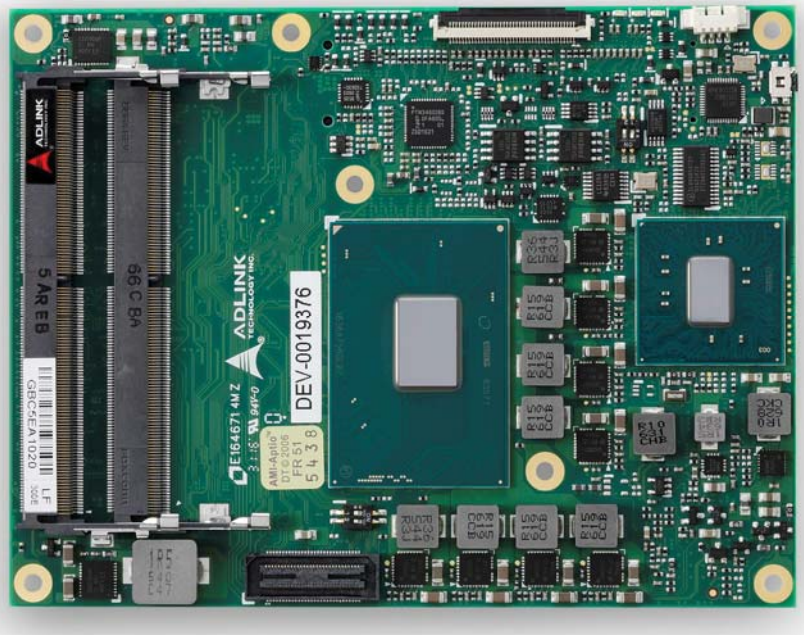
Express-KL

User's Manual

COM Express Basic Size Type 6 Module with
Mobile 7th Gen Intel® Core™ and Xeon® E3-1500 v6 Processors



COM Express®

Manual Rev.: 1.0
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Preface

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Revision History

Revision	Description	Date	By
1.0	Initial release	2017-07-03	JC

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1. Introduction

The Express-KL/KLE is a COM Express® COM.0 R2.1 Basic Size Type 6 module supporting the 64-bit 7th Generation Intel® Core™ and Xeon® processor E3 (codename “Kaby Lake-H”) with Mobile Intel® QM175, HM175, CM238 Chipset. The Express-KL/KLE is specifically designed for customers who need excellent graphics performance and high-level processing performance in a long product life solution.

The Express-KL/KLE features Intel® Hyper-Threading Technology (up to 4 cores, 8 threads) and DDR4 dual-channel memory at 2133/2400 MHz with ECC/non-ECC support determined by CPU/chipset combination to provide excellent overall performance. Intel® Flexible Display Interface and Direct Media Interface provide high speed connectivity from the CPU to the Intel® QM175, HM175, CM238 Chipset.

Integrated Intel® Generation 9 Graphics includes features such as OpenGL 4.4/4.3/4.2, DirectX 11, 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 as a build option. The Express-KL/KLE 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.

The Express-KL/KLE has dual stacked SODIMM sockets supporting up to 32 GB of DDR4 ECC/non-ECC memory. In addition to the onboard integrated graphics, a multiplexed PCIe x16 graphics bus is available for discrete graphics expansion. Input/output features include a single onboard Gigabit Ethernet port, eight PCIe x1 Gen3 lanes, 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	**7th Generation Intel® Core™ and and Xeon® E3-15xx v6 processor (formerly "Kaby Lake-H")** • Intel® Xeon® E3-1505M v6 3.0/4.0GHz (Turbo), 45W/35W(cTDP, 4C/GT2) • Intel® Xeon® E3-1505L v6 2.2/3.0GHz (Turbo), 25W (4C/GT2) • Intel® Core™ i7-7820EQ 3.0/3.7GHz (Turbo), 45W/35W(cTDP, 4C/GT2) • Intel® Core™ i5-7440EQ 2.9/3.6GHz (Turbo), 45W/35W(cTDP, 4C/GT2) • Intel® Core™ i5-7442EQ 2.1/2.9GHz (Turbo), 25W (4C/GT2) • Intel® Core™ i3-7100E 2.9GHz, 35W (2C/GT2) • Intel® Core™ i3-7102E 2.1GHz, 25W (2C/GT2) 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) **Note:** Power Limit option available in BIOS settings (see 7.3.1) to adjust TDP from 45W to 20-30W (45W SKUs only).
Cache	8MB for Xeon®/Core™ i7, 6MB for Core™ i5, 3MB for Core™ i3
Memory	Dual channel ECC or non-ECC 2133/2400 MHz DDR4 memory up to 32GB in dual stacked SODIMM sockets **Note**: Only Xeon® and Core™ i3 processors paired with the CM238 Chipset can support both of ECC and non-ECC memory. Other processor/chipset combinations support non-ECC memory.
Chipset	Mobile Intel® QM175, HM175 and CM238 Chipset (HM175 does not support Intel® AMT)
Embedded BIOS	AMI EFI with CMOS backup in 16MB SPI BIOS with Intel® AMT 11 support
CPU and Chipset Combinations	**Express-KL** (non-ECC memory support) • Core™ i7/i5 with QM175 Chipset • Core™ i3 with HM175 Chipset **Express-KLE** (ECC memory support and non-ECC memory support) • Xeon® with CM238 Chipset • Core™ i3 with CM238 Chipset (supported by project basis; please contact your ADLINK representative) **Note**: Combinations not listed above may be supported by project basis. Please contact your ADLINK representative.

2.2. Expansion Busses

PCI Express	PCI Express x16 Gen3 (can be configured to 1x16, 2 x8 or 1 x8 with 2 x4) 6 PCI Express x1 Gen3 (AB): Lanes 0/1/2/3/4/5 2 PCI Express x1 Gen3 (CD): Lane 6/7 Note: 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.
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) • 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 12, DirectX 11.3, DirectX 11, DirectX 10.1, DirectX 10, DirectX 9 support • OpenGL up to 4.4, OpenCL up to 2.1 support • High Dynamic Range (HDR) Rec. 2020 support **Note:** Availability of features s dependent on operating system (Windows 10 64-bit, Linux 64-bit, VxWorks 7)
Display Interface Support	• **LVDS**: single/dual channel 18/24-bit LVDS through eDP to LVDS, supports DE mode and Hsync/Vsync mode • **eDP:** eDP 1.4 up to 4 lane support, in place of LVDS (BOM option) • **Digital Display Ports x3:** DDI1/2/3 support DisplayPort/HDMI/DVI

2.4. Audio

Integrated	Intel® HD Audio integrated in QM175/HM175/CM238 Chipset
Codec	Located on carrier Express-BASE6 (ALC886 standard support)

2.5. LAN

Integrated	MAC integrated in QM175/HM175/CM238 Chipset
Intel PHY	Intel® Ethernet Controller I219-LM or I219-V
Interface	10/100/1000 Mbit/s connection

2.6. Multi I/O and Storage

Integrated	Intel® QM175/HM175/CM238 Chipset
USB	4x USB 3.0 (USB 0,1,2,3), 4x USB 2.0 (USB 4,5,6,7)
SATA*	4x SATA 6Gb/s (SATA 0,1,2,3)
GPIO	4 GPO and 4 GPI

***Note:** 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	10	0x240	Yes
COM 2	Supported by module (SER1, A101/A102), via NCT5104D	11	0x248	Yes
COM 3	Supported by Super I/O (W83627DHG) on carrier board	4	0x3F8	Yes
COM 4	Supported by Super I/O (W83627DHG) on carrier board	3	0x2F8	Yes

2.8. Trusted Platform Module (TPM)

- **Chipset:** Infineon SLB 9665XT2.0 FW5.51
- **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

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, S3, S4, S5 (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
Extreme Rugged Operating Temperature (optional)	-40°C to +85°C (Standard Voltage Input) Storage: -40°C to +85°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 2.1 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) • VxWorks
Extended Support (BSP)	• Linux (64-bit) • VxWorks

2.17. Functional Diagram

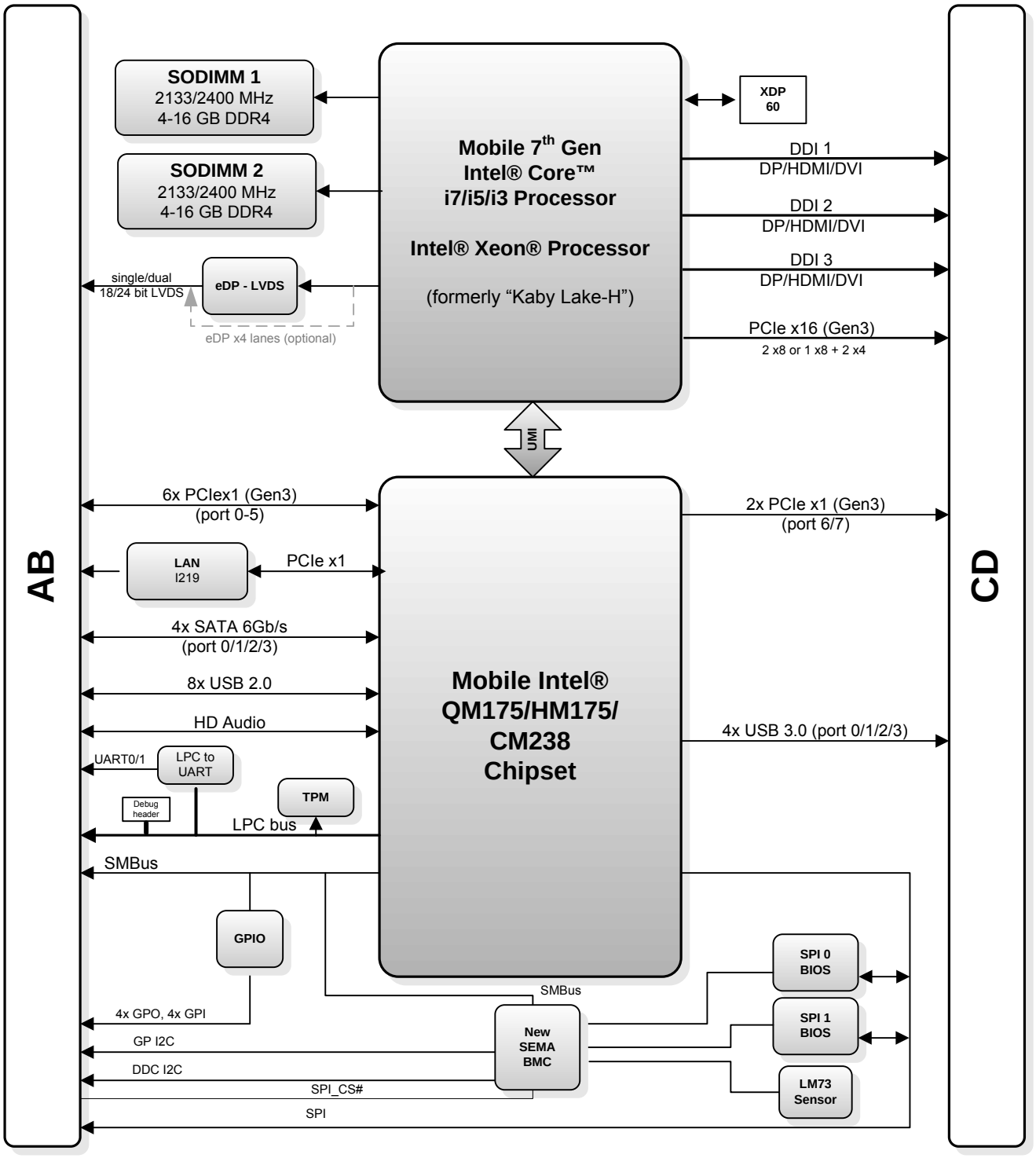
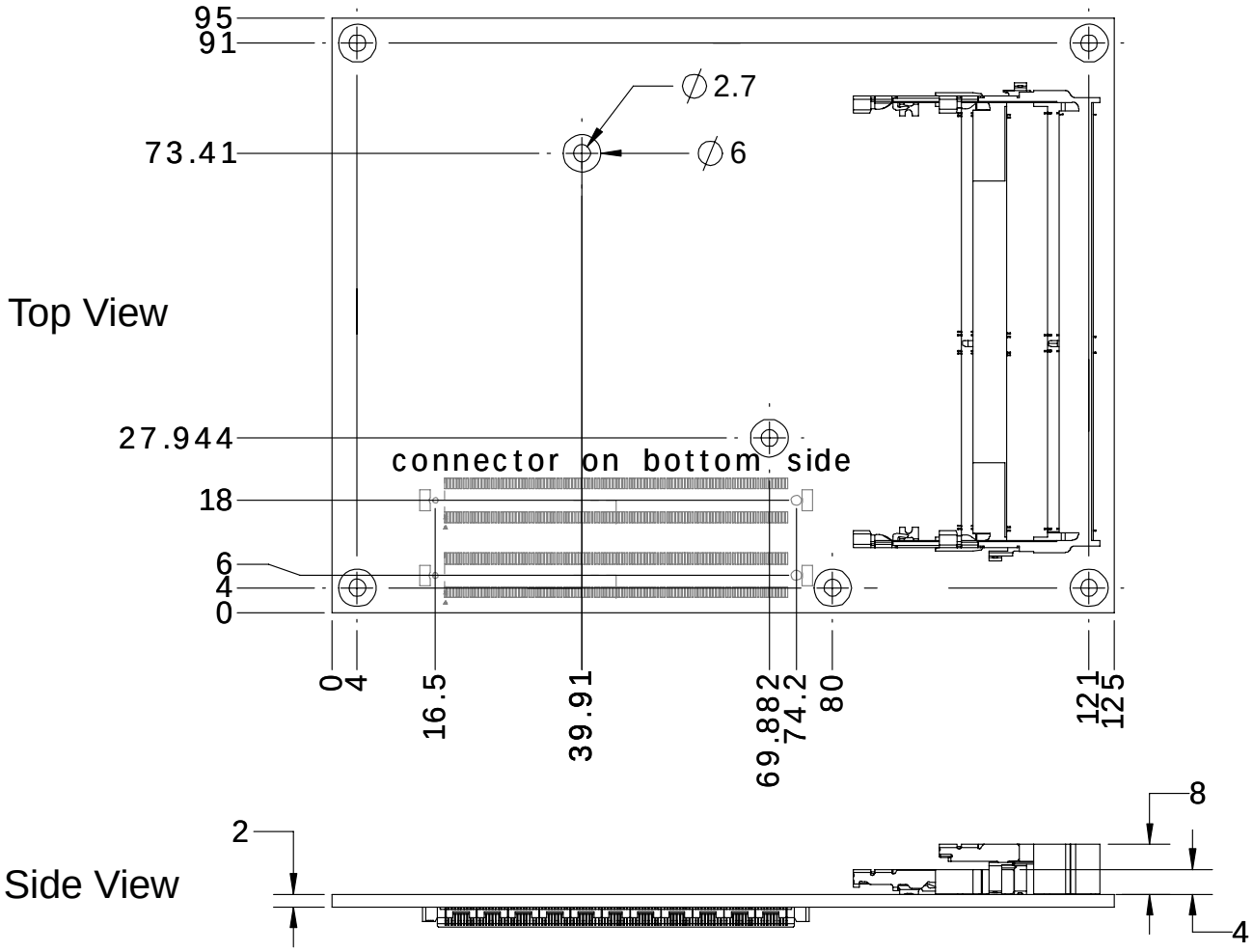


Figure 1: Express-KL/KLE Functional Block Diagram

2.18. Mechanical Drawing



All are dimensions shown in millimeters.

Tolerances should be ± 0.25mm, 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.

Figure 2: Express-KL/KLE Mechanical Drawing

3. Pinouts and Signal Descriptions

3.1. AB/CD Pin Definitions

The Express-KL/KLE 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-KL/KLE. Those not supported on the Express-KL/KLE module are ~~crossed out~~.

Table 1: Express-KL/KLE 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**	AC/HDA_SDIN2	**C28**	RSVD	**D28**	RSVD
A29	AC/HDA_SYNC	**B29**	AC/HDA_SDIN1	**C29**	~~DDI1_PAIR5+~~	**D29**	DDI1_PAIR1+
A30	AC/HDA_RST#	**B30**	AC/HDA_SDIN0	**C30**	~~DDI1_PAIR5-~~	**D30**	DDI1_PAIR1-
A31	GND (fixed)	**B31**	GND (fixed)	**C31**	GND (fixed)	**D31**	GND (fixed)
A32	AC/HDA_BITCLK	**B32**	SPKR	**C32**	DDI2_CTRLCLK_AUX+	**D32**	DDI1_PAIR2+
A33	AC/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

	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	EXCD1_PERST#	C47	DDI3_PAIR2-	D47	DDI2_PAIR2-
A48	EXCD0_PERST#	B48	EXCD1_CPPE#	C48	RSVD	D48	RSVD
A49	EXCD0_CPPE#	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	TYPE0#	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	RSVD	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-

	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 / ~~CAN_TX~~	**B98**	RSVD	**C98**	PEG_RX14+	D98	PEG_TX14+
A99	SER0_RX / ~~CAN_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)

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

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

3.3. AB Signal Descriptions

3.3.1. Audio Signals

Signal	Pin #	Description	I/O	PU/PD	Comment
AC_RST# / HDA_RST#	A30	Reset output to CODEC, active low.	O 3.3VSB		
AC_SYNC / HDA_SYNC	A29	Sample-synchronization signal to the CODEC(s).	O 3.3VSB		
AC_BITCLK / HDA_BITCLK	A32	Serial data clock generated by the external CODEC(s).	I/O 3.3VSB		
AC _SDOUT / HDA_SDOUT	A33	Serial TDM data output to the CODEC.	O 3.3VSB		Boot strap pin, no external pull-up or pull-down resistor on carrier board is recommended to avoid change the configuration of this signal
AC _SDIN[2:0] HDA_SDIN[2:0]	B28 B29 B30	Serial TDM data inputs from up to 3 CODECs.	I 3.3VSB		AC_SDIN0: supported AC_SDIN1: supported AC_SDIN2: not supported

3.3.2. Analog VGA

Note: No VGA support on this product.

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 5V		
VGA_VSYNC	B94	Vertical sync output to VGA monitor	O 5V		
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	

3.3.3. LVDS

Signal	Pin #	Description	I/O	PU/PD	Comment
LVDS_A0+ / eDP_TX2+ LVDS_A0- / eDP_TX2- LVDS_A1+ / eDP_TX1+ LVDS_A1- / eDP_TX1- LVDS_A2+ / eDP_TX0+ LVDS_A2- / eDP_TX0- 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+ / eDP_TX3+ LVDS_A_CK- / eDP_TX3-	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	PD 10K	
LVDS_BKLT_EN	B79	LVDS panel backlight enable	O 3.3V	PD 10K	
LVDS_BKLT_CTRL	B83	LVDS panel backlight brightness control	O 3.3V	PD 100K	
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	

3.3.4. eDP

Note: eDP is a BOM option, in place of LVDS.

Signal	Pin #	Description	I/O	PU/PD	Comment
eDP_TX2+ eDP_TX2- eDP_TX1+ eDP_TX1- eDP_TX0+ eDP_TX0--	A71 A72 A73 A74 A75 A76	eDP differential pairs	O PCIE		AC coupled off module
eDP_TX3+ eDP_TX3--	A81 A82	eDP differential pairs	O PCIE		AC coupled off module
eDP_VDD_EN	A77	eDP power enable	O 3.3V	PD 10K	

Signal	Pin #	Description	I/O	PU/PD	Comment
eDP_BKLT_EN	B79	eDP backlight enable	O 3.3V	PD 10K	
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		
GBE0_LINK#	A8	Gigabit Ethernet Controller 0 link indicator, active low.	OD 3.3VSB		
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

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

Signal	Pin #	Description	I/O	PU/PD	Comment
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	

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		

3.3.8. Express Card

Signal	Pin #	Description	I/O	PU/PD	Comment
EXCD0_CPPE# EXCD1_CPPE#	A49 B48	PCI ExpressCard: PCI Express capable card request	I 3.3V	PU 10k 3.3V	
EXCD0_PERST# EXCD1_PERST#	A48 B47	PCI ExpressCard: reset	O 3.3V		

3.3.9. 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		Chipset has internal pull-up
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 10k 3.3V	
LPC_CLK	B10	LPC clock output –33MHz nominal	O 3.3V		

3.3.10. 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	I 3.3VSB	PU 10k 3.3VSB	Do not pull high on carrier

Signal	Pin #	Description	I/O	PU/PD	Comment
		may drive this line low. .			
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

3.3.11. USB Root Segmentation

All USB from XHCI controller

3.3.12. 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

3.3.13. 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	PU 10k 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 10k 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 1k	PD only when TPM on module

3.3.14. 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	PU 2.2K 3.3VSB	

3.3.15. 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
I2C_DAT	B34	General purpose I²C port data I/O line	I/O OD 3.3VSB	PU 2k2 3.3VSB	Source SEMA BMC

3.3.16. General Purpose I/O (GPIO)

Signal	Pin #	Description	I/O	PU/PD	Comment
GPO[0]	A93	General purpose output pins.	O 3.3V	PU 10K 3.3V	After hardware RESET output low
GPO[1]	B54	General purpose output pins.	O 3.3V	PU 10K 3.3V	After hardware RESET output low
GPO[2]	B57	General purpose output pins.	O 3.3V	PU 10K 3.3V	After hardware RESET output low
GPO[3]	B63	General purpose output pins.	O 3.3V	PU 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	

3.3.17. 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

3.3.18. 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	PD 100K	

Signal	Pin #	Description	I/O	PU/PD	Comment
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 10k 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 10K 3.3VSB	Emulated on GPIO (BIOS)

3.3.19. 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		

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

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	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	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	

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	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	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	

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	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	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	

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		

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+	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	PCI Express Graphics receive differential pairs.	O PCIE		AC couple on module

Signal	Pin	Description	I/O	PU/PD	Comment
PEG_TX15-	D102				
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	

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) 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		

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

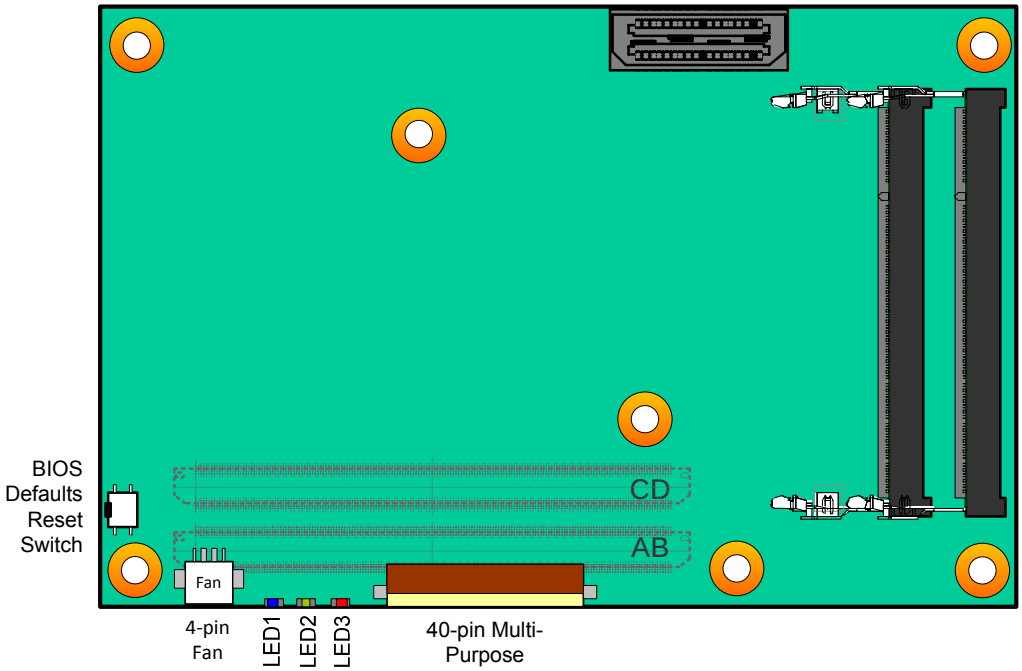


Figure 3: Express-KL/KLE Connector, Switch and LED Locations

Express-KL/KLE and the DB40 Debug Module

For illustration purposes only

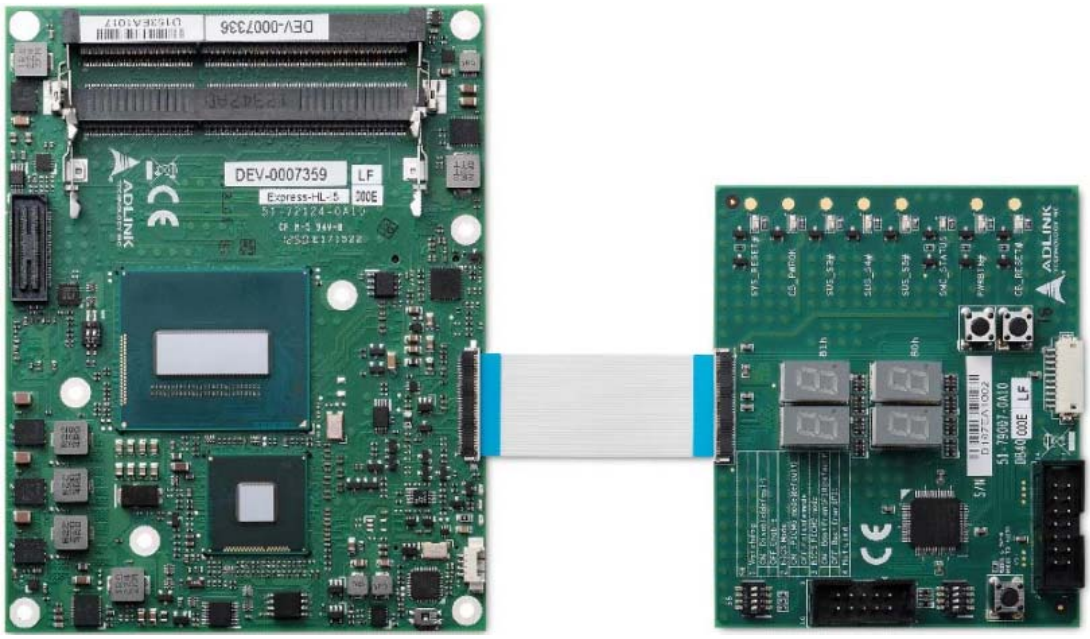


Figure 4: Express-KL/KLE and the DB40 Debug Module

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_CS0#	
4		SPI_BIOS_CS1#	
5		SPI_BIOS_MISO	
6		SPI_BIOS_MOSI	
7		SPI_BIOS_CLK	
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.

4.3. Status LEDs

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

LED1 LED2 LED3

LED Descriptions

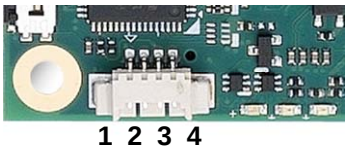
Name	Color	Connection	Function
LED1	Blue	BMC output	Power Sequence Status Code (BMC) Power Changes, RESET (see 5.1.4 Exception Codes below)
LED2	Green	Power Source 3Vcc	S0 LED ON S3/S4/S5 LED OFF ECO mode LED OFF
LED3	Red	BMC output and same signal as WDT (B27) on BtB connector	Module power up WD LED = 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-KL/KLE LED Descriptions

4.4. Fan Connector

Connector Type: JVE 24W1125A-04M00

Pin Orientation

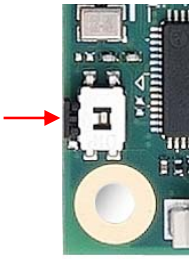


Pin Assignment

Name	Description
1	FAN_PWMOUT
2	FAN_TACHIN
3	Ground
4	5V

Table 4: Fan Connector Pin Definition

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.

4.6. Switch Settings

Switch Locations

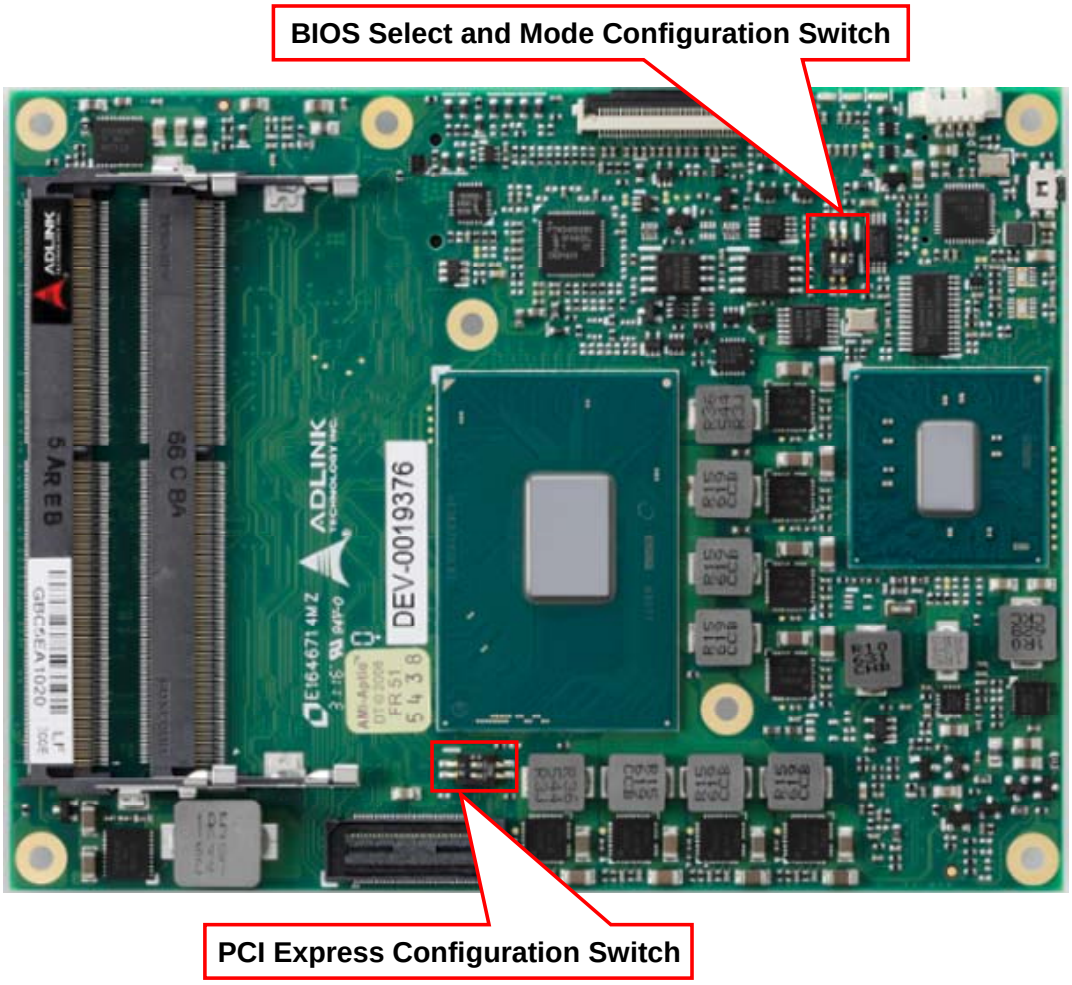


Figure 5: cExpress Switch Locations

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

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 (also referred to as the Failsafe BIOS 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

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

The Express-KL/KLE 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)

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/**.

5.1. Board Specific SEMA Functions

5.1.1. Voltages

The BMC of the Express-KL/KLE 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 3.3 / 1024
1	VGFX	(MSB<<8 + LSB) x 3.3 / 1024
2	VMEM	(MSB<<8 + LSB) x 3.3 / 1024
3	5VSB	(MSB<<8 + LSB) x 1.826 x 3.3 / 1024
4	VIN	(MSB<<8 + LSB) x 6.000 x 3.3 / 1024
5	5V	(MSB<<8 + LSB) x 1.826 x 3.3 / 1024
6	3.3V	(MSB<<8 + LSB) x 1.100 x 3.3 / 1024
7	3.3VSB	(MSB<<8 + LSB) x 1.100 x 3.3 / 1024
8	(MAIN CURRENT)	Use Main Current Function

Table 7: SEMA Onboard Voltage Monitor

5.1.2. Main Current

The BMC of the Express-KL/KLE 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.

Main Current = (MSB_n<<8 + LSB_n) x 8.06mA

5.1.3. BMC Status

This register shows the status of BMC controlled signals on the Express-KL/KLE.

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
13	NO_SYS_GD
14	NO_3V3_A_PGD
15	NO_VDDQ_PG
16	NO_P_5V_3V3_S0_PG
17	NO_1V0_A_PG
18	NO_VCORE_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 (decimal)	Address Range (hex)	Size	Description
(4GB-2MB)	FFE00000 – FFFFFFFF	2 MB	High BIOS Area
(4GB-18MB) – (4GB-17MB-1)	FEE00000 – FEEFFFFF	1 MB	MSI Interrupts
(4GB-20MB) – (4GB-19MB-1)	FEC00000 – FECFFFFF	1 MB	APIC Configuration Space
15MB – 16MB	F00000 – FFFFFF	1 MB	ISA Hole
1MB -15MB	100000 - EFFFFF	14 MB	Main Memory
0K –1MB	00000 – FFFFFF	1 MB	DOS Compatibility Memory

6.2. Direct Memory Access Channels

Channel Number	Data Width	System Resource
0	8-bits	Generic
1	8-bits	Generic
2	8-bits	Generic
3	8-bits	Generic
4		Reserved - cascade channel
5	16-bits	Generic
6	16-bits	Generic
7	16-bits	Generic

6.3. I/O Map

Hex Range	Device
20h – 21h	Interrupt Controller
24h – 25h	Interrupt Controller
28h – 29h	Interrupt Controller
2Ch – 2Dh	Interrupt Controller
02E-02F	LPC/eSPI
30h – 31h	Interrupt Controller
34h – 35h	Interrupt Controller
38h – 39h	Interrupt Controller
3Ch – 3Dh	Interrupt Controller
040	Timer/Counter
42h – 43h	Timer/Counter
4Eh – 4Fh	LPC/eSPI
50h	Timer/Counter

Hex Range	Device
52h – 53h	Timer/Counter
60h	LPC/eSPI
61h	NMI Controller
62h	Microcontroller
63h	NMI Controller1
64h	Microcontroller
65h	NMI Controller1
66h	Microcontroller
67h	NMI Controller1
70h	RTC Controller
71h	RTC Controller
72h	RTC Controller
73h	RTC Controller
74h	RTC Controller
75h	RTC Controller
76h – 77h	RTC Controller
80h	LPC/eSPI or PCIe
84h – 86h	Reserved
88h	Reserved
8Ch – 8Eh	Reserved
90h	(Alias to 80h)
092	Reset Generator
94h – 96h	(Aliases to 8xh)
98h	(Alias to 88h)
9Ch – 9Eh	(Alias to 8xh)
A0h – A1h	Interrupt Controller
A4h – A5h	Interrupt Controller
A8h – A9h	Interrupt Controller
ACh – ADh	Interrupt Controller
B0h – B1h	Interrupt Controller
B2h – B3h	Interrupt Controller
B4h – B5h	Interrupt Controller
B8h – B9h	Interrupt Controller
BCh – BDh	Interrupt Controller
200 – 207h	Gameport Low
208–20Fh	Gameport High
4D0h – 4D1h	Interrupt Controller
CF9h	Reset Generator

6.4. 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 4 (COM4)	IRQ3 via SERIRQ / PIRQ	Note (1)
4	Serial Port 3 (COM3)	IRQ4 via SERIRQ / PIRQ	Note (1)
5	Serial Port 2 (COM2)	IRQ5 via SERIRQ / PIRQ	Note (1)
6	Generic	IRQ6 via SERIRQ / PIRQ	No
7	Serial Port 1 (COM1)	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)
12	PS/2 Mouse	IRQ12 via SERIRQ / PIRQ	Note (1)
13	GSPI, UART, I2C, SDIO	N/A	Note (1)
14	Gpio	PIRQ	Note (1)
15	Gpio	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 4 (COM4)	IRQ3 via SERIRQ	Note (1)
4	Serial Port 3 (COM3)	IRQ4 via SERIRQ	Note (1)
5	Serial Port 2 (COM2)	IRQ5 via SERIRQ	Note (1)
6	N/A	N/A	Note (1)
7	Serial Port 1 (COM1)	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	Primary IDE controller	IRQ14 via SERIRQ	Note (1)

IRQ#	Typical Intterupt Resource	Connected to Pin	Available
15	Secondary IDE controller	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)
20	N/A	Gbe Controller	Note (1)
21	N/A	N/A	Note (1)
22	N/A	Intel HDA	Note (1)
23	N/A	N/A	Note (1)

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

6.5. 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	14h	00h	Internal	xHCI Controller
00h	16h	00h	Internal	Intel Management Engine Interface
00h	17h	00h	Internal	Intel AHCI controller
00h	1Ch	00h	Internal	Intel PCI Express Root port 1
00h	1Ch	01h	Internal	Intel PCI Express Root port 2
00h	1Ch	02h	Internal	Intel PCI Express Root port 3
00h	1Ch	03h	Internal	Intel PCI Express Root port 4
00h	1Dh	00h	Internal	Intel PCI Express Root port5
00h	1Dh	01h	Internal	Intel PCI Express Root port 6
00h	1Dh	02h	Internal	Intel PCI Express Root port 7
00h	1Dh	03h	Internal	Intel PCI Express Root port 8
00h	1Fh	00h	N/A	Intel LPC Interface Bridge
00h	1Fh	02h	Internal	Memory Controller
00h	1Fh	03h	Internal	HDA Controller
00h	1Fh	04h	Internal	SMBus Controller
00h	1Fh	06h	Internal	Ethernet Controller

6.6. PCI Interrupt Routing Map

INT Line	P.E.G. Root Port	xHCI Controller	ME Controller #1	GbE Controller	HD Audio Controller
Int0	INTA:16	INTA:16	INTA:16	INTA:16	INTA:16
Int1	INTB:17		INTD:19		
Int2	INTC:18		INTC:18		
Int3	INTD:19	INTD:19	INTB:17		

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

INT Line	LPC Controller	SATA Controller	SMBus Controller	Thermal Subsystem
Int0	INTA:16	INTA:16	INTA:16	
Int1	INTB:17			
Int2	INTC:18			INTC:18
Int3	INTD:19			

6.7. SMBus Address Table

Device	Address
DIMM A	A0h
DIMM B	A4h
BMC	50h
Extend GPIO	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	Security	Boot	Save & Exit
BIOS Information	CPU ►	Password Description ►	Boot Configuration ►	Reset Options ►
Processor Information	Memory ►	Secure Boot Menu ►	CSM Configuration ►	Save Options ►
PCH Information	Graphics ►			
SPI Clock Frequency	SATA ►			
System Management ►	USB ►			
System Date	Network ►			
System Time	PCI and PCIe ►			
	Super IO ►			
	ACPI and Power Management ►			
	Sound ►			
	Serial Port Console ►			
	ICC ►			
	Thermal ►			
	Miscellaneous ►			

Notes:

► indicates a submenu

Gray text indicates info only

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. System Information

Feature	Options	Description
BIOS Vender	Info only	American Megatrends
Core Version	Info only	Display Core version
Compliancy	Info only	Display compliancy information
Project Version	Info only	ADLINK BIOS version.
Build Date and Time	Info only	ADLINK date the BIOS was build.
Access Level	Info only	

7.2.2. Processor Information

Feature	Options	Description
Name	Info only	Display CPU Brand Name.
CPU Signature	Info only	Display CPU Signature.
CPU Speed	Info only	Display CPU Frequency.
Processor ID	Info only	Display CPU ID.
Stepping	Info only	Display CPU Stepping.
Number of Processors	Info only	Display number of Processors.
GT Info	Info only	Display GT info of Intel Graphics.
IGFX VBIOS Version	Info only	Display VBIOS Version.
Memory RC Version	Info only	Display memory version
Total Memory	Info only	Display installed memory size.
Memory Frequency	Info only	Display memory frequency

7.2.3. PCH Information

Feature	Options	Description
Name	Info only	Display PCH name.
PCH SKU	Info only	Display PCH SKU.
Stepping	Info only	Display PCH stepping.
LAN PHY Revision	Info only	Display LAN PHY revision
ME FW Version	Info only	Display version of ME.
ME Firmware SKU	Info only	Display ME Firmware Kit SKU number.

7.2.4. SPI Clock Frequency

Feature	Options	Description
Dual Output Fast Read support	Info only	
Read Status Clock Frequency	Info only	Display frequency.
Write Status Clock Frequency	Info only	Display frequency.
Fast Read Status Clock Frequency	Info only	Display frequency.

7.2.5. System Management

7.2.5.1. System Management > Board Information

Board Information	Info only	Description
SMC Firmware	Read only	Display SMC Firmware.
Build Date	Read only	Display SMC firmware build date.
SMC Boot loader	Read only	Display SMC boot loader.
Build Date	Read only	Display SMC boot loader build date.
Hardware Version	Read only	Display SMC hardware Version.
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

7.2.5.2. System Management > Temperatures and Fan Speed

Feature	Options	Description
Temperatures and Fan	Info only	
CPU Temperature	Info only	
Current	Read only	Display CPU current temperature.
Startup	Read only	Display CPU startup temperature.
Min	Read only	Display CPU min temperature.
Max	Read only	Display CPU max temperature.
Board Temperatures	Info only	
Current	Read only	Display board current temperature.
Startup	Read only	Display board startup temperature.
Min	Read only	Display board min temperature.
Max	Read only	Display board max temperature.
CPU Fan Speed	Read only	Display CPU fan speed.

7.2.5.3. System 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.
VCC_CORE	Read only	Display actual voltage of the VCC_CORE.
VCC_GT	Read only	Display actual voltage of the VCC_GT.
1V0_A	Read only	Display actual voltage of the 1V0_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.
V5_S	Read only	Display actual voltage of the V5_S.
0V95_VCCIO	Read only	Display actual voltage of the 0V95_VCCIO.
1V0_VCCSTG	Read only	Display actual voltage of the 1V0_VCCSTG.
VCCSA	Read only	Display actual voltage of the VCCSA.
1v8_VCCOPC	Read only	Display actual voltage of the 1v8_VCCOPC.
V5VSB	Read only	Display actual voltage of the V5VSB.
V12	Read only	Display actual voltage of the V12.

7.2.5.4. System Management > Runtime Statistics

Feature	Options	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.

7.2.5.5. System Management > Flags

Feature	Options	Description
Flags	Info only	
BMC Flags	Read only	
BIOS Select	Read only	Display the selection of current BIOS ROM.

Feature	Options	Description
ATX/AT-Mode	Read only	Display ATX/AT-Mode.
Exception Code	Read only	System exception reason.

7.2.5.6. System Management > Power Up

Feature	Options	Description
Power Up	Info only	
Power Up watchdog Attention: F12 disables the Power Up Watchdog.	Enabled **Disabled**	The Power-Up Watchdog resets the system after a certain amount of time after power-up.
ECO Mode	**Disabled** Enable	Reduces the power consumption of the system.
Power-up Mode Attention: The Power-Up Mode only has effect, if the module is in ATX-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 be pressed. Last State: when powered on during a power failure the system will automatically power on when power is restored

7.2.5.7. System Management > LVDS Backlight

Feature	Options	Description
LVDS Backlight	Info only	
LVDS Backlight Bright	255	The value range starts by 0 and ends by 255.

7.2.5.8. System Management > Smart Fan

Feature	Options	Description
Smart Fan	Info only	
CPU Smart FanTemperature Source	**CPU Sensor** System Sensor	Select CPU smart fan source.
CPU Fan Mode	**AUTO (Smart Fan)** Fan Off Fan On	Select CPU Fan Mode.
PWM Level	100	Select PWM level.

7.2.6. 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

7.3. Advanced

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

7.3.1. CPU

Feature	Options	Description
CPU	Info only	Manufacturer, model, speed
CPU Signature	Info only	Display CPU Signature.
Microcode Revision	Info only	Display Microcode Revision.
Processor Cores	Info only	Display Processor Cores.
VMX	Info only	Display Intel Virtualization Technology support or not.
SMX/TXT	Info only	Display Intel SMX Technology support or not.
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	Inf o only	Display cache info.
L4 Cache	Inf o only	Display cache info.
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). When Disabled only one thread per enabled core is enabled.
VT-d	Disabled **Enabled**	Check to enable VT-d function on MCH.
Intel (VMX) Virtualization Technology	Disabled **Enabled**	Enable/Disable support for the Intel virtualization technology.
Intel(R) SpeedStep(TM)	Disabled **Enabled**	Allows more than two frequency ranges to be supported.
Turbo Mode	Disabled **Enabled**	Enable/Disable turbo mode.
Configurable TDP Boot Mode	**TDP Nominal** TDP Down Disabled	Configure TDP Mode as Nominal/Down/Disabled. Disabled option will set MSR to Nominal and MMIO to Zero.
Config TDP Lock	**Disabled** Enabled	Configurable TDP Mode Lock sets the Lock bits on TURBO_ACTIVATION_RATIO and CONFIG_TDP_CONTROL. Note: When CTDP Lock is enabled Custom ConfigTDP Count will be forced to 1 and Custom ConfigTDP Boot Index will be forced to 0.
Custom Configurable TDP	**Disabled** Enabled	Custom Configurable TDP settings
Power Limit 1	**15W** 20W 25W 30W 35W 40W	Power Limit 1 in Milli Watts.Overclocking SKU: Value must be between Max and Min Power Limits (specified by PACKAGE_POWER_SKU_MSR). Other SKUs: This value must be between Min Power Limit and TDP Limit.

Feature	Options	Description
Power Limit 1 Time Window	**0** 1 2 3 4 5 6 7 8 10 12 14 16 20 24 28	Power Limit 1 Time Window value in seconds. The value may vary from 0 to 28. 0 = default value (28 sec for Mobile and 8 sec for Desktop). Defines time window which TDP value should be maintained.
CPU C state	Disabled **Enabled**	Enable or disable CPU C states
C-State Auto Demotion	Disabled C1 C3 **C1 and C3**	Configure C-State Auto Demotion
Package C State limit	**Auto** C2 C3 C6 C7 Auto	Package C State limit
DTS SMM	Disabled **Enabled**	Enable/Disable CPU DTS.
ACPI T-states	**Disabled** Enabled	Enable/Disable ACPI 3.0 T-States.

7.3.2. Memory

Feature	Options	Description
Memory RC Version	Info only	Display Memory Reference Code Version.
Memory Frequency	Info only	Display Memory Frequency.
Total Memory	Info only	Display Total Memory.
VDD	Info only	Display Memory Voltage.
DIMM#0/1	Info only	Display DIMM#0/1.
Memory Timings(tCL-tRCD-tRP-tRAS)	Info only	Display Memory timings
I2C Write Protect Control	Active **Write Protect**	I2C write protect control
SPD Write Protect	**Enabled** Disabled	Enable:Writes to SMBus slave addresses A0h - AEh are disabled.

Feature	Options	Description
Maximum Memory Frequency	**Auto** 1067 1200 1333 1400 1600 1800 1867 2000 2133 2200 2400 2600 2667 2800 2933 3000 3200 3467 3733 4000 4133	Maximun Memory Frequency Selections in MHz
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	Maximum Value of TOLUD. Dynamic assignment would adjust TOLUD automatically based on largest MMIO length of installed graphic controller.

7.3.3. Graphics

Feature	Options	Description
Graphics Configuration	Info only	
IGFX VBIOS Version	Info only	Display VBIOS Version.
Graphics Turbo IMON Current	Number entry field	Graphics turbo IMON current values supported (14-31).
Primary Display	**Auto** IGFX PEG PCIE	Select which of IGFX/PEG/PCI Graphics device should be Primary Display Or select SG for Switchable Gfx.
Primary PEG	**Auto** PEG11 PEG12	Select PEG0/PEG1/PEG2/PEG3 Graphics device should be Primary PEG.
Primary PCIE	**Auto** PCIE2 PCIE3 PCIE4 PCIE5 PCIE6 PCIE7 PCIE8	Select Auto/PCIE2/PCIE3/PCIE4 of D28:F0/F1/F2/F3, PCIE5/PCIE6/PCIE7/PCIE8 of D29:F0/F1/F2/F3, Graphics device should be Primary PCIE.
Internal Graphics	**Auto** Disabled Enable	Keep IGD enabled based on the setup options.
Aperture Size	128MB **256MB** 512MB 1024MB 2048MB 4096MB	Select the Aperture Size.
DVMT Pre-Allocated	**XXM**	Select DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.
DVMT Total Gfx Mem	**XXXM**	Select DVMT5.0 Total Graphic Memory size used by the Internal Graphics Device.
Gfx Low Power Mode	**Enabled** Disabled	This option is applicable for SFF only.
EDP to LVDS Bridge Configuration	**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	**Single LVDS bus** Dual LVDS bus	Single/Dual mode select
DE Polarity	Active High **Active Low**	DE Polarity select
Vsync Polarity	**Active High** Active Low	Vsync Polarity select

Feature	Options	Description
Hsync Polarity	**Active High** Active Low	Hsync Polarity select
LVDS/eDP Backlight Mode	**BMC Mode** GTT Mode	Select LVDS Backlight control function.
GTT LVDS/eDP Backlight Control	0% 20% 40% 60% 80% **100%**	Actual backlight value in percent of the maximum setting.
DDI port 1	No device Display Port HDMI **DisplayPort with HDMI/DVI Compatible**	DDI port 1 function choose to Display Port or HDMI.
DDI port 2	No device Display Port HDMI **DisplayPort with HDMI/DVI Compatible**	DDI port 2 function choose to Display Port or HDMI.
DDI port 3	No device Display Port HDMI **DisplayPort with HDMI/DVI Compatible**	DDI port 3 function choose to Display Port or HDMI.
Primary IGFX Boot Display	**VBIOS Default**	Select the Video Device which will be activated during POS.
Select Secondary Display	**Disabled**	Select Secondary Display Device.
LCD Panel Type	**VBIOS Default** 640X480 800X600 1024X768 1280X1024 1400X1050 1600X1200 1366X768 1680X1050 1920X1200 1440X900 1600X900 1024X768 LVDS2 1280X800 1920X1080 2048X1536	Select LCD panel used by Internal Graphics Device by selecting the appropriate setup item.
Active LFP	No LVDS **eDP Port-A**	Select the Active LFP Configuration.
Panel Scaling	**Auto** Off Force Scaling	Select the LCD panel scaling option used by the Internal Graphics Device.
RC6(Render Standby)	Enable **Disable**	Check to enable render standby support.

7.3.4. SATA

Feature	Options	Description
SATA Controller(s)	**Enabled** Disabled	Enable/Disable SATA Device.
SATA Mode Selection	**AHCI** Intel RST Premium	Determines how SATA controller(s) operate.
SATA Speed Selection	Default Gen1 **Gen2** Gen3	Indicates the maximum speed the SATA controller can support.
SATA Test Mode	Enabled **Disabled**	Test Mode Enable/Disable (Loop Back)
Software Feature Mask Configuration	Submenu	
Aggressive LPM Support	**Enabled** Disabled	Enable PCH to aggressively enter link power state.
SATA Port Configuration	Info only	
Serial ATA Port X	Info only	
Software Preserve	Info only	
Port X	Disabled **Enabled**	Enable/Disable SATA Port.
Hot Plug	Disabled **Enabled**	Designates this port as Hot Pluggable.
Configured as eSATA	Info only	
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** Sold State Drive	Identify the SATA port is connected to Solid State Drive or Hard Disk Drive.
SATA Device Type	**Hard Disk Drive** Solid State Drive	Identify the SATA port is connected to Solid State Drive or Hard Disk Drive.
Topology	**Unknown** ISATA Direct Connect Flex M2	Identify the SATA Topology if it is Default, ISATA, Flex, DirectConnect or M2.
SATA Port X DevSlp	**Disabled** Enabled	Enable/Disable SATA Port X DevSlp. Board rework for LP needed before enable.
DITO Configuration	**Disabled** Enabled	Enable/Disable DITO Configuration.

7.3.4.1. SATA > Software Feature Mask Configuration

Feature	Options	Description
Software Feature Mask Configuration	Info only	
HDD Unlock	**Enabled** Disabled	If enabled, indicates that the HDD password unlock in the OS is enabled.
LED Locate	**Enabled** Disabled	If enabled, indicates that the LED/SGPIO hardware is attached and ping to locate feature is enabled on the OS.

7.3.5. USB

Feature	Options	Description
USB Configuration	Submenu	
USB Module Version	Info only	
USB Devices	Info only	X Drive, X Keyboards, X Mouse, X Hubs
Legacy USB Support	**Enabled** Disabled Auto	Enables legacy USB support. Auto option disables legacy support if no USB devices are connected. Disable option will keep USB devices available only for EFI applications and setup.
XHCI Hand-off	**Enabled** Disabled	This is a workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by the XHCI OS driver.
USB Mass Storage Driver Support	**Enabled** Disabled	Enable/Disable USB Mass Storage Driver Support.
Port 60/64 Emulation	Enabled **Disabled**	Enables I/O port 60h/64h emulation support. This should be enabled for the complete USB keyboard legacy support for non-USB aware OSes.
USB hardware delays and time-outs:	Info only	
USB transfer time-out	1 sec 5 sec 10 sec **20 sec**	The time-out value for Control, Bulk, and Interrupt transfers
Device reset time-out	10 sec **20 sec** 30 sec 40 sec	USB mass storage device Start Unit command time-out.
Device power-up delay	**Auto** Manual	Maximum time the device will take before it properly reports itself to the Host Controller. 'Auto' uses default value: for a Root port it is 100 ms, for a Hub port the delay is taken from Hub descriptor.
Mass Storage Devices	Info only	List current USB max stroge device.

7.3.5.1. USB > USB Configuration

Feature	Options	Description
XHCI Disable Compliance Mode	**FALSE** TRUE	Options to disable Compliance Mode. Default is FALSE to not disable Compliance Mode. Set TRUE to disable Compliance Mode.
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.

7.3.6. Network

Feature	Options	Description
Network Stack	Enabled **Disabled**	Enable/Disable UEFI network stack.
PCH LAN Controller	**Enabled** Disabled	Enable/Disable onboard NIC.
Wake on LAN	**Enabled** Disabled	Enable/Disable integrated LAN to wake the system.
AMT BIOS Features	Enabled **Disabled**	When disabled AMT BIOS Features are 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	Enabled **Disabled**	OEMFLag Bit 1: Enable automatic MEBx hotkey press.
MEBx Selection Screen	Enabled **Disabled**	OEMFLag Bit 2: Enable MEBx selection screen with 2 options: Press 1 to enter ME Configuration Screens Press 2 to initiate a remote connection Note: Network Access must be activated from MEBx Setup for this screen to be displayed.
Hide Un-Configure ME Confirmation Prompt	Enabled **Disabled**	OEMFlag Bit 6: Hide Unconfigure ME confirmation prompt when attempting ME unconfiguration.
MEBx Debug Message Output Enable	Enabled **Disabled**	OEMFlag Bit 14: Enable OEM debug menu in MEBx.
UnConfigure ME	Enabled **Disabled**	OEMFlag Bit 15: Unconfigure ME with resetting MEBx password to default.
ASF support	**Enabled** Disabled	Enable/Disable Alert Standard Format support.
Activate Remote Assistance Process	Enabled **Disabled**	Trigger CIRA boot Note: Network Access must be activated first from MEBx Setup.
USB Provisioning of AMT	Enabled **Disabled**	Enable/Disable of AMT USB Provisioning.
PET Progress	**Enabled** Disabled	Enable/Disable PET Events Progress to receive PET Events.
CIRA Timeout	0	OEM defined timeout for MPS connection to be established. 0 - use the default timeout value of 60 seconds. 255 - MEBX waits until the connection succeeds.
Watchdog	Enabled **Disabled**	Enable/Disable WatchDog Timer.

Feature	Options	Description
OS Timer		Set OS watchdog timer.
BIOS Timer		Set BIOS watchdog timer.

7.3.7. PCI and PCIe

Feature	Options	Description
PCI BUS Driver Version	Info only	
PCI Devices Common Settings:	Info only	
PCIE Ports 1-4 Configuration	**4x1 Port** 1x2 2x1 Port 2x2 Port 1x4 Port	Configures PCI-E Port 1-4 of PCH. [4X1]: Port 1-4 (x1) and Port 8 (x1) [1x2 2x1]: Port 1 (x2), Port 2 (disabled), Ports 3-4 (x1) [2x2]: Port 1-2 (x2) and Ports 3-4 (x2) [1x4]: Port 1 (x4), Ports 2-4 (disabled)
PCIE Ports 5-8 Configuration	**4x1 Port** 1x2 2x1 Port 2x2 Port 1x4 Port	Configures PCI-E Port 5-8 of PCH. [4X1]: Port 5-8 (x1) [1x2 2x1]: Port 5 (x2), Port 6 (disabled), Ports 7-8 (x1) [2x2]: Port 5-6 (x2) and Port 7-8 (x2) [1x4]: Port 5 (x4), Ports 6-8 (disabled)
PCI Latency Timer	**32 PCI Bus Clocks** 64 PCI Bus Clocks 96 PCI Bus Clocks 128 PCI Bus Clocks 160 PCI Bus Clocks 192 PCI Bus Clocks 224 PCI Bus Clocks 248 PCI Bus Clocks	Value to be programmed into PCI Latency Timer Register.
PCI-X Latency Timer	32 PCI Bus Clocks **64 PCI Bus Clocks** 96 PCI Bus Clocks 128 PCI Bus Clocks 160 PCI Bus Clocks 192 PCI Bus Clocks 224 PCI Bus Clocks 248 PCI Bus Clocks	Value to be programmed into PCI Latency Timer Register.
VGA Palette Snoop	**Disabled** Enabled	Allow PCI cards that do not contain their own VGA color palette to access the video core's palette
PERR# Generation	**Disabled** Enabled	Enables or Disables PCI Device to Generate PERR#.
SERR# Generation	**Disabled** Enabled	Enables/Disables PCI Device to Generate SERR#.
PCI Express Configuration	Submenu	
PEG Configuration	Submenu	

7.3.7.1. PCI and PCIe > PEG Configuration

Feature	Options	Description
PEG Configuration	Info only	
PCI Express Clock Gating	Disabled **Enable**	Enable/Disable PCI Express Clock Gating for each root port.
DMI Link ASPM Control	**Disabled** Enable	The control of Active State Power Management of the DMI Link.Auto is equal to POR setting.
Port8xh Decode	Disabled	PCI Express Port8xh Decode Enable/Disable.
Compliance Test Mode	Disabled	Enable when using Compliance Load Board.
PCI Express Gen3 EQ Lanes	Submenu	
PCI Express Root Port X	Submenu	

PCI and PCIe > PCI Express Configuration > PCI Express Gen3 EQ Lanes

Feature	Options	Description
Override SW EQ settings	**Disabled** Enable	Override SW EQ settings

PCI and PCIe > PCI Express Configuration > PCI Express Root Port X

Feature	Options	Description
PCI Express Root Port	Disabled **Enable**	Control the PCI Express Root Port.
Topology	**Unknown** x1 x4 Sata Express M2	Identify the SATA Topology: Default, ISATA, Flex, DirectConnect or M2.
ASPM Support	**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 L1.1 L1.2 **L1.1 & L1.2**	PCI Express L1 Substates settings.
Gen3 Eq Phase3 Method	Hardware Static Coeff. **Software Search**	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
URR	**Disabled** Enable	PCI Express Unsupported Request Reporting Enable/Disable.

Feature	Options	Description
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.
Extra Bus Reserved	**0**	Extra Bus Reserved (0-7) for bridges behind this Root Bridge.
Reseved Memory	**10**	Reserved Memory Range for this Root Bridge.
Prefetchable Memory	**10**	Prefetchable Memory Range for this Root Bridge.
Reserved I/O	**4**	Reserved I/O (4K/8K/12K/16K/.../48K) Range for this Root Bridge.
PCH PCIE LTR	Disabled **Enable**	PCH PCIE Latency Reporting Enable/Disable.
Snoop Latency Ocerrid	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 Ocerrid	Disabled Manual **Auto**	Non Snoop Latency Override for PCH PCIE. Disabled: Disable override.Manual: Manually enter override values. Auto (default): Maintain default BIOS flow.

Feature	Options	Description
PCIE LTR Lock	**Disabled** Enable	PCIE LTR Configuration Lock.
PCH PCIe CLKREQ# Configuration	Info	
PCIEX CLKREQ Mappin Override	Default **No CLKREQ** Customer number	PCIE CLKREQ Override for default platform mapping.

7.3.7.2. PCI and PCIe > PEG Configuration

Feature	Options	Description
PEG Configuration	Info only	
PEGX	**Not Present**	Display PEGX present or not.
Enable Root Port	Disabled Enabled **Auto**	Enable/Disable the Root Port.
Max Link Speed	**Auto** Gen1 Gen2 Gen3	Configure 0:1:X 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.
PEGX 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
Detect Non-compliance Device	**Disabled** Enable	Detect Non-Compliance PCI Express Device in PEG.
Program PCIe ASPM after OpROM	**Disabled** Enabled	Enabled: PCIe ASPM will be programmed after OpROM. Disabled: PCIe ASPM will be programmed before OpROM.
Program Static Phase1 Eq	**Enabled** Disable	Program Phase1 Presets/CTLEp
Gen3 Root Port Preset Value for each lane 0~15	**7**	Root Port preset value per lane for Gen3 Equalization
Gen3 Endpoint Preset value for each Lane 0~15	**7**	Endpoint preset value per lane for Gen3 Equalization
Gen3 Endpoint Hint value for each Lane 0~15	**2**	Endpoint Hint value per lane for Gen3 Equalization
PEG Gen3 RxCTLE Control 0~7	**0**	PEG Gen3 RxCTLE Control per Bundle
Always Attempt SW EQ	**Disabled** Enabled	Always Attempt SW EQ, even it has been done once

Feature	Options	Description
Number of Presets to test	7, 3, 5 0 – 9 **Auto**	Choose between 7,3,5 and 0-9. Auto = current default for CPU
Allow PERST# GPIO Usage	**Enabled** Disable	Enable/Disable GPIO-based resets to PEG endpoint(s) during margin search, if needed
SW EQ Enable VOC	Jitter Only Test Mode Jitter & VOC Test Mode **Auto**	Select Jitter & VOC test mode (default) or Jitter only test mode. Auto will current default (Enabled)
Jitter Dwell Time	**3000**	PEG Gen3 Preset Search dwell time [0..65535] in [usec]
Jitter Error Target	**2**	The margin search error target value [1..65535]
VOC Dwell Time	**10000**	The VOC margin search dwell time [0..65535] in [usec]
VOC Error Target	**2**	The VOC margin search error target value [1..65535]
Generate BDAT PEG Margin Data	**Disabled** Enabled	Enable to generate BDAT PCIe margin tables
PCIe Rx CEM Test Mode	**Disabled** Enabled	Enable/Disable PEG Rx CEM Loopback Mode
PCIe Spread Spectrum Clocking	**Enabled** Disable	Allows disabling of Spread Spectrum Clocking for compliance testing

7.3.8. Super IO

Feature	Options	Description
Super IO Chip	Info only	
W83627DHG Super IO Configuration	Info only	
Serial Port 1 Configuration Serial Port	**Enabled** Disabled	Enable/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=3,4,5,6,7,10,11,12 IO=2F8h; IRQ=3,4,5,6,7,10,11,12 IO=3E8h; IRQ=3,4,5,6,7,10,11,12 IO=2E8h; IRQ=3,4,5,6,7,10,11,12	Select an optimal setting for Super IO device.
Serial Port 2 Configuration Serial Port	**Enabled** Disabled	Enable/Disable Serial Port (COM).
Device Settings	IO=2F8h; IRQ=4	Fixed configuration of serial port.
Change Settings	**Auto** IO=2F8h; IRQ=3	Select an optimal setting for Super IO device.

Feature	Options	Description
Device Mode	IO=3F8h; IRQ=3,4,5,6,7,10,11,12 IO=2F8h; IRQ=3,4,5,6,7,10,11,12 IO=3E8h; IRQ=3,4,5,6,7,10,11,12 IO=2E8h; IRQ=3,4,5,6,7,10,11,12 **Standard Serial Port Mode** IrDA Active pulse 1.6 uS IrDA Active pulse 3/16 bit time ASKIR Mode	
NCT5104DSEC Super IO Configuration	Info only	
Serial Port 1 Configuration Serial Port Device Settings Change Settings	 **Enabled** Disabled IO=240h; IRQ=7 **Auto** IO=240h; IRQ=7 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	 Enable/Disable Serial Port (COM). Fixed configuration of serial port. Select an optimal setting for Super IO device.
Serial Port 2 Configuration Serial Port Device Settings Change Settings	 **Enabled** Disabled IO=248h; IRQ=5 **Auto** IO=248h; IRQ=5 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	 Enable/Disable Serial Port (COM). Fixed configuration of serial port. Select an optimal setting for Super IO device.

7.3.9. ACPI and Power Management

Feature	Options	Description
ACPI and Power Management	Info only	
Enable ACPI Auto Configuration	Enabled **Disabled**	Enables or Disables BIOS ACPI Auto Configuration.
Enable Hibernation	**Enabled** Disabled	Enables or Disables System ability to Hibernate (OS/S4 Sleep State). This option may be not effective with some OS.
ACPI Sleep State	**S3 (Suspend to RAM)**	Select ACPI sleep state the system will enter when the SUSPEND button is pressed.
Lock Legacy Resources	Enabled **Disabled**	Enables or Disables Lock of Legacy Resources
ACPI Low Power S0 Idle	Enabled **Disabled**	This variable determines if we enable ACPI Lower Power S0 Idle Capability (Mutually exclusive with Smart connect).

Feature	Options	Description
Emulation AT/ATX	Emulation AT **ATX**	Select Emulation AT or ATX function. If this option set to [Emulation AT], BIOS will report no suspend functions to ACPI OS. In windows XP, it will make OS show shutdown message during system shutdown.

7.3.10. Sound

Feature	Options	Description
Sound	Info only	
HD Audio	Disabled Enabled **Auto**	Control Detection of the HD-Audio device. Disabled: HDA will be unconditionally disabled. Enabled: HDA will be unconditionally enabled. Auto: HDA will be enabled if present, disabled otherwis.

7.3.11. Serial Port Console

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

7.3.11.1. 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	Selects serial port transmission speed.

Feature	Options	Description
	38400 57600 **115200**	
Data Bits	7 **8**	Select Data Bits.
Parity	**None** Even Odd Mark Space	Select Parity.
Stop Bits	1 **2**	Select number of stop bits.
Flow Control	**None** Hardware RTS/CTS	Select flow control.
VT-UTF8 Combo Key Support	Disabled **Enable**	Enable VT-UTF8 Combination Key Support for 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
Legacy OS Redirection	**80x24** 80x25	On Legacy OS, the Number of Rows and Columns supported redirection
Putty KeyPad	**VT100** LINUX XTERMR6 SCO ESCN VT400	Select FunctionKey and KeyPad on Putty.
Redirection After BIOS Post	**Always Enabled** BootLoader	The Settings specify if BootLoader is selected than Legacy console redirection is disabled before booting to Legacy OS. Default value is Always Enable which means Legaacy console Redirection is enabled for Legacy OS.

7.3.12. ICC Configuration

Feature	Options	Description
ICC Information	Info only	

Note: The item is “info only” in the standard BIOS. The options can be opened by customer request.

7.3.13. Thermal

Feature	Options	Description
Thermal	Info only	
Active Cooling Trip Point	Disabled 40 C 50 C 60 C	This value is the temperature threshold of the Active Cooling Trip Point.

Feature	Options	Description
	70 C **BMC Default**	
Passive Cooling Trip Point	**Disabled** 80 C 90 C	This value is the temperature threshold of the Passive Cooling Trip Point.
Critical Trip Point	**Disabled** 65 C 75 C 85 C	This value is the temperature threshold of the Critical Trip Point.
Watchdog ACPI Even Shutdown	**Disabled** Enable	Watchdog ACPI Even Shutdown Enable/Disable.

7.3.14. Miscellaneous

Feature	Options	Description
NVME Configuration	Submenu	
Trusted Computing	Submenu	

7.3.14.1. Miscellaneous > Trusted Computing

Feature	Options	Description
Security Device Support	**Enabled** Disabled	Enables or Disables BIOS support for security device. When disabled OS wil not show Security Device. TCG EFI protocol and INT1A interface will not be available
TPM State	**Enabled** Disabled	Enable/Disable Security Device. NOTE: Your Computer will reboot during restart in order to change State of the Device.
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.
Device Start	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

7.3.14.2. Miscellaneous > NVME Configuration

Feature	Options	Description
NVME controller and Drive information	Info Only	

7.4. Boot

7.4.1. Boot Configuration

Feature	Options	Description
Boot Configuration	Info only	
Setup Prompt Timeout	**1**	Enable/Disable the onboard SATA controllers.
Bootup NumLock State	**On**	Select SATA controller mode.
Quiet Boot	Disabled **Enabled**	Enable/Disable the PATA port. In fact this enables or disables the SATA channel on which the onboard SATA to PATA converter is attached. When set to enabled the system boot will be delayed for the time specified in PATA Port Detection Timeout if no PATA device is connected. Auto: Scan for PATA device and enable per default.
CSM Configuration	Submenu	
Fast Boot	**Disabled** Enabled	Define the maximum time to wait for drive detection on PATA port.
New Boot Option Policy	**Default** Place First Place Last	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.
Boot Option Priorities	Info only	

7.4.1.1. CSM Configuration

Feature	Options	Description
CSM Support	**Enabled** Disable	This option controls if CSM will be launched.
CSM16 Module Version	Info only	
GateA20 Active	**Upon Request** Always	UPON REQUEST - GA20 can be disabled using BIOS services. ALWAYS - do not allow disabling GA20; this option is useful when any RT code is executed above 1MB.
Option ROM Messages	**Force BIOS** Keep Current	Set display mode for Option ROM.
INT19 Trap Response	**Immediate** Postponed	BIOS reaction on INT19 trapping by Option ROM: IMMEDIATE - execute the trap right away; POSTPONED - execute the trap during legacy boot.
Boot Option filter	**UEFI and Legacy** Legacy only UEFI only	This option controls what devices system can to boot.
Option ROM execution	Info only	
Network	**Do not launch** Legacy only UEFI only	Controls the execution of UEFI and Legacy PXE OpROM.
Storage	Do not launch UEFI only **Legacy only**	Controls the execution of UEFI and Legacy Storage OpROM.

Feature	Options	Description
Video	Do not launch UEFI only **Legacy only**	Controls the execution of UEFI and Legacy Video OpROM.
Other PCI devices	UEFI OpROM **Legacy OpROM**	For PCI devices other than Network, Mass storage or Video defines which OpROM to launch.

7.5. Security

7.5.1. Password Description

Feature	Options	Description
Administrator Password	Enter password	
User Password	Enter password	
HDD Security Configuration:	Info only	
Px: xxxxxxxx	Info only	

7.6. Save & Exit

7.6.1. Reset Options

Feature	Options	Description
Save Changes and Reset	Save changes and reset the system.	Save Changes and Reset
Discard Changes and Reset	Reset the system without saving any changes.	Discard Changes and Reset

7.6.2. 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.

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

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

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

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

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

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

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)

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

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.)

9.2. Thermal Solution

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

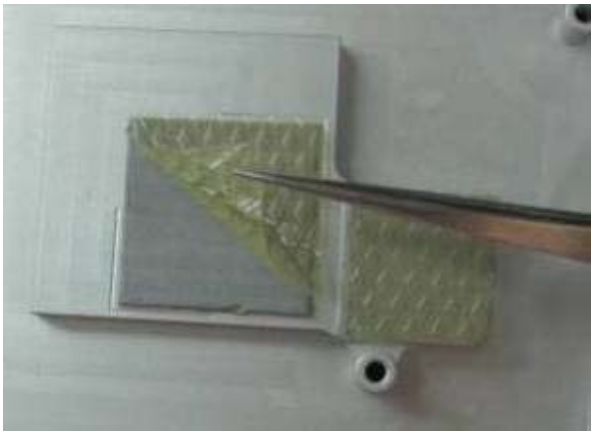
A heat sink can be used as a thermal solution for a specific COM Express module and can have a fan or be fanless, depending on the thermal requirements.

9.2.3. Installation

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

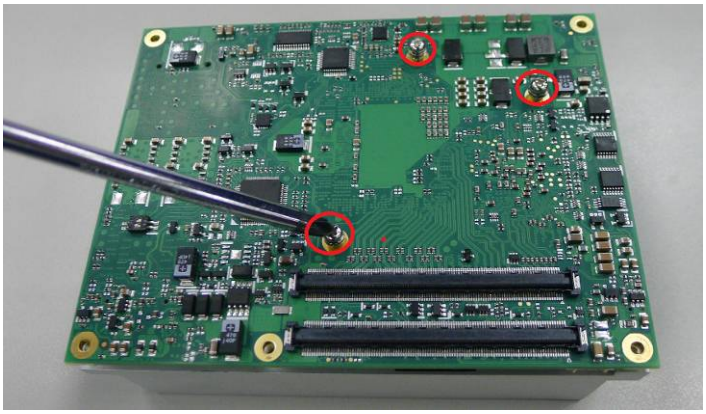
Step 1: Before mounting the heatsink, install the required memory modules onto the SODIMM socket(s) on the COM Express module.

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



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.

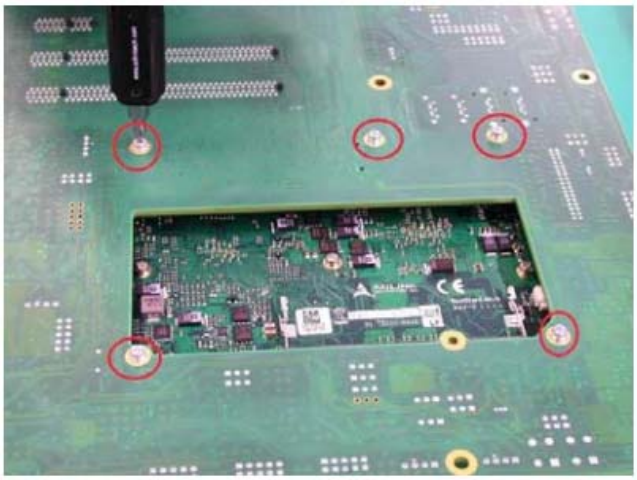


Note: The Express-KL/KLE uses two screws to attach the heatsink to the COM Express module.

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.

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.

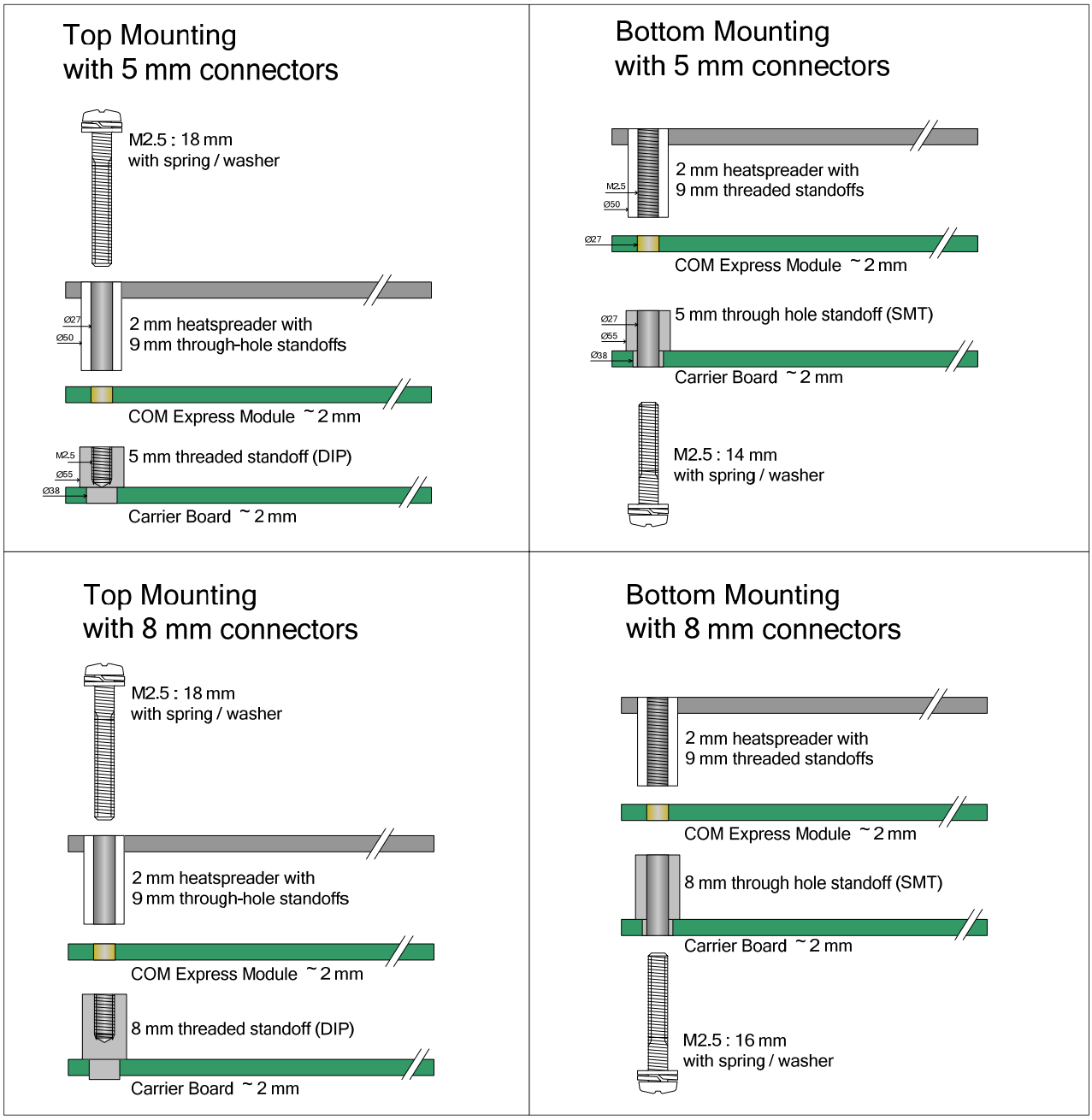


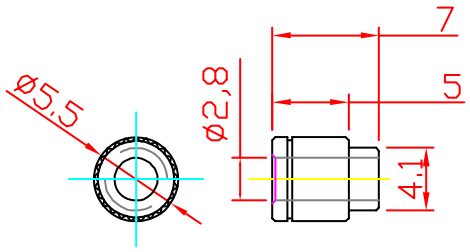
Figure 6: COM Express Mounting Methods

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.

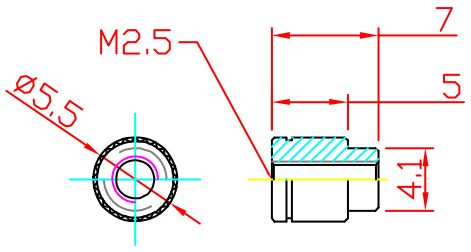
5mm through-hole standoff (SMT type)

P/N: 33-72000-0050



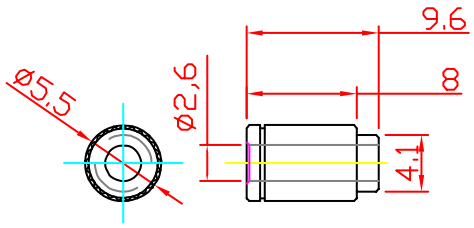
5mm threaded standoff (DIP type)

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

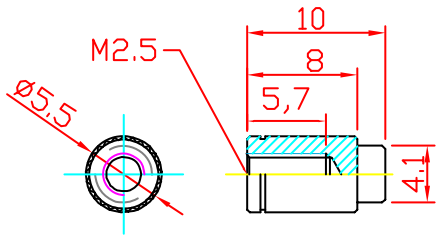


Figure 7: COM Express Standoff Types

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.

Getting Service

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