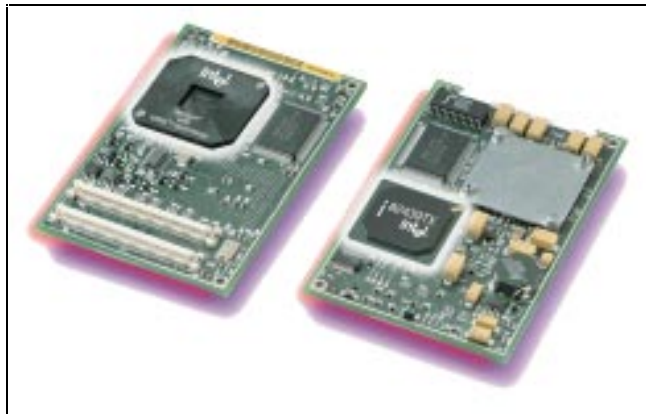




INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE ON .25 MICRON

- Intel Pentium® Processor with MMX™ Technology on .25 Micron running at 166/200/233/266 MHz
- Second-level cache of pipeline burst SRAM
 - Burst read/write at 3-1-1-1; back-to-back burst reads at 3-1-1-1-1-1-1-1
 - Supports up to 64MB of cacheable system memory (non-PCI memory)
- Supports ZZ snooze mode power management
- Processor core voltage regulation supports input voltages
 - 5V to 20V at or above 85% peak efficiency
 - All CPU and I/O ring voltages supplied by the module.
- Thermal transfer plate for heat dissipation
- Intel 430TX PCIset system controller
 - DRAM controller supports EDO and SDRAM at 3.3V
 - Provides PCI CLKRUN# signal to control memory clock on the PCI bus
 - SDRAM clock enable support and self refresh of EDO or SDRAM during Suspend mode
 - Compatible SMRAM (C_SMRAM) and Extended SMRAM (E_SMRAM) modes of power management; E_SMRAM mode supports write-back cacheable SMRAM up to 1MB
 - 3.3V PCI bus control, Rev 2.1 compliant
- Active thermal feedback (ATF) sensing
 - Internal A/D - digital signaling (SMBUS) across the module interface
 - Programmable trip point interrupt or poll mode for reading temperature

The Intel Pentium® Processor with MMX™ Technology 166/200/233/266 MHz Mobile Module is a small, highly integrated assembly containing an Intel mobile processor and its immediate system-level support. Specifically, the power supply for the processor's unique voltage requirements, the system Level 2 cache memory and the core logic required to bridge the processor to the standard system buses are on the module. The module interfaces electrically to its host system via a 3.3-volt PCI bus, a 3.3-volt memory bus, and 2.5-volt Intel 430TX PCIset control signals.



Information in this document is provided in connection with Intel products. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Intel's Terms and Conditions of Sale for such products, Intel assumes no liability whatsoever, and Intel disclaims any express or implied warranty, relating to sale and/or use of Intel products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright or other intellectual property right. Intel products are not intended for use in medical, life saving, or life sustaining applications.

Intel may make changes to specifications and product descriptions at any time, without notice.

Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them.

The Intel Mobile Module may contain design defects or errors known as errata. Current characterized errata are available on request.

MPEG is a international standard for video compression/decompression promoted by ISO. Implementations of MPEG CODEC's, or MPEG enabled platforms may require licenses from various entities, including Intel Corporation.

Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order.

Copies of documents which have an ordering number and are referenced in this document, or other Intel literature, may be obtained by calling 1-800-548-4725 or by visiting Intel's website at <http://www.intel.com>

Copyright © Intel Corporation 1997.

* Third-party brands and names are the property of their respective owners.



CONTENTS

	PAGE		PAGE
1.0. INTRODUCTION.....	4	3.3.2. 64-MBIT SDRAM SUPPORT.....	21
1.1. ARCHITECTURE OVERVIEW	4	3.3.3. PCI INTERFACE.....	22
1.2. INTEL MOBILE MODULE REVISION IDENTIFICATION	5	3.4. PROCESSOR CORE VOLTAGE REGULATION	23
2.0. MODULE CONNECTOR INTERFACE	6	3.4.1. VOLTAGE REGULATOR EFFICIENCY.....	23
2.1. SIGNAL DEFINITIONS	6	3.4.2. VOLTAGE REGULATOR CONTROL.....	24
2.1.1. MEMORY (108 SIGNALS).....	7	3.4.3. VOLTAGE SIGNAL DEFINITION AND SEQUENCING	25
2.1.2. PCI (56 SIGNALS).....	8	Voltage Plane Sequencing.....	26
2.1.3. PROCESSOR/PIIX4 ISA BRIDGE SIDEBAND (9 SIGNALS)	10	3.5. ACTIVE THERMAL FEEDBACK	26
2.1.4. POWER MANAGEMENT (8 SIGNALS).....	11	3.6. THERMAL TRANSFER PLATE.....	27
2.1.5. CLOCK (8 SIGNALS)	12	3.7. MODULE THERMAL RESISTANCE	27
2.1.6. VOLTAGES (39 SIGNALS)	13	4.0. MECHANICAL REQUIREMENTS.....	27
2.1.7. ITP/JTAG (7 SIGNALS).....	14	4.1. MODULE DIMENSIONS.....	27
2.1.8. MISCELLANEOUS (44 SIGNALS).....	15	4.1.1. BOARD AREA	27
2.2. CONNECTOR PIN ASSIGNMENTS	16	4.1.2. PRINTED CIRCUIT BOARD THICKNESS.....	30
2.3. CONNECTOR FOOTPRINT	18	4.1.3. HEIGHT RESTRICTIONS	30
2.3.1. PIN AND PAD ASSIGNMENT	18	4.2. MODULE PHYSICAL SUPPORT	32
2.4. CONNECTOR SPECIFICATIONS	19	4.3. MODULE MOUNTING REQUIREMENTS	32
3.0. FUNCTIONAL DESCRIPTION.....	20	4.4. MODULE PRODUCT TRACKING CODE.....	34
3.1. INTEL MOBILE MODULE.....	20	5.0. ENVIRONMENTAL STANDARDS.....	35
3.2. L2 CACHE	20		
3.3. 430TX PCISSET SYSTEM CONTROLLER.....	20		
3.3.1. MEMORY ORGANIZATION.....	21		



INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

processors and the next Northbridge device for the next generation of Intel mobile processors.

1.0. INTRODUCTION

The Intel Pentium® processor with MMX™ technology Mobile Module is the fundamental building block for a system manufacturer to incorporate into a notebook system. The Intel Mobile Module incorporates an Intel Pentium Processor with MMX Technology Mobile Processor, second-level cache, Intel 430TX PCIset Northbridge system controller, voltage regulator, and thermal sensor on a single printed circuit board.

Intel's PCIset architecture allows for physical partitioning at both the PCI and DRAM interfaces; therefore the electrical interconnect defined for the Intel Mobile Module includes the PCI bus, DRAM memory bus and some PCIset sideband signals. An onboard voltage regulator provides the DC conversion from the system manufacturer's DC voltage to the processor's core voltage and the 2.5V CPU interface signals. This isolation of the processor voltage requirements allows the system manufacturer to incorporate Intel Mobile Modules with different processor variants into a notebook system.

Building around this modular design gives the system manufacturer these advantages:

- Avoids complexities associated with designing high-speed processor core logic boards
- No requirement for manufacturing capabilities of Tape Carrier Package (TCP) processors
- Future Intel Mobile Modules provide an upgrade path for notebook designs using a standard interface
- Eliminates the need to design for unique voltage requirements over succeeding generations of processors.

The 430TX PCIset (Northbridge) is one of two physical VLSI devices that constitute the Intel 430TX PCIset controller. The second 430TX device (Southbridge) is known as the PIIX4 ISA bridge. The manufacturer's system electronics, which connects to the Intel Mobile Module, must include a PIIX4 ISA bridge device. The PIIX4 ISA bridge provides extensive power management capabilities and is designed to support both the 430TX PCIset for current mobile Pentium

1.1. Architecture Overview

The Intel Mobile Module is a small, highly integrated assembly containing the Pentium Processor with MMX Technology 166/200/233/266 MHz Mobile Processor with internal/bus frequencies of 166/66, 200/66, 233/66, and 266/66 MHz and its immediate system-level support. The module interfaces electrically to its host system via a 3.3V PCI bus, a 3.3V memory bus, 2.5V CPU interface signals, and the Intel 430TX PCIset system controller.

The Intel Mobile Module includes a second-level cache of pipeline burst SRAM with capabilities to burst read/write at 3-1-1-1 and back-to-back burst reads at 3-1-1-1-1-1-1-1. The module supports up to 64 MB of cacheable system memory (non-PCI memory) and ZZ snooze mode power management.

The Intel Mobile Module contains key features of the Intel 430TX PCIset system controller. The DRAM controller supports EDO at 3.3V with a burst read at 5-2-2-2 (60ns) and SDRAM at 3.3V with a burst read at 6-1-1-1 (66 MHz, CL=2). The system controller provides a PCI CLKRUN# signal to control memory clock on the PCI bus as well as the internal clock control (also known as Chip Standby or Gated Clock). The SDRAM clock enables support and self refresh of EDO or SDRAM during Suspend mode and is fully compatible SMRAM (C_SMRAM) and Extended SMRAM (E_SMRAM) modes of power management; E_SMRAM mode supports write-back cacheable SMRAM up to 1 MB. The Intel 430TX PCIset system controller is a 3.3V PCI bus control which is compliant with PCI Rev 2.1 specifications.

The processor core voltage regulation supports input voltages from 5V to 20V (+5 percent) enabling at or above 85 percent peak efficiencies and de-couples processor voltage requirements from the system.

The Intel Mobile Module incorporates Active Thermal Feedback (ATF) sensing which is ACPI Rev 1.0 compliant by including an internal A/D - digital signaling (SMBUS) across the module interface and a programmable trip point interrupt or poll mode for reading temperature.

A thermal transfer plate for heat dissipation from the processor provides a standard thermal attach point to which the system manufacturer connects a system heat pipe and heat spreader plate.

unique revision levels. The system electronics can use these pins to determine a particular revision level of an Intel Mobile Module. System manufacturer software can query these revision ID bits, along with the 430TX PCIset, to provide complete revision level identification.

Figure 1 illustrates the block diagram of the Intel Mobile Module.

1.2. Intel Mobile Module Revision Identification

The Intel Mobile Module provides four dedicated connector pins for the sole purpose of identifying the revisions. These four pins allow up to 16

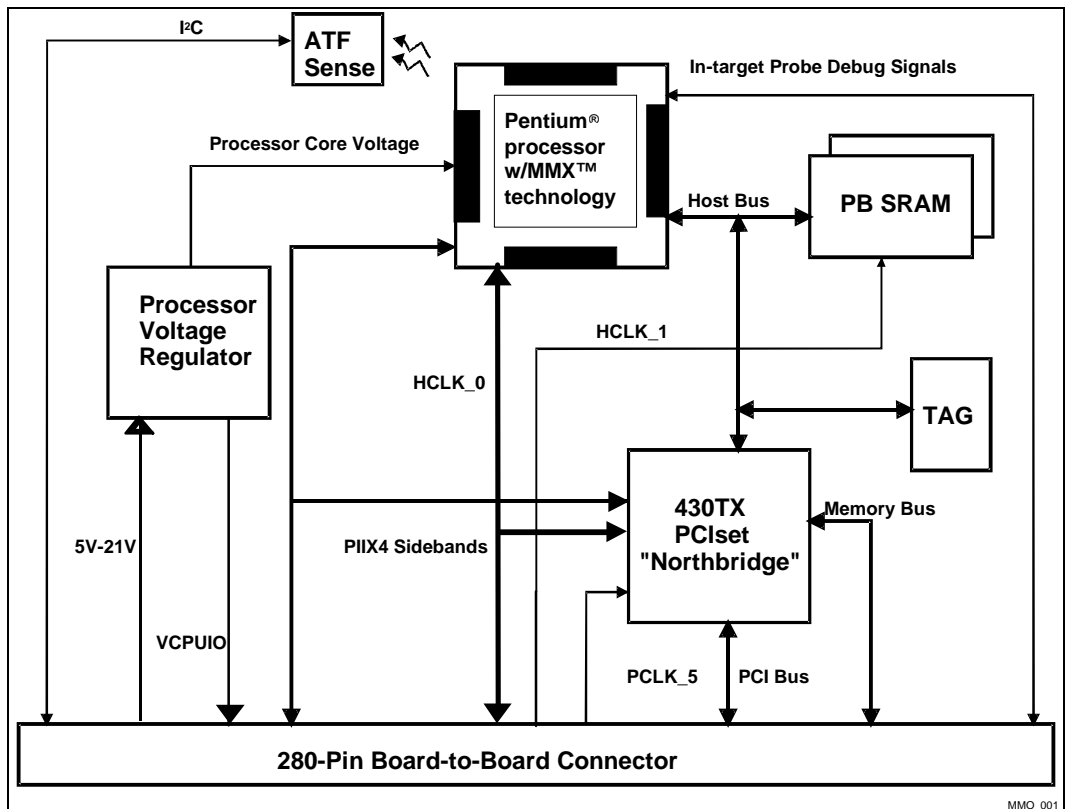


Figure 1. Block Diagram for the Intel Mobile Module

2.0. MODULE CONNECTOR INTERFACE

2.1. Signal Definitions

The Intel Mobile Module connector signals are defined with the intention of supporting future modules. Table 1 provides a list of signals by category and the corresponding number of signals in each category.

Table 1. Module Connector Signal Summary

Signal Group	Number
Memory	108
PCI	56
Processor/PIIX4 ISA bridge Sideband	9
Power Management	8
Clocks	8
Voltage: V_DC	10
Voltage: V_3S	20
Voltage: V_5	1
Voltage: V_3	5
Voltage: V_CPUIO	3
ITP/JTAG	7
Misc. & Module ID	5
Ground	32
Reserved	7
Total	280



INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

2.1.1. MEMORY (108 SIGNALS)

Table 2 lists the Intel Mobile Module memory interface signals. Some signals are defined as "RESERVED" for future use.

Table 2. Memory Signal Descriptions

Name	Type	Voltage	Description
MPD[7:0]	I/O	V_3S	Memory Parity Data: These signals connect to the DRAM parity. These pins are not implemented in the 430TX PCIsset and are reserved.
*RAS[5:0]# or CS[5:0]#	O	V_3S	Row Address Strobe (EDO): These pins select the DRAM row. Chip Select (SDRAM): These pins activate the SDRAMs. SDRAM accepts any command when its CS# pin is active low.
*CAS[7:0]# or DQM[7:0]	O	V_3S	Column Address Strobe (EDO): These pins select the DRAM column. Input/Output Data Mask (SDRAM): These pins act as synchronized output enables during a read cycle and as a byte mask during a write cycle.
*MA[13:0]	O	V_3S	Memory Address (EDO/SDRAM): This is the row and column address for DRAM. These buffers now include programmable size selection, as controlled by the DRAMEC[MAD] bit. The 430TX PCIsset implements (and the Intel Mobile Module supports) only MA[13:0]. See Figure 3 for more details.
*MWE[A,B]#	O	V_3S	Memory Write Enable (EDO/SDRAM): MWE[A,B]# should be used as the write enable for the memory data bus. Each copy is intended to support four rows, for loading purposes.
*SRAS[A,B]#	O	V_3S	SDRAM Row Address Strobe (SDRAM): When active low, this signal latches Row Address on the positive edge of the clock. This signal also allows Row access and pre-charge. Each copy is intended to support four rows, for loading purposes. The SRASA signal is used to configure the Mobile Mode of the 430TX PCIsset. When the RST# signal is active, SRASA is an input. The Intel Mobile Module has a pull-down resistor so that SRASA is sampled low at the rising edge of RST#; thereby configuring the 430TX PCIsset in Mobile Mode.
*SCAS[A,B]#	O	V_3S	SDRAM Column Address Strobe (SDRAM): When active low, this signal latches Column Address on the positive edge of the clock. This signal also allows Column access. Each copy is intended to support four rows, for loading purposes.
*CKE[A,B]#	O	V_3S	SDRAM Clock Enable (SDRAM): SDRAM clock enable pin. When these signals are de-asserted, SDRAM enters power-down mode. Each copy is intended to support four rows, for loading purposes.
MD[63:0]	I/O	V_3S	Memory Data: These signals are connected to the DRAM data bus. They are not terminated on the Intel Mobile Module and it is recommended that the system electronics provide series termination of 33Ω.

* - These signals are terminated with a 22Ω series resistor on the Intel Mobile Module.

INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

2.1.2. PCI (56 SIGNALS)

Table 3 lists the Intel Mobile Module's PCI interface signals.

Table 3. PCI Signal Descriptions

Name	Type	Voltage	Description
AD[31:0]	I/O	V_3S	Address/Data: The standard PCI address and data lines. The address is driven with FRAME# assertion, and data is driven or received in following clocks.
C/BE[3:0]#	I/O	V_3S	Command/Byte Enable: The command is driven with FRAME# assertion, and byte enables corresponding to supplied or requested data are driven on following clocks.
FRAME#	I/O	V_3S	Frame: Assertion indicates the address phase of a PCI transfer. Negation indicates that one more data transfer is desired by the cycle initiator.
DEVSEL#	I/O	V_3S	Device Select: This signal is driven by the 430TX PCIsset when a PCI initiator is attempting to access DRAM. DEVSEL# is asserted at medium decode time.
IRDY#	I/O	V_3S	Initiator Ready: Asserted when the initiator is ready for data transfer.
TRDY#	I/O	V_3S	Target Ready: Asserted when the target is ready for a data transfer.
STOP#	I/O	V_3S	Stop: Asserted by the target to request the master to stop the current transaction.
LOCK#	I/O	V_3S	Lock: Used to establish, maintain and release resource locks on PCI.
REQ[3:0]#	I	V_3S	PCI Request: PCI master requests for PCI.
GNT[3:0]#	O	V_3S	PCI Grant: Permission is given to the master to use PCI.
*PHOLD#	I	V_3S	PCI Hold: This signal comes from the expansion bridge; it is the bridge request for PCI. The 430TX PCIsset will drain the DRAM write buffers, drain the processor-to-PCI posting buffers, and acquire the host bus before granting the request via PHLDA#. This ensures that GAT timing is met for ISA masters. The PHOLD# protocol has been modified to include support for passive release.
*PHLDA#	O	V_3S	PCI Hold Acknowledge: This signal is driven by the 430TX PCIsset to grant PCI to the expansion bridge. The PHLDA# protocol has been modified to include support for passive release.
PAR	I/O	V_3S	Parity: A single parity bit is provided over AD[31:0] and C/BE[3:0]



INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

*SERR#	O	V_3S	System Error: This signal is driven low by any PCI device that detects a system error. It is not implemented in the 430TX PCIset, however to maintain compatibility with future modules a pull up is required.
*CLKRUN#	I/O	V_3S	Clock Run: An open-drain output and also an input. The 430TX PCIset requests the central resource (PIIX4 ISA bridge) to start or maintain the PCI clock by asserting CLKRUN#. The 430TX PCIset tri-states CLKRUN# upon de-assertion of Reset. An external 8.2K Ω to 10K Ω pull up resistor is required.
PCI_RST#	I	V_3S	Reset: This signal asynchronously resets the 430TX PCIset. The PCI signals also tri-state, compliant with PCI Rev 2.0 and 2.1 specifications.

* - These signals are open-drain and require a pull up resistor on the system electronics.



INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

**2.1.3. PROCESSOR/PIIX4 ISA BRIDGE
SIDE BAND (9 SIGNALS)**

Table 4 lists the Intel Mobile Module's processor and PIIX4 ISA bridge sideband signals at the

connector interface. (Refer to the PIIX4 ISA Bridge External Architecture Specification (Order Number 290562-001) for complete signal descriptions and detailed functions.) The voltage level for these signals is determined by V_CPUIO, which is supplied by the Intel Mobile Module

Table 4. Processor/PIIX4 ISA Bridge Sideband Signal Descriptions

Name	Type	Voltage	Description
FERR#	O	V_CPUIO	Numeric Coprocessor Error: This pin functions as a FERR# signal supporting coprocessor errors. This signal is tied to the coprocessor error signal on the processor and is driven by the processor to the PIIX4 ISA bridge. NOTE: This signal does NOT require a pull up on the system electronics. A pull up is present on the Intel Mobile Module.
*CPURST	I	V_CPUIO	Processor Reset: The PIIX4 ISA bridge asserts CPURST to reset the processor. The PIIX4 ISA bridge asserts CPURST# during power-up and when a hard reset sequence is initiated through the RC register.
*IGNNE#	I	V_CPUIO	Ignore Error: This signal is connected to the ignore error pin on the processor and is driven by the PIIX4 ISA bridge.
*INIT#	I	V_CPUIO	Initialization: INIT is asserted by the PIIX4 ISA bridge to the processor for system initialization. NOTE: The system manufacturer should provide a pull up/pull down option on this pin, and connect this PIIX4 ISA bridge input to the Intel Mobile Module connector PIN BB38.
*INTR	I	V_CPUIO	Processor Interrupt: INTR is driven by the PIIX4 ISA bridge to signal the processor that an interrupt request is pending and needs to be serviced.
*NMI	I	V_CPUIO	Non-Maskable Interrupt: NMI is used to force a non-maskable interrupt to the processor. The PIIX4 ISA bridge generates an NMI when either SERR# or IOCHK# is asserted, depending on how the NMI Status and Control Register is programmed.
*A20M#	I	V_CPUIO	Address Bit 20 Mask: When enabled, this causes the processor to emulate the address wraparound at one Mbyte which occurs on the Intel 8086 processor.
*SMI#	I	V_CPUIO	System Management Interrupt: SMI# is an active low synchronous output that is asserted by the PIIX4 ISA bridge in response to one of many enabled hardware or software events. The SMI# signal can be an asynchronous input to the processor. However, in this chip set SMI# is synchronous to PCLK.
*STPCLK#	I	V_CPUIO	Stop Clock: STPCLK# is an active low synchronous output that is asserted by the PIIX4 ISA bridge in response to one of many hardware or software events. STPCLK# connects directly to the processor and is synchronous to PCLK. When the processor samples STPCLK# asserted it responds by stopping its internal clock.

* - These signals are open-drain and require a pull up resistor on the system electronics.



**2.1.4. POWER MANAGEMENT
(8 SIGNALS)**

Table 5 lists the Intel Mobile Module's Power Management signals. The SM_CLK and SM_DATA signals refer to the two-wire serial SMBus interface.

Although this interface is currently used solely for the digital thermometer thermal sensor, there are reserved serial addresses for future use.

Table 5. Power Management Signal Descriptions

Name	Type	Voltage	Description
*OEM_PU	I	V_3	OEM Pull-up: A pull up resistor of 10KΩ is required on OEM_PU.
L2_ZZ	I	V_3	Low-Power Mode For Cache SRAM: This pin is used to power down the L2 cache SRAMs . See PIIX4 ISA Bridge External Architecture Specification (Order Number 290562-001) on ZZ.
SUS_STAT#	I	**V_3ALWAYS	Suspend Status: This signal connects to the SUS_STAT1# output of the PIIX4. It provides information on the host clock status and is asserted during all suspend states..
VR_ON	I	V_3S	VR_ON: Voltage regulator on. This 3.3V signal controls the operation of the Intel Mobile Module's voltage regulator. This signal should be generated as a function of the PIIX4 SUSB# signal. VR_ON should be timed to rise after the switch power planes have stabilized. Please refer to section 3.4.2 for proper VR_ON sequencing.
VR_PWRGD	O	V_3S	VR_PWRGD: Driven by the Intel Mobile Module to indicate the voltage regulator is stable. Can be used in some combination to generate the system PWROK signal. CAUTION: This signal has an output impedance of approximately 100kΩ. Care must be taken to prevent loading of this signal.
SM_CLK	I	V_3	Serial Clock: Clock signal used on the SMBUS - SMBus interface to the digital thermometer.
SM_DATA	I/O	V_3	Serial Data: Data signal on the SMBUS - SMBus interface to the digital thermometer.
*ATF_INT#	O	V_3	ATF Interrupt: Output signal of the digital thermometer. See National Semiconductor LM75 specification for pull up values.

* - These signals are open-drain and require a pull up resistor on the system electronics.

** - V_3ALWAYS is the 3.3V continuous supply. This voltage is generated whenever V_DC is available and supplied to the PIIX4 resume well.

INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

2.1.5. CLOCK (8 SIGNALS)

Table 6 lists the Intel Mobile Module's clock signals.

Table 6. Clock Signal Descriptions

Name	Type	Voltage	Description															
*OEM_PD	I	V_3	OEM Pull-Down: A pull-down resistor of 1KΩ is required on OEM_PD.															
PCLK	I	V_3S	PCI Clock In: PCLK is an input to the Intel Mobile Module from the CKDM66-M clock source and is one of the system's PCI clocks. This clock is used by all of the 430TX PCIset logic in the PCI clock domain. This clock is stopped when the PIIX4 ISA bridge PCI_STP# signal is asserted.															
HCLK[1:0]	I	V_CPUIO	Host Clock In: These pins are used solely for CKDM66-M Host clocking. This clock is used by the processor, 430TX PCIset and L2. This clock is stopped when the PIIX4 ISA bridge PCI_STP# signal is asserted.															
SUSCLK	I	V_3	Suspend Clock: 32 KHz input for DRAM refresh circuitry and clocking events in suspend state. The DRAM refresh during suspend and non-suspend states is performed based on this clock.															
FQS[1:0]	O	V_3S	<p>Frequency Status: Provides status of the host clock frequency to the system electronics. These signals are static and are pulled either low or high to the V_3S voltage.</p> <table border="1"> <thead> <tr> <th>FQS1</th> <th>FQS0</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>60 MHz</td> </tr> <tr> <td>0</td> <td>1</td> <td>66 MHz</td> </tr> <tr> <td>1</td> <td>0</td> <td>Reserved</td> </tr> <tr> <td>1</td> <td>1</td> <td>Reserved</td> </tr> </tbody> </table>	FQS1	FQS0	Frequency	0	0	60 MHz	0	1	66 MHz	1	0	Reserved	1	1	Reserved
FQS1	FQS0	Frequency																
0	0	60 MHz																
0	1	66 MHz																
1	0	Reserved																
1	1	Reserved																
CPU3.3_2.5#	O	V_CPUIO	Clock Voltage Select: Provides status to the system electronics about the voltage level at which the CKDM66-M clock generator should be operating.															

* - This signal requires a pull down resistor on the system electronics.



INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

2.1.6. VOLTAGES (39 SIGNALS)

Table 7 lists the Intel Mobile Module's voltage signal definitions.

Table 7. Voltage Descriptions

Name	Type	Number	Description
V_DC	I	10	DC Input: 5 - 20V +5%
V_3S	I	20	SUSB# controlled 3.3V: Power-managed 3.3 voltage supply. An output of the voltage regulator on the system electronics. This rail is off during STR, STD, and Soff.
V_5	I	1	SUSC# controlled 5V: Power-managed 5.0 voltage supply. An output of the voltage regulator on the system electronics. This rail is off during STD and Soff. NOTE: V_5S can be used as a SUSB# controlled voltage supply.
V_3	I	5	SUSC# controlled 3.3V: Power-managed 3.3 voltage supply. An output of the voltage regulator on the system electronics. This rail is off during STD and Soff.
V_CPUIO	O	3	Processor I/O Ring: Driven by the Intel Mobile Module to power processor interface signals such as the PIIX4 ISA bridge open-drain pull ups for the processor/PIIX4 ISA bridge sideband signals.

INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

2.1.7. ITP/JTAG (7 SIGNALS)

Table 8 lists the Intel Mobile Module's In-target Probe (ITP)/JTAG signals, which the system electronics can use to implement a processor debug port. The system manufacturer can use debug port signals on development-level boards, or on production boards for manufacturing testability.

Please check with your local Intel Sales Representative for further details on recommendations and requirements for a debug port.

Table 8. ITP/JTAG Pins

Name	Type	Voltage	Description
*TDO	O	V_CPUIO	JTAG Test Data Out: Serial output port. TAP instructions and data are shifted out of the processor from this port.
*TDI	I	V_CPUIO	JTAG Test Data In: Serial input port. TAP instructions and data are shifted into the processor from this port.
*TMS	I	V_CPUIO	JTAG Test Mode Select: Controls the TAP controller change sequence.
*TCLK	I	V_CPUIO	JTAG Test Clock: Testability clock for clocking the JTAG boundary scan sequence.
*TRST#	I	V_CPUIO	JTAG Test Reset: Asynchronously resets the TAP controller in the processor.
*ITP(1:0) ITP1: PRDY ITP0: R/S#	O I	V_CPUIO	Debug Port Signals: Currently defined for the generation of Pentium® processors. Future uses are not yet defined.

* - Termination for the ITP signals must be done on the system electronics. The Intel Mobile Module does not provide series termination for these signals.



INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

2.1.8. MISCELLANEOUS (44 SIGNALS)

Table 9 lists the Intel Mobile Module's miscellaneous signal pins.

Table 9. Miscellaneous Pins

Name	Type	Number	Description
Module ID	O	4	Module Revision ID. These pins track the revision of the Intel Mobile Module. Each pin requires a 100K pull up resistor to the switched 3.3V supply.
PPP_PP#	O	1	Pentium® Pro processor or Pentium Processor present. A high on this signal indicates to the PIIX4 ISA bridge CONFIG1 pin that the processor is based on the Pentium Pro architecture, a low indicates that it is of the Pentium Processor family. This signal is not connected on Pentium Pro modules, and grounded on Pentium Processor modules; the system electronics should provide a 100K pull up to the non-switched 3.3V supply.
Ground	I	32	Ground
Reserved	RSVD	7	Unallocated Reserved Pins

2.2. Connector Pin Assignments

Table 10 lists the signals for each pin of the connector from the Intel Mobile Module to the

system electronics. Refer to Section 2.3 for the pin assignments of the pads on the connector.

Table 10. Connector Pin Assignments

Pin#	Row AA	Row AB	Row BA	Row BB
1	Gnd	Gnd	Gnd	Gnd
2	MD40	MD00	MID0	MID1
3	MD41	MD04	Reserved	Reserved
4	MD42	MD02	V_DC	V_DC
5	MD43	MD03	V_DC	V_DC
6	V_3S	V_3S	V_DC	V_DC
7	MD44	MD01	V_DC	V_DC
8	MD45	MD05	V_DC	V_DC
9	MD46	MD06	Reserved	Reserved
10	MD47	MD07	MID2	MID3
11	Gnd	Gnd	Gnd	Gnd
12	CAS5#/DQM5	CAS0#/DQM0	AD00	FRAME#
13	CAS1#/DQM1	CAS2#/DQM2	AD01	LOCK#
14	MA00	MA01	AD02	DEVSEL#
15	CKEA	CKEB	AD03	IRDY#
16	V_3S	V_3S	V_3S	V_3S
17	MA02	MA04	AD04	TRDY#
18	MA03	MA05	AD05	STOP#
19	MD08	MD17	AD06	PHOLD#
20	MD09	MD16	AD07	PHLDA#
21	Gnd	Gnd	Gnd	Gnd
22	MD10	MD18	AD08	PCI_RST#
23	MD11	MD19	AD09	PAR
24	MD12	MD20	AD10	SERR#
25	MD13	MD21	AD11	REQ0#



INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

Table 10. Connector Pin Assignments (Continued)

Pin	Row AA	Row AB	Row BA	Row BB
26	V_3S	V_3S	V_3S	REQ1#
27	MD14	MD22	AD12	REQ2#
28	MD15	MD23	AD13	REQ3#
29	SRASA#	SCASA#	AD14	GNT0#
30	SRASB#	SCASB#	AD15	GNT1#
31	Gnd	Gnd	Gnd	Gnd
32	MWEA#	MPD0	AD16	GNT2#
33	MWEB#	MPD4	AD17	GNT3#
34	RAS0#/CS0#	MPD1	AD18	L2_ZZ
35	RAS1#/CS1#	MPD5	AD19	Reserved
36	V_3S	V_3S	V_3S	V_3S
37	MD36	MPD2	AD20	Reserved
38	MD39	MPD6	AD21	PPP_PP#
39	MD37	MPD3	AD22	CLKRUN#
40	Gnd	Gnd	Gnd	Gnd
41	MD35	MPD7	RAS2#/CS2#	SM_CLK
42	MD34	MD48	RAS3#/CS3#	SM_DATA
43	MD38	MD50	RAS4#/CS4#	ATF_INT#
44	MD33	MD49	RAS5#/CS5#	SUSCLK
45	V_3S	V_3S	V_3	V_3
46	MD32	MD51	AD23	SUS_STAT#
47	MA06	MD52	AD24	V_3
48	MA07	MD53	AD25	OEM_PU
49	MA08	MD54	AD26	VR_ON
50	Gnd	Gnd	Gnd	Gnd
51	MA09	MD55	AD27	VR_PWRGD
52	CAS4#/DQM4	CAS6#/DQM6	AD28	V_3
53	CAS3#/DQM3	CAS7#/DQM7	AD29	V_3
54	MA10	MA12	AD30	Reserved

Table 10. Connector Pin Assignments (Continued)

Pin#	Row AA	Row AB	Row BA	Row BB
55	V_3S	V_3S	V_3S	Reserved
56	MA11	MA13	AD31	INIT#
57	MD25	MD56	C/BE0#	V_CPUIO
58	MD24	MD60	C/BE1#	INTR
59	MD26	MD58	C/BE2#	CPURST
60	Gnd	Gnd	Gnd	Gnd
61	MD27	MD57	C/BE3#	STPCLK#
62	MD28	MD61	IGNNE#	SMI#
63	MD31	MD59	FERR#	NMI
64	MD30	MD62	A20M#	V_5
65	MD29	MD63	V_CPUIO	V_CPUIO
66	V_3S	V_3S	TDO	TRST#
67	OEM_PD	PCLK	ITP0	TDI
68	FQS0	FQS1	ITP1	TMS
69	HCLK1	HCLK0	CPU3.3_2.5#	TCLK
70	Gnd	Gnd	Gnd	Gnd

NOTE:

Pins AB54 and BA43 as well as pins AB56 and BA44 are connected together on the Intel Mobile Module. Future PCIsets will independently drive address and RAS signals separately, so caution should be taken when connecting to this interface.

2.3. Connector Footprint

This section contains the 280-pin connector pad assignment.

2.3.1. PIN AND PAD ASSIGNMENT

Figure 2 shows the connector pad assignments for the manufacturer's system electronics. This

footprint is viewed from the secondary side of the Intel Mobile Module (the side of the printed circuit board on which the 280-pin connector is soldered). For additional information regarding the orientation of the connector with respect to the system electronics, please contact your local Intel Sales Representative.

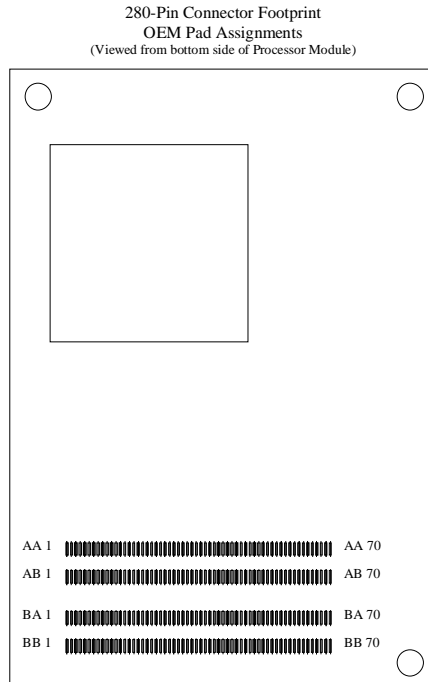


Figure 2. 280-Pin Connector Footprint Pad Numbers, Intel Mobile Module - Secondary Side

2.4. Connector Specifications

The Intel Mobile Module connector is a surface mount, 0.6 mm pitch, 280-pin connector. There are currently four unique connectors that will be offered by vendors for the Intel Mobile Module

Table 11 summarizes some of the more critical specifications for the connector.

Table 11. Connector Specifications

Parameter	Condition	Specification
Material	Contact	Copper Alloy
	Housing	Thermo Plastic Molded Compound: LCP
Electrical	Current	0.4 A
	Voltage	50 VAC
	Insulation Resistance	100MΩ min. @ 500 VDC
	Termination Resistance	20mΩ max. @ 20mV open circuit with 10mA
	Capacitance	5pF max. Per contact
Mechanical	Mating Cycles	50 cycles
	Connector Mating Force	0.9N (90gf) max. Per contact
	Contact Un-mating Force	0.1N (10gf) min. Per contact

3.0. FUNCTIONAL DESCRIPTION

3.1. Intel Mobile Module

The Intel Mobile Module will support the Pentium Processor with MMX Technology Mobile Processor running at 166/66, 200/66, 233/66, and 266/66 MHz with 16 KB on-chip code and data cache sizes.

3.2. L2 Cache

The Pentium Processor with MMX Technology Mobile Processor's internal cache is complimented with a second-level 2.5V cache using a high-performance pipeline burst SRAM. The L2 cache can support up to 64 MB of system memory, the maximum amount of cacheable system memory supported by the 430TX PCIset system controller. The Intel Mobile Module has two 100-pin TSOP (Thin Small Outline Package) footprints for 512K direct-mapped write-back L2 cache.

The Intel Mobile Module supports the ZZ, or snooze mode power management features in current pipeline burst SRAM (PBSRAM). The PIIX4 ISA bridge

Southbridge component on the system electronics is the source for the generation of ZZ mode. This ZZ signal is named L2_ZZ on the Intel Mobile Module interface, clarifying its sole purpose of ZZ support for second-level cache.

3.3. 430TX PCIset System Controller

Intel's 430TX PCIset system controller is a highly integrated device that combines the mobile Pentium Processor bus controller, the DRAM controller, second-level cache controller and PCI bus controller into one component. The 430TX PCIset has multiple power management features specifically for notebook systems:

- CLKRUN# is a feature that enables controlling of the PCI clock on or off
- 430TX PCIset suspend modes include Suspend to RAM (STR), Suspend to Disk (STD) and Powered On Suspend (POS)



INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

- System Management RAM (SMRAM) power management modes include Compatible SMRAM (C_SMRAM) and Extended SMRAM (E_SMRAM). C_SMRAM is the traditional SMRAM feature implemented in all Intel PCI chipsets. E_SMRAM is a new feature that supports write-back cacheable SMRAM space up to 1Mbyte. To minimize power consumption while the system is idle, the internal 430TX PCIset clock is turned off (gated off) when there is no processor and PCI activity.

The Intel Mobile Module supports only the 430TX PCIset features available in the Mobile Mode of operation. Refer to Intel's latest revision of the 430TX PCIset specification for complete details.

3.3.1. MEMORY ORGANIZATION

The complete memory interface of the 430TX PCIset is available at the Intel Mobile Module's connector; all of the 430TX PCIset Mobile Mode memory configurations and modes of operation are supported. Two memory features not supported by the 430TX PCIset Mobile Mode are Parity and Error Detection and Correction (EDC).

DRAM technologies supported by 430TX PCIset include Extended Data Out (EDO) and SDRAM.

NOTE

The Intel Mobile Module does not support the use of fast page mode (FPM) memory on the system electronics.

These memory types may be mixed in the system, but only on a row-by-row basis. In other words, all DRAM in a particular row (RAS[5:0]#) must be of the same technology. The 430TX PCIset targets 60ns

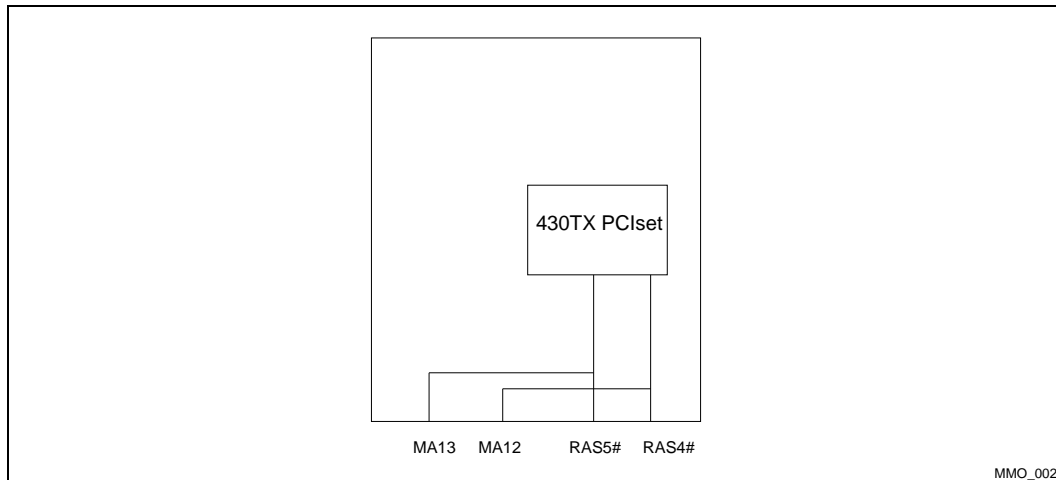
DRAMs, but also supports 50ns and 70ns components.

The Intel Mobile Module's clocking architecture supports the use of SDRAM. Due to the tight timing requirements of 66-MHz SDRAM clocks, the clocking mode for SDRAM or system manufacturer custom memory configurations allows all host and SDRAM clocks to be generated from the same physical device on the manufacturer's system electronics. Driving all of these clocks out of a single device ensures minimal skew and jitter between clock outputs. For complete details about using SDRAM memory, and for trace length guidelines, contact your local Intel Sales Representative.

For details on memory device support, organization, size and addressing, refer to 430TX PCIset documentation and PCD application notes.

3.3.2. 64-MBIT SDRAM SUPPORT

Support for 64-Mbit SDRAM memory technology is provided by the 430TX PCIset Northbridge component. See the 430TX PCIset documentation for operational details on how this support is implemented by the component. To provide the equivalent support at the Intel Mobile Module connector and maintain compatibility with future Northbridge architectures, the memory signals on the Intel Mobile Module are routed to the connector as shown in Figure 3. Memory control signals that allow the 430TX PCIset to support 64-Mbit SDRAM memory devices are the RAS4/MA12 and RAS5/MA13. These signals are multiplexed and configurable within the 430TX PCIset. Figure 3 shows a wiring diagram on the Intel Mobile Module of the RAS4/MA12 and RAS5/MA13 signals for clarification. Proper routing of these signals is required to ensure future Intel Mobile Modules are compatible.



MMO_002

Figure 3. Pentium® Processor Address Routing

For proper signal routing, the System OEM must determine the memory configuration that will be supported during the 430TX PCIset generation of Intel Mobile Modules. If the I/O planar is designed to support four banks of memory and 64-Mbit SDRAM memory devices, then the System OEM should route the upper two address signals from the Intel Mobile Module's address pins MA[12:13] to the upper order address bits on the SODIMM socket and not the RAS[4:5]# pins. Subsequently if the I/O design supports six banks of memory and does not intend to support 64-Mbit memory devices, then RAS[4:5]# should be routed from the Intel Mobile Module's RAS[4:5]# pins to the SODIMM RAS pins.

Even though these two sets of Intel Mobile Module pins are electrically equivalent on the module, connecting the memory address and control signals as suggested will help maintain compatibility with future modules.

NOTE

The 430TX PCIset does not support six banks of memory and 64-Mbit SDRAM devices simultaneously, however, future PCIsets may provide this flexibility. To design today for this type of upgrade, it is recommended that Q-switches be used on either the RAS[4:5]# or MA[12:13] signals, or both. This would ensure that the trace lengths of the RAS signals are kept to a

minimum, and signal quality is not compromised.

3.3.3. PCI INTERFACE

The 430TX PCIset is compliant with the PCI 2.1 specification, which improves the worst-case PCI bus access latency from earlier PCI specifications. The complete PCI interface of the 430TX PCIset is available at the Intel Mobile Module's connector. The 430TX PCIset supports the PCI Clockrun protocol for power management of PCI. In this protocol, PCI devices assert the CLKRUN# open-drain signal when they require the use of the PCI interface. (Refer to the PCI Mobile addendum for complete details on the PCI Clockrun protocol.)

The 430TX PCIset is responsible for arbitrating the PCI bus. When configured in Mobile Mode, the 430TX PCIset can support up to four PCI bus masters. There are four PCI Request/Grant pairs, REQ[3:0]# and GNT[3:0]# available on the connector to the manufacturer's system electronics.

The 430TX PCIset supports only Mechanism #1 for accessing PCI configuration space, as detailed in the PCI specification. This implies that signals AD[31:11] are available for PCI IDSEL signals. However, since the 430TX PCIset is always device #0; AD11 will never be asserted during PCI configuration cycles as an IDSEL. Thus, AD12 is the first available address line usable as an IDSEL.



3.4. Processor Core Voltage Regulation

The Intel Mobile Module supports an input DC voltage range of 5V - 20V (+5 percent) slew-rate controlled from the system battery/power supply. Maximum peak input voltage is 21.1V including ripple.

The Intel Mobile Module's DC voltage regulator (DC/DC converter) is designed to support the CPU core voltage and the 2.5V-only CPU interface signals so no special voltage regulation is required on the system electronics. The CPU interface signals between the CPU and PIIX4 South Bridge

require proper termination to the V_CPUIO (2.5V) power plane and should be treated with special attention. Please refer to the signal definitions for recommended resistor termination values.

3.4.1. VOLTAGE REGULATOR EFFICIENCY

The voltage regulator is optimized for Pentium Processors and is most efficient in the 1A to 3A range. When placed in suspend mode, the module will consume approximately 20mW. See Table 12a and 12b for details over the entire current range.

Table 12a. Typical Voltage Regulator Efficiency, V_{CORE} = 1.8V (166/200/233 MHz)

V _{DC} (V)	I _{DC} (A)	V ₅ (V)	I ₅ (mA)	V _{CORE} (V)	I _{CORE} (A)	V _{I/O} (V)	I _{I/O} (mA)	Eff. (%)
5	0.429	5.0	13	1.81	1	2.55	52	87
5	0.845	5.0	13	1.81	2	2.55	52	87
5	1.293	5.0	13	1.81	3	2.55	52	85
5	1.776	5.0	13	1.81	4	2.55	52	82
12	0.187	5.0	13	1.82	1	2.55	52	83
12	0.356	5.0	13	1.82	2	2.55	52	86
12	0.54	5.0	13	1.82	3	2.55	52	85
12	0.737	5.0	13	1.82	4	2.55	52	83
18	0.128	5.0	13	1.83	1	2.55	52	82
18	0.244	5.0	13	1.83	2	2.55	52	84
18	0.367	5.0	13	1.83	3	2.55	52	84
18	0.500	5.0	13	1.83	4	2.56	52	82

NOTES:

1. The above measured efficiencies are typical values from a limited sample size. Results may vary across different modules.
2. These efficiencies will change with future voltage regulators that accommodate higher input voltages.



INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

Table 13b. Typical Voltage Regulator Efficiency, V_{CORE} = 2.0V (266 MHz)

V _{DC} (V)	I _{DC} (A)	V ₅ (V)	I ₅ (mA)	V _{CORE} (V)	I _{CORE} (A)	V _{I/O} (V)	I _{I/O} (mA)	Eff. (%)
4.75	0.530	5.0	14	2.00	1	2.52	100	87
4.75	1.032	5.0	14	1.99	2	2.52	100	85
4.75	1.548	5.0	14	1.99	3	2.52	100	84
4.75	2.162	5.0	14	1.99	4	2.52	100	79
12	0.220	5.0	14	2.00	1	2.52	100	83
12	0.415	5.0	14	2.00	2	2.52	100	84
12	0.624	5.0	14	2.00	3	2.52	100	82
12	0.841	5.0	14	1.99	4	2.52	100	81
21	0.128	5.0	14	2.01	1	2.52	100	82
21	0.238	5.0	14	2.00	2	2.52	100	84
21	0.355	5.0	14	2.00	3	2.52	100	83
21	0.478	5.0	41	1.99	4	2.52	100	81

NOTES:

1. The above measured efficiencies are typical values from a limited sample size. Results may vary across different modules.
2. These efficiencies will change with future voltage regulators that accommodate higher input voltages.

3.4.2. VOLTAGE REGULATOR CONTROL

The VR_ON pin on the connector allows a digital signal (3.3V, 5V safe) to control the voltage regulator. The system manufacturer can use this signal to turn the Intel Mobile Module's voltage regulator on or off. VR_ON should be controlled with the same digital control signal used to control the system's switched 3.3V power planes. The PIIX4 South Bridge defines Suspend B as the power management state in which power is physically removed from the processor, L2 cache, 430TX PCIsset, and voltage regulator. In this state, the SUSB# pin on the PIIX4 ISA bridge controls these power planes.

From the assertion of VR_ON, the voltage regulator has a turn-on time latency of approximately 6ms. In order to bring both the processor's core and I/O ring voltages up together, the system manufacturer must ensure that the system's switched 3.3V supply (voltage plane V_3S) turns on and off with the Intel Mobile Module's core voltage. This requires properly sequencing of the system's voltage regulator and the VR_ON signal as shown in Figure 4.



3.4.3. VOLTAGE SIGNAL DEFINITION AND SEQUENCING

Table 14. Voltage Signal Definitions and Sequences

Signal	Source	Definitions and Sequences
V_DC	System Electronics	DC voltage driven from the power supply and is required to be between 5V and 20V DC +5% (maximum peak voltage is 21.1V including ripple). V_DC powers the Intel Mobile Module's DC-to-DC converter for processor core and I/O voltages. CAUTION: The Intel Mobile Module must not be inserted or removed while V_DC is powered on.
V_3	System Electronics	V_3 is supplied by the system electronics; the MTXC uses it during the Suspend to DRAM state.
V_5	System Electronics	V_5 is supplied by the system electronics. It is used by the Intel Mobile Module's voltage regulator.
V_3S	System Electronics	V_3S are supplied by the system electronics for the processor, MTXC, and cache devices. Each must be powered off during system Suspend-to-DRAM and Suspend-to-Disk states, typically this signal is switched by a FET switch.
VR_ON	System Electronics	This 3.3V signal controls the operation of the Intel Mobile Module's voltage regulator. This signal should be generated as a function of the PIIIX4 SUSB# signal. VR_ON should be timed to rise after the switch power planes have stabilized. Please refer to section 3.4.2 for proper VR_ON sequencing. NOTE: The system electronics should subtract 6ms for the maximum latency of VR_ON to V_CORE of the voltage regulator on the Intel Mobile Module.
V_CORE	Intel Mobile Module Only	A result of VR_ON being asserted, V_CORE is an output of the DC-DC regulator on the Intel Mobile Module and is driven to the appropriate voltage level of the processor: 1.8 or 2.0.
VR_PWRGD	Intel Mobile Module Only	Upon sampling the voltage level of V_CORE for the processor, minus tolerances for ripple, VR_PWRGD is driven active high (3.3V) for the system electronics to sample prior to providing PWROK to the PIIIX4. If VR_PWRGD is not sampled active within 1 second of the assertion of VR_ON the system electronics should deassert VR_ON. CAUTION: This signal has an output impedance of approximately 100kΩ. Care must be taken to prevent loading of this signal.
V_CPUIO	Intel Mobile Module Only	V_CPUIO is 2.5V. The system electronics uses this voltage to power the PIIIX4-to-processor interface circuitry, as well as the HCLK_(0:1) drivers for the SDRAM/OEM processor clock.

Voltage Plane Sequencing

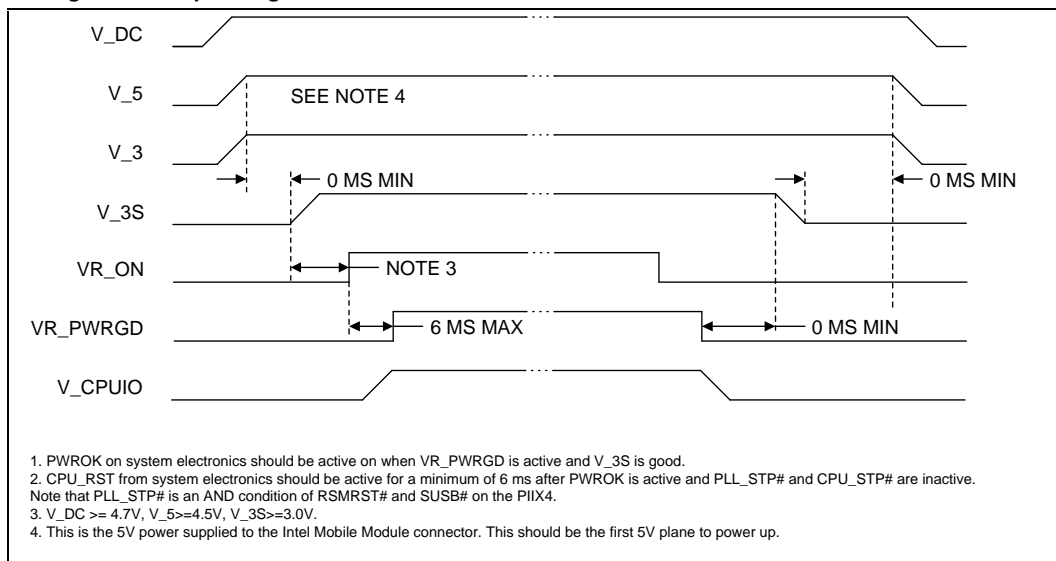


Figure 4. Power On Sequence Timing

Figure 4 details the sequencing of Signals and Voltage planes required for normal operation of the Intel Mobile Module.

The Intel Mobile Module also provides the VR_PWRGD signal, which indicates that the voltage regulator power is operating at a stable voltage level. The system manufacturer should use this signal on the system electronics to control power inputs, and gate PWROK to the PIIX4 South Bridge.

Please contact your local Intel Sales Representative for more details about the voltage regulator, power sequencing, and proper voltage signaling.

3.5. Active Thermal Feedback

Table 15 identifies three addresses allocated for the System Management Bus (SMBus) on the Intel Mobile Module. Two of these addresses are reserved for future use.

Table 15. LM75 SMBUS Address Table

Function	Fixed Address AD Bits (6:3)	Selectable Address AD Bits (2:0)
LM75 Thermal Sensor	1001	000
Reserved	1001	001
Reserved	1001	010

NOTES:

The LM75 is not electrically compatible with SMBus addressing. The 4-bit fixed address used by the LM75 is currently invalid under Revision 1.0 of the System Management Bus Specification from Intel.

After consulting your local Intel Sales Representative, refer to the datasheet for the LM75 digital thermometer for complete device programming details.

3.6. Thermal Transfer Plate

The Intel Mobile Module provides a thermal transfer plate connected to the processor in a standard position called the thermal attach point. The thermal attach point is a fixed location relative to the mounting holes and other physical datum on the Intel Mobile Module. The system manufacturer can use both a heat pipe and a heat spreader plate in contact with the thermal attach point to transfer heat through the notebook system.

The thermal transfer plate is physically mounted to the Intel Mobile Module, and may be different from one generation of Intel Mobile Module to the next. However, the thermal attach point will remain fixed across future generations of Intel Mobile Modules. Figure 5 shows the conceptual relationship between the circuit board, thermal transfer plate and thermal attach point.

3.7. Module Thermal Resistance

Intel has completed extensive thermal testing of the module in a variety of environments to

determine the overall thermal resistance between the CPU TCP packaging and the top of the TTP. The worst case thermal resistance guaranteed by Intel is 2.5° C/W though typically this resistance will be less. System OEMs should take this under consideration when designing system thermal solutions.

4.0. MECHANICAL REQUIREMENTS

4.1. Module Dimensions

This section provides the physical dimensions for the Intel Mobile Module

4.1.1. BOARD AREA

Figure 6 shows the board dimensions and the connector orientation for the Intel Mobile Module . These dimensions are necessary to accommodate the next generation of Intel mobile processor and PCI Northbridge chipset controller.

INTEL PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY MOBILE MODULE

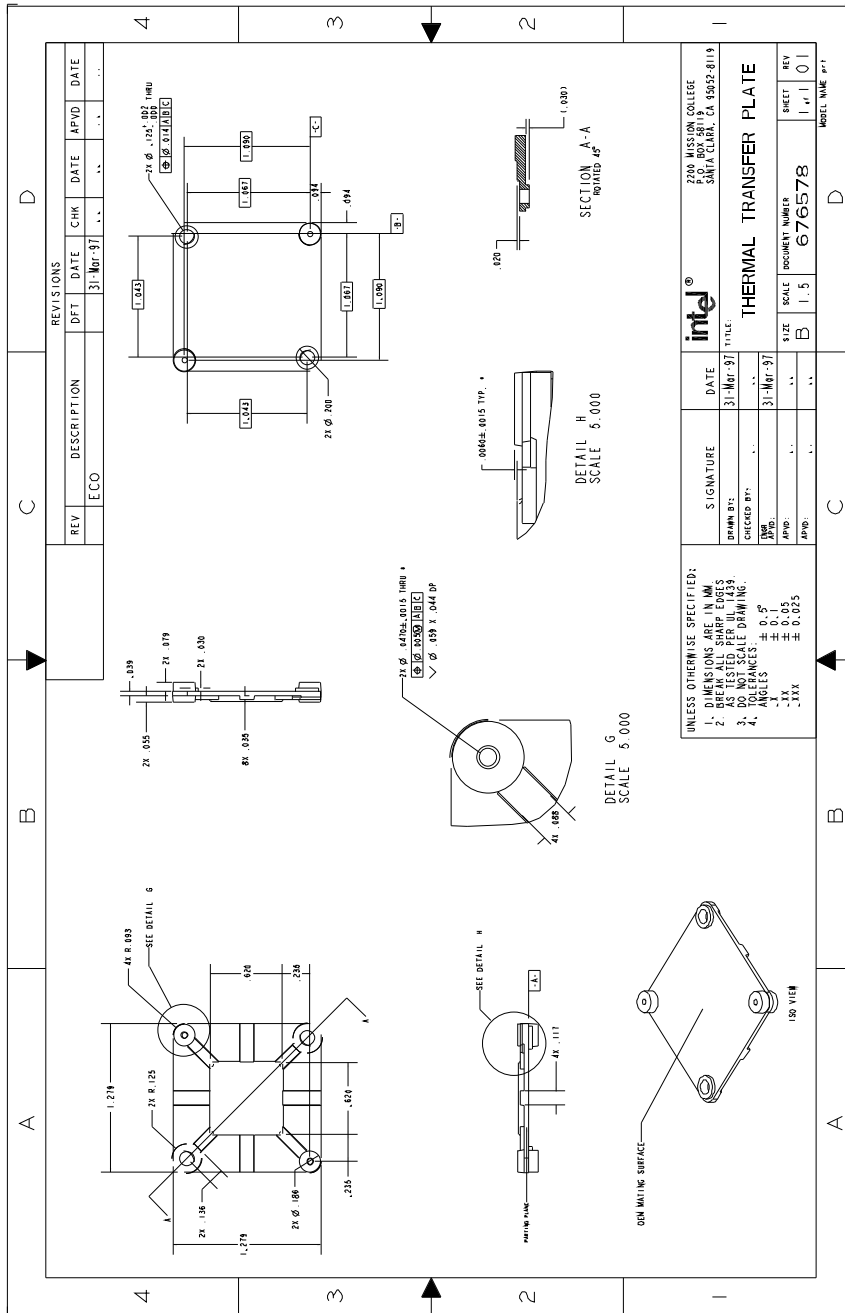


Figure 5. Intel Mobile Module Thermal Transfer Plate

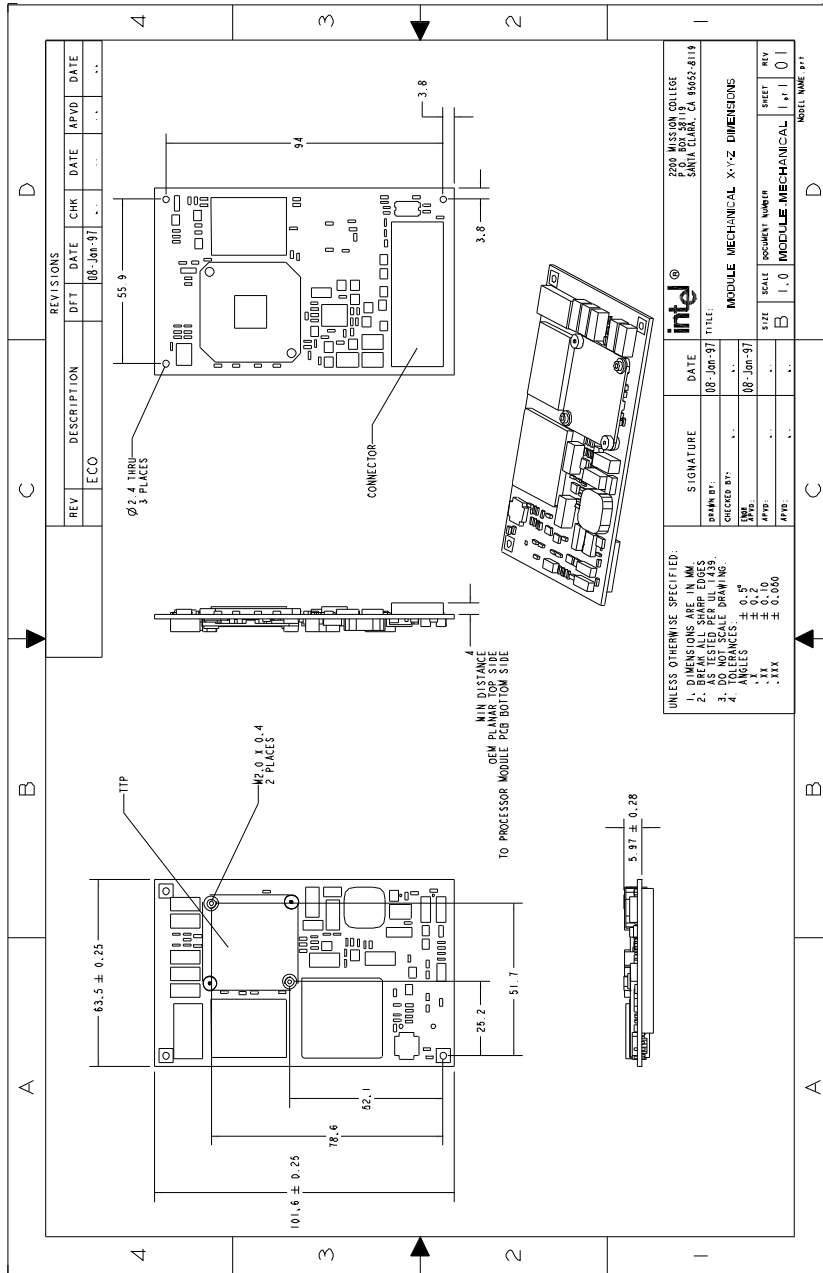


Figure 6. Board Dimensions with 280-Pin Connector Orientation

4.1.2. PRINTED CIRCUIT BOARD THICKNESS

Figure 7 shows the Intel Mobile Module profile and the associated minimum and maximum thickness of the printed circuit board (PCB). The range of PCB thickness allows for different PCB technologies to be used with current and future modules.

NOTE

The system manufacturer must ensure that the mechanical restraining method and/or system-level EMI contacts are able to support this range of PCB thickness, to ensure compatibility with future modules.

4.1.3. HEIGHT RESTRICTIONS

Figure 8 shows the Intel Mobile Module mechanical stackup and associated component clearance requirements. This "block" represents the volume that may be occupied by components on the various versions of the processor module. The OEM system should be defined so that no part of the system will intrude into this volume, which may result in part-to-part interference.

The system manufacturer establishes the board-to-board clearance between the Intel Mobile Module and the system electronics by selecting one of three possible mating connectors. The mating connectors provide board-to-board clearance distances of 4 mm, 6 mm or 8 mm. With these three options, the system manufacturer has reasonable flexibility in choosing components on the system electronics that are between the two boards.

NOTE

The Intel Mobile Module top side component clearance is referenced from the bottom of the PCB, so it is independent of the PCB thickness. Figure 8 shows the module volume assuming a 4mm board-to-board connector. When using the 4mm connector, 2mm of the connector height extends beyond the module volume shown in figure 8. If the 6mm board-to-board connector is used on the system electronics, then 4mm extends beyond the module "keep-out" volume. If using the 8mm connector, 6mm will extend beyond the module "keep-out" volume.

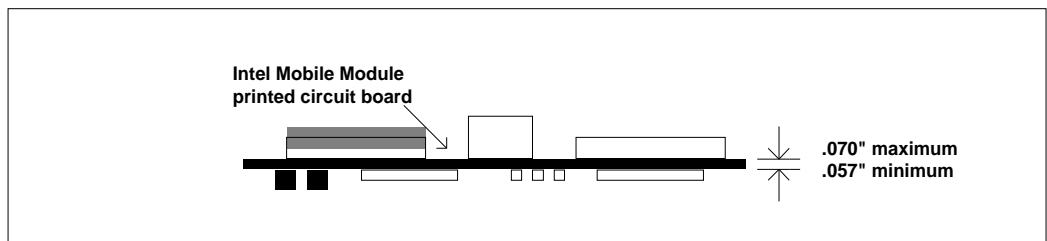


Figure 7. PCB Board Thickness

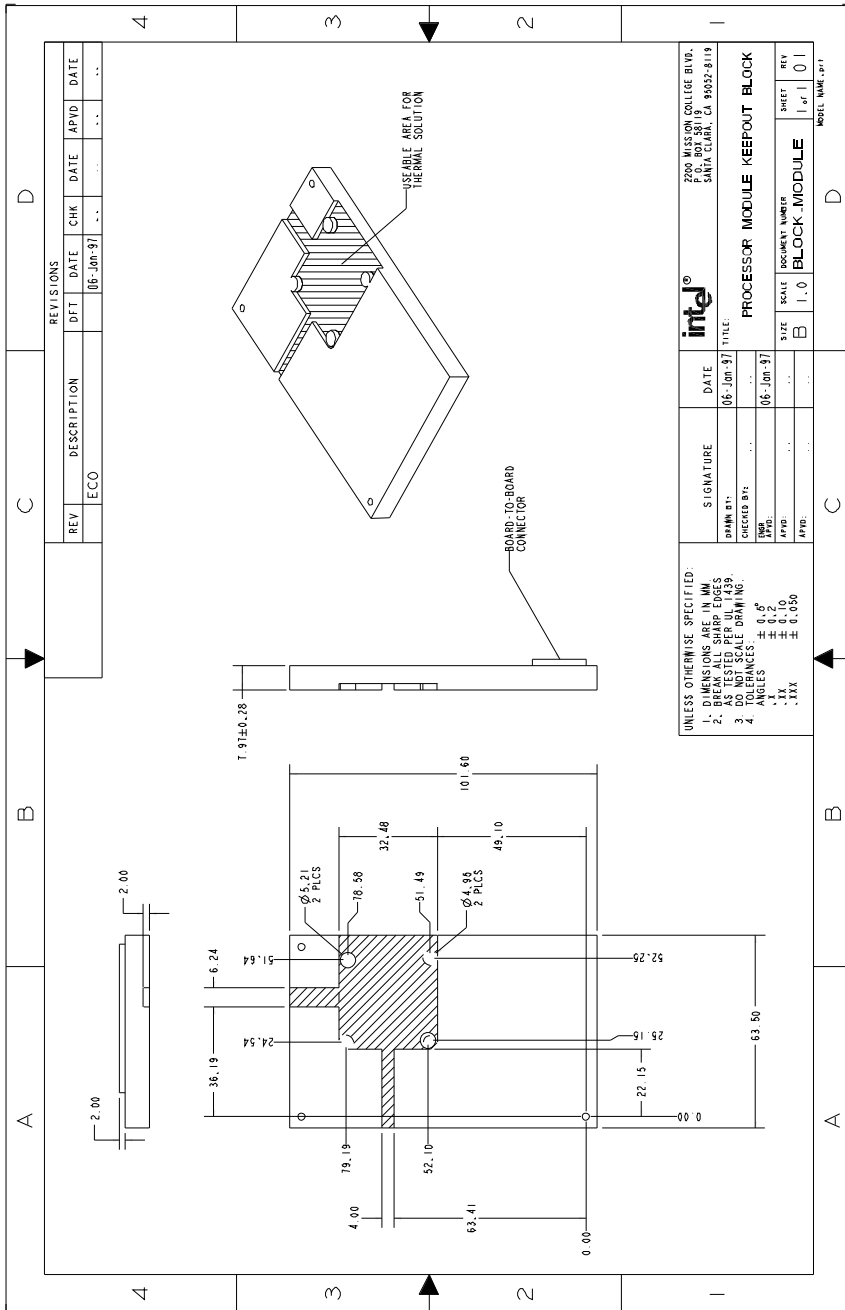


Figure 8. 3-D Mechanical Drawing

4.2. Module Physical Support

Figure 9 shows the Intel Mobile Module standoff support hole patterns and the board edge clearance around the perimeter of the module.

These hole locations and board edge clearances will remain fixed for all Intel Mobile Modules. The hole patterns and board edge clearance lets the system manufacturer develop several methods for mechanically supporting the Intel Mobile Module within a particular notebook system.

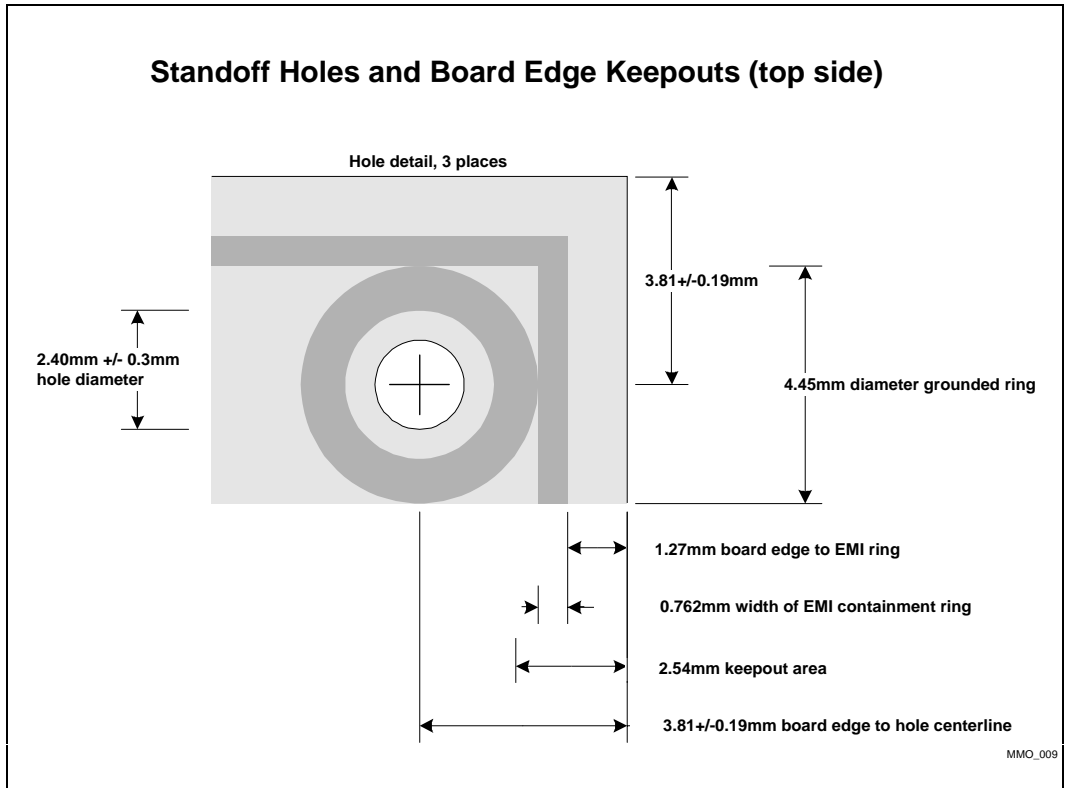


Figure 9. Standoff Holes, Board Edge Clearance and EMI Containment Ring

The board edge clearance includes a 0.762 mm (0.030 in) width EMI containment ring around the perimeter of the module. This ring is on each layer of the module PCB and is grounded. On the surface of the module, the metal is exposed for EMI shielding purposes. The hole patterns placed on the module also have a plated surrounding ring and one can use a metal standoff to contact the ring for EMI shielding purposes. Figure 9 shows the dimensions of the EMI containment ring and the keepout area. No components are placed on the board in the keepout area.

4.3. Module Mounting Requirements

Three mounting holes are available to the System OEM for securing the module to the system base or the system electronics. See Figure 6 for relative hole placements. It is strongly recommended the System OEM utilize mounting screws through all three of these holes to ensure long term reliability of the mechanical and EMI integrity of the system.

To interface to the module's thermal transfer plate (TTP), it is recommended that the exact dimensions shown in Figure 10 for the OEM thermal interface block be used. These dimensions provide maximum contact area to the TTP while ensuring that no warpage of the TTP occurs. If warpage occurs, due to the use of an improperly-designed interface, or over-tightening of assembly screws, the thermal resistance of the module could be adversely affected.

When attaching the mating block to the module TTP, material such as a thermal elastimer or thermal grease should be used. This material is designed to reduce the thermal resistance and should be placed between the TTP and the OEM mating block. This will improve the overall system thermal efficiency.

Once the OEM has placed the mating thermal transfer plate, secure it with 2.0mm screws using a maximum torque of 1.5 - 2.0 Kg*cm (equivalent to 0.147 - .197 N*m)

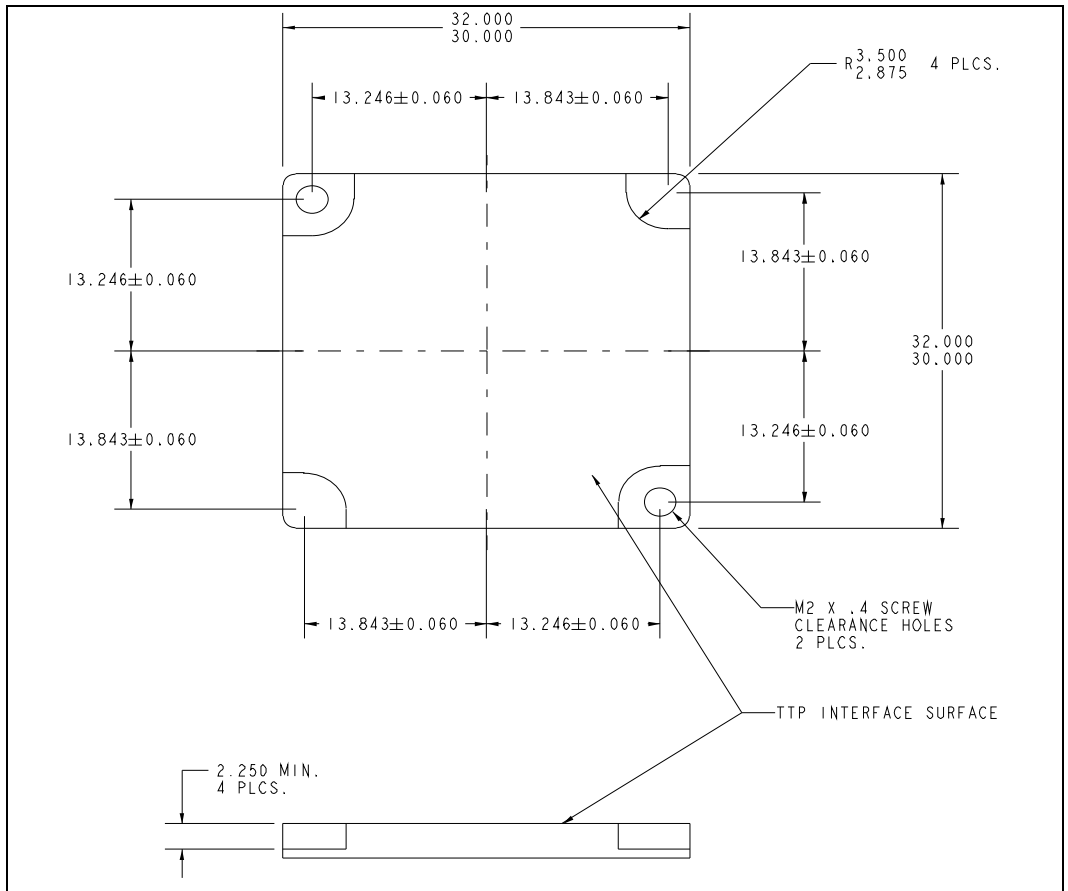


Figure 10. TTP Interface Block Dimensions

4.4. Module Product Tracking Code

The Intel Mobile Module incorporates a Product Tracking Code (PTC) for OEMs to inspect module speed, cache size, and revision. The PTC is etched on the secondary side of the module to the right of the Product ID Matrix label as shown in Figure 11. The PTC consists of thirteen characters defined by:

PMCaabbccdd

where:

PMC - Intel Mobile Module on .25 Micron

aaa - Processor Frequency
(166/200/233/266 Mhz)

bb - Cache Size
(00-No Cache, 02-256K, 05-512K)

ccc - Design Revision (Start at 001)

dd - Processor Revision (Start at AA)

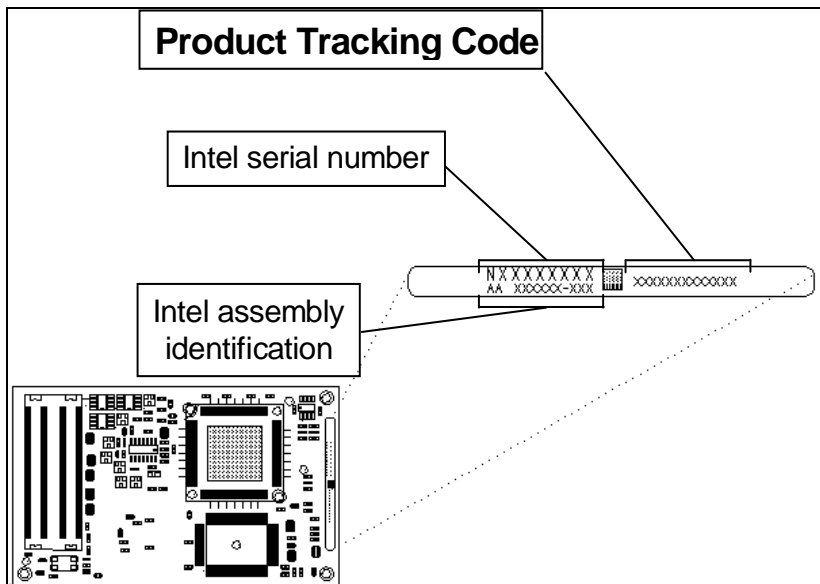


Figure 11. Product Tracking Code



5.0. ENVIRONMENTAL STANDARDS

Table 16 lists the Intel Mobile Module's environmental standards.

Table 16. Environmental Standards

Parameter	Condition	Specification
Temperature	Non-Operating	-40°C to 70°C
	Operating	0°C to 55°C
Humidity		95% relative humidity @ 30 °C
Voltage	V_DC	+/- 5%
	V_3S	+/- 5%
	V_3	+/- 5%
Shock	Operating	Half Sine, 2G, 11msec
	Unpackaged	Trapezoidal, 30G, 11msec
	Packaged	Inclined Impact @5.7ft/s
	Packaged	Half Sine, 2msec @42" Simulated Free Fall
Vibration	Unpackaged	5Hz to 500Hz 2.2gRMS random
	Packaged	10Hz to 500Hz 1.0gRMS
	Packaged	11,800 impacts 2Hz to 5Hz (low frequency)
ESD	Air Discharge	0 to 2kV (no detectable err)
		0 to 8kV (no intermittent err)
		0 to 20kV (no hard failures)



UNITED STATES, Intel Corporation
2200 Mission College Blvd., P.O. Box 58119, Santa Clara, CA 95052-8119
Tel: +1 408 765-8080

JAPAN, Intel Japan K.K.
5-6 Tokodai, Tsukuba-shi, Ibaraki-ken 300-26
Tel: + 81-29847-8522

FRANCE, Intel Corporation S.A.R.L.
1, Quai de Grenelle, 75015 Paris
Tel: +33 1-45717171

UNITED KINGDOM, Intel Corporation (U.K.) Ltd.
Pipers Way, Swindon, Wiltshire, England SN3 1RJ
Tel: +44 1-793-641440

GERMANY, Intel GmbH
Dornacher Strasse 1
85622 Feldkirchen/ Muenchen
Tel: +49 89/99143-0

HONG KONG, Intel Semiconductor Ltd.
32/F Two Pacific Place, 88 Queensway, Central
Tel: +852 2844-4555

CANADA, Intel Semiconductor of Canada, Ltd.
190 Attwell Drive, Suite 500
Rexdale, Ontario M9W 6H8
Tel: +416 675-2438