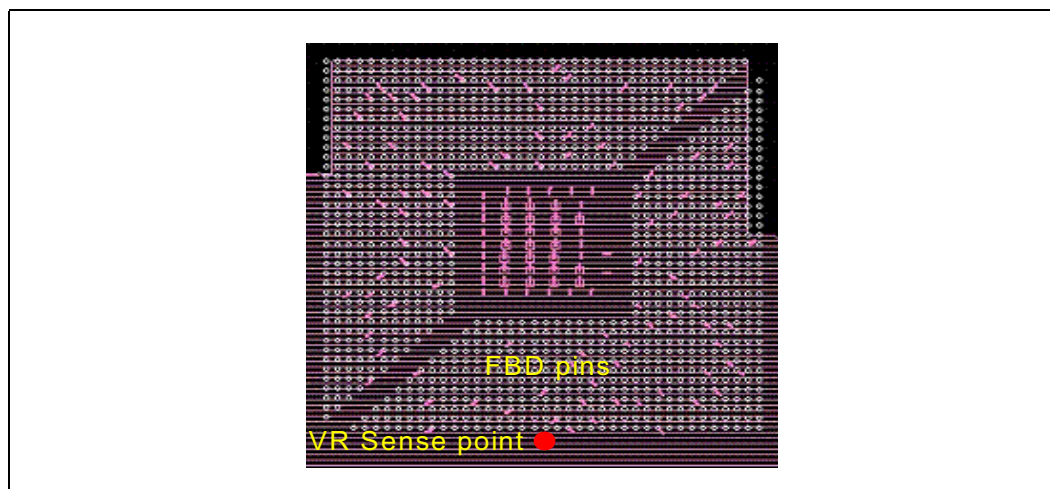
**Table 2-23. PIROM Signal Group DC Specifications**

Symbol	Parameter	Min	TYP	Max	Unit	Notes
V <sub>IL</sub>	Input Low Voltage	-0.6		V <sub>CC</sub> *0.3		2,1
V <sub>IH</sub>	Input High Voltage	V <sub>CC</sub> *0.7		V <sub>CC</sub> +0.5		2,1
V <sub>OL2</sub>	Output Low Voltage (I <sub>OL</sub> = 2.1 mA)			0.4		2
V <sub>OL1</sub>	Output Low Voltage (I <sub>OL</sub> = 0.15 mA)			0.2		2
I <sub>ILeak</sub>	Input Leakage Current		0.1	3.0		2
I <sub>OLeak</sub>	Output Leakage Current		0.05	3.0		2

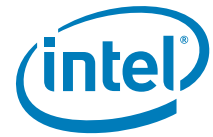
**Notes:**

1. V<sub>IL</sub>(min) and V<sub>IH</sub>(max) are reference only and are not tested.
2. Applicable over recommended operating range T = -40 °C to +88 °C; V<sub>CC</sub> = +1.7 V to +3.6 V.

## 2.6.5 Motherboard-Socket Specification for VR Sense Point

**Figure 2-13. VR Sense Point (Representation)**


**Note:** ±1.5% DC (DC to 1 MHz) and ±1% AC (1 MHz to 20 MHz) specified at MB/socket.



## 2.7 Core and Uncore Voltage Identification

The VID\_VCCCORE[6:0] and VID\_VCCUNCORE[6:0] lands supply the encoding that determine the voltage to be supplied by the VCCCORE and VCCUNCORE (the core and system interface voltages for the Intel® Itanium® processor 9300 series) voltage regulators. The VID\_VCCCORE and VID\_VCCUNCORE specifications for the processor are defined in the *Ararat 170 Watt Voltage Regulator Design Guide*. The voltage set by the VID\_VCCCORE and VID\_VCCUNCORE lands are the maximum VCCCORE and VCCUNCORE voltage allowed by the processor.

Individual processor VID\_VCCCORE and VID\_VCCUNCORE values may be calibrated during manufacturing such that two devices at the same core speed may have different default VID\_VCCCORE and VID\_VCCUNCORE settings. Furthermore, any Intel® Itanium® processor 9300 series can drive different VID\_VCCCORE and VID\_VCCUNCORE settings during normal operation.

The Intel® Itanium® processor 9300 series uses seven voltage identification lands (VID\_VCCCORE[6:0]) and seven system interface voltage identifications (VID\_VCCUNCORE[6:0]) to support automatic selection of Ararat voltages. [Table 2-24](#) specifies the voltage levels corresponding to the state of VID\_VCCCORE[6:0] and VID\_VCCUNCORE[6:0]. A '1' in this table refers to a high voltage level and a '0' refers to a low voltage level.

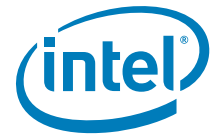
The Intel® Itanium® processor 9300 series provides the ability to operate while transitioning to an adjacent VID and its associated processor core voltage (VCCCORE). This will represent a DC shift in the load line. It should be noted that a low-to-high or high-to-low voltage state change may result in as many VID transitions as necessary to reach the target core voltage. Transitions above the specified VID are not permitted.

The Ararat voltage regulator must be capable of regulating its output to the value defined by the new VID. Please refer to the *Ararat 170 Watt Voltage Regulator Design Guide*.



**Table 2-24. VCCCORE (VID\_VCCCORE) and VCCUNCORE and (VID\_VCCUNCORE) Voltage Identification Definition for Ararat**

Hex	VID 6	VID 5	VID 4	VID 3	VID 2	VID 1	VID 0	VID (V)	Hex	VID 6	VID 5	VID 4	VID 3	VID 2	VID 1	VID 0	VID (V)
00	0	0	0	0	0	0	0	OFF	2E	0	1	0	1	1	1	0	1.0375
01	0	0	0	0	0	0	1	1.6000	2F	0	1	0	1	1	1	1	1.0250
02	0	0	0	0	0	1	0	1.5875	30	0	1	1	0	0	0	0	1.0125
03	0	0	0	0	0	1	1	1.5750	31	0	1	1	0	0	0	1	1.0000
04	0	0	0	0	1	0	0	1.5625	32	0	1	1	0	0	1	0	0.9875
05	0	0	0	0	1	0	1	1.5500	33	0	1	1	0	0	1	1	0.9750
06	0	0	0	0	1	1	0	1.5375	34	0	1	1	0	1	0	0	0.9625
07	0	0	0	0	1	1	1	1.5250	35	0	1	1	0	1	0	1	0.9500
08	0	0	0	1	0	0	0	1.5125	36	0	1	1	0	1	1	0	0.9375
09	0	0	0	1	0	0	1	1.5000	37	0	1	1	0	1	1	1	0.9250
0A	0	0	0	1	0	1	0	1.4875	38	0	1	1	1	0	0	0	0.9125
0B	0	0	0	1	0	1	1	1.4750	39	0	1	1	1	0	0	1	0.9000
0C	0	0	0	1	1	0	0	1.4625	3A	0	1	1	1	0	1	0	0.8875
0D	0	0	0	1	1	0	1	1.4500	3B	0	1	1	1	0	1	1	0.8750
0E	0	0	0	1	1	1	0	1.4375	3C	0	1	1	1	1	0	0	0.8625
0F	0	0	0	1	1	1	1	1.4250	3D	0	1	1	1	1	0	1	0.8500
10	0	0	1	0	0	0	0	1.4125	3E	0	1	1	1	1	1	0	0.8375
11	0	0	1	0	0	0	1	1.4000	3F	0	1	1	1	1	1	1	0.8250
12	0	0	1	0	0	1	0	1.3875	40	1	1	1	0	0	0	0	0.8125
13	0	0	1	0	0	1	1	1.3750	41	1	1	1	0	0	0	1	0.8000
14	0	0	1	0	1	0	0	1.3625	42	1	1	1	0	0	1	0	0.7875
15	0	0	1	0	1	0	1	1.3500	43	1	0	1	0	0	1	1	0.7750
16	0	0	1	0	1	1	0	1.3375	44	1	0	0	0	1	0	0	0.7625
17	0	0	1	0	1	1	1	1.3250	45	1	0	0	0	1	0	1	0.7500
18	0	0	1	1	0	0	0	1.3125	46	1	0	0	0	1	1	0	0.7375
19	0	0	1	1	0	0	1	1.3000	47	1	0	0	0	1	1	1	0.7250
1A	0	0	1	1	0	1	0	1.2870	48	1	0	0	1	0	0	0	0.7125
1B	0	0	1	1	0	1	1	1.2750	49	1	0	0	1	0	0	1	0.7000
1C	0	0	1	1	1	0	0	1.2625	4A	1	0	0	1	0	1	0	0.6875
1D	0	0	1	1	1	0	1	1.2500	4B	1	0	0	1	0	1	1	0.6750
1E	0	0	1	1	1	1	0	1.2375	4C	1	0	0	1	1	0	0	0.6625
1F	0	0	1	1	1	1	1	1.2250	4D	1	0	0	1	1	0	1	0.6500
20	0	1	0	0	0	0	0	1.2125	4E	1	0	0	1	1	1	0	0.6375
21	0	1	0	0	0	0	1	1.2000	4F	1	0	0	1	1	1	1	0.6250
22	0	1	0	0	0	1	0	1.1875	50	1	0	0	0	0	0	0	0.6125
23	0	1	0	0	0	1	1	1.1750	51	1	0	0	0	0	0	1	0.6000
24	0	1	0	0	1	0	0	1.1625	52	1	0	0	0	0	1	0	0.5875
25	0	1	0	0	1	0	1	1.1500	53	1	0	0	0	0	1	1	0.5750
26	0	1	0	0	1	1	0	1.1375	54	1	0	1	0	1	0	0	0.5625
27	0	1	0	0	1	1	1	1.1250	55	1	0	1	0	1	0	1	0.5500
28	0	1	0	1	0	0	0	1.1125	56	1	0	1	0	1	1	0	0.5375
29	0	1	0	1	0	0	1	1.1000	57	1	0	1	0	1	1	1	0.5250
2A	0	1	0	1	0	1	0	1.0875	58	1	0	1	1	0	0	0	0.5125
2B	0	1	0	1	0	1	1	1.0750	59	1	0	1	1	0	0	1	0.5000
2C	0	1	0	1	1	0	0	1.0625	7F	1	1	1	1	1	1	1	OFF
2D	0	1	0	1	1	0	1	1.0500									



## 2.8 Cache Voltage Identification

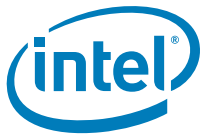
The Cache Voltage Identification (CVID) lands, VID\_VCCCACHE[5:0], supply the voltage for VCCCACHE, the L3 cache voltage for the processor. The VID\_VCCCACHE specification for the processor is supported by the *Ararat 170 Watt Voltage Regulator Design Guide*. The voltage set by the VID\_VCCCACHE pins is the maximum VCCCACHE voltage allowed by the processor.

Individual processor CVID values may be calibrated during manufacturing such that two devices at the same core speed may have different default VID\_VCCCACHE settings.

The processor uses six voltage identification lands (VID\_VCCCACHE[5:0]) to support automatic selection of power supply voltages. [Table 2-25](#) specifies the voltage level corresponding to the state of VID\_VCCCACHE[5:0]. A '1' in this table refers to a high voltage level and a '0' refers to a low voltage level. See the *Ararat 170 Watt Voltage Regulator Design Guide* for more details.

**Table 2-25. Cache (VID\_VCCCACHE) Voltage Identification Definition for Ararat**

Hex	VID 5	VID 4	VID 3	VID 2	VID 1	VID 0	VID (V)	Hex	VID5	VID4	VID3	VID2	VID1	VID0	VID (V)
00	0	0	0	0	0	0	OFF	20	1	0	0	0	0	0	1.2125
01	0	0	0	0	0	1	1.6000	21	1	0	0	0	0	1	1.2000
02	0	0	0	0	1	0	1.5875	22	1	0	0	0	1	0	1.1875
03	0	0	0	0	1	1	1.5750	23	1	0	0	0	1	1	1.1750
04	0	0	0	1	0	0	1.5625	24	1	0	0	1	0	0	1.1625
05	0	0	0	1	0	1	1.5500	25	1	0	0	1	0	1	1.1500
06	0	0	0	1	1	0	1.5375	26	1	0	0	1	1	0	1.1375
07	0	0	0	1	1	1	1.5250	27	1	0	0	1	1	1	1.1250
08	0	0	1	0	0	0	1.5125	28	1	0	1	0	0	0	1.1125
09	0	0	1	0	0	1	1.5000	29	1	0	1	0	0	1	1.1000
0A	0	0	1	0	1	0	1.4875	2A	1	0	1	0	1	0	1.0875
0B	0	0	1	0	1	1	1.4750	2B	1	0	1	0	1	1	1.0750
0C	0	0	1	1	0	0	1.4625	2C	1	0	1	1	0	0	1.0625
0D	0	0	1	1	0	1	1.4500	2D	1	0	1	1	0	1	1.0500
0E	0	0	1	1	1	0	1.4375	2E	1	0	1	1	1	0	1.0375
0F	0	0	1	1	1	1	1.4250	2F	1	0	1	1	1	1	1.0250
10	0	1	0	0	0	0	1.4125	30	1	1	0	0	0	0	1.0125
11	0	1	0	0	0	1	1.4000	31	1	1	0	0	0	1	1.0000
12	0	1	0	0	1	0	1.3875	32	1	1	0	0	1	0	0.9875
13	0	1	0	0	1	1	1.3750	33	1	1	0	0	1	1	0.9750
14	0	1	0	1	0	0	1.3625	34	1	1	0	1	0	0	0.9625
15	0	1	0	1	0	1	1.3500	35	1	1	0	1	0	1	0.9500
16	0	1	0	1	1	0	1.3375	36	1	1	0	1	1	0	0.9375
17	0	1	0	1	1	1	1.3250	37	1	1	0	1	1	1	0.9250
18	0	1	1	0	0	0	1.3125	38	1	1	1	0	0	0	0.9125
19	0	1	1	0	0	1	1.3000	39	1	1	1	0	0	1	0.9000
1A	0	1	1	0	1	0	1.2875	3A	1	1	1	0	1	0	0.8875
1B	0	1	1	0	1	1	1.2750	3B	1	1	1	0	1	1	0.8750
1C	0	1	1	1	0	0	1.2625	3C	1	1	1	1	0	0	0.8625
1D	0	1	1	1	0	1	1.2500	3D	1	1	1	1	0	1	0.8500
1E	0	1	1	1	1	0	1.2375	3E	1	1	1	1	1	0	0.8375
1F	0	1	1	1	1	1	1.2250	3F	1	1	1	1	1	1	0.8250



## 2.9 RSVD, Unused, and DEBUG Pins

All RSVD (RESERVED) pins must be left unconnected. Connection of these pins to power, VSS, or to any other signal (including each other) can result in component malfunction or incompatibility with future processors.

For reliable operation, always terminate unused inputs or bi-directional signals to their respective deasserted states. A resistor must be used when tying bi-directional signals to power or ground, also allowing for system testability. Unused pins of Intel QuickPath Interconnect and FB-DIMM ports may be left as no-connects since termination is provided on the processor silicon.

Unused outputs may be terminated on the system board or left connected. Note that leaving unused outputs unterminated may interfere with some Test Access Port (TAP) functions, complicate debug probing, and prevent boundary scan testing. Signal termination for these signal types is discussed in latest revisions of *Intel® Itanium® Processor 9300 Series Platform Design Guide* and the *Intel® Itanium® Processor 9300 Series Platform Debug Port Design Guide*.

Debug pins have ODT and can be left as no-connects. Their routing guidelines are provided in the *Intel® Itanium® Processor 9300 Series Platform Design Guide*.

## 2.10 Mixing Processors

Intel will support mixing CPUs in the same system or hard partition as defined below. A hard partition is a smaller system capable of booting an OS, consisting of one or more processors, memory and I/O controller hubs that are formed by domain partitioning.

1. CPUs from adjacent steppings. For example if one cpu is from stepping N, and another cpu is from the next stepping, N+1, then CPU<sub>N</sub> and CPU<sub>N+1</sub> are compatible. Similarly CPU<sub>N</sub> is not compatible with CPU<sub>N+2</sub>
2. If variable frequency mode (VFM) is enabled in one CPU it must be enabled in all CPUs. If VFM mode is disabled in one CPU it must be disabled in all CPUs
3. All CPUs in the system or hard partition must have the same core clock speed or speed range and the same cache size.
4. All Intel QPI links must have the same data rate, except for Intel QPI links which are disabled or in slow mode.
5. Core level lockstep (CLL) parts with other CLL parts or the top-bin non-CLL parts only.

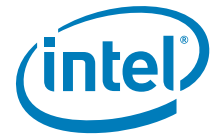
Intel will not support mixing processors in the same system or hard partition per the following:

1. Mixing an enabled VFM part with an fixed frequency mode (FFM) part within the same system or hard partition.

## 2.11 Preferred Power-up Voltage Sequence

The preferred order of voltage sequencing for the processor is VCC33\_SM, VccArarat(12 V), VCCA, VCCIO, VCCUNCORE, VCCCORE, and VCCCACHE. The processor will not sustain damage if VccArarat(12 V) is applied before VCC33\_SM. The application of VCC33\_SM before VccArarat(12 V) allows the PIROM to be read before the processor is powered.

VCC33\_SM is brought up first to allow platforms to read the socket Processor Information data and the PROCTYPE pin.



VccArarat(12 V) is the input voltage to the Ararat regulator. The VCCA supply is used to power the processor's analog circuits. VCCIO is used to power the I/O circuits and the QR (power and thermal management) unit. Once VCCIO is up and stable the external environment can generate the SYSINT clock signals. Once the SYSINT clocks are valid the external environment can assert the VROUTPUT\_ENABLE signal. After VROUTPUT\_ENABLE is asserted the sequence of powering up the VCCUNCORE, VCCCORE and VCCCACHE supplies begins. The VCCUNCORE, VCCCORE and VCCCACHE supplies power the remainder of the sysint, the cores and the large cache arrays, respectively.

When all supplies are up and stable, Ararat asserts VRPWRGD which signals the external environment that it can assert the PWRGOOD signal. PWRGOOD assertion initiates the processor internal cold reset sequence.

It is important to keep in mind that during platform initialization, the RESET\_N pin to any component in the platform can be removed ONLY after all other components have had sufficient time to sample their respective reset pins. This is needed to prevent unknown behavior that may result if any one system component comes out of reset before other components have received the reset signal.

With the exception of standby miscellaneous pins, all input pins, bi-directional pins, and terminated output pins must not be allowed to exceed the processor's actual VCCIO voltage prior to and during ramp up of the VCCIO supply.

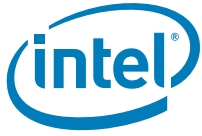
## 2.12 Preferred Power-down Voltage Sequence

It should be noted that when the processor is required to be physically removed from its socket, power rails VCC33\_SM and Vcc(12 V) must also be powered down before removal of the processor.

## 2.13 Test Access Port (TAP) Connection

The recommended TAP connectivity is detailed in the *Intel® Itanium® Processor 9300 Series Platform Debug Port Design Guide*.

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## 3 Pin Listing

### 3.1 Processor Package *Bottom* Pin Assignments

This section provides a sorted package bottom pin list in [Table 3-1](#) and [Table 3-2](#). [Table 3-1](#) is a listing of all processor package bottom side pins ordered alphabetically by pin name. [Table 3-2](#) is a listing of all processor package bottom side pins ordered by pin number.

#### 3.1.1 Package Bottom Pin Listing by Pin Name

**Table 3-1. Pin List by Pin Name (Sheet 1 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
G10	BOOTMODE[0]		I
G9	BOOTMODE[1]		I
C3	CPU_PRES1_N		I/O
D37	CPU_PRES2_N		I/O
AT36	CPU_PRES3_N		I/O
AT3	CPU_PRES4_N		I/O
J37	CSIORNCLK	Differential	I
B33	CSIORNDAT[0]	Differential	I
D34	CSIORNDAT[1]	Differential	I
B34	CSIORNDAT[2]	Differential	I
D35	CSIORNDAT[3]	Differential	I
C36	CSIORNDAT[4]	Differential	I
E37	CSIORNDAT[5]	Differential	I
F36	CSIORNDAT[6]	Differential	I
G35	CSIORNDAT[7]	Differential	I
H36	CSIORNDAT[8]	Differential	I
J35	CSIORNDAT[9]	Differential	I
L36	CSIORNDAT[10]	Differential	I
L38	CSIORNDAT[11]	Differential	I
N37	CSIORNDAT[12]	Differential	I
P36	CSIORNDAT[13]	Differential	I
R37	CSIORNDAT[14]	Differential	I
T36	CSIORNDAT[15]	Differential	I
T38	CSIORNDAT[16]	Differential	I
U36	CSIORNDAT[17]	Differential	I
V38	CSIORNDAT[18]	Differential	I
W37	CSIORNDAT[19]	Differential	I

**Table 3-1. Pin List by Pin Name (Sheet 2 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
K37	CSIORPCLK	Differential	I
A33	CSIORPDAT[0]	Differential	I
C34	CSIORPDAT[1]	Differential	I
B35	CSIORPDAT[2]	Differential	I
E35	CSIORPDAT[3]	Differential	I
D36	CSIORPDAT[4]	Differential	I
E38	CSIORPDAT[5]	Differential	I
F37	CSIORPDAT[6]	Differential	I
G36	CSIORPDAT[7]	Differential	I
H37	CSIORPDAT[8]	Differential	I
J36	CSIORPDAT[9]	Differential	I
L37	CSIORPDAT[10]	Differential	I
M38	CSIORPDAT[11]	Differential	I
N38	CSIORPDAT[12]	Differential	I
P37	CSIORPDAT[13]	Differential	I
R38	CSIORPDAT[14]	Differential	I
T37	CSIORPDAT[15]	Differential	I
U38	CSIORPDAT[16]	Differential	I
V36	CSIORPDAT[17]	Differential	I
V37	CSIORPDAT[18]	Differential	I
W36	CSIORPDAT[19]	Differential	I
K33	CSIoTNCLK	Differential	O
K30	CSIoTNDAT[0]	Differential	O
J31	CSIoTNDAT[1]	Differential	O
G31	CSIoTNDAT[2]	Differential	O
F30	CSIoTNDAT[3]	Differential	O
K32	CSIoTNDAT[4]	Differential	O



**Table 3-1. Pin List by Pin Name (Sheet 3 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
F31	CSI0TNDAT[5]	Differential	O
E32	CSI0TNDAT[6]	Differential	O
F33	CSI0TNDAT[7]	Differential	O
H33	CSI0TNDAT[8]	Differential	O
L31	CSI0TNDAT[9]	Differential	O
L33	CSI0TNDAT[10]	Differential	O
M34	CSI0TNDAT[11]	Differential	O
N32	CSI0TNDAT[12]	Differential	O
N34	CSI0TNDAT[13]	Differential	O
R34	CSI0TNDAT[14]	Differential	O
R33	CSI0TNDAT[15]	Differential	O
U33	CSI0TNDAT[16]	Differential	O
V32	CSI0TNDAT[17]	Differential	O
V34	CSI0TNDAT[18]	Differential	O
W32	CSI0TNDAT[19]	Differential	O
K34	CSI0TPCLK	Differential	O
J30	CSI0TPDAT[0]	Differential	O
H31	CSI0TPDAT[1]	Differential	O
G30	CSI0TPDAT[2]	Differential	O
E30	CSI0TPDAT[3]	Differential	O
J32	CSI0TPDAT[4]	Differential	O
F32	CSI0TPDAT[5]	Differential	O
E33	CSI0TPDAT[6]	Differential	O
G33	CSI0TPDAT[7]	Differential	O
H34	CSI0TPDAT[8]	Differential	O
L32	CSI0TPDAT[9]	Differential	O
M33	CSI0TPDAT[10]	Differential	O
M35	CSI0TPDAT[11]	Differential	O
N33	CSI0TPDAT[12]	Differential	O
P34	CSI0TPDAT[13]	Differential	O
R35	CSI0TPDAT[14]	Differential	O
T33	CSI0TPDAT[15]	Differential	O
U34	CSI0TPDAT[16]	Differential	O
V33	CSI0TPDAT[17]	Differential	O
W34	CSI0TPDAT[18]	Differential	O
Y32	CSI0TPDAT[19]	Differential	O
AK38	CSI1RNCLK	Differential	I
AU33	CSI1RNDAT[0]	Differential	I

**Table 3-1. Pin List by Pin Name (Sheet 4 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AV33	CSI1RNDAT[1]	Differential	I
AV34	CSI1RNDAT[2]	Differential	I
AR34	CSI1RNDAT[3]	Differential	I
AT35	CSI1RNDAT[4]	Differential	I
AP36	CSI1RNDAT[5]	Differential	I
AP37	CSI1RNDAT[6]	Differential	I
AN37	CSI1RNDAT[7]	Differential	I
AM36	CSI1RNDAT[8]	Differential	I
AL37	CSI1RNDAT[9]	Differential	I
AJ37	CSI1RNDAT[10]	Differential	I
AH38	CSI1RNDAT[11]	Differential	I
AG36	CSI1RNDAT[12]	Differential	I
AF38	CSI1RNDAT[13]	Differential	I
AF36	CSI1RNDAT[14]	Differential	I
AE37	CSI1RNDAT[15]	Differential	I
AD36	CSI1RNDAT[16]	Differential	I
AC37	CSI1RNDAT[17]	Differential	I
AA38	CSI1RNDAT[18]	Differential	I
Y38	CSI1RNDAT[19]	Differential	I
AK37	CSI1RPCLK	Differential	I
AT33	CSI1RPDAT[0]	Differential	I
AV32	CSI1RPDAT[1]	Differential	I
AU34	CSI1RPDAT[2]	Differential	I
AR33	CSI1RPDAT[3]	Differential	I
AU35	CSI1RPDAT[4]	Differential	I
AP35	CSI1RPDAT[5]	Differential	I
AR37	CSI1RPDAT[6]	Differential	I
AN36	CSI1RPDAT[7]	Differential	I
AM35	CSI1RPDAT[8]	Differential	I
AL36	CSI1RPDAT[9]	Differential	I
AJ36	CSI1RPDAT[10]	Differential	I
AH37	CSI1RPDAT[11]	Differential	I
AH36	CSI1RPDAT[12]	Differential	I
AG38	CSI1RPDAT[13]	Differential	I
AF37	CSI1RPDAT[14]	Differential	I
AE38	CSI1RPDAT[15]	Differential	I
AD37	CSI1RPDAT[16]	Differential	I
AC38	CSI1RPDAT[17]	Differential	I



**Table 3-1. Pin List by Pin Name (Sheet 5 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AB38	CSI1RPDAT[18]	Differential	I
Y37	CSI1RPDAT[19]	Differential	I
AJ32	CSI1TNCLK	Differential	O
AL27	CSI1TNDAT[0]	Differential	O
AN28	CSI1TNDAT[1]	Differential	O
AL28	CSI1TNDAT[2]	Differential	O
AN29	CSI1TNDAT[3]	Differential	O
AP31	CSI1TNDAT[4]	Differential	O
AL30	CSI1TNDAT[5]	Differential	O
AN32	CSI1TNDAT[6]	Differential	O
AN34	CSI1TNDAT[7]	Differential	O
AM31	CSI1TNDAT[8]	Differential	O
AL33	CSI1TNDAT[9]	Differential	O
AK33	CSI1TNDAT[10]	Differential	O
AH34	CSI1TNDAT[11]	Differential	O
AH32	CSI1TNDAT[12]	Differential	O
AG33	CSI1TNDAT[13]	Differential	O
AE33	CSI1TNDAT[14]	Differential	O
AE34	CSI1TNDAT[15]	Differential	O
AC34	CSI1TNDAT[16]	Differential	O
AB34	CSI1TNDAT[17]	Differential	O
AA35	CSI1TNDAT[18]	Differential	O
Y34	CSI1TNDAT[19]	Differential	O
AK32	CSI1TPCLK	Differential	O
AL26	CSI1TPDAT[0]	Differential	O
AN27	CSI1TPDAT[1]	Differential	O
AM28	CSI1TPDAT[2]	Differential	O
AP29	CSI1TPDAT[3]	Differential	O
AP30	CSI1TPDAT[4]	Differential	O
AM30	CSI1TPDAT[5]	Differential	O
AP32	CSI1TPDAT[6]	Differential	O
AN33	CSI1TPDAT[7]	Differential	O
AN31	CSI1TPDAT[8]	Differential	O
AL32	CSI1TPDAT[9]	Differential	O
AK34	CSI1TPDAT[10]	Differential	O
AJ34	CSI1TPDAT[11]	Differential	O
AH33	CSI1TPDAT[12]	Differential	O
AG34	CSI1TPDAT[13]	Differential	O

**Table 3-1. Pin List by Pin Name (Sheet 6 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AF33	CSI1TPDAT[14]	Differential	O
AE35	CSI1TPDAT[15]	Differential	O
AD34	CSI1TPDAT[16]	Differential	O
AB35	CSI1TPDAT[17]	Differential	O
AA36	CSI1TPDAT[18]	Differential	O
Y35	CSI1TPDAT[19]	Differential	O
A21	CSI2RNCLK	Differential	I
J22	CSI2RNDAT[0]	Differential	I
H21	CSI2RNDAT[1]	Differential	I
G20	CSI2RNDAT[2]	Differential	I
F21	CSI2RNDAT[3]	Differential	I
E23	CSI2RNDAT[4]	Differential	I
E20	CSI2RNDAT[5]	Differential	I
D21	CSI2RNDAT[6]	Differential	I
C21	CSI2RNDAT[7]	Differential	I
B20	CSI2RNDAT[8]	Differential	I
C22	CSI2RNDAT[9]	Differential	I
B23	CSI2RNDAT[10]	Differential	I
B25	CSI2RNDAT[11]	Differential	I
C26	CSI2RNDAT[12]	Differential	I
A25	CSI2RNDAT[13]	Differential	I
D26	CSI2RNDAT[14]	Differential	I
C27	CSI2RNDAT[15]	Differential	I
B28	CSI2RNDAT[16]	Differential	I
B30	CSI2RNDAT[17]	Differential	I
C31	CSI2RNDAT[18]	Differential	I
C33	CSI2RNDAT[19]	Differential	I
A22	CSI2RPCLK	Differential	I
J21	CSI2RPDAT[0]	Differential	I
G21	CSI2RPDAT[1]	Differential	I
G19	CSI2RPDAT[2]	Differential	I
F20	CSI2RPDAT[3]	Differential	I
E22	CSI2RPDAT[4]	Differential	I
D20	CSI2RPDAT[5]	Differential	I
D22	CSI2RPDAT[6]	Differential	I
B21	CSI2RPDAT[7]	Differential	I
A20	CSI2RPDAT[8]	Differential	I
C23	CSI2RPDAT[9]	Differential	I



**Table 3-1. Pin List by Pin Name (Sheet 7 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
A23	CSI2RPDAT[10]	Differential	I
B24	CSI2RPDAT[11]	Differential	I
B26	CSI2RPDAT[12]	Differential	I
A26	CSI2RPDAT[13]	Differential	I
D27	CSI2RPDAT[14]	Differential	I
C28	CSI2RPDAT[15]	Differential	I
B29	CSI2RPDAT[16]	Differential	I
A30	CSI2RPDAT[17]	Differential	I
B31	CSI2RPDAT[18]	Differential	I
C32	CSI2RPDAT[19]	Differential	I
H29	CSI2TNCLK	Differential	O
H23	CSI2TNDAT[0]	Differential	O
G24	CSI2TNDAT[1]	Differential	O
F25	CSI2TNDAT[2]	Differential	O
D24	CSI2TNDAT[3]	Differential	O
H26	CSI2TNDAT[4]	Differential	O
F26	CSI2TNDAT[5]	Differential	O
E29	CSI2TNDAT[6]	Differential	O
J26	CSI2TNDAT[7]	Differential	O
F28	CSI2TNDAT[8]	Differential	O
H27	CSI2TNDAT[9]	Differential	O
K28	CSI2TNDAT[10]	Differential	O
M29	CSI2TNDAT[11]	Differential	O
P30	CSI2TNDAT[12]	Differential	O
M31	CSI2TNDAT[13]	Differential	O
R30	CSI2TNDAT[14]	Differential	O
P32	CSI2TNDAT[15]	Differential	O
T31	CSI2TNDAT[16]	Differential	O
U29	CSI2TNDAT[17]	Differential	O
U31	CSI2TNDAT[18]	Differential	O
W30	CSI2TNDAT[19]	Differential	O
J29	CSI2TPCLK	Differential	O
G23	CSI2TPDAT[0]	Differential	O
G25	CSI2TPDAT[1]	Differential	O
E25	CSI2TPDAT[2]	Differential	O
E24	CSI2TPDAT[3]	Differential	O
G26	CSI2TPDAT[4]	Differential	O
F27	CSI2TPDAT[5]	Differential	O

**Table 3-1. Pin List by Pin Name (Sheet 8 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
D29	CSI2TPDAT[6]	Differential	O
J27	CSI2TPDAT[7]	Differential	O
G28	CSI2TPDAT[8]	Differential	O
H28	CSI2TPDAT[9]	Differential	O
K29	CSI2TPDAT[10]	Differential	O
M30	CSI2TPDAT[11]	Differential	O
P31	CSI2TPDAT[12]	Differential	O
N31	CSI2TPDAT[13]	Differential	O
T30	CSI2TPDAT[14]	Differential	O
R32	CSI2TPDAT[15]	Differential	O
T32	CSI2TPDAT[16]	Differential	O
U30	CSI2TPDAT[17]	Differential	O
V31	CSI2TPDAT[18]	Differential	O
W31	CSI2TPDAT[19]	Differential	O
AU21	CSI3RNCLK	Differential	I
AN18	CSI3RNDAT[0]	Differential	I
AL17	CSI3RNDAT[1]	Differential	I
AM16	CSI3RNDAT[2]	Differential	I
AN17	CSI3RNDAT[3]	Differential	I
AP19	CSI3RNDAT[4]	Differential	I
AR19	CSI3RNDAT[5]	Differential	I
AV17	CSI3RNDAT[6]	Differential	I
AU18	CSI3RNDAT[7]	Differential	I
AV19	CSI3RNDAT[8]	Differential	I
AT20	CSI3RNDAT[9]	Differential	I
AT22	CSI3RNDAT[10]	Differential	I
AU23	CSI3RNDAT[11]	Differential	I
AV24	CSI3RNDAT[12]	Differential	I
AU25	CSI3RNDAT[13]	Differential	I
AU26	CSI3RNDAT[14]	Differential	I
AT27	CSI3RNDAT[15]	Differential	I
AU28	CSI3RNDAT[16]	Differential	I
AV29	CSI3RNDAT[17]	Differential	I
AU30	CSI3RNDAT[18]	Differential	I
AV31	CSI3RNDAT[19]	Differential	I
AT21	CSI3RPCLK	Differential	I
AM18	CSI3RPDAT[0]	Differential	I
AL16	CSI3RPDAT[1]	Differential	I



**Table 3-1. Pin List by Pin Name (Sheet 9 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AM15	CSI3RPDAT[2]	Differential	I
AN16	CSI3RPDAT[3]	Differential	I
AN19	CSI3RPDAT[4]	Differential	I
AR18	CSI3RPDAT[5]	Differential	I
AV16	CSI3RPDAT[6]	Differential	I
AT18	CSI3RPDAT[7]	Differential	I
AU19	CSI3RPDAT[8]	Differential	I
AR20	CSI3RPDAT[9]	Differential	I
AR22	CSI3RPDAT[10]	Differential	I
AT23	CSI3RPDAT[11]	Differential	I
AV23	CSI3RPDAT[12]	Differential	I
AU24	CSI3RPDAT[13]	Differential	I
AT26	CSI3RPDAT[14]	Differential	I
AR27	CSI3RPDAT[15]	Differential	I
AT28	CSI3RPDAT[16]	Differential	I
AV28	CSI3RPDAT[17]	Differential	I
AU29	CSI3RPDAT[18]	Differential	I
AU31	CSI3RPDAT[19]	Differential	I
AK29	CSI3TNCLK	Differential	O
AL20	CSI3TNDAT[0]	Differential	O
AM20	CSI3TNDAT[1]	Differential	O
AM23	CSI3TNDAT[2]	Differential	O
AN21	CSI3TNDAT[3]	Differential	O
AN23	CSI3TNDAT[4]	Differential	O
AM24	CSI3TNDAT[5]	Differential	O
AP25	CSI3TNDAT[6]	Differential	O
AN26	CSI3TNDAT[7]	Differential	O
AM26	CSI3TNDAT[8]	Differential	O
AJ27	CSI3TNDAT[9]	Differential	O
AH29	CSI3TNDAT[10]	Differential	O
AJ30	CSI3TNDAT[11]	Differential	O
AG31	CSI3TNDAT[12]	Differential	O
AF30	CSI3TNDAT[13]	Differential	O
AF31	CSI3TNDAT[14]	Differential	O
AD32	CSI3TNDAT[15]	Differential	O
AC31	CSI3TNDAT[16]	Differential	O
AB33	CSI3TNDAT[17]	Differential	O
AA31	CSI3TNDAT[18]	Differential	O

**Table 3-1. Pin List by Pin Name (Sheet 10 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AA32	CSI3TNDAT[19]	Differential	O
AK28	CSI3TPCLK	Differential	O
AK20	CSI3TPDAT[0]	Differential	O
AM21	CSI3TPDAT[1]	Differential	O
AL23	CSI3TPDAT[2]	Differential	O
AP21	CSI3TPDAT[3]	Differential	O
AN22	CSI3TPDAT[4]	Differential	O
AN24	CSI3TPDAT[5]	Differential	O
AR25	CSI3TPDAT[6]	Differential	O
AP26	CSI3TPDAT[7]	Differential	O
AM25	CSI3TPDAT[8]	Differential	O
AK27	CSI3TPDAT[9]	Differential	O
AJ29	CSI3TPDAT[10]	Differential	O
AJ31	CSI3TPDAT[11]	Differential	O
AH31	CSI3TPDAT[12]	Differential	O
AG30	CSI3TPDAT[13]	Differential	O
AF32	CSI3TPDAT[14]	Differential	O
AE32	CSI3TPDAT[15]	Differential	O
AC32	CSI3TPDAT[16]	Differential	O
AC33	CSI3TPDAT[17]	Differential	O
AB31	CSI3TPDAT[18]	Differential	O
AA33	CSI3TPDAT[19]	Differential	O
H18	CSI4RNCLK	Differential	I
B15	CSI4RNDAT[0]	Differential	I
D15	CSI4RNDAT[1]	Differential	I
C16	CSI4RNDAT[2]	Differential	I
A17	CSI4RNDAT[3]	Differential	I
B18	CSI4RNDAT[4]	Differential	I
C17	CSI4RNDAT[5]	Differential	I
D19	CSI4RNDAT[6]	Differential	I
E17	CSI4RNDAT[7]	Differential	I
E18	CSI4RNDAT[8]	Differential	I
F17	CSI4RNDAT[9]	Differential	I
G18	CSI4RPCLK	Differential	I
A15	CSI4RPDAT[0]	Differential	I
D16	CSI4RPDAT[1]	Differential	I
B16	CSI4RPDAT[2]	Differential	I
A18	CSI4RPDAT[3]	Differential	I



**Table 3-1. Pin List by Pin Name (Sheet 11 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
B19	CSI4RPDAT[4]	Differential	I
C18	CSI4RPDAT[5]	Differential	I
C19	CSI4RPDAT[6]	Differential	I
D17	CSI4RPDAT[7]	Differential	I
E19	CSI4RPDAT[8]	Differential	I
F18	CSI4RPDAT[9]	Differential	I
L21	CSI4TNCLK	Differential	O
M14	CSI4TNDAT[0]	Differential	O
K13	CSI4TNDAT[1]	Differential	O
K15	CSI4TNDAT[2]	Differential	O
J14	CSI4TNDAT[3]	Differential	O
G15	CSI4TNDAT[4]	Differential	O
J16	CSI4TNDAT[5]	Differential	O
K17	CSI4TNDAT[6]	Differential	O
L18	CSI4TNDAT[7]	Differential	O
K19	CSI4TNDAT[8]	Differential	O
L20	CSI4TNDAT[9]	Differential	O
L22	CSI4TPCLK	Differential	O
M15	CSI4TPDAT[0]	Differential	O
K14	CSI4TPDAT[1]	Differential	O
J15	CSI4TPDAT[2]	Differential	O
H14	CSI4TPDAT[3]	Differential	O
G16	CSI4TPDAT[4]	Differential	O
H16	CSI4TPDAT[5]	Differential	O
J17	CSI4TPDAT[6]	Differential	O
K18	CSI4TPDAT[7]	Differential	O
J19	CSI4TPDAT[8]	Differential	O
K20	CSI4TPDAT[9]	Differential	O
AP17	CSI5RNCLK	Differential	I
AL12	CSI5RNDAT[0]	Differential	I
AM13	CSI5RNDAT[1]	Differential	I
AN14	CSI5RNDAT[2]	Differential	I
AP15	CSI5RNDAT[3]	Differential	I
AR13	CSI5RNDAT[4]	Differential	I
AT13	CSI5RNDAT[5]	Differential	I
AU14	CSI5RNDAT[6]	Differential	I
AR15	CSI5RNDAT[7]	Differential	I
AU15	CSI5RNDAT[8]	Differential	I

**Table 3-1. Pin List by Pin Name (Sheet 12 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AT16	CSI5RNDAT[9]	Differential	I
AR17	CSI5RPCLK	Differential	I
AL13	CSI5RPDAT[0]	Differential	I
AN13	CSI5RPDAT[1]	Differential	I
AP14	CSI5RPDAT[2]	Differential	I
AP16	CSI5RPDAT[3]	Differential	I
AR14	CSI5RPDAT[4]	Differential	I
AU13	CSI5RPDAT[5]	Differential	I
AV14	CSI5RPDAT[6]	Differential	I
AT15	CSI5RPDAT[7]	Differential	I
AU16	CSI5RPDAT[8]	Differential	I
AT17	CSI5RPDAT[9]	Differential	I
AJ22	CSI5TNCLK	Differential	O
AG13	CSI5TNDAT[0]	Differential	O
AH14	CSI5TNDAT[1]	Differential	O
AJ15	CSI5TNDAT[2]	Differential	O
AG16	CSI5TNDAT[3]	Differential	O
AH17	CSI5TNDAT[4]	Differential	O
AH19	CSI5TNDAT[5]	Differential	O
AK18	CSI5TNDAT[6]	Differential	O
AG19	CSI5TNDAT[7]	Differential	O
AJ20	CSI5TNDAT[8]	Differential	O
AL21	CSI5TNDAT[9]	Differential	O
AK22	CSI5TPCLK	Differential	O
AH13	CSI5TPDAT[0]	Differential	O
AJ14	CSI5TPDAT[1]	Differential	O
AK15	CSI5TPDAT[2]	Differential	O
AH16	CSI5TPDAT[3]	Differential	O
AJ17	CSI5TPDAT[4]	Differential	O
AJ19	CSI5TPDAT[5]	Differential	O
AK19	CSI5TPDAT[6]	Differential	O
AG20	CSI5TPDAT[7]	Differential	O
AJ21	CSI5TPDAT[8]	Differential	O
AL22	CSI5TPDAT[9]	Differential	O
H12	ERROR[0]_N		O
J12	ERROR[1]_N		O
AT11	FBDONBIAN[0]	Differential	I
AU9	FBDONBIAN[1]	Differential	I



**Table 3-1. Pin List by Pin Name (Sheet 13 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AV8	FBDONBIAN[2]	Differential	I
AR10	FBDONBIAN[3]	Differential	I
AT8	FBDONBIAN[4]	Differential	I
AT6	FBDONBIAN[5]	Differential	I
AP4	FBDONBIAN[6]	Differential	I
AN2	FBDONBIAN[7]	Differential	I
AN3	FBDONBIAN[8]	Differential	I
AL3	FBDONBIAN[9]	Differential	I
AL1	FBDONBIAN[10]	Differential	I
AK2	FBDONBIAN[11]	Differential	I
AR2	FBDONBIAN[12]	Differential	I
AU4	FBDONBIAN[13]	Differential	I
AV11	FBDONBIAN[14]	Differential	I
AU11	FBDONBIAP[0]	Differential	I
AU10	FBDONBIAP[1]	Differential	I
AV9	FBDONBIAP[2]	Differential	I
AT10	FBDONBIAP[3]	Differential	I
AU8	FBDONBIAP[4]	Differential	I
AU6	FBDONBIAP[5]	Differential	I
AR4	FBDONBIAP[6]	Differential	I
AP2	FBDONBIAP[7]	Differential	I
AN4	FBDONBIAP[8]	Differential	I
AM3	FBDONBIAP[9]	Differential	I
AL2	FBDONBIAP[10]	Differential	I
AK3	FBDONBIAP[11]	Differential	I
AR3	FBDONBIAP[12]	Differential	I
AU5	FBDONBIAP[13]	Differential	I
AV12	FBDONBIAP[14]	Differential	I
AN9	FBDONBIBN[0]	Differential	I
AM9	FBDONBIBN[1]	Differential	I
AP7	FBDONBIBN[2]	Differential	I
AP6	FBDONBIBN[3]	Differential	I
AM5	FBDONBIBN[4]	Differential	I
AK5	FBDONBIBN[5]	Differential	I
AG1	FBDONBIBN[6]	Differential	I
AF3	FBDONBIBN[7]	Differential	I
AF2	FBDONBIBN[8]	Differential	I
AE3	FBDONBIBN[9]	Differential	I

**Table 3-1. Pin List by Pin Name (Sheet 14 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AD1	FBDONBIBN[10]	Differential	I
AB1	FBDONBIBN[11]	Differential	I
AH2	FBDONBIBN[12]	Differential	I
AJ4	FBDONBIBN[13]	Differential	I
AM10	FBDONBIBN[14]	Differential	I
AP9	FBDONBIBP[0]	Differential	I
AM8	FBDONBIBP[1]	Differential	I
AR7	FBDONBIBP[2]	Differential	I
AN6	FBDONBIBP[3]	Differential	I
AM6	FBDONBIBP[4]	Differential	I
AL5	FBDONBIBP[5]	Differential	I
AH1	FBDONBIBP[6]	Differential	I
AG3	FBDONBIBP[7]	Differential	I
AF1	FBDONBIBP[8]	Differential	I
AE2	FBDONBIBP[9]	Differential	I
AD2	FBDONBIBP[10]	Differential	I
AC1	FBDONBIBP[11]	Differential	I
AJ2	FBDONBIBP[12]	Differential	I
AK4	FBDONBIBP[13]	Differential	I
AL10	FBDONBIBP[14]	Differential	I
AR5	FBDONBICKANO	Differential	I
AT5	FBDONBICKAPO	Differential	I
AH3	FBDONBICKBNO	Differential	I
AH4	FBDONBICKBPO	Differential	I
AL6	FBDOREFSYSCLKN	Differential	I
AL7	FBDOREFSYSCLKP	Differential	I
V4	FBDOSBOAN[0]	Differential	O
W1	FBDOSBOAN[1]	Differential	O
V2	FBDOSBOAN[2]	Differential	O
U1	FBDOSBOAN[3]	Differential	O
T1	FBDOSBOAN[4]	Differential	O
N3	FBDOSBOAN[5]	Differential	O
M1	FBDOSBOAN[6]	Differential	O
L3	FBDOSBOAN[7]	Differential	O
L1	FBDOSBOAN[8]	Differential	O
P1	FBDOSBOAN[9]	Differential	O
J2	FBDOSBOAN[10]	Differential	O
W4	FBDOSBOAP[0]	Differential	O

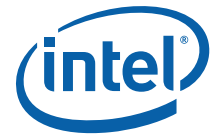


**Table 3-1. Pin List by Pin Name (Sheet 15 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
W2	FBD0SBOAP[1]	Differential	O
V3	FBD0SBOAP[2]	Differential	O
V1	FBD0SBOAP[3]	Differential	O
T2	FBD0SBOAP[4]	Differential	O
N2	FBD0SBOAP[5]	Differential	O
N1	FBD0SBOAP[6]	Differential	O
M3	FBD0SBOAP[7]	Differential	O
L2	FBD0SBOAP[8]	Differential	O
P2	FBD0SBOAP[9]	Differential	O
K2	FBD0SBOAP[10]	Differential	O
AK8	FBD0SBOBN[0]	Differential	O
AJ7	FBD0SBOBN[1]	Differential	O
AH6	FBD0SBOBN[2]	Differential	O
AF7	FBD0SBOBN[3]	Differential	O
AF6	FBD0SBOBN[4]	Differential	O
AC4	FBD0SBOBN[5]	Differential	O
AB3	FBD0SBOBN[6]	Differential	O
AD6	FBD0SBOBN[7]	Differential	O
AA2	FBD0SBOBN[8]	Differential	O
AD7	FBD0SBOBN[9]	Differential	O
Y3	FBD0SBOBN[10]	Differential	O
AK9	FBD0SBOBP[0]	Differential	O
AK7	FBD0SBOBP[1]	Differential	O
AH7	FBD0SBOBP[2]	Differential	O
AF8	FBD0SBOBP[3]	Differential	O
AG6	FBD0SBOBP[4]	Differential	O
AD4	FBD0SBOBP[5]	Differential	O
AC3	FBD0SBOBP[6]	Differential	O
AD5	FBD0SBOBP[7]	Differential	O
AA3	FBD0SBOBP[8]	Differential	O
AE7	FBD0SBOBP[9]	Differential	O
Y4	FBD0SBOBP[10]	Differential	O
R2	FBD0SBOCLKANO	Differential	O
R3	FBD0SBOCLKAPO	Differential	O
AE5	FBD0SBOCLKBNO	Differential	O
AF5	FBD0SBOCLKBPO	Differential	O
L8	FBD1NBICKCNO	Differential	I
M8	FBD1NBICKCPO	Differential	I

**Table 3-1. Pin List by Pin Name (Sheet 16 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
R7	FBD1NBICKDNO	Differential	I
P7	FBD1NBICKDPO	Differential	I
V9	FBD1NBICN[0]	Differential	I
V7	FBD1NBICN[1]	Differential	I
T8	FBD1NBICN[2]	Differential	I
U10	FBD1NBICN[3]	Differential	I
R9	FBD1NBICN[4]	Differential	I
P9	FBD1NBICN[5]	Differential	I
K9	FBD1NBICN[6]	Differential	I
J11	FBD1NBICN[7]	Differential	I
G11	FBD1NBICN[8]	Differential	I
G8	FBD1NBICN[9]	Differential	I
H9	FBD1NBICN[10]	Differential	I
F11	FBD1NBICN[11]	Differential	I
L12	FBD1NBICN[12]	Differential	I
M9	FBD1NBICN[13]	Differential	I
Y8	FBD1NBICN[14]	Differential	I
W9	FBD1NBICP[0]	Differential	I
V8	FBD1NBICP[1]	Differential	I
U8	FBD1NBICP[2]	Differential	I
U9	FBD1NBICP[3]	Differential	I
R8	FBD1NBICP[4]	Differential	I
N9	FBD1NBICP[5]	Differential	I
K8	FBD1NBICP[6]	Differential	I
J10	FBD1NBICP[7]	Differential	I
H11	FBD1NBICP[8]	Differential	I
H8	FBD1NBICP[9]	Differential	I
J9	FBD1NBICP[10]	Differential	I
F10	FBD1NBICP[11]	Differential	I
L11	FBD1NBICP[12]	Differential	I
M10	FBD1NBICP[13]	Differential	I
Y9	FBD1NBICP[14]	Differential	I
AB6	FBD1NBIDN[0]	Differential	I
AA6	FBD1NBIDN[1]	Differential	I
W7	FBD1NBIDN[2]	Differential	I
W6	FBD1NBIDN[3]	Differential	I
U5	FBD1NBIDN[4]	Differential	I
T7	FBD1NBIDN[5]	Differential	I



**Table 3-1. Pin List by Pin Name (Sheet 17 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
M6	FBD1NBIDN[6]	Differential	I
M5	FBD1NBIDN[7]	Differential	I
N8	FBD1NBIDN[8]	Differential	I
K4	FBD1NBIDN[9]	Differential	I
L7	FBD1NBIDN[10]	Differential	I
J7	FBD1NBIDN[11]	Differential	I
P5	FBD1NBIDN[12]	Differential	I
R5	FBD1NBIDN[13]	Differential	I
AC8	FBD1NBIDN[14]	Differential	I
AB5	FBD1NBIDP[0]	Differential	I
AA7	FBD1NBIDP[1]	Differential	I
Y7	FBD1NBIDP[2]	Differential	I
V6	FBD1NBIDP[3]	Differential	I
U6	FBD1NBIDP[4]	Differential	I
T6	FBD1NBIDP[5]	Differential	I
N6	FBD1NBIDP[6]	Differential	I
L5	FBD1NBIDP[7]	Differential	I
N7	FBD1NBIDP[8]	Differential	I
K5	FBD1NBIDP[9]	Differential	I
L6	FBD1NBIDP[10]	Differential	I
K7	FBD1NBIDP[11]	Differential	I
P6	FBD1NBIDP[12]	Differential	I
T5	FBD1NBIDP[13]	Differential	I
AB8	FBD1NBIDP[14]	Differential	I
AD9	FBD1REFSYSCLKN	Differential	I
AC9	FBD1REFSYSCLKP	Differential	I
A8	FBD1SBOCLKCNO	Differential	O
A7	FBD1SBOCLKCPO	Differential	O
E4	FBD1SBOCLKDNO	Differential	O
E3	FBD1SBOCLKDPO	Differential	O
D12	FBD1SBOCN[0]	Differential	O
E8	FBD1SBOCN[1]	Differential	O
E7	FBD1SBOCN[2]	Differential	O
C9	FBD1SBOCN[3]	Differential	O
C8	FBD1SBOCN[4]	Differential	O
B10	FBD1SBOCN[5]	Differential	O
C11	FBD1SBOCN[6]	Differential	O
A12	FBD1SBOCN[7]	Differential	O

**Table 3-1. Pin List by Pin Name (Sheet 18 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
C13	FBD1SBOCN[8]	Differential	O
B9	FBD1SBOCN[9]	Differential	O
B13	FBD1SBOCN[10]	Differential	O
D11	FBD1SBOCP[0]	Differential	O
E9	FBD1SBOCP[1]	Differential	O
D7	FBD1SBOCP[2]	Differential	O
D9	FBD1SBOCP[3]	Differential	O
C7	FBD1SBOCP[4]	Differential	O
A10	FBD1SBOCP[5]	Differential	O
B11	FBD1SBOCP[6]	Differential	O
A11	FBD1SBOCP[7]	Differential	O
C12	FBD1SBOCP[8]	Differential	O
B8	FBD1SBOCP[9]	Differential	O
A13	FBD1SBOCP[10]	Differential	O
H1	FBD1SBODN[0]	Differential	O
G3	FBD1SBODN[1]	Differential	O
G4	FBD1SBODN[2]	Differential	O
F2	FBD1SBODN[3]	Differential	O
D2	FBD1SBODN[4]	Differential	O
C4	FBD1SBODN[5]	Differential	O
B6	FBD1SBODN[6]	Differential	O
D5	FBD1SBODN[7]	Differential	O
F7	FBD1SBODN[8]	Differential	O
B4	FBD1SBODN[9]	Differential	O
G6	FBD1SBODN[10]	Differential	O
H2	FBD1SBODP[0]	Differential	O
H3	FBD1SBODP[1]	Differential	O
G5	FBD1SBODP[2]	Differential	O
F3	FBD1SBODP[3]	Differential	O
E2	FBD1SBODP[4]	Differential	O
D4	FBD1SBODP[5]	Differential	O
C6	FBD1SBODP[6]	Differential	O
D6	FBD1SBODP[7]	Differential	O
F6	FBD1SBODP[8]	Differential	O
B5	FBD1SBODP[9]	Differential	O
H6	FBD1SBODP[10]	Differential	O
N28	FLASHROM_CFG[0]		I
M28	FLASHROM_CFG[1]		I

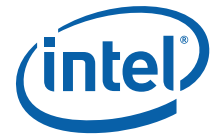


**Table 3-1. Pin List by Pin Name (Sheet 19 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
L28	FLASHROM_CFG[2]		I
N27	FLASHROM_CLK		O
L30	FLASHROM_CS[0]_N		O
P29	FLASHROM_CS[1]_N		O
R29	FLASHROM_CS[2]_N		O
N29	FLASHROM_CS[3]_N		O
T28	FLASHROM_DATAI		I
R28	FLASHROM_DATAO		O
L27	FLASHROM_WP_N		I
K10	FORCEPR_N		I
M11	LRGSCLSYS		I
K12	MEM_THROTTLE_L		I
AJ25	PIR_A0	Power/Other	I
AJ24	PIR_A1	Power/Other	I
AG24	PIR_SCL	Power/Other	I
AH24	PIR_SDA	Power/Other	I/O
AF11	PRBMODE_RDY_N		O
AF12	PRBMODE_REQST_N		I
L10	PROCHOT_N		O
AP1	PROCTYPE		I
AR9	PWRGOOD		I
V12	RESET_N	Power/Other	I
AD12	RSVD		I
A1	RSVD		
A2	RSVD		
A35	RSVD		
A37	RSVD		
A38	RSVD		
A4	RSVD		
AA11	RSVD		
AA27	RSVD		
AC12	RSVD		
AC27	RSVD		
AC28	RSVD		
AC29	RSVD		
AD27	RSVD		
AD29	RSVD		
AD30	RSVD		

**Table 3-1. Pin List by Pin Name (Sheet 20 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AE12	RSVD		
AE27	RSVD		
AE30	RSVD		
AG21	RSVD		
AH21	RSVD		
AK12	RSVD		
AL31	RSVD		
AL8	RSVD		
AM11	RSVD		
AM38	RSVD		
AN11	RSVD		
AN38	RSVD		
AP27	RSVD		
AR1	RSVD		
AR38	RSVD		
AT2	RSVD		
AT37	RSVD		
AT38	RSVD		
AU1	RSVD		
AU2	RSVD		
AU3	RSVD		
AU36	RSVD		
AU37	RSVD		
AV1	RSVD		
AV2	RSVD		
AV35	RSVD		
AV37	RSVD		
AV38	RSVD		
AV4	RSVD		
B2	RSVD		
B3	RSVD		
B36	RSVD		
B37	RSVD		
B38	RSVD		
C1	RSVD		
C2	RSVD		
C37	RSVD		
D1	RSVD		



**Table 3-1. Pin List by Pin Name (Sheet 21 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
D38	RSVD		
F1	RSVD		
F38	RSVD		
G1	RSVD		
G38	RSVD		
H13	RSVD		
J20	RSVD		
L13	RSVD		
M13	RSVD		
M20	RSVD		
M21	RSVD		
M36	RSVD		
M4	RSVD		
P10	RSVD		
P27	RSVD		
R10	RSVD		
R27	RSVD		
T11	RSVD		
U4	RSVD		
V27	RSVD		
V29	RSVD		
W10	RSVD		
W12	RSVD		
W27	RSVD		
Y10	RSVD		
AG29	SKTID[0]		I
AH28	SKTID[1]		I
AG28	SKTID[2]		I
AE28	SM_WP		I
AT32	SMBCLK	SMBus	I/O
AR32	SMBDAT	SMBus	I/O
AT30	SPDCLK		I/O
AT31	SPDDAT		I/O
Y12	SYSCLK	Differential	I
AA12	SYSCLK_N	Differential	I
V11	SYSUTST_REFCLK	Differential	I
U11	SYSUTST_REFCLK_N	Differential	I
P11	TCK		I

**Table 3-1. Pin List by Pin Name (Sheet 22 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
P12	TDI		I
N12	TDO		O
Y28	TESTHI[1]		I
W29	TESTHI[2]		I
V28	TESTHI[4]		I
A5	THERMALERT_N		O
A6	THERMTRIP_N		O
R12	TMS		I
AL11	TRIGGER[0]_N		I/O
AP11	TRIGGER[1]_N		I/O
N11	TRST_N		I
AV6	VCC33_SM	Power/Other	
AV7	VCC33_SM	Power/Other	
A27	VCCA	Power/Other	
A28	VCCA	Power/Other	
A31	VCCA	Power/Other	
A32	VCCA	Power/Other	
AV21	VCCA	Power/Other	
AV22	VCCA	Power/Other	
AV26	VCCA	Power/Other	
AV27	VCCA	Power/Other	
AA37	VCCIO	Power/Other	
AB28	VCCIO	Power/Other	
AB30	VCCIO	Power/Other	
AB36	VCCIO	Power/Other	
AD11	VCCIO	Power/Other	
AD31	VCCIO	Power/Other	
AE29	VCCIO	Power/Other	
AF10	VCCIO	Power/Other	
AF27	VCCIO	Power/Other	
AG14	VCCIO	Power/Other	
AG18	VCCIO	Power/Other	
AG25	VCCIO	Power/Other	
AG35	VCCIO	Power/Other	
AH12	VCCIO	Power/Other	
AH22	VCCIO	Power/Other	
AH27	VCCIO	Power/Other	
AK13	VCCIO	Power/Other	



**Table 3-1. Pin List by Pin Name (Sheet 23 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AK17	VCCIO	Power/Other	
AK23	VCCIO	Power/Other	
AL15	VCCIO	Power/Other	
AL25	VCCIO	Power/Other	
AL35	VCCIO	Power/Other	
AM14	VCCIO	Power/Other	
AM19	VCCIO	Power/Other	
AM29	VCCIO	Power/Other	
AM33	VCCIO	Power/Other	
AN12	VCCIO	Power/Other	
AP20	VCCIO	Power/Other	
AP24	VCCIO	Power/Other	
AP34	VCCIO	Power/Other	
AR12	VCCIO	Power/Other	
AR23	VCCIO	Power/Other	
AR28	VCCIO	Power/Other	
AR30	VCCIO	Power/Other	
AR35	VCCIO	Power/Other	
AT25	VCCIO	Power/Other	
AU20	VCCIO	Power/Other	
C14	VCCIO	Power/Other	
C24	VCCIO	Power/Other	
C29	VCCIO	Power/Other	
D32	VCCIO	Power/Other	
E14	VCCIO	Power/Other	
E27	VCCIO	Power/Other	
E34	VCCIO	Power/Other	
F16	VCCIO	Power/Other	
F23	VCCIO	Power/Other	
F35	VCCIO	Power/Other	
G13	VCCIO	Power/Other	
G29	VCCIO	Power/Other	
G34	VCCIO	Power/Other	
H17	VCCIO	Power/Other	
H19	VCCIO	Power/Other	
H22	VCCIO	Power/Other	
H24	VCCIO	Power/Other	
H32	VCCIO	Power/Other	

**Table 3-1. Pin List by Pin Name (Sheet 24 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
J34	VCCIO	Power/Other	
K24	VCCIO	Power/Other	
K27	VCCIO	Power/Other	
K35	VCCIO	Power/Other	
L15	VCCIO	Power/Other	
M18	VCCIO	Power/Other	
M23	VCCIO	Power/Other	
M26	VCCIO	Power/Other	
N36	VCCIO	Power/Other	
T27	VCCIO	Power/Other	
T35	VCCIO	Power/Other	
U28	VCCIO	Power/Other	
W35	VCCIO	Power/Other	
Y27	VCCIO	Power/Other	
Y30	VCCIO	Power/Other	
Y33	VCCIO	Power/Other	
AA1	VCCIO_FBD	Power/Other	
AA8	VCCIO_FBD	Power/Other	
AB4	VCCIO_FBD	Power/Other	
AB9	VCCIO_FBD	Power/Other	
AC2	VCCIO_FBD	Power/Other	
AC6	VCCIO_FBD	Power/Other	
AE4	VCCIO_FBD	Power/Other	
AE8	VCCIO_FBD	Power/Other	
AG4	VCCIO_FBD	Power/Other	
AJ1	VCCIO_FBD	Power/Other	
AJ5	VCCIO_FBD	Power/Other	
AM4	VCCIO_FBD	Power/Other	
AN7	VCCIO_FBD	Power/Other	
AP10	VCCIO_FBD	Power/Other	
AP5	VCCIO_FBD	Power/Other	
AR8	VCCIO_FBD	Power/Other	
AT7	VCCIO_FBD	Power/Other	
E10	VCCIO_FBD	Power/Other	
E12	VCCIO_FBD	Power/Other	
E5	VCCIO_FBD	Power/Other	
F8	VCCIO_FBD	Power/Other	
H7	VCCIO_FBD	Power/Other	


**Table 3-1. Pin List by Pin Name (Sheet 25 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
J1	VCCIO_FBD	Power/Other	
J4	VCCIO_FBD	Power/Other	
N4	VCCIO_FBD	Power/Other	
T10	VCCIO_FBD	Power/Other	
T3	VCCIO_FBD	Power/Other	
W5	VCCIO_FBD	Power/Other	
Y2	VCCIO_FBD	Power/Other	
T12	VFUSERM		I
AN1	VR_FAN_N		O
K38	VR_THERMALERT_N		O
H38	VR_THERMTRIP_N		O
AL38	VROUTPUT_ENABLE0		I
AM1	VRPWRGD		O
A14	VSS	Power/Other	
A16	VSS	Power/Other	
A19	VSS	Power/Other	
A24	VSS	Power/Other	
A29	VSS	Power/Other	
A3	VSS	Power/Other	
A34	VSS	Power/Other	
A36	VSS	Power/Other	
A9	VSS	Power/Other	
AA10	VSS	Power/Other	
AA28	VSS	Power/Other	
AA29	VSS	Power/Other	
AA30	VSS	Power/Other	
AA34	VSS	Power/Other	
AA4	VSS	Power/Other	
AA5	VSS	Power/Other	
AA9	VSS	Power/Other	
AB10	VSS	Power/Other	
AB11	VSS	Power/Other	
AB12	VSS	Power/Other	
AB2	VSS	Power/Other	
AB27	VSS	Power/Other	
AB29	VSS	Power/Other	
AB32	VSS	Power/Other	
AB37	VSS	Power/Other	

**Table 3-1. Pin List by Pin Name (Sheet 26 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AB7	VSS	Power/Other	
AC10	VSS	Power/Other	
AC11	VSS	Power/Other	
AC30	VSS	Power/Other	
AC35	VSS	Power/Other	
AC36	VSS	Power/Other	
AC5	VSS	Power/Other	
AC7	VSS	Power/Other	
AD10	VSS	Power/Other	
AD28	VSS	Power/Other	
AD3	VSS	Power/Other	
AD33	VSS	Power/Other	
AD35	VSS	Power/Other	
AD38	VSS	Power/Other	
AD8	VSS	Power/Other	
AE1	VSS	Power/Other	
AE10	VSS	Power/Other	
AE11	VSS	Power/Other	
AE31	VSS	Power/Other	
AE36	VSS	Power/Other	
AE6	VSS	Power/Other	
AE9	VSS	Power/Other	
AF28	VSS	Power/Other	
AF29	VSS	Power/Other	
AF34	VSS	Power/Other	
AF35	VSS	Power/Other	
AF4	VSS	Power/Other	
AF9	VSS	Power/Other	
AG12	VSS	Power/Other	
AG15	VSS	Power/Other	
AG17	VSS	Power/Other	
AG2	VSS	Power/Other	
AG22	VSS	Power/Other	
AG23	VSS	Power/Other	
AG26	VSS	Power/Other	
AG27	VSS	Power/Other	
AG32	VSS	Power/Other	
AG37	VSS	Power/Other	



**Table 3-1. Pin List by Pin Name (Sheet 27 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AG5	VSS	Power/Other	
AG7	VSS	Power/Other	
AH10	VSS	Power/Other	
AH15	VSS	Power/Other	
AH18	VSS	Power/Other	
AH20	VSS	Power/Other	
AH23	VSS	Power/Other	
AH25	VSS	Power/Other	
AH26	VSS	Power/Other	
AH30	VSS	Power/Other	
AH35	VSS	Power/Other	
AH5	VSS	Power/Other	
AJ12	VSS	Power/Other	
AJ13	VSS	Power/Other	
AJ16	VSS	Power/Other	
AJ18	VSS	Power/Other	
AJ23	VSS	Power/Other	
AJ26	VSS	Power/Other	
AJ28	VSS	Power/Other	
AJ3	VSS	Power/Other	
AJ33	VSS	Power/Other	
AJ35	VSS	Power/Other	
AJ38	VSS	Power/Other	
AJ6	VSS	Power/Other	
AJ8	VSS	Power/Other	
AK1	VSS	Power/Other	
AK11	VSS	Power/Other	
AK14	VSS	Power/Other	
AK16	VSS	Power/Other	
AK21	VSS	Power/Other	
AK24	VSS	Power/Other	
AK25	VSS	Power/Other	
AK26	VSS	Power/Other	
AK30	VSS	Power/Other	
AK31	VSS	Power/Other	
AK35	VSS	Power/Other	
AK36	VSS	Power/Other	
AK6	VSS	Power/Other	

**Table 3-1. Pin List by Pin Name (Sheet 28 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AL14	VSS	Power/Other	
AL18	VSS	Power/Other	
AL19	VSS	Power/Other	
AL24	VSS	Power/Other	
AL29	VSS	Power/Other	
AL34	VSS	Power/Other	
AL4	VSS	Power/Other	
AL9	VSS	Power/Other	
AM12	VSS	Power/Other	
AM17	VSS	Power/Other	
AM2	VSS	Power/Other	
AM22	VSS	Power/Other	
AM27	VSS	Power/Other	
AM32	VSS	Power/Other	
AM34	VSS	Power/Other	
AM37	VSS	Power/Other	
AM7	VSS	Power/Other	
AN10	VSS	Power/Other	
AN15	VSS	Power/Other	
AN20	VSS	Power/Other	
AN25	VSS	Power/Other	
AN30	VSS	Power/Other	
AN35	VSS	Power/Other	
AN5	VSS	Power/Other	
AN8	VSS	Power/Other	
AP12	VSS	Power/Other	
AP13	VSS	Power/Other	
AP18	VSS	Power/Other	
AP22	VSS	Power/Other	
AP23	VSS	Power/Other	
AP28	VSS	Power/Other	
AP3	VSS	Power/Other	
AP33	VSS	Power/Other	
AP38	VSS	Power/Other	
AP8	VSS	Power/Other	
AR11	VSS	Power/Other	
AR16	VSS	Power/Other	
AR21	VSS	Power/Other	


**Table 3-1. Pin List by Pin Name (Sheet 29 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AR24	VSS	Power/Other	
AR26	VSS	Power/Other	
AR29	VSS	Power/Other	
AR31	VSS	Power/Other	
AR36	VSS	Power/Other	
AR6	VSS	Power/Other	
AT1	VSS	Power/Other	
AT12	VSS	Power/Other	
AT14	VSS	Power/Other	
AT19	VSS	Power/Other	
AT24	VSS	Power/Other	
AT29	VSS	Power/Other	
AT34	VSS	Power/Other	
AT4	VSS	Power/Other	
AT9	VSS	Power/Other	
AU12	VSS	Power/Other	
AU17	VSS	Power/Other	
AU22	VSS	Power/Other	
AU27	VSS	Power/Other	
AU32	VSS	Power/Other	
AU38	VSS	Power/Other	
AU7	VSS	Power/Other	
AV10	VSS	Power/Other	
AV13	VSS	Power/Other	
AV15	VSS	Power/Other	
AV18	VSS	Power/Other	
AV20	VSS	Power/Other	
AV25	VSS	Power/Other	
AV3	VSS	Power/Other	
AV30	VSS	Power/Other	
AV36	VSS	Power/Other	
AV5	VSS	Power/Other	
B1	VSS	Power/Other	
B12	VSS	Power/Other	
B14	VSS	Power/Other	
B17	VSS	Power/Other	
B22	VSS	Power/Other	
B27	VSS	Power/Other	

**Table 3-1. Pin List by Pin Name (Sheet 30 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
B32	VSS	Power/Other	
B7	VSS	Power/Other	
C10	VSS	Power/Other	
C15	VSS	Power/Other	
C20	VSS	Power/Other	
C25	VSS	Power/Other	
C30	VSS	Power/Other	
C35	VSS	Power/Other	
C38	VSS	Power/Other	
C5	VSS	Power/Other	
D10	VSS	Power/Other	
D13	VSS	Power/Other	
D14	VSS	Power/Other	
D18	VSS	Power/Other	
D23	VSS	Power/Other	
D25	VSS	Power/Other	
D28	VSS	Power/Other	
D3	VSS	Power/Other	
D30	VSS	Power/Other	
D31	VSS	Power/Other	
D33	VSS	Power/Other	
D8	VSS	Power/Other	
E1	VSS	Power/Other	
E11	VSS	Power/Other	
E13	VSS	Power/Other	
E15	VSS	Power/Other	
E16	VSS	Power/Other	
E21	VSS	Power/Other	
E26	VSS	Power/Other	
E28	VSS	Power/Other	
E31	VSS	Power/Other	
E36	VSS	Power/Other	
E6	VSS	Power/Other	
F12	VSS	Power/Other	
F13	VSS	Power/Other	
F14	VSS	Power/Other	
F15	VSS	Power/Other	
F19	VSS	Power/Other	



**Table 3-1. Pin List by Pin Name (Sheet 31 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
F22	VSS	Power/Other	
F24	VSS	Power/Other	
F29	VSS	Power/Other	
F34	VSS	Power/Other	
F4	VSS	Power/Other	
F5	VSS	Power/Other	
F9	VSS	Power/Other	
G12	VSS	Power/Other	
G14	VSS	Power/Other	
G17	VSS	Power/Other	
G2	VSS	Power/Other	
G22	VSS	Power/Other	
G27	VSS	Power/Other	
G32	VSS	Power/Other	
G37	VSS	Power/Other	
G7	VSS	Power/Other	
H10	VSS	Power/Other	
H15	VSS	Power/Other	
H20	VSS	Power/Other	
H25	VSS	Power/Other	
H30	VSS	Power/Other	
H35	VSS	Power/Other	
H4	VSS	Power/Other	
H5	VSS	Power/Other	
J13	VSS	Power/Other	
J18	VSS	Power/Other	
J23	VSS	Power/Other	
J24	VSS	Power/Other	
J25	VSS	Power/Other	
J28	VSS	Power/Other	
J3	VSS	Power/Other	
J33	VSS	Power/Other	
J38	VSS	Power/Other	
J5	VSS	Power/Other	
J6	VSS	Power/Other	
J8	VSS	Power/Other	
K1	VSS	Power/Other	
K11	VSS	Power/Other	

**Table 3-1. Pin List by Pin Name (Sheet 32 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
K16	VSS	Power/Other	
K21	VSS	Power/Other	
K22	VSS	Power/Other	
K23	VSS	Power/Other	
K25	VSS	Power/Other	
K26	VSS	Power/Other	
K3	VSS	Power/Other	
K31	VSS	Power/Other	
K36	VSS	Power/Other	
K6	VSS	Power/Other	
L14	VSS	Power/Other	
L16	VSS	Power/Other	
L17	VSS	Power/Other	
L19	VSS	Power/Other	
L23	VSS	Power/Other	
L24	VSS	Power/Other	
L25	VSS	Power/Other	
L26	VSS	Power/Other	
L29	VSS	Power/Other	
L34	VSS	Power/Other	
L35	VSS	Power/Other	
L4	VSS	Power/Other	
L9	VSS	Power/Other	
M12	VSS	Power/Other	
M16	VSS	Power/Other	
M17	VSS	Power/Other	
M19	VSS	Power/Other	
M2	VSS	Power/Other	
M22	VSS	Power/Other	
M24	VSS	Power/Other	
M25	VSS	Power/Other	
M27	VSS	Power/Other	
M32	VSS	Power/Other	
M37	VSS	Power/Other	
M7	VSS	Power/Other	
N10	VSS	Power/Other	
N30	VSS	Power/Other	
N35	VSS	Power/Other	


**Table 3-1. Pin List by Pin Name (Sheet 33 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
N5	VSS	Power/Other	
P28	VSS	Power/Other	
P3	VSS	Power/Other	
P33	VSS	Power/Other	
P35	VSS	Power/Other	
P38	VSS	Power/Other	
P4	VSS	Power/Other	
P8	VSS	Power/Other	
R1	VSS	Power/Other	
R11	VSS	Power/Other	
R31	VSS	Power/Other	
R36	VSS	Power/Other	
R4	VSS	Power/Other	
R6	VSS	Power/Other	
T29	VSS	Power/Other	
T34	VSS	Power/Other	
T4	VSS	Power/Other	
T9	VSS	Power/Other	
U12	VSS	Power/Other	
U2	VSS	Power/Other	
U27	VSS	Power/Other	
U3	VSS	Power/Other	
U32	VSS	Power/Other	
U35	VSS	Power/Other	
U37	VSS	Power/Other	
U7	VSS	Power/Other	
V10	VSS	Power/Other	
V30	VSS	Power/Other	
V35	VSS	Power/Other	
V5	VSS	Power/Other	
W11	VSS	Power/Other	
W28	VSS	Power/Other	
W3	VSS	Power/Other	
W33	VSS	Power/Other	
W38	VSS	Power/Other	
W8	VSS	Power/Other	
Y1	VSS	Power/Other	
Y11	VSS	Power/Other	

**Table 3-1. Pin List by Pin Name (Sheet 34 of 34)**

Pin Number	Pin Name	Signal Buffer Type	Direction
Y29	VSS	Power/Other	
Y31	VSS	Power/Other	
Y36	VSS	Power/Other	
Y5	VSS	Power/Other	
Y6	VSS	Power/Other	
AJ11	XDPOCP_STRB_IN_N		I
AH11	XDPOCP_STRB_OUT_N		O
AH8	XDPOCPD[0]_N		I/O
AG8	XDPOCPD[1]_N		I/O
AJ9	XDPOCPD[2]_N		I/O
AG9	XDPOCPD[3]_N		I/O
AH9	XDPOCPD[4]_N		I/O
AG10	XDPOCPD[5]_N		I/O
AJ10	XDPOCPD[6]_N		I/O
AK10	XDPOCPD[7]_N		I/O
AG11	XDPOCPFRAME_N		I/O



### 3.1.2 Pin Listing by Pin Number

Table 3-2. Pin List by Pin Number (Sheet 1 of 33)

Pin Number	Pin Name	Signal Buffer Type	Direction
A1	RSVD		
A2	RSVD		
A3	VSS	Power/Other	
A4	RSVD		
A5	THERMALERT_N		O
A6	THERMTRIP_N		O
A7	FBD1SBOCLKCP0	Differential	O
A8	FBD1SBOCLKCN0	Differential	O
A9	VSS	Power/Other	
A10	FBD1SBOCP[5]	Differential	O
A11	FBD1SBOCP[7]	Differential	O
A12	FBD1SBOCN[7]	Differential	O
A13	FBD1SBOCP[10]	Differential	O
A14	VSS	Power/Other	
A15	CSI4RPDAT[0]	Differential	I
A16	VSS	Power/Other	
A17	CSI4RNDAT[3]	Differential	I
A18	CSI4RPDAT[3]	Differential	I
A19	VSS	Power/Other	
A20	CSI2RPDAT[8]	Differential	I
A21	CSI2RNCLK	Differential	I
A22	CSI2RPCLK	Differential	I
A23	CSI2RPDAT[10]	Differential	I
A24	VSS	Power/Other	
A25	CSI2RNDAT[13]	Differential	I
A26	CSI2RPDAT[13]	Differential	I
A27	VCCA	Power/Other	
A28	VCCA	Power/Other	
A29	VSS	Power/Other	
A30	CSI2RPDAT[17]	Differential	I
A31	VCCA	Power/Other	
A32	VCCA	Power/Other	
A33	CSI0RPDAT[0]	Differential	I
A34	VSS	Power/Other	
A35	RSVD		
A36	VSS	Power/Other	

Table 3-2. Pin List by Pin Number (Sheet 2 of 33)

Pin Number	Pin Name	Signal Buffer Type	Direction
A37	RSVD		
A38	RSVD		
AA1	VCCIO_FBD	Power/Other	
AA2	FBD0SBOBN[8]	Differential	O
AA3	FBD0SBOBP[8]	Differential	O
AA4	VSS	Power/Other	
AA5	VSS	Power/Other	
AA6	FBD1NBIDN[1]	Differential	I
AA7	FBD1NBIDP[1]	Differential	I
AA8	VCCIO_FBD	Power/Other	
AA9	VSS	Power/Other	
AA10	VSS	Power/Other	
AA11	RSVD		
AA12	SYSCLK_N	Differential	I
AA27	RSVD		
AA28	VSS	Power/Other	
AA29	VSS	Power/Other	
AA30	VSS	Power/Other	
AA31	CSI3TNDAT[18]	Differential	O
AA32	CSI3TNDAT[19]	Differential	O
AA33	CSI3TPDAT[19]	Differential	O
AA34	VSS	Power/Other	
AA35	CSI1TNDAT[18]	Differential	O
AA36	CSI1TPDAT[18]	Differential	O
AA37	VCCIO	Power/Other	
AA38	CSI1RNDAT[18]	Differential	I
AB1	FBD0NBIBN[11]	Differential	I
AB2	VSS	Power/Other	
AB3	FBD0SBOBN[6]	Differential	O
AB4	VCCIO_FBD	Power/Other	
AB5	FBD1NBIDP[0]	Differential	I
AB6	FBD1NBIDN[0]	Differential	I
AB7	VSS	Power/Other	
AB8	FBD1NBIDP[14]	Differential	I
AB9	VCCIO_FBD	Power/Other	
AB10	VSS	Power/Other	



Table 3-2. Pin List by Pin Number (Sheet 3 of 33)

Pin Number	Pin Name	Signal Buffer Type	Direction
AB11	VSS	Power/Other	
AB12	VSS	Power/Other	
AB27	VSS	Power/Other	
AB28	VCCIO	Power/Other	
AB29	VSS	Power/Other	
AB30	VCCIO	Power/Other	
AB31	CSI3TPDAT[18]	Differential	O
AB32	VSS	Power/Other	
AB33	CSI3TNDAT[17]	Differential	O
AB34	CSI1TNDAT[17]	Differential	O
AB35	CSI1TPDAT[17]	Differential	O
AB36	VCCIO	Power/Other	
AB37	VSS	Power/Other	
AB38	CSI1RPDAT[18]	Differential	I
AC1	FBD0NBIBP[11]	Differential	I
AC2	VCCIO_FBD	Power/Other	
AC3	FBD0SBOBP[6]	Differential	O
AC4	FBD0SBOBN[5]	Differential	O
AC5	VSS	Power/Other	
AC6	VCCIO_FBD	Power/Other	
AC7	VSS	Power/Other	
AC8	FBD1NBIDN[14]	Differential	I
AC9	FBD1REFSYSCLKP	Differential	I
AC10	VSS	Power/Other	
AC11	VSS	Power/Other	
AC12	RSVD		
AC27	RSVD		
AC28	RSVD		
AC29	RSVD		
AC30	VSS	Power/Other	
AC31	CSI3TNDAT[16]	Differential	O
AC32	CSI3TPDAT[16]	Differential	O
AC33	CSI3TPDAT[17]	Differential	O
AC34	CSI1TNDAT[16]	Differential	O
AC35	VSS	Power/Other	
AC36	VSS	Power/Other	
AC37	CSI1RNDAT[17]	Differential	I
AC38	CSI1RPDAT[17]	Differential	I

Table 3-2. Pin List by Pin Number (Sheet 4 of 33)

Pin Number	Pin Name	Signal Buffer Type	Direction
AD1	FBD0NBIBN[10]	Differential	I
AD2	FBD0NBIBP[10]	Differential	I
AD3	VSS	Power/Other	
AD4	FBD0SBOBP[5]	Differential	O
AD5	FBD0SBOBP[7]	Differential	O
AD6	FBD0SBOBN[7]	Differential	O
AD7	FBD0SBOBN[9]	Differential	O
AD8	VSS	Power/Other	
AD9	FBD1REFSYSCLKN	Differential	I
AD10	VSS	Power/Other	
AD11	VCCIO	Power/Other	
AD12	RSVD		
AD27	RSVD		
AD28	VSS	Power/Other	
AD29	RSVD		
AD30	RSVD		
AD31	VCCIO	Power/Other	
AD32	CSI3TNDAT[15]	Differential	O
AD33	VSS	Power/Other	
AD34	CSI1TPDAT[16]	Differential	O
AD35	VSS	Power/Other	
AD36	CSI1RNDAT[16]	Differential	I
AD37	CSI1RPDAT[16]	Differential	I
AD38	VSS	Power/Other	
AE1	VSS	Power/Other	
AE2	FBD0NBIBP[9]	Differential	I
AE3	FBD0NBIBN[9]	Differential	I
AE4	VCCIO_FBD	Power/Other	
AE5	FBD0SBOCLKBN0	Differential	O
AE6	VSS	Power/Other	
AE7	FBD0SBOBP[9]	Differential	O
AE8	VCCIO_FBD	Power/Other	
AE9	VSS	Power/Other	
AE10	VSS	Power/Other	
AE11	VSS	Power/Other	
AE12	RSVD		
AE27	RSVD		
AE28	SM_WP		I

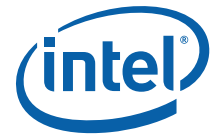


**Table 3-2. Pin List by Pin Number (Sheet 5 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AE29	VCCIO	Power/Other	
AE30	RSVD		
AE31	VSS	Power/Other	
AE32	CSI3TPDAT[15]	Differential	O
AE33	CSI1TNDAT[14]	Differential	O
AE34	CSI1TNDAT[15]	Differential	O
AE35	CSI1TPDAT[15]	Differential	O
AE36	VSS	Power/Other	
AE37	CSI1RNDAT[15]	Differential	I
AE38	CSI1RPDAT[15]	Differential	I
AF1	FBD0NBIBP[8]	Differential	I
AF2	FBD0NBIBN[8]	Differential	I
AF3	FBD0NBIBN[7]	Differential	I
AF4	VSS	Power/Other	
AF5	FBD0SBOCLKBP0	Differential	O
AF6	FBD0SBOBN[4]	Differential	O
AF7	FBD0SBOBN[3]	Differential	O
AF8	FBD0SBOBP[3]	Differential	O
AF9	VSS	Power/Other	
AF10	VCCIO	Power/Other	
AF11	PRBMODE_RDY_N		O
AF12	PRBMODE_REQST_N		I
AF27	VCCIO	Power/Other	
AF28	VSS	Power/Other	
AF29	VSS	Power/Other	
AF30	CSI3TNDAT[13]	Differential	O
AF31	CSI3TNDAT[14]	Differential	O
AF32	CSI3TPDAT[14]	Differential	O
AF33	CSI1TPDAT[14]	Differential	O
AF34	VSS	Power/Other	
AF35	VSS	Power/Other	
AF36	CSI1RNDAT[14]	Differential	I
AF37	CSI1RPDAT[14]	Differential	I
AF38	CSI1RNDAT[13]	Differential	I
AG1	FBD0NBIBN[6]	Differential	I
AG2	VSS	Power/Other	
AG3	FBD0NBIBP[7]	Differential	I
AG4	VCCIO_FBD	Power/Other	

**Table 3-2. Pin List by Pin Number (Sheet 6 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AG5	VSS	Power/Other	
AG6	FBD0SBOBP[4]	Differential	O
AG7	VSS	Power/Other	
AG8	XDPOCPD[1]_N		I/O
AG9	XDPOCPD[3]_N		I/O
AG10	XDPOCPD[5]_N		I/O
AG11	XDPOCPFRAME_N		I/O
AG12	VSS	Power/Other	
AG13	CSI5TNDAT[0]	Differential	O
AG14	VCCIO	Power/Other	
AG15	VSS	Power/Other	
AG16	CSI5TNDAT[3]	Differential	O
AG17	VSS	Power/Other	
AG18	VCCIO	Power/Other	
AG19	CSI5TNDAT[7]	Differential	O
AG20	CSI5TPDAT[7]	Differential	O
AG21	RSVD		
AG22	VSS	Power/Other	
AG23	VSS	Power/Other	
AG24	PIR_SCL	Power/Other	I
AG25	VCCIO	Power/Other	
AG26	VSS	Power/Other	
AG27	VSS	Power/Other	
AG28	SKTID[2]		I
AG29	SKTID[0]		I
AG30	CSI3TPDAT[13]	Differential	O
AG31	CSI3TNDAT[12]	Differential	O
AG32	VSS	Power/Other	
AG33	CSI1TNDAT[13]	Differential	O
AG34	CSI1TPDAT[13]	Differential	O
AG35	VCCIO	Power/Other	
AG36	CSI1RNDAT[12]	Differential	I
AG37	VSS	Power/Other	
AG38	CSI1RPDAT[13]	Differential	I
AH1	FBD0NBIBP[6]	Differential	I
AH2	FBD0NBIBN[12]	Differential	I
AH3	FBD0NBICLKBN0	Differential	I
AH4	FBD0NBICLKBP0	Differential	I


**Table 3-2. Pin List by Pin Number (Sheet 7 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AH5	VSS	Power/Other	
AH6	FBD0SBOBN[2]	Differential	O
AH7	FBD0SBOBP[2]	Differential	O
AH8	XDPOCPD[0]_N		I/O
AH9	XDPOCPD[4]_N		I/O
AH10	VSS	Power/Other	
AH11	XDPOCP_STRB_OUT_N		O
AH12	VCCIO	Power/Other	
AH13	CSI5TPDAT[0]	Differential	O
AH14	CSI5TNDAT[1]	Differential	O
AH15	VSS	Power/Other	
AH16	CSI5TPDAT[3]	Differential	O
AH17	CSI5TNDAT[4]	Differential	O
AH18	VSS	Power/Other	
AH19	CSI5TNDAT[5]	Differential	O
AH20	VSS	Power/Other	
AH21	RSVD		
AH22	VCCIO	Power/Other	
AH23	VSS	Power/Other	
AH24	PIR_SDA	Power/Other	I/O
AH25	VSS	Power/Other	
AH26	VSS	Power/Other	
AH27	VCCIO	Power/Other	
AH28	SKTID[1]		I
AH29	CSI3TNDAT[10]	Differential	O
AH30	VSS	Power/Other	
AH31	CSI3TPDAT[12]	Differential	O
AH32	CSI1TNDAT[12]	Differential	O
AH33	CSI1TPDAT[12]	Differential	O
AH34	CSI1TNDAT[11]	Differential	O
AH35	VSS	Power/Other	
AH36	CSI1RPDAT[12]	Differential	I
AH37	CSI1RPDAT[11]	Differential	I
AH38	CSI1RNDAT[11]	Differential	I
AJ1	VCCIO_FBD	Power/Other	
AJ2	FBD0NBIBP[12]	Differential	I
AJ3	VSS	Power/Other	
AJ4	FBD0NBIBN[13]	Differential	I

**Table 3-2. Pin List by Pin Number (Sheet 8 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AJ5	VCCIO_FBD	Power/Other	
AJ6	VSS	Power/Other	
AJ7	FBD0SBOBN[1]	Differential	O
AJ8	VSS	Power/Other	
AJ9	XDPOCPD[2]_N		I/O
AJ10	XDPOCPD[6]_N		I/O
AJ11	XDPOCP_STRB_IN_N		I
AJ12	VSS	Power/Other	
AJ13	VSS	Power/Other	
AJ14	CSI5TPDAT[1]	Differential	O
AJ15	CSI5TNDAT[2]	Differential	O
AJ16	VSS	Power/Other	
AJ17	CSI5TPDAT[4]	Differential	O
AJ18	VSS	Power/Other	
AJ19	CSI5TPDAT[5]	Differential	O
AJ20	CSI5TNDAT[8]	Differential	O
AJ21	CSI5TPDAT[8]	Differential	O
AJ22	CSI5TNCLK	Differential	O
AJ23	VSS	Power/Other	
AJ24	PIR_A1	Power/Other	I
AJ25	PIR_A0	Power/Other	I
AJ26	VSS	Power/Other	
AJ27	CSI3TNDAT[9]	Differential	O
AJ28	VSS	Power/Other	
AJ29	CSI3TPDAT[10]	Differential	O
AJ30	CSI3TNDAT[11]	Differential	O
AJ31	CSI3TPDAT[11]	Differential	O
AJ32	CSI1TNCLK	Differential	O
AJ33	VSS	Power/Other	
AJ34	CSI1TPDAT[11]	Differential	O
AJ35	VSS	Power/Other	
AJ36	CSI1RPDAT[10]	Differential	I
AJ37	CSI1RNDAT[10]	Differential	I
AJ38	VSS	Power/Other	
AK1	VSS	Power/Other	
AK2	FBD0NBIAN[11]	Differential	I
AK3	FBD0NBIAP[11]	Differential	I
AK4	FBD0NBIBP[13]	Differential	I

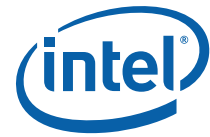


**Table 3-2. Pin List by Pin Number (Sheet 9 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AK5	FBD0NBIBN[5]	Differential	I
AK6	VSS	Power/Other	
AK7	FBD0SBOBP[1]	Differential	O
AK8	FBD0SBOBN[0]	Differential	O
AK9	FBD0SBOBP[0]	Differential	O
AK10	XDPOCPD[7]_N		I/O
AK11	VSS	Power/Other	
AK12	RSVD		
AK13	VCCIO	Power/Other	
AK14	VSS	Power/Other	
AK15	CSI5TPDAT[2]	Differential	O
AK16	VSS	Power/Other	
AK17	VCCIO	Power/Other	
AK18	CSI5TNDAT[6]	Differential	O
AK19	CSI5TPDAT[6]	Differential	O
AK20	CSI3TPDAT[0]	Differential	O
AK21	VSS	Power/Other	
AK22	CSI5TPCLK	Differential	O
AK23	VCCIO	Power/Other	
AK24	VSS	Power/Other	
AK25	VSS	Power/Other	
AK26	VSS	Power/Other	
AK27	CSI3TPDAT[9]	Differential	O
AK28	CSI3TPCLK	Differential	O
AK29	CSI3TNCLK	Differential	O
AK30	VSS	Power/Other	
AK31	VSS	Power/Other	
AK32	CSI1TPCLK	Differential	O
AK33	CSI1TNDAT[10]	Differential	O
AK34	CSI1TPDAT[10]	Differential	O
AK35	VSS	Power/Other	
AK36	VSS	Power/Other	
AK37	CSI1RPCLK	Differential	I
AK38	CSI1RNCLK		I
AL1	FBD0NBIAN[10]	Differential	I
AL2	FBD0NBIAP[10]	Differential	I
AL3	FBD0NBIAN[9]	Differential	I
AL4	VSS	Power/Other	

**Table 3-2. Pin List by Pin Number (Sheet 10 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AL5	FBD0NBIBP[5]	Differential	I
AL6	FBD0REFSYSCLKN	Differential	I
AL7	FBD0REFSYSCLKP	Differential	I
AL8	RSVD		
AL9	VSS	Power/Other	
AL10	FBD0NBIBP[14]	Differential	I
AL11	TRIGGER[0]_N		I/O
AL12	CSI5RNDAT[0]	Differential	I
AL13	CSI5RPDAT[0]	Differential	I
AL14	VSS	Power/Other	
AL15	VCCIO	Power/Other	
AL16	CSI3RPDAT[1]	Differential	I
AL17	CSI3RNDAT[1]	Differential	I
AL18	VSS	Power/Other	
AL19	VSS	Power/Other	
AL20	CSI3TNDAT[0]	Differential	O
AL21	CSI5TNDAT[9]	Differential	O
AL22	CSI5TPDAT[9]	Differential	O
AL23	CSI3TPDAT[2]	Differential	O
AL24	VSS	Power/Other	
AL25	VCCIO	Power/Other	
AL26	CSI1TPDAT[0]	Differential	O
AL27	CSI1TNDAT[0]	Differential	O
AL28	CSI1TNDAT[2]	Differential	O
AL29	VSS	Power/Other	
AL30	CSI1TNDAT[5]	Differential	O
AL31	RSVD		
AL32	CSI1TPDAT[9]	Differential	O
AL33	CSI1TNDAT[9]	Differential	O
AL34	VSS	Power/Other	
AL35	VCCIO	Power/Other	
AL36	CSI1RPDAT[9]	Differential	I
AL37	CSI1RNDAT[9]	Differential	I
AL38	VROUTPUT_ENABLE0		I
AM1	VRPWRGD		O
AM2	VSS	Power/Other	
AM3	FBD0NBIAP[9]	Differential	I
AM4	VCCIO_FBD	Power/Other	



**Table 3-2. Pin List by Pin Number (Sheet 11 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AM5	FBD0NBIBN[4]	Differential	I
AM6	FBD0NBIBP[4]	Differential	I
AM7	VSS	Power/Other	
AM8	FBD0NBIBP[1]	Differential	I
AM9	FBD0NBIBN[1]	Differential	I
AM10	FBD0NBIBN[14]	Differential	I
AM11	RSVD		
AM12	VSS	Power/Other	
AM13	CSI5RNDAT[1]	Differential	I
AM14	VCCIO	Power/Other	
AM15	CSI3RPDAT[2]	Differential	I
AM16	CSI3RNDAT[2]	Differential	I
AM17	VSS	Power/Other	
AM18	CSI3RPDAT[0]	Differential	I
AM19	VCCIO	Power/Other	
AM20	CSI3TNDAT[1]	Differential	O
AM21	CSI3TPDAT[1]	Differential	O
AM22	VSS	Power/Other	
AM23	CSI3TNDAT[2]	Differential	O
AM24	CSI3TNDAT[5]	Differential	O
AM25	CSI3TPDAT[8]	Differential	O
AM26	CSI3TNDAT[8]	Differential	O
AM27	VSS	Power/Other	
AM28	CSI1TPDAT[2]	Differential	O
AM29	VCCIO	Power/Other	
AM30	CSI1TPDAT[5]	Differential	O
AM31	CSI1TNDAT[8]	Differential	O
AM32	VSS	Power/Other	
AM33	VCCIO	Power/Other	
AM34	VSS	Power/Other	
AM35	CSI1RPDAT[8]	Differential	I
AM36	CSI1RNDAT[8]	Differential	I
AM37	VSS	Power/Other	
AM38	RSVD		
AN1	VR_FAN_N		O
AN2	FBD0NBIAN[7]	Differential	I
AN3	FBD0NBIAN[8]	Differential	I
AN4	FBD0NBIAP[8]	Differential	I

**Table 3-2. Pin List by Pin Number (Sheet 12 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AN5	VSS	Power/Other	
AN6	FBD0NBIBP[3]	Differential	I
AN7	VCCIO_FBD	Power/Other	
AN8	VSS	Power/Other	
AN9	FBD0NBIBN[0]	Differential	I
AN10	VSS	Power/Other	
AN11	RSVD		
AN12	VCCIO	Power/Other	
AN13	CSI5RPDAT[1]	Differential	I
AN14	CSI5RNDAT[2]	Differential	I
AN15	VSS	Power/Other	
AN16	CSI3RPDAT[3]	Differential	I
AN17	CSI3RNDAT[3]	Differential	I
AN18	CSI3RNDAT[0]	Differential	I
AN19	CSI3RPDAT[4]	Differential	I
AN20	VSS	Power/Other	
AN21	CSI3TNDAT[3]	Differential	O
AN22	CSI3TPDAT[4]	Differential	O
AN23	CSI3TNDAT[4]	Differential	O
AN24	CSI3TPDAT[5]	Differential	O
AN25	VSS	Power/Other	
AN26	CSI3TNDAT[7]	Differential	O
AN27	CSI1TPDAT[1]	Differential	O
AN28	CSI1TNDAT[1]	Differential	O
AN29	CSI1TNDAT[3]	Differential	O
AN30	VSS	Power/Other	
AN31	CSI1TPDAT[8]	Differential	O
AN32	CSI1TNDAT[6]	Differential	O
AN33	CSI1TPDAT[7]	Differential	O
AN34	CSI1TNDAT[7]	Differential	O
AN35	VSS	Power/Other	
AN36	CSI1RPDAT[7]	Differential	I
AN37	CSI1RNDAT[7]	Differential	I
AN38	RSVD		
AP1	PROCTYPE		I
AP2	FBD0NBIAP[7]	Differential	I
AP3	VSS	Power/Other	
AP4	FBD0NBIAN[6]	Differential	I



**Table 3-2. Pin List by Pin Number (Sheet 13 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AP5	VCCIO_FBD	Power/Other	
AP6	FBD0NBIBN[3]	Differential	I
AP7	FBD0NBIBN[2]	Differential	I
AP8	VSS	Power/Other	
AP9	FBD0NBIBP[0]	Differential	I
AP10	VCCIO_FBD	Power/Other	
AP11	TRIGGER[1]_N		I/O
AP12	VSS	Power/Other	
AP13	VSS	Power/Other	
AP14	CSI5RPDAT[2]	Differential	I
AP15	CSI5RNDAT[3]	Differential	I
AP16	CSI5RPDAT[3]	Differential	I
AP17	CSI5RNCLK	Differential	I
AP18	VSS	Power/Other	
AP19	CSI3RNDAT[4]	Differential	I
AP20	VCCIO	Power/Other	
AP21	CSI3TPDAT[3]	Differential	O
AP22	VSS	Power/Other	
AP23	VSS	Power/Other	
AP24	VCCIO	Power/Other	
AP25	CSI3TNDAT[6]	Differential	O
AP26	CSI3TPDAT[7]	Differential	O
AP27	RSVD		
AP28	VSS	Power/Other	
AP29	CSI1TPDAT[3]	Differential	O
AP30	CSI1TPDAT[4]	Differential	O
AP31	CSI1TNDAT[4]	Differential	O
AP32	CSI1TPDAT[6]	Differential	O
AP33	VSS	Power/Other	
AP34	VCCIO	Power/Other	
AP35	CSI1RPDAT[5]	Differential	I
AP36	CSI1RNDAT[5]	Differential	I
AP37	CSI1RNDAT[6]	Differential	I
AP38	VSS	Power/Other	
AR1	RSVD		
AR2	FBD0NBIAN[12]	Differential	I
AR3	FBD0NBIAP[12]	Differential	I
AR4	FBD0NBIAP[6]	Differential	I

**Table 3-2. Pin List by Pin Number (Sheet 14 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AR5	FBD0NBICLKAN0	Differential	I
AR6	VSS	Power/Other	
AR7	FBD0NBIBP[2]	Differential	I
AR8	VCCIO_FBD	Power/Other	
AR9	PWRGOOD		I
AR10	FBD0NBIAN[3]	Differential	I
AR11	VSS	Power/Other	
AR12	VCCIO	Power/Other	
AR13	CSI5RNDAT[4]	Differential	I
AR14	CSI5RPDAT[4]	Differential	I
AR15	CSI5RNDAT[7]	Differential	I
AR16	VSS	Power/Other	
AR17	CSI5RPCLK	Differential	I
AR18	CSI3RPDAT[5]	Differential	I
AR19	CSI3RNDAT[5]	Differential	I
AR20	CSI3RPDAT[9]	Differential	I
AR21	VSS	Power/Other	
AR22	CSI3RPDAT[10]	Differential	I
AR23	VCCIO	Power/Other	
AR24	VSS	Power/Other	
AR25	CSI3TPDAT[6]	Differential	O
AR26	VSS	Power/Other	
AR27	CSI3RPDAT[15]	Differential	I
AR28	VCCIO	Power/Other	
AR29	VSS	Power/Other	
AR30	VCCIO	Power/Other	
AR31	VSS	Power/Other	
AR32	SMBDAT	SMBus	I/O
AR33	CSI1RPDAT[3]	Differential	I
AR34	CSI1RNDAT[3]	Differential	I
AR35	VCCIO	Power/Other	
AR36	VSS	Power/Other	
AR37	CSI1RPDAT[6]	Differential	I
AR38	RSVD		
AT1	VSS	Power/Other	
AT2	RSVD		
AT3	CPU_PRES4_N		I/O
AT4	VSS	Power/Other	



**Table 3-2. Pin List by Pin Number (Sheet 15 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AT5	FBD0NBICLKAP0	Differential	I
AT6	FBD0NBIAN[5]	Differential	I
AT7	VCCIO_FBD	Power/Other	
AT8	FBD0NBIAN[4]	Differential	I
AT9	VSS	Power/Other	
AT10	FBD0NBIAP[3]	Differential	I
AT11	FBD0NBIAN[0]	Differential	I
AT12	VSS	Power/Other	
AT13	CSI5RNDAT[5]	Differential	I
AT14	VSS	Power/Other	
AT15	CSI5RPDAT[7]	Differential	I
AT16	CSI5RNDAT[9]	Differential	I
AT17	CSI5RPDAT[9]	Differential	I
AT18	CSI3RPDAT[7]	Differential	I
AT19	VSS	Power/Other	
AT20	CSI3RNDAT[9]	Differential	I
AT21	CSI3RPCLK	Differential	I
AT22	CSI3RNDAT[10]	Differential	I
AT23	CSI3RPDAT[11]	Differential	I
AT24	VSS	Power/Other	
AT25	VCCIO	Power/Other	
AT26	CSI3RPDAT[14]	Differential	I
AT27	CSI3RNDAT[15]	Differential	I
AT28	CSI3RPDAT[16]	Differential	I
AT29	VSS	Power/Other	
AT30	SPDCLK		I/O
AT31	SPDDAT		I/O
AT32	SMBCLK	SMBus	I/O
AT33	CSI1RPDAT[0]	Differential	I
AT34	VSS	Power/Other	
AT35	CSI1RNDAT[4]	Differential	I
AT36	CPU_PRES3_N		I/O
AT37	RSVD		
AT38	RSVD		
AU1	RSVD		
AU2	RSVD		
AU3	RSVD		
AU4	FBD0NBIAN[13]	Differential	I

**Table 3-2. Pin List by Pin Number (Sheet 16 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AU5	FBD0NBIAP[13]	Differential	I
AU6	FBD0NBIAP[5]	Differential	I
AU7	VSS	Power/Other	
AU8	FBD0NBIAP[4]	Differential	I
AU9	FBD0NBIAN[1]	Differential	I
AU10	FBD0NBIAP[1]	Differential	I
AU11	FBD0NBIAP[0]	Differential	I
AU12	VSS	Power/Other	
AU13	CSI5RPDAT[5]	Differential	I
AU14	CSI5RNDAT[6]	Differential	I
AU15	CSI5RNDAT[8]	Differential	I
AU16	CSI5RPDAT[8]	Differential	I
AU17	VSS	Power/Other	
AU18	CSI3RNDAT[7]	Differential	I
AU19	CSI3RPDAT[8]	Differential	I
AU20	VCCIO	Power/Other	
AU21	CSI3RNCLK	Differential	I
AU22	VSS	Power/Other	
AU23	CSI3RNDAT[11]	Differential	I
AU24	CSI3RPDAT[13]	Differential	I
AU25	CSI3RNDAT[13]	Differential	I
AU26	CSI3RNDAT[14]	Differential	I
AU27	VSS	Power/Other	
AU28	CSI3RNDAT[16]	Differential	I
AU29	CSI3RPDAT[18]	Differential	I
AU30	CSI3RNDAT[18]	Differential	I
AU31	CSI3RPDAT[19]	Differential	I
AU32	VSS	Power/Other	
AU33	CSI1RNDAT[0]	Differential	I
AU34	CSI1RPDAT[2]	Differential	I
AU35	CSI1RPDAT[4]	Differential	I
AU36	RSVD		
AU37	RSVD		
AU38	VSS	Power/Other	
AV1	RSVD		
AV2	RSVD		
AV3	VSS	Power/Other	
AV4	RSVD		

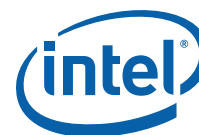


**Table 3-2. Pin List by Pin Number (Sheet 17 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
AV5	VSS	Power/Other	
AV6	VCC33_SM	Power/Other	
AV7	VCC33_SM	Power/Other	
AV8	FBD0NBIAN[2]	Differential	I
AV9	FBD0NBIAP[2]	Differential	I
AV10	VSS	Power/Other	
AV11	FBD0NBIAN[14]	Differential	I
AV12	FBD0NBIAP[14]	Differential	I
AV13	VSS	Power/Other	
AV14	CSI5RPDAT[6]	Differential	I
AV15	VSS	Power/Other	
AV16	CSI3RPDAT[6]	Differential	I
AV17	CSI3RNDAT[6]	Differential	I
AV18	VSS	Power/Other	
AV19	CSI3RNDAT[8]	Differential	I
AV20	VSS	Power/Other	
AV21	VCCA	Power/Other	
AV22	VCCA	Power/Other	
AV23	CSI3RPDAT[12]	Differential	I
AV24	CSI3RNDAT[12]	Differential	I
AV25	VSS	Power/Other	
AV26	VCCA	Power/Other	
AV27	VCCA	Power/Other	
AV28	CSI3RPDAT[17]	Differential	I
AV29	CSI3RNDAT[17]	Differential	I
AV30	VSS	Power/Other	
AV31	CSI3RNDAT[19]	Differential	I
AV32	CSI1RPDAT[1]	Differential	I
AV33	CSI1RNDAT[1]	Differential	I
AV34	CSI1RNDAT[2]	Differential	I
AV35	RSVD		
AV36	VSS	Power/Other	
AV37	RSVD		
AV38	RSVD		
B1	VSS	Power/Other	
B2	RSVD		
B3	RSVD		
B4	FBD1SBODN[9]	Differential	O

**Table 3-2. Pin List by Pin Number (Sheet 18 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
B5	FBD1SBODP[9]	Differential	O
B6	FBD1SBODN[6]	Differential	O
B7	VSS	Power/Other	
B8	FBD1SBOCP[9]	Differential	O
B9	FBD1SBOCN[9]	Differential	O
B10	FBD1SBOCN[5]	Differential	O
B11	FBD1SBOCP[6]	Differential	O
B12	VSS	Power/Other	
B13	FBD1SBOCN[10]	Differential	O
B14	VSS	Power/Other	
B15	CSI4RNDAT[0]	Differential	I
B16	CSI4RPDAT[2]	Differential	I
B17	VSS	Power/Other	
B18	CSI4RNDAT[4]	Differential	I
B19	CSI4RPDAT[4]	Differential	I
B20	CSI2RNDAT[8]	Differential	I
B21	CSI2RPDAT[7]	Differential	I
B22	VSS	Power/Other	
B23	CSI2RNDAT[10]	Differential	I
B24	CSI2RPDAT[11]	Differential	I
B25	CSI2RNDAT[11]	Differential	I
B26	CSI2RPDAT[12]	Differential	I
B27	VSS	Power/Other	
B28	CSI2RNDAT[16]	Differential	I
B29	CSI2RPDAT[16]	Differential	I
B30	CSI2RNDAT[17]	Differential	I
B31	CSI2RPDAT[18]	Differential	I
B32	VSS	Power/Other	
B33	CSI0RNDAT[0]	Differential	I
B34	CSI0RNDAT[2]	Differential	I
B35	CSI0RPDAT[2]	Differential	I
B36	RSVD		
B37	RSVD		
B38	RSVD		
C1	RSVD		
C2	RSVD		
C3	CPU_PRES1_N		I/O
C4	FBD1SBODN[5]	Differential	O


**Table 3-2. Pin List by Pin Number (Sheet 19 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
C5	VSS	Power/Other	
C6	FBD1SBODP[6]	Differential	O
C7	FBD1SBOCP[4]	Differential	O
C8	FBD1SBOCN[4]	Differential	O
C9	FBD1SBOCN[3]	Differential	O
C10	VSS	Power/Other	
C11	FBD1SBOCN[6]	Differential	O
C12	FBD1SBOCP[8]	Differential	O
C13	FBD1SBOCN[8]	Differential	O
C14	VCCIO	Power/Other	
C15	VSS	Power/Other	
C16	CSI4RNDAT[2]	Differential	I
C17	CSI4RNDAT[5]	Differential	I
C18	CSI4RPDAT[5]	Differential	I
C19	CSI4RPDAT[6]	Differential	I
C20	VSS	Power/Other	
C21	CSI2RNDAT[7]	Differential	I
C22	CSI2RNDAT[9]	Differential	I
C23	CSI2RPDAT[9]	Differential	I
C24	VCCIO	Power/Other	
C25	VSS	Power/Other	
C26	CSI2RNDAT[12]	Differential	I
C27	CSI2RNDAT[15]	Differential	I
C28	CSI2RPDAT[15]	Differential	I
C29	VCCIO	Power/Other	
C30	VSS	Power/Other	
C31	CSI2RNDAT[18]	Differential	I
C32	CSI2RPDAT[19]	Differential	I
C33	CSI2RNDAT[19]	Differential	I
C34	CSI0RPDAT[1]	Differential	I
C35	VSS	Power/Other	
C36	CSI0RNDAT[4]	Differential	I
C37	RSVD		
C38	VSS	Power/Other	
D1	RSVD		
D2	FBD1SBODN[4]	Differential	O
D3	VSS	Power/Other	
D4	FBD1SBODP[5]	Differential	O

**Table 3-2. Pin List by Pin Number (Sheet 20 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
D5	FBD1SBODN[7]	Differential	O
D6	FBD1SBODP[7]	Differential	O
D7	FBD1SBOCP[2]	Differential	O
D8	VSS	Power/Other	
D9	FBD1SBOCP[3]	Differential	O
D10	VSS	Power/Other	
D11	FBD1SBOCP[0]	Differential	O
D12	FBD1SBOCN[0]	Differential	O
D13	VSS	Power/Other	
D14	VSS	Power/Other	
D15	CSI4RNDAT[1]	Differential	I
D16	CSI4RPDAT[1]	Differential	I
D17	CSI4RPDAT[7]	Differential	I
D18	VSS	Power/Other	
D19	CSI4RNDAT[6]	Differential	I
D20	CSI2RPDAT[5]	Differential	I
D21	CSI2RNDAT[6]	Differential	I
D22	CSI2RPDAT[6]	Differential	I
D23	VSS	Power/Other	
D24	CSI2TNDAT[3]	Differential	O
D25	VSS	Power/Other	
D26	CSI2RNDAT[14]	Differential	I
D27	CSI2RPDAT[14]	Differential	I
D28	VSS	Power/Other	
D29	CSI2TPDAT[6]	Differential	O
D30	VSS	Power/Other	
D31	VSS	Power/Other	
D32	VCCIO	Power/Other	
D33	VSS	Power/Other	
D34	CSI0RNDAT[1]	Differential	I
D35	CSI0RNDAT[3]	Differential	I
D36	CSI0RPDAT[4]	Differential	I
D37	CPU_PRES2_N		I/O
D38	RSVD		
E1	VSS	Power/Other	
E2	FBD1SBODP[4]	Differential	O
E3	FBD1SBOCLKDP0	Differential	O
E4	FBD1SBOCLKDN0	Differential	O

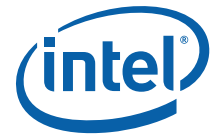


**Table 3-2. Pin List by Pin Number (Sheet 21 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
E5	VCCIO_FBD	Power/Other	
E6	VSS	Power/Other	
E7	FBD1SBOCN[2]	Differential	O
E8	FBD1SBOCN[1]	Differential	O
E10	VCCIO_FBD	Power/Other	
E11	VSS	Power/Other	
E12	VCCIO_FBD	Power/Other	
E13	VSS	Power/Other	
E14	VCCIO	Power/Other	
E15	VSS	Power/Other	
E16	VSS	Power/Other	
E17	CSI4RNDAT[7]	Differential	I
E18	CSI4RNDAT[8]	Differential	I
E19	CSI4RPDAT[8]	Differential	I
E20	CSI2RNDAT[5]	Differential	I
E21	VSS	Power/Other	
E22	CSI2RPDAT[4]	Differential	I
E23	CSI2RNDAT[4]	Differential	I
E24	CSI2TPDAT[3]	Differential	O
E25	CSI2TPDAT[2]	Differential	O
E26	VSS	Power/Other	
E27	VCCIO	Power/Other	
E28	VSS	Power/Other	
E29	CSI2TNDAT[6]	Differential	O
E30	CSI0TPDAT[3]	Differential	O
E31	VSS	Power/Other	
E32	CSI0TNDAT[6]	Differential	O
E33	CSI0TPDAT[6]	Differential	O
E34	VCCIO	Power/Other	
E35	CSI0RPDAT[3]	Differential	I
E36	VSS	Power/Other	
E37	CSI0RNDAT[5]	Differential	I
E38	CSI0RPDAT[5]	Differential	I
E9	FBD1SBOCP[1]	Differential	O
F1	RSVD		
F2	FBD1SBODN[3]	Differential	O
F3	FBD1SBODP[3]	Differential	O
F4	VSS	Power/Other	

**Table 3-2. Pin List by Pin Number (Sheet 22 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
F5	VSS	Power/Other	
F6	FBD1SBODP[8]	Differential	O
F7	FBD1SBODN[8]	Differential	O
F8	VCCIO_FBD	Power/Other	
F9	VSS	Power/Other	
F10	FBD1NBICP[11]	Differential	I
F11	FBD1NBICN[11]	Differential	I
F12	VSS	Power/Other	
F13	VSS	Power/Other	
F14	VSS	Power/Other	
F15	VSS	Power/Other	
F16	VCCIO	Power/Other	
F17	CSI4RNDAT[9]	Differential	I
F18	CSI4RPDAT[9]	Differential	I
F19	VSS	Power/Other	
F20	CSI2RPDAT[3]	Differential	I
F21	CSI2RNDAT[3]	Differential	I
F22	VSS	Power/Other	
F23	VCCIO	Power/Other	
F24	VSS	Power/Other	
F25	CSI2TNDAT[2]	Differential	O
F26	CSI2TNDAT[5]	Differential	O
F27	CSI2TPDAT[5]	Differential	O
F28	CSI2TNDAT[8]	Differential	O
F29	VSS	Power/Other	
F30	CSI0TNDAT[3]	Differential	O
F31	CSI0TNDAT[5]	Differential	O
F32	CSI0TPDAT[5]	Differential	O
F33	CSI0TNDAT[7]	Differential	O
F34	VSS	Power/Other	
F35	VCCIO	Power/Other	
F36	CSI0RNDAT[6]	Differential	I
F37	CSI0RPDAT[6]	Differential	I
F38	RSVD		
G1	RSVD		
G2	VSS	Power/Other	
G3	FBD1SBODN[1]	Differential	O
G4	FBD1SBODN[2]	Differential	O


**Table 3-2. Pin List by Pin Number (Sheet 23 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
G5	FBD1SBODP[2]	Differential	O
G6	FBD1SBODN[10]	Differential	O
G7	VSS	Power/Other	
G8	FBD1NBICN[9]	Differential	I
G9	BOOTMODE[1]		I
G10	BOOTMODE[0]		I
G11	FBD1NBICN[8]	Differential	I
G12	VSS	Power/Other	
G13	VCCIO	Power/Other	
G14	VSS	Power/Other	
G15	CSI4TNDAT[4]	Differential	O
G16	CSI4TPDAT[4]	Differential	O
G17	VSS	Power/Other	
G18	CSI4RPCLK	Differential	I
G19	CSI2RPDAT[2]	Differential	I
G20	CSI2RNDAT[2]	Differential	I
G21	CSI2RPDAT[1]	Differential	I
G22	VSS	Power/Other	
G23	CSI2TPDAT[0]	Differential	O
G24	CSI2TNDAT[1]	Differential	O
G25	CSI2TPDAT[1]	Differential	O
G26	CSI2TPDAT[4]	Differential	O
G27	VSS	Power/Other	
G28	CSI2TPDAT[8]	Differential	O
G29	VCCIO	Power/Other	
G30	CSI0TPDAT[2]	Differential	O
G31	CSI0TNDAT[2]	Differential	O
G32	VSS	Power/Other	
G33	CSI0TPDAT[7]	Differential	O
G34	VCCIO	Power/Other	
G35	CSI0RNDAT[7]	Differential	I
G36	CSI0RPDAT[7]	Differential	I
G37	VSS	Power/Other	
G38	RSVD		
H1	FBD1SBODN[0]	Differential	O
H2	FBD1SBODP[0]	Differential	O
H3	FBD1SBODP[1]	Differential	O
H4	VSS	Power/Other	

**Table 3-2. Pin List by Pin Number (Sheet 24 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
H5	VSS	Power/Other	
H6	FBD1SBODP[10]	Differential	O
H7	VCCIO_FBD	Power/Other	
H8	FBD1NBICP[9]	Differential	I
H9	FBD1NBICN[10]	Differential	I
H10	VSS	Power/Other	
H11	FBD1NBICP[8]	Differential	I
H12	ERROR[0]_N		O
H13	RSVD		
H14	CSI4TPDAT[3]	Differential	O
H15	VSS	Power/Other	
H16	CSI4TPDAT[5]	Differential	O
H17	VCCIO	Power/Other	
H18	CSI4RNCLK	Differential	I
H19	VCCIO	Power/Other	
H20	VSS	Power/Other	
H21	CSI2RNDAT[1]	Differential	I
H22	VCCIO	Power/Other	
H23	CSI2TNDAT[0]	Differential	O
H24	VCCIO	Power/Other	
H25	VSS	Power/Other	
H26	CSI2TNDAT[4]	Differential	O
H27	CSI2TNDAT[9]	Differential	O
H28	CSI2TPDAT[9]	Differential	O
H29	CSI2TNCLK	Differential	O
H30	VSS	Power/Other	
H31	CSI0TPDAT[1]	Differential	O
H32	VCCIO	Power/Other	
H33	CSI0TNDAT[8]	Differential	O
H34	CSI0TPDAT[8]	Differential	O
H35	VSS	Power/Other	
H36	CSI0RNDAT[8]	Differential	I
H37	CSI0RPDAT[8]	Differential	I
H38	VR_THERMTRIP_N		O
J1	VCCIO_FBD	Power/Other	
J2	FBD0SBOAN[10]	Differential	O
J3	VSS	Power/Other	
J4	VCCIO_FBD	Power/Other	



**Table 3-2. Pin List by Pin Number (Sheet 25 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
J5	VSS	Power/Other	
J6	VSS	Power/Other	
J7	FBD1NBIDN[11]	Differential	I
J8	VSS	Power/Other	
J9	FBD1NBICP[10]	Differential	I
J10	FBD1NBICP[7]	Differential	I
J11	FBD1NBICN[7]	Differential	I
J12	ERROR[1]_N		O
J13	VSS	Power/Other	
J14	CSI4TNDAT[3]	Differential	O
J15	CSI4TPDAT[2]	Differential	O
J16	CSI4TNDAT[5]	Differential	O
J17	CSI4TPDAT[6]	Differential	O
J18	VSS	Power/Other	
J19	CSI4TPDAT[8]	Differential	O
J20	RSVD		
J21	CSI2RPDAT[0]	Differential	I
J22	CSI2RNDAT[0]	Differential	I
J23	VSS	Power/Other	
J24	VSS	Power/Other	
J25	VSS	Power/Other	
J26	CSI2TNDAT[7]	Differential	O
J27	CSI2TPDAT[7]	Differential	O
J28	VSS	Power/Other	
J29	CSI2TPCLK	Differential	O
J30	CSI0TPDAT[0]	Differential	O
J31	CSI0TNDAT[1]	Differential	O
J32	CSI0TPDAT[4]	Differential	O
J33	VSS	Power/Other	
J34	VCCIO	Power/Other	
J35	CSI0RNDAT[9]	Differential	I
J36	CSI0RPDAT[9]	Differential	I
J37	CSI0RNCLK	Differential	I
J38	VSS	Power/Other	
K1	VSS	Power/Other	
K2	FBD0SBOAP[10]	Differential	O
K3	VSS	Power/Other	
K4	FBD1NBIDN[9]	Differential	I

**Table 3-2. Pin List by Pin Number (Sheet 26 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
K5	FBD1NBIDP[9]	Differential	I
K6	VSS	Power/Other	
K7	FBD1NBIDP[11]	Differential	I
K8	FBD1NBICP[6]	Differential	I
K9	FBD1NBICN[6]	Differential	I
K10	FORCEPR_N		I
K11	VSS	Power/Other	
K12	MEM_THROTTLE_L		I
K13	CSI4TNDAT[1]	Differential	O
K14	CSI4TPDAT[1]	Differential	O
K15	CSI4TNDAT[2]	Differential	O
K16	VSS	Power/Other	
K17	CSI4TNDAT[6]	Differential	O
K18	CSI4TPDAT[7]	Differential	O
K19	CSI4TNDAT[8]	Differential	O
K20	CSI4TPDAT[9]	Differential	O
K21	VSS	Power/Other	
K22	VSS	Power/Other	
K23	VSS	Power/Other	
K24	VCCIO	Power/Other	
K25	VSS	Power/Other	
K26	VSS	Power/Other	
K27	VCCIO	Power/Other	
K28	CSI2TNDAT[10]	Differential	O
K29	CSI2TPDAT[10]	Differential	O
K30	CSI0TNDAT[0]	Differential	O
K31	VSS	Power/Other	
K32	CSI0TNDAT[4]	Differential	O
K33	CSI0TNCLK	Differential	O
K34	CSI0TPCLK	Differential	O
K35	VCCIO	Power/Other	
K36	VSS	Power/Other	
K37	CSI0RPCLK	Differential	I
K38	VR_THERMALERT_N		O
L1	FBD0SBOAN[8]	Differential	O
L2	FBD0SBOAP[8]	Differential	O
L3	FBD0SBOAN[7]	Differential	O
L4	VSS	Power/Other	



**Table 3-2. Pin List by Pin Number (Sheet 27 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
L5	FBD1NBIDP[7]	Differential	I
L6	FBD1NBIDP[10]	Differential	I
L7	FBD1NBIDN[10]	Differential	I
L8	FBD1NBICLKCN0	Differential	I
L9	VSS	Power/Other	
L10	PROCHOT_N		O
L11	FBD1NBICP[12]	Differential	I
L12	FBD1NBICN[12]	Differential	I
L13	RSVD		
L14	VSS	Power/Other	
L15	VCCIO	Power/Other	
L16	VSS	Power/Other	
L17	VSS	Power/Other	
L18	CSI4TNDAT[7]	Differential	O
L19	VSS	Power/Other	
L20	CSI4TNDAT[9]	Differential	O
L21	CSI4TNCLK	Differential	O
L22	CSI4TPCLK	Differential	O
L23	VSS	Power/Other	
L24	VSS	Power/Other	
L25	VSS	Power/Other	
L26	VSS	Power/Other	
L27	FLASHROM_WP_N		I
L28	FLASHROM_CFG[2]		I
L29	VSS	Power/Other	
L30	FLASHROM_CS[0]_N		O
L31	CSI0TNDAT[9]	Differential	O
L32	CSI0TPDAT[9]	Differential	O
L33	CSI0TNDAT[10]	Differential	O
L34	VSS	Power/Other	
L35	VSS	Power/Other	
L36	CSI0RNDAT[10]	Differential	I
L37	CSI0RPDAT[10]	Differential	I
L38	CSI0RNDAT[11]	Differential	I
M1	FBD0SBOAN[6]	Differential	O
M2	VSS	Power/Other	
M3	FBD0SBOAP[7]	Differential	O
M4	RSVD		

**Table 3-2. Pin List by Pin Number (Sheet 28 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
M5	FBD1NBIDN[7]	Differential	I
M6	FBD1NBIDN[6]	Differential	I
M7	VSS	Power/Other	
M8	FBD1NBICLKCP0	Differential	I
M9	FBD1NBICN[13]	Differential	I
M10	FBD1NBICP[13]	Differential	I
M11	LRGSCLSYS		I
M12	VSS	Power/Other	
M13	RSVD		
M14	CSI4TNDAT[0]	Differential	O
M15	CSI4TPDAT[0]	Differential	O
M16	VSS	Power/Other	
M17	VSS	Power/Other	
M18	VCCIO	Power/Other	
M19	VSS	Power/Other	
M20	RSVD		
M21	RSVD		
M22	VSS	Power/Other	
M23	VCCIO	Power/Other	
M24	VSS	Power/Other	
M25	VSS	Power/Other	
M26	VCCIO	Power/Other	
M27	VSS	Power/Other	
M28	FLASHROM_CFG[1]		I
M29	CSI2TNDAT[11]	Differential	O
M30	CSI2TPDAT[11]	Differential	O
M31	CSI2TNDAT[13]	Differential	O
M32	VSS	Power/Other	
M33	CSI0TPDAT[10]	Differential	O
M34	CSI0TNDAT[11]	Differential	O
M35	CSI0TPDAT[11]	Differential	O
M36	RSVD		
M37	VSS	Power/Other	
M38	CSI0RPDAT[11]	Differential	I
N1	FBD0SBOAP[6]	Differential	O
N2	FBD0SBOAP[5]	Differential	O
N3	FBD0SBOAN[5]	Differential	O
N4	VCCIO_FBD	Power/Other	

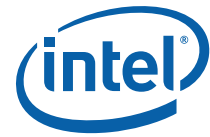


**Table 3-2. Pin List by Pin Number (Sheet 29 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
N5	VSS	Power/Other	
N6	FBD1NBIDP[6]	Differential	I
N7	FBD1NBIDP[8]	Differential	I
N8	FBD1NBIDN[8]	Differential	I
N9	FBD1NBICP[5]	Differential	I
N10	VSS	Power/Other	
N11	TRST_N		I
N12	TDO		O
N27	FLASHROM_CLK		O
N28	FLASHROM_CFG[0]		I
N29	FLASHROM_CS[3]_N		O
N30	VSS	Power/Other	
N31	CSI2TPDAT[13]	Differential	O
N32	CSI0TNDAT[12]	Differential	O
N33	CSI0TPDAT[12]	Differential	O
N34	CSI0TNDAT[13]	Differential	O
N35	VSS	Power/Other	
N36	VCCIO	Power/Other	
N37	CSI0RNDAT[12]	Differential	I
N38	CSI0RPDAT[12]	Differential	I
P1	FBD0SBOAN[9]	Differential	O
P2	FBD0SBOAP[9]	Differential	O
P3	VSS	Power/Other	
P4	VSS	Power/Other	
P5	FBD1NBIDN[12]	Differential	I
P6	FBD1NBIDP[12]	Differential	I
P7	FBD1NBICLKDP0	Differential	I
P8	VSS	Power/Other	
P9	FBD1NBICN[5]	Differential	I
P10	RSVD		
P11	TCK		I
P12	TDI		I
P27	RSVD		
P28	VSS	Power/Other	
P29	FLASHROM_CS[1]_N		O
P30	CSI2TNDAT[12]	Differential	O
P31	CSI2TPDAT[12]	Differential	O
P32	CSI2TNDAT[15]	Differential	O

**Table 3-2. Pin List by Pin Number (Sheet 30 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
P33	VSS	Power/Other	
P34	CSI0TPDAT[13]	Differential	O
P35	VSS	Power/Other	
P36	CSI0RNDAT[13]	Differential	I
P37	CSI0RPDAT[13]	Differential	I
P38	VSS	Power/Other	
R1	VSS	Power/Other	
R2	FBD0SBOCLKAN0	Differential	O
R3	FBD0SBOCLKAP0	Differential	O
R4	VSS	Power/Other	
R5	FBD1NBIDN[13]	Differential	I
R6	VSS	Power/Other	
R7	FBD1NBICLKDN0	Differential	I
R8	FBD1NBICP[4]	Differential	I
R9	FBD1NBICN[4]	Differential	I
R10	RSVD		
R11	VSS	Power/Other	
R12	TMS		I
R27	RSVD		
R28	FLASHROM_DATO		O
R29	FLASHROM_CS[2]_N		O
R30	CSI2TNDAT[14]	Differential	O
R31	VSS	Power/Other	
R32	CSI2TPDAT[15]	Differential	O
R33	CSI0TNDAT[15]	Differential	O
R34	CSI0TNDAT[14]	Differential	O
R35	CSI0TPDAT[14]	Differential	O
R36	VSS	Power/Other	
R37	CSI0RNDAT[14]	Differential	I
R38	CSI0RPDAT[14]	Differential	I
T1	FBD0SBOAN[4]	Differential	O
T2	FBD0SBOAP[4]	Differential	O
T3	VCCIO_FBD	Power/Other	
T4	VSS	Power/Other	
T5	FBD1NBIDP[13]	Differential	I
T6	FBD1NBIDP[5]	Differential	I
T7	FBD1NBIDN[5]	Differential	I
T8	FBD1NBICN[2]	Differential	I


**Table 3-2. Pin List by Pin Number (Sheet 31 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
T9	VSS	Power/Other	
T10	VCCIO_FBD	Power/Other	
T11	RSVD		
T12	VFUSERM		I
T27	VCCIO	Power/Other	
T28	FLASHROM_DATI		I
T29	VSS	Power/Other	
T30	CSI2TPDAT[14]	Differential	O
T31	CSI2TNDAT[16]	Differential	O
T32	CSI2TPDAT[16]	Differential	O
T33	CSI0TPDAT[15]	Differential	O
T34	VSS	Power/Other	
T35	VCCIO	Power/Other	
T36	CSI0RNDAT[15]	Differential	I
T37	CSI0RPDAT[15]	Differential	I
T38	CSI0RNDAT[16]	Differential	I
U1	FBD0SBOAN[3]	Differential	O
U2	VSS	Power/Other	
U3	VSS	Power/Other	
U4	RSVD		
U5	FBD1NBIDN[4]	Differential	I
U6	FBD1NBIDP[4]	Differential	I
U7	VSS	Power/Other	
U8	FBD1NBICP[2]	Differential	I
U9	FBD1NBICP[3]	Differential	I
U10	FBD1NBICN[3]	Differential	I
U11	SYSUTST_REFCLK_N	Differential	I
U12	VSS	Power/Other	
U27	VSS	Power/Other	
U28	VCCIO	Power/Other	
U29	CSI2TNDAT[17]	Differential	O
U30	CSI2TPDAT[17]	Differential	O
U31	CSI2TNDAT[18]	Differential	O
U32	VSS	Power/Other	
U33	CSI0TNDAT[16]	Differential	O
U34	CSI0TPDAT[16]	Differential	O
U35	VSS	Power/Other	
U36	CSI0RNDAT[17]	Differential	I

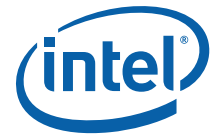
**Table 3-2. Pin List by Pin Number (Sheet 32 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
U37	VSS	Power/Other	
U38	CSI0RPDAT[16]	Differential	I
V1	FBD0SBOAP[3]	Differential	O
V2	FBD0SBOAN[2]	Differential	O
V3	FBD0SBOAP[2]	Differential	O
V4	FBD0SBOAN[0]	Differential	O
V5	VSS	Power/Other	
V6	FBD1NBIDP[3]	Differential	I
V7	FBD1NBICN[1]	Differential	I
V8	FBD1NBICP[1]	Differential	I
V9	FBD1NBICN[0]	Differential	I
V10	VSS	Power/Other	
V11	SYSUTST_REFCLK	Differential	I
V12	RESET_N	Power/Other	I
V27	RSVD		
V28	TESTHI[4]		I
V29	RSVD		
V30	VSS	Power/Other	
V31	CSI2TPDAT[18]	Differential	O
V32	CSI0TNDAT[17]	Differential	O
V33	CSI0TPDAT[17]	Differential	O
V34	CSI0TNDAT[18]	Differential	O
V35	VSS	Power/Other	
V36	CSI0RPDAT[17]	Differential	I
V37	CSI0RPDAT[18]	Differential	I
V38	CSI0RNDAT[18]	Differential	I
W1	FBD0SBOAN[1]	Differential	O
W2	FBD0SBOAP[1]	Differential	O
W3	VSS	Power/Other	
W4	FBD0SBOAP[0]	Differential	O
W5	VCCIO_FBD	Power/Other	
W6	FBD1NBIDN[3]	Differential	I
W7	FBD1NBIDN[2]	Differential	I
W8	VSS	Power/Other	
W9	FBD1NBICP[0]	Differential	I
W10	RSVD		
W11	VSS	Power/Other	
W12	RSVD		



**Table 3-2. Pin List by Pin Number (Sheet 33 of 33)**

Pin Number	Pin Name	Signal Buffer Type	Direction
W27	RSVD		
W28	VSS	Power/Other	
W29	TESTHI[2]		I
W30	CSI2TNDAT[19]	Differential	O
W31	CSI2TPDAT[19]	Differential	O
W32	CSI0TNDAT[19]	Differential	O
W33	VSS	Power/Other	
W34	CSI0TPDAT[18]	Differential	O
W35	VCCIO	Power/Other	
W36	CSI0RPDAT[19]	Differential	I
W37	CSI0RNDAT[19]	Differential	I
W38	VSS	Power/Other	
Y1	VSS	Power/Other	
Y2	VCCIO_FBD	Power/Other	
Y3	FBD0SBOBN[10]	Differential	O
Y4	FBD0SBOBP[10]	Differential	O
Y5	VSS	Power/Other	
Y6	VSS	Power/Other	
Y7	FBD1NBIDP[2]	Differential	I
Y8	FBD1NBICN[14]	Differential	I
Y9	FBD1NBICP[14]	Differential	I
Y10	RSVD		
Y11	VSS	Power/Other	
Y12	SYSCLK	Differential	I
Y27	VCCIO	Power/Other	
Y28	TESTHI[1]		I
Y29	VSS	Power/Other	
Y30	VCCIO	Power/Other	
Y31	VSS	Power/Other	
Y32	CSI0TPDAT[19]	Differential	O
Y33	VCCIO	Power/Other	
Y34	CSI1TNDAT[19]	Differential	O
Y35	CSI1TPDAT[19]	Differential	O
Y36	VSS	Power/Other	
Y37	CSI1RPDAT[19]	Differential	I
Y38	CSI1RNDAT[19]	Differential	I



## 3.2 Processor Package Top Pin Assignments

This section provides two-dimensional tables of the package top pin assignments. These pins connect to the Ararat Voltage Regulator Power Module and do not connect to the motherboard.

### 3.2.1 Top-Side J1 Connector Two-Dimensional Table

Table 3-3 is a two-dimensional table of the processor package top-side J1 connectors.

**Table 3-3. Top-Side J1 Connector Two-Dimensional Table (Sheet 1 of 2)**

	1	2	3	4	
A	VID_VCCCORE[1]	NO CONNECT	VID_VCCCORE[2]	NO CONNECT	A
B	VID_VCCCORE[3]		VID_VCCCORE[4]		B
C	VID_VCCCORE[5]		VID_VCCCORE[6]		C
D	VCCCORE				D
E	VCCCORE				E
F	VSS				F
G	VSS				G
H	VCCCORE				H
J	VCCCORE				J
K	VSS				K
L	VSS				L
M	VCCCORE				M
N	VCCCORE				N
P	VSS				P
R	VSS				R
T	VCCCACHE				T
U	VCCCACHE				U
V	VSS				V
W	VSS				W
Y	VCCCACHE				Y
AA	VCCCACHE				AA
AB	VCCCACHE				AB
AC	VSS				AC
AD	VSS				AD
AE	VCCCACHE				AE
	1	2	3	4	



**Table 3-3. Top-Side J1 Connector Two-Dimensional Table (Sheet 2 of 2)**

	1	2	3	4	
AF	VCCCACHE				AF
AG	VSS				AG
AH	VSS				AH
AJ	VCCCORE				AJ
AK	VCCCORE				AK
AL	VSS				AL
AM	VSS				AM
AN	VCCCORE				AN
AP	VCCCORE				AP
AR	VSS				AR
AT	VSS				AT
AU	Reserved	NO CONNECT	Reserved	NO CONNECT	AU
AV	VSSCACHESENSE		VCCCACHESENSE		AV
AW	VROUTPUT_ENABLE0		CPU_PRESA_N		AW
AY	VR_PROCTYPE_0		VR_PROCTYPE_1		AY
	1	2	3	4	

### 3.2.2 Top-Side J2 Connector Two-Dimensional Table

Table 3-4 is a two-dimensional table of the processor package top-side J2 connectors.

**Table 3-4. Top-Side J2 Connector Two-Dimensional Table (Sheet 1 of 2)**

	1	2	3	4	
A	VID_VCCUNCORE[1]	NO CONNECT	VID_VCCUNCORE[3]	NO CONNECT	A
B	VID_VCCUNCORE[2]		VID_VCCUNCORE[5]		B
C	VID_VCCUNCORE[4]		VID_VCCUNCORE[6]		C
D	VCCCORE				D
E	VCCCORE				E
F	VSS				F
G	VSS				G
H	VCCCORE				H
J	VCCCORE				J
K	VSS				K
	1	2	3	4	



Table 3-4. Top-Side J2 Connector Two-Dimensional Table (Sheet 2 of 2)

	1	2	3	4	
L	VSS				L
M	VCCCORE				M
N	VCCCORE				N
P	VSS				P
R	VSS				R
T	VCCUNCORE				T
U	VCCUNCORE				U
V	VSS				V
W	VSS				W
Y	VCCUNCORE				Y
AA	VCCUNCORE				AA
AB	VCCUNCORE				AB
AC	VSS				AC
AD	VSS				AD
AE	VCCUNCORE				AE
AF	VCCUNCORE				AF
AG	VSS				AG
AH	VSS				AH
AJ	VCCCORE				AJ
AK	VCCCORE				AK
AL	VSS				AL
AM	VSS				AM
AN	VCCCORE				AN
AP	VCCCORE				AP
AR	VSS				AR
AT	VSS				AT
AU	Reserved	NO CONNECT	Reserved	NO CONNECT	AU
AV	VCCCORESENSE		VR_THERMTRIP_N		AV
AW	VSSCORESENSE		VR_THERMALERT_N		AW
AY	VID_VCCCORE[0]		CPU_PRESB_N		AY
	1	2	3	4	

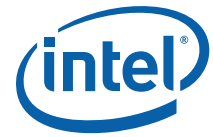


### 3.2.3 Top-Side J3 Connector Two-Dimensional Table

Table 3-5 is a two-dimensional table of the processor package top-side J3 connectors.

Table 3-5. Top-Side J3 Connector Two-Dimensional Table (Sheet 1 of 2)

	1	2	3	4	
A	Reserved	NO CONNECT	Reserved	NO CONNECT	A
B	VR_FAN_N		Reserved		B
C	Reserved		VRPWRGD		C
D	VCCCORE				D
E	VCCCORE				E
F	VSS				F
G	VSS				G
H	VCCCORE				H
J	VCCCORE				J
K	VSS				K
L	VSS				L
M	VCCCORE				M
N	VCCCORE				N
P	VSS				P
R	VSS				R
T	VCCCACHE				T
U	VCCCACHE				U
V	VSS				V
W	VSS				W
Y	VCCCACHE				Y
AA	VCCCACHE				AA
AB	VCCCACHE				AB
AC	VSS				AC
AD	VSS				AD
AE	VCCCACHE				AE
AF	VCCCACHE				AF
AG	VSS				AG
AH	VSS				AH
AJ	VCCCORE				AJ
	1	2	3	4	



**Table 3-5. Top-Side J3 Connector Two-Dimensional Table (Sheet 2 of 2)**

	1	2	3	4	
AK	VCCCORE				AK
AL	VSS				AL
AM	VSSVSS				AM
AN	VCCCORE				AN
AP	VCCCORE				AP
AR	VSS				AR
AT	VSS				AT
AU	Reserved	NO CONNECT	Reserved	NO CONNECT	AU
AV	CPU_PRESB_N		VSSUNCORESENSE		AV
AW	VID_VCCUNCORE[0]		VCCUNCORESENSE		AW
AY	Reserved		Reserved		AY
	1	2	3	4	

### 3.2.4 Top-Side J4 Connector Two-Dimensional Table

Table 3-6 is a two-dimensional table of the processor package top-side J4 connectors.

**Table 3-6. Top-Side J4 Connector Two-Dimensional Table (Sheet 1 of 2)**

	1	2	3	4	
A	VID_VCCCACHE[0]	NO CONNECT	VID_VCCCACHE[1]	NO CONNECT	A
B	VID_VCCCACHE[5]		VID_VCCCACHE[2]		B
C	VID_VCCCACHE[4]		VID_VCCCACHE[3]		C
D	VCCCORE				D
E	VCCCORE				E
F	VSS				F
G	VSS				G
H	VCCCORE				H
J	VCCCORE				J
K	VSS				K
L	VSS				L
M	VCCCORE				M
N	VCCCORE				N
P	VSS				P
	1	2	3	4	



Table 3-6. Top-Side J4 Connector Two-Dimensional Table (Sheet 2 of 2)

	1	2	3	4	
R	VSS				R
T	VCCUNCORE				T
U	VCCUNCORE				U
V	VSS				V
W	VSS				W
Y	VCCUNCORE				Y
AA	VCCUNCORE				AA
AB	VCCUNCORE				AB
AC	VSS				AC
AD	VSS				AD
AE	VCCUNCORE				AE
AF	VCCUNCORE				AF
AG	VSS				AG
AH	VSS				AH
AJ	VCCCORE				AJ
AK	VCCCORE				AK
AL	VSS				AL
AM	VSS				AM
AN	VCCCORE				AN
AP	VCCCORE				AP
AR	VSS				AR
AT	VSS				AT
AU	VCCIO	NO CONNECT	Reserved	NO CONNECT	AU
AV	Reserved		Reserved		AV
AW	Reserved		CPU_PRESA_N		AW
AY	Reserved		Reserved		AY
	1	2	3	4	

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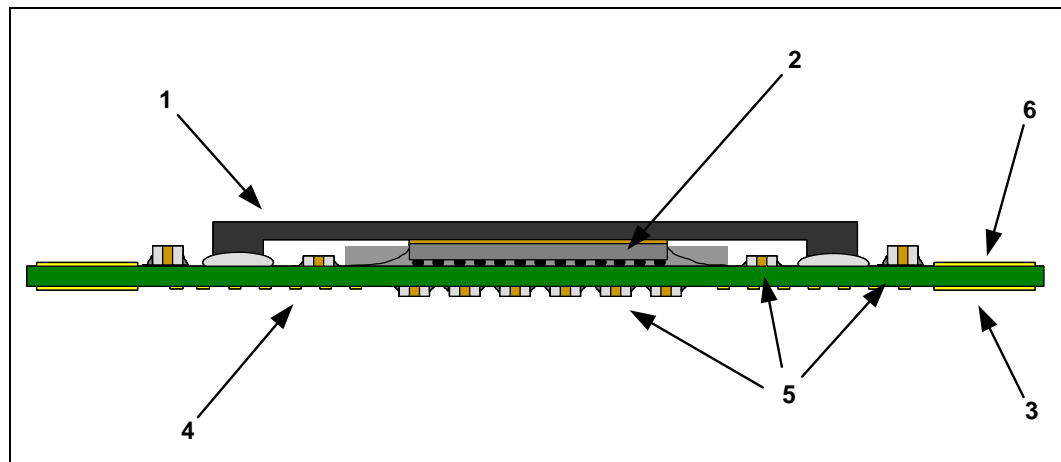
## 4 Mechanical Specifications

The Intel Itanium processor 9300 series is packaged in a FC-LGA package that interfaces with the motherboard via an LGA1248 socket. The package top side consists of lands that interface with a LGA connector for direct power delivery to the core, cache and system interface. The package also consists of an integrated heatsink spreader (IHS), which is attached to the package substrate and die and serves as the mating surface for the processor component thermal solutions, such as a heatsink. The bottom side of the package has 1248 lands, a 38 x 38 mm pad array which interfaces with the LGA1248 socket. [Figure 4-1](#) shows a sketch of the processor package components and how they are assembled together.

The package components shown in [Figure 4-1](#) include the following:

1. Integrated Heat Spreader (IHS).
2. Processor die.
3. Internal test pads for power delivery.
4. LGA lands for I/O.
5. Decoupling and server management components.
6. LGA lands for power delivery.

**Figure 4-1. Processor Package Assembly Sketch**



**Note:** This drawing is not to scale and is for reference only. Processor power delivery and thermal solutions, and the socket are not shown.



## 4.1 Package Mechanical Drawing

The package mechanical drawings are shown in [Figure 4-2](#), [Figure 4-3](#), [Figure 4-4](#) and [Figure 4-5](#). The drawings include dimensions necessary to design a thermal solution for the processor. These dimensions will include:

1. Package reference with tolerances (total height, length, width, and so on).
2. IHS parallelism and tilt.
3. Land dimensions.
4. Top-side and back-side component keepout dimensions.
5. Reference datums.

All drawing dimensions are in mm.

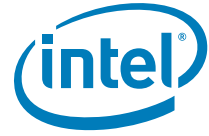


Figure 4-2. Processor Package Drawing (Sheet 1 of 4)

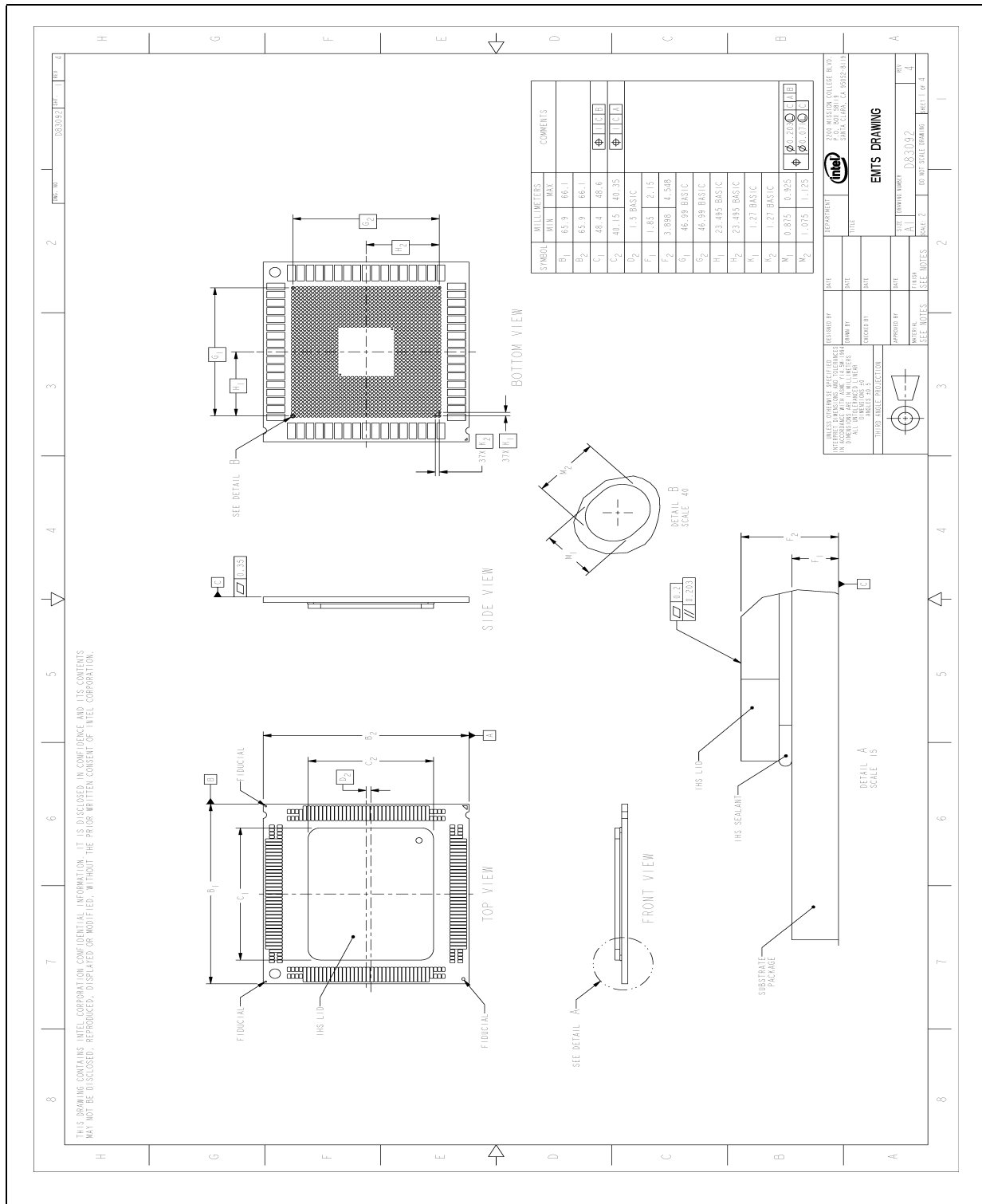
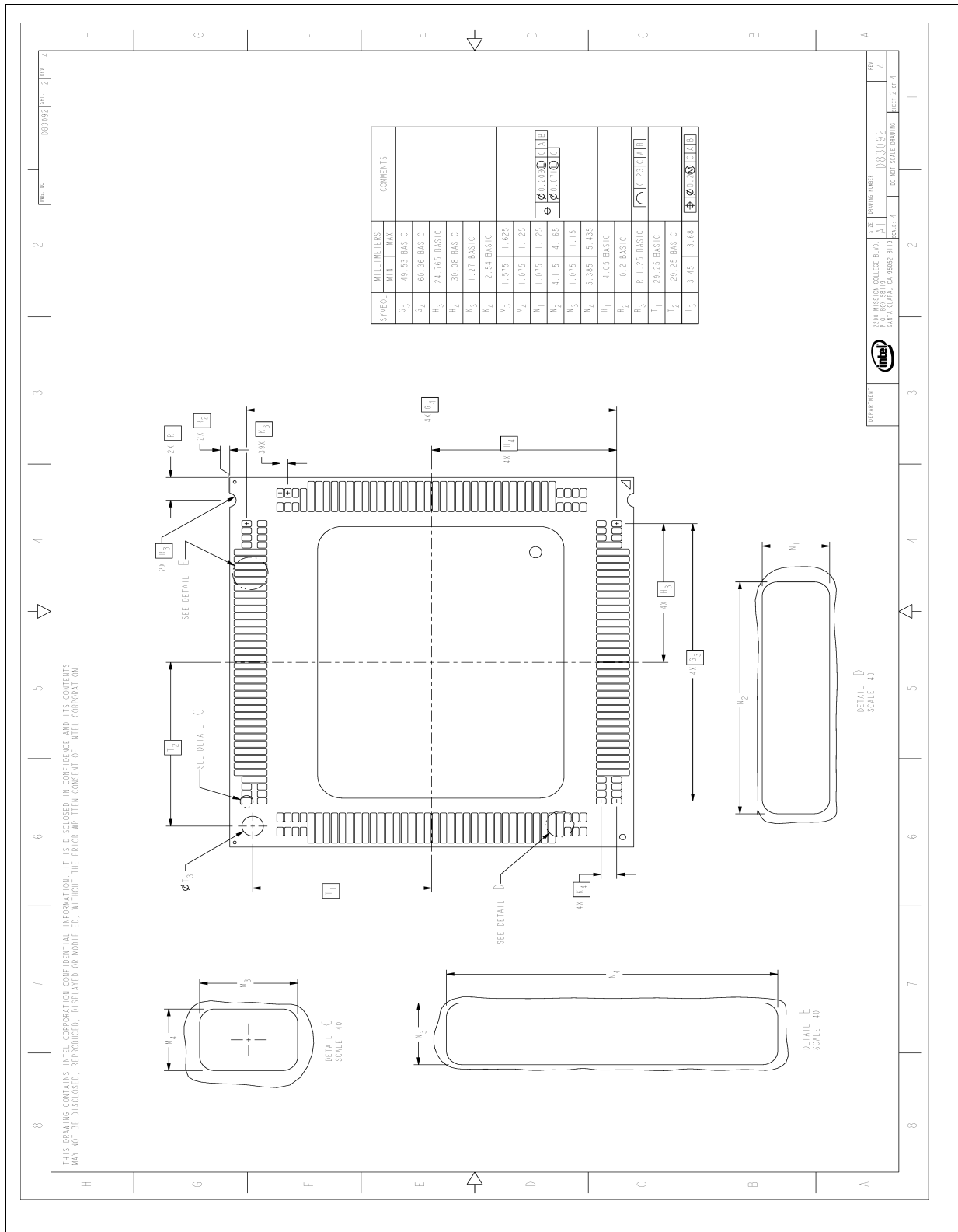


Figure 4-3. Processor Package Drawing (Sheet 2 of 4)





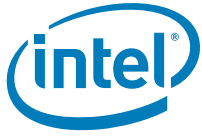
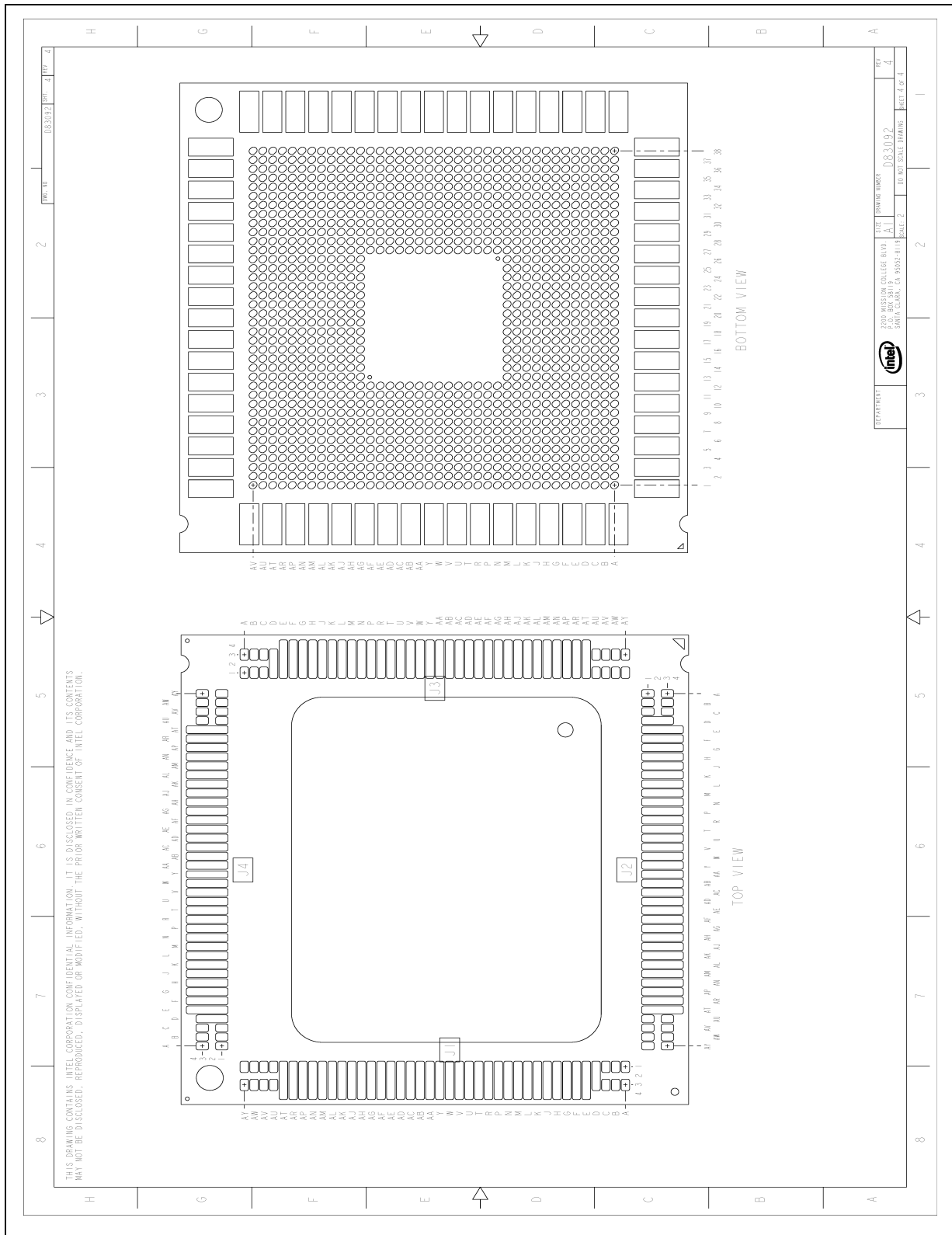


Figure 4-5. Processor Package Drawing (Sheet 4 of 4)





## 4.2 Processor Component Keepout Zones

The processor may contain components on the substrate that define component keepout zone requirements. A thermal and mechanical solution design must not intrude into the required keepout zones. Decoupling capacitors are typically mounted to both the top-side and bottom-side of the package substrate. See [Figure 4-4](#) for keepout zones.

## 4.3 Package Loading Specifications

[Table 4-1](#) provides dynamic and static load specifications for the processor package. These mechanical load limits should not be exceeded during heatsink assembly, shipping conditions, or standard use condition. Also, any mechanical system or component testing should not exceed the maximum limits. The processor package substrate should not be used as a mechanical reference or load-bearing surface for thermal and mechanical solutions.

**Table 4-1. Processor Loading Specifications**

Parameter	Maximum	Unit	Notes
Static Compressive Load	1000	N	1, 2, 3
Dynamic Compressive Load	1793	N	<30ms see 1, 3
Transient	1090	N	< 1s see 1, 3

**Notes:**

1. These specifications apply to uniform compressive loading in a direction perpendicular to the IHS top surface.
2. This is the allowable static force that can be applied by the heatsink and retention solution to maintain the heatsink and processor interface.
3. These parameters are based on limited testing for design characterization. Loading limits are for the package only and do not include the limits of the processor socket.

## 4.4 Package Handling Guidelines

[Table 4-2](#) includes a list of guidelines on package handling in terms of recommended maximum loading on the processor IHS relative to a fixed substrate. These package handling loads may be experienced during heatsink removal.

**Table 4-2. Package Handling Guidelines**

Parameter	Maximum Recommended	Unit	Notes
Shear	356	N	1, 4
Tensile	156	N	2, 4
Torque	8	N-m	3, 4

**Note:**

1. A shear load is defined as a load applied to the IHS in a direction parallel to the IHS top surface.
2. A tensile load is defined as a pulling load applied to the IHS in the direction normal to the IHS surface.
3. A torque load is defined as a twisting load applied to the IHS in an axis of rotation normal to the IHS top surface.
4. These guidelines are based on limited testing for design characterization.

The Intel Itanium processor 9300 series can be inserted into and removed from a LGA1248 socket and engaged and disengaged with the Ararat voltage regulator up to a maximum limit as specified in [Table 4-3](#).



**Table 4-3. Processor Package Insertion Specification**

Package	Durability Limit
1248-Land FCLGA	15

## 4.5 Processor Mass Specifications

The typical mass of the Intel Itanium processor 9300 series processor is 55 g. This mass [weight] includes all the components that are included in the package.

## 4.6 Processor Materials

Table 4-4 lists some of the package components and associated materials.

Lead and other materials banned in Restriction on Hazardous Substances (RoHS) Directive are either (1) below all applicable substrate thresholds as proposed by the EU or (2) an approved/pending exemption applies.

**Note:** RoHS implementation details are not fully defined and may change.

**Table 4-4. Package Materials**

Component	Material
Integrated Heat Spreader (IHS)	Nickel Plating over Copper
Substrate	Fiber-Reinforced Resin
Package Lands	Gold Plating over Nickel

## 4.7 Package Markings

Bottom side marks on the package substrate provide the necessary processor identification and tracking information. This information is captured in Table 4-5 and their locations are illustrated in Figure 4-6.

**Table 4-5. 1248 FCLGA Package Marking Zones**

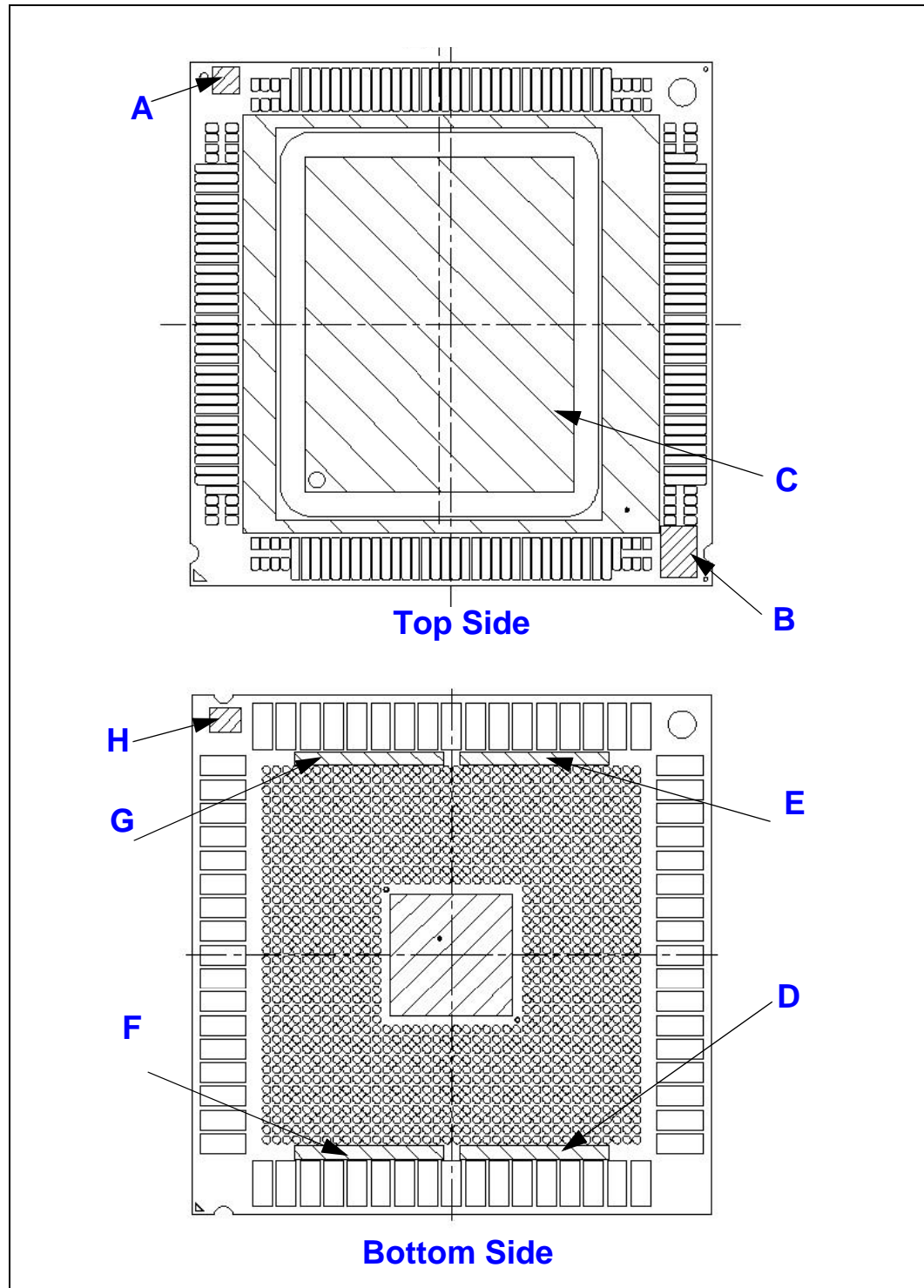
Zone	Engineering Samples	Production Units
Zone A	2D Matrix Mark: VID	
Zone B	Visual Identification (VID) Mark	
Zone C	Line 1: INTEL CONFIDENTIAL Line 2: Mask and Copy Right Date Codes	Line 1: Product Name Line 2: Mask and Copy Right Date Codes, Lead Free product designator
Zone D	QDF#, engineering sample, and Country of Origin	S-spec and Country of Origin
Zone E	Intel	
Zone F	Finish Process Order (FPO) and Serial #	
Zone G	Processor ID	
Zone H	2D Matrix Mark: Finish Process Order (FPO) and Serial #	

**Notes:**

1. VID (Visual Identification): Is a unique number which can be used for the purpose of tracking the processor. It is used by Intel to retrieve processor related information.

2. FPO (Finish Process Order): Is a unique number. It can be used for tracking purposes. It is used by Intel to retrieve processor and shipping order information.

**Figure 4-6. Processor Marking Zones**



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# 5 Thermal Specifications

This chapter provides the thermal specifications of the Intel Itanium processor 9300 series.

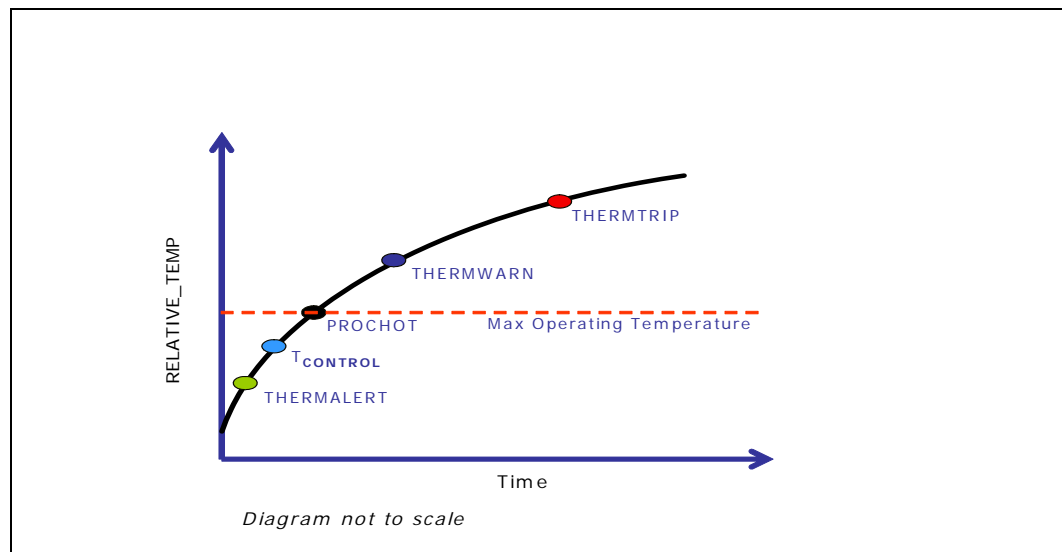
The Intel Itanium processor 9300 series implements power and thermal management. The Intel Itanium processor 9300 series power management system is built from four subsystems or components. These are power measurement components, the temperature measurement components, the frequency control components and the voltage control components that work in concert to maximize performance within a given power and thermal envelope.

## 5.1 Intel Itanium Processor 9300 Series Thermal Features

The Intel Itanium processor 9300 series have internal thermal sensors which sense when a certain temperature is reached on the processor core. These sensors are used to control various thermal states. Figure 5-1 shows an approximate relationship between temperature, time, and the THERMALERT, TCONTROL, PROCHOT, THERMWARN, and THERMTRIP points.

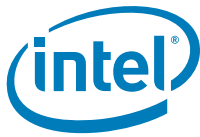
**Note:** Figure 5-1 is not intended to show an exact relationship in time or temperature as a processor's thermal state advances from one state to the next state. Cooling solution performance degradation and processor workload variations will affect the processor thermal state.

Figure 5-1. Intel Itanium Processor 9300 Series Thermal States



### 5.1.1 Digital Thermometer

The Intel Itanium processor 9300 series uses a thermal sensing device called Digital Thermometer (DT) to read the values from the thermal sensors available on the processor die. The DT also compares these values to a thermal trip point that is hard-wired. Calibration information is used to translate the DT output to processor temperature in degrees Celsius relative to the PROCHOT setpoint. DT readout is



available in CSR or via SMBus. When it is below the PROCHOT setpoint the DT readout will have a positive value. The DT has a limited range. It will report out the value of its upper or lower limits when it has reached the limits and set QR\_CSR\_IPF\_THERM\_STATUS.valid = 1'b0.

Table 5-1 shows the processor thermal sensor accuracy with respect to the DT readout. The margin of error is relative to PROCHOT and represents the typical +/-3-sigma range. This data is for a large sample of parts. It should be noted that a particular part should be consistent across the entire operating range.

Table 5-1. Thermal Sensor Accuracy Distribution

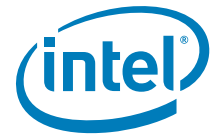
DT Readout	Expected Margin of Error Relative to PROCHOT
0x83 - 0x80, 0x00 - 0x07	±1C
0x08 - 0x0E	±2C
0x0F - 0x14	±3C
0x15 - 0x1B	±4C
0x1C - 0x22	±5C
0x23 - 0x29	±6C
0x2A - 0x30	±7C
0x31 - 0x37	±8C
0x38- 0x3E	±9C
0x3F - 0x45	±10C

## 5.1.2 Intel Itanium Processor 9300 Series Thermal Management

### 5.1.2.1 Overview

The Thermal Management controller on the processor will measure the die temperature using thermal sensors placed in several key locations on the die. Each sensor is fed into a central thermometer logic block. For the Intel Itanium processor 9300 series, the central thermometer logic block will report the highest temperature of all sensors. Referring to Figure 5-1, the sequence of steps taken by the processor thermal management system are presented in steps (a) to (d).

- a. If  $T \geq T_{PROCHOT}$  and the processor is operating at boost frequency, then the thermal management system will instruct the processor to go to base voltage and frequency.  
*After a delay, if the processor temperature is below the  $T_{PROCHOT}$  threshold, normal operation will resume including the processor being allowed to operate at boost frequency if appropriate.*
- b. If  $T \geq T_{PROCHOT}$  and the processor is already at or below base voltage and frequency, then the thermal management system will assert PROCHOT\_N and the processor will enter Single Issue Mode (SIM) and transitions to the voltage and frequency of the lowest supported P-state.  
*A Corrected Machine Check Interrupt (CMCI) is issued when processor enters and exits SIM.  
The Intel Itanium processor 9300 series will remain in this low power mode until the temperature decreases and drops below  $(T_{PROCHOT} - T_{HYSTERESIS})$ . The processor will be in this low power mode for a minimum of 1 second and after 1 second will resume normal operation as soon as the temperature has decreased sufficiently.*



- c. If  $T > T_{THERMWARN}$ , then the processor will issue a fatal MCA and *PROCHOT\_N* will remain asserted; the Foxton controller becomes non-functional. The processor cannot recover except via cold reset. The processor will continue to throttle if  $T > T_{PROCHOT}$  when it comes out of reset. Data integrity is not guaranteed beyond  $T_{THERMWARN}$ .
- d. If  $T > T_{THERMTRIP}$ , then the thermal management system will assert *THERMTRIP\_N* and halt processor clocks.  $T_{THERMTRIP}$  is enforced to prevent physical damage to the processor. Cold reset is required to recover.

### 5.1.2.2 Implementation

The Intel Itanium processor 9300 series thermal management features are designed to operate independently of software, including the operating system. The thermal sensors are on the die of the processor and the frequency and voltage control resides completely on the processor. In order to reduce the processor power while throttling, some execution units on the processor are shut down, limiting the processor to executing only one instruction per cycle.

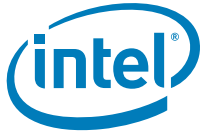
### 5.1.3 Thermal Alert

*THERMALERT\_N* is a programmable thermal alert signal which is part of the Intel Itanium processor 9300 series thermal management system. *THERMALERT\_N* is asserted when the measured temperature from the processor's digital thermometer (DT) is equal to or exceeds  $QR\_CSR\_IPF\_THERM\_CONFIG.thermalert\_assert\_hot\_thresh$  below *PROCHOT*. *THERMALERT\_N* will deassert after the DT readout is below *PROCHOT* by the sum of the values in  $QR\_CSR\_IPF\_THERM\_CONFIG.thermalert\_assert\_hot\_thresh$  and  $QR\_CSR\_IPF\_THERM\_CONFIG.thermalert\_deassert\_thresh$ . Intel recommends using the values listed in the PIROM when programming  $QR\_CSR\_IPF\_THERM\_CONFIG.thermalert\_assert\_hot\_thresh$  and  $QR\_CSR\_IPF\_THERM\_CONFIG.thermalert\_deassert\_thresh$ . The default values for  $QR\_CSR\_IPF\_THERM\_CONFIG.thermalert\_assert\_hot\_thresh$  and  $QR\_CSR\_IPF\_THERM\_CONFIG.thermalert\_deassert\_thresh$  are 10C and 2C respectively.

This signal can be used by the platform to implement thermal regulation features such as generating an external interrupt to tell the operating system that the processor core die temperature is increasing.

### 5.1.4 $T_{CONTROL}$

$T_{CONTROL}$  is a thermal monitoring setpoint which is specified as a relative temperature in degrees Celsius below the *PROCHOT\_N* threshold. The minimum value of the  $T_{CONTROL}$  threshold is specified in [Table 5-2](#) and the default value is available in the PIROM.  $T_{CONTROL}$  value applies to the full range of the processor operating power and is independent of the processor core configuration or executed applications. A server thermal management controller can monitor the processor temperature via the Digital Thermal Sensor (DTS) readout, and use the  $T_{CONTROL}$  value as the threshold at which active system thermal management must be engaged. This will ensure reliable processor operation over its expected life. Note that no internal response is generated by the processor at  $T_{CONTROL}$ . Customers can utilize *THERMALERT\_N* as an interrupt to program an alternative temperature monitoring threshold value to provide margin in



their cooling solution design. See *Intel® Itanium® Processor 9300 Series Processor Thermal Mechanical Design Guide* for additional guidance on implementing a compliant processor thermal solution.

### 5.1.5 Thermal Warning

THERMWARN is the temperature beyond which data integrity is not guaranteed and PROCHOT\_N remains asserted.

### 5.1.6 Thermal Trip

The Intel Itanium processor 9300 series protects itself from catastrophic overheating by use of an internal thermal sensor. The sensor trip point is set well above the maximum operating temperature to ensure that there are no false trips. The Intel Itanium processor 9300 series will issue THERMTRIP\_N and stop all execution when the junction temperature exceeds a safe operating level. At this point THERMTRIP\_N is asserted. If THERMTRIP\_N is asserted, processor voltages (VCCCORE, VCCUNCORE, AND VCCCACHE) must be removed within the timeframe defined in [Table 2-24](#).

Data will be lost or corrupt, and transaction time outs will occur if the Intel Itanium processor 9300 series goes into thermal trip. The part that shuts down may still have pending snoops or memory reads that the other sockets in the partition may have requested.

Once THERMTRIP\_N is asserted, the Intel Itanium processor 9300 series remains stopped until RESET\_N is asserted. If the die temperature has dropped below the trip level, a RESET\_N pulse can be used to reset the processor. If the temperature has not dropped below the trip level, the processor will continue to drive THERMTRIP\_N and remain stopped. It is recommended to allow the processor case temperature to drop below the specified design target before issuing a reset to the processor. Please see [Section 5.2](#) and [Table 5-2](#) for details on the case temperature.

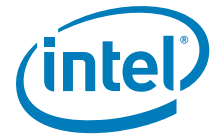
**Note:** In a partitioned system, sockets in the same partition are in the same coherency domain, so they cannot continue to operate if even one of the processors asserts THERMTRIP\_N and shuts down. Moreover, a cold reset is required to get the part back up after a THERMTRIP event. Because cold reset will reset all the sockets in the partition, the other sockets cannot continue running without a reset event.

### 5.1.7 PROCHOT

The temperature at PROCHOT represents the maximum normal operating temperature of the processor. PROCHOT\_N is asserted when the processor temperature is greater than or equal to  $T_{\text{PROCHOT}}$ .

PROCHOT\_N is a signal from the processor to the platform indicating that the processor has detected an over-temperature condition and it is taking corrective measures. This pin is not asserted when FORCEPR\_N or VR\_THERMALERT\_N is asserted unless the thermal system has detected a PROCHOT condition independent of those input signals. The condition may occur due to any of the following conditions:

- The thermal environment is outside of the limits defined for full performance operation.
- The processor power consumption is unbalanced due to very high activity factors in some cores coupled with very low activity factors in others.



### 5.1.8 FORCEPR\_N Signal Pin

FORCEPR\_N is an input pin that will force the processor into one of two modes. The default mode is the same state as PROCHOT\_N. The processor will go into Single Issue Mode (SIM) and also transition to the voltage and frequency of the lowest supported P-state. Time limits and CMCI generation are the same as PROCHOT\_N. The second mode, selectable via QR\_CSR\_IPF\_THERM\_CONFIG.forcepr\_mode, disables SIM and timer functions while maintaining core frequency and voltage throttling. Both modes can be disabled via QR\_CSR\_IPF\_THERM\_CONFIG.forcepr\_disable.

### 5.1.9 Ararat Voltage Regulator Thermal Signals

The Intel Itanium processor 9300 series package allows the Ararat Voltage Regulator to signal to the platform when it approaches its own thermal limits. The specific signals for this purpose are VR\_FAN\_N, VR\_THERMALERT\_N, and VR\_THERMTRIP\_N.

The processor does not monitor or respond to the VR\_FAN\_N and VR\_THERMTRIP\_N pins. The response to VR\_THERMALERT\_N is to force the processor into the same state as PROCHOT\_N. The processor will go into SIM and also transition to the voltage and frequency of the lowest supported P-state. Time limits and CMCI generation are active. This response may be disabled via QR\_CSR\_IPF\_THERM\_CONFIG.vr\_thermalert\_disable.

## 5.2 Package Thermal Specifications and Considerations

This section lists the thermal parameters of the Intel Itanium processor 9300 series package. See Table 5-2 for the T<sub>CASE</sub> design target at Thermal Design Power (TDP) and the minimum T<sub>CONTROL</sub> specification. The case temperature is defined as the temperature measured at the center of the processor substrate on the top surface of the IHS.

Table 5-2. Thermal Specification

TDP - Thermal Design Power (W)	Max Operating Temperature (DT Readout)	T <sub>CASE</sub> (°C) Min	T <sub>CASE</sub> (°C) @ TDP	Minimum T <sub>CONTROL</sub> (DT Readout)	Notes
185	0	5	88	5	1, 2, 3, 4, 5
155	0	5	88	5	1, 2, 3, 4, 5
130	0	5	88	5	1, 2, 3, 4, 5

**Notes:**

1. The processor maximum temperature is reached at T<sub>PROCHOT</sub>. That is when DT readout is equal to zero.
2. Intel recommends that the thermal solution designs target the processor Thermal Design Power (TDP), instead of its spontaneous maximum power consumption.
3. Processor TDP is determined at the T<sub>CASE</sub> equal to T<sub>CASE@TDP</sub>
4. T<sub>CASE</sub> is provided for the purpose of designing a processor compatible thermal solution.
5. The THERMALERT and TCONTROL values are temperature offsets below T<sub>PROCHOT</sub>.

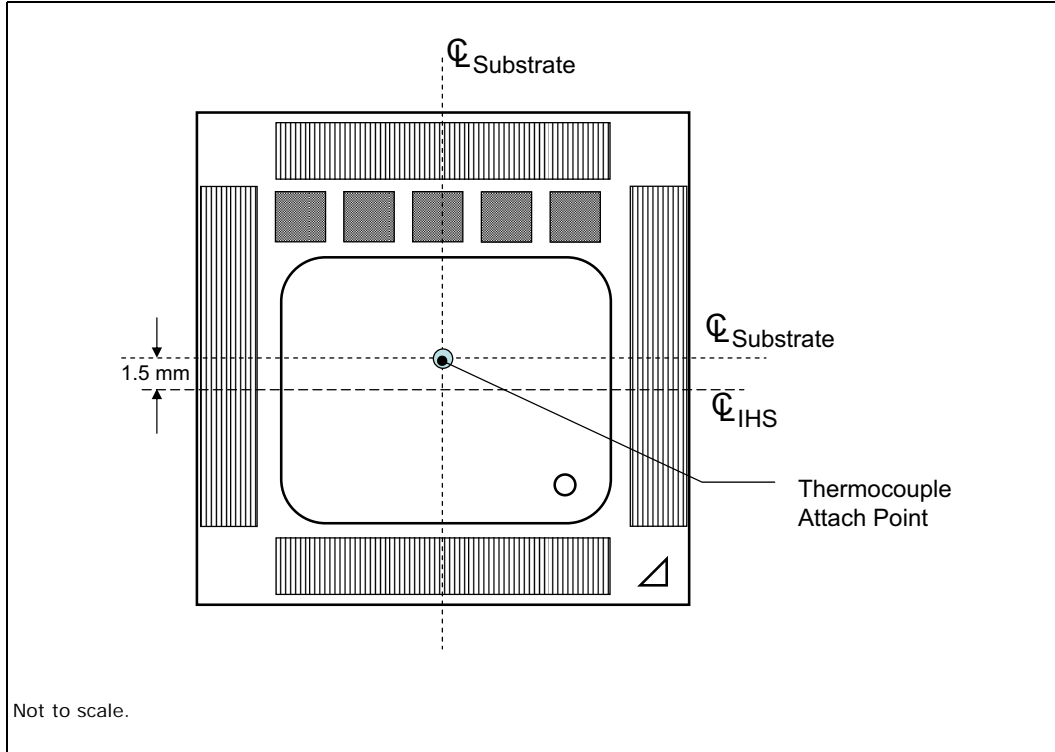
**Note:** T<sub>CASE</sub> cannot be used as proxy for power dissipation due to the variation in work load imbalances between cores.

TDPmax is 185 W or 155 W or 130 W depending on the SKU.

The combined max short-term (<250 μs) power for the Ararat supplies (VCC\_CORE, VCC\_UNCORE and VCC\_CACHE) is limited to 230 W, and the total of all supplies is limited to 250 W for the 185 W SKUs.

Figure 5-2 contains dimensions for the thermocouple location on the Intel Itanium processor 9300 series package. This is the recommended location for the placement of a thermocouple for case temperature measurement.

**Figure 5-2. Intel Itanium Processor 9300 Series Package Thermocouple Location**



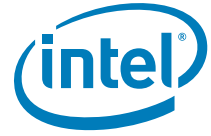
**Note:** Refer to the Package Mechanical Drawings in Chapter 4.

### 5.3 Storage Conditions Specifications

Environmental Storage Condition limits define the temperature and relative humidity limits to which the device is exposed to while being stored. The specified storage conditions are for component level prior to installation onto board.

Non operating storage condition limits for the component once installed onto the application board are not specified. Intel does not conduct component level certification assessments post subsequent applications such as components sub-assembly (FRU: Field Replaceable Unit), or installation onto a board given the multitude of attach methods, and board types used by customers. Provided as general guidance only, Intel® board products are specified and certified to meet the following temperature and humidity limits (Non-Operating Temperature Limit: -40°C to 70°C and Humidity: 50% to 90%, non condensing with a maximum wet bulb of 28°C).

Table specifies absolute maximum and minimum storage temperature limits which represent the maximum or minimum device condition beyond which damage, latent or otherwise, may occur. The table also specifies sustained storage temperature, relative humidity, and time-duration limits. These limits specify the maximum or minimum device storage conditions for a sustained period of time. At conditions outside sustained limits, but within absolute maximum and minimum ratings, quality & reliability may be affected.



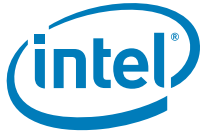
**Table 5-3. Storage Condition Ratings**

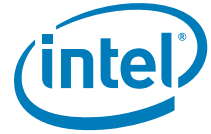
Symbol	Parameter	Min	Max	Notes 1, 2,3,4,5
T <sub>abs storage</sub>	The minimum/maximum device storage temperature beyond which damage (latent or otherwise) may occur when subjected to for any length of time.	-55°C	125°C	
T <sub>sustained storage</sub>	The minimum/maximum device storage temperature for a sustained period of time.	-5°C	40°C	
RH <sub>sustained storage</sub>	The maximum device storage relative humidity for a sustained period of time.	-	60% @ 24°C	
T <sub>imesustained storage</sub>	A prolonged or extended period of time; typically associated with sustained storage conditions.	0 months	12 months	

**Notes:**

1. Storage conditions are applicable to storage environments only. In this scenario, the processor must not receive a clock, and no lands can be connected to a voltage bias. Storage within these limits will not affect the long-term reliability of the device. For functional operation, please refer to the processor case temperature specifications.
2. These ratings apply to the Intel component and do not include the tray or packaging.
3. Failure to adhere to this specification can affect the long-term reliability of the processor.
4. Device storage temperature qualification methods follow JESD22-A119 (low temp) and JESD22-A103 (high temp) standards.

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# 6 System Management Bus Interface

The Intel Itanium processor 9300 series package includes a system management bus (SMBus) interface. This chapter describes the features of the SMBus and its components.

## 6.1 Introduction

The processor includes an SMBus interface which allows access to several processor features. The SMBus components include the Processor Information EEPROM (PIROM), the Scratch EEPROM, and sideband access to the processor's control and status registers.

The processor information EEPROM (PIROM) is programmed by Intel with manufacturing and feature information specific to the Intel Itanium processor 9300 series. This information is permanently write-protected. The other EEPROM is a scratch EEPROM that is available for other data at the system vendor's discretion. [Section 6.2](#) provides detail on the PIROM and the scratch EEPROM.

## 6.2 SMBus Memory Component

### 6.2.1 Processor Information ROM

**Table 6-1. Processor Information ROM Data (Sheet 1 of 6)**

Sec #	Offset	Field Name	Data Type	Description	Example
<b>General</b>					
0	00h	Data Format Revision	Hex	Incremented with PIROM Table revisions	Rev 1.6 = 0x10
1	01h	EEPROM Size	Hex	Size in Bytes	128 bytes = 0080h; ie. 02h[7:0] = 0x00 01h[7:0] = 0x80
2	02h				
3	03h	Processor Data Address	hex Byte pointer	Pointer to the section of PI-ROM containing Processor Production Data	0x0F; 0x00 if not present
4	04h	Processor Core Address	hex Byte pointer	Pointer to the section of PI-ROM containing Processor Core Data	0x22; 0x00 if not present
5	05h	Processor Uncore Address	hex Byte pointer	Pointer to the section of PI-ROM containing Processor Uncore Data	0x2E; 0x00 if not present
6	06h	Processor Cache Address	hex Byte pointer	Pointer to the section of PI-ROM containing Processor Cache Data	0x46; 0x00 if not present
7	07h	Package Data Address	hex Byte pointer	Pointer to the section of PI-ROM containing Processor Package Data	0x4F; 0x00 if not present



Table 6-1. Processor Information ROM Data (Sheet 2 of 6)

Sec #	Offset	Field Name	Data Type	Description	Example
8	08h	Part Number Data Address	hex Byte pointer	Pointer to the section of PI-ROM containing Processor Part Number Data	0x56; 0x00 if not present
9	09h	Thermal Reference Data Address	hex Byte pointer	Pointer to the section of PI-ROM containing Processor Thermal Reference Data	0x6B; 0x00 if not present
10	0Ah	Feature Data Address	hex Byte pointer	Pointer to the section of PI-ROM containing Processor Features Data	0x72; 0x00 if not present
11	0Bh	Other Data Address	hex Byte pointer	Pointer to the section of PI-ROM containing Processor "Other" Data	0x7D; 0x00 if not present
12	0Ch	RESERVED	hex	Reserved for future use	0Ch = 0x00
13	0Dh				0Dh = 0x00
14	0Eh	Checksum	hex	Add up by byte and take 2's compliment	
<b>Processor</b>					
15	0Fh	S-spec/QDF Number	4 8-bit ASCII hex Characters and two NULL characters	A parts System Specification (S-SPEC) or Qualification Detail Form (QDF) number as identified by Intel	"QDF number of Q1DK would be: 0Fh = 0x51 (Q) 10h = 0x31 (1) 11h = 0x44 (D) 12h = 0x4B (K) 13h = 0x00 (NULL) 14h = 0x00 (NULL)
16	10h				
17	11h				
18	12h				
19	13h				
20	14h				
21	15h	Sample/Production	hex	Identifies sample parts separately from production parts	0x01 = Production 0x00 = Sample
22	16h	Voltage Regulator Type Required	hex	Identifies Ararat type required	0x00 = TKW, 0x01 = PSN
23	17h	VCCA	4 binary coded decimal (bcd) digits	Processor Analog Voltage Supply in four 4-bit hex digits (in mV)	1.800V = 1800 17h = 00 18h = 18
24	18h				
25	19h	VCCA Voltage Tolerance High	2 hex digits	Total tolerance (DC+AC) in mV	61mV = 3Dh
26	1Ah	VCCA Voltage Tolerance Low	2 hex digits	Total tolerance (DC+AC) in mV	61mV = 3Dh
27	1Bh	VCCIO Voltage	6 bcd digits	Voltage in six 4-bit hex digits in mV^-2	1.11250V = 0011125 1Bh = 25 1Ch = 11 1Dh = 00
28	1Ch				
29	1Dh				
30	1Eh	VCCIO Voltage Tolerance High	2 hex digits	Total tolerance (DC+AC) in mV	28mv = 0x1C
31	1Fh	VCCIO Voltage Tolerance Low	2 hex digits	Total tolerance (DC+AC) in mV	28mv = 0x1C
32	20h	RESERVED	hex	Reserved for future use	0x00
33	21h	Checksum	hex	Add up by byte and take 2's compliment	
<b>Core</b>					
34	22h	Architecture Revision	2 hex Digits	From CPUID	Taken from CPUID[3].archrev



Table 6-1. Processor Information ROM Data (Sheet 3 of 6)

Sec #	Offset	Field Name	Data Type	Description	Example
35	23h	Processor Core Family	2 hex Digits	From CPUID	Taken from CPUID[3].family
36	24h	Processor Core Model	2 hex Digits	From CPUID	Taken from CPUID[3].model
37	25h	Processor Core Stepping	2 hex Digits	From CPUID	Taken from CPUID[3].revision
38	26h	Boost Core Frequency	4 bcd digits	Maximum Specified operating frequency of this part in MHz	1733 MHz = 1733 26h = 33 27h = 17
39	27h				
40	28h	Core Voltage ID	4 bcd digits	Voltage in four 4-bit hex digits (in mV)	1200 mV = 1200h 28h = 00 29h = 12
41	29h				
42	2Ah	Core Voltage Tolerance, High	2 hex digits	Edge finger tolerance in mV, +	20 mV = 0x14
43	2Bh	Core Voltage Tolerance, Low	2 hex digits	Edge finger tolerance in mV, -	20 mV = 0x14
44	2Ch	RESERVED	hex	Reserved for future use	0x00
45	2Dh	Checksum	hex	Add up by byte and take 2's compliment	
<b>Uncore</b>					
46	2Eh	Maximum Intel® QuickPath Interconnect Link Transfer Rate	6 bcd digits	Maximum Intel QuickPath Interconnect Link Transfer rate for this part in MT/s	4.8 GT/s = 004800 2Eh = 00 2Fh = 48 30h = 00
47	2Fh				
48	30h				
49	31h	Minimum Intel QuickPath Interconnect Link Transfer Rate	6 bcd digits	Minimum Intel QuickPath Interconnect Link Transfer rate for this part in MT/s	4.8 GT/s = 004800 31h = 00 32h = 48 33h = 00
50	32h				
51	33h				
52	34h	Intel QuickPath Interconnect version Number	4 8-bit ASCII hex characters	Intel QuickPath Interconnect version number supported by processor	01.0 = 34h = 0x30 35h = 0x2E 36h = 0x31 37h = 0x30
53	35h				
54	36h				
55	37h				
56	38h	Memory Support flags	hex	1 FBD1 Support (LSB) 1 MB Support 6 (MSB) reserved 1 = supported, 0 = not supported	0x01 = FB-DIMM 1 only 0x02 = MB 1 only 0x03 = FB-DIMM 1 and MB 1 supported
57	39h	Maximum Memory Transfer Rate	6 bcd digits	Maximum Memory Transfer rate for this part in GT/s	800 MT/s = 000800 GT/s 39h = 00 3Ah = 08 3Bh = 00
58	3Ah				
59	3Bh				
60	3Ch	Minimum Memory Transfer Rate	6 bcd digits	Minimum Memory Transfer rate for this part in MT/s	800 MT/s = 000800 GT/s 3Ch = 00 3Dh = 08 3Eh = 00
61	3Dh				
62	3Eh				
63	3Fh	Uncore Voltage ID	4 bcd digits	Voltage in four 4-bit hex digits (in mV)	1200 mV = 1200 3Fh = 00 40h = 12
64	40h				
65	41h	Uncore Voltage Tolerance, High	2 hex digits	Edge finger tolerance in mV, +	20 mV = 0x14
66	42h	Uncore Voltage Tolerance, Low	2 hex digits	Edge finger tolerance in mV, -	20 mV = 0x14



**Table 6-1. Processor Information ROM Data (Sheet 4 of 6)**

Sec #	Offset	Field Name	Data Type	Description	Example
67	43h	RESERVED	hex	Reserved for future use	42h = 0x00
68	44h				43h = 0x00
69	45h	Checksum	hex	Add up by byte and take 2's compliment	
<b>Cache</b>					
70	46h	L3 Cache Size	4 bcd digits	Size of the Cache on this part in MB in hex	24MB = 0024
71	47h				46h = 24
					47h = 00
72	48h	Cache Voltage ID	4 bcd digits	Voltage in four 4-bit hex digits (in mV)	1163 mV = 1163
73	49h				48h = 63
					49h = 11
74	4Ah	Cache Voltage Tolerance, High	2 hex digits	Edge finger tolerance in mV, +	20 mV = 0x14
75	4Bh	Cache Voltage Tolerance, Low	2 hex digits	Edge finger tolerance in mV, -	20 mV = 0x14
76	4Ch	RESERVED	hex	Reserved for future use	4Ch = 0x00
77	4Dh				4Dh = 0x00
78	4Eh	Checksum	hex	Add up by byte and take 2's compliment	
<b>Package</b>					
79	4Fh	Package Revision	Five 8-bit ASCII hex characters	Package Revision Tracking Number	Revision = 01NT3
80	50h				4Fh = 0x30
81	51h				50h = 0x49
82	52h				51h = 0x4E
83	53h				52h = 0x54
					53h = 0x33
84	54h	Substrate Revision Software ID	hex	2-bit substrate revision number: 2 Bits (MSB) 6 Bits RESERVED (LSB)	00b MSB 000000b Reserved
85	55h	Checksum	hex	Add up by byte and take 2's compliment	
<b>Part Numbers</b>					
86	56h	Processor Part Number	Seven 8-bit ASCII hex Characters	Processor Part Number	PPN = 80603LW
87	57h				56h = 0x57 = "W"
88	58h				57h = 0x4C = "L"
89	59h				58h = 0x33 = "3"
90	5Ah				59h = 0x30 = "0"
91	5Bh				5Ah = 0x36 = "6"
92	5Ch				5Bh = 0x30 = "0"
		5Ch = 0x38 = "8"			



Table 6-1. Processor Information ROM Data (Sheet 5 of 6)

Sec #	Offset	Field Name	Data Type	Description	Example
93	5Dh	Processor Electronic Signature	16 Digit hex Number	64 - bit identification number; may have padded zeros.	
94	5Eh				
95	5Fh				
96	60h				
97	61h				
98	62h				
99	63h				
100	64h				
101	65h	Base Core Freq	4 bcd digits	Base Core Frequency for this part	f = 1600 Mhz 65h = 00 66h = 16
102	66h				
103	67h	RESERVED	hex	Reserved for future use	67h = 0x00 68h = 0x00 69h = 0x00
104	68h				
105	69h				
106	6Ah	Checksum	hex	Add up by byte and take 2's compliment	
<b>Thermal Reference</b>					
107	6Bh	THERMALERT_N hot assertion	2 hex digits	Recommended THERMALERT_N assertion threshold value	10C below PROCHOT_N = 0x0A
108	6Ch	THERMALERT_N hot deassertion hysteresis	2 hex digits	Recommended THERMALERT_N deassertion threshold value	2C deassert = 0x02 This indicates a THERMALERT_N deassert of 10C + 2C = 12C below PROCHOT_N
109	6Dh	Maximum TDP	2 hex digits	Thermal Design Power Max	185 W = 0xB9
110	6Eh	Tcontrol	2 hex digits	Default processor thermal monitoring setpoint in C	5C below PROCHOT_N = 0x5
111	6Fh	RESERVED	hex	Reserved for future use	6Fh = 0x00 70h = 0x00
112	70h				
113	71h	Checksum	hex	Add up by byte and take 2's compliment	
<b>Features</b>					
114	72h	Processor Core Feature Flags	8 digit hex number	From CPUID	Flag = 0x4387FBFF 72h = 0xFF 73h = 0xFB 74h = 0x87 75h = 0x43
115	73h				
116	74h				
117	75h				
118	76h	RESERVED	hex	Reserved for future use	76h = 0x00 77h = 0x00
119	77h				



**Table 6-1. Processor Information ROM Data (Sheet 6 of 6)**

Sec #	Offset	Field Name	Data Type	Description	Example
120	78h	Package Feature Flags	hex	all other are reserved Bit[3] = THERMALERT_N threshold values present Bit[2] = SCRATCH EEPROM present Bit[1] = Core VID present where a 1 indicates valid data	Flag = 0x000E 78h = 0x0E 79h = 0x00
121	79h				
122	7Ah	RESERVED	hex	Reserved for future use	7Ah = 0x00
123	7Bh	Number of Devices in TAP Chain	hex	Bits [7:4] Number Devices in processor TAP chain Bits [3:0] Reserved	5 devices for TKW = 0x50
124	7Ch	Checksum	hex	Add up by byte and take 2's compliment	
<b>Other</b>					
125	7Dh	RESERVED	hex	Reserved for future use	7Dh = 0x00 7Eh = 0x00 7Fh = 0x00
126	7Eh				
127	7Fh				

### 6.2.2 Scratch EEPROM

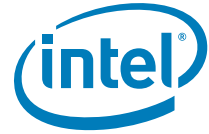
Intel Itanium processor 9300 series supports a Scratch EEPROM section, which may be used for other data at the system vendor's discretion. The data in this EEPROM, once programmed, can be write-protected by asserting the active-high SM\_WP signal. This signal has a weak pull-down (10 kΩ) to allow the EEPROM to be programmed in systems with no implementation of this signal. The Scratch EEPROM resides in the upper half of the memory component (addresses 80 - FFh). The lower half comprises the Processor Information ROM (addresses 00 - 7Fh), which is permanently write-protected.

### 6.2.3 PIROM and Scratch EEPROM Supported SMBus Transactions

The PIROM responds to two SMBus packet types: Read Byte and Write Byte. However, since the PIROM is write-protected, it will acknowledge a Write Byte command but ignores the data. The Scratch EEPROM responds to Read Byte and Write Byte commands. [Table 6-2](#) illustrates the Read Byte command. [Table 6-3](#) illustrates the Write Byte command.

In the tables, 'S' represents the SMBus start bit, 'P' represents a stop bit, 'A' represents an acknowledge (ACK), and '///' represents a negative acknowledge (NACK). The shaded bits are transmitted by the PIROM or Scratch EEPROM, and the bits that aren't shaded are transmitted by the SMBus host controller. In the tables, the data addresses indicate 8 bits.

The SMBus host controller should transmit 8 bits with the most significant bit indicating which section of the EEPROM is to be addressed: the PIROM (MSB = 0) or the Scratch EEPROM (MSB = 1).



**Table 6-2. Read Byte SMBus Packet**

S	Slave Address	Write	A	Command Code	A	S	Slave Address	Read	A	Data	///	P
1	7-bits	1	1	8-bits	1	1	7-bits	1	1	8-bits	1	1

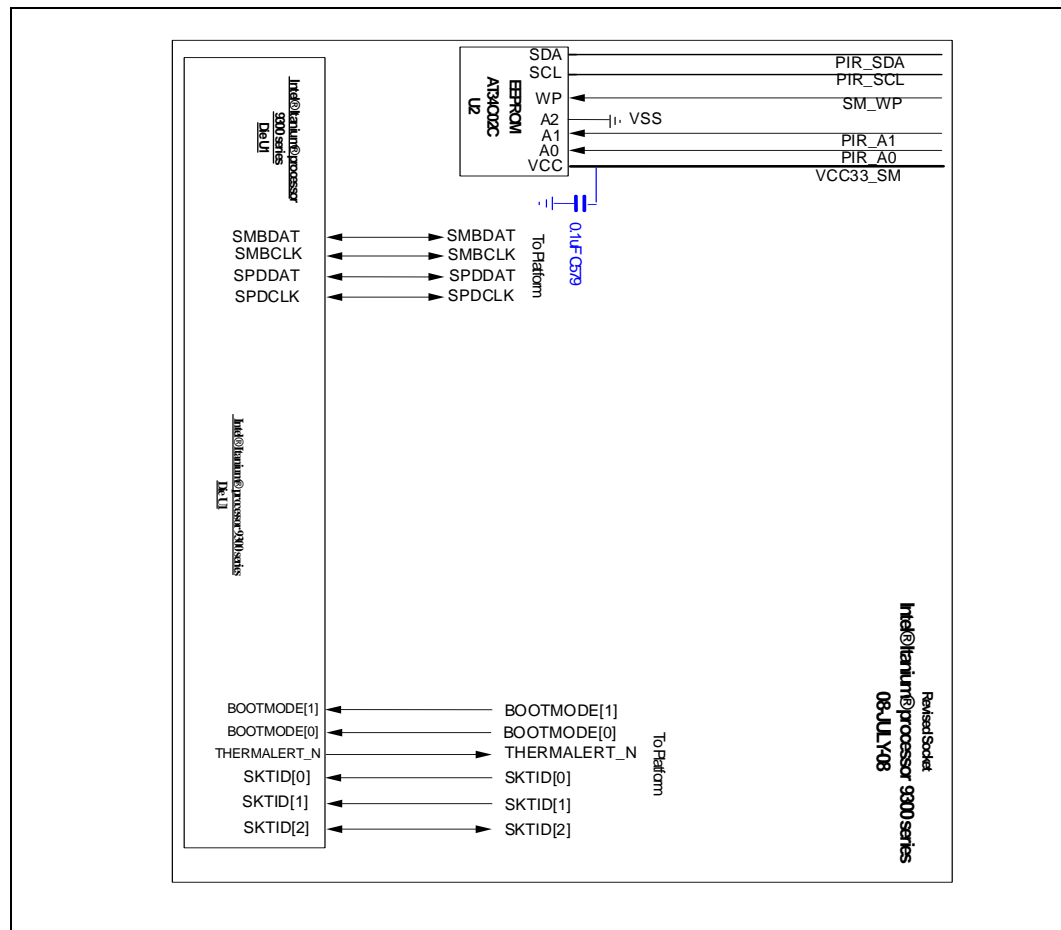
**Table 6-3. Write Byte SMBus Packet**

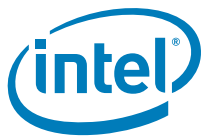
S	Slave Address	Write	A	Command Code	A	Data	A	P
1	7-bits	1	1	8-bits	1	8-bits	1	1

### 6.3 Memory Component Addressing

The Intel Itanium processor 9300 series PIR\_A[1:0] pins are used as the memory address selection signals. The processor does not specify the value on these pins. It is left to the system architect to set the SMBus memory map. If the processor is the only device on the bus, these pins may be tied to VSS. PIR\_A[2] is tied to VSS internal to the processor. Figure 6-1 shows the address connections within the processor package.

**Figure 6-1. Intel Itanium Processor 9300 Series Processor Package**





## 6.4 PIROM Field Definitions

PIROM data is divided into sections containing similar data. Each section contains specific fields defined in the following sections.

### 6.4.1 General

To maintain backward compatibility, the General section defines the starting address for each subsequent section of the PIROM. Software should check for the offset before reading data from a particular section of the ROM.

The General section begins with offset 00h which contains Data Format Revision information, followed by the EEPROM size, both formatted in hex bytes. The data format revision is used whenever fields within the PIROM are updated with new values. Normally the revision would begin at a value of 1. If a field, or bit assignment within a field, is changed such that software needs to discern between the old and new definition, then the data format revision field should be incremented.

### 6.4.2 Processor Data

This section contains following pieces of data:

- The S-SPEC or QDF of the part in hex ASCII format.
- Sample or Production field to identify a pre-production sample or a production unit.
- Required voltage regulator field
- VCCA and VCCIO voltage specs.

The S-SPEC or QDF field is six bytes of ASCII characters and is programmed with the same S-spec or QDF value as marked on the processor.

The sample or production field is a two-bit, LSB-aligned value. 0x00 indicates unlocked PIROM section. This is the case in most samples. 0x01 indicates a locked PIROM section. Some samples and all production parts will be locked.

The required voltage regulator field for the Intel Itanium processor 9300 series is 0x00.

### 6.4.3 Processor Core Data

This section contains silicon-related data relevant to the processor cores.

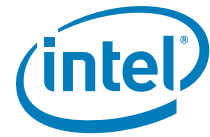
#### 6.4.3.1 CPUID

Offset 22h-25h contains a copy of the results in EAX[31:0] from Function 1 of the CPUID instruction.

#### 6.4.3.2 Boost Core Frequency

Offset 26h-27h provides the boost core frequency for the processor. The frequency should equate to the markings on the processor and/or the QDF/S-spec speed even if the parts are not limited or locked to the intended speed. Format of this field is in MHz, rounded to a whole number, and encoded as four 4 bit-bcd digits.

**Example:** A 1733 GHz processor will have a value of 1733h.



### 6.4.3.3 Core Voltage

Offset 28h-29h is the nominal core voltage for this part, rounded to the next thousandth, is in mV and is reflected in bcd.

**Example:** 1500 mV is represented as 1500 h.

### 6.4.3.4 Core Voltage Tolerance

Offsets 2Ah and 2Bh contain the core voltage tolerances, high and low respectively. These use a decimal to hexadecimal conversion. Example: 19 mV tolerance would be saved as 13h.

## 6.4.4 Processor Uncore Data

This section contains silicon-related data relevant to the processor Uncore.

### 6.4.4.1 Maximum Intel® QuickPath Interconnect Link Transfer Rate

Offset 2Eh-30h provides maximum operating link transfer rate of 4.8 GT/s as 6 bcd digits in MT/s. Example: 4.8 GT/s = 004800.

### 6.4.4.2 Minimum Operating Intel® QuickPath Interconnect Link Transfer Rate

Offset 31h-33h provides minimum “operating” link transfer rate. Systems may need to read this offset to decide if all installed processors support the same link transfer rate. This does not relate to the “link power up” transfer rate of 1/4th Ref Clk. This value is represented by 6 bcd digits.

### 6.4.4.3 Intel® QuickPath Interconnect Version Number

Offset 34h-37h provides the Intel QuickPath Interconnect Version Number as four 8-bit ASCII characters.

**Example:** The Intel Itanium processor 9300 series supports Intel QuickPath Interconnect Version Number 1.0. Therefore, offset 34h-37h has an ASCII value “01.0”, in reverse order.

34h: 30h, 35h: 2E, 36h: 31h, 37h: 30h.

### 6.4.4.4 Memory Type Support

Offset 38h signifies the type of memory support for this processor and platform.

A 01h signifies FBD1, 02h is Intel® 7500 Scalable Memory Buffer, and 03h represents support for both memory types.

### 6.4.4.5 Maximum Memory Transfer Rate

Offset 39h-3Bh provides maximum memory transfer rate. Systems may need to read this offset to decide if processors and Intel 7500 Scalable Memory Buffers support the same FB-DIMM transfer rate. Six 4-bit BCD digits are used to provide the maximum transfer rate in MT/s.

**Example:** A speed of 4.8 GT/s is shown as 004800h.



#### 6.4.4.6 Minimum Memory Transfer Rate

Offset 3Ch-3Eh provides minimum “operating” memory transfer rate.

#### 6.4.4.7 Uncore Voltage

Offset 3Fh-40h is the nominal processor Uncore voltage for this part, rounded to the next thousandth in mV and reflected in BCD.

**Example:** 1200 mV is stored as 3Fh: 00, 40h: 12h.

#### 6.4.4.8 Uncore Voltage Tolerance

Offset 41h and 42h contain the Uncore voltage tolerances, high and low respectively. These use a decimal to hexadecimal conversion. Example: 20 mV tolerance would be saved as 14h.

### 6.4.5 Cache Data

This section contains cache related data.

#### 6.4.5.1 L3 Cache Size

Offset 46h-47h is the L3 cache size field. The field reflects the size of the level three cache in MBytes in bcd format.

**Example:** The Intel Itanium processor 9300 series has a 24 MB L3 cache. Thus, offsets 46h & 47h will contain 24 & 00 respectively.

#### 6.4.5.2 Cache Voltage

Offset 48h-49h is the nominal processor cache voltage for this part, rounded to the next thousandth in mV and reflected in BCD.

#### 6.4.5.3 Cache Voltage Tolerance

Offset 4Ah and 4Bh contain the cache voltage tolerances, high and low respectively. These use a decimal to hexadecimal conversion. Example: 20 mV tolerance would be saved as 14h.

### 6.4.6 Package Data

#### 6.4.6.1 Package Revision

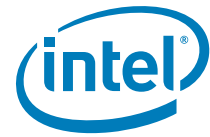
This section describes the package revision location at offset 4Fh-53h used to capture package technology. This field tracks the highest level revision. It is provided in ASCII hex format of five characters.

#### 6.4.6.2 Substrate Revision Software ID

This field is at offset 54h for the substrate layout design.

### 6.4.7 Part Number Data

This section between 56h and 6Ah provides part tracing ability.



#### 6.4.7.1 Processor Part Number

Offset 56h-5Ch contains seven ASCII characters reflecting the Intel part number for the processor. This information is typically marked on the outside of the processor. If the part number is less than 7 characters, a leading space is inserted into the value.

**Example:** A processor with a part number of 80546KF will have data as 46h, 4bh, 36h, 34h, 35h, 30h, 38h starting at offset 56h.

#### 6.4.7.2 Processor Electronic Signature

Offset 5Dh-64h contains a unique 64-bit identification number.

#### 6.4.7.3 Base Frequency (Core)

Offset 65h-66h contain a bcd representation of core base frequency.

**Example:** A processor with a core base frequency of 1600 MHz will have data as 00, 16 starting at offset 65h.

### 6.4.8 Thermal Reference Data

#### 6.4.8.1 Recommended Thermalert Hot Assertion Byte

Offset 6Bh contains the thermalert threshold expressed as the number of degrees C below the PROCHOT\_N (thermal throttling) temperature in hex format.

#### 6.4.8.2 Recommended Thermalert Hot De-assertion Hysteresis

The de-assertion threshold is expressed as the number of degrees C below the thermalert hot threshold value in hex format.

**Example:** reading offset 6Bh=00001010 and 6Ch=0000010, then programming the CSRs with these values means THERMALERT\_N will be asserted when junction temperature rises to 10C below the PROCHOT\_N (thermal throttle) threshold and will remain asserted until the junction temperature drops to 12C below the PROCHOT\_N threshold.

#### 6.4.8.3 Thermal Design Power

Offset 6Dh is programmed with 2 hex digits representing the max TDP of the part.

**Example:** 6Dh = 0xB9 indicates a 185 W part.

#### 6.4.8.4 TControl

Offset 6Eh contains the recommended TControl spec in degrees C below PROCHOT\_N temperature in hex format.

### 6.4.9 Feature Data

This section provides information on key features that the platform may need to understand without powering on the processor.



### 6.4.9.1 Processor Core Feature Flags

Offset 72h-75h contains a copy of results in EDX[31:0] from Function 1 of the CPUID instruction. These details provide instruction and feature support by product family.

### 6.4.9.2 Package Feature Flags

Offset 78h-79h provides additional feature information from the processor. This field is defined as follows:

**Table 6-4. Offset 78h/79h Definitions**

Bit	Definition
4-32	Reserved
3	Thermal calibration offset byte present
2	Scratch (OEM) EEPROM present (set if there is a scratch ROM at offset 80 - FFh)
1	Core VID present (set if there is a VID provided by the processor)
0	Reserved

### 6.4.9.3 Number of Devices in TAP Chain

At offset 7Bh, a 4-bit hex digit is used to tell how many devices are in the TAP Chain. The four bits are the most significant bits at this offset.

Since Intel Itanium processor 9300 series has one TAP per core plus a sysint TAP, this field would be set to 50h. Note that even reduced core count Itanium products (for example, 2-core Itanium products) will still have five devices on the TAP chain.

### 6.4.10 Other Data

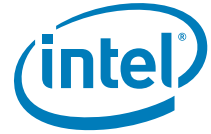
Addresses 7Dh-7Fh are listed as reserved.

### 6.4.11 Checksums

The Processor Information section of the ROM includes multiple checksums. [Table 6-5](#) includes the checksum values for each section defined in the 128 byte PIROM section, except the Other Data section.

**Table 6-5. 128 Byte PIROM Checksum Values**

Section	Checksum Address
General	0Eh
Processor Data	21h
Processor Core Data	2Dh
Processor Uncore Data	45h
Cache Data	4Eh
Package Data	55h
Part Number Data	6Ah
Thermal Reference Data	71h
Feature Data	7Ch
Other Data	None Defined



Checksums are automatically calculated and programmed. The first step in calculating the checksum is to add each byte from the field to the next subsequent byte. The second step is to take the 2's complement of the first step. This value is the checksum.

**Example:** For a byte string of AA445Ch, the resulting checksum will be B6h.

AA = 10101010      44 = 01000100      5C = 0101100

First step: add the bytes.

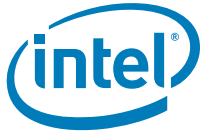
AA + 44 + 5C = 01001010

Second step: take 2's complement.

10110101 + 1 = 10110110

Checksum is 0xB6







# 7 Intel Itanium Processor 9300 Series Signal Definitions

This Chapter provides an alphabetical listing of all Intel Itanium Processor 9300 series signals. The tables list the signal directions (Input, Output, I/O) and signal descriptions.

For a complete pinout listing including processor specific pins, please refer to Chapter 3, “Pin Listing”

**Table 7-1. Signal Definitions Intel Itanium Processor 9300 Series (Sheet 1 of 8)**

Name	Type	Description										
BOOTMODE[1:0]	I	The BOOTMODE[1:0] inputs specify which way the Intel® Itanium® processor 9300 series will boot. For details on the modes refer to the <i>Intel® Itanium® processor 9300 series External Design Specification</i> . To pull any of these inputs high, they should be strapped to 1.1 V through a pull-up resistor, and to pull these low, they should be strapped to GND. These pins are sampled during all resets except warm-logic reset.										
CPU_PRES[A B]_N	I/O	CPU Present pads. These pins at the top of the package are part of a daisy chain that indicates to the platform that the processor and Ararat are properly installed into the socket.										
CPU_PRES[1:4]_N,	I/O	CPU Present Pads. These pads at the bottom of the package are part of a daisy chain that indicates to the platform that the processor and Ararat are properly installed into the socket. Motherboard routing guidelines for these pins are documented in <i>Intel Itanium Processor 9300 Series Platform Design Guide</i> .										
CSI[5:0]R[P/N]CLK	I	<p>The receive clock signals are inputs to the Intel® Itanium® processor 9300 series and are required to be the same frequency at both ends but may differ by a fixed phase. An Intel QuickPath Interconnect local receiver port receives a forwarded clock from the transmitter side of the remote port and vice-versa, to maintain timing reference at either end of the link.</p> <table border="1"> <thead> <tr> <th>Intel® QuickPath Interconnect</th> <th>5:0</th> <th>R</th> <th>P/N</th> <th>CLK0</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Port Number</td> <td>Receiver</td> <td>Differential Pair Polarity Positive/Negative</td> <td>Clock0</td> </tr> </tbody> </table> <p>Example: CSI4RPCLK represents port 5 clock receive signal and positive bit of the differential pair.</p>	Intel® QuickPath Interconnect	5:0	R	P/N	CLK0	Interface Name	Port Number	Receiver	Differential Pair Polarity Positive/Negative	Clock0
Intel® QuickPath Interconnect	5:0	R	P/N	CLK0								
Interface Name	Port Number	Receiver	Differential Pair Polarity Positive/Negative	Clock0								
CSI[5:0]T[P/N]CLK	O	<p>These transmit clock signals are driven by the processor and are required to be the same frequency at both ends but may differ by a fixed phase. An Intel QuickPath Interconnect local port transmit side sends a forwarded clock to the receive side of the remote port and vice-versa, to maintain timing reference at either end of the link.</p> <table border="1"> <thead> <tr> <th>Intel® QuickPath Interconnect</th> <th>5:0</th> <th>T</th> <th>P/N</th> <th>CLK0</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Port Number</td> <td>Transmitter</td> <td>Differential Pair Polarity Positive/Negative</td> <td>Clock0</td> </tr> </tbody> </table> <p>Example: CSI4TPCLK represents port 5 clock transmit signal and positive bit of the differential pair.</p>	Intel® QuickPath Interconnect	5:0	T	P/N	CLK0	Interface Name	Port Number	Transmitter	Differential Pair Polarity Positive/Negative	Clock0
Intel® QuickPath Interconnect	5:0	T	P/N	CLK0								
Interface Name	Port Number	Transmitter	Differential Pair Polarity Positive/Negative	Clock0								



Table 7-1. Signal Definitions Intel Itanium Processor 9300 Series (Sheet 2 of 8)

Name	Type	Description														
CSI[3:0]R[P/N]Dat[19:0], CSI[5:4]R[P/N]Dat[9:0]	I	<p>These input data signals provide means of communication between two ports via one uni-directional transfer link (In). The RX links, are terminally ground referenced. The ports [3:0] with [19:0] bit lanes can be configured as a full width link with all 20 active lanes, a half width link with 10 active lanes or as a quarter width link with five active lanes.</p> <table border="1"> <thead> <tr> <th>Intel® QuickPath Interconnect</th> <th>5:0</th> <th>R</th> <th>P/N</th> <th>DAT[19:0]</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Port Number</td> <td>Receiver</td> <td>Differential Pair Polarity Positive/Negative</td> <td>Lane Number</td> </tr> </tbody> </table> <p>Example: CSI4RPDAT[0] represents port 5 Data, lane 0, receive signal and positive bit of the differential pair.</p>	Intel® QuickPath Interconnect	5:0	R	P/N	DAT[19:0]	Interface Name	Port Number	Receiver	Differential Pair Polarity Positive/Negative	Lane Number				
Intel® QuickPath Interconnect	5:0	R	P/N	DAT[19:0]												
Interface Name	Port Number	Receiver	Differential Pair Polarity Positive/Negative	Lane Number												
CSI[3:0]T[P/N]Dat[19:0], CSI[5:4]T[P/N]Dat[9:0]	O	<p>These output data signals provide means of communication between two ports via one uni-directional transfer link (Out).The links, Tx, are terminally ground referenced. The ports [3:0] with [19:0] bit lanes can be configured as a full width link with 20 active lanes, a half width link with 10 active lanes or as a quarter width link with five active lanes.</p> <table border="1"> <thead> <tr> <th>Intel® QuickPath Interconnect</th> <th>5:0</th> <th>T</th> <th>P/N</th> <th>DAT[19:0]</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Port Number</td> <td>Transmitter</td> <td>Differential Pair Polarity Positive/Negative</td> <td>Lane Number</td> </tr> </tbody> </table> <p>Example: CSI4TPDAT[0] represents port 5 Data, lane 0, transmit signal and positive bit of the differential pair.</p>	Intel® QuickPath Interconnect	5:0	T	P/N	DAT[19:0]	Interface Name	Port Number	Transmitter	Differential Pair Polarity Positive/Negative	Lane Number				
Intel® QuickPath Interconnect	5:0	T	P/N	DAT[19:0]												
Interface Name	Port Number	Transmitter	Differential Pair Polarity Positive/Negative	Lane Number												
ERROR[0]_N	O	<p>Side band signaling for system management. Refer to <i>Intel® Itanium® 9300 Plus Platform Design Guide-MC Platform Design Guide</i> for pin considerations and <i>Intel® Itanium® 9300 Series External Design Specification</i> for detailed signal description.</p>														
ERROR[1]_N	O	<p>Side band signaling for system management. Assertion on this pin indicates that an error reset response is required from the platform. Refer to <i>Intel® Itanium® 9300 Plus Platform Design Guide</i> for pin considerations and <i>Intel® Itanium® 9300 Series External Design Specification</i> for detailed signal description.</p>														
FBD0NBICLK[A/B][P/N]0	I	<p>These differential pair clock signals generated from the branch zero, channel A and B of FB-DIMMs are input to the processor.</p> <table border="1"> <thead> <tr> <th>FB-DIMM</th> <th>0</th> <th>NB</th> <th>I</th> <th>CLK</th> <th>A/B</th> <th>P/N</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Branch Number</td> <td>North Bound</td> <td>Input</td> <td>Clock</td> <td>Channel</td> <td>Differential Pair Polarity Positive/Negative</td> </tr> </tbody> </table> <p>Example: FBD0NBICLKAP0 represents FB-DIMM branch 0, northbound clock input signal of channel A and positive bit of the differential pair.</p>	FB-DIMM	0	NB	I	CLK	A/B	P/N	Interface Name	Branch Number	North Bound	Input	Clock	Channel	Differential Pair Polarity Positive/Negative
FB-DIMM	0	NB	I	CLK	A/B	P/N										
Interface Name	Branch Number	North Bound	Input	Clock	Channel	Differential Pair Polarity Positive/Negative										

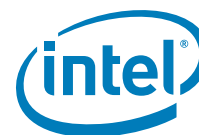


Table 7-1. Signal Definitions Intel Itanium Processor 9300 Series (Sheet 3 of 8)

Name	Type	Description														
FBD1NBICLK[C/D][P/N]0	I	<p>These differential pair clock signals generated from the branch one, channel C and D of FB-DIMMs are input to the Intel® Itanium® processor 9300 series</p> <table border="1"> <thead> <tr> <th>FB-DIMM</th> <th>1</th> <th>NB</th> <th>I</th> <th>CLK</th> <th>C/D</th> <th>P/N</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Branch Number</td> <td>North Bound</td> <td>Input</td> <td>Clock</td> <td>Channel</td> <td>Differential Pair Polarity Positive/Negative</td> </tr> </tbody> </table> <p>Example: FBD1NBICLKDP0 represent FB-DIMM branch 1, northbound clock input signal of channel D and positive bit of the differential pair.</p>	FB-DIMM	1	NB	I	CLK	C/D	P/N	Interface Name	Branch Number	North Bound	Input	Clock	Channel	Differential Pair Polarity Positive/Negative
FB-DIMM	1	NB	I	CLK	C/D	P/N										
Interface Name	Branch Number	North Bound	Input	Clock	Channel	Differential Pair Polarity Positive/Negative										
FBD0SBOCLK[A/B][P/N]0	O	<p>These differential pair output clock signals generated from the processor are inputs to the branch zero, channel A and B of FB-DIMMs.</p> <table border="1"> <thead> <tr> <th>FB-DIMM</th> <th>0</th> <th>SB</th> <th>O</th> <th>CLK</th> <th>A/B</th> <th>P/N</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Branch Number</td> <td>South Bound</td> <td>Output</td> <td>Clock</td> <td>Channel</td> <td>Differential Pair Polarity Positive/Negative</td> </tr> </tbody> </table> <p>Example: FBD0SBICLKAP0 represent FB-DIMM branch 0, southbound clock output signal of channel A and positive bit of the differential pair.</p>	FB-DIMM	0	SB	O	CLK	A/B	P/N	Interface Name	Branch Number	South Bound	Output	Clock	Channel	Differential Pair Polarity Positive/Negative
FB-DIMM	0	SB	O	CLK	A/B	P/N										
Interface Name	Branch Number	South Bound	Output	Clock	Channel	Differential Pair Polarity Positive/Negative										
FBD1SBOCLK[C/D][P/N]0	O	<p>These differential pair output clock signals generated from the processor are inputs to the branch one, channel C and D of FB-DIMMs.</p> <table border="1"> <thead> <tr> <th>FB-DIMM</th> <th>1</th> <th>SB</th> <th>O</th> <th>CLK</th> <th>C/D</th> <th>P/N</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Branch Number</td> <td>South Bound</td> <td>Output</td> <td>Clock</td> <td>Channel</td> <td>Differential Pair Polarity Positive/Negative</td> </tr> </tbody> </table> <p>Example: FBD1SBICLKDP0 represents FB-DIMM branch 1, southbound clock output signal of channel D and positive bit of the differential pair.</p>	FB-DIMM	1	SB	O	CLK	C/D	P/N	Interface Name	Branch Number	South Bound	Output	Clock	Channel	Differential Pair Polarity Positive/Negative
FB-DIMM	1	SB	O	CLK	C/D	P/N										
Interface Name	Branch Number	South Bound	Output	Clock	Channel	Differential Pair Polarity Positive/Negative										
FBDONBI[A/B][P/N][12:0]	I	<p>These differential pair data signals generated from the branch zero, channel A and B of FB-DIMMs are input to the processor.</p> <table border="1"> <thead> <tr> <th>FB-DIMM</th> <th>0</th> <th>NB</th> <th>I</th> <th>A/B</th> <th>P/N</th> <th>[12:0]</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Branch Number</td> <td>North Bound</td> <td>Input</td> <td>Channel</td> <td>Differential Pair Polarity Positive/Negative</td> <td>Lane Number</td> </tr> </tbody> </table> <p>Example: FBDONBIAP[0] represent FB-DIMM branch 0, northbound data input lane 0 signal of channel A and positive bit of the differential pair.</p>	FB-DIMM	0	NB	I	A/B	P/N	[12:0]	Interface Name	Branch Number	North Bound	Input	Channel	Differential Pair Polarity Positive/Negative	Lane Number
FB-DIMM	0	NB	I	A/B	P/N	[12:0]										
Interface Name	Branch Number	North Bound	Input	Channel	Differential Pair Polarity Positive/Negative	Lane Number										
FBDONBI[A/B][P/N][13]	I	<p>These signals are spare lanes, and are intended for Reliability, Availability, and Serviceability (RAS) coverage on future Intel Itanium processors. These signals are not used by Intel Itanium processor 9300 series processor.</p>														



Table 7-1. Signal Definitions Intel Itanium Processor 9300 Series (Sheet 4 of 8)

Name	Type	Description														
FBD[0/1]REFSYSCLK[P/N]	I	<p>These differential pair input clock signals are inputs to the branch zero and branch one of FB-DIMMs. They provide the 133.33 MHz differential reference clock.</p> <table border="1"> <thead> <tr> <th>FB-DIMM</th> <th>0</th> <th>REFSYSCLK</th> <th>P/N</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Branch Number</td> <td>Reference Clock</td> <td>Differential Pair Polarity Positive/Negative</td> </tr> </tbody> </table> <p>Example: FBD1REFSYSCLKP represents FB-DIMM branch 1, reference clk positive bit of the differential pair.</p>	FB-DIMM	0	REFSYSCLK	P/N	Interface Name	Branch Number	Reference Clock	Differential Pair Polarity Positive/Negative						
FB-DIMM	0	REFSYSCLK	P/N													
Interface Name	Branch Number	Reference Clock	Differential Pair Polarity Positive/Negative													
FBD1NBI[C/D][P/N][12:0]	I	<p>These differential pair data signals generated from the branch one, channel C and D of FB-DIMMs are input to the Intel® Itanium® processor 9300 series.</p> <table border="1"> <thead> <tr> <th>FB-DIMM</th> <th>1</th> <th>NB</th> <th>I</th> <th>C/D</th> <th>P/N</th> <th>[12:0]</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Branch Number</td> <td>North Bound</td> <td>Input</td> <td>Channel</td> <td>Differential Pair Polarity Positive/Negative</td> <td>Lane Number</td> </tr> </tbody> </table> <p>Example: FBD1NBICP[0] represents FB-DIMM branch 1, northbound data input lane 0 signal of channel C and positive bit of the differential pair.</p>	FB-DIMM	1	NB	I	C/D	P/N	[12:0]	Interface Name	Branch Number	North Bound	Input	Channel	Differential Pair Polarity Positive/Negative	Lane Number
FB-DIMM	1	NB	I	C/D	P/N	[12:0]										
Interface Name	Branch Number	North Bound	Input	Channel	Differential Pair Polarity Positive/Negative	Lane Number										
FBD1NBI[C/D][P/N][13]	I	<p>These signals are spare lanes, and are intended for RAS coverage on future Intel Itanium processors. These signals are not used by the processor</p>														
FBD0SBO[A/B][P/N][9:0]	O	<p>These differential pair output data signals generated from the processor to the branch zero, channel A and B of FB-DIMMs.</p> <table border="1"> <thead> <tr> <th>FB-DIMM</th> <th>0</th> <th>SB</th> <th>O</th> <th>A/B</th> <th>P/N</th> <th>[9:0]</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Branch Number</td> <td>South Bound</td> <td>Output</td> <td>Channel</td> <td>Differential Pair Polarity Positive/Negative</td> <td>Lane Number</td> </tr> </tbody> </table> <p>Example: FBD0SBOAP[0] represents FB-DIMM branch 1, southbound data output lane 0 signal of channel A and positive bit of the differential pair.</p>	FB-DIMM	0	SB	O	A/B	P/N	[9:0]	Interface Name	Branch Number	South Bound	Output	Channel	Differential Pair Polarity Positive/Negative	Lane Number
FB-DIMM	0	SB	O	A/B	P/N	[9:0]										
Interface Name	Branch Number	South Bound	Output	Channel	Differential Pair Polarity Positive/Negative	Lane Number										
FBD0SBO[A/B][P/N][10]	O	<p>These signals are spare lanes, and are intended for RAS coverage on future Intel Itanium processors. These signals are not used by Intel Itanium processor 9300 series.</p>														
FBD1SBO[C/D][P/N][9:0]	O	<p>These differential pair output data signals generated from the processor to the branch one, channel C and D of FB-DIMMs.</p> <table border="1"> <thead> <tr> <th>FB-DIMM</th> <th>1</th> <th>NB</th> <th>O</th> <th>C/D</th> <th>P/N</th> <th>[9:0]</th> </tr> </thead> <tbody> <tr> <td>Interface Name</td> <td>Branch Number</td> <td>North Bound</td> <td>Output</td> <td>Channel</td> <td>Differential Pair Polarity Positive/Negative</td> <td>Lane Number</td> </tr> </tbody> </table> <p>Example: FBD1SBOCP[0] represents FB-DIMM branch 1, southbound data output lane 0 signal of channel C and positive bit of the differential pair.</p>	FB-DIMM	1	NB	O	C/D	P/N	[9:0]	Interface Name	Branch Number	North Bound	Output	Channel	Differential Pair Polarity Positive/Negative	Lane Number
FB-DIMM	1	NB	O	C/D	P/N	[9:0]										
Interface Name	Branch Number	North Bound	Output	Channel	Differential Pair Polarity Positive/Negative	Lane Number										
FBD1SBO[C/D][P/N][10]	O	<p>These signals are spare lanes, and are intended for RAS coverage on future Intel Itanium processors. These signals are not used by Intel Itanium processor 9300 series.</p>														



Table 7-1. Signal Definitions Intel Itanium Processor 9300 Series (Sheet 5 of 8)

Name	Type	Description
FLASHROM_CFG[2:0]	I	These are input signals to the processor that would initialize and map the Flash ROM upon reset. After reset is deasserted this input would be ignored by the processor logic. These pins are sampled during all resets except warm-logic reset.
FLASHROM_CLK	O	The Flash ROM clock.
FLASHROM_CS[3:0]_N	O	Flash ROM chip selects. Up to four separate flash ROM parts may be used.
FLASHROM_DATI	I	Serial Data Input (from ROM(s) to processor).
FLASHROM_DATO	O	Serial Data Output (from processor to ROM(s))
FLASHROM_WP_N	O	Flash ROM write-protect.
FORCEPR_N	I	When logic 0, forces processor power reduction through the FOXTON controller. Refer to <i>Intel® Itanium® 9300 Series External Design Specification</i> for detailed signal description.
LRGSCLSYS	I	The header mode is selected by the LRGSCLSYS strapping pin value sampled only during COLD reset. LRGSCLSYS, when tied to 1.1 V using a 50 ohm resistor, puts the processor in extended header mode, and LRGSCLSYS, when tied to GND, puts the the processor in standard header mode.
MEM_THROTTLE_L	I	When this pin is asserted, the internal memory controllers throttle the memory command issue rate to a configurable fraction of the nominal command rate settings.
PIR_SCL	I	(Processor Information ROM Serial Clock): The PIR_SCL input clock is used to clock data into and out of the on package PIROM device. This signal applies to the EEPROM, which is composed of the PIROM and the OEM Scratch PAD.
PIR_SDA	I/O	(Processor Information ROM Serial Data): The PIR_SDA pin is a bidirectional signal for serial data transfer. This signal applies to the EEPROM, which is composed of the PIROM and the OEM Scratch PAD
PIR_A0, PIR_A1	I	(Processor Information ROM Address[0:1]): The PIR_A[0:1] pins are used as the PIROM memory address selection signals. This bus applies to the EEPROM, which is composed of the PIROM and the OEM Scratch PAD
SM_WP	I	WP (Write Protect) can be used to write protect the Scratch EEPROM. The Scratch EEPROM is write-protected when this input is pulled high to VCC33_SM.
PRBMODE_REQ_N	I	Input from Extended Debug Port (XDP) to make a probe mode request.
PRBMODE_RDY_N	O	Output to XDP to acknowledge probe mode request.
PROCHOT_N	O	The assertion of PROCHOT_N (processor hot) indicates that the processor die temperature has reached its thermal limit.
PROCTYPE	O	PROCTYPE output informs the platform the processor type. PROCTYPE is tied to VSS internally to indicate the Intel® Itanium® processor 9300 series. This pin does not require a platform pull-up or pull-down.
PWRGOOD	I	The processor requires this signal to be a clean indication that all the processor clocks and power supplies are stable and within their specifications. "Clean" implies that the signal will remain low (capable of sinking leakage current), without glitches, from the time that the power supplies are turned on until they come within specification. The signal must then transition monotonically to a high state. PWRGOOD can be driven inactive at any time, but clocks and power must again be stable before a subsequent rising edge of PWRGOOD. The PWRGOOD signal must be supplied to the processor. This signal is used to protect internal circuits against voltage sequencing issues. It should be driven high throughout boundary scan operation.
RESET_N	I	Asserting the RESET_N signal resets the processor to a known state and invalidates its internal caches without writing back any of their contents. BOOTMODE[0:1] signals are sampled during all RESET_N assertions for selecting appropriate BOOTMODE.
RSVD		These pins are reserved and should be left unconnected.
SKTID[2:0]	I	Socket ID strapping pins. To pull any of these inputs high, they should be strapped to VCCIO, and to pull them low, they should be strapped to VSS. SKTID[2:0] partially determine the node address.



Table 7-1. Signal Definitions Intel Itanium Processor 9300 Series (Sheet 6 of 8)

Name	Type	Description
SMBCLK	I/O	The SMBus Clock (SMBCLK) signal is an input clock to the system management logic which is required for operation of the system management features of the Intel Itanium processor 9300 series. This clock is driven by the SMBus controller and is asynchronous to other clocks in the processor. This is an open drain signal. Intel Itanium processor 9300 series is Slave only.
SMBDAT	I/O	The SMBus Data (SMBDAT) signal is the data signal for the SMBus. This signal provides the single-bit mechanism for transferring data between SMBus devices. This is an open drain signal. Intel Itanium processor 9300 series is Slave only.
SPDCLK	I/O	This is a bi-directional clock signal between the processor, DRAM SPD registers and external components on the board. This is an open drain signal. The processor is Master only; refer to <i>Intel® Itanium® 9300 Series External Design Specification</i> for limitations.
SPDDAT	I/O	This is a bi-directional data signal between the processor, DRAM SPD registers and external components on the board. This is an open drain signal. Intel Itanium processor 9300 series is Master only; refer to <i>Intel® Itanium® Processor 9300 Series External Design Specification</i> for limitations.
SYSCLK/SYSCLK_N	I	The differential clock pair SYSCLK/SYSCLK_N provides the fundamental clock source for the processor. All processor link agents must receive these signals to drive their outputs and latch their inputs. All external timing parameters are specified with respect to the rising edge of SYSCLK crossing the falling edge of SYSCLK_N. This differential clock pair should not be asserted until VCCA, VCCIO, VCC33_SM, and VCC (12 V Ararat) are stabilized.
SYSUTST_REFCLK/ SYSUTST_REFCLK_N	I	These serve as reference clocks for the processor socket logic analyzer interposer device during debug. It is not used by the processor, and is not connected internally to the die. Electrical specifications on these clocks are identical to SYSCLK/ SYSCLK_N
TCK	I	Test Clock (TCK) provides the clock input for the processor TAP.
TDI	I	Test Data In (TDI) transfers serial test data into the processor. TDI provides the serial input needed for JTAG specification support.
TDO	O	Test Data Out (TDO) transfers serial test data out of the processor. TDO provides the serial output needed for JTAG specification support.
TESTHI[1]	I	This pin must be tied to 1.1 V using a 50 ohm resistor.
TESTHI[2]	I	This pin must be tied to 1.1 V using a 50 ohm resistor.
TESTHI[4]	I	This pin must be tied to 1.1 V using a 5k ohm resistor.
THERMALERT_N	O	Thermal Alert (THERMALERT_N) is an output signal and is asserted when the on-die thermal sensors readings exceed a pre-programmed threshold.
THERMTRIP_N	O	The processor protects itself from catastrophic overheating by use of an internal thermal sensor. Thermal Trip will activate at a temperature that is significantly above the maximum case temperature (TCASE) to ensure that there are no false trips. Once activated, the processor will stop all execution and the signal remains latched until RESET_N goes active. There is no hysteresis built into the thermal sensor itself; as long as the die temperature drops below the trip level, a RESET_N pulse will reset the processor and execution will continue. If the temperature has not dropped below the trip level, the processor will continue to drive THERMTRIP_N and remain stopped.
TMS	I	Test Mode Select (TMS) is a JTAG specification support signal used by debug tools.
TRIGGER[1:0]	I	TRIGGER[1:0] pins are needed for XDP connectivity; please refer to <i>RS - Boxboro-MC Platform OEM Test and Debug Guide</i> for routing guidelines.
TRST_N	I	Test Reset (TRST_N) resets the TAP logic. TRST_N must be driven electrically low during power on Reset. Please refer to <i>RS - Boxboro-MC Platform OEM Test and Debug Guide</i> for routing guidelines.
VCC33_SM	I	VCC33_SM is a 3.3 V supply to the processor package, required for the PIROM interface on the processor package and also Flash device. This pin must be routed to a 3.3 V supply.
VCCA	I	VCCA provides a +1.8 V isolated power supply to the analog portion of the internal PLL's. Refer to the <i>Intel® Itanium® Processor 9300 Series Platform Design Guide</i> for routing/decoupling recommendations for VCCA.

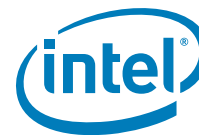


Table 7-1. Signal Definitions Intel Itanium Processor 9300 Series (Sheet 7 of 8)

Name	Type	Description
VCCCACHE	I	This provides power to the L3 cache on the processor. This is on the top of the package and is driven by the Ararat Voltage Regulator. Actual value of the voltage is determined by the settings of VID_VCCCACHE[5:0]
VCCCACHESENSE/ VSSCACHESENSE		Remote sense lines used by the Ararat Voltage Regulator to sense VCCCACHE die voltage. The Voltage Regulator should not draw more than 0.1mA from these pads.
VCCCORE	I	This provides power to the Cores on the processor. This is on the top of the package and is driven by the Ararat Voltage Regulator. Actual value of the voltage is determined by the settings of VID_VCCCORE[6:0]
VCCCORESENSE/ VSSCORESENSE		Remote sense lines used by the Ararat Voltage Regulator to sense VCCCORE die voltage. The Voltage Regulator should not draw more than 0.1 mA from these pads.
VCCUNCORE	I	This provides power to the Uncore on the processor. This is on the top of the package and is driven by the Ararat Voltage Regulator. Actual value of the voltage is determined by the settings of VID_VCCUNCORE[6:0]
VCCUNCORESENSE/ VSSUNCORESENSE		Remote sense lines used by the Ararat Voltage Regulator to sense VCCUNCORE die voltage. The Voltage Regulator should not draw more than 0.1 mA from these pads.
VCCIO	I	VCCIO provides power to the input/output interface on the processor die.
VCCIO_FBD	I	VCCIO_FBD provides power to the FBD_DIMM input/output interface on the processor die.
VFUSERM	I	This pin must be tied to VCCIO or connected to VCCIO via 0 ohm resistor.
VID_VCCCORE[6:0] VID_VCCUNCORE[6:0] VID_VCCCACHE[5:0]	O	VCCCORE_VID, VCCUNCORE_VID and VID_VCCCACHE (Voltage ID) pads are used to support automatic selection of VCCCORE, VCCUNCORE and VCCCACHE. The VCCCORE, VCCUNCORE and VCCCACHE Voltage Regulator (Ararat) outputs must be disabled prior to these pins becoming invalid. The VID pins are needed to support processor voltage specification variations. The VCCCORE, VCCUNCORE and VCCCACHE Voltage Regulator (Ararat) outputs must supply the voltage that is requested by these pins, or disable itself.
VR_FAN_N	I/O	This signal is open drain/collector driven by Ararat Voltage Regulator into a pad at the top of the processor package and out through a pin at the bottom of the processor package. When asserted, it indicates that the temperature on the Ararat solution is approximately 10% below the VR_THERMTRIP_N limit. <i>The Processor cores do not monitor or respond to this signal.</i> The Platform could monitor this pin to implement thermal management, such as controlling fan speed (airflow).
VR_PROCTYPE[1:0]	O	VR_PROCTYPE output informs the Ararat Voltage Regulator the processor type. These pins are tied to VSS ('00) on Intel Itanium processor 9300 series. These pads are located at the top of the package. Future processors may use different bit configurations for this bus.
VR_THERMALERT_N	I/O	This signal is open drain/collector driven by Ararat Voltage Regulator into a pad at the top of the processor package and out through a pin at the bottom of the processor package. When asserted, it indicates that the temperature on the Ararat solution is about to exceed the VR_THERMTRIP_N limit. <i>When enabled in the processor, this signal causes the processor to enter a throttling state to reduce the power consumption level.</i> The Platform could monitor this pin to implement thermal management.
VR_THERMTRIP_N	I/O	This signal is open drain/collector driven by Ararat Voltage Regulator into a pad at the top of the processor package and out through a pin at the bottom of the processor package. When asserted, it indicates that the temperature on the Ararat solution has exceeded a critical threshold and it is required to shut down the Ararat solution immediately. <i>The Processor cores do not monitor or respond to this signal.</i> The Platform should immediately de-assert VROUTPUT_ENABLE0. If the Platform does not respond to this signal, the Ararat Voltage Regulator is permitted to shutdown, but should latch VR_THERMTRIP_N low, which can be reset by a power cycle or de-assertion of VROUTPUT_ENABLE0. VR_THERMTRIP_N trip point is determined by the Ararat Voltage Regulator Design and it should be set such that VR_THERMTRIP_N is asserted prior to permanent damage to the Ararat voltage regulator.
VROUTPUT_ENABLE	I/O	This signal is an input to the processor package (bottom), and drives into the Ararat voltage regulator from the top of the package. This should be driven by an open collector/drain driver, and a pull-up resistor should be located on the Ararat Voltage Regulator with a maximum load of 2mA, pulled to either 3.3 V or 1.1 V. When this signal is pulled down, the Ararat Voltage regulator should shut down VCCCORE, VCCUNCORE and VCCCACHE.



Table 7-1. Signal Definitions Intel Itanium Processor 9300 Series (Sheet 8 of 8)

Name	Type	Description
VRPWRGD	I /O	This signal is open drain/collector driven by Ararat Voltage Regulator into a pad at the top of the processor package and out through a pin at the bottom of the processor package. When pulled up (active high state), it indicates that the supply voltages to VCCCORE, VCCUNCORE, and VCCCACHE are stable within their voltage specification, and indicates that the Ararat VR start up sequence is completed. This signal will transition to a logic low for power off sequencing and/or any Ararat VR fault condition.
VSS	I	VSS is the ground plane for the processor.
VSSCACHESENSE		See VCCCACHESENSE
VSSCORESENSE		See VCCCORESENSE
VSSUNCORESENSE		See VCCUNCORESENSE
XDPOCPD[7:0]	I/O	Bidirectional XDP data
XDPOCP_STRB_IN_N	I	input clock center-aligned with XDPOCP_FRAME_N and XDPOCPD[7:0]
XDPOCP_STRB_OUT_N	O	output clock edge-aligned with XDPOCP_FRAME_N and XDPOCPD[7:0]
XDPOCP_FRAME_N	I/O	Bidirectional signal indicating valid data on XDPOCPD[7:0]

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