1 Overview

Thank you for choosing the SYS86550VGGA, an excellent industrial computer board.

Based on the innovative Intel® C236/ H110 chipset for optimal system efficiency, the SYS86550VGGA accommodates the Intel® Skylake-S processor and supports up to 2 DDR4 2133MHz SO-DIMM slots to provide the maximum of 32GB memory capacity.

Designed to withstand harsh industrial conditions, the SYS86550VGGA is engineered to provide reliable performance for a wide variety of industrial applications.

Motherboard Specifications

Processor

- Intel® Core™ i7/ i5/ i3 or Xeon®, Celeron series processor

Chipset

- SKU1: Intel® C236
- SKU2: Intel® H110

Memory

- 2 x SO-DIMM slots
- Dual channel DDR4, up to 2133MHz
- ECC for C236 (SKU1)
- Non ECC for H110 (SKU2)
- Up to 32GB

Network

- 1 x Intel® I211-AT GbE LAN
- 1 x Intel® I219-LM GbE LAN PHY

Storage

- SKU1
  - 4 x SATA 6Gb/s (RAID 0, 1, 5, 10)
  - 1 x mSATA
- SKU2
  - 3 x SATA 6Gb/s
  - 1 x mSATA

Expansion Slot

- 1 x PCIe x16 slot
- 1 x full-size Mini-PCIe slot
- 1 x M.2 slot ((M Key, PCIe x4, SATA 6Gb/s, SKU1 only)

Internal I/O

- 1 x 4-pin power connector
- 1 x 24-pin power connector
- 1 x System fan connector
- 1 x CPU fan connector
- 1 x USB2.0 connector (2 ports)
- 1 x USB2.0 port
- 1 x RS-232 COM port header (4 ports)
- 1 x GPIO header
- 1 x Front panel header
- 1 x S/PDIF connector
- 1 x Amplifier header
- 1 x TPM header
- 1 x LVDS connector
- 1 x LVDS inverter connector
- 1 x Chassis intrusion header
- 1 x Clear CMOS jumper
- 1 x AT/ATX select jumper
- 2 x COM port jumpers
- 1 x LVDS power jumper
- 1 x ME jumper

Rear I/O

- 1 x PS/2 mouse/keyboard combo port
- 2 x USB2.0 ports
- 1 x RS-232/422/485 serial port (0V/5V/12V)
- 1 x HDMI port
- 1 x VGA port
- 1 x DVI-D port
- 2 x RJ45 GbE LAN ports
- 4 x USB3.0 ports
- 3 x Audio jacks (Line-In, Line-Out, Mic-In)

Graphics

- Integrated Intel® HD Graphics
  - 1 x VGA (Max resolution 1920 x 1200)
  - 1 x DVI-D (Max resolution 1920 x 1200)
  - 1 x HDMI (Max resolution 3840 x 2160)
  - 1 x LVDS (18/24 bit, Dual Channel)
- SKU1: Up to 3 independent displays (VGA + DVI-D, HDMI, LVDS)
- SKU2: Up to 2 independent displays (VGA + DVI-D, HDMI, LVDS)

Audio

- Realtek® ALC887/888S HD Audio Codec
- 1 x Amplifier header
- 1 x S/PDIF connector
- 3 x Audio jacks (Line-In, Line-Out, Mic-In)

Environment

- Operating Temperature: -10 ~ 60°C
- Storage Temperature: -20 ~ 80°C
- Humidity: 5 ~ 95% RH, non-condensing

Form Factor

- Mini-ITX: 170 mm x 170 mm

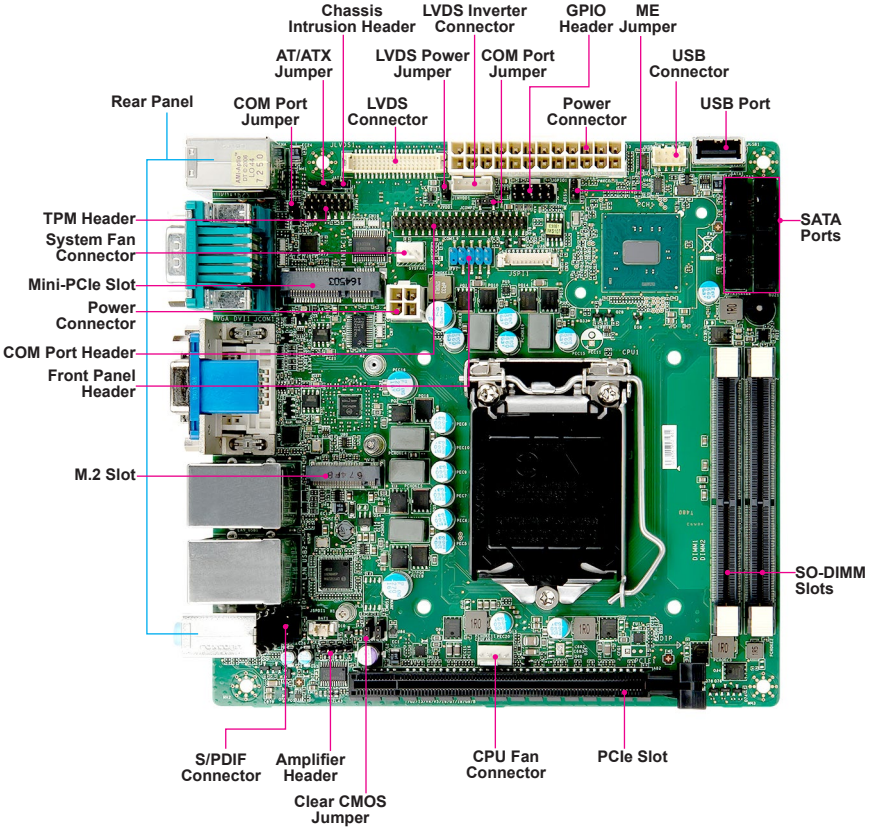
Certification

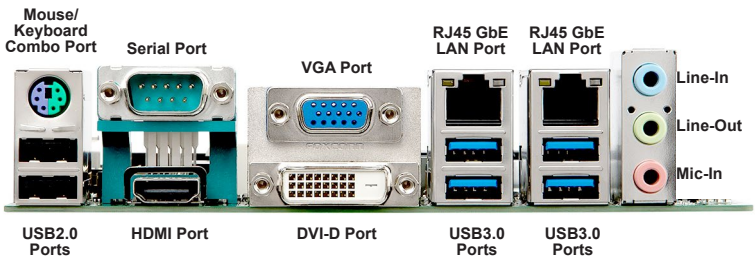
- CE, FCC, BSMI, VCCI, C-Tick

SKU Comparison

SKUs / Features	SKU1	SKU2
PCH	C236	H110
Memory	DDR4, support ECC	DDR4, non-ECC
SATA	4 x SATA 6Gb/s	3 x SATA 6Gb/s
M.2	Yes	No

Motherboard Layout





2 Hardware Setup

This chapter provides you with the information about hardware setup procedures. While doing the installation, be careful in holding the components and follow the installation procedures. For some components, if you install in the wrong orientation, the components will not work properly.
Use a grounded wrist strap before handling computer components. Static electricity may damage the components.

Components Reference Guide

CPU (Central Processing Unit)

When installing the CPU, make sure that you install the cooler to prevent overheating. If you do not have the CPU cooler, consult your dealer before turning on the computer.

Important

Overheating

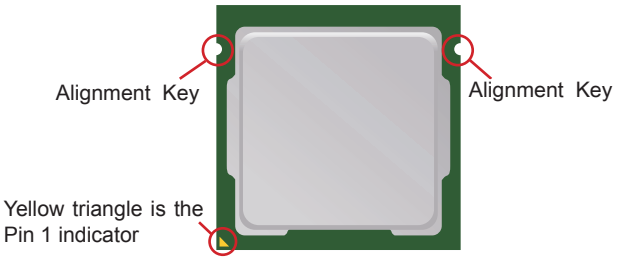
Overheating will seriously damage the CPU and system. Always make sure the cooling fan can work properly to protect the CPU from overheating. Make sure that you apply an even layer of thermal paste (or thermal tape) between the CPU and the heatsink to enhance heat dissipation.

Replacing the CPU

While replacing the CPU, always turn off the power supply or unplug the power supply's power cord from the grounded outlet first to ensure the safety of CPU.

Introduction to LGA 115x CPU

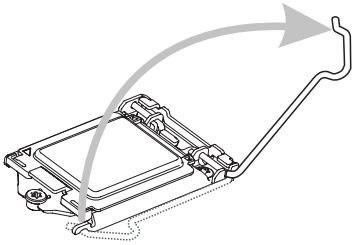
The surface of LGA 115x CPU. Remember to apply some thermal paste on it for better heat dispersion.



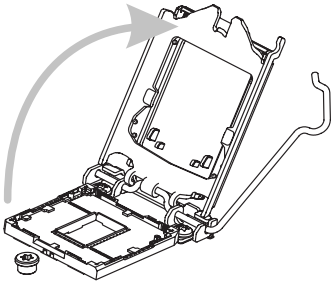
CPU Installation

When you are installing the CPU, **make sure the CPU has a cooler attached on the top to prevent overheating**. Meanwhile, do not forget to apply some thermal paste on CPU before installing the heat sink/cooler fan for better heat dispersion.

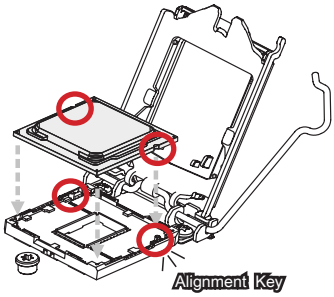
1. Open the load lever and remove the plastic cap.



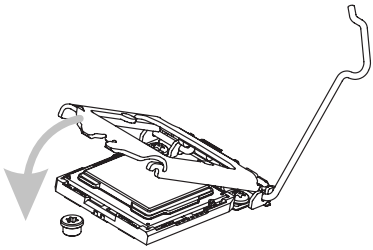
2. Lift the load lever up to fully open position.



3. After confirming the CPU direction for correct mating, put down the CPU in the socket housing frame. Be sure to grasp on the edge of the CPU base. Note that the alignment keys are matched.



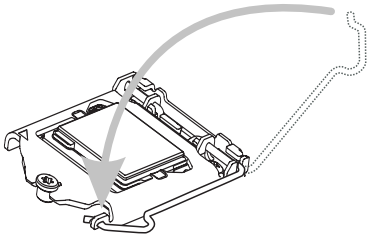
4. Engage the load lever while pressing down lightly onto the load plate.



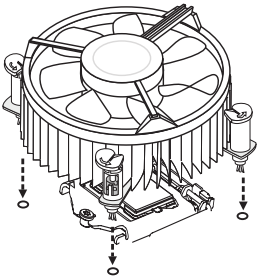
Important

Visually inspect if the CPU is seated well into the socket. If not, take out the CPU with pure vertical motion and reinstall.

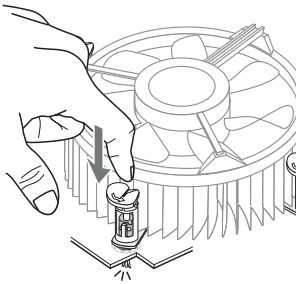
5. Secure the load lever with the hook under the retention tab.



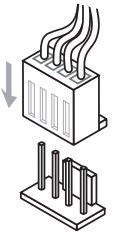
6. Make sure the four hooks are in proper position before you install the cooler. Align the holes on the motherboard with the cooler. Push down the cooler until its four clips get wedged into the holes of the motherboard.



7. Press the four hooks down to fasten the cooler. Turn over the motherboard to confirm that the clip-ends are correctly inserted.



8. Finally, attach the CPU Fan cable to the CPU fan connector on the motherboard.



Important

- *Confirm if your CPU cooler is firmly installed before turning on your system.*
- *Do not touch the CPU socket pins to avoid damage.*
- *Whenever CPU is not installed, always protect your CPU socket pins with the plastic cap covered.*
- *Please refer to the documentation in the CPU cooler package for more details about the CPU cooler installation.*
- *Read the CPU status in BIOS.*

Memory

Dual-Channel Mode

In Dual-Channel mode, make sure that you install memory modules of the **same type and density** in different channel DIMM slots.

Recommended Memory Population

Number of DIMMs installed	1	2
DIMM1 (ch A)	V	V
DIMM2 (ch B)		V

Important

- *"V" indicates a populated DIMM slot.*
- *Paired memory installation for Max performance.*
- *Populate the same DIMM type in each channel, specifically: 1. Use the same DIMM size; 2. Use the same number of ranks per DIMM.*

Installing Memory Modules

1. Unlock the SO-DIMM slot by flipping open its side clips.
2. Vertically insert the SO-DIMM into the slot. The SO-DIMM has an off-center notch at the bottom that will only allow it to fit one way into the slot. Push the SO-DIMM deeply into the slot. The side clips of the slot will automatically close when the SO-DIMM is properly seated and an audible click should be heard.
3. Manually check if the SO-DIMM has been locked in place by the slot's side clips.

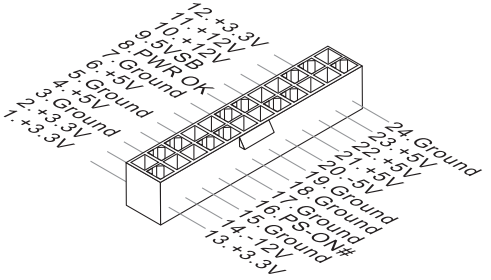
Important

You can barely see the golden finger if the SO-DIMM is properly inserted in the DIMM slot.

Power Supply

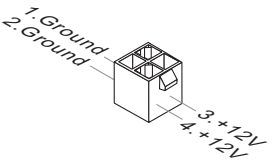
System Power Connector: PWRCONN1

This connector allows you to connect a power supply. To connect to the power supply, make sure the plug of the power supply is inserted in the proper orientation and the pins are aligned. Then push down the power supply firmly into the connector.



CPU Power Connector: JPWR2

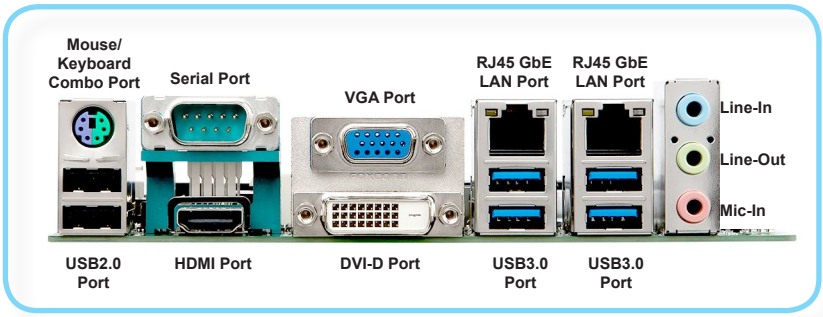
This connector is used to provide power to the CPU.



Important

Make sure that all power connectors are connected to the power supply to ensure stable operation of the motherboard.

Rear Panel I/O



➤ Mouse / Keyboard Combo Port

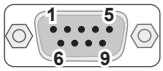
The standard PS/2® mouse/keyboard DIN connector is for a PS/2® mouse/keyboard.

➤ USB2.0 Port

The USB (Universal Serial Bus) port is for attaching USB devices such as keyboard, mouse, or other USB-compatible devices.

➤ RS-232/422/485 Serial Port: JCOM1

The serial port is a 16550A high speed communications port that sends/receives 16 bytes FIFOs. With Auto-Flow Control and RI Function Support, it supports barcode scanners, barcode printers, bill printers, credit card machine, etc.



RS-232

PIN	SIGNAL	DESCRIPTION
1	NDCD	Data Carrier Detect
2	NSIN	Signal In
3	NSOUT	Signal Out
4	NDTR	Data Terminal Ready
5	GND	Signal Ground
6	NDSR	Data Set Ready
7	NRTS	Request To Send
8	NCTS	Clear To Send
9	VCC	5V or 12V selected by jumper

RS-422

PIN	SIGNAL	DESCRIPTION
1	422 TXD-	Transmit Data, Negative
2	422 RXD+	Receive Data, Positive
3	422 TXD+	Transmit Data, Positive
4	422 RXD-	Receive Data, Negative
5	GND	Signal Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection

RS-485

PIN	SIGNAL	DESCRIPTION
1	485 TXD-	Transmit Data, Negative
2	NC	No Connection
3	485 TXD+	Transmit Data, Positive
4	NC	No Connection
5	GND	Signal Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection

➤ HDMI Port

The High-Definition Multimedia Interface (HDMI) is an all-digital audio/video interface capable of transmitting uncompressed streams. HDMI supports all TV format, including standard, enhanced, or high-definition video, plus multi-channel digital audio on a single cable.

➤ VGA Port

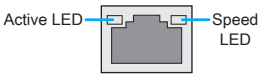
The DB15-pin female connector is provided for monitor.

➤ DVI-D Port

The DVI-D (Digital Visual Interface-Digital) connector allows you to connect an LCD monitor. It provides a high-speed digital interconnection between the computer and its display device. To connect an LCD monitor, simply plug your monitor cable into the DVI connector, and make sure that the other end of the cable is properly connected to your monitor (refer to your monitor manual for more information.)

➤ RJ45 GbE LAN Port

The standard single RJ45 LAN jack is provided for connection to the Local Area Network (LAN). You can connect a network cable to it.



LED	LED Status	Description
Active LED	Off	No link
	Yellow	Linked
	Blinking	Data activity
Speed LED	Off	10 Mbps connection
	Green	100 Mbps connection
	Orange	1 Gbps connection

➤ USB3.0 Port

The USB 3.0 port is backward-compatible with USB 2.0 devices and supports data transfer rate up to 5 Gbit/s (SuperSpeed).

➤ Line-In Jack

For external CD player, tapeplayer or other audio devices.

➤ Line-Out Jack

For speakers or headphones.

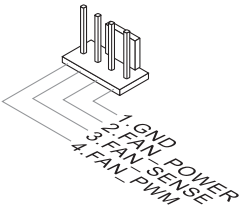
➤ Mic-In Jack

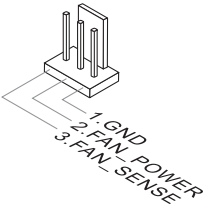
For microphones.

Connector

Fan Power Connector: CPUFAN1, SYSFAN1

The fan power connectors support system cooling fan with +12V. When connecting the wire to the connectors, always note that the red wire is the positive and should be connected to the +12V; the black wire is Ground and should be connected to GND. If the motherboard has a System Hardware Monitor chipset onboard, you must use a specially designed fan with speed sensor to take advantage of the CPU fan control.



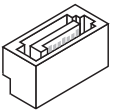


Important

- *Please refer to the recommended CPU fans at processor's official website or consult the vendors for proper CPU cooling fan.*
- *Fan cooler sets with 3- or 4-pin power connector are both available.*

Serial ATA Connector: SATA1, SATA2, SATA3, SATA4 *(4 x SATA 6Gb/s for SKU1, 3 x SATA 6Gb/s for SKU2)*

This connector is a high-speed Serial ATA interface port. Each connector can connect to one Serial ATA device.

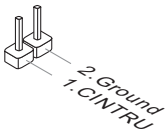


Important

Please do not fold the SATA cable into a 90-degree angle. Otherwise, data loss may occur during transmission.

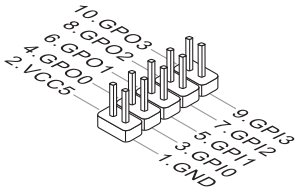
Chassis Intrusion Header: J1

This connector connects to the chassis intrusion switch cable. If the computer case is opened, the chassis intrusion mechanism will be activated. The system will record this intrusion and a warning message will flash on screen. To clear the warning, you must enter the BIOS utility and clear the record.



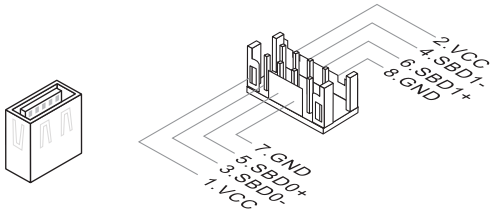
GPIO Connector: JGPIO1

This connector is provided for the General-Purpose Input/Output (GPIO) peripheral module.



USB2.0 Connector: JUSB1, JUSB2

This connector, compliant with Intel I/O Connectivity Design Guide, is ideal for connecting high-speed USB interface peripherals such as USB HDD, digital cameras, MP3 players, printers, modems and the like.

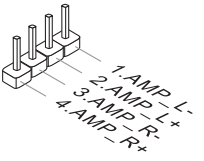


Important

Note that the pins of VCC and GND must be connected correctly to avoid possible damage.

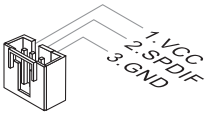
Audio Amplifier Connector: JSPK1

The connector is used to connect audio amplifiers to enhance audio performance.



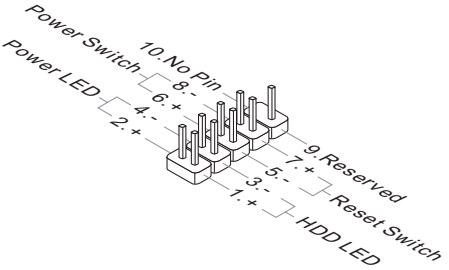
S/PDIF-Out Connector: JSPDI1

This header is used to connect S/PDIF (Sony & Philips Digital Interconnect Format) interface for digital audio transmission.



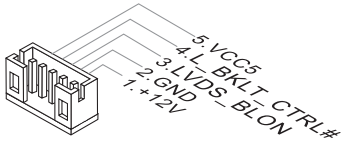
Front Panel Header: JFP1

This front panel connector is provided for electrical connection to the front panel switches & LEDs and is compliant with Intel Front Panel I/O Connectivity Design Guide.



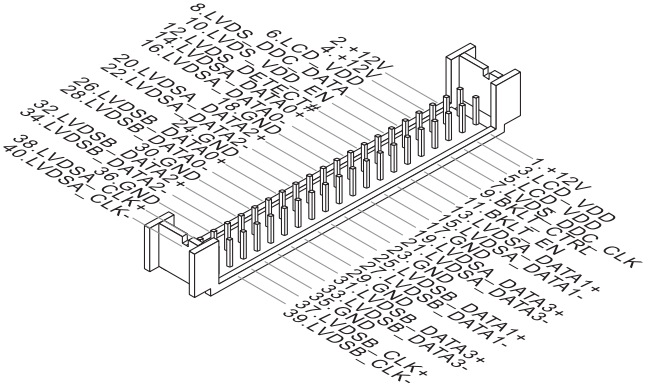
LVDS Inverter Connector: JINVDD1

The connector is provided for LCD backlight options.



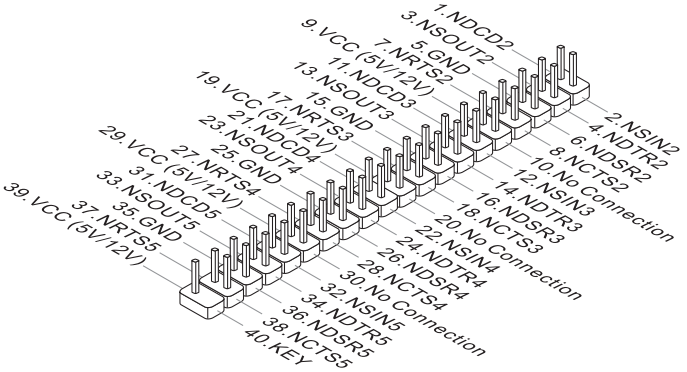
LVDS Connector: JLVDS1

The LVDS (Low Voltage Differential Signal) connector provides a digital interface typically used with flat panels. After connecting an LVDS interface flat panel to the JLVDS1, be sure to check the panel datasheet and set the LVDS jumper to proper power voltage.



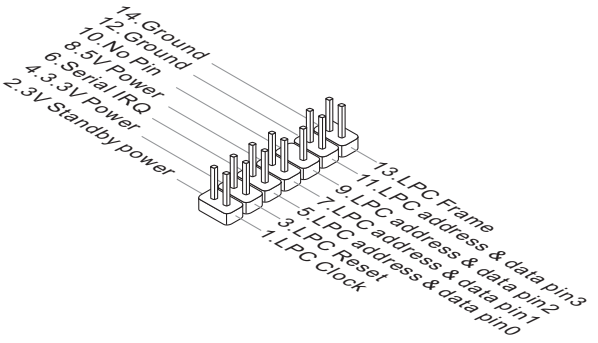
RS-232 COM Port Header: JCOM3

This connector is a 16550A high speed communications port that sends/receives 16 bytes FIFOs. You can attach serial devices to it through the optional serial port bracket.



LPC Debug Port Connector: JTPM1 *(With TPM Support)*

This connector works as LPC debug port and supports TPM modules.



Jumper

Important

Avoid adjusting jumpers when the system is on; it will damage the motherboard.

Clear CMOS Jumper: J_CMOS1

There is a CMOS RAM onboard that has a power supply from an external battery to keep the data of system configuration. With the CMOS RAM, the system can automatically boot OS every time it is turned on. If you want to clear the system configuration, set the jumper to clear data.

Normal

Clear CMOS

Important

You can clear CMOS by shorting 2-3 pin while the system is off. Then return to 1-2 pin position. Avoid clearing the CMOS while the system is on; it will damage the motherboard.

AT/ATX Select Jumper: JAT1

This jumper allows users to select between AT and ATX power.

ATX

AT

COM Port Power Jumper: JCOMP1 *(for JCOM1)*, JCOMP2 *(for JCOM3)*

These jumpers specify the operation voltage of the onboard serial ports.

JCOMP1
(for JCOM1)

+5V

RI Support

JCOMP2
(for JCOM3)

+5V

+12V

LVDS Power Jumper: JVDD1

Use this jumper to specify the operation voltage of the LVDS display.

+3V

+5V

ME Jumper: ME_DIS1

This jumper enables/disables ME.

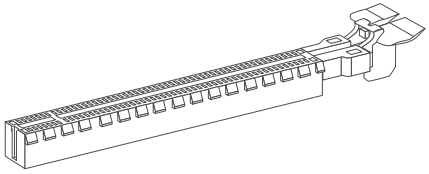
Normal

ME Disable

Slot

PCIe (Peripheral Component Interconnect Express) Slot

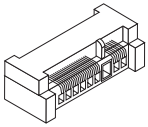
The PCI Express slot supports PCIe interface expansion cards.



PCIe x16 slot

Mini-PCIe (Peripheral Component Interconnect Express) Slot

The Mini-PCIe slot is provided for WiFi modules, Bluetooth modules, TV tuner cards and other Mini-PCIe cards.



Important

When adding or removing expansion cards, make sure that you unplug the power supply first. Meanwhile, read the documentation for the expansion card to configure any necessary hardware or software settings for the expansion card, such as jumpers, switches or BIOS configuration.

Appendix
WDT & GPIO

This appendix provides the sample codes of WDT (Watch Dog Timer) and GPIO (General Purpose Input/ Output).

WDT Sample Code

```
SIO_INDEX_Port    equ 04Eh
SIO_DATA_Port     equ 04Fh
SIO_UnLock_Value  equ 087h
SIO_Lock_Value    equ 0AAh
WatchDog_LDN      equ 007h
WDT_UNIT          equ  60h    ;60h=second, 68h=minute, 40h=Disabled Watchdog timer
WDT_Timer         equ  30     ;ex. 30 seconds

Sample code:
;Enable config mode
    mov     dx, SIO_INDEX_Port
    mov     al, SIO_UnLock_Value
    out     dx, al
    jmp     short $+2             ;Io_delay
    jmp     short $+2             ;Io_delay
    out     dx, al
;Change to WDT
    mov     dx, SIO_INDEX_Port
    mov     al, 07h
    out     dx, al
    mov     dx, SIO_DATA_Port
    mov     al, WatchDog_LDN
    out     dx, al
;Acive WDT
    mov     dx, SIO_INDEX_Port
    mov     al, 30h
    out     dx, al
    mov     dx, SIO_DATA_Port
    in      al, dx
    or      al, 01h
    out     dx, al
 ;set timer
    mov     dx, SIO_INDEX_Port
    mov     al, 0F6h
    out     dx, al
    mov     dx, SIO_DATA_Port
    mov     al, WDT_Timer
    out     dx, al
;set UINT
    mov     dx, SIO_INDEX_Port
    mov     al, 0F5h
    out     dx, al
    mov     dx, SIO_DATA_Port
    mov     al, WDT_UNIT
    out     dx, al
;enable reset
    mov     dx, SIO_INDEX_Port
    mov     al, 0FAh
    out     dx, al
    mov     dx, SIO_DATA_Port
    in      al, dx
    or      al, 01h
    out     dx, al
;close config mode
    mov     dx, SIO_INDEX_Port
    mov     al, SIO_Lock_Value
    out     dx, al
```

GPIO Sample Code

- GPI 0 ~ GPI 3

	GPI 0	GPI 1	GPI 2	GPI 3				
IO Address								
SIO GPIO Register	8Ah	8Ah	8Ah	8Ah				
Bit	0	1	2	3				
Sample code	#1	#1	#1	#1				

- GPO 0 ~ GPO 3

	GPO 0	GPO 1	GPO 2	GPO 3				
IO Address								
SIO GPIO Register	82h	82h	82h	82h				
Bit	4	5	6	7				
Sample code	#2	#2	#2	#2				

```
SIO_INDEX_Port        equ    04Eh
SIO_DATA_Port         equ    04Fh
SIO_UnLock_Value      equ    087h
SIO_Lock_Value        equ    0AAh
SIO_LDN_GPIO          equ    06h
GPI_REG               equ    08Ah
GPO_REG               equ    082h
GPO_0                 equ    00010000b
```

Sample Code:

#1 : Get GPI 0 status

```
  ; Enable config mode
    mov    dx, SIO_INDEX_Port
    mov    al, SIO_UnLock_Value
    out    dx, al
    jmp    short $+2              ;Io_delay
    jmp    short $+2              ;Io_delay
    out    dx, al
  ; Switch GPIO Configuration for SIO LDN 0x06
    mov     dx, SIO_INDEX_Port
    mov     al, 07h
    out     dx, al
    mov     dx, SIO_DATA_Port
    mov     al, SIO_LDN_GPIO
    out     dx, al
  ; Get GPI 0 Pin Status Register
    mov     dx, SIO_INDEX_Port
```

```
    mov     al, GPI_REG
    out     dx, al
    mov     dx, SIO_DATA_Port
    in      al, dx
    ;al bit0 = GPI 0 status
  ; Exit SIO
    mov    dx, SIO_INDEX_Port
    mov    al, SIO_Lock_Value
    out    dx, al
```

#2 : Set GPO 0 status to high

```
    ; Enable config mode
    mov    dx, SIO_INDEX_Port
    mov    al, SIO_UnLock_Value
    out    dx, al
    jmp    short $+2              ;Io_delay
    jmp    short $+2              ;Io_delay
    out    dx, al
  ; Switch GPIO Configuration for SIO LDN 0x06
    mov     dx, SIO_INDEX_Port
    mov     al, 07h
    out     dx, al
    mov     dx, SIO_DATA_Port
    mov     al, SIO_LDN_GPIO
    out     dx, al
  ; Set GPO 0 Pin to High
    mov     dx, SIO_INDEX_Port
    mov     al, GPO_REG
    out     dx, al
    mov     dx, SIO_DATA_Port
    in      al, dx
    or      al, GPO_0
    out     dx, al
    ;al bit4 = GP0 0 status
  ; Exit SIO
    mov    dx, SIO_INDEX_Port
    mov    al, SIO_Lock_Value
    out    dx, al
```