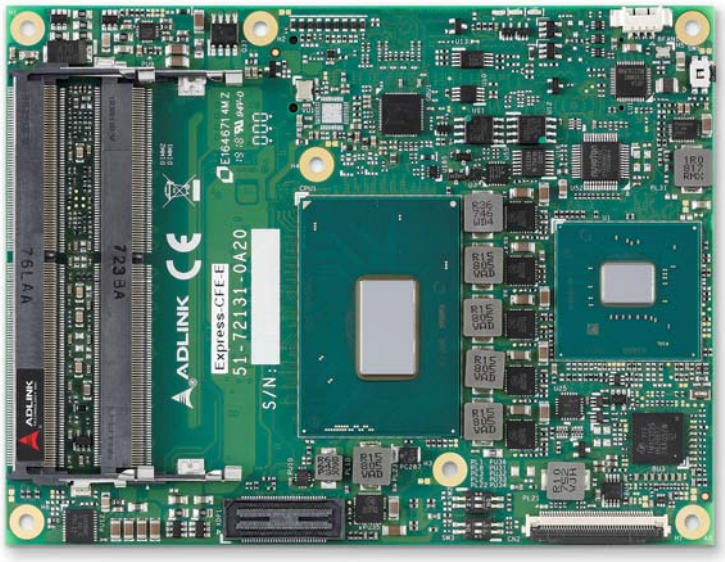
Express-CFR

User's Manual

COM Express Basic Size Type 6 Module with Hexa-core
Mobile 9th Gen Intel® Core™ and Intel® Xeon® Processors



COM Express®

Manual Rev.: 1.0
Revision Date: September 30, 2019
Part Number: 50-1J099-1000

Leading EDGE COMPUTING

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Preface

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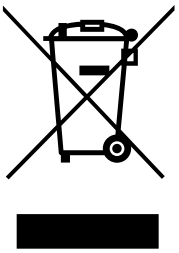
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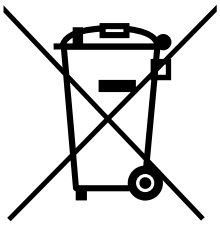
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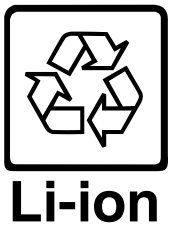
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Revision History

Revision	Description	Date	By
1.0	Initial release	2019-09-30	JC

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1. Introduction

The Express-CFR is the first COM Express® COM.0 R3.0 Basic Size Type 6 module supporting the Hexa-core (6 cores) 64-bit 9th Generation Intel® Core™ i7 and Xeon® processors and quad-core (4 cores) Intel® Core™ i5/i3 processors (codename “Coffeelake-H”) with Mobile Intel® QM370, HM370, CM246 Chipset. The Hexa-core processors support up to 12 threads (Intel® Hyper-Threading Technology) as well as an impressive turbo boost of up to 4.5GHz. These combined features make the Express-CFR well suited to customers who need uncompromising system performance and responsiveness in a long product life solution.

The Express-CFR has up to three SODIMM sockets supporting up to 96GB of DDR4 memory (two on top by default, one on bottom by build option) while still fully complying with PICMG COM.0 mechanical specifications. Modules equipped with the Xeon® processor and CM246 Chipset support both ECC and non-ECC SODIMMs.

Integrated Intel® Generation 9 Graphics includes features such as OpenGL 4.5, DirectX 12/11, OpenCL 2.1/2.0/1.2, Intel® Clear Video HD Technology, Advanced Scheduler 2.0, 1.0, XPDM support, and DirectX Video Acceleration (DXVA) support for full H.265/HEVC 10-bit, MPEG2 hardware codec. In addition, High Dynamic Range is supported for enhanced picture color and quality and digital content protection has been upgraded to HDCP 2.2. Graphics outputs include LVDS and three DDI ports supporting HDMI/DVI/DisplayPort and eDP/VGA as a build option. The Express-CFR is specifically designed for customers with high-performance processing graphics requirements who want to outsource the custom core logic of their systems for reduced development time. In addition to the onboard integrated graphics, a multiplexed PCIe x16 graphics bus is available for discrete graphics expansion.

Input/output features include eight PCIe Gen3 lanes that can be used for NVMe SSD and Intel® Optane™ memory, allowing applications access to the highest speed storage solutions and include a single onboard Gigabit Ethernet port, USB 3.0 ports and USB 2.0 ports, and SATA 6 Gb/s ports. Support is provided for SMBus and I2C. The module is equipped with SPI AMI EFI BIOS with CMOS backup, supporting embedded features such as remote console, hardware monitor, and watchdog timer.

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2. Specifications

2.1. Core System

CPU	**Hexa-core 9th Generation Intel® Core™ and and Xeon® processor (formerly "Coffee Lake Refresh)** • Xeon® E-2276ME, 2.8(4.5)GHz, 12MB, 45W (35W cTDP, 6C/GT2) • Xeon® E-2276ML, 2.0(4.2)GHz, 12MB, 25W (6C/GT2) • Xeon® E-2254ME, 2.6(3.8)GHz, 8MB, 45W (35W cTDP, 4C/GT2) • Xeon® E-2254ML, 1.7(3.5)GHz, 8MB, 25W (4C/GT2) • Core™ i7-9850HE, 2.7(4.4)GHz, 9MB, 45W (35W cTDP, 6C/GT2) • Core™ i7-9850HL, 1.9(4.1)GHz, 9MB, 25W (6C/GT2) • Core™ i3-9100HL, 1.6(2.9)GHz, 6MB, 25W (4C/GT2) • Pentium® G5600E, 2.6(3.1)GHz, 4MB, 35W (2C/GT1) • Celeron® G4930E, 2.4GHz, 2MB, 35W (2C/GT1) • Celeron® G4930E, 1.9GHz, 2MB, 25W (2C/GT1) Supporting: Intel® VT, Intel® TXT, Intel® SSE4.2, Intel® HT Technology, Intel® 64 Architecture, Execute Disable Bit, Intel® Turbo Boost Technology 2.0, Intel® AVX2, Intel® AES-NI, PCLMULQDQ Instruction, Intel® Device Protection Technology with Intel® Secure Key, Intel® TSXNI (availability of features may vary between processor SKUs)
Cache	12MB for Xeon®, 9MB for Core™ i7, 8MB for Core™ i5, 6MB for Core™ i3
Memory	2133/2400 MHz DDR4 memory up to 96GB in three SODIMM sockets Maximum 16GB per socket **Notes**: Only Xeon® processors paired with the CM246 Chipset can support both of ECC and non-ECC memory. Other processor/chipset combinations support non-ECC memory. Third SODIMM on bottom side is supported by build option.
Chipset	Mobile Intel® QM370, HM370 and CM246 Chipset (HM370 does not support Intel® AMT)
Embedded BIOS	AMI Aptio V UEFI with CMOS backup in 32 (or 16) MB SPI BIOS with Intel® AMT 12 support
CPU and Chipset Combinations	**Express-CF** (non-ECC memory support) • Core™ i7/i5 with QM370 Chipset • Core™ i3 with HM370 Chipset **Express-CFE** (ECC and non-ECC memory support) • Xeon® with CM246 Chipset **Note**: Combinations not listed above may be supported by project basis. Please contact your ADLINK representative.

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2.2. Expansion Busses

PCI Express	PCI Express x16 Gen3 (can be configured to 1x16, 2 x8 or 1 x8 plus 2 x4) 6 PCI Express x1 Gen3 (AB): Lanes 0/1/2/3/4/5 2 PCI Express x1 Gen3 (CD): Lane 6/7 **Notes:** PCIe lanes 0/1/2/3 can also be configured to x2, x4 PCIe lanes 4/5/6/7 can also be configured to x2, x4. Lane polarity inversion also supported PCIe lanes 0-7 can support Intel® Optane Memory Technology
Other	• LPC bus • SMBus (system) • I^2C (user)

2.3. Video

Integrated on Processor	Intel® Generation 9 Graphics core architecture
GPU Feature Support	• 3 independent and simultaneous combinations of DisplayPort/HDMI/LVDS graphics outputs (eDP optional in place of LVDS) (VGA optional in place of DDI 3) • Encode/transcode HD content • Playback of high definition content including Blu-ray Disc • Playback of Blu-ray Disc 3D content using HDMI (1.4a spec compliant with 3D) • DirectX Video Acceleration (DXVA) support for accelerated video processing • HEVC/H.265 10-bit, H.264, M/JPEG, MPEG2, VC1, WMV9, VP9 10-bit HW decode • HEVC/H.265 10-bit, M/JPEG, MPEG2 HW encode • Advanced Scheduler 2.0, 1.0, XPDM support • DirectX up to 12 • OpenGL up to 4.5, OpenCL up to 2.1 support **Note:** Availability of features s dependent on operating system (Windows 10 64-bit, Linux 64-bit)
Display Interface Support	• **LVDS**: single/dual channel 18/24-bit LVDS through eDP to LVDS, supports DE mode and Hsync/Vsync mode. Max. resolution is 1920x1200@60Hz in dual mode. Pixel clock frequency up to 112 MHz. VESA and JEIDA panel data formats supported. • **eDP:** eDP 1.4 up to 4 lane support, in place of LVDS (BOM option), max. resolution is 4096x2304@60Hz, 24bpp • **Digital Display Ports x3:** DDI1/2/3 support DisplayPort 1.2/HDMI 1.4/DVI • **VGA:** VGA support, in place of DDI 3. max. resolution is 1920x1200@60Hz

2.4. Audio

Integrated	Intel® HD Audio integrated in QM370/HM370/CM246 Chipset
Codec	Located on carrier Express-BASE6 (ALC886 standard support)

2.5. LAN

Integrated	MAC integrated in QM370/HM370/CM246 Chipset
Intel PHY	Intel® Ethernet Controller I219-LM or I219-V (only LM version supports iAMT)
Interface	10/100/1000 Mbit/s connection

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2.6. Multi I/O and Storage

Integrated	Intel® QM370/HM370/CM246 Chipset
USB[(1)]	4x USB 3.0 (USB 0,1,2,3), 4x USB 2.0 (USB 4,5,6,7) All USB supported by xHCI controllers
SATA[(2)]	4x SATA 6Gb/s (SATA 0,1,2,3)
GPIO/SD	4 GPO and 4 GPI (GPI with interrupt) SD/GPIO muxed design, switched by BIOS setting SD functions as storage device only

Notes: [(1)]USB 3.1 Gen2 support is dependent on carrier board design.
[(2)]For SATA 6Gb/s compatibility, it is strongly recommended to use a SATA redriver on the carrier board.

2.7. Serial I/O on Module

- **Chipset:** Nuvoton NCT5104D
- **Ports:** 2x UARTs Rx/Tx only
- **Console Redirection:** COM 1 or COM 2 selectable in BIOS

COM Port	Description	IRQ	Address	Console redirection support
COM 1	Supported by module (SER0, A98/A99), via NCT5104D	4	0x3F8	Yes
COM 2	Supported by module (SER1, A101/A102), via NCT5104D	3	0x2F8	Yes
COM 3	Supported by Super I/O (W83627DHG) on carrier board	5	0x240	Yes
COM 4	Supported by Super I/O (W83627DHG) on carrier board	7	0x248	Yes

Note: NCT5104D is 16550-compatible and supports up to 1.5Mb/s (baud rate at 24MHz).

2.8. Trusted Platform Module (TPM)

- **Chipset:** Infineon solution
- **Type:** TPM 2.0 (TPM 1.2 by BOM option, support by project basis)

2.9. SEMA Board Controller

- **Type:** ADLINK Smart Embedded Management Agent (SEMA)
- **Functions:**
  - Voltage/Current monitoring
  - Power sequence debug support
  - AT/ATX mode control
  - Logistics and forensic information
  - Flat panel control
  - General purpose I2C
  - Failsafe BIOS (dual BIOS)
  - Watchdog timer and fan control

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2.10. Debug

- 40-pin flat cable connector to be used with DB-40 debug module
  Supports: BIOS POST code LED, BMC access, SPI BIOS flashing, power testpoints, debug LEDs
- 60-pin XDP header for ICE debug of CPU/chipset

2.11. Power Specifications

Power Modes	AT and ATX mode (AT mode startup controlled by SEMA Board Controller)
Standard Voltage Input	ATX: 12V±5% / 5Vsb ±5% or AT = 12V±5%
Wide Voltage Input	ATX: 8.5-20V, 5Vsb ±5% or AT @ 8.5-20V
Power Management	ACPI 5.0 compliant, Smart Battery support
Power States	Supports C1-C6, S0, S1, S3, S4, S5, S5 ECO mode (Wake-on-USB S3/S4, WoL S3/S4/S5)
ECO Mode	Supports deep S5 for 5Vsb power saving

2.12. Power Consumption

Please contact your ADLINK representative for the document “COM Express Module Power Consumption”.

2.13. Operating Temperatures

Standard Operating Temperature	0°C to +60°C (Wide Voltage Input) Storage: -20°C to +70°C

2.14. Environmental

Humidity	Operating: 5-90% RH, non-condensing Storage: 5-95% RH (and operating with conformal coating)
Shock and Vibration	IEC 60068-2-64 and IEC-60068-2-27 MIL-STD-202F, Method 213B, Table 213-I, Condition A and Method 214A, Table 214-I, Condition D
HALT	Thermal Stress, Vibration Stress, Thermal Shock and Combined Test

2.15. Specification Compliance

- PICMG COM.0: Rev 3.0 Type 6, Basic size 125 x 95 mm

2.16. Operating Systems

Standard Support	• Windows 10 (64-bit) • Windows 10 IOT Enterprise (64-bit) • Linux (64-bit)
Extended Support (BSP)	• Linux (64-bit)

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2.17. Functional Diagram

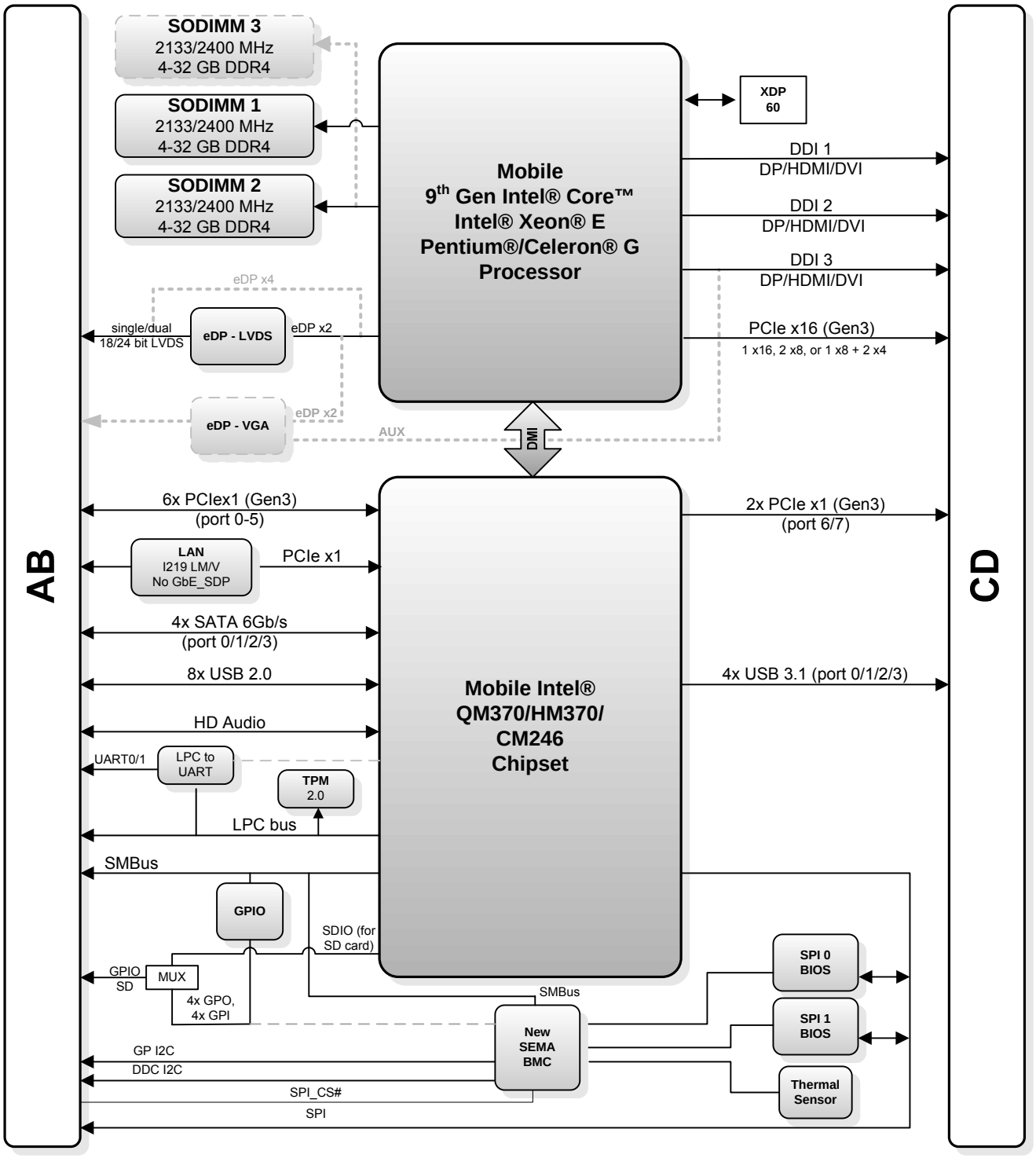
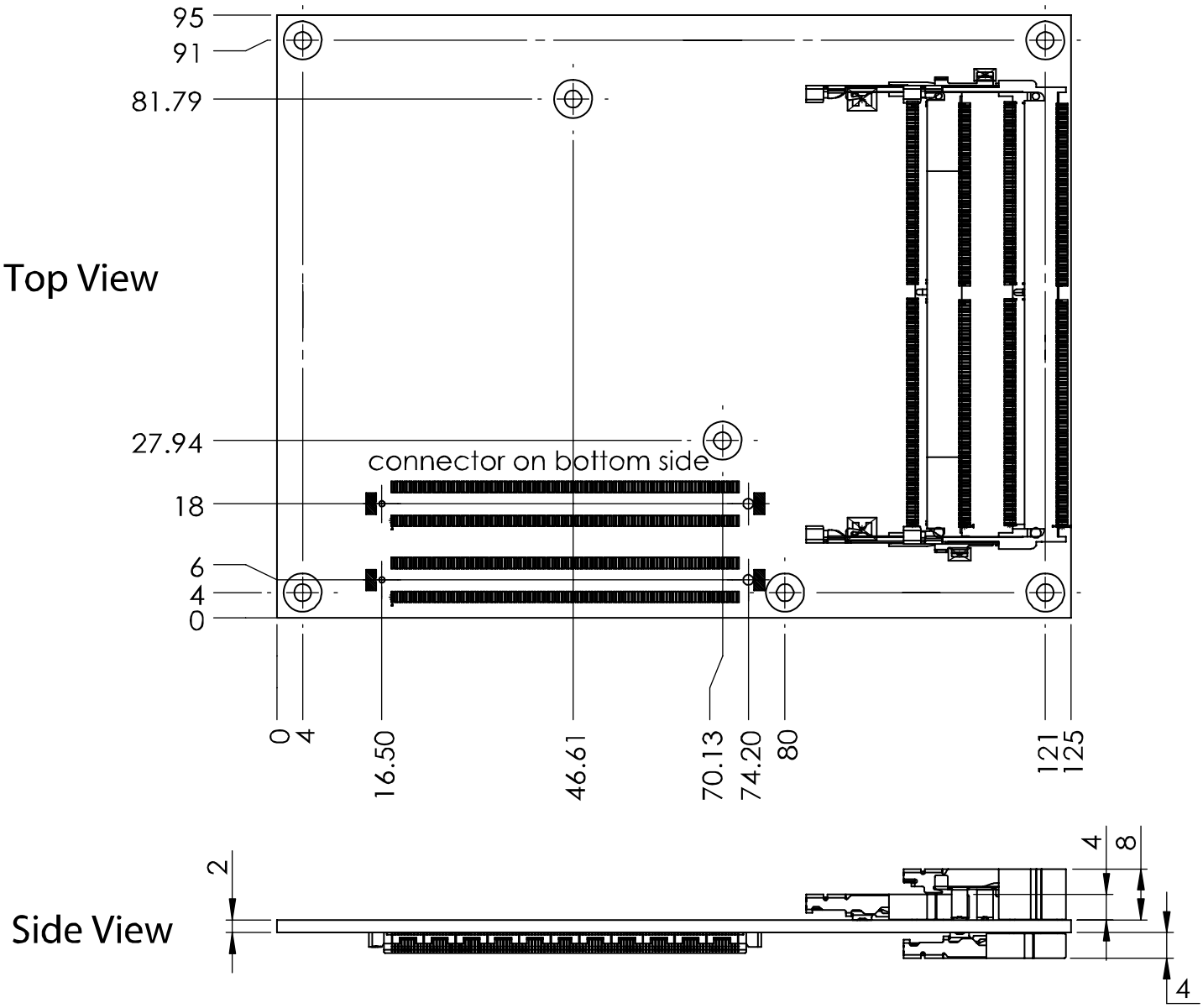


Figure 1: Express-CFR Functional Block Diagram

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2.18. Mechanical Drawing



All are dimensions shown in millimeters.

Tolerances should be ± 0.25mm (±0.010”), unless otherwise noted. The tolerances of the module connector locating peg holes (dimensions [16.50, 6.00] and [16.50, 18.00]) should be ±0.10mm (±0.004”).

Figure 2: Express-CFR Mechanical Drawing

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3. Pinouts and Signal Descriptions

3.1. AB/CD Pin Definitions

The Express-CFR is a Type 6 module supporting USB 3.0 upgrade signals and DDI channels on the CD connector. All pins in the COM Express specification are described, including those not supported on the Express-CFR. Those not supported on the Express-CFR module are ~~crossed out~~.

Table 1: Express-CFR AB/CD Pin Definitions

	Row A		Row B		Row C		Row D
Pin	**Name**	**Pin**	**Name**	**Pin**	**Name**	**Pin**	**Name**
A1	GND (fixed)	**B1**	GND (fixed)	**C1**	GND (fixed)	**D1**	GND (fixed)
A2	GBE0_MDI3-	**B2**	GBE0_ACT#	**C2**	GND	**D2**	GND
A3	GBE0_MDI3+	**B3**	LPC_FRAME#	**C3**	USB_SSRX0-	**D3**	USB_SSTX0-
A4	GBE0_LINK100#	**B4**	LPC_AD0	**C4**	USB_SSRX0+	**D4**	USB_SSTX0+
A5	GBE0_LINK1000#	**B5**	LPC_AD1	**C5**	GND	**D5**	GND
A6	GBE0_MDI2-	**B6**	LPC_AD2	**C6**	USB_SSRX1-	D6	USB_SSTX1-
A7	GBE0_MDI2+	**B7**	LPC_AD3	**C7**	USB_SSRX1+	D7	USB_SSTX1+
A8	GBE0_LINK#	**B8**	LPC_DRQ0#	**C8**	GND	D8	GND
A9	GBE0_MDI1-	**B9**	LPC_DRQ1#	**C9**	USB_SSRX2-	D9	USB_SSTX2-
A10	GBE0_MDI1+	**B10**	LPC_CLK	**C10**	USB_SSRX2+	D10	USB_SSTX2+
A11	GND (fixed)	**B11**	GND (fixed)	**C11**	GND (fixed)	D11	GND (fixed)
A12	GBE0_MDI0-	**B12**	PWRBTN#	**C12**	USB_SSRX3-	D12	USB_SSTX3-
A13	GBE0_MDI0+	**B13**	SMB_CK	**C13**	USB_SSRX3+	D13	USB_SSTX3+
A14	GBE0_CTREF	**B14**	SMB_DAT	**C14**	GND	**D14**	GND
A15	SUS_S3#	**B15**	SMB_ALERT#	**C15**	~~DDI1_PAIR6+~~	**D15**	DDI1_CTRLCLK_AUX+
A16	SATA0_TX+	**B16**	SATA1_TX+	**C16**	~~DDI1_PAIR6-~~	**D16**	DDI1_CTRLDATA_AUX
A17	SATA0_TX-	**B17**	SATA1_TX-	**C17**	RSVD	**D17**	RSVD
A18	SUS_S4#	**B18**	SUS_STAT#	**C18**	RSVD	**D18**	RSVD
A19	SATA0_RX+	**B19**	SATA1_RX+	**C19**	PCIE_RX6+	D19	PCIE_TX6+
A20	SATA0_RX-	**B20**	SATA1_RX-	**C20**	PCIE_RX6-	D20	PCIE_TX6-
A21	GND (fixed)	**B21**	GND (fixed)	**C21**	GND (fixed)	**D21**	GND (fixed)
A22	SATA2_TX+	**B22**	SATA3_TX+	**C22**	PCIE_RX7+	**D22**	PCIE_TX7+
A23	SATA2_TX-	**B23**	SATA3_TX-	**C23**	PCIE_RX7-	**D23**	PCIE_TX7-
A24	SUS_S5#	**B24**	PWR_OK	**C24**	DDI1_HPD	**D24**	RSVD
A25	SATA2_RX+	**B25**	SATA3_RX+	**C25**	~~DDI1_PAIR4+~~	**D25**	RSVD
A26	SATA2_RX-	**B26**	SATA3_RX-	**C26**	~~DDI1_PAIR4-~~	**D26**	DDI1_PAIR0+
A27	BATLOW#	**B27**	WDT	**C27**	RSVD	**D27**	DDI1_PAIR0-
A28	(S)ATA_ACT#	**B28**	~~HDA_SDIN2~~	**C28**	RSVD	**D28**	RSVD
A29	HDA_SYNC	**B29**	HDA_SDIN1	**C29**	~~DDI1_PAIR5+~~	**D29**	DDI1_PAIR1+
A30	HDA_RST#	**B30**	HDA_SDIN0	**C30**	~~DDI1_PAIR5-~~	**D30**	DDI1_PAIR1-
A31	GND (fixed)	**B31**	GND (fixed)	**C31**	GND (fixed)	**D31**	GND (fixed)
A32	HDA_BITCLK	**B32**	SPKR	**C32**	DDI2_CTRLCLK_AUX+	**D32**	DDI1_PAIR2+
A33	HDA_SDOUT	**B33**	I2C_CK	**C33**	DDI2_CTRLDATA_AUX-	**D33**	DDI1_PAIR2-
A34	BIOS_DIS0#	**B34**	I2C_DAT	**C34**	DDI2_DDC_AUX_SEL	**D34**	DDI1_DDC_AUX_SEL
A35	THRMTRIP#	**B35**	THRM#	**C35**	RSVD	**D35**	RSVD

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	Row A		Row B		Row C		Row D
Pin	**Name**	**Pin**	**Name**	**Pin**	**Name**	**Pin**	**Name**
A36	USB6-	**B36**	USB7-	**C36**	DDI3_CTRLCLK_AUX+	**D36**	DDI1_PAIR3+
A37	USB6+	**B37**	USB7+	**C37**	DDI3_CTRLDATA_AUX-	**D37**	DDI1_PAIR3-
A38	USB_6_7_OC#	**B38**	USB_4_5_OC#	**C38**	DDI3_DDC_AUX_SEL	**D38**	RSVD
A39	USB4-	**B39**	USB5-	**C39**	DDI3_PAIR0+	**D39**	DDI2_PAIR0+
A40	USB4+	**B40**	USB5+	**C40**	DDI3_PAIR0-	**D40**	DDI2_PAIR0-
A41	GND (fixed)	**B41**	GND (fixed)	**C41**	GND (fixed)	**D41**	GND (fixed)
A42	USB2-	**B42**	USB3-	**C42**	DDI3_PAIR1+	**D42**	DDI2_PAIR1+
A43	USB2+	**B43**	USB3+	**C43**	DDI3_PAIR1-	**D43**	DDI2_PAIR1-
A44	USB_2_3_OC#	**B44**	USB_0_1_OC#	**C44**	DDI3_HPD	**D44**	DDI2_HPD
A45	USB0-	**B45**	USB1-	**C45**	RSVD	**D45**	RSVD
A46	USB0+	**B46**	USB1+	**C46**	DDI3_PAIR2+	**D46**	DDI2_PAIR2+
A47	VCC_RTC	**B47**	~~ESPI_EN#~~	**C47**	DDI3_PAIR2-	**D47**	DDI2_PAIR2-
A48	RSVD	**B48**	~~USB0_HOST_PRSNT~~	**C48**	RSVD	**D48**	RSVD
A49	GBE0_SDP	**B49**	SYS_RESET#	**C49**	DDI3_PAIR3+	**D49**	DDI2_PAIR3+
A50	LPC_SERIRQ	**B50**	CB_RESET#	**C50**	DDI3_PAIR3-	**D50**	DDI2_PAIR3-
A51	GND (fixed)	**B51**	GND (fixed)	**C51**	GND (fixed)	**D51**	GND (fixed)
A52	PCIE_TX5+	**B52**	PCIE_RX5+	**C52**	PEG_RX0+	D52	PEG_TX0+
A53	PCIE_TX5-	**B53**	PCIE_RX5-	**C53**	PEG_RX0-	D53	PEG_TX0-
A54	GPI0	**B54**	GPO1	**C54**		**D54**	PEG_LANE_RV#
A55	PCIE_TX4+	**B55**	PCIE_RX4+	**C55**	PEG_RX1+	D55	PEG_TX1+
A56	PCIE_TX4-	**B56**	PCIE_RX4-	**C56**	PEG_RX1-	D56	PEG_TX1-
A57	GND	**B57**	GPO2	**C57**	TYPE1#	**D57**	TYPE2#
A58	PCIE_TX3+	**B58**	PCIE_RX3+	**C58**	PEG_RX2+	D58	PEG_TX2+
A59	PCIE_TX3-	**B59**	PCIE_RX3-	**C59**	PEG_RX2-	D59	PEG_TX2-
A60	GND (fixed)	**B60**	GND (fixed)	**C60**	GND (fixed)	D60	GND (fixed)
A61	PCIE_TX2+	**B61**	PCIE_RX2+	**C61**	PEG_RX3+	D61	PEG_TX3+
A62	PCIE_TX2-	**B62**	PCIE_RX2-	**C62**	PEG_RX3-	D62	PEG_TX3-
A63	GPI1	**B63**	GPO3	**C63**	RSVD	D63	RSVD
A64	PCIE_TX1+	**B64**	PCIE_RX1+	**C64**	RSVD	D64	RSVD
A65	PCIE_TX1-	**B65**	PCIE_RX1-	**C65**	PEG_RX4+	D65	PEG_TX4+
A66	GND	**B66**	WAKE0#	**C66**	PEG_RX4-	D66	PEG_TX4-
A67	GPI2	**B67**	WAKE1#	**C67**	RAPID_SHUTDOWN*	D67	GND
A68	PCIE_TX0+	**B68**	PCIE_RX0+	**C68**	PEG_RX5+	D68	PEG_TX5+
A69	PCIE_TX0-	**B69**	PCIE_RX0-	**C69**	PEG_RX5-	D69	PEG_TX5-
A70	GND (fixed)	**B70**	GND (fixed)	**C70**	GND (fixed)	D70	GND (fixed)
A71	LVDS_A0+	**B71**	LVDS_B0+	**C71**	PEG_RX6+	D71	PEG_TX6+
A72	LVDS_A0-	**B72**	LVDS_B0-	**C72**	PEG_RX6-	D72	PEG_TX6-
A73	LVDS_A1+	**B73**	LVDS_B1+	**C73**	GND	D73	GND
A74	LVDS_A1-	**B74**	LVDS_B1-	**C74**	PEG_RX7+	D74	PEG_TX7+
A75	LVDS_A2+	**B75**	LVDS_B2+	**C75**	PEG_RX7-	D75	PEG_TX7-
A76	LVDS_A2-	**B76**	LVDS_B2-	**C76**	GND	D76	GND
A77	LVDS_VDD_EN	**B77**	LVDS_B3+	**C77**	RSVD	D77	RSVD
A78	LVDS_A3+	**B78**	LVDS_B3-	**C78**	PEG_RX8+	D78	PEG_TX8+
A79	LVDS_A3-	**B79**	LVDS_BKLT_EN	**C79**	PEG_RX8-	D79	PEG_TX8-

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	Row A		Row B		Row C		Row D
Pin	**Name**	**Pin**	**Name**	**Pin**	**Name**	**Pin**	**Name**
A80	GND (FIXED)	**B80**	GND (FIXED)	**C80**	GND (FIXED)	**D80**	GND (FIXED)
A81	LVDS_A_CK+	**B81**	LVDS_B_CK+	**C81**	PEG_RX9+	D81	PEG_TX9+
A82	LVDS_A_CK-	**B82**	LVDS_B_CK-	**C82**	PEG_RX9-	D82	PEG_TX9-
A83	LVDS_I2C_CK	**B83**	LVDS_BKLT_CTRL	**C83**	RSVD	D83	RSVD
A84	LVDS_I2C_DAT	**B84**	VCC_5V_SBY	**C84**	GND	D84	GND
A85	GPI3	**B85**	VCC_5V_SBY	**C85**	PEG_RX10+	D85	PEG_TX10+
A86	RSVD	**B86**	VCC_5V_SBY	**C86**	PEG_RX10-	D86	PEG_TX10-
A87	RSVD	**B87**	VCC_5V_SBY	**C87**	GND	D87	GND
A88	PCIE0_CK_REF+	**B88**	BIOS_DIS1#	**C88**	PEG_RX11+	D88	PEG_TX11+
A89	PCIE0_CK_REF-	**B89**	VGA_RED*	**C89**	PEG_RX11-	D89	PEG_TX11-
A90	GND (fixed)	**B90**	GND (fixed)	**C90**	GND (fixed)	D90	GND (fixed)
A91	SPI_POWER	**B91**	VGA_GRN*	**C91**	PEG_RX12+	D91	PEG_TX12+
A92	SPI_MISO	**B92**	VGA_BLU*	**C92**	PEG_RX12-	D92	PEG_TX12-
A93	GPO0	**B93**	VGA_HSYNC*	**C93**	GND	D93	GND
A94	SPI_CLK	**B94**	VGA_VSYNC*	**C94**	PEG_RX13+	D94	PEG_TX13+
A95	SPI_MOSI	**B95**	VGA_I2C_CK*	**C95**	PEG_RX13-	D95	PEG_TX13-
A96	TPM_PP	**B96**	VGA_I2C_DAT*	**C96**	GND	D96	GND
A97	TYPE10#	**B97**	SPI_CS#	**C97**	RSVD	D97	RSVD
A98	SER0_TX	**B98**	RSVD	**C98**	PEG_RX14+	D98	PEG_TX14+
A99	SER0_RX	**B99**	RSVD	**C99**	PEG_RX14-	D99	PEG_TX14-
A100	GND (fixed)	**B100**	GND (fixed)	**C100**	GND (fixed)	D100	GND (fixed)
A101	SER1_TX	**B101**	FAN_PWMOUT	**C101**	PEG_RX15+	D101	PEG_TX15+
A102	SER1_RX	**B102**	FAN_TACHIN	**C102**	PEG_RX15-	D102	PEG_TX15-
A103	LID# **		SLEEP# **	**C103**	GND	D103	GND
A104	VCC_12V	**B104**	VCC_12V	**C104**	VCC_12V	**D104**	VCC_12V
A105	VCC_12V	**B105**	VCC_12V	**C105**	VCC_12V	**D105**	VCC_12V
A106	VCC_12V	**B106**	VCC_12V	**C106**	VCC_12V	**D106**	VCC_12V
A107	VCC_12V	**B107**	VCC_12V	**C107**	VCC_12V	**D107**	VCC_12V
A108	VCC_12V	**B108**	VCC_12V	**C108**	VCC_12V	**D108**	VCC_12V
A109	VCC_12V	**B109**	VCC_12V	**C109**	VCC_12V	**D109**	VCC_12V
A110	GND (fixed)	**B110**	GND (fixed)	**C110**	GND (fixed)	**D110**	GND (fixed)

Notes: 4-lane eDP is available as BOM option in place of LVDS.

VGA is available as BOM option in place of DDI 3.

RAPID_SHUTDOWN is available as BOM option (TBD).

I2C bus from chipset is available as BOM option.

SER 0/1 from chipset is available as BOM option.

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3.2. Signal Description Terminology

The following terms are used in the COM Express AB/CD Signal Descriptions below.

I	Input to the Module
O	Output from the Module
I/O	Bi-directional input/output signal
OD	Open drain output
I 3.3V	Input 3.3V tolerant
I 5V	Input 5V tolerant
O 3.3V	Output 3.3V signal level
O 5V	Output 5V signal level
I/O 3.3V	Bi-directional signal 3.3V tolerant
I/O 5V	Bi-directional signal 5V tolerant
I/O 3.3Vsb	Input 3.3V tolerant active in standby state
P	Power Input/Output
REF	Reference voltage output that may be sourced from a module power plane.
PDS	Pull-down strap. This is an output pin on the module that is either tied to GND or not connected. The signal is used to indicate the PICMG module type to the Carrier Board.
PU	ADLINK implemented pull-up resistor on module
PD	ADLINK implemented pull-down resistor on module

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3.3. AB Signal Descriptions

3.3.1. Audio Signals

Signal	Pin #	Description	I/O	PU/PD	Comment
HDA_RST#	A30	Reset output to CODEC, active low.	O 3.3VSB		
HDA_SYNC	A29	Sample-synchronization signal to the CODEC(s).	O 3.3V		
HDA_BITCLK	A32	Serial data clock generated by the external CODEC(s).	I/O 3.3V		
HDA_SDOUT	A33	Serial TDM data output to the CODEC.	O 3.3V		
HDA_SDIN[2:0]	B28 B29 B30	Serial TDM data inputs from up to 3 CODECs.	I 3.3VSB		HDA_SDIN0: supported HDA_SDIN1: supported HDA_SDIN2: not supported

3.3.2. Analog VGA

Note: VGA is supported by build option, in place of DDI 3.

Signal	Pin #	Description	I/O	PU/PD	Comment
VGA_RED	B89	Red for monitor. Analog DAC output, designed to drive a 37.5-Ohm equivalent load.	O Analog	PD 150R	shall also be terminated on the carrier with 150Ω resistor to ground close to VGA connector
VGA_GRN	B91	Green for monitor Analog DAC output, designed to drive a 37.5-Ohm equivalent load.	O Analog	PD 150R	shall also be terminated on the carrier with 150Ω resistor to ground close to VGA connector
VGA_BLU	B92	Blue for monitor. Analog DAC output, designed to drive a 37.5-Ohm equivalent load.	O Analog	PD 150R	shall also be terminated on the carrier with 150Ω resistor to ground close to VGA connector
VGA_HSYNC	B93	Horizontal sync output to VGA monitor	O 3.3V		
VGA_VSYNC	B94	Vertical sync output to VGA monitor	O 3.3V		
VGA_I2C_CK	B95	DDC clock line (I²C port dedicated to identify VGA monitor capabilities)	I/O OD 3.3V	PU 2K2 3.3V	
VGA_I2C_DAT	B96	DDC data line.	I/O OD 3.3V	PU 2K2 3.3V	

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3.3.3. LVDS

Signal	Pin #	Description	I/O	PU/PD	Comment
LVDS_A0+ LVDS_A0- LVDS_A1+ LVDS_A1- LVDS_A2+ LVDS_A2- LVDS_A3+ LVDS_A3-	A71 A72 A73 A74 A75 A76 A78 A79	LVDS Channel A differential pairs	O LVDS		LVDS is default support
LVDS_A_CK+ LVDS_A_CK-	A81 A82	LVDS Channel A differential clock	O LVDS		
LVDS_B0+ LVDS_B0- LVDS_B1+ LVDS_B1- LVDS_B2+ LVDS_B2- LVDS_B3+ LVDS_B3-	B71 B72 B73 B74 B75 B76 B77 B78	LVDS Channel B differential pairs	O LVDS		
LVDS_B_CK+ LVDS_B_CK-	B81 B82	LVDS Channel B differential clock	O LVDS		
LVDS_VDD_EN	A77	LVDS panel power enable	O 3.3V		
LVDS_BKLT_EN	B79	LVDS panel backlight enable	O 3.3V		
LVDS_BKLT_CTRL	B83	LVDS panel backlight brightness control	O 3.3V	PD 100K	eDP to LVDS IC requirement
LVDS_I2C_CK	A83	DDC lines used for flat panel detection and control.	I/O OD 3.3V	PU 2K2 3.3V	
LVDS_I2C_DAT	A84	DDC lines used for flat panel detection and control.	I/O OD 3.3V	PU 2K2 3.3V	

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3.3.4. eDP

Note: eDP is supported by build option, in place of LVDS.

Signal	Pin #	Description	I/O	PU/PD	Comment
eDP_TX3+ eDP_TX3- eDP_TX2+ eDP_TX2- eDP_TX1+ eDP_TX1- eDP_TX0+ eDP_TX0-	A81 A82 A71 A72 A73 A74 A75 A76	eDP differential pairs	O PCIE		AC coupled off module
eDP_VDD_EN	A77	eDP power enable	O 3.3V		
eDP_BKLT_EN	B79	eDP backlight enable	O 3.3V		
eDP_BKLT_CTRL	B83	eDP backlight brightness control	O 3.3V	PD 100K	
eDP_AUX+	A83	eDP AUX+	I/O PCIE		AC coupled off module
eDP_AUX-	A84	eDP AUX-	I/O PCIE		AC coupled off module
eDP_HPD	A87	Detection of Hot Plug / Unplug and notification of the link layer	I 3.3V	PD 100K	PD 100K on this pin when eDP is supported

3.3.5. Gigabit Ethernet

Gigabit Ethernet	Pin #	Description	I/O	PU/PD	Comment
GBE0_MDI0+ GBE0_MDI0- GBE0_MDI1+ GBE0_MDI1- GBE0_MDI2+ GBE0_MDI2- GBE0_MDI3+ GBE0_MDI3-	A13 A11 A10 A9 A7 A6 A3 A2	Gigabit Ethernet Controller 0: Media Dependent Interface Differential Pairs 0, 1, 2, 3. The MDI can operate in 1000, 100, and 10Mbit/sec modes. Some pairs are unused in some modes according to the following: **1000 / 100 / 10** MDI[0]+/- B1_DA+/- TX+/- TX+/- MDI[1]+/- B1_DB+/- RX+/- RX+/- MDI[2]+/- B1_DC+/- MDI[3]+/- B1_DD+/-	I/O Analog		Twisted pair signals for external transformer.
GBE0_ACT#	B2	Gigabit Ethernet Controller 0 activity indicator, active low.	OD 3.3VSB		Shares same source as A8
GBE0_LINK#	A8	Gigabit Ethernet Controller 0 link indicator, active low.	OD 3.3VSB		Shares same as B2
GBE0_LINK100#	A4	Gigabit Ethernet Controller 0 100Mbit/sec link indicator, active low.	OD 3.3VSB		
GBE0_LINK1000#	A5	Gigabit Ethernet Controller 0 1000Mbit/sec link indicator, active low.	OD 3.3VSB		
GBE0_CTREF	A14	Reference voltage for Carrier Board Ethernet channel 1 and 2 magnetics center tap. The reference voltage is determined by the requirements of the Module PHY and may be as low as 0V and as high as 3.3V. The reference voltage output shall be current limited on the Module. In the case in which the reference is shorted to ground, the current shall be 250 mA or less.	GND min 3.3V max		NC pin
GBE0_SDP	A49	Gigabit Ethernet Controller 0 Software-Definable Pin. Can also be used for IEEE1588 support such as 1pps signal.	IO 3.3VSB		Not supported

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3.3.6. SATA

Signal	Pin #	Description	I/O	PU/PD	Comment
SATA0_TX+ SATA0_TX-	A16 A17	Serial ATA channel 0, Transmit Output differential pair.	O SATA		AC coupled on Module
SATA0_RX+ SATA0_RX-	A19 A20	Serial ATA channel 0, Receive Input differential pair.	I SATA		AC coupled on Module
SATA1_TX+ SATA1_TX-	B16 B17	Serial ATA channel 1, Transmit Output differential pair.	O SATA		AC coupled on Module
SATA1_RX+ SATA1_RX-	B19 B20	Serial ATA channel 1, Receive Input differential pair.	I SATA		AC coupled on Module
SATA2_TX+ SATA2_TX-	A22 A23	Serial ATA channel 2, Transmit Output differential pair.	O SATA		AC coupled on Module
SATA2_RX+ SATA2_RX-	A25 A26	Serial ATA channel 2, Receive Input differential pair.	I SATA		AC coupled on Module
SATA3_TX+ SATA3_TX-	B22 B23	Serial ATA channel 3, Transmit Output differential pair.	O SATA		AC coupled on Module
SATA3_RX+ SATA3_RX-	B25 B26	Serial ATA channel 3, Receive Input differential pair.	I SATA		AC coupled on Module
(S)ATA_ACT#	A28	ATA (parallel and serial) or SAS activity indicator, active low.	O 3.3V	PU 10K 3.3V	

PCH HSIO Lane Assignments

SATA on COMe Module	HSIO Function on PCH	Comment
SATA 0	SATA #1b	
SATA 1	SATA #0b	
SATA 2	SATA #5	
SATA 3	SATA #4	

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3.3.7. PCI Express

Signal	Pin #	Description	I/O	PU/PD	Comment
PCIE_TX0+ PCIE_TX0-	A68 A69	PCI Express channel 0, Transmit Output differential pair.	O PCIE		AC coupled on Module
PCIE_RX0+ PCIE_RX0-	B68 B69	PCI Express channel 0, Receive Input differential pair.	I PCIE		AC coupled off Module
PCIE_TX1+ PCIE_TX1-	A64 A65	PCI Express channel 1, Transmit Output differential pair.	O PCIE		AC coupled on Module
PCIE_RX1+ PCIE_RX1-	B64 B65	PCI Express channel 1, Receive Input differential pair.	I PCIE		AC coupled off Module
PCIE_TX2+ PCIE_TX2-	A61 A62	PCI Express channel 2, Transmit Output differential pair.	O PCIE		AC coupled on Module
PCIE_RX2+ PCIE_RX2-	B61 B62	PCI Express channel 2, Receive Input differential pair.	I PCIE		AC coupled off Module
PCIE_TX3+ PCIE_TX3-	A58 A59	PCI Express channel 3, Transmit Output differential pair.	O PCIE		AC coupled on Module
PCIE_RX3+ PCIE_RX3-	B58 B59	PCI Express channel 3, Receive Input differential pair.	I PCIE		AC coupled off Module
PCIE_TX4+ PCIE_TX4-	A55 A56	PCI Express channel 4, Transmit Output differential pair.	O PCIE		AC coupled on Module
PCIE_RX4+ PCIE_RX4-	B55 B56	PCI Express channel 4, Receive Input differential pair.	I PCIE		AC coupled off Module
PCIE_TX5+ PCIE_TX5-	A52 A53	PCI Express channel 5, Transmit Output differential pair.	O PCIE		AC coupled on Module
PCIE_RX5+ PCIE_RX5-	B52 B53	PCI Express channel 5, Receive Input differential pair.	I PCIE		AC coupled off Module
PCIE_CLK_REF+ PCIE_CLK_REF-	A88 A89	PCI Express Reference Clock output for all PCI Express and PCI Express Graphics Lanes.	O PCIE		

PCH HSIO Lane Assignments

PCIe on COMe Module	HSIO Function on PCH	Comment
PCIE 0	PCIe #9	PCIE 0-3 support Intel® RST for PCIe storage
PCIE 1	PCIe #10	
PCIE 2	PCIe #11	
PCIE 3	PCIe #12	
PCIE 4	PCIe #21	PCIE 4-7 support Intel® RST for PCIe storage
PCIE 5	PCIe #22	
PCIE 6	PCIe #23	
PCIE 7	PCIe #24	

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3.3.8. LPC Bus

Signal	Pin #	Description	I/O	PU/PD	Comment
LPC_AD[0:3]	B4-B7	LPC multiplexed address, command and data bus	I/O 3.3V		
LPC_FRAME#	B3	LPC frame indicates the start of an LPC cycle	O 3.3V		
LPC_DRQ0# LPC_DRQ1#	B8 B9	LPC serial DMA request	I 3.3V		NC pins
LPC_SERIRQ	A50	LPC serial interrupt	I/O OD 3.3V	PU 8.2K 3.3V	
LPC_CLK	B10	LPC clock output –33MHz nominal	O 3.3V		The LPC_CLK frequency is 24MHz on this platform

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3.3.9. USB

Signal	Pin #	Description	I/O	PU/PD	Comment
USB0+ USB0-	A46 A45	USB differential data pairs for Port 0	I/O 3.3VSB		USB 1.1/ 2.0 compliant
USB1+ USB1-	B46 B45	USB differential data pairs for Port 1	I/O 3.3VSB		USB 1.1/ 2.0 compliant
USB2+ USB2-	A43 A42	USB differential data pairs for Port 1	I/O 3.3VSB		USB 1.1/ 2.0 compliant
USB3+ USB3-	B43 B42	USB differential data pairs for Port 2	I/O 3.3VSB		USB 1.1/ 2.0 compliant
USB4+ USB4-	A40 A39	USB differential data pairs for Port 3	I/O 3.3VSB		USB 1.1/ 2.0 compliant
USB5+ USB5-	B40 B39	USB differential data pairs for Port 4	I/O 3.3VSB		USB 1.1/ 2.0 compliant
USB6+ USB6-	A37 A36	USB differential data pairs for Port 5	I/O 3.3VSB		USB 1.1/ 2.0 compliant
USB7+ USB7-	B37 B37	USB differential data pairs for Port 6	I/O 3.3VSB		USB 1.1/ 2.0 compliant
USB_0_1_OC#	B44	USB over-current sense, USB ports 0 and 1. A pull-up for this line shall be present on the module. An open drain driver from a USB current monitor on the carrier board may drive this line low.	I 3.3VSB	PU 10K 3.3VSB	Do not pull high on carrier
USB_2_3_OC#	A44	USB over-current sense, USB ports 2 and 3. A pull-up for this line shall be present on the module. An open drain driver from a USB current monitor on the carrier board may drive this line low. .	I 3.3VSB	PU 10K 3.3VSB	Do not pull high on carrier
USB_4_5_OC#	B38	USB over-current sense, USB ports 4 and 5. A pull-up for this line shall be present on the module. An open drain driver from a USB current monitor on the carrier board may drive this line low.	I 3.3VSB	PU 10K 3.3VSB	Do not pull high on carrier
USB_6_7_OC#	A38	USB over-current sense, USB ports 6 and 7. A pull-up for this line shall be present on the module. An open drain driver from a USB current monitor on the carrier board may drive this line low.	I 3.3VSB	PU 10K 3.3VSB	Do not pull high on carrier
USB0_HOST_PRSNT	B48	Module USB client may detect the presence of a USB host on USB0. A high value indicates that a host is present.	I 3.3VSB		The detection pin of the chipset is connected to B48 on the module (USB0_HOST_ PRSNT), but the function is not on the platform vendor's support list.

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3.3.10. USB Root Segmentation

USB on COMe Module	HSIO Function on PCH	Comment
USB 0	USB 3.1 #1	All USB are from XHCI controllers.
USB 1	USB 3.1 #4	
USB 2	USB 3.1 #3	
USB 3	USB 3.1 #2	

3.3.11. SPI (BIOS only)

Signal	Pin #	Description	I/O	PU/PD	Comment
SPI_CS#	B97	Chip select for Carrier Board SPI BIOS Flash.	O 3.3VSB	PU 10K 3.3VSB	
SPI_MISO	A92	Data in to module from carrier board SPI BIOS flash.	I 3.3VSB		
SPI_MOSI	A95	Data out from module to carrier board SPI BIOS flash.	O 3.3VSB		
SPI_CLK	A94	Clock from module to carrier board SPI BIOS flash.	O 3.3VSB		
SPI_POWER	A91	Power supply for Carrier Board SPI – sourced from Module – nominally 3.3V. The Module shall provide a minimum of 100mA on SPI_POWER. Carriers shall use less than 100mA of SPI_POWER. SPI_POWER shall only be used to power SPI devices on the Carrier	O P 3.3VSB		
BIOS_DIS0#	A34	Selection strap to determine the BIOS boot device.	I	PU 10K 3.3VSB	Carrier shall pull to GND or leave not-connected.
BIOS_DIS1#	B88	Selection strap to determine the BIOS boot device.	I	PU 10K 3.3VSB	Carrier shall pull to GND or leave not-connected

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3.3.12. Miscellaneous

Signal	Pin #	Description	I/O	PU/PD	Comment
SPKR	B32	Output for audio enunciator, the “speaker” in PC-AT systems	O 3.3V		
WDT	B27	Output indicating that a watchdog time-out event has occurred.	O 3.3V		
THRM#	B35	Input from off-module temp sensor indicating an over-temp situation.	I 3.3VSB		
THRMTRIP#	A35	Active low output indicating that the CPU has entered thermal shutdown.	O 3.3V		
FAN_PWMOUT	B101	Fan speed control. Uses the Pulse Width Modulation (PWM) technique to control the fan’s RPM.	O OD 3.3V	PU 2.2K 3.3V	There shall be PD on carrier board
FAN_TACHIN	B102	Fan tachometer input for a fan with a two pulse output.	I OD 3.3V	PU 47K 3.3V	
TPM_PP	A96	Trusted Platform Module (TPM) Physical Presence pin. Active high. TPM chip has an internal pull down. This signal is used to indicate Physical Presence to the TPM.	I 3.3V	PD 100K	PD only when TPM on module. Modules implementing a TPM shall pull down TPM_PP.

3.3.13. SMBus

Signal	Pin #	Description	I/O	PU/PD	Comment
SMB_CK	B13	System Management Bus bidirectional clock line. Power sourced through 3.3V standby rail and main power rails.	I/O OD 3.3VSB	PU 2.2K 3.3VSB	
SMB_DAT#	B14	System Management Bus bidirectional data line. Power sourced through 3.3V standby rail and main power rails.	I/O OD 3.3VSB	PU 2.2K 3.3VSB	
SMB_ALERT#	B15	System Management Bus Alert – active low input can be used to generate an SMI# (System Management Interrupt) or to wake the system. Power sourced through 3.3V standby rail and main power rails.	I 3.3VSB		

3.3.14. I2C Bus

Signal	Pin #	Description	I/O	PU/PD	Comment
I2C_CK	B33	General purpose I²C port clock output/input	I/O OD 3.3VSB	PU 2K2 3.3VSB	Source SEMA BMC as default (chipset by build option)
I2C_DAT	B34	General purpose I²C port data I/O line	I/O OD 3.3VSB	PU 2K2 3.3VSB	Source SEMA BMC as default (chipset by build option)

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3.3.15. General Purpose I/O (GPIO)

Signal	Pin #	Description	I/O	PU/PD	Comment
GPO[0]	A93	General purpose output pins.	O 3.3V	PD 10K 3.3V	After hardware RESET output low
GPO[1]	B54	General purpose output pins.	O 3.3V	PD 10K 3.3V	After hardware RESET output low
GPO[2]	B57	General purpose output pins.	O 3.3V	PD 10K 3.3V	After hardware RESET output low
GPO[3]	B63	General purpose output pins.	O 3.3V	PD 10K 3.3V	After hardware RESET output low
GPI[0]	A54	General purpose input pins. Pulled high internally on the module.	I 3.3V	PU 10K 3.3V	
GPI[1]	A63	General purpose input pins. Pulled high internally on the module.	I 3.3V	PU 10K 3.3V	
GPI[2]	A67	General purpose input pins. Pulled high internally on the module.	I 3.3V	PU 10K 3.3V	
GPI[3]	A85	General purpose input pins. Pulled high internally on the module.	I 3.3V	PU 10K 3.3V	

3.3.16. Serial Interface Signals

Signal	Pin #	Description	I/O	PU/PD	Comment
SER0_TX	A98	General purpose serial port transmitter (TTL level output)	O CMOS		Power rail tolerance 5V, 12V There shall be PD on carrier board
SER0_RX	A99	General purpose serial port receiver (TTL level input)	I CMOS	PU 47K 3.3V	Power rail tolerance 5V, 12V
SER1_TX	A101	General purpose serial port transmitter (TTL level output)	O CMOS		Power rail tolerance 5V, 12V There shall be PD on carrier board
SER1_RX	A102	General purpose serial port receiver (TTL level input)	I CMOS	PU 47K 3.3V	Power rail tolerance 5V, 12V

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3.3.17. Power and System Management

Signal	Pin #	Description	I/O	PU/PD	Comment
PWRBTN#	B12	Power button to bring system out of S5 (soft off), active on falling edge.	I 3.3VSB	PU 10K 3.3VSB	
SYS_RESET#	B49	Reset button input. Active low request for module to reset and reboot. May be falling edge sensitive. For situations when SYS_RESET# is not able to reestablish control of the system, PWR_OK or a power cycle may be used.	I 3.3VSB	PU 10K 3.3VSB	
CB_RESET#	B50	Reset output from module to Carrier Board. Active low. Issued by module chipset and may result from a low SYS_RESET# input, a low PWR_OK input, a VCC_12V power input that falls below the minimum specification, a watchdog timeout, or may be initiated by the module software.	O 3.3V		
PWR_OK	B24	Power OK from main power supply. A high value indicates that the power is good. This signal can be used to hold off Module startup to allow carrier based FPGAs or other configurable devices time to be programmed.	I 3.3VSB	PU 10K 3.3VSB	Should have weak pull up.
SUS_STAT#	B18	Indicates imminent suspend operation; used to notify LPC devices.	O 3.3VSB		
SUS_S3#	A15	Indicates system is in Suspend to RAM state. Active-low output. An inverted copy of SUS_S3# on the carrier board (also known as “PS_ON”) may be used to enable the non-standby power on a typical ATX power supply.	O 3.3VSB		
SUS_S4#	A18	Indicates system is in Suspend to Disk state. Active low output.	O 3.3VSB		
SUS_S5#	A24	Indicates system is in Soft Off state.	O 3.3VSB		
WAKE0#	B66	PCI Express wake up signal.	I 3.3VSB	PU 10K 3.3VSB	
WAKE1#	B67	General purpose wake up signal. May be used to implement wake-up on PS/2 keyboard or mouse activity.	I 3.3VSB	PU 10K 3.3VSB	Connect to WAKE 0#
BATLOW#	A27	Battery low input. This signal may be driven low by external circuitry to signal that the system battery is low, or may be used to signal some other external power-management event.	I 3.3VSB	PU 10K 3.3VSB	
LID#	A103	LID button. Low active signal used by the ACPI operating system for a LID switch.	I OD 3.3VSB	PU 47K 3.3VSB	Emulated on GPIO (BIOS)
SLEEP#	B103	Sleep button. Low active signal used by the ACPI operating system to bring the system to sleep state or to wake it up again.	I OD 3.3VSB	PU 47K 3.3VSB	Emulated on GPIO (BIOS)
RAPID_ SHUTDOWN	C67	Trigger for Rapid Shutdown. Must be driven to 5V though a <=50 ohm source impedance for ≥ 20 µs.	I CMOS 5VSB		Build Option support

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3.3.18. Power and Ground

Signal	Pin #	Description	I/O	PU/ PD	Comment
VCC_12V	A104-A109 B104-B109	Primary power input: +12V nominal (wide range 5 ~ 20V). All available VCC_12V pins on the connector(s) shall be used.	P		8.5-20 V
VCC_5V_SBY	B84-B87	Standby power input: +5.0V nominal. See section 7 “Electrical Specifications“ for allowable input range. If VCC5_SBY is used, all available VCC_5V_SBY pins on the connector(s) shall be used. Only used for standby and suspend functions. May be left unconnected if these functions are not used in the system design.	P		5Vsb ±5%
VCC_RTC	A47	Real-time clock circuit-power input. Nominally +3.0V.	P		
GND	A1, A11, A21, A31, A41, A51, A57, A60, A66, A70, A80, A90, A100, A110, B1, B11, B21,B31, B41, B51, B60, B70, B80, B90, B100, B110	Ground - DC power and signal and AC signal return path.	P		

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3.4. CD Signal Descriptions

3.4.1. USB 3.0 Extension

Signal	Pin #	Description	I/O	PU/PD	Comment
USB_SSRX0- USB_SSRX0+	C3 C4	Additional Receive signal differential pairs for the SuperSpeed USB data path on USB0	I PCIE		AC coupled off module
USB_SSTX0- USB_SSTX0+	D3 D4	Additional Transmit signal differential pairs for the SuperSpeed USB data path on USB0	O PCIE		AC coupled on module
USB_SSRX1- USB_SSRX1+	C6 C7	Additional Receive signal differential pairs for the SuperSpeed USB data path on USB1	I PCIE		AC coupled off module
USB_SSTX1- USB_SSTX1+	D6 D7	Additional Transmit signal differential pairs for the SuperSpeed USB data path on USB1	O PCIE		AC coupled on module
USB_SSRX2- USB_SSRX2+	C9 C10	Additional Receive signal differential pairs for the SuperSpeed USB data path on USB2	I PCIE		AC coupled off module
USB_SSTX2- USB_SSTX2+	D9 D10	Additional Transmit signal differential pairs for the SuperSpeed USB data path on USB2	O PCIE		AC coupled on module
USB_SSRX3- USB_SSRX3+	C12 C13	Additional Receive signal differential pairs for the SuperSpeed USB data path on USB3	I PCIE		AC coupled off module
USB_SSTX3- USB_SSTX3+	D12 D13	Additional Transmit signal differential pairs for the SuperSpeed USB data path on USB3	O PCIE		AC coupled on module

3.4.2. PCI Express x1

Signal	Pin #	Description	I/O	PU/PD	Comment
PCIE_TX6+ PCIE_TX6-	D19 D20	PCI Express channel 6, Transmit Output differential pair.	O PCIE		AC coupled on module
PCIE_RX6+ PCIE_RX6-	C19 C20	PCI Express channel 6, Receive Input differential pair.	I PCIE		AC coupled off module
PCIE_TX7+ PCIE_TX7-	D22 D23	PCI Express channel 7, Transmit Output differential pair.	O PCIE		AC coupled on module
PCIE_RX7+ PCIE_RX7-	C22 C23	PCI Express channel 7, Receive Input differential pair.	I PCIE		AC coupled off module

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3.4.3. DDI Channels

DDI 1

Signal	Pin	Description	I/O	PU/PD	Comment
DDI1_PAIR0+ DDI1_PAIR0- DDI1_PAIR1+ DDI1_PAIR1- DDI1_PAIR2+ DDI1_PAIR2- DDI1_PAIR3+ DDI1_PAIR3- DDI1_PAIR4+ DDI1_PAIR4- DDI1_PAIR5+ DDI1_PAIR5- DDI1_PAIR6+ DDI1_PAIR6-	D26 D27 D29 D30 D32 D33 D36 D37 C25 C26 C29 C30 C15 C16	Digital Display Interface1 differential pairs	O PCIE		Pair 4 to Pair 6 Not supported
DDI1_HPD	C24	Digital Display Interface Hot-Plug Detect	I 3.3V	PD 100K	
DDI1_CTRLCLK_AUX+	D15	If DDI1_DDC_AUX_SEL is floating	I/O PCIE	PD 100K	AC couple on Module DP1_AUX+
		If DDI1_DDC_AUX_SEL pulled high	I/O OD 3.3V		HDMI1_CTRLCLK PU 2.2K 3.3V when DDC_AUX_SEL is high
DDI1_CTRLDATA_AUX-	D16	If DDI1_DDC_AUX_SEL is floating	I/O PCIE	PU 100K 3.3V	AC couple on Module DP1_AUX-
		If DDI1_DDC_AUX_SEL pulled high	I/O OD 3.3V		HDMI1_CTRLDATA PU 2.2K 3.3V when DDC_AUX_SEL is high
DDI1_DDC_AUX_SEL	D34	Selects the function of DDI1_CTRLCLK_AUX+ and DDI1_CTRLDATA_AUX-. This pin shall have a 1M pull-down to logic ground on the Module.If this input is floating the AUX pair is used for the DP AUX+/- signals. If pulled-high the AUX pair contains the CRTLCLK and CTRLDATA signals.	I 3.3V	PD 1M	

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DDI 2

Signal	Pin	Description	I/O	PU/PD	Comment
DDI2_PAIR0+ DDI2_PAIR0- DDI2_PAIR1+ DDI2_PAIR1- DDI2_PAIR2+ DDI2_PAIR2- DDI2_PAIR3+ DDI2_PAIR3-	D39 D40 D42 D43 D46 D47 D49 D50	Digital Display Interface2 differential pairs	O PCIE		
DDI2_HPD	D44		I 3.3V	PD 100K	
DDI2_CTRLCLK_AUX+	C32	If DDI2_DDC_AUX_SEL is floating	I/O PCIE	PD 100K	AC couple on Module DP2_AUX+
		If DDI2_DDC_AUX_SEL pulled high	I/O OD 3.3V		HDMI2_CTRLCLK PU 2.2K 3.3V when DDC_AUX_SEL is high
DDI2_CTRLDATA_AUX-	C33	If DDI2_DDC_AUX_SEL is floating	I/O PCIE	PU 100K 3.3V	AC couple on Module DP2_AUX-
		If DDI2_DDC_AUX_SEL pulled high	I/O OD 3.3V		HDMI2_CTRLDATA PU 2.2K 3.3V when DDC_AUX_SEL is high
DDI2_DDC_AUX_SEL	C34	Selects the function of DDI2_CTRLCLK_AUX+ and DDI2_CTRLDATA_AUX-. This pin shall have a 1M pull-down to logic ground on the Module. If this input is floating the AUX pair is used for the DP AUX+/- signals. If pulled-high the AUX pair contains the CRTLCLK and CTRLDATA signals.	I 3.3V	PD 1M	

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DDI 3

Signal	Pin	Description	I/O	PU/PD	Comment
DDI3_PAIR0+ DDI3_PAIR0- DDI3_PAIR1+ DDI3_PAIR1- DDI3_PAIR2+ DDI3_PAIR2- DDI3_PAIR3+ DDI3_PAIR3-	C39 C40 C42 C43 C46 C47 C49 C50	Digital Display Interface3 differential pairs	O PCIE		
DDI3_HPD	C44		I 3.3V	PD 100K	
DDI3_CTRLCLK_AUX+	C36	If DDI3_DDC_AUX_SEL is floating	I/O PCIE	PD 100K	AC couple on Module DP2_AUX+
		If DDI3_DDC_AUX_SEL pulled high	I/O OD 3.3V		HDMI2_CTRLCLK PU 2.2K 3.3V when DDC_AUX_SEL is high
DDI3_CTRLDATA_AUX-	C37	If DDI3_DDC_AUX_SEL is floating	I/O PCIE	PU 100K 3.3V	AC couple on Module DP2_AUX-
		If DDI3_DDC_AUX_SEL pulled high	I/O OD 3.3V		HDMI2_CTRLDATA PU 2.2K 3.3V when DDC_AUX_SEL is high
DDI3_DDC_AUX_SEL	C38	Selects the function of DDI3_CTRLCLK_AUX+ and DDI3_CTRLDATA_AUX-. This pin shall have a 1M pull-down to logic ground on the Module. If this input is floating the AUX pair is used for the DP AUX+/- signals. If pulled-high the AUX pair contains the CRTLCLK and CTRLDATA signals.	I 3.3V	PD 1M	

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3.4.4. DDI to DP/HDMI Mapping

Pin	Pin Name	DP	HDMI / DVI
D26	DDI1_PAIR0+	DP1_LANE0+	TMDS1_DATA2+
D27	DDI1_PAIR0-	DP1_LANE0-	TMDS1_DATA2-
D29	DDI1_PAIR1+	DP1_LANE1+	TMDS1_DATA1+
D30	DDI1_PAIR1-	DP1_LANE1-	TMDS1_DATA1-
D32	DDI1_PAIR2+	DP1_LANE2+	TMDS1_DATA0+
D33	DDI1_PAIR2-	DP1_LANE2-	TMDS1_DATA0-
D36	DDI1_PAIR3+	DP1_LANE3+	TMDS1_CLK+
D37	DDI1_PAIR3-	DP1_LANE3-	TMDS1_CLK-
C25	DDI1_PAIR4+		
C26	DDI1_PAIR4-		
C29	DDI1_PAIR5+		
C30	DDI1_PAIR5-		
C15	DDI1_PAIR6+		
C16	DDI1_PAIR6-		
C24	DDI1_HPD	DP1_HPD	HDMI1_HPD
D15	DDI1_CTRLCLK_AUX+	DP1_AUX+	HMDI1_CTRLCLK
D16	DDI1_CTRLDATA_AUX-	DP1_AUX-	HMDI1_CTRLDATA
D34	DDI1_DDC_AUX_SEL		
D39	DDI2_PAIR0+	DP2_LANE0+	TMDS2_DATA2+
D40	DDI2_PAIR0-	DP2_LANE0-	TMDS2_DATA2-
D42	DDI2_PAIR1+	DP2_LANE1+	TMDS2_DATA1+
D43	DDI2_PAIR1-	DP2_LANE1-	TMDS2_DATA1-
D46	DDI2_PAIR2+	DP2_LANE2+	TMDS2_DATA0+
D47	DDI2_PAIR2-	DP2_LANE2-	TMDS2_DATA0-
D49	DDI2_PAIR3+	DP2_LANE3+	TMDS2_CLK+
D50	DDI2_PAIR3-	DP2_LANE3-	TMDS2_CLK-
D44	DDI2_HPD	DP2_HPD	HDMI2_HPD
C32	DDI2_CTRLCLK_AUX+	DP2_AUX+	HDMI2_CTRLCLK
C33	DDI2_CTRLDATA_AUX-	DP2_AUX-	HDMI2_CTRLDATA
C34	DDI2_DDC_AUX_SEL		
C39	DDI3_PAIR0+	DP3_LANE0+	TMDS3_DATA2+
C40	DDI3_PAIR0-	DP3_LANE0-	TMDS3_DATA2-
C42	DDI3_PAIR1+	DP3_LANE1+	TMDS3_DATA1+
C43	DDI3_PAIR1-	DP3_LANE1-	TMDS3_DATA1-
C46	DDI3_PAIR2+	DP3_LANE2+	TMDS3_DATA0+
C47	DDI3_PAIR2-	DP3_LANE2-	TMDS3_DATA0-
C49	DDI3_PAIR3+	DP3_LANE3+	TMDS3_CLK+
C50	DDI3_PAIR3-	DP3_LANE3-	TMDS3_CLK-
C44	DDI3_HPD	DP3_HPD	HDMI3_HPD
C36	DDI3_CTRLCLK_AUX+	DP3_AUX+	HDMI3_CTRLCLK
C37	DDI3_CTRLDATA_AUX-	DP3_AUX-	HDMI3_CTRLDATA
C38	DDI3_DDC_AUX_SEL		

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3.4.5. PCI Express Graphics x16 (PEG)

Signal	Pin	Description	I/O	PU/PD	Comment
PEG_RX0+ PEG_RX0- PEG_RX1+ PEG_RX1- PEG_RX2+ PEG_RX2- PEG_RX3+ PEG_RX3- PEG_RX4+ PEG_RX4- PEG_RX5+ PEG_RX5- PEG_RX6+ PEG_RX6- PEG_RX7+ PEG_RX7- PEG_RX8+ PEG_RX8- PEG_RX9+ PEG_RX9- PEG_RX10+ PEG_RX10- PEG_RX11+ PEG_RX11- PEG_RX12+ PEG_RX12- PEG_RX13+ PEG_RX13- PEG_RX14+ PEG_RX14- PEG_RX15+ PEG_RX15	C52 C53 C55 C56 C58 C59 C61 C62 C65 C66 C68 C69 C71 C72 C74 C75 C78 C79 C81 C82 C85 C86 C88 C89 C91 C92 C94 C95 C98 C99 C101 C102	PCI Express Graphics transmit differential pairs.	I PCIE		AC couple off module
PEG_TX0+ PEG_TX0- PEG_TX1+ PEG_TX1- PEG_TX2+ PEG_TX2- PEG_TX3+ PEG_TX3- PEG_TX4+ PEG_TX4- PEG_TX5+ PEG_TX5- PEG_TX6+ PEG_TX6- PEG_TX7+ PEG_TX7- PEG_TX8+ PEG_TX8- PEG_TX9+ PEG_TX9- PEG_TX10+ PEG_TX10- PEG_TX11+ PEG_TX11- PEG_TX12+ PEG_TX12- PEG_TX13+ PEG_TX13- PEG_TX14+ PEG_TX14- PEG_TX15+ PEG_TX15-	D52 D53 D55 D56 D58 D57 D61 D62 D65 D66 D68 D69 D71 D72 D74 D75 D78 D79 D81 D82 D85 D86 D88 D89 D91 D92 D94 D95 D98 D99 D101 D102	PCI Express Graphics receive differential pairs.	O PCIE		AC couple on module
PEG_LANE_RV#	D54	PCI Express Graphics lane reversal input strap. Pull low on the Carrier board to reverse lane order.	I 3.3V	PU 10K 3.3V	

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3.4.6. Module Type Definition

Signal	Pin #	Description	I/O	Comment
TYPE0# TYPE1# TYPE2#	C54 C57 D57	The TYPE pins indicate to the Carrier Board the Pin-out Type that is implemented on the module. The pins are tied on the module to either ground (GND) or are no-connects (NC). For Pinout Type 1, these pins are don't care (X). TYPE2# TYPE1# TYPE0# X X X Pinout Type 1 NC NC NC Pinout Type 2 NC NC GND Pinout Type 3 (no IDE) NC GND NC Pinout Type 4 (no PCI) NC GND GND Pinout Type 5 (no IDE, no PCI) GND NC NC Pinout Type 6 (no IDE, no PCI) GND NC GND Pinout Type 7 The Carrier Board should implement combinatorial logic that monitors the module TYPE pins and keeps power off (e.g deactivates the ATX_ON signal for an ATX power supply) if an incompatible module pin-out type is detected. The Carrier Board logic may also implement a fault indicator such as an LED.		Type 6

3.4.7. Power and Ground

Signal	Pin #	Description	I/O	PU/PD	Comment
VCC_12V	C104-C109 D104-D109	Primary power input: +12V nominal (wide range 5 ~ 20V). All available VCC_12V pins on the connector(s) shall be used	P		8.5-20V
GND	C1, C2, C5, C8, C11, C14, C21, C31, C41, C51, C60, C70, C73, C76, C80, C84, C87, C90, C93, C96, C100, C103, C110, D1, D2, D5, D8, D11, D14, D21, D31, D41, D51, D60, D67, D70, D73, D76, D80, D84, D87, D90, D93, D96, D100, D103, D110	Ground - DC power and signal and AC signal return path. All available GND connector pins shall be used and tied to carrier board GND plane.	P		

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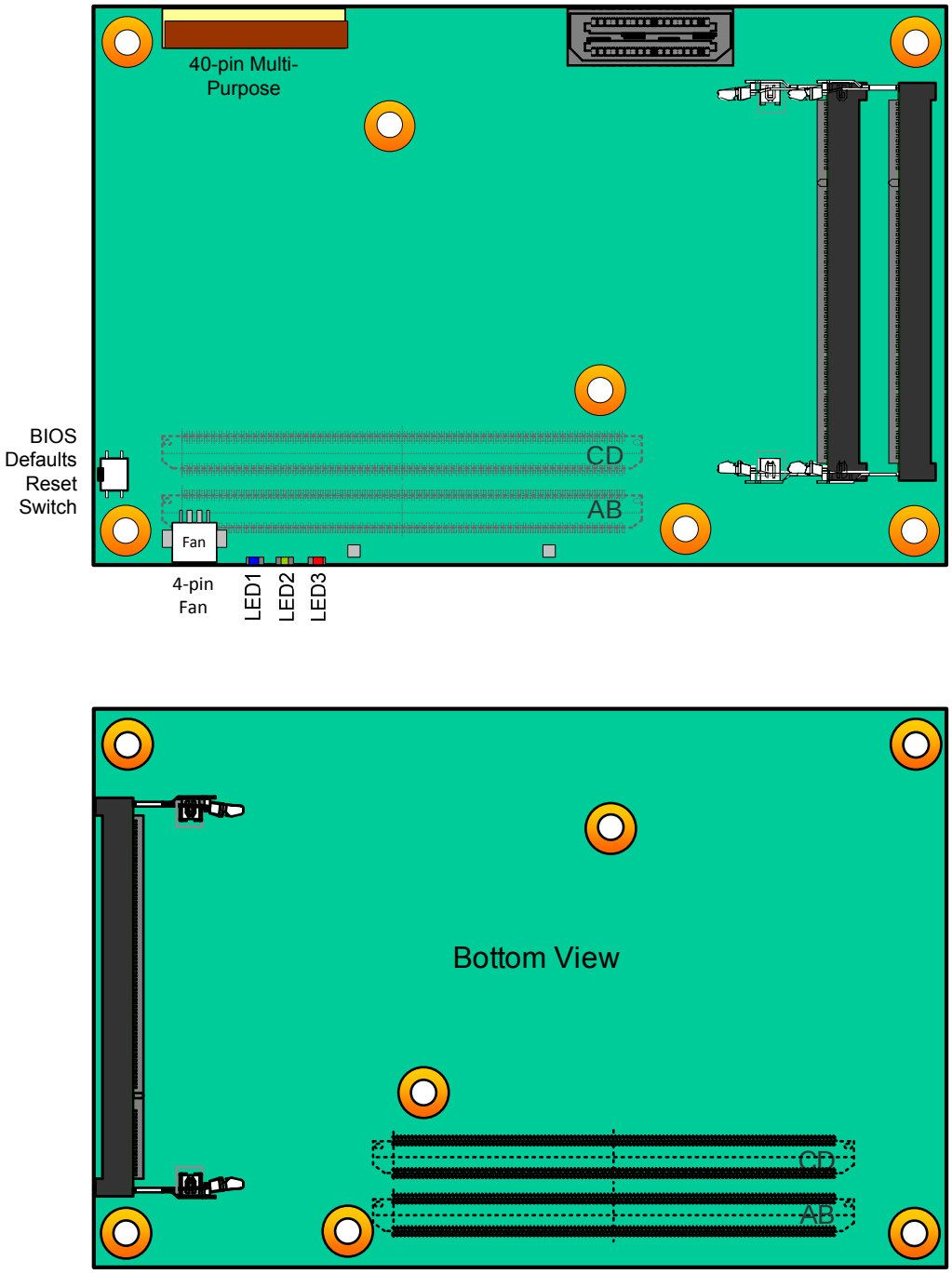
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4. Connector Pinouts on Module

This chapter describes connectors and pinouts, LEDs and switches that are used on the module but are not included in the PICMG standard specification

4.1. Connector, Switch and LED Locations



Note: 3rd SO-DIMM socket on bottom side is supported by build option.

Figure 3: Express-CFR Connector, Switch and LED Locations

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Express-CFR and the DB40 Debug Module

For illustration purposes only

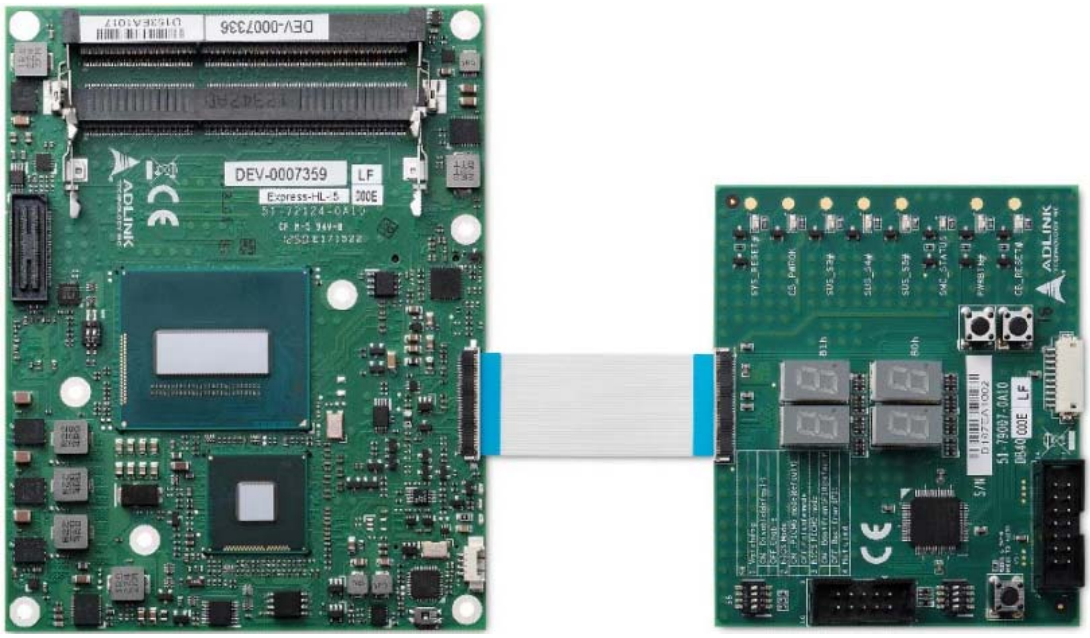


Figure 4: Express-CFR and the DB40 Debug Module

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4.2. 40-pin Debug Connector

FPC Connector Type: FCI 59GF Flex 10042867

Pin Orientation



1 40

40-pin Debug Connector Pin Definition on the COM Express Module

Pin	Interface	Signal	Remark
1	SPI Program interface	VCC_SPI_IN	SPI Power Input from flash tool to module. HW need add MOS FET to switch SPI power for SPI ROM
2		GND	
3		SPI_BIOS_CS 0#	
4		SPI_BIOS_CS 1#	
5		SPI_BIOS_MI SO	
6		SPI_BIOS_M OSI	
7		SPI_BIOS_CL K	
8	LPC Bus	3V3_LPC	System power 3.3V provide from COM module
9		GND	
10		BIOS_DIS0	
11		RST#	
12		CLK33_LPC	
13		LPC_FRAME #	
14		LPC_AD3	
15		LPC_AD2	
16		LPC_AD1	always power 3.3V provide from COM module
17		LPC_AD0	
18	BMC Program interface	3.3V_BMC	always power 3.3V provide from COM module
19		3.3V_BMC	always power 3.3V provide from COM module
20		GND	

Pin	Interface	Signal	Remark
21	BMC Program interface (cont'd)	TXD6	
22		RXD6	
23		FUMD0	
24		RESET_IN#	
25		DATA	
26		CLK	
27		OCD0A	Include a jumper to connect OCD0A via 1K0 pull-up to 3.3V_BMC
28		OCD0B	Include a jumper to connect OCD0A via 1K0 pull-up to 3.3V_BMC
29	Test points	PWRBTN#	
30		SYS_RESET#	
31		CB_RESET#	
32		CB_PWROK	
33		SUS_S3#	
34		SUS_S4#	
35		SUS_S5#	
36	BMC Debug signals	POSTWDT_DIS #	Connect to Jumper for Debug
37		SEL_BIOS	Connect to Jumper for Debug
38		BIOS_MODE	Connect to Jumper for Debug
39		BMC_STATUS	
40	Reserved		

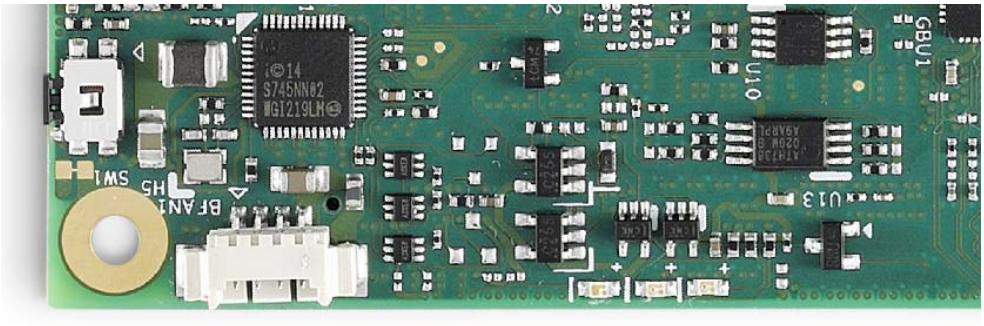
Table 2: 40-pin Debug Connector Pin Definition

Note: The pin definition on the debug module is the inverse of that on the COM Express module.

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4.3. Status LEDs

To facilitate easier maintenance, status LED's are mounted on the board.



LED1 LED2 LED3

LED Descriptions

Name	Color	Connection	Function
LED1	Blue	BMC output	Power Sequence Status Code (BMC) Power Changes, RESET (see 5.1.4 Exception Codes below)
LED2	Green	Power Source 3Vcc	S0 LED ON S3/S4/S5 LED OFF ECO mode LED OFF
LED3	Red	BMC output and same signal as WDT (B27) on BtB connector	Module power up WD LED = LED OFF Watchdog counting WD LED = Keep Last State Watchdog timed out WD LED = LED ON Watchdog RESET WD LED = LED ON Rebooted after WD RESET WD LED = LED ON Rebooted after PWRBTN WD LED = LED OFF Rebooted after RESET BTN WD LED = LED OFF **Note:** only a RESET not initiated by the BMC can clear the WD LED (user action)

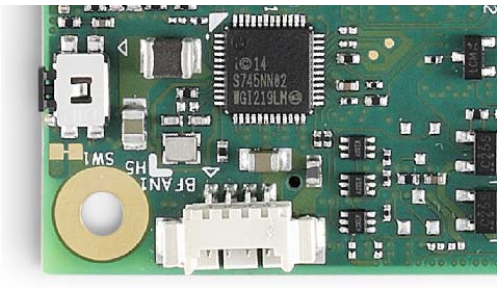
Table 3: Express-CFR LED Descriptions

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4.4. Fan Connector

Connector Type: JVE 24W1125A-04M00

Pin Orientation



1 2 3 4

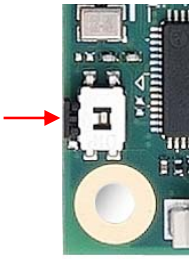
Pin Assignment

Name	Description
1	FAN_PWMOUT
2	FAN_TACHIN
3	Ground
4	5V

Table 4: Fan Connector Pin Definition

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4.5. BIOS Setup Defaults Reset Button



To perform a hardware reset of BIOS default settings, perform the following steps:

1. Shut down the system.
2. Press the BIOS Setup Defaults RESET Button continuously and boot up the system. You can release the button when the BIOS prompt screen appears
3. The BIOS prompt screen will display a confirmation that BIOS defaults have been reset and request that you reboot the system.



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4.6. Switch Settings

Switch Locations

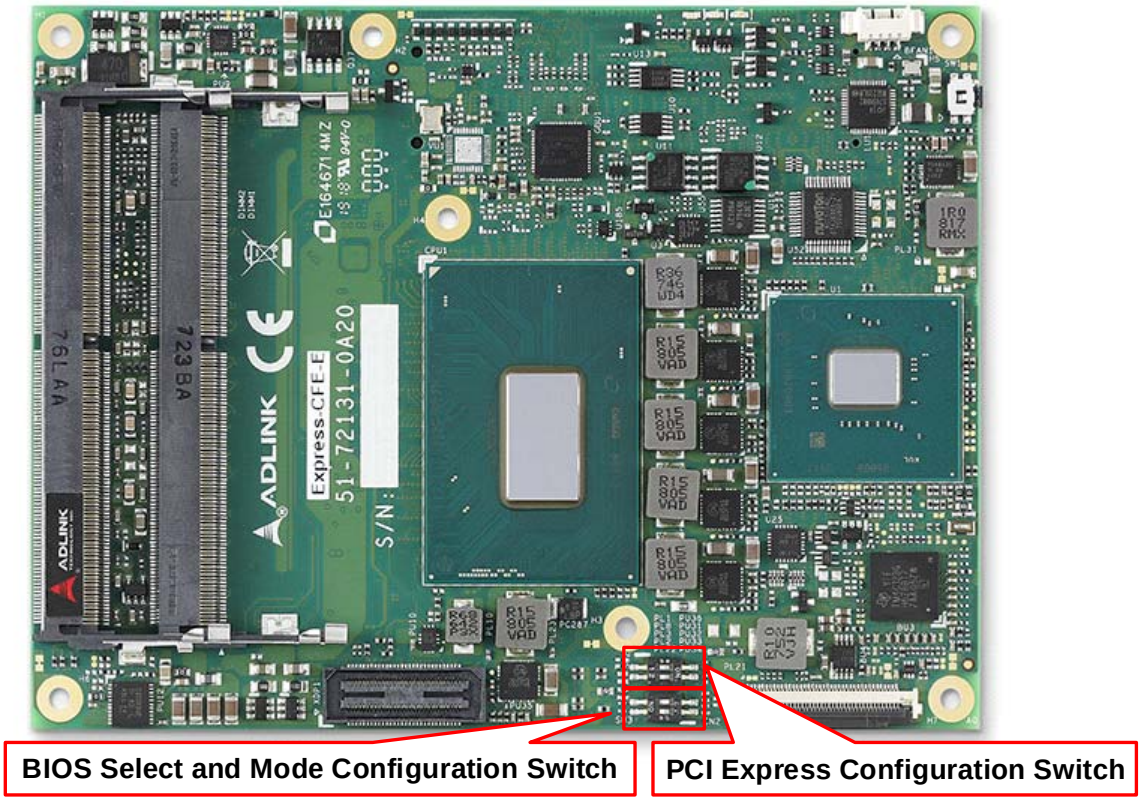


Figure 5: Express-CFR Switch Locations

4.6.1. PCI Express Configuration Switch.

PCI Express Configuration Switch (also referred to as the PEG config. switch) allows you to configure the PCI Express x16 lanes from the CPU as 1 PCIe x16, 2 PCIe x8, or 1 PCIe x8 + 2 PCIe x4.

Mode	Pin 1	Pin 2
1x PCIe x16 (default)	Off	Off
2x PCIe x8	On	Off
1x PCIe x8 + 2x PCIe x4	On	On
Reserved	Off	On

Table 5: PCI Express Configuration Switch Settings

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4.6.2. BIOS Select and Mode Configuration Switch

The module has two BIOS chips and BIOS operation can be configured to "PICMG" and dual-BIOS "Failsafe" modes using BIOS Select and Mode Configuration Switch, Pin 2.

Setting the module to PICMG mode will configure the BIOS chips on the module as SPI0 and SPI1. In PICMG mode, a BIOS chip cannot be placed in the SPI0 slot on the carrier.

In dual-BIOS Failsafe mode, both BIOS chips on the module are configured as SPI1. Only one of the two is connected to the SPI bus at any given time. In case of failure of the primary SPI1 BIOS, the system will reboot and switch to the secondary SPI1 BIOS on the module. In Failsafe mode, the SPI0 BIOS socket on the carrier can be populated.

In either mode, BIOS Select and Mode Configuration Switch Pin 1 is used to select whether to boot from SPI0 or SPI1.

Mode	Pin 1	Pin 2
Boot from SPI0 (default)	On	—
Boot from SPI1	Off	—
Set BIOS to PICMG mode	—	On
Set BIOS to Failsafe BIOS mode (default)	—	Off

Table 6: BIOS Select and Mode Configuration Switch Settings

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4.7. PCIe x16-to-two-x8 Adapter Card

The Express-CFR can be used with the PCIe x16-to-two-x8 Adapter Card on the Express-BASE6 Reference Carrier to support bifurbication of the CPU's PEG interface (PCIe x16). The card reroutes the PCIe x16 to two x8 and allows testing of two independent PCIe add-on cards with x8/x4/x2/x1 width. To use the card, set **BIOS > Advanced > Graphics > GFX LINK CFG** to "2 x8 " as described in Error! Reference source not found. **.**Error! Reference source not found. on page **Error! Bookmark not defined.**.



PCIex16-to-two-x8 Adapter Card
(Model: P16TO28, Part No.: 91-79301-0010)

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5. Smart Embedded Management Agent (SEMA)

The onboard microcontroller (BMC) implements power sequencing and Smart Embedded Management Agent (SEMA) functionality. The microcontroller communicates via the System Management Bus with the CPU/chipset. The following functions are implemented:

- Total operating hours counter. Counts the number of hours the module has been run in minutes.
- On-time minutes counter. Counts the seconds since last system start.
- Temperature monitoring of CPU and board temperature. Minimum and maximum temperature values of CPU and board are stored in flash.
- Power cycles counter
- Boot counter. Counts the number of boot attempts.
- Watchdog Timer. Set/Reset/Disable Watchdog Timer. Features auto-reload at power-up.
- System Restart Cause. Power loss/BIOS Fail/Watchdog/Internal Reset/External Reset
- Fail-safe BIOS support. In case of a boot failure, hardware signals tells external logic to boot from fail-safe BIOS.
- Flash area. 1kB Flash area for customer data
- 2K Bytes Protected Flash area. Keys, IDs, etc. can be stored in a write- and clear-protectable region.
- Board Identify. Vendor/Board/Serial number/Production Date
- Main-current & voltage. Monitors drawn current and main voltages

For a detailed description of SEMA features and functionality, please refer to **SEMA Technical Manual** and **SEMA Software Manual**, downloadable at: **http://www.adlinktech.com/sema/**.

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5.1. Board Specific SEMA Functions

5.1.1. Voltages

The BMC of the Express-CFR implements a voltage monitor and samples several onboard voltages. The voltages can be read by calling the SEMA function “Get Voltages”. The function returns a 16-bit value divided into high-byte (MSB) and low-byte (LSB).

ADC Channel	Voltage Name	Voltage Formula [V]
0	VCORE	(MSB<<8 + LSB) x 1 / 1024
1	VCC_GT	(MSB<<8 + LSB) x 1/ 1024
2	1V05_A	(MSB<<8 + LSB) x 1 / 1024
3	VDDQ	(MSB<<8 + LSB) x 1 x 3.3 / 1024
4	VRTC	(MSB<<8 + LSB) x 1.01 x 3.3 / 1024
5	V3P3S	(MSB<<8 + LSB) x 1.1 x 3.3 / 1024
6	V3P3A	(MSB<<8 + LSB) x 1.100 x 3.3 / 1024
7	V5S	(MSB<<8 + LSB) x 1.826 x 3.3 / 1024
8	VCCST	(MSB<<8 + LSB) x 1 x 3.3 / 1024
9	VCCIO	(MSB<<8 + LSB) x 1 x 3.3 / 1024
10	VCCSTG	(MSB<<8 + LSB) x 1 x 3.3 / 1024
11	VCCSA	(MSB<<8 + LSB) x 1 x 3.3 / 1024
12	1V8_A	(MSB<<8 + LSB) x 1 x 3.3 / 1024
13	V5SBY	(MSB<<8 + LSB) x 1.826 x 3.3 / 1024
14	V12	(MSB<<8 + LSB) x 6 x 3.3 / 1024
15	(MAIN CURRENT)	Use Main Current Function

Table 7: SEMA Onboard Voltage Monitor

5.1.2. Main Current

The BMC of the Express-CFR implements a current monitor. The current can be read by calling the SEMA function “Get Main Current”. The function returns four 16-bit values divided in high-byte (MSB) and low-byte (LSB). These 4 values represent the last 4 currents drawn by the board. The values are sampled every 250ms. The order of the 4 values is NOT in chronological order. Access by the BMC may increase the drawn current of the whole system. In this case, there are still 3 samples not influenced by the read access.

$$\text{Main Current} = (\text{MSB_n}<<8 + \text{LSB_n}) \times 8.06\text{mA}$$

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5.1.3. BMC Status

This register shows the status of BMC controlled signals on the Express-CFR.

Status Bit	Signal
0	WDT_OUT
1	LVDS_VDDEN
2	LVDS_BKLTEN
3	BIOS_MODE
4	POSTWDT_DISn
5	SEL_BIOS
6	BIOS_DIS0n
7	BIOS_DIS1n

Table 8: SEMA BMC Status

5.1.4. Exception Codes

In case of an error, the BMC drives a blinking code on the blue Status LED (LED1). The same error code is also reported by the BMC Flags register. The Exception Code is not stored in the Flash Storage and is cleared when the power is removed. Therefore, a “Clear Exception Code” command is not needed or supported.

Exception Code	Error Message
0	NOERROR
2	NO_SUSCLK
3	NO_SLP_S5
4	NO_SLP_S4
5	NO_SLP_S3
6	NO_CB_PWRGD
7	BIOS_FAIL
8	RESET_FAIL
9	RESETIN_FAIL
10	CRITICAL_TEMP
11	POWER_FAIL
12	VOLTAGE_FAIL
14	NO_VDDQ_PG
15	NO_V1P05S_PG
16	NO_VCORE_PG
17	NO_SYS_GD
18	NO_V5SBY
19	NO_V3P3A

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Exception Code	Error Message
20	NO_V5_DUAL
21	NO_PWRSRC_GD
22	NO_P_5V_3V3_S0_PG

Table 9: SEMA Exception Codes

5.1.5. BMC Flags

The BMC Flags register returns the last detected Exception Code since power-up and shows the BIOS in use and the power mode.

Bit	Description
[0 ~ 4]	Exception Code
[6]	0 = AT mode 1 = ATX mode
[7]	0 = Standard BIOS 1 = Fail-safe BIOS.

Table 10: SEMA BMC Flags

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6. System Resources

6.1. System Memory Map

Address Range (hex)	Description
FF000000-FFFFFFFF	Motherboard resources
FEE00000-FEEFFFFF	Motherboard resources
FED45000-FED93FFF	Motherboard resources
FED40000-FED44FFF	Trusted Platform Module 2.0
FED10000-FED3FFFF	Motherboard resources
FED00000-FED003FF	High precision event timer
FC800000-FE7FFFFF	PCI Express Root Complex
E0000000-EFFFFFFF	Motherboard resources
90000000-DFFFFFFF	PCI Express Root Complex
000A0000-000BFFFF	PCI Express Root Complex

6.2. I/O Map

Hex Range	Device
20h – 21h	Interrupt Controller
24h – 25h	Interrupt Controller
28h – 29h	Interrupt Controller
2Ch – 2Dh	Interrupt Controller
2E-02F	Motherboard resources
30h – 31h	Interrupt Controller
34h – 35h	Interrupt Controller
38h – 39h	Interrupt Controller
3Ch – 3Dh	Interrupt Controller
40h – 43h	System timer
4Eh – 4Fh	Motherboard resources
50h – 53h	System timer
60h	Standard PS/2 Keyboard
61h	Motherboard resources
62h	Microsoft ACPI-Compliant Embedded Controller
63h	Motherboard resource
64h	Standard PS/2 Keyboard
65h	Motherboard resources
66h	Microsoft ACPI-Compliant Embedded Controller
67h	Motherboard resources
70h	RTC Controller

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Hex Range	Device
71h	RTC Controller
72h	RTC Controller
73h	RTC Controller
74h	RTC Controller
75h	RTC Controller
76h – 77h	RTC Controller
80h	Motherboard resources
92h	Motherboard resources
A0h – A1h	Interrupt Controller
B2h – B3h	Motherboard resources
B4h – B5h	Interrupt Controller
B8h – B9h	Interrupt Controller
BCh – BDh	Interrupt Controller
240h – 247h	Communications Port (COM3)
248h – 24Fh	Communications Port (COM4)
2F8h – 2FFh	Communications Port (COM2)
3F8h – 3FFh	Communications Port (COM1)
4D0h – 4D1h	Interrupt Controller
680h – 69Fh	Motherboard resources
6A0h	Motherboard resources
CF9h	Reset Generator

6.3. Interrupt Request (IRQ) Lines

PIC Mode

IRQ#	Typical Intterupt Resource	Connected to Pin	Available
0	Counter 0	N/A	No
1	Keyboard controller	IRQ1 via SERIRQ	No
2	Cascade interrupt from slave PIC	N/A	No
3	Serial Port 2 (COM2)	IRQ3 via SERIRQ / PIRQ	Note (1)
4	Serial Port 1 (COM1)	IRQ4 via SERIRQ / PIRQ	Note (1)
5	Serial Port 3 (COM3)	IRQ5 via SERIRQ / PIRQ	Note (1)
6	Generic	IRQ6 via SERIRQ / PIRQ	No
7	Serial Port 4 (COM4)	IRQ7 via SERIRQ / PIRQ	Note (1)
8	Real-time clock	N/A	No
9	Generic	N/A	Note (1)
10	Generic	IRQ10 via SERIRQ / PIRQ	Note (1)
11	Generic	IRQ11 via SERIRQ / PIRQ	Note (1)

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IRQ#	Typical Intterupt Resource	Connected to Pin	Available
12	PS/2 Mouse	IRQ12 via SERIRQ / PIRQ	Note (1)
13	N/A	N/A	Note (1)
14	Intel Serial IO GPIO Host Controller	PIRQ	Note (1)
15	N/A	PIRQ	Note (1)

Note (1): These IRQs can be used for PCI devices when onboard device is disabled.

APIC Mode

IRQ#	Typical Intterupt Resource	Connected to Pin	Available
0	Counter 0	N/A	No
1	Keyboard controller	IRQ1 via SERIRQ	No
2	Cascade interrupt from slave PIC	N/A	No
3	Serial Port 2 (COM2)	IRQ3 via SERIRQ	Note (1)
4	Serial Port 1 (COM1)	IRQ4 via SERIRQ	Note (1)
5	Serial Port 3 (COM3)	IRQ5 via SERIRQ	Note (1)
6	N/A	N/A	Note (1)
7	Serial Port 4 (COM4)	IRQ7 via SERIRQ	Note (1)
8	Real-time clock	N/A	No
9	N/A	N/A	Note (1)
10	N/A	N/A	Note (1)
11	N/A	N/A	Note (1)
12	PS/2 Mouse	IRQ12 via SERIRQ	Note (1)
13	Math Processor	N/A	Note (1)
14	SATA Primary	IRQ14 via SERIRQ	Note (1)
15	SATA Secondary	IRQ15 via SERIRQ	Note (1)
16	N/A	P.E.G Root Port,Intel HDA, PCIE Port 0/1/2/3/4/5/6, I.G.D., XHCI Controller	Note (1)
17	N/A	PCIE Port 0/1/2/3/4/5/6, P.E.G Root Port,	Note (1)
18	N/A	PCIE Port 0/1/2/3/4/5/6, P.E.G Root Port, SMBus Controller	Note (1)
19	N/A	PCIE Port 0/1/2/3/4/5/6, P.E.G Root Port,	Note (1)

Note (1): These IRQs can be used for PCI devices when onboard device is disabled.

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6.4. PCI Configuration Space Map

Bus Number	Device Number	Function Number	Routing	Description
00h	00h	00h	N/A	Intel host Bridge
00h	02h	00h	Internal	Intel I.G.D.
00h	08h	00h	Internal	Gaussian Mixture Model
00h	12h	00h	Internal	Thermal Subsystem
00h	14h	00h	Internal	xHCI Controller
00h	14h	02h	Internal	Intel RAM
00h	14h	05h	Internal	Intel Corporation System Device
00h	15h	00h	Internal	I2C Interface 0
00h	15h	01h	Internal	I2C Interface 1
00h	16h	00h	Internal	Intel Management Engine Interface
00h	16h	03h	Internal	Intel Active Management Technology - SOL
00h	17h	00h	Internal	Intel AHCI controller
00h	1Bh	00h	Internal	Intel PCI Express Root port 5
00h	1Bh	01h	Internal	Intel PCI Express Root port 6
00h	1Bh	02h	Internal	Intel PCI Express Root port 7
00h	1Bh	03h	Internal	Intel PCI Express Root port 8
00h	1Dh	00h	Internal	Intel PCI Express Root port 1
00h	1Dh	01h	Internal	Intel PCI Express Root port 2
00h	1Dh	02h	Internal	Intel PCI Express Root port 3
00h	1Dh	03h	Internal	Intel PCI Express Root port 4
00h	1Fh	00h	Internal	Intel LPC Interface Bridge
00h	1Fh	03h	Internal	HDA Controller
00h	1Fh	04h	Internal	SMBus Controller
00h	1Fh	05h	Internal	SPI
00h	1Fh	06h	Internal	GbE Controller

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6.5. PCI Interrupt Routing Map

INT Line	P.E.G. Root Port	IGFX	LPC Bridge	HD Audio Controller	SMBus	GbE Controller
Int0	INTA:16	INTA:16	INTA:16	INTA:16	INTA:16	INTA:16
Int1	INTB:17		INTB:17			
Int2	INTC:18		INTC:18			
Int3	INTD:19		INTD:19			

INT Line	SATA Controller	ME Controller	XHCI Controller	Thermal Controller
Int0	INTA:16	INTA:16	INTA:16	INTA:16
Int1		INTB:17	INTB:17	INTB:24
Int2		INTC:18	INTC:18	INTC:18
Int3		INTD:19	INTD:19	INTD:19

INT Line	PCIE Port1	PCIE Port 2	PCIE Port 3	PCIE Port 4	PCIE Port 5	PCIE Port 6	PCIE Port 7	PCIE Port 8
Int0	INTA:16	INTB:17	INTC:18	INTD:19	INTA:16	INTB:17	INTC:18	INTD:19
Int1	INTB:17	INTC:18	INTD:19	INTA:16	INTB:17	INTC:18	INTD:19	INTA:16
Int2	INTC:18	INTD:19	INTA:16	INTB:17	INTC:18	INTD:19	INTA:16	INTB:17
Int3	INTD:19	INTA:16	INTB:17	INTC:18	INTD:19	INTA:16	INTB:17	INTC:18

6.6. SMBus Address Table

Device	Address
DDR4 Channel A(SO-DIMM1)	A0h
DDR4 Channel B(SO-DIMM2)	A4h
DDR4 Channel B(SO-DIMM3)	A6h
Thermal Sensor	92h
BMC	50h
Extend GPIO (PCA9535)	40h
NXP (eDP to LVDS transmitter)	C0h

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7. BIOS Setup

7.1. Menu Structure

This section presents the six primary menus of the BIOS Setup Utility. Use the following table as a quick reference for the contents of the BIOS Setup Utility. The subsections in this section describe the Submenus and setting options for each menu item. The default setting options are presented in **bold**, and the function of each setting is described in the right hand column of the respective table.

Main	Advanced	Chipset	Security	Boot	Save & Exit
BIOS Information System Information Board Information ► System Date System Time	CPU Configuration ► Graphics Configuration ► Power Management ► USB Configuration ► AMT Configuration ► System Management ► Thermal Management ► Watchdog Timer ► Super IO Configuration ► Serial Console Redirection ► Miscellaneous ► AMI Graphic Output Protocol Policy ► Network Stack Configuration ►	System Agent (SA) Configuration ► PCH-IO Configuration ►	Password Description Secure Boot Menu ► HDD Security Configuration ►	Boot Configuration	Save Options Boot Override

Notes:

► indicates a Submenu
Gray text indicates info only

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7.2. Main

The Main Menu provides read-only information about your system and also allows you to set the System Date and Time. Refer to the tables below the screen shot of this menu for details of the Submenus and settings.

7.2.1. BIOS Information

Feature	Options	Description
BIOS Vender	Info only	American Megatrends
BIOS Version	Info only	Display Core version
Build Date	Info only	Display Build Date
MRC Version	Info only	Display MRC information
GOP Version	Info only	Display GOP version.
ME FW Version	Info only	Display ME FW version.
BIOS Boot Source	Info only	SPI Boot Source

7.2.2. System Information

Board Information	Info only	Description
Project Name	Info only	Display Project Name.
CPU Board Version	Info only	Display CPU signature.
CPU Brand String	Info only	Display CPU brand name.
Stepping	Info only	Display CPU stepping.
GT Info	Info only	Display GT info of Intel Graphics.
CPU Frequency	Info only	Display CPU frequency
Total Memory	Info only	Display installed memory size.
Memory Frequency	Info only	Display memory frequency.
PCH SKU	Info only	Display PCH information.
Stepping	Info only	Display PCH stepping.
Board Information	Submenu	

7.2.3. Board Information

Board Information	Info only	Description
Serial Number	Read only	Display SMC serial number
Manufacturing Date	Read only	Display SMC manufacturing date.
Last Repair Date	Read only	Display SMC last repair date.
MAC ID	Read only	Display SMC MAC ID.

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Board Information	Info only	Description
Runtime Statistics	Info only	
Total Runtime	Read only	The returned value specifies the total time in minutes the system is running in S0 state.
Current Runtime	Read only	The returned value specifies the time in seconds the system is running in S0 state. This counter is cleared when the system is removed from the external power supply.
Power Cycles	Read only	The returned value specifies the number of times the external power supply has been shut down.
Boot Cycles	Read only	The Bootcounter is increased after a HW- or SW-Reset or after a successful power-up.
Boot Reason	Read only	The boot reason is the event which causes the reboot of the system.

7.2.4. System Date and Time

Feature	Options	Description
System Date	Weekday, MM/DD/YYYY	Requires the alpha-numeric entry of the day of the week, day of the month, calendar month, and all 4 digits of the year, indicating the century and year (Fri XX/XX/20XX)
System Time	HH/MM/SS	Presented as a 24-hour clock setting in hours, minutes, and seconds

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7.3. Advanced

This menu contains the settings for most of the user interfaces in the system

7.3.1. CPU Configuration

Feature	Options	Description
Type	Info only	Display CPU information.
ID	Info only	Display CPU information.
Microcode Revision	Info only	Display CPU Microcode Revision.
Speed	Info only	Display CPU frequency.
L1 Data Cache	Info only	Display cache info.
L1 Instruction Cache	Info only	Display cache info.
L2 Cache	Info only	Display cache info.
L3 Cache	Info only	Display cache info.
L4 Cache	Info only	Display cache info.
VMX	Info only	Display Intel Virtualization Technology support or not.
SMX/TXT	Info only	Display Intel SMX Technology support or not.
Boot performance mode	Max Battery **Max Non-Turbo Performance** Turbo Performance	Select the performance state that the BIOS will set starting from reset vector.
Hyper-Threading	Disabled **Enabled**	Enabled for Windows XP and Linux (OS optimized for Hyper-Threading Technology) and Disabled for other OS (OS not optimized for Hyper-Threading Technology).
Intel(R) SpeedStep(tm)	Disabled **Enabled**	Allows more than two frequency ranges to be supported.
Intel(R) Speed Shift Technology	Disabled **Enabled**	Enable/Disable Intel(R) Speed Shift Technology support. Enabling will expose the CPPC v2 interface to allow for hardware controlled P-states
Turbo Mode	Disabled **Enabled**	Enable/Disable processor Turbo Mode (requires Intel Speed Step or Intel Speed Shift to be available and enabled).
Configurable TDP Boot Mode	**Nominal** Down Deactivate	Configurable TDP Mode as Nominal/Up/Down/Deactivate TDP selection. Deactivate option will set MSR to Nominal and MMIO to Zero.
Platform PL1 Enable	Disabled **Enabled**	Enabled for Windows XP and Linux (OS optimized for Hyper-Threading Technology) and Disabled for other OS (OS not optimized for Hyper-Threading Technology). When Disabled only one thread per enabled core is enabled.
Platform PL1 Power	**0**	Platform Power Limit 1 Power in Milli Watts. BIOS will round to the nearest 1/8W when programming. Any value can be programmed between Max and Min Power Limits (specified by PACKAGE_POWER_SKU_MSR). For 12.50W, enter 12500. This setting will act as the new PL1 value for

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Feature	Options	Description
		the Package RAPL algorithm.
Platform PL1 Time Window	0	Platform Power Limit 1 Time Window value in seconds. The value may vary from 0 to 128. 0 = default values. Indicates the time window over which Platform TDP value should be maintained.
C states	**Disabled** Enabled	Enable/Disable CPU Power Management. Allows CPU to go to C states when it's not 100% utilized.
Package C State Limit	C0/C1 C2 C3 C6 C7 C7S C8 C9 C10 CPU Default **Auto**	Maximum Package C State Limit Setting. Cpu Default: Leaves to Factory default value.Auto: Initializes to deepest available Package C State Limit.
Active Processor Cores	**All** 1 2 3 4 5 6 7 8	Number of cores to enable in each processor package.
VT-d	Disabled **Enabled**	VT-d capability.
DTS SMM	Disabled **Enabled** Critical Temp Reporting (Out of spec)	Disabled: ACPI thermal management uses EC reported temperature values. Enabled: ACPI thermal management uses DTS SMM mechanism to obtain CPU temperature values. Out of Spec: ACPI Thermal Management uses EC reported temperature values and DTS SMM is used to handle Out of Spec condition.
Intel Trusted Execution Technology	**Disabled** Enabled	Enables utilization of additional hardware capabilities provided by Intel (R) Trusted Execution Technology. Changes require a full power cycle to take effect.

7.3.2. Graphic Configuration

Feature	Options	Description
LVDS	Info only	
Data format and Color Depth	VESA 24 bpp JEIDA 24 bpp **JEIDA/VESA 18 bpp**	Data format and Color Depth select
LVDS Output Mode	Dual LVDS bus **Single LVDS bus**	Single/Dual mode select.
DE Polarity	**Active High** Active Low	DE Polarity select.
Hsync Polarity	**Active High** Active Low	Hsync Polarity select.

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Feature	Options	Description
LVDS Backlight Mode	**BMC Mode** GTT Mode	Select LVDS Backlight control function.
LVDS Backlight Brightness	FF	A change takes effect immediately.
Brightness Setting	**255**	Set GOP Brightness value
Integrated Display Configuration	Info only	
eDP/LVDS	**Disable** Enable	Enable/Disable eDP/LVDS
DDI port 1	No Device Display Port HDMI **DisplayPort with HDMI/DVI Compatible**	Set DDI port 1 function to DisplayPort or HDMI.
DDI port 2	No Device Display Port HDMI **DisplayPort with HDMI/DVI Compatible**	Set DDI port 2 function to DisplayPort or HDMI.
DDI port 3	No Device Display Port HDMI **DisplayPort with HDMI/DVI Compatible***	Set DDI port 3 function to DisplayPort or HDMI. ***Note:** Default is “HDMI” if the module supports the DP-to-VGA build option.
LFP Panel Type	**VBIOS Default** 640x480 800x600 1024x768 1280x1024 1400x1050 LVDS1 1400x1050 LVDS2 1600x1200 1366x768 1680x1050 1920x1200 1440x900 1600x900 1024x768 1280x800 1920x1080 2048x1536	Select LFP panel used by Internal Graphics Device by selecting the appropriate setup item.
DP To VGA Function*	Disabled **Enabled**	Enable/Disable DP To VGA Function ***Note:** This option is hidden unless the module supports the DP-to-VGA build option.

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7.3.3. Power Management

Feature	Options	Description
Power Management	Info only	
Enable ACPI Auto Configuration	**Disabled** Enabled	Enables or Disables BIOS ACPI Auto Configuration.
Enable Hibernation	Disabled **Enabled**	Enables or Disables System ability to Hibernate (OS/S4 Sleep State). This option may not be effective with some operating systems.
ACPI Sleep State	Suspend Disabled **S3 (Suspend to RAM)**	Select the highest ACPI sleep state the system will enter when the SUSPEND button is pressed.
LID Function	**Disabled** Enabled	Enable/Disable LID Function
ECO Mode	**Disabled** Enabled	Reduces the power consumption of the system, but after a shut down, you have to wait at least 5 seconds before you can restart the system.
Power-Up Mode	**Turn On** Remain Off Last State	Turn On: The machine starts automatically when the power supply is turned on. Remain off: To start the machine the power button has to pressed. Last State: The machine will power up to last power state
Power Consumption	Submenu	

7.3.3.1. Power Management > Power Consumption

Feature	Options	Description
Power Consumption	Info only	
Current Input Current	Read only	Display input current.
Current Input Power	Read only	Display input power.
VCORE	Read only	Display actual voltage of the VCC_CORE.
VCC_GT	Read only	Display actual voltage of the VCC_GT.
1V05_A	Read only	Display actual voltage of the 1V05_A.
VDDQ	Read only	Display actual voltage of the VDDQ.
VRTC	Read only	Display actual voltage of the VRTC.
V3P3S	Read only	Display actual voltage of the V3P3S.
V3P3A	Read only	Display actual voltage of the V3P3A.
V5S	Read only	Display actual voltage of the V5_S.
VCCST	Read only	Display actual voltage of the VCCST.
VCCIO	Read only	Display actual voltage of the VCCIO.
VCCSTG	Read only	Display actual voltage of the VCCSTG.
VCCSA	Read only	Display actual voltage of the VCCSA.
1V8_A	Read only	Display actual voltage of the 1V8_A.

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Feature	Options	Description
V5SBY	Read only	Display actual voltage of the V5VSB.
V12	Read only	Display actual voltage of the V12.

7.3.4. USB Configuration

Feature	Options	Description
USB Configuration	Info only	
USB Module Version	Info only	
USB Controllers:	Info only	
USB Devices:	Info only	
XHCI Compliance Mode	**Disabled** Enabled	Option to enable Compliance Mode. Default is to disable Compliance Mode. Change to enabled for Compliance Mode testing.
xDCI Support	**Disabled** Enabled	Enable/Disable xDCI (USB OTG Device).
USB Port Disable Override	**Disabled** Select Per-Pin	Selectively Enable/Disable the corresponding USB port from reporting a Device Connection to the controller.

7.3.5. AMT Configuration

Feature	Options	Description
AMT Configuration	Info only	
AMT BIOS Feature	Disabled **Enabled**	When disabled AMT BIOS Feature is no longer supported and user is no longer able to access MEBx Setup. Note: This option does not disable Manageability features in FW.
MEBx hotkey Pressed	**Disabled** Enabled	OEMFLag Bit 1: Enable automatic MEBx hotkey press.

7.3.6. System Management

Feature	Options	Description
System Management	Info only	
SEMA Firmware	Read only	
Build Date	Read only	
SEMA Bootloader	Read only	
SEMA Features	Submenu	
Flags	Submenu	

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7.3.6.1. System Management > SEMA Features

Feature	Options	Description
SEMA Features:	Info only	Displays the SEMA features.

7.3.6.2. System Management > Flags

Feature	Options	Description
Flags	Info only	
BMC Flags	Read only	
BIOS Select	Read only	
ATX/AT-Mode	Read only	
Exception Code	Read only	

7.3.7. Thermal Management

Feature	Options	Description
Temperatures and Fan Speed	Info only	
CPU Temperature	Info only	
Current	Read only	
Startup	Read only	
Min	Read only	
Max	Read only	
Board Temperatures	Info only	
Current	Read only	
Startup	Read only	
Min	Read only	
Max	Read only	
CPU Fan Speed	Read only	
Smart Fan	Submenu	
Critical Trip Point	**Disabled** 80 C 90 C 95 C	This value is the temperature threshold of the Critical Trip Point.
Passive Cooling Trip Point	**Disabled** 70 C 80 C 90 C 99 C	This value is the temperature threshold of the Passive Cooling Trip Point.
Active Cooling Trip Point	Disabled 40 C 50 C 60 C 70 C **Refer to BMC**	This value is the temperature threshold of the Active Cooling Trip Point.

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7.3.7.1. Temperatures and Fan Speed > Smart Fan

Feature	Options	Description
Smart Fan	Info only	
CPU Smart FanTemperature Source	**CPU Sensor** Board Sensor	CPU Smart FanTemperature Source.
CPU Fan Mode	**AUTO (Smart Fan)** Fan Off Fan On	CPU Fan Mode
Trigger Point 1	Info only	
Trigger Temperature	30	Trigger Temperature
PWM Level	25	PWM Level
Trigger Point 2	Info only	
Trigger Temperature	50	Trigger Temperature
PWM Level	500	PWM Level
Trigger Point 3	Info only	
Trigger Temperature	65	Trigger Temperature
PWM Level	75	PWM Level
Trigger Point 4	Info only	
Trigger Temperature	85	Trigger Temperature
PWM Level	100	PWM Level

7.3.8. Watchdog Timer

Feature	Options	Description
Watchdog Timer	Info only	
Power-Up watchdog	**Disabled** Enabled	The Power Up Watchdog resets the system after a certain amount of time after power up. Press F12 during start uo disable the Power Up Watchdog.
ATTENTION: Pressing F12 during start up disables the Power Up Watchdog.	Info only	
RunTime Watchdog	**Disabled** Enabled	The RunTime Watchdog resets the system after a certain amount of time after power up.
Watchdog ACPI Event Shutdown	**Disabled** Enabled	Watchdog ACPI Event Shutdown Enabled/Disabled.

7.3.9. Super IO Configuration

Feature	Options	Description
W83627DHGSEC Super IO Configuration	Info only	
Serial Port 1 Configuration	Submenu	

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Feature	Options	Description
Serial Port 2 Configuration	Submenu	
NCT5104D Super IO Configuration	Info only	
Serial Port 1 Configuration	Submenu	
Serial Port 2 Configuration	Submenu	
NCT5104DSEC Super IO Configuration	Info only	

7.3.9.1. W83627DHGSEC Super IO Configuration > Serial Port 1 Configuration

Feature	Options	Description
Serial Port 1 Configuration	Info only	
Serial Port	**Enabled** Disabled	Enable or Disable Serial Port (COM).
Device Settings	IO=240h; IRQ=5	Fixed configuration of serial port.
Change Settings	**Auto** IO=240h; IRQ=10 IO=240h; IRQ=3,4,5,6,7,10,11,12 IO=248h; IRQ=3,4,5,6,7,10,11,12 IO=250h; IRQ=3,4,5,6,7,10,11,12 IO=258h; IRQ=3,4,5,6,7,10,11,12 IO=260h; IRQ=3,4,5,6,7,10,11,12 IO=268h; IRQ=3,4,5,6,7,10,11,12	Select an optimal setting for Super IO device.

7.3.9.2. W83627DHGSEC Super IO Configuration > Serial Port 2 Configuration

Feature	Options	Description
Serial Port 2 Configuration	Info only	
Serial Port	**Enabled** Disabled	Enable or Disable Serial Port (COM).
Device Settings	IO=248h; IRQ=7	Fixed configuration of serial port.
Change Settings	**Auto** IO=248h; IRQ=10 IO=240h; IRQ=3,4,5,6,7,10,11,12 IO=248h; IRQ=3,4,5,6,7,10,11,12 IO=250h; IRQ=3,4,5,6,7,10,11,12 IO=258h; IRQ=3,4,5,6,7,10,11,12 IO=260h;	Select an optimal setting for Super IO device.

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Feature	Options	Description
	IRQ=3,4,5,6,7,10,11,12 IO=268h; IRQ=3,4,5,6,7,10,11,12	

7.3.9.3. NCT5104D Super IO Configuration > Serial Port 1 Configuration

Feature	Options	Description
Serial Port 1 Configuration	Info only	
Serial Port	**Enabled** Disabled	Enable or Disable Serial Port (COM).
Device Settings	IO=3f8h; IRQ=4	Fixed configuration of serial port.
Change Settings	**Auto** IO=3F8h; IRQ=4 IO=3F8h; IRQ=3,4,5,6,7,9,10,11,12 IO=2F8h; IRQ=3,4,5,6,7,9,10,11,12 IO=3E8h; IRQ=3,4,5,6,7,9,10,11,12 IO=2E8h; IRQ=3,4,5,6,7,9,10,11,12	Select an optimal setting for Super IO device.

7.3.9.4. NCT5104D Super IO Configuration > Serial Port 2 Configuration

Feature	Options	Description
Serial Port 2 Configuration	Info only	
Serial Port	**Enabled** Disabled	Enable or Disable Serial Port (COM).
Device Settings	IO=2F8h; IRQ=3	Fixed configuration of serial port.
Change Settings	**Auto** IO=2F8h; IRQ=3 IO=3F8h; IRQ=3,4,5,6,7,9,10,11,12 IO=2F8h; IRQ=3,4,5,6,7,9,10,11,12 IO=3E8h; IRQ=3,4,5,6,7,9,10,11,12 IO=2E8h; IRQ=3,4,5,6,7,9,10,11,12	Select an optimal setting for Super IO device.

7.3.10. Serial Console Redirection

Feature	Options	Description
Serial Port Console	Info only	
COM1	Info only	
Console Redirection	Enabled	Console Redirection Enable or Disable.

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Feature	Options	Description
	Disabled	
Console Redirection Settings	Submenu	
COM2	Info only	
Console Redirection	Enabled **Disabled**	Console Redirection Enable or Disable.
Console Redirection Settings	Submenu	
COM3	Info only	
Console Redirection	Enabled **Disabled**	Console Redirection Enable or Disable.
Console Redirection Settings	Submenu	
COM4	Info only	
Console Redirection	Enabled **Disabled**	Console Redirection Enable or Disable.
Console Redirection Settings	Submenu	

7.3.10.1. Serial Port Console > Console Redirection Settings

Feature	Options	Description
Console Redirection Settings	Info only	
Terminal Type	VT100 VT100+ VT-UTF8 **ANSI**	Emulation: ANSI: Extended ASCII char set. VT100: ASCII char set. VT100+: Extends VT100 to support color, function keys, etc. VT-UTF8: Uses UTF8 encoding to map Unicode chars onto 1 or more bytes.
Bits per second	9600 19200 38400 57600 **115200**	Selects serial port transmission speed. The speed must be matched on the other side. Long or noisy lines may require lower speeds.
Data Bits	7 **8**	Data Bits.
Parity	**None** Even Odd Mark Space	A parity bit can be sent with the data bits to detect some transmission errors. Even: parity bit is 0 if the num of 1's in the data bits is even. Odd: parity bit is 0 if num of 1's in the data bits is odd. Mark: parity bit is always 1. Space: Parity bit is always 0. Mark and Space Parity do not allow for error detection..
Stop Bits	1 **2**	Stop bits indicate the end of a serial data packet. (A start bit indicates the beginning). The standard setting is 1 stop bit. Communication with slow devices may require more than 1 stop bit.
Flow Control	**None** Hardware RTS/CTS	Flow control can prevent data loss from buffer overflow. When sending data, if the receiving buffers are full, a 'stop' signal can be sent to stop the data flow. Once the buffers are empty, a 'start' signal can be sent to re-start the flow. Hardware flow control uses two wires to send start/stop signals.
VT-UTF8 Combo Key Support	Disabled	Enable VT-UTF8 Combination Key Support for

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Feature	Options	Description
	Enable	ANSI/VT100 terminals.
Recorder Mode	**Disabled** Enable	With this mode enabled only text will be sent. This is to capture Terminal data.
Resolution 100x31	**Disabled** Enable	Enables or disables extended terminal resolution
Putty KeyPad	**VT100** LINUX XTERMR6 SCO ESCN VT400	Select FunctionKey and KeyPad on Putty.

7.3.10.2. Serial Port Console > Legacy Console Redirection Settings

Feature	Options	Description
Legacy Console Redirection Settings	Info only	
Redirection COM Port	**COM1** COM2 COM3 COM4	Select a COM port to display redirection of Legacy OS and Legacy OPROM Messages.
Resolution	**80x24** 80x25	On Legacy OS, the Number of Rows and Columns supported redirection.
Redirect After POST	**Always Enable** BootLoader	When Bootloader is selected, then Legacy Console Redirection is disabled before booting to legacy OS. When Always Enable is selected, then Legacy Console Redirection is enabled for legacy OS. Default setting for this option is set to Always Enable.

7.3.11. Miscellaneous

Feature	Options	Description
Miscellaneous	Info only	
Trusted Computing	Submenu	
NVMe Configuration	Submenu	
Smart Battery Function	**Disabled** Enabled Auto	Enable/Disable Smart Battery function. Auto: disable Smart Battery function if charger IC not be detected.
SD Card/GPIO Mode	**GPIO** SD Card	Select SD Card or GPIO function.
Power Supply Unit	Emulate AT Mode **ATX Mode**	ATX: OS will turn off system power when shutdown. NOTE: AT mode will not support S3 & S4 & S5, so it will change Power Loss State to Power On.
BMC I2C Mode	**100Kbps** 400Kbps	BMC I2C Mode

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Feature	Options	Description
Miscellaneous	Info only	
Network	**Do not launch** UEFI	Controls the execution of UEFI Network OpROM

7.3.11.1. Miscellaneous > Trusted Computing

Feature	Options	Description
Security Device Support	**Disabled** Enabled	Enables or Disables BIOS support for security device. O.S. will not show Security Device. TCG EFI protocol and INT1A interface will not be available.
Active PCR banks	Read only	
Available PCR banks	Read only	
SHA-1 PCR Bank	Disabled **Enabled**	Enable or Disable SHA-1 PCR Bank
SHA256 PCR Bank	Disabled **Enabled**	Enable or Disable SHA256 PCR Bank
Pending operation	**None** TPM Clear	Schedule an Operation for the Security Device. NOTE: Your Computer will reboot during restart in order to change State of Security Device.
Platform Hierarchy	Disabled **Enabled**	Enable or Disable Platform Hierarchy
Storage Hierarchy	Disabled **Enabled**	Enable or Disable Storage Hierarchy
Endorsement Hierarchy	Disabled **Enabled**	Enable or Disable Endorsement Hierarchy
TPM2.0 UEFI Spec Version	TCG_1_2 **TCG_2**	Select the TCG2 Spec Version Support, TCG_1_2 : the compatible mode for Win8/Win10, TCG_2 : Support new TCG2 protocol and event format for Win10 or later.
Physical Presence Spec Version	1.2 **1.3**	Select to Tell O.S. to support PPI Spec Version 1.2 or 1.3. Note some HCK tests might not support 1.3.
Device Select	TPM 1.2 TPM 2.0 **Auto**	TPM 1.2 will restrict support to TPM 1.2 devices, TPM 2.0 will restrict support to TPM 2.0 devices, Auto will support both with the default set to TPM 2.0 devices if not found, TPM 1.2 devices will be enumerated

7.3.11.2. Miscellaneous > NVME Configuration

Feature	Options	Description
NVMe Configuration	Info Only	Displays NVME device information.

7.3.12. AMI Graphic Output Protocol Policy

Feature	Options	Description
Intel(R) Graphics Controller	Info only	Displays GOP graphic driver version.

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7.3.13. Network Stack Configuration

Feature	Options	Description
Network Stack	**Disabled** Enabled	Enable/Disable UEFI network stack.
IPv4 PXE Support	**Disabled** Enabled	Enable/Disable IPv4 PXE boot support. If disabled, IPv4 PXE boot support will not be available.
IPv4 HTTP Support	**Disabled** Enabled	Enable/Disable IPv4 HTTP boot support. If disabled, IPv4 HTTP boot support will not be available.
IPv6 PXE Support	**Disabled** Enabled	Enable/Disable IPv6 PXE boot support. If disabled, IPv6 PXE boot support will not be available.
IPv6 HTTP Support	**Disabled** Enabled	Enable/Disable IPv6 HTTP boot support. If disabled, IPv6 HTTP boot support will not be available.
IPSEC Certificate	Disabled **Enabled**	Support to Enable/Disable IPSEC certificate for Ikev.
PXE boot wait time	0	Wait time in seconds to press ESC key to abort the PXE boot. Use either +/- or numeric keys to set the value.
Media detect count	1	Number of times the presence of media will be checked.Use either +/- or numberic keys to set the value.

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7.4. Chipset

Feature	Options	Description
System Agent (SA) Configuration	Submenu	
PCH-IO Configuration	Submenu	

7.4.1. Chipset > System Agent (SA) Configuration

Feature	Options	Description
System Agent (SA) Configuration	Info only	
SA PCIe Code Version	Read only	
VT-d	Read only	
Memory Configuration	Submenu	
Graphics Configuration	Submenu	
PEG Port Configuration	Submenu	
Above 4GB MMIO BIOS assignment	Enabled **Disabled**	Enable/Disable above 4GB MemoryMappedIO BIOS assignment

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7.4.1.1. Chipset > System Agent (SA) Configuration > Memory Configuration

Feature	Options	Description
Memory Configuration	Info only	
Maximum Memory Frequency	**Auto** 1067 1200 1333 1400 1600 1800 1867 2000 2133 2200 2400 2600 2667 2800 2933 3000 3200 3400 3467 3600 3733 3800 4000 4200 4267 4400 4533 4600 4800 5000 5067 5200 5333 5400 5600 5800 5867 6000 6133 6200	Maximum Memory Frequency Selections in MHz. Valid values should match the refclk, i.e. divide by 133 or 100
Max TOLUD	**Dynamic** 1 GB 1.25 GB 1.5 GB 1.75 GB 2 GB 2.25 GB 2.5 GB 2.75 GB 3 GB 3.25 GB 3.5 GB	Maximum Value of TOLUD. Dynamic assignment would adjust TOLUD automatically based on largest MMIO length of installed graphic controller

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7.4.1.2. Chipset > System Agent (SA) Configuration > Graphics Configuration

Feature	Options	Description
Graphics Configuration	Info only	
Skip Scaning of External Gfx Card	**Disabled** Enabled	If Enable, it will not scan for External Gfx Card on PEG and PCH PCIE Ports
Primary Display	**Auto** IGFX PEG PCIe	Select which of IGFX/PEG/PCI Graphics device should be Primary Display Or select SG for Switchable Gfx.
Select PCIE Card	**Auto** Elk Creek 4 PEG Eval	Select the card used on the platform. Auto:Skip GPIO based Power Enable to dGPU Elk Creek 4: DGPU Power Enable = ActiveLow PEG Eval: DGPU Power Enable = ActiveHigh
Internal Graphics	**Auto** Disabled Enabled	Keep IGFX enabled based on the setup options.
GTT Size	2MB 4MB **8MB**	Select the GTT Size
Aperture Size	128MB **256MB** 512MB 1024MB 2048MB	Select the Aperture Size Note:Above 4G MMIO BIOS assignment is automatically enabled when selecting 2048MB aperture.To use this feature, Please disable CSM Support.
DVMT Pre-Allocated	0M **32M** 64M 4M 8M 12M 16M 20M 24M 28M 32M/F7 36M 40M 44M 48M 52M 56M 60M	Select DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.
DVMT Total Gfx Mem	128M **256M** MAX	Select DVMT5.0 Total Graphic Memory size used by the Internal Graphics Device.

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7.4.1.3. Chipset > System Agent (SA) Configuration > PEG Port Configuration

Feature	Options	Description
PEG Port Configuration	Info only	
PEG 0:1:0	Read only	
Enable Root Port	Disabled Enabled **Auto**	Enable or Disable the Root Port
Max Link Speed	**Auto** Gen1 Gen2 Gen3	Configure PEG 0:1:0 Max Speed
PEG0 Slot Power Limit Value	75	Sets the upper limit on power supplied by slot. Power limit (in watts) is calculated by multiplying this value by the Slot Power Limit Scale. Values 0-255
PEG0 Slot Power Limit Scale	**1.0x** 0.1x 0.01x 0.001x	Select the scale used for the Slot Power Limit Value.
PEG0 Physical Slot Number	1	Set the physical slot number attached to this Port. The number has to be globally unique within the chassis. Values 0-8191
PEG 0:1:1	Read only	
Enable Root Port	Disabled Enabled **Auto**	Enable or Disable the Root Port
Max Link Speed	**Auto** Gen1 Gen2 Gen3	Configure PEG 0:1:1 Max Speed
PEG0 Slot Power Limit Value	75	Sets the upper limit on power supplied by slot. Power limit (in Watts) is calculated by multiplying this value by the Slot Power Limit Scale. Values 0-255
PEG0 Slot Power Limit Scale	**1.0x** 0.1x 0.01x 0.001x	Select the scale used for the Slot Power Limit Value.
PEG0 Physical Slot Number	2	Set the physical slot number attached to this Port. The number has to be globally unique within the chassis. Values 0-8191
PEG 0:1:2	Read only	
Enable Root Port	Disabled Enabled **Auto**	Enable or Disable the Root Port
Max Link Speed	**Auto** Gen1 Gen2 Gen3	Configure PEG 0:1:2 Max Speed

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Feature	Options	Description
PEG0 Slot Power Limit Value	75	Sets the upper limit on power supplied by slot. Power limit (in Watts) is calculated by multiplying this value by the Slot Power Limit Scale. Values 0-255
PEG0 Slot Power Limit Scale	**1.0x** 0.1x 0.01x 0.001x	Select the scale used for the Slot Power Limit Value.
PEG0 Physical Slot Number	3	Set the physical slot number attached to this Port. The number has to be globally unique within the chassis. Values 0-8191
PEG 0:6:0	Read only	
Enable Root Port	Disabled Enabled **Auto**	Enable or Disable the Root Port
Max Link Speed	**Auto** Gen1 Gen2 Gen3	Configure PEG 0:6:0 Max Speed
PEG0 Slot Power Limit Value	75	Sets the upper limit on power supplied by slot. Power limit (in Watts) is calculated by multiplying this value by the Slot Power Limit Scale. Values 0-255
PEG0 Slot Power Limit Scale	**1.0x** 0.1x 0.01x 0.001x	Select the scale used for the Slot Power Limit Value.
PEG0 Physical Slot Number	3	Set the physical slot number attached to this Port. The number has to be globally unique within the chassis. Values 0-8191
Gen3 RxCTLE Control	Submenu	
PCIe Rx CEM Test Mode	**Disabled** Enabled	Enable/Disable PEG Rx CEM Loopback Mode
PCIe Spread Spectrum Clocking	**Enabled** Disabled	Allows disableing Spread Spectrum Clocking for compliance testing

7.4.1.4. Chipset > System Agent (SA) Configuration > PEG Port Configuration > Gen3 RxCTLE Control

Feature	Options	Description
Gen3 RxCTLE Control	Info only	
Bundle0	0x00	Gen3 RxCTLE setting for Bundle0 (Lane0, Lane1)
Bundle1	0x00	Gen3 RxCTLE setting for Bundle1 (Lane2, Lane3)
Bundle2	0x00	Gen3 RxCTLE setting for Bundle2 (Lane4, Lane5)
Bundle3	0x00	Gen3 RxCTLE setting for Bundle3 (Lane6, Lane7)
Bundle4	0x00	Gen3 RxCTLE setting for Bundle4 (Lane8, Lane9)
Bundle5	0x00	Gen3 RxCTLE setting for Bundle5 (Lane10, Lane11)
Bundle6	0x00	Gen3 RxCTLE setting for Bundle6 (Lane12, Lane13)
Bundle7	0x00	Gen3 RxCTLE setting for Bundle7 (Lane14, Lane15)
PEG10 RxCTLE Overide	**Disabled** Enabled	When Enabled, overrides PEG0 RxCTLE adaptive behavior

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Feature	Options	Description
PEG11 RxCTLE Overide	**Disabled** Enabled	When Enabled, overrides PEG1 RxCTLE adaptive behavior
PEG12 RxCTLE Overide	**Disabled** Enabled	When Enabled, overrides PEG2 RxCTLE adaptive behavior
DMI RxCTLE Overide	**Disabled** Enabled	When Enabled, overrides DMI RxCTLE adaptive behavior

7.4.2. Chipset > PCH-IO Configuration

Feature	Options	Description
PCH-IO Configuration	Info only	
SA PCIe Code Version	Read only	
PCI Express Configuration	Submenu	
SATA And RST Configuration	Submenu	
HD Audio Configuration	Submenu	
SCS Configuration	Submenu	
Serial IO Configuration	Submenu	
PCH LAN Controller	**Enabled** Disabled	Enable/Disable onboard NIC.
Wake on LAN Enable for S5 Enable	**Enabled** Disabled	Enable/Disable integrated LAN to wake the system only for S5.
Serial IRQ Mode	Quiet **Continuous**	Configure Serial IRQ Mode.
High Precision Timer	Disabled **Enabled**	Enable or Disable the High Precision Event Timer.
Pcie Pll SSC	**Auto** 0.0% 0.1% 0.2% 0.3% 0.4% 0.5% 0.6% 0.7% 0.8% 0.9% 1.0% 1.1% 1.2% 1.3% 1.4% 1.5% 1.6% 1.7% 1.8% 1.9% 2.0%	Pcie Pll SSC percentage.AUTO - Keep hw default, no BIOS override. Range is 0.0%-2.0%.
SPD Write Disable	**True** False	Enable/Disable setting SPD Write Disable. For security recommendations, SPD write disable bit must be set.

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7.4.2.1. Chipset > PCH-IO Configuration > PCI Express Configuration

Feature	Options	Description
PCI Express Configuration	Info only	
PCI Express Clock Gating	Disabled **Enabled**	PCI Express Clock Gating Enable/Disable for each root port.
DMI Link ASPM Control	**Disabled** L0s L1 L0sL1 Auto	The control of Active State Power Management of the DMI Link.
PCIE Port assigned to LAN	Read only	
Compliance Test Mode	**Disabled** Enabled	Enable when using Compliance Load Board.
PCIe-USB Glitch W/A	**Disabled** Enabled	PCIe-USB Glitch W/A for bad USB device(s) connected behind PCIE/PEG Port.
PCIe function swap	Disabled **Enabled**	When Disabled, prevents PCIE rootport function swap. If any function other than 0th is enabled, 0th will become visible.
PCIE Ports 0-3 Configuration	**4x1 Port** 1x2 2x1 Port 2x2 Port 1x4 Port	To configure PCIe Port 1-4 of chipset [4X1]: Port 0-3 (x1) and Port 8 (x1) [1x2 2x1]: Port 0 (x2), Port 1 (disabled), Ports 2 and Port 3 (x1) [2x2]: Port 0-1 (x2) and Port 2-3 (x2) [1x4]: Port 0 (x4), Ports 1-3 (disabled) (Default is 4x1, other configurations require a customized BIOS.)
PCIE Ports 4-7 Configuration	**4x1 Port** 1x2 2x1 Port 2x2 Port 1x4 Port	To configure PCIe Port 4-7 of chipset. [4X1]: Port 4-7 (x1) and Port 8 (x1) [1x2 2x1]: Port 4 (x2), Port 5 (disabled), Ports 6 and Port 7 (x1) [2x2]: Port 4-5 (x2) and Port 6-7 (x2) [1x4]: Port 4 (x4), Ports 5-7 (disabled) (Default is 4x1, other configurations require a customized BIOS.)
PCI Express Root Port X	Submenu	

Chipset > PCH-IO Configuration > PCI Express Configuration > PCI Express Root Port X

Feature	Options	Description
PCI Express Root Port X	Disabled **Enable**	Control the PCI Express Root Port.
Connection Type	Built-in **Slot**	Built-In: a built-in device is connected to this rootport. SlotImplemented bit will be clear. Slot: this rootport connects to user-accessible slot. SlotImplemented bit will be set.
ASPM	**Disabled** L0s L1 L0sL1 Auto	Set the ASPM Level. Force L0s - Force all links to L0s State Auto - BIOS auto configure; Disabled - Disables ASPM
L1 Substates	Disabled	PCI Express L1 Substates settings.

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Feature	Options	Description
	L1.1 **L1.1 & L1.2**	
Gen3 Eq Phase3 Method	**Hardware** Static Coeff.	PCIe Gen3 Equalization Phase 3 Method
UPTP	**5**	Upstream Port Transmitter Preset
DPTP	**7**	Downstream Port Transmitter Preset
ACS	Disabled **Enable**	Enable/Disable Access Control Services Extended Capability
PTM	Disabled **Enable**	Enable/Disable Precision Time Measurement
DPC	Disabled **Enable**	Enable/Disable Downstream Port Containment
EDPC	Disabled **Enable**	Enable/Disable Rootport extensions for Downstream Port Containment
URR	**Disabled** Enable	PCI Express Unsupported Request Reporting Enable/Disable.
FER	**Disabled** Enable	PCI Express Device Fatal Error Reporting Enable/Disable.
NFER	**Disabled** Enable	PCI Express Device Non-Fatal Error Reporting Enable/Disable.
CER	**Disabled** Enable	PCI Express Device Correctable Error Reporting Enable/Disable.
CTO	**Disabled** Enable	PCI Express Completion Timer TO Enable/Disable
SEFE	**Disabled** Enable	Root PCI Express System Error on Fatal Error Enable/Disable.
SENFE	**Disabled** Enable	Root PCI Express System Error on Non-Fatal Error Enable/Disable.
SECE	**Disabled** Enable	Root PCI Express System Error on Correctable Error Enable/Disable.
PME SCI	Disabled **Enable**	PCI Express PME SCI Enable/Disable.
Hot Plug	**Disabled** Enable	PCI Express Hot Plug Enable/Disable.
Advanced Error Reporting	Disabled **Enable**	Advanced Error Reporting Enable/Disale.
PCIe Speed	**Auto** Gen1 Gen2 Gen3	Configure PCIe Speed.
Transmitter Half Swing	**Disabled** Enabled	Transmitter Half Swing Enable/Disable.
Detect Non-Compiance	**Disabled** Enable	Detect Non-Compliance PCI Express Device. If enabled, it will take more time at POST time.
Detect Timeout	**0**	The number of milliseconds reference code will wait for link to exit Detect state for enabled ports before assuming there is no device and potentially disabling the port.

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Feature	Options	Description
Extra Bus Reserved	**0**	Extra Bus Reserved (0-7) for bridges behind this Root Bridge.
Reseved Memory	**10**	Reserved Memory for this Root Bridge (1-20) MB.
Reserved I/O	**4**	Reserved I/O (4K/8K/12K/16K/20K) Range for this Root Bridge.
PCH PCIe LTR Configuration	Info only	
LTR	Disabled **Enable**	PCH PCIE Latency Reporting Enable/Disable.
Snoop Latency Override	Disabled Manual **Auto**	Snoop Latency Override for PCH PCIE. Disabled: Disable override. Manual: Manually enter override values. Auto (default): Maintain default BIOS flow."
Non Snoop Latency Override	Disabled Manual **Auto**	Non Snoop Latency Override for PCH PCIE. Disabled: Disable override.Manual: Manually enter override values. Auto (default): Maintain default BIOS flow.
Force LTR Override	**Disabled** Enable	Force LTR Override for PCH PCIE. Disabled: LTR override values will not be forced. Enabled: LTR override values will be forced and LTR messages from the device will be ignored.
LTR Lock	**Disabled** Enable	PCIE LTR Configuration Lock

7.4.2.2. Chipset > PCH-IO Configuration > SATA and RST Configuration

Feature	Options	Description
SATA And RST Configuration	Info only	
SATA Controller(s)	**Enabled** Disabled	Enable/Disable SATA Device.
SATA Mode Selection	**AHCI** Intel RST Premium With Intel Optane System Acceleration	Determines how SATA controller(s) operate.
SATA Interrupt Selection	**Msix** Msi Legacy	Select which interrupt will be available to OS. This option only takes effect if SATA controller is in RAID mode.
PCIe Storage Dev On Port 0	RST Controlled **Not RST Controlled**	Enable/Disable RST Pcie Storage Remapping
PCIe Storage Dev On Port 2	RST Controlled **Not RST Controlled**	Enable/Disable RST Pcie Storage Remapping
PCIe Storage Dev On Port 4	RST Controlled **Not RST Controlled**	Enable/Disable RST Pcie Storage Remapping
PCIe Storage Dev On Port 6	RST Controlled **Not RST Controlled**	Enable/Disable RST Pcie Storage Remapping
SATA Test Mode	Enabled **Disabled**	Test Mode Enable/Disable (Loop Back).
RAID Device ID	**Client**	Choose RAID Device ID

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Feature	Options	Description
	Alternate Server	
Software Feature Mask Configuration	Submenu	
Aggressive LPM Support	Disabled **Enabled**	Enable PCH to aggressively enter link power state.
SATA Controller Speed	Default Gen1 **Gen2** Gen3	Indicates the maximum speed the SATA controller can support.
Serial ATA Port X	Info only	
Software Preserve	Info only	
Port X	Disabled **Enabled**	Enable or Disable SATA Port
Hot Plug	**Disabled** Enabled	Designates this port as Hot Pluggable.
Configured as eSATA	Info only	
External	**Disabled** Enabled	Marks this port as external.
Spin Up Device	**Disabled** Enabled	If enabled for any of ports Staggerred Spin Up will be performed and only the drives which have this option enabled will spin up at boot. Otherwise all drives spin up at boot.
SATA Device Type	**Hard Disk Drive** Solid State Drive	Identify the SATA port is connected to Solid State Drive or Hard Disk Drive
SATA Port X DevSlp	**Disabled** Enabled	Enable/Disable SATA Port 0 DevSlp. For DevSlp to work, both hard drive and SATA port need to support DevSlp function, otherwise an unexpected behavior might happen. Please check board design before enabling it.
DITO Configuration	**Disabled** Enabled	Enable/Disable DITO Configuration

7.4.2.3. Chipset > PCH-IO Configuration > HD Audio Configuration

Feature	Options	Description
HD Audio Subsystem Configuration Settings	Info only	
HD Audio	Disabled **Enabled**	Control Detection of the HD-Audio device. Disabled: HDA will be unconditionally disabled Enabled:HDA will be unconditionally enabled.

7.4.2.4. Chipset > PCH-IO Configuration > SCS Configuration

Feature	Options	Description
SDCard 3.0 Controller	Disabled **Enabled**	Enable or Disable SCS SDHC 3.0 Controller.

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7.4.2.5. Chipset > PCH-IO Configuration > Serial IO Configuration

Feature	Options	Description
I2C0 Controller	Disabled **Enabled**	Enables or Disables Serial IO Controller. If given device is Function 0 PSF disabling is skipped. PSF default will remain and device PCI CFG Space will still be visible. This is needed to allow PCI enumerator access functions above 0 in a multifunction device.
I2C1 Controller	Disabled **Enabled**	Enables or Disables Serial IO Controller If given device is Function 0 PSF disabling is skipped. PSF default will remain and device PCI CFG Space will still be visible. This is needed to allow PCI enumerator access functions above 0 in a multifunction device.

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7.5. Security

Feature	Options	Description
Password Description	Info only	
Administrator Password	Enter password	
User Password	Enter password	
Secure Boot menu	Submenu	

7.5.1. Secure Boot menu

Feature	Options	Description
Secure Boot	Info only	
Secure Boot Control	**Disabled** Enabled	Secure Boot feature is Active if Secure Boot is Enabled,platform Key(PK) is enrolled and the System is in User mode, The mode change requires platform reset
Secure Boot Mode	**Standard** Custom	Secure Boot mode options: Standard or Custom, In Custom mode,Secure Boot Policy variables can be configured by a physically present user without full authentication
Key Management	Submenu	

7.5.1.1. Secure Boot Menu > Key Management

Feature	Options	Description
Factory Key Provision	**Disabled** Enabled	Install factory default Secure Boot Keys after the platform reset and while the System is in Setup mode
Restore Factory Keys		Force System to User Mode. Install factory default Secure Boot key databases
Reset To Setup Mode		Delete all Secure Boot key databases from NVRAM
Export Secure Boot variables		Copy NVRAM content of Secure Boot variables to files in a root folder on a file system device
Enroll Efi Image		Allow the image to run in Secure Boot mode. Enroll SHA256 Hash certificate of a PE image into Authorized Signature Database (db)
Platform Key(PK)	Details Export Update Append Delete	Enroll Factory Defaults or load the keys from a file with: 1. Public Key Certificate in: a) EFI_SIGNATURE_LIST b) EFI_CERT_X509 (DER encoded) c) EFI_CERT_RSA2048 (bin) d) EFI_CERT_SHA256 (bin) 2. Authenticated UEFI Variable 3.EFI PE/COFF Image(SHA256) Key Source: Factory,External,Mixed

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Feature	Options	Description
Key Exchange Keys	Details Export Update Append Delete	Enroll Factory Defaults or load the keys from a file with: 1. Public Key Certificate in: a) EFI_SIGNATURE_LIST b) EFI_CERT_X509 (DER encoded) c) EFI_CERT_RSA2048 (bin) d) EFI_CERT_SHA256 (bin) 2. Authenticated UEFI Variable 3.EFI PE/COFF Image(SHA256) Key Source: Factory,External,Mixed
Authorized Signatures	Details Export Update Append Delete	Enroll Factory Defaults or load the keys from a file with: 1. Public Key Certificate in: a) EFI_SIGNATURE_LIST b) EFI_CERT_X509 (DER encoded) c) EFI_CERT_RSA2048 (bin) d) EFI_CERT_SHA256 (bin) 2. Authenticated UEFI Variable 3.EFI PE/COFF Image(SHA256) Key Source: Factory,External,Mixed
Forbidden Signatures	Update Append	Enroll Factory Defaults or load the keys from a file with: 1. Public Key Certificate in: a) EFI_SIGNATURE_LIST b) EFI_CERT_X509 (DER encoded) c) EFI_CERT_RSA2048 (bin) d) EFI_CERT_SHA256 (bin) 2. Authenticated UEFI Variable 3.EFI PE/COFF Image(SHA256) Key Source: Factory,External,Mixed
Authorized TimeStamps	Update Append	Enroll Factory Defaults or load the keys from a file with: 1. Public Key Certificate in: a) EFI_SIGNATURE_LIST b) EFI_CERT_X509 (DER encoded) c) EFI_CERT_RSA2048 (bin) d) EFI_CERT_SHA256 (bin) 2. Authenticated UEFI Variable 3.EFI PE/COFF Image(SHA256) Key Source: Factory,External,Mixed
OsRecovery Signatures	Update Append	Enroll Factory Defaults or load the keys from a file with: 1. Public Key Certificate in: a) EFI_SIGNATURE_LIST b) EFI_CERT_X509 (DER encoded) c) EFI_CERT_RSA2048 (bin) d) EFI_CERT_SHA256 (bin) 2. Authenticated UEFI Variable 3.EFI PE/COFF Image(SHA256) Key Source: Factory,External,Mixed

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7.5.2. HDD Security Configuration

Feature	Options	Description
HDD Password Description	Info only	
Set User Password	Enter HDD User password	Set HDD User Password. *** It is advised to power cycle the system after setting the HDD password ***. Discard or Save changes option in setup does not have any impact on HDD when password is set or removed.If the 'Set HDD User Password' option is hidden,do power cycle to enable the option again
Set Master Password	Enter HDD Master password	Set HDD Master Password. *** It is advised to power cycle the system after setting the HDD password ***. Discard or Save changes option in setup does not have any impact on HDD when password is set or removed.If the 'Set HDD Master Password' option is hidden,user may have entered setup with user HDD Security

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7.6. Boot

7.6.1. Boot Configuration

Feature	Options	Description
Boot Configuration	Info only	
Setup Prompt Timeout	**1**	Number of seconds to wait for setup activation key. 65535(0xFFFF) means indefinite waiting.
Bootup NumLock State	On **Off**	Select the keyboard NumLock state
Quiet Boot	Disabled **Enabled**	Enables or disables Quiet Boot option
Fast Boot	Disabled **Enabled**	Enables or disables boot with initialization of a minimal set of devices required to launch active boot option. Has no effect for BBS boot options.
SATA Support	**Last Boot HDD Only** All Sata Devices	If Last Boot HDD Only, Only last boot HDD device will be available in Post. If All Sata Devices, all SATA devices will be available in OS and Post.
VGA Support	Auto **EFI Driver**	If Auto, only install Legacy OpRom with Legacy OS and logo would NOT be shown during post. Efi driver will still be installed with EFI OS.
USB Support	Disabled **Full Initial** Partial Initial	If Disabled, all USB devices will NOT be available until after OS boot. If Partial Initial, USB Mass Storage and specific USB port/device will NOT be available before OS boot. If Enabled, all USB devices will be available in OS and Post.
PS2 Devices Support	Disabled **Enabled**	If Disabled, PS2 devices will be skipped.
NetWork Stack Driver Support	**Disabled** Enabled	If Disabled, NetWork Stack Driver will be skipped.
Redirection Support	**Disabled** Enabled	If disable, Redirection function will be disabled.
Boot Configuration	Info only	
Boot Option Priorities	Info only	

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7.7. Save & Exit

7.7.1. Reset Options

Feature	Options	Description
Save Changes and Reset		Save Changes and Reset
Save Changes and Exit		Exit system setup after saving the changes.
Discard Changes and Exit		Exit system setup without saving any changes.
Save Changes and Reset		Reset the system after saving the changes.
Discard Changes and Reset		Reset system setup without saving any changes.

7.7.2. Save Options

Feature	Options	Description
Save Changes		Save Changes done so far to any of the setup options.
Discard Changes		Discard Changes done so far to any of the setup options.
Restore Defaults		Restore/Load Default values for all the setup options.
Save as User Defaults		Save the changes done so far as User Defaults.
Restore User Defaults		Restore the User Defaults to all the setup options.
Boot Override	Info only	

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8. BIOS Checkpoints, Beep Codes

This section of this document lists checkpoints and beep codes generated by AMI Aptio BIOS. The checkpoints defined in this document are inherent to the AMIBIOS generic core, and do not include any chipset or board specific checkpoint definitions.

Checkpoints and Beep Codes Definition

A checkpoint is either a byte or word value output to I/O port 80h. The BIOS outputs checkpoints throughout bootblock and Power-On Self Test (POST) to indicate the task the system is currently executing. Checkpoints are very useful for debugging problems that occur during the preboot process.

Beep codes are used by the BIOS to indicate a serious or fatal error. They are used when an error occurs before the system video has been initialized, and generated by the system board speaker.

Aptio Boot Flow

While performing the functions of the traditional BIOS, Aptio 5.x core follows the firmware model described by the Intel Platform Innovation Framework for EFI (“the Framework”). The Framework refers the following “boot phases”, which may apply to various status code & checkpoint descriptions:

- Security (SEC) – initial low-level initialization
- Pre-EFI Initialization (PEI) – memory initialization[1]
- Driver Execution Environment (DXE) – main hardware initialization[2]
- Boot Device Selection (BDS) – system setup, pre-OS user interface & selecting a bootable device (CD/DVD, HDD, USB, Network, Shell, …)

Viewing BIOS Checkpoints

Viewing all checkpoints generated by the BIOS requires a checkpoint card, also referred to as a □OST Card or POST Diagnostic Card. These are PCI add-in cards that show the value of I/O port 80h on a LED display.

Some computers display checkpoints in the bottom right corner of the screen during POST. This display method is limited, since it only displays checkpoints that occur after the video card has been activated.

Keep in mind that not all computers using AMI Aptio BIOS enable this feature. In most cases, a checkpoint card is the best tool for viewing AMI Aptio BIOS checkpoints.

[1]Analogous to “bootblock” functionality of legacy BIOS
[2]Analogous to “POST” functionality in legacy BIOS

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8.1. Status Code Ranges

Status Code Range	Description
0x01 – 0x0B	SEC execution
0x0C – 0x0F	SEC errors
0x10 – 0x2F	PEI execution up to and including memory detection
0x30 – 0x4F	PEI execution after memory detection
0x50 – 0x5F	PEI errors
0x60 – 0x8F	DXE execution up to BDS
0x90 – 0xCF	BDS execution
0xD0 – 0xDF	DXE errors
0xE0 – 0xE8	S3 Resume (PEI)
0xE9 – 0xEF	S3 Resume errors (PEI)
0xF0 – 0xF8	Recovery (PEI)
0xF9 – 0xFF	Recovery errors (PEI)

8.2. Standard Status Codes

8.2.1. SEC Phase

Status Code	Description
0x00	Not used
Progress Codes	
0x01	Power on. Reset type detection (soft/hard).
0x02	AP initialization before microcode loading
0x03	North Bridge initialization before microcode loading
0x04	South Bridge initialization before microcode loading
0x05	OEM initialization before microcode loading
0x06	Microcode loading
0x07	AP initialization after microcode loading
0x08	North Bridge initialization after microcode loading
0x09	South Bridge initialization after microcode loading
0x0A	OEM initialization after microcode loading
0x0B	Cache initialization

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SEC Error Codes	
0x0C – 0x0D	Reserved for future AMI SEC error codes
0x0E	Microcode not found
0x0F	Microcode not loaded

8.2.2. SEC Beep Codes

None

8.2.3. PEI Phase

Status Code	Description
Progress Codes	
0x10	PEI Core is started
0x11	Pre-memory CPU initialization is started
0x12	Pre-memory CPU initialization (CPU module specific)
0x13	Pre-memory CPU initialization (CPU module specific)
0x14	Pre-memory CPU initialization (CPU module specific)
0x15	Pre-memory North Bridge initialization is started
0x16	Pre-Memory North Bridge initialization (North Bridge module specific)
0x17	Pre-Memory North Bridge initialization (North Bridge module specific)
0x18	Pre-Memory North Bridge initialization (North Bridge module specific)
0x19	Pre-memory South Bridge initialization is started
0x1A	Pre-memory South Bridge initialization (South Bridge module specific)
0x1B	Pre-memory South Bridge initialization (South Bridge module specific)
0x1C	Pre-memory South Bridge initialization (South Bridge module specific)
0x1D – 0x2A	OEM pre-memory initialization codes
0x2B	Memory initialization. Serial Presence Detect (SPD) data reading
0x2C	Memory initialization. Memory presence detection
0x2D	Memory initialization. Programming memory timing information
0x2E	Memory initialization. Configuring memory
0x2F	Memory initialization (other).
0x30	Reserved for ASL (see ASL Status Codes section below)
0x31	Memory Installed
0x32	CPU post-memory initialization is started
0x33	CPU post-memory initialization. Cache initialization
0x34	CPU post-memory initialization. Application Processor(s) (AP) initialization

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Status Code	Description
0x35	CPU post-memory initialization. Boot Strap Processor (BSP) selection
0x36	CPU post-memory initialization. System Management Mode (SMM) initialization
0x37	Post-Memory North Bridge initialization is started
0x38	Post-Memory North Bridge initialization (North Bridge module specific)
0x39	Post-Memory North Bridge initialization (North Bridge module specific)
0x3A	Post-Memory North Bridge initialization (North Bridge module specific)
0x3B	Post-Memory South Bridge initialization is started
0x3C	Post-Memory South Bridge initialization (South Bridge module specific)
0x3D	Post-Memory South Bridge initialization (South Bridge module specific)
0x3E	Post-Memory South Bridge initialization (South Bridge module specific)
0x3F-0x4E	OEM post memory initialization codes
0x4F	DXE IPL is started
PEI Error Codes	
0x50	Memory initialization error. Invalid memory type or incompatible memory speed
0x51	Memory initialization error. SPD reading has failed
0x52	Memory initialization error. Invalid memory size or memory modules do not match.
0x53	Memory initialization error. No usable memory detected
0x54	Unspecified memory initialization error.
0x55	Memory not installed
0x56	Invalid CPU type or Speed
0x57	CPU mismatch
0x58	CPU self test failed or possible CPU cache error
0x59	CPU micro-code is not found or micro-code update is failed
0x5A	Internal CPU error
0x5B	reset PPI is not available
0x5C-0x5F	Reserved for future AMI error codes
S3 Resume Progress Codes	
0xE0	S3 Resume is stared (S3 Resume PPI is called by the DXE IPL)
0xE1	S3 Boot Script execution
0xE2	Video repost
0xE3	OS S3 wake vector call
0xE4-0xE7	Reserved for future AMI progress codes

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Status Code	Description
S3 Resume Error Codes	
0xE8	S3 Resume Failed
0xE9	S3 Resume PPI not Found
0xEA	S3 Resume Boot Script Error
0xEB	S3 OS Wake Error
0xEC-0xEF	Reserved for future AMI error codes
Recovery Progress Codes	
0xF0	Recovery condition triggered by firmware (Auto recovery)
0xF1	Recovery condition triggered by user (Forced recovery)
0xF2	Recovery process started
0xF3	Recovery firmware image is found
0xF4	Recovery firmware image is loaded
0xF5-0xF7	Reserved for future AMI progress codes
Recovery Error Codes	
0xF8	Recovery PPI is not available
0xF9	Recovery capsule is not found
0xFA	Invalid recovery capsule
0xFB – 0xFF	Reserved for future AMI error codes

8.2.4. PEI Beep Codes

# of Beeps	Description
1	Memory not Installed
1	Memory was installed twice (InstallPeiMemory routine in PEI Core called twice)
2	Recovery started
3	DXEIPL was not found
3	DXE Core Firmware Volume was not found
4	Recovery failed
4	S3 Resume failed
7	Reset PPI is not available

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8.2.5. DXE Status Codes

Status Code	Description
0x60	DXE Core is started
0x61	NVRAM initialization
0x62	Installation of the South Bridge Runtime Services
0x63	CPU DXE initialization is started
0x64	CPU DXE initialization (CPU module specific)
0x65	CPU DXE initialization (CPU module specific)
0x66	CPU DXE initialization (CPU module specific)
0x67	CPU DXE initialization (CPU module specific)
0x68	PCI host bridge initialization
0x69	North Bridge DXE initialization is started
0x6A	North Bridge DXE SMM initialization is started
0x6B	North Bridge DXE initialization (North Bridge module specific)
0x6C	North Bridge DXE initialization (North Bridge module specific)
0x6D	North Bridge DXE initialization (North Bridge module specific)
0x6E	North Bridge DXE initialization (North Bridge module specific)
0x6F	North Bridge DXE initialization (North Bridge module specific)
0x70	South Bridge DXE initialization is started
0x71	South Bridge DXE SMM initialization is started
0x72	South Bridge devices initialization
0x73	South Bridge DXE Initialization (South Bridge module specific)
0x74	South Bridge DXE Initialization (South Bridge module specific)
0x75	South Bridge DXE Initialization (South Bridge module specific)
0x76	South Bridge DXE Initialization (South Bridge module specific)
0x77	South Bridge DXE Initialization (South Bridge module specific)
0x78	ACPI module initialization
0x79	CSM initialization
0x7A – 0x7F	Reserved for future AMI DXE codes
0x80 – 0x8F	OEM DXE initialization codes
0x90	Boot Device Selection (BDS) phase is started
0x91	Driver connecting is started
0x92	PCI Bus initialization is started
0x93	PCI Bus Hot Plug Controller Initialization
0x94	PCI Bus Enumeration

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Status Code	Description
0x95	PCI Bus Request Resources
0x96	PCI Bus Assign Resources
0x97	Console Output devices connect
0x98	Console input devices connect
0x99	Super IO Initialization
0x9A	USB initialization is started
0x9B	USB Reset
0x9C	USB Detect
0x9D	USB Enable
0x9E – 0x9F	Reserved for future AMI codes
0xA0	IDE initialization is started
0xA1	IDE Reset
0xA2	IDE Detect
0xA3	IDE Enable
0xA4	SCSI initialization is started
0xA5	SCSI Reset
0xA6	SCSI Detect
0xA7	SCSI Enable
0xA8	Setup Verifying Password
0xA9	Start of Setup
0xAA	Reserved for ASL (see ASL Status Codes section below)
0xAB	Setup Input Wait
0xAC	Reserved for ASL (see ASL Status Codes section below)
0xAD	Ready To Boot event
0xAE	Legacy Boot event
0xAF	Exit Boot Services event
0xB0	Runtime Set Virtual Address MAP Begin
0xB1	Runtime Set Virtual Address MAP End
0xB2	Legacy Option ROM Initialization
0xB3	System Reset
0xB4	USB hot plug
0xB5	PCI bus hot plug
0xB6	Clean-up of NVRAM
0xB7	Configuration Reset (reset of NVRAM settings)

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Status Code	Description
0xB8 – 0xBF	Reserved for future AMI codes
0xC0 – 0xCF	OEM BDS initialization codes
DXE Error Codes	
0xD0	CPU initialization error
0xD1	North Bridge initialization error
0xD2	South Bridge initialization error
0xD3	Some of the Architectural Protocols are not available
0xD4	PCI resource allocation error. Out of Resources
0xD5	No Space for Legacy Option ROM
0xD6	No Console Output Devices are found
0xD7	No Console Input Devices are found
0xD8	Invalid password
0xD9	Error loading Boot Option (LoadImage returned error)
0xDA	Boot Option is failed (StartImage returned error)
0xDB	Flash update is failed
0xDC	Reset protocol is not available

8.2.6. DXE Beep Codes

# of Beeps	Description
1	Invalid password
4	Some of the Architectural Protocols are not available
5	No Console Output Devices are found
5	No Console Input Devices are found
6	Flash update is failed
7	Reset protocol is not available
8	Platform PCI resource requirements cannot be met

8.2.7. ACPI/ASL Checkpoint

Status Code	Description
0x01	System is entering S1 sleep state
0x02	System is entering S2 sleep state
0x03	System is entering S3 sleep state
0x04	System is entering S4 sleep state
0x05	System is entering S5 sleep state

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Status Code	Description
0x10	System is waking up from the S1 sleep state
0x20	System is waking up from the S2 sleep state
0x30	System is waking up from the S3 sleep state
0x40	System is waking up from the S4 sleep state
0xAC	System has transitioned into ACPI mode. Interrupt controller is in PIC mode.
0xAA	System has transitioned into ACPI mode. Interrupt controller is in APIC mode.

8.3. OEM-Reserved Checkpoint Ranges

Status Code	Description
0x05	OEM SEC initialization before microcode loading
0x0A	OEM SEC initialization after microcode loading
0x1D – 0x2A	OEM pre-memory initialization codes
0x3F – 0x4E	OEM PEI post memory initialization codes
0x80 – 0x8F	OEM DXE initialization codes
0xC0 – 0xCF	OEM BDS initialization codes

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9. Mechanical Information

9.1. Board-to-Board Connectors

To allow for different stacking heights, the receptacles for COM Express carrier boards are available in two heights: 5 mm and 8 mm. When 5 mm receptacles are chosen, the carrier board should be free of components.

Tyco 3-1827253-6

Foxconn QT002206-2131-3H

- 220-pin board-to-board connector with 0.5mm for a stacking height of 5 mm.
- This connector can be used with 5 mm through-hole standoffs (SMT type).



Tyco 3-6318491-6

Foxconn QT002206-4141-3H

- 220-pin board-to-board connector with 0.5mm for a stacking height of 8 mm.
- This connector can be used with 8 mm through-hole standoffs (SMT type).



Common Specifications

- Current capacity: 0.5A per pin
- Rated voltage: 50 VAC
- Insulation resistance: 100M or greater @ 500 VDC
- Temperature rating: -40°C ~ 85°C
- UL certification (ECBT2.E28476)
- Copper alloy (contacts)
- Housing: thermo-plastic molded compound (L.C.P.)

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9.2. Thermal Solution

This section presents general thermal solution information for COM Express modules for your reference. Photos and details may vary depending on the specific module.

9.2.1. Heat Spreaders

The function of the heat spreader is to ensure an identical mechanical profile for all COM Express modules. By using a heat spreader, the thermal solution that is built on top of the module is compatible with all COM Express modules.

9.2.2. Heat Sinks

A heat sink can be used as a thermal solution for a specific COM Express module and can have a fan or be fanless, depending on the thermal requirements.

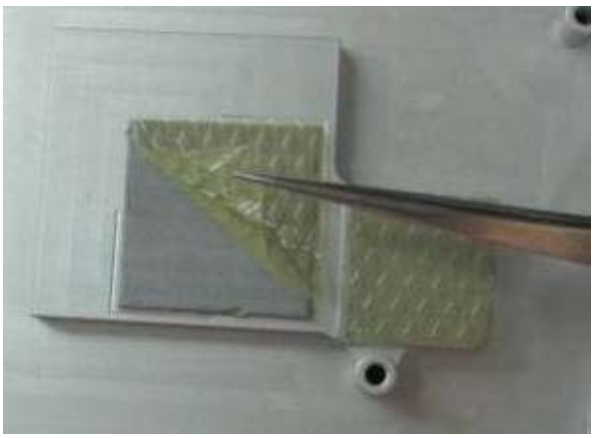
9.2.3. Installation

Install a heat spreader or heat sink using the following instructions.

Step 1: Before mounting the heatsink, install the required memory modules onto the SODIMM socket(s) on the COM Express module.



Step 2: Remove the protective membranes from the thermal pads.

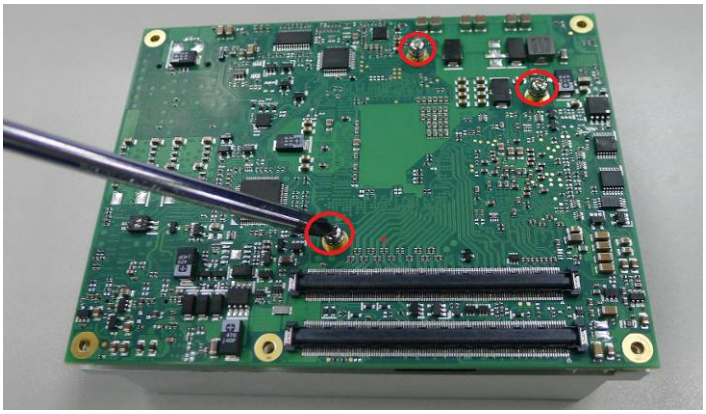


Note: Not all thermal pads have a protective membrane (module dependent).

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Step 3: Assemble the heatsink onto the COM Express module.

Use the three M2.5, L=6mm screws provided to fasten the heatsink to the module.





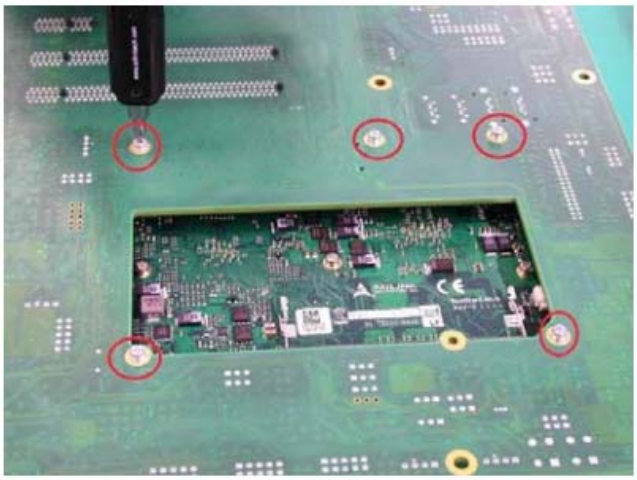
Note: The Express-CFR uses three screws to attach the heatsink to the COM Express module.

Step 4: Place the COM Express module and heatsink assembly onto the connectors on the carrier board as shown.



Then press down on the module until it is firmly seated on the carrier board.

Step 5: Use the five M2.5, L=16mm screws provided to secure the COM Express module to the carrier board from the solder side.





Step 6: If you are installing a heatsink with a fan, plug the fan connector into the carrier board as shown.



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9.3. Mounting Methods

There are several standard ways to mount the COM Express module with a thermal solution onto a carrier board. In addition to the choice of 5 mm or 8mm board-to-board connectors, there is the choice of Top and Bottom mounting. In Top mounting, the threaded standoffs are on the carrier board and the thermal solution is equipped with through-hole standoffs. In Bottom mounting, the threaded standoffs are on the thermal solution and the carrier board has through-hole standoffs.

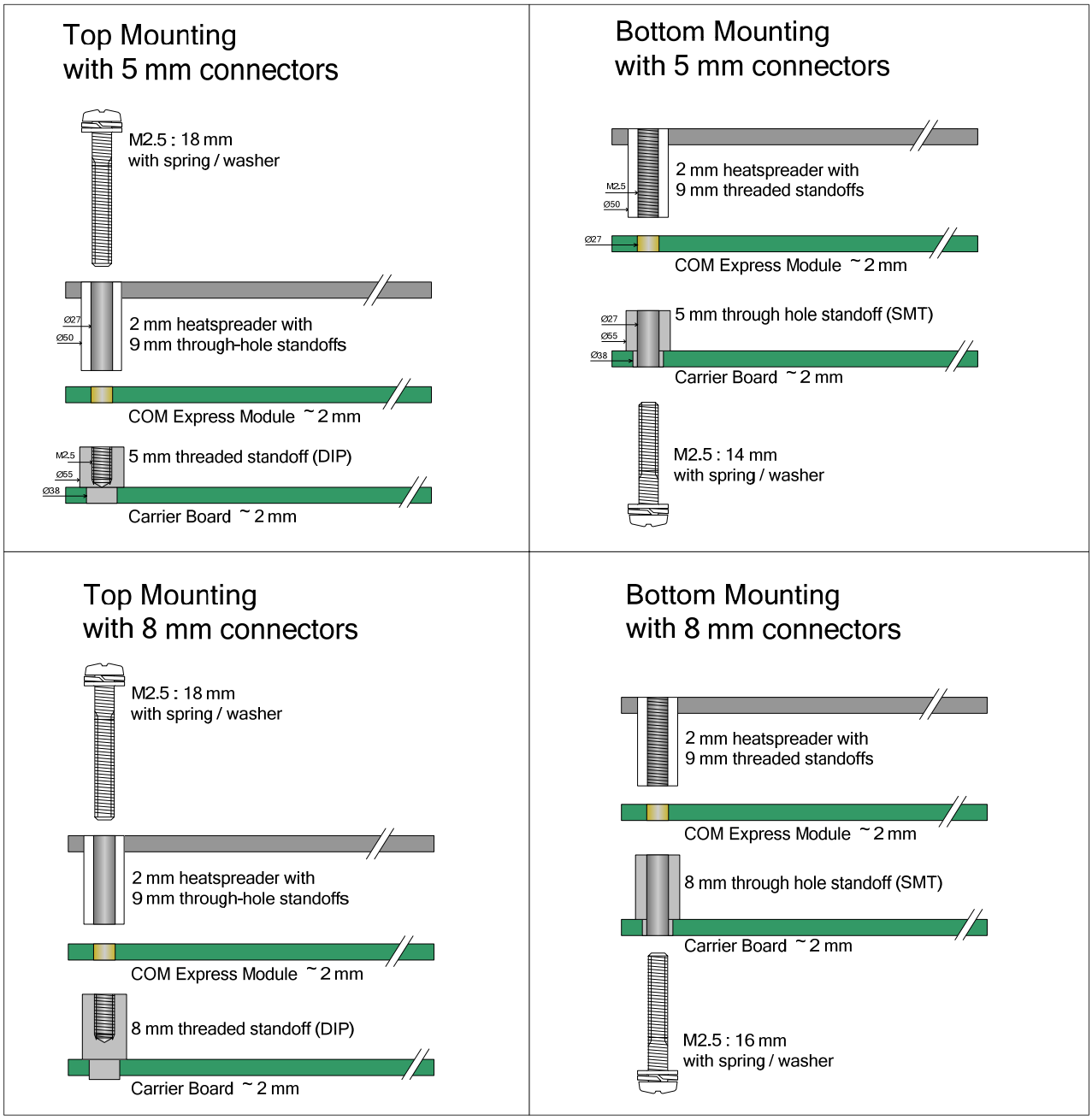


Figure 6: COM Express Mounting Methods

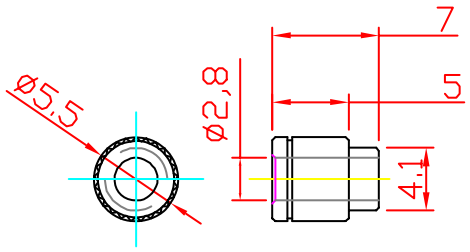
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9.4. Standoff Types

The standoffs available for Top and Bottom mounting methods are shown below. Note that threaded standoffs are DIP type and through-hole standoffs are SMT type. Other types not listed are available upon request.

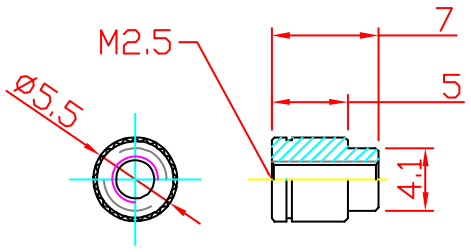
5mm through-hole standoff (SMT type)

P/N: 33-72000-0050



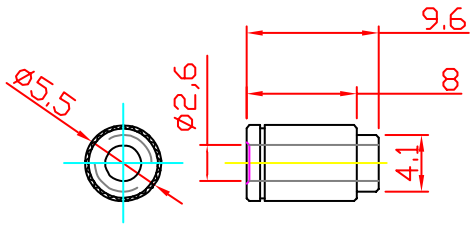
5mm threaded standoff (DIP type)

P/N: 33-72016-0050



8mm through-hole standoff (SMT type)

P/N: 33-72000-0080



8mm threaded standoff (DIP type)

P/N: 33-72015-0050

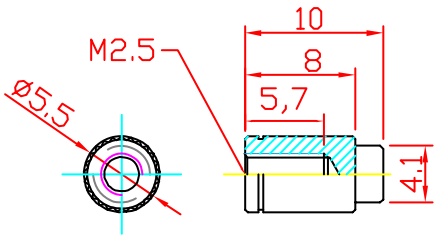


Figure 7: COM Express Standoff Types

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Safety Instructions

Read and follow all instructions marked on the product and in the documentation before you operate your system. Retain all safety and operating instructions for future use.

- Please read these safety instructions carefully.
- Please keep this User‘s Manual for later reference.
- Read the specifications section of this manual for detailed information on the operating environment of this equipment.
- When installing/mounting or uninstalling/removing equipment, turn off the power and unplug any power cords/cables.
- To avoid electrical shock and/or damage to equipment:
  - Keep equipment away from water or liquid sources.
  - Keep equipment away from high heat or high humidity.
  - Keep equipment properly ventilated (do not block or cover ventilation openings).
  - Make sure to use recommended voltage and power source settings.
  - Always install and operate equipment near an easily accessible electrical socket-outlet.
  - Secure the power cord (do not place any object on/over the power cord).
  - Only install/attach and operate equipment on stable surfaces and/or recommended mountings.
  - If the equipment will not be used for long periods of time, turn off and unplug the equipment from its power source.
- Never attempt to fix the equipment. Equipment should only be serviced by qualified personnel.

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