C621 AORUS XTREME

User's Manual

Rev. 1001

12ME-C621AX-1001R

For more product details, please visit GIGABYTE's website.

To reduce the impacts on global warming, the packaging materials of this product are recyclable and reusable. GIGABYTE works with you to protect the environment.

Declaration of Conformity

We, Manufacturer/Importer,

G.B.T. Technology Trading GMbH

Address: Bullenkoppel 16, 22047 Hamburg, Germany

Declare that the product

Product Type: Server Motherboard

Product Name: C621 AORUS XTREME

conforms with the essential requirements of the following directives:

☒ EMC Directive 2014/30/EU:

☒ Conduction & Radiated Emissions:	EN 55032:2012+AC:2013
☒ Immunity:	EN 55024:2010+A1:2015
☒ Power-line harmonics:	EN 61000-3-2:2014
☒ Power-line flicker:	EN 61000-3-3:2013

☒ Low Voltage Directive 2014/35/EU:

☒ Safety:	EN60950-1:2006+A11:2009+A12:2011+A2:2013

☒ RoHS Directive 2011/65/EU

☒ Restriction of use of certain substances in electronic equipment:	This product does not contain any of the restricted substances listed in Annex II, in concentrations and applications banned by the directive.

☒ CE marking

CE

Signature: Timmy Huang

(Stamp) Date: Apr. 3, 2019 Name: Timmy Huang

DECLARATION OF CONFORMITY

Per FCC Part 2 Section 2.1077(a)

FC

Responsible Party Name: G.B.T. INC. (U.S.A.)

Address: 17358 Railroad Street
City of Industry, CA 91748

Phone/Fax No: (626) 854-9338/ (626) 854-9326

hereby declares that the product

Product Name: Server Motherboard

Model Number: C621 AORUS XTREME

Conforms to the following specifications:

FCC Part 15, Subpart B, Section 15.107(a) and Section 15.109 (a),Class A Digital Device

Supplementary Information:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful and (2) this device must accept any inference received, including that may cause undesired operation.

Representative Person's Name: ERIC LU

Signature: Eric Lu

Date: Apr. 3, 2019

Copyright

© 2019 GIGA-BYTE TECHNOLOGY CO., LTD. All rights reserved.
The trademarks mentioned in this manual are legally registered to their respective owners.

Disclaimer

Information in this manual is protected by copyright laws and is the property of GIGABYTE.
Changes to the specifications and features in this manual may be made by GIGABYTE without prior notice.

No part of this manual may be reproduced, copied, translated, transmitted, or published in any form or by any means without GIGABYTE's prior written permission.

- In order to assist in the use of this product, carefully read the User's Manual.
- For product-related information, check on our website at: https://www.gigabyte.com

Identifying Your Motherboard Revision

The revision number on your motherboard looks like this: "REV: X.X." For example, "REV: 1.0" means the revision of the motherboard is 1.0. Check your motherboard revision before updating motherboard BIOS, drivers, or when looking for technical information.

Example:

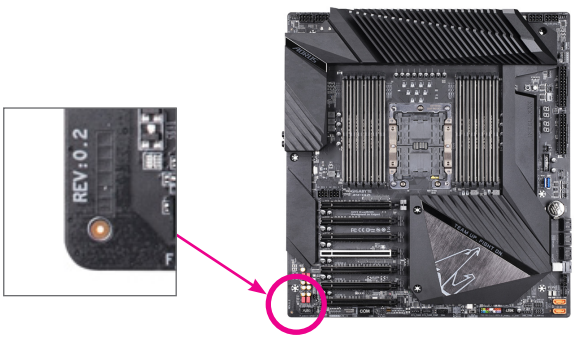


Table of Contents

C621 AORUS XTREME Motherboard Layout 4

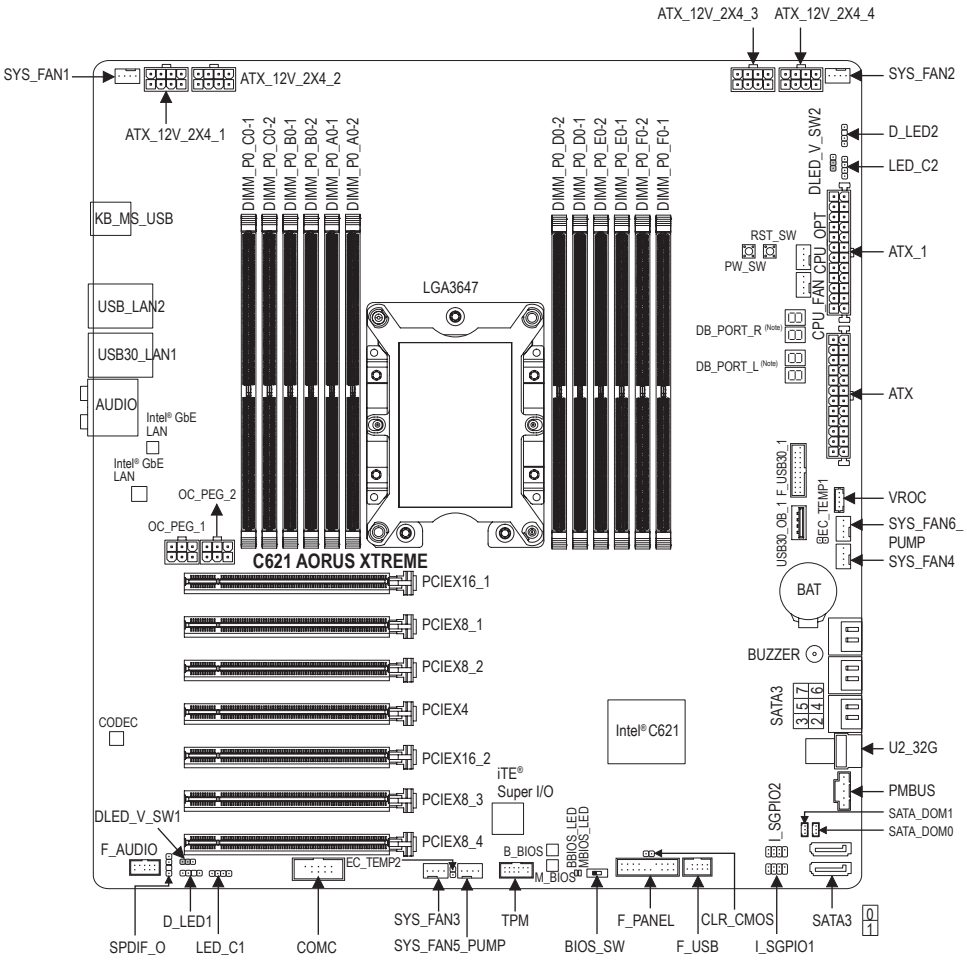
Chapter 1 Hardware Installation 5
- 1-1 Installation Precautions 5
- 1-2 Product Specifications 6
- 1-3 Installing the CPU 9
- 1-4 Installing the Memory 10
- 1-5 Installing an Expansion Card 11
- 1-6 Setting up AMD CrossFire™/NVIDIA® SLI™ Configuration 11
- 1-7 Back Panel Connectors 12
- 1-8 Internal Connectors 14

Chapter 2 BIOS Setup 27
- 2-1 Startup Screen 27
- 2-2 The Main Menu 28
- 2-3 M.I.T. 29
- 2-4 System 36
- 2-5 BIOS 37
- 2-6 Peripherals 40
- 2-7 Power 43
- 2-8 Save & Exit 45

Chapter 3 Appendix 46
- 3-1 Configuring a RAID Set 46
- 3-2 Configuring Intel® Virtual RAID on CPU (Intel® VROC) 47
- 3-3 Drivers Installation 49
- 3-4 Debug LED Codes 50

Regulatory Statements 54
Contact Us 56

C621 AORUS XTREME Motherboard Layout



Box Contents

- ☑ C621 AORUS XTREME Motherboard
- ☑ One AORUS USB flash drive with drivers
- ☑ User's Manual
- ☑ One RGB (RGBW) LED strip extension cable
- ☑ Two addressable LED strip adapter cables
- ☑ Four SATA cables
- ☑ One G Connector
- ☑ Two Velcro Cable Ties
- ☑ Two thermistor cables

* The box contents above are for reference only and the actual items shall depend on the product package you obtain. The box contents are subject to change without notice.

(Note) For debug code information, please refer to Chapter 3.

Chapter 1 Hardware Installation

1-1 Installation Precautions

The motherboard contains numerous delicate electronic circuits and components which can become damaged as a result of electrostatic discharge (ESD). Prior to installation, carefully read the user's manual and follow these procedures:

- Prior to installation, make sure the chassis is suitable for the motherboard.
- Prior to installation, do not remove or break motherboard S/N (Serial Number) sticker or warranty sticker provided by your dealer. These stickers are required for warranty validation.
- Always remove the AC power by unplugging the power cord from the power outlet before installing or removing the motherboard or other hardware components.
- When connecting hardware components to the internal connectors on the motherboard, make sure they are connected tightly and securely.
- When handling the motherboard, avoid touching any metal leads or connectors.
- It is best to wear an electrostatic discharge (ESD) wrist strap when handling electronic components such as a motherboard, CPU or memory. If you do not have an ESD wrist strap, keep your hands dry and first touch a metal object to eliminate static electricity.
- Prior to installing the motherboard, please have it on top of an antistatic pad or within an electrostatic shielding container.
- Before connecting or unplugging the power supply cable from the motherboard, make sure the power supply has been turned off.
- Before turning on the power, make sure the power supply voltage has been set according to the local voltage standard.
- Before using the product, please verify that all cables and power connectors of your hardware components are connected.
- To prevent damage to the motherboard, do not allow screws to come in contact with the motherboard circuit or its components.
- Make sure there are no leftover screws or metal components placed on the motherboard or within the computer casing.
- Do not place the computer system on an uneven surface.
- Do not place the computer system in a high-temperature or wet environment.
- Turning on the computer power during the installation process can lead to damage to system components as well as physical harm to the user.
- If you are uncertain about any installation steps or have a problem related to the use of the product, please consult a certified computer technician.
- If you use an adapter, extension power cable, or power strip, ensure to consult with its installation and/or grounding instructions.

1-2 Product Specifications

CPU	◆ Support for Intel® Xeon® W-3175X Scalable processor in the LGA3647 package (Go to GIGABYTE's website for the latest CPU support list.) ◆ L3 cache varies with CPU
Chipset	◆ Intel® C621 Chipset
Memory	◆ 12 x DDR4 DIMM sockets supporting up to 192 GB of system memory ◆ 6 channel memory architecture ◆ Support for DDR4 4200(O.C.)/4000(O.C.)/3800(O.C.)/3733(O.C.)/3600(O.C.)/3466(O.C.)/3400(O.C.)/3200(O.C.)/3000(O.C.)/2933(O.C.)/2800(O.C.)/2666/2400/2133 MHz ◆ Support for ECC Registered DIMM memory modules ◆ Support for ECC Un-buffered DIMM memory modules ◆ Support for Extreme Memory Profile (XMP) memory modules (Go to GIGABYTE's website for the latest supported memory speeds and memory modules.)
Audio	◆ Realtek® ALC1220-VB codec * The back panel line out jack supports DSD audio. ◆ High Definition Audio ◆ 2/4/5.1/7.1-channel ◆ Support for S/PDIF Out
LAN	◆ 2 x Intel® GbE LAN chips (10/100/1000 Mbit)
Expansion Slots	◆ 2 x PCI Express x16 slots, running at x16 (PCIEX16_1/2) * For optimum performance, if only one PCI Express graphics card is to be installed, be sure to install it in the PCIEX16_1 slot. ◆ 4 x PCI Express x16 slots, running at x8 (PCIEX8_1/2/3/4) * The PCIEX8_1 slot shares bandwidth with the PCIEX16_1 slot and the PCIEX8_3 with PCIEX16_2. When PCIEX8_1/PCIEX8_3 is populated, PCIEX16_1/PCIEX16_2 operates at up to x8 mode. ◆ 1 x PCI Express x16 slot, running at x4 (PCIEX4) (All of the PCI Express slots conform to PCI Express 3.0 standard.)
Multi-Graphics Technology	◆ Support for NVIDIA® Quad-GPU SLI™ and 4-Way/3-Way/2-Way NVIDIA® SLI™ technologies ◆ Support for AMD Quad-GPU CrossFire™ and 4-Way/3-Way/2-Way AMD CrossFire™ technologies
Storage Interface	◆ Chipset: - 8 x SATA 6Gb/s connectors - Support for RAID 0, RAID 1, RAID 5, and RAID 10 - 1 x U.2 connector
USB	◆ Chipset: - 5 x USB 3.1 Gen 1 ports (2 ports on the back panel, 2 ports available through the internal USB header, 1 onboard) - 6 x USB 2.0/1.1 ports (4 ports on the back panel, 2 ports available through the internal USB header)

Internal Connectors	◆ 2 x 24-pin ATX main power connectors ◆ 4 x 8-pin ATX 12V power connectors ◆ 2 x OC_PEG power connectors ◆ 1 x CPU fan header ◆ 1 x water cooling CPU fan header ◆ 4 x system fan headers ◆ 2 x system fan/water cooling pump headers ◆ 2 x addressable LED strip headers ◆ 2 x addressable LED strip power select jumpers ◆ 2 x RGB LED strip headers ◆ 8 x SATA 6Gb/s connectors ◆ 1 x U.2 connector ◆ 2 x SATA power headers ◆ 2 x SATA detection headers ◆ 1 x power information detection header ◆ 1 x front panel header ◆ 1 x front panel audio header ◆ 1 x S/PDIF Out header ◆ 1 x USB 3.1 Gen 1 header ◆ 1 x USB 3.1 Gen 1 port ◆ 1 x USB 2.0/1.1 header ◆ 1 x Trusted Platform Module (TPM) header (2x6 pin, for the GC-TPM2.0_S module only) ◆ 1 x Intel® VROC Upgrade Key header ◆ 1 x serial port header ◆ 1 x Clear CMOS jumper ◆ 1 x reset button ◆ 1 x power button ◆ 2 x temperature sensor headers ◆ 1 x BIOS switch ◆ 1 x buzzer
Back Panel Connectors	◆ 1 x PS/2 keyboard/mouse port ◆ 4 x USB 2.0/1.1 ports ◆ 2 x USB 3.1 Gen 1 ports ◆ 2 x RJ-45 ports ◆ 1 x optical S/PDIF Out connector ◆ 5 x audio jacks

I/O Controller	◆	iTE® I/O Controller Chip
Hardware Monitor	◆ ◆ ◆ ◆ ◆ ◆ ◆	Voltage detection Temperature detection Fan speed detection Water cooling flow rate detection Overheating warning Fan fail warning Fan speed control * Whether the fan (pump) speed control function is supported will depend on the fan (pump) you install.
BIOS	◆ ◆ ◆ ◆	2 x 256 Mbit flash Use of licensed AMI UEFI BIOS Support for DualBIOS™ PnP 1.0a, DMI 2.7, WfM 2.0, SM BIOS 2.7, ACPI 5.0
Unique Features	◆ ◆ ◆ ◆	Support for @BIOS Support for Q-Flash Support for RGB Fusion Support for System Information Viewer
Bundled Software	◆	Norton® Internet Security (OEM version)
Operating System	◆	Support for Windows 10 64-bit
Form Factor	◆	E-ATX Form Factor; 38.6cm x 35.9cm (Go to GIGABYTE's website for the latest chassis support list)

* GIGABYTE reserves the right to make any changes to the product specifications and product-related information without prior notice.

Please visit GIGABYTE's website for support lists of CPU, memory modules, and SSDs.

Please visit the **Support\Utility List** page on GIGABYTE's website to download the latest version of apps.

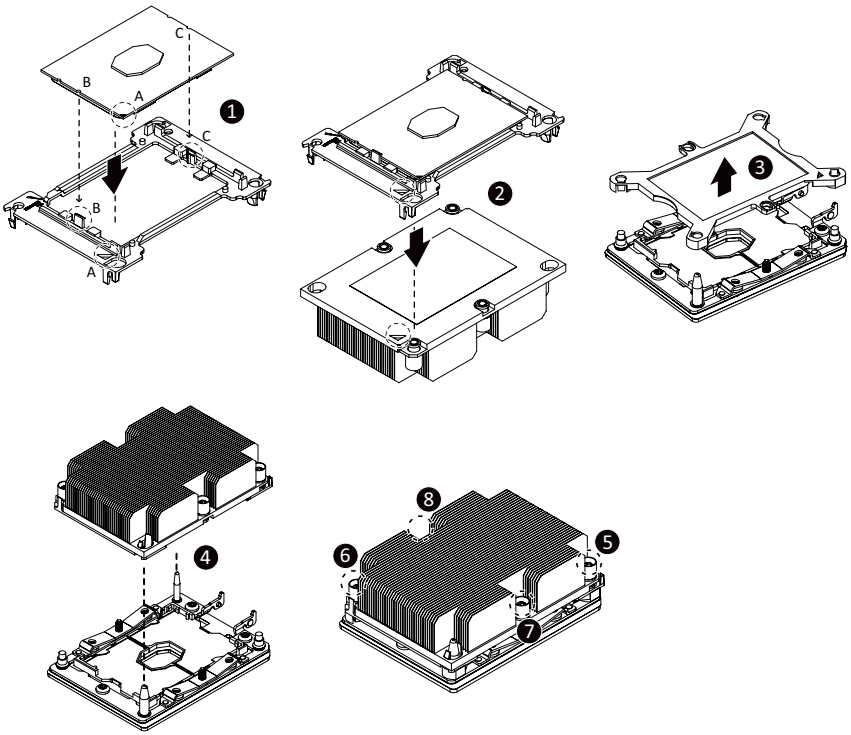
1-3 Installing the CPU

Read the following guidelines before you begin to install the CPU:

- Make sure that the motherboard supports the CPU.
  (Go to GIGABYTE's website for the latest CPU support list.)
- Always turn off the computer and unplug the power cord from the power outlet before installing the CPU to prevent hardware damage.
- Locate the pin one of the CPU. The CPU cannot be inserted if oriented incorrectly.
- Apply an even and thin layer of thermal grease on the surface of the CPU.
- Do not turn on the computer if the CPU cooler is not installed, otherwise overheating and damage of the CPU may occur.
- Set the CPU host frequency in accordance with the CPU specifications. It is not recommended that the system bus frequency be set beyond hardware specifications since it does not meet the standard requirements for the peripherals. If you wish to set the frequency beyond the standard specifications, please do so according to your hardware specifications including the CPU, graphics card, memory, hard drive, etc.

Installing the CPU

Locate the alignment keys on the CPU carrier clip and the notches on the CPU.



1-4 Installing the Memory

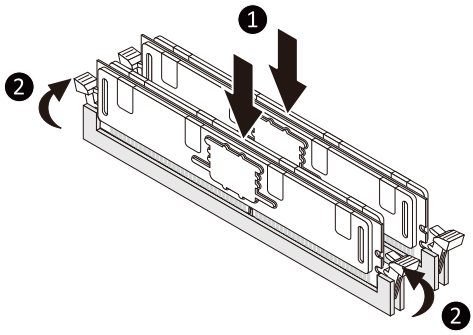
Read the following guidelines before you begin to install the memory:

- Make sure that the motherboard supports the memory. It is recommended that memory of the same capacity, brand, speed, and chips be used.
  (Go to GIGABYTE's website for the latest supported memory speeds and memory modules.)
- Always turn off the computer and unplug the power cord from the power outlet before installing the memory to prevent hardware damage.
- Memory modules have a foolproof design. A memory module can be installed in only one direction. If you are unable to insert the memory, switch the direction.

6 Channel Memory Configuration

This motherboard provides twelve memory sockets and supports 6 Channel Technology. After the memory is installed, the BIOS will automatically detect the specifications and capacity of the memory. The twelve memory sockets are divided into six channels and each channel has two memory sockets as following:

- Channel A: DIMM_P0_A0-1, DIMM_P0_A0-2
- Channel B: DIMM_P0_B0-1, DIMM_P0_B0-2
- Channel C: DIMM_P0_C0-1, DIMM_P0_C0-2
- Channel D: DIMM_P0_D0-2, DIMM_P0_D0-1
- Channel E: DIMM_P0_E0-2, DIMM_P0_E0-1
- Channel F: DIMM_P0_F0-2, DIMM_P0_F0-1



- Refer to the table below for memory installation according to the number of the memory modules you want to install:

	1 Module	2 Modules	4 Modules	6 Modules	8 Modules	12 Modules
DIMM_P0_A0-1	✓	✓	✓	✓	✓	✓
DIMM_P0_A0-2	✗	✗	✗	✗	✓	✓
DIMM_P0_B0-1	✗	✗	✓	✓	✓	✓
DIMM_P0_B0-2	✗	✗	✗	✗	✓	✓
DIMM_P0_C0-1	✗	✗	✗	✓	✗	✓
DIMM_P0_C0-2	✗	✗	✗	✗	✗	✓
DIMM_P0_D0-2	✗	✗	✗	✗	✓	✓
DIMM_P0_D0-1	✗	✓	✓	✓	✓	✓
DIMM_P0_E0-2	✗	✗	✗	✗	✓	✓
DIMM_P0_E0-1	✗	✗	✓	✓	✓	✓
DIMM_P0_F0-2	✗	✗	✗	✗	✗	✓
DIMM_P0_F0-1	✗	✗	✗	✓	✗	✓

✓ : Installed ✗ : Not Installed.

Note: When installing the memory, make sure to begin with the first socket of each channel, such as DIMM_P0_A0-1/DIMM_P0_B0-1/DIMM_P0_C0-1/DIMM_P0_D0-1/DIMM_P0_E0-1/DIMM_P0_F0-1.

1-5 Installing an Expansion Card

Read the following guidelines before you begin to install an expansion card:

- Make sure the motherboard supports the expansion card. Carefully read the manual that came with your expansion card.
- Always turn off the computer and unplug the power cord from the power outlet before installing an expansion card to prevent hardware damage.

1-6 Setting up AMD CrossFire™/NVIDIA® SLI™ Configuration

A. System Requirements

- Windows 10 64-bit operating system
- A CrossFire/SLI-supported motherboard with two or more PCI Express x16 slots and correct driver
- CrossFire/SLI-ready graphics cards of identical brand and chip and correct driver
  (For the latest GPUs that support the 4-way/3-way CrossFire/SLI technology, please refer to the AMD/NVIDIA® website.) (Note 1)
- CrossFire (Note 2)/SLI bridge connectors
- A power supply with sufficient power is recommended (Refer to the manual of your graphics cards for the power requirement)

B. Connecting the Graphics Cards

Step 1:
Observe the steps in "1-5 Installing an Expansion Card" and install CrossFire/SLI graphics cards on the PCI Express x16 slots. (To set up a 2-Way configuration, we recommend installing the graphics cards on the PCIEX16_1 and PCIEX16_2 slots.)
Step 2:
Insert the CrossFire (Note 2)/SLI bridge connectors in the CrossFire/SLI gold edge connectors on top of the cards.
Step 3:
Plug the display cable into the graphics card on the PCIEX16_1 slot.

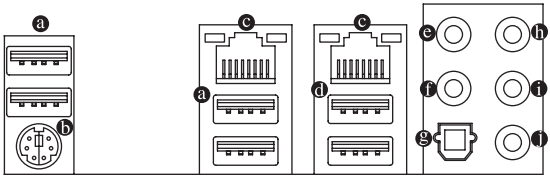
C. Configuring the Graphics Card Driver

C-1. To Enable CrossFire Function
After installing the graphics card driver in the operating system, go to the **AMD RADEON SETTINGS** screen. Browse to **Gaming\Global Settings** and ensure **AMD CrossFire** is set to **On**.
C-2. To Enable SLI Function
After installing the graphics card driver in the operating system, go to the **NVIDIA Control Panel**. Browse to the **Configure SLI, Surround, Physx** screen and ensure **Maximize 3D performance** is enabled.

(Note 1) When using dual core graphics cards, only 2-way is supported.
(Note 2) The bridge connector(s) may be needed or not depending on your graphics cards.
(Note 3) When two or more graphics cards are installed, we recommend that you connect the power cable from the power supply to the OC_PEG1/OC_PEG2 connector to ensure system stability.

Procedure and driver screen for enabling CrossFire/SLI technology may differ by graphics cards and driver version. Refer to the manual that came with your graphics cards for more information about enabling CrossFire/SLI technology.

1-7 Back Panel Connectors



a USB 2.0/1.1 Port

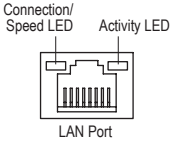
The USB port supports the USB 2.0/1.1 specification. Use this port for USB devices.

b PS/2 Keyboard/Mouse Port

Use this port to connect a PS/2 mouse or keyboard.

c RJ-45 LAN Port

The Gigabit Ethernet LAN port provides Internet connection at up to 1 Gbps data rate. The following describes the states of the LAN port LEDs.



Connection/Speed LED:

State	Description
Orange	1 Gbps data rate
Green	100 Mbps data rate
Off	10 Mbps data rate

Activity LED:

State	Description
Blinking	Data transmission or receiving is occurring
On	No data transmission or receiving is occurring

d USB 3.1 Gen 1 Port

The USB 3.1 Gen 1 port supports the USB 3.1 Gen 1 specification and is compatible to the USB 2.0 specification. Use this port for USB devices.

e Center/Subwoofer Speaker Out

Use this audio jack to connect center/subwoofer speakers.

f Rear Speaker Out

Use this audio jack to connect rear speakers.

g Optical S/PDIF Out Connector

This connector provides digital audio out to an external audio system that supports digital optical audio. Before using this feature, ensure that your audio system provides an optical digital audio in connector.

h Line In/Side Speaker Out

The line in jack. Use this audio jack for line in devices such as an optical drive, walkman, etc.

i Line Out/Front Speaker Out

The line out jack. This jack supports audio amplifying function. For better sound quality, it is recommended that you connect your headphone/speaker to this jack (actual effects may vary by the device being used).

l Mic In/Side Speaker Out

The Mic in jack.

Audio Jack Configurations:

Jack	Headphone/ 2-channel	4-channel	5.1-channel	7.1-channel
Center/Subwoofer Speaker Out			✔	✔
Rear Speaker Out		✔	✔	✔
Line In/Side Speaker Out				✔
Line Out/Front Speaker Out	✔	✔	✔	✔
Mic In/Side Speaker Out				✔

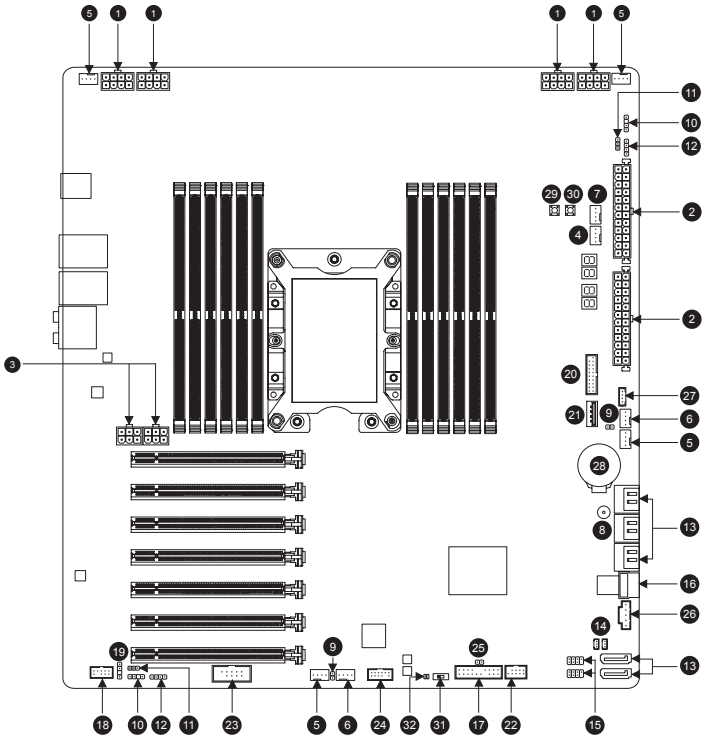


If you want to install a Side Speaker, you need to retask either the Line in or Mic in jack to be Side Speaker out through the audio driver.



- When removing the cable connected to a back panel connector, first remove the cable from your device and then remove it from the motherboard.
- When removing the cable, pull it straight out from the connector. Do not rock it side to side to prevent an electrical short inside the cable connector.

1-8 Internal Connectors



1	ATX_12V_2X4_1~4	12	LED_C1/C2	23	COMC
2	ATX/ATX_1	13	SATA3 0~7	24	TPM
3	OC_PEG_1/2	14	SATA_DOM0/1	25	CLR_CMOS
4	CPU_FAN	15	I_SGPIO1/2	26	PMBUS
5	SYS_FAN1~4	16	U2_32G	27	VROC
6	SYS_FAN5/6_PUMP	17	F_PANEL	28	BAT
7	CPU_OPT	18	F_AUDIO	29	PW_SW
8	BUZZER	19	SPDIF_O	30	RST_SW
9	EC_TEMP1/2	20	F_USB30_1	31	BIOS_SW
10	D_LED1/2	21	USB30_OB_1	32	MBIOS/BBIOS_LED
11	DLED_V_SW1/2	22	F_USB		

Read the following guidelines before connecting external devices:

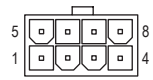
- First make sure your devices are compliant with the connectors you wish to connect.
- Before installing the devices, be sure to turn off the devices and your computer. Unplug the power cord from the power outlet to prevent damage to the devices.
- After installing the device and before turning on the computer, make sure the device cable has been securely attached to the connector on the motherboard.

1/2) ATX_12V_2X4_1~4/ATX/ATX_1 (2x4 12V Power Connectors and 2x12 Main Power Connectors)

With the use of the power connector, the power supply can supply enough stable power to all the components on the motherboard. Before connecting the power connector, first make sure the power supply is turned off and all devices are properly installed. The power connector possesses a foolproof design. Connect the power supply cable to the power connector in the correct orientation.

The 12V power connector mainly supplies power to the CPU. If the 12V power connector is not connected, the computer will not start.

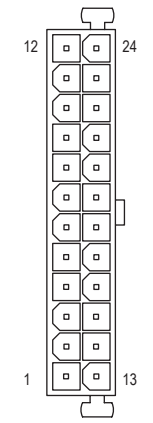
To meet expansion requirements, it is recommended that a power supply that can withstand high power consumption be used. If a power supply is used that does not provide the required power, the result can lead to an unstable or unbootable system.



ATX_12V_2X4

ATX_12V_2X4_1~4:

Pin No.	Definition	Pin No.	Definition
1	GND (Only for 2x4-pin 12V)	5	+12V (Only for 2x4-pin 12V)
2	GND (Only for 2x4-pin 12V)	6	+12V (Only for 2x4-pin 12V)
3	GND	7	+12V
4	GND	8	+12V



ATX

ATX/ATX_1:

Pin No.	Definition	Pin No.	Definition
1	3.3V	13	3.3V
2	3.3V	14	-12V
3	GND	15	GND
4	+5V	16	PS_ON (soft On/Off)
5	GND	17	GND
6	+5V	18	GND
7	GND	19	GND
8	Power Good	20	NC
9	5VSB (stand by +5V)	21	+5V
10	+12V	22	+5V
11	+12V (Only for 2x12-pin ATX)	23	+5V (Only for 2x12-pin ATX)
12	3.3V (Only for 2x12-pin ATX)	24	GND (Only for 2x12-pin ATX)

Guidelines for connecting the power supply and power connectors:

This motherboard can be powered by two power supplies. Actual power requirement is dependent on your hardware configuration. The following table explains how to connect the power supply cables when one or two power supplies are used.

- **When one power supply is used:**

ATX Connector (Main)	ATX_1 Connector	ATX_12V_2X4_1 and ATX_12V_2X4_2 (on the left)	ATX_12V_2X4_3 and ATX_12V_2X4_4 (on the right)
Connect	Do Not Connect	Connect either one	Connect either one

- **When two power supplies are used:**

ATX Connector (Main)	ATX_1 Connector	ATX_12V_2X4_1 and ATX_12V_2X4_2 (on the left)	ATX_12V_2X4_3 and ATX_12V_2X4_4 (on the right)
Connect	Connect	Connect both	Connect both

3) OC_PEG_1/OC_PEG_2 (PCIe Power Connectors)

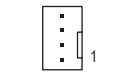
The power connectors provide auxiliary power to the onboard PCI Express x16 slots. When two or more graphics cards are installed, we recommend that you connect the power cables from the power supply to the connectors to ensure system stability.



Pin No.	Definition
1	+12V
2	+12V
3	+12V
4	GND
5	GND
6	GND

4/5) CPU_FAN/SYS_FAN1/2/3/4 (Fan Headers)

All fan headers on this motherboard are 4-pin. Most fan headers possess a foolproof insertion design. When connecting a fan cable, be sure to connect it in the correct orientation (the black connector wire is the ground wire). The speed control function requires the use of a fan with fan speed control design. For optimum heat dissipation, it is recommended that a system fan be installed inside the chassis.



CPU_FAN/SYS_FAN4



SYS_FAN1/SYS_FAN2



SYS_FAN3

Pin No.	Definition
1	GND
2	Voltage Speed Control
3	Sense
4	PWM Speed Control

6) SYS_FAN5/6_PUMP (System Fan/Water Cooling Pump Headers)

The fan/pump header is 4-pin and possesses a foolproof insertion design. Most fan headers possess a foolproof insertion design. When connecting a fan cable, be sure to connect it in the correct orientation (the black connector wire is the ground wire). The speed control function requires the use of a fan with fan speed control design. For optimum heat dissipation, it is recommended that a system fan be installed inside the chassis. The header also provides speed control for a water cooling pump, refer to Chapter 2, "BIOS Setup," "M.I.T.," for more information.



SYS_FAN5_PUMP



SYS_FAN6_PUMP

Pin No.	Definition
1	GND
2	Voltage Speed Control
3	Sense
4	PWM Speed Control

- Be sure to connect fan cables to the fan headers to prevent your CPU and system from overheating. Overheating may result in damage to the CPU or the system may hang.
- These fan headers are not configuration jumper blocks. Do not place a jumper cap on the headers.

7) CPU_OPT (Water Cooling CPU Fan Header)

The fan header is 4-pin and possesses a foolproof insertion design. Most fan headers possess a foolproof insertion design. When connecting a fan cable, be sure to connect it in the correct orientation (the black connector wire is the ground wire). The speed control function requires the use of a fan with fan speed control design.



Pin No.	Definition
1	GND
2	Voltage Speed Control
3	Sense
4	PWM Speed Control

- Be sure to connect fan cables to the fan headers to prevent your CPU and system from overheating. Overheating may result in damage to the CPU or the system may hang.
- These fan headers are not configuration jumper blocks. Do not place a jumper cap on the headers.

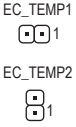
8) BUZZER

The system reports system startup status by issuing a beep code. One single short beep will be heard if no problem is detected at system startup.



9) EC_TEMP1/EC_TEMP2 (Temperature Sensor Headers)

Connect the thermistor cables to the headers for temperature detection.



Pin No.	Definition
1	SENSOR IN
2	GND

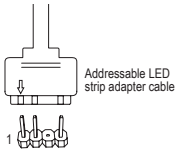
10) D_LED1/D_LED2 (Addressable LED Strip Headers)

The headers can be used to connect a standard 5050 addressable LED strip, with maximum power rating of 5A (12V or 5V) and maximum number of 1000 LEDs. There are 12V and 5V addressable LED strips. Be sure to verify the voltage requirements of your addressable LED strip and set the DLED_V_SW1 and DLED_V_SW2 jumpers accordingly.





Pin No.	Definition
1	V
2	D
3	No Pin
4	G



Connect one end of the included addressable LED strip adapter cable to this header and the other end to your addressable LED strip. The power pin (marked with a triangle on the plug) of the LED strip must be connected to Pin 1 of the addressable LED strip header. Incorrect connection may lead to the damage of the LED strip.

For how to turn on/off the lights of the LED strip please visit the "Unique Features" webpage of GIGABYTE's website.

Before installing the devices, be sure to turn off the devices and your computer. Unplug the power cord from the power outlet to prevent damage to the devices.

11) DLED_V_SW1/DLED_V_SW2 (Addressable LED Strip Power Select Jumpers)

The jumpers allow you to select the supply voltage of the D_LED1 and D_LED2 headers. Be sure to verify the voltage requirements of your addressable LED strip and set the correct voltage with this jumper before connection. Incorrect connection may lead to the damage of the LED strip.



1-2: 5V (Default)



2-3: 12V

DLED_V_SW1



1-2: 5V (Default)

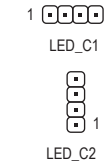


2-3: 12V

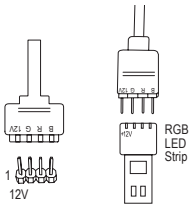
DLED_V_SW2

12) LED_C1/LED_C2 (RGB LED Strip Headers)

The headers can be used to connect a standard 5050 RGB LED strip (12V/G/R/B), with maximum power rating of 2A (12V) and maximum length of 2m.



Pin No.	Definition
1	12V
2	G
3	R
4	B

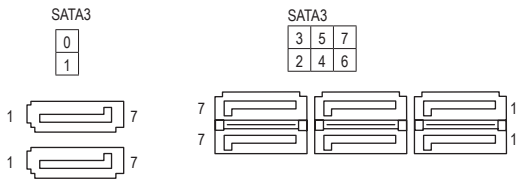


Connect one end of the RGB LED strip extension cable to the header and the other end to your RGB LED strip. The black wire (marked with a triangle on the plug) of the extension cable must be connected to Pin 1 (12V) of this header. The 12V pin (marked with an arrow) on the other end of the extension cable must be lined up with the 12V of the LED strip. Be careful with the connection orientation of the LED strip; incorrect connection may lead to the damage of the LED strip.

Before installing the devices, be sure to turn off the devices and your computer. Unplug the power cord from the power outlet to prevent damage to the devices.

13) SATA3 0/1/2/3/4/5/6/7 (SATA 6Gb/s Connectors)

The SATA connectors conform to SATA 6Gb/s standard and are compatible with SATA 3Gb/s and SATA 1.5Gb/s standard. Each SATA connector supports a single SATA device. The Intel® Chipset supports RAID 0, RAID 1, RAID 5, and RAID 10. Refer to Chapter 3, "Configuring a RAID Set," for instructions on configuring a RAID array.



Pin No.	Definition
1	GND
2	TXP
3	TXN
4	GND
5	RXN
6	RXP
7	GND

To enable hot-plugging for the SATA ports, refer to Chapter 2, "BIOS Setup," "Peripherals\PCH SATA Configuration," for more information.

14) SATA_DOM0/1 (SATA Power Headers)

The headers can provide power to SATA devices.



Pin No.	Definition
1	+5V
2	GND
3	NC

15) I_SGPIO1/I_SGPIO2 (SATA Detection Headers)

The headers can connect to SATA detection devices.



I_SGPIO1:

Pin No.	Definition
1	NC
2	No Pin
3	DATA0
4	NC
5	NC
6	LOAD
7	NC
8	CLOCK

I_SGPIO2:

Pin No.	Definition
1	NC
2	No Pin
3	DATA1
4	NC
5	NC
6	LOAD
7	NC
8	CLOCK

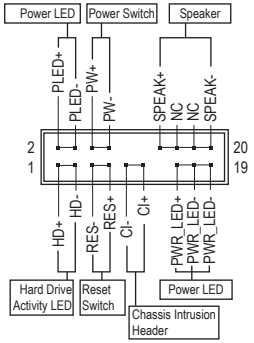
16) U2_32G (U.2 Connector)

The U.2 connector supports a single U.2 device.



17) F_PANEL (Front Panel Header)

Connect the power switch, reset switch, speaker, chassis intrusion switch/sensor and system status indicator on the chassis to this header according to the pin assignments below. Note the positive and negative pins before connecting the cables.



- **PLED/PWR_LED** (Power LED, Yellow/Purple):

System Status	LED
S0	On
S3/S4/S5	Off

Connects to the power status indicator on the chassis front panel. The LED is on when the system is operating. The LED is off when the system is in S3/S4 sleep state or powered off (S5).

- **PW** (Power Switch, Red):
  Connects to the power switch on the chassis front panel. You may configure the way to turn off your system using the power switch (refer to Chapter 2, "BIOS Setup," "Power," for more information).
- **SPEAK** (Speaker, Orange):
  Connects to the speaker on the chassis front panel. The system reports system startup status by issuing a beep code. One single short beep will be heard if no problem is detected at system startup.
- **HD** (Hard Drive Activity LED, Blue):
  Connects to the hard drive activity LED on the chassis front panel. The LED is on when the hard drive is reading or writing data.
- **RES** (Reset Switch, Green):
  Connects to the reset switch on the chassis front panel. Press the reset switch to restart the computer if the computer freezes and fails to perform a normal restart.
- **CI** (Chassis Intrusion Header, Gray):
  Connects to the chassis intrusion switch/sensor on the chassis that can detect if the chassis cover has been removed. This function requires a chassis with a chassis intrusion switch/sensor.
- **NC** (Orange): No Connection.

The front panel design may differ by chassis. A front panel module mainly consists of power switch, reset switch, power LED, hard drive activity LED, speaker and etc. When connecting your chassis front panel module to this header, make sure the wire assignments and the pin assignments are matched correctly.

18) F_AUDIO (Front Panel Audio Header)

The front panel audio header supports High Definition audio (HD). You may connect your chassis front panel audio module to this header. Make sure the wire assignments of the module connector match the pin assignments of the motherboard header. Incorrect connection between the module connector and the motherboard header will make the device unable to work or even damage it.



Pin No.	Definition	Pin No.	Definition
1	MIC2_L	6	Sense
2	GND	7	FAUDIO_JD
3	MIC2_R	8	No Pin
4	NC	9	LINE2_L
5	LINE2_R	10	Sense

Some chassis provide a front panel audio module that has separated connectors on each wire instead of a single plug. For information about connecting the front panel audio module that has different wire assignments, please contact the chassis manufacturer.

19) SPDIF_O (S/PDIF Out Header)

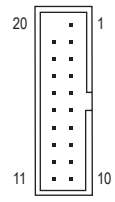
This header supports digital S/PDIF Out and connects a S/PDIF digital audio cable (provided by expansion cards) for digital audio output from your motherboard to certain expansion cards like graphics cards and sound cards. For example, some graphics cards may require you to use a S/PDIF digital audio cable for digital audio output from your motherboard to your graphics card if you wish to connect an HDMI display to the graphics card and have digital audio output from the HDMI display at the same time. For information about connecting the S/PDIF digital audio cable, carefully read the manual for your expansion card.



Pin No.	Definition
1	5VDUAL
2	No Pin
3	SPDIFO
4	GND

20) F_USB30_1 (USB 3.1 Gen 1 Header)

The header conforms to USB 3.1 Gen 1 and USB 2.0 specification and can provide two USB ports. For purchasing the optional 3.5" front panel that provides two USB 3.1 Gen 1 ports, please contact the local dealer.



Pin No.	Definition	Pin No.	Definition	Pin No.	Definition
1	VBUS	8	D1-	15	SSTX2-
2	SSRX1-	9	D1+	16	GND
3	SSRX1+	10	NC	17	SSRX2+
4	GND	11	D2+	18	SSRX2-
5	SSTX1-	12	D2-	19	VBUS
6	SSTX1+	13	GND	20	No Pin
7	GND	14	SSTX2+		

Prior to installing the USB bracket, be sure to turn off your computer and unplug the power cord from the power outlet to prevent damage to the USB bracket.

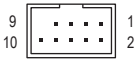
21) USB30_OB_1 (USB 3.1 Gen 1 Port)

The USB port makes it easier to save data, flash the BIOS or install software in open bench testing platforms whether for extreme overclocking or simply pretesting the PC before final component installation inside a case scenarios where accessing the rear panel IO can be an inconvenience.



22) F_USB (USB 2.0/1.1 Header)

The header conforms to USB 2.0/1.1 specification. Each USB header can provide two USB ports via an optional USB bracket. For purchasing the optional USB bracket, please contact the local dealer.

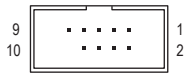


Pin No.	Definition	Pin No.	Definition
1	Power (5V)	6	USB DY+
2	Power (5V)	7	GND
3	USB DX-	8	GND
4	USB DY-	9	No Pin
5	USB DX+	10	NC

- Do not plug the IEEE 1394 bracket (2x5-pin) cable into the USB 2.0/1.1 header.
- Prior to installing the USB bracket, be sure to turn off your computer and unplug the power cord from the power outlet to prevent damage to the USB bracket.

23) COMC (Serial Port Header)

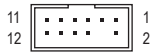
The COM header can provide one serial port via an optional COM port cable. For purchasing the optional COM port cable, please contact the local dealer.



Pin No.	Definition	Pin No.	Definition
1	NDCD-	6	NDSR-
2	NSIN	7	NRTS-
3	NSOUT	8	NCTS-
4	NDTR-	9	NRI-
5	GND	10	No Pin

24) TPM (Trusted Platform Module Header)

You may connect a TPM (Trusted Platform Module) to this header.



Pin No.	Definition	Pin No.	Definition
1	LAD0	7	LAD3
2	VCC3	8	GND
3	LAD1	9	LFRAME
4	No Pin	10	NC
5	LAD2	11	SERIRQ
6	LCLK	12	LRESET

25) CLR_CMOS (Clear CMOS Jumper)

Use this jumper to clear the BIOS configuration and reset the CMOS values to factory defaults. To clear the CMOS values, use a metal object like a screwdriver to touch the two pins for a few seconds.


Open: Normal


Short: Clear CMOS Values

- Always turn off your computer and unplug the power cord from the power outlet before clearing the CMOS values.
- After system restart, go to BIOS Setup to load factory defaults (select Load Optimized Defaults) or manually configure the BIOS settings (refer to Chapter 2, "BIOS Setup," for BIOS configurations).

26) PMBUS (Power Information Detection Header)

The header allows for detection of the power information which can be displayed via the system software.



Pin No.	Definition
1	PMBUS_CLOCK
2	PMBUS_DATA
3	PMBUS_ALERT
4	GND
5	3.3V

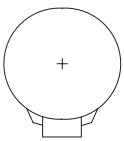
27) VROC (Intel® VROC Upgrade Key Header)

This header can be used to connected an Intel® VROC Upgrade Key.



28) BAT (Battery)

The battery provides power to keep the values (such as BIOS configurations, date, and time information) in the CMOS when the computer is turned off. Replace the battery when the battery voltage drops to a low level, or the CMOS values may not be accurate or may be lost.



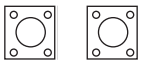
You may clear the CMOS values by removing the battery:

1. Turn off your computer and unplug the power cord.
2. Gently remove the battery from the battery holder and wait for one minute. (Or use a metal object like a screwdriver to touch the positive and negative terminals of the battery holder, making them short for 5 seconds.)
3. Replace the battery.
4. Plug in the power cord and restart your computer.

- Always turn off your computer and unplug the power cord before replacing the battery.
- Replace the battery with an equivalent one. Damage to your devices may occur if the battery is replaced with an incorrect model.
- Contact the place of purchase or local dealer if you are not able to replace the battery by yourself or uncertain about the battery model.
- When installing the battery, note the orientation of the positive side (+) and the negative side (-) of the battery (the positive side should face up).
- Used batteries must be handled in accordance with local environmental regulations.

29/30) PW_SW/RST_SW (Power Button/Reset Button)

The power button and reset button allow users to quickly turn on/off or reset the computer in an open-case environment when they want to change hardware components or conduct hardware testing.



PW_SW RST_SW

31) BIOS_SW (BIOS Switch)

32) MBIOS_LED/BBIOS_LED (BIOS LED Indicators)

The BIOS switch allows users to easily select a different BIOS for boot up or overclocking, helping to reduce BIOS failure during overclocking. The LED indicator (MBIOS_LED/BBIOS_LED) shows which BIOS is active.



1: Main BIOS (Boot from the main BIOS)



2: Backup BIOS (Boot from the backup BIOS)



Always turn off your computer and unplug the power cord from the power outlet before using the BIOS switch.

Chapter 2 BIOS Setup

BIOS (Basic Input and Output System) records hardware parameters of the system in the CMOS on the motherboard. Its major functions include conducting the Power-On Self-Test (POST) during system startup, saving system parameters and loading operating system, etc. BIOS includes a BIOS Setup program that allows the user to modify basic system configuration settings or to activate certain system features.
When the power is turned off, the battery on the motherboard supplies the necessary power to the CMOS to keep the configuration values in the CMOS.
To access the BIOS Setup program, press the <Delete> key during the POST when the power is turned on.
To upgrade the BIOS, use either the GIGABYTE Q-Flash or @BIOS utility.

- Q-Flash allows the user to quickly and easily upgrade or back up BIOS without entering the operating system.
- @BIOS is a Windows-based utility that searches and downloads the latest version of BIOS from the Internet and updates the BIOS.

- Because BIOS flashing is potentially risky, if you do not encounter problems using the current version of BIOS, it is recommended that you not flash the BIOS. To flash the BIOS, do it with caution. Inadequate BIOS flashing may result in system malfunction.
- It is recommended that you not alter the default settings (unless you need to) to prevent system instability or other unexpected results. Inadequately altering the settings may result in system's failure to boot. If this occurs, try to clear the CMOS values and reset the board to default values. (Refer to the "Load Optimized Defaults" section in this chapter or introductions of the battery/clear CMOS jumper in Chapter 1 for how to clear the CMOS values.)

2-1 Startup Screen

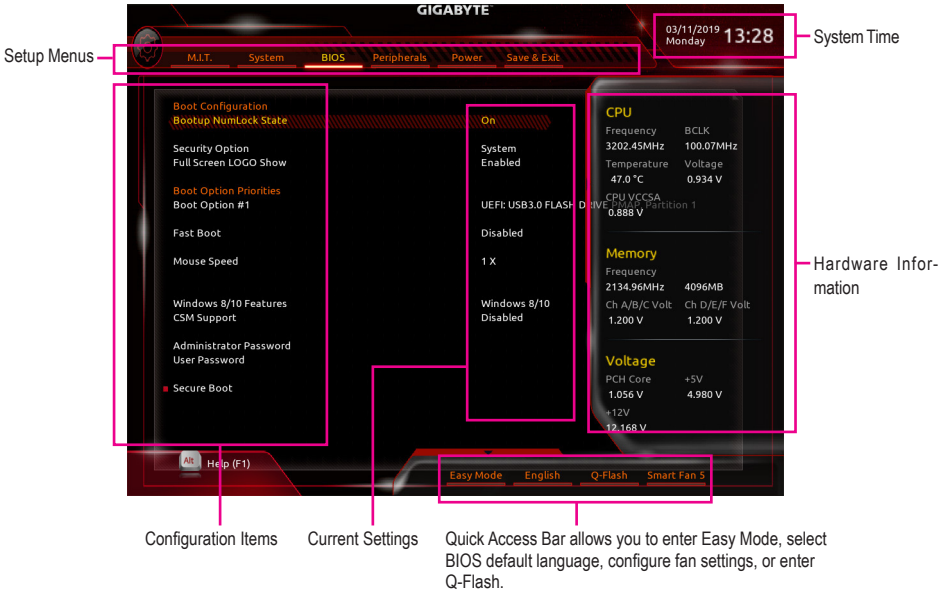
The following startup Logo screen will appear when the computer boots.
(Sample BIOS Version: T10)



There are two different BIOS modes as follows and you can use the <F2> key to switch between the two modes. The Classic Setup mode provides detailed BIOS settings. You can press the arrow keys on your keyboard to move among the items and press <Enter> to accept or enter a sub-menu. Or you can use your mouse to select the item you want. Easy Mode allows users to quickly view their current system information or to make adjustments for optimum performance. In Easy Mode, you can use your mouse to move through configuration items.

- When the system is not stable as usual, select the **Load Optimized Defaults** item to set your system to its defaults.
- The BIOS Setup menus described in this chapter are for reference only and may differ by BIOS version.

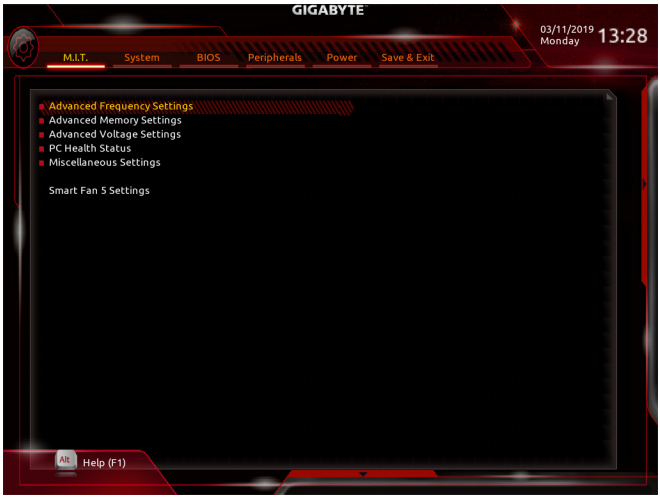
2-2 The Main Menu



Classic Setup Function Keys

<←><→>	Move the selection bar to select a setup menu
<↑><↓>	Move the selection bar to select an configuration item on a menu
<Enter>	Execute command or enter a menu
<+>/<Page Up>	Increase the numeric value or make changes
<->/<Page Down>	Decrease the numeric value or make changes
<F1>	Show descriptions of the function keys
<F2>	Switch to Easy Mode
<F5>	Restore the previous BIOS settings for the current submenus
<F7>	Load the Optimized BIOS default settings for the current submenus
<F8>	Access the Q-Flash utility
<F9>	Display system information
<F10>	Save all the changes and exit the BIOS Setup program
<F12>	Capture the current screen as an image and save it to your USB drive
<Esc>	Main Menu: Exit the BIOS Setup program Submenus: Exit current submenu

2-3 M.I.T.



Whether the system will work stably with the overclock/overvoltage settings you made is dependent on your overall system configurations. Incorrectly doing overclock/overvoltage may result in damage to CPU, chipset, or memory and reduce the useful life of these components. This page is for advanced users only and we recommend you not to alter the default settings to prevent system instability or other unexpected results. (Inadequately altering the settings may result in system's failure to boot. If this occurs, clear the CMOS values and reset the board to default values.)

▶ Advanced Frequency Settings

☞ CPU BCLK Frequency

Allows you to manually set the CPU base clock in 0.01 MHz increments. (Default: Auto)

Important: It is highly recommended that the CPU frequency be set in accordance with the CPU specifications.

☞ PCIe/DMI/PEG Frequency

Allows you to manually set the host clock frequency (which controls CPU, PCIe, and memory frequencies) in 0.01 MHz increments.

☞ BCLK Coarse Ratio (Note)

This value is determined by multiplying the **PCIe/DMI/PEG Frequency** value by several preset host clock multipliers.

☞ Target CPU BCLK Frequency

Displays the current CPU BCLK Frequency.

☞ Spread Spectrum Control (Note)

Enables or disables CPU/PCIe Spread Spectrum. (Default: Auto)

☞ CPU Clock Ratio

Allows you to alter the clock ratio for the installed CPU. The adjustable range is dependent on the CPU being installed.

☞ CPU Frequency

Displays the current operating CPU frequency.

(Note) This item is present only when you install a CPU that supports this feature. For more information about Intel® CPUs' unique features, please visit Intel's website.

▶ Advanced CPU Core Settings

☞ CPU Clock Ratio, CPU Frequency

The settings above are synchronous to those under the same items on the **Advanced Frequency Settings** menu.

☞ AVX Offset (Note)

AVX offset is the negative offset of AVX ratio.

☞ AVX 512 (Note)

Allows you to configure AVX 512 instructions. (Default: Auto)

☞ TjMAX Temperature (Note)

Allows you to fine-tune the TJ Max offset value. (Default: 0)

☞ CPU PLL Trim (Note)/MC PLL Trim (Note)/PLL Trim Threshold (Note)

Allows you to fine-tune CPU/MC PLL related settings. (Default: Auto)

☞ Turbo Residency Tweak LUT0~LUT3 (Note)

Allows you to fine-tune the Turbo Residency related settings. (Default: Auto)

☞ CLR (MESH) Ratio

Allows you to set the CPU Uncore ratio. The adjustable range is dependent on the CPU being used.

☞ CLR (MESH) Frequency

Displays the current CPU Uncore frequency.

☞ CPU Flex Ratio Override (Note)

Enables or disables the CPU Flex Ratio. The maximum CPU clock ratio will be based on the **CPU Flex Ratio Settings** value if **CPU Clock Ratio** is set to **Auto**. (Default: Disabled)

☞ CPU Flex Ratio Settings (Note)

Allows you to set the CPU Flex Ratio. The adjustable range may vary by CPU.

☞ Intel(R) Turbo Boost Technology (Note)

Allows you to determine whether to enable the Intel® CPU Turbo Boost technology. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ Turbo Ratio (Note)

Allows you to set the CPU Turbo ratios for different number of active cores. **Auto** sets the CPU Turbo ratios according to the CPU specifications. (Default: Auto)

☞ Active Cores Control (Note)

Allows you to select the number of CPU cores to enable in an Intel® multi-core CPU (the number of CPU cores may vary by CPU). **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ Hyper-Threading Technology (Note)

Allows you to determine whether to enable multi-threading technology when using an Intel® CPU that supports this function. This feature only works for operating systems that support multi-processor mode. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ Power Limit TDP (Watts) / Power Limit Time

Allows you to set the power limit for CPU Turbo mode and how long it takes to operate at the specified power limit. If the specified value is exceeded, the CPU will automatically reduce the core frequency in order to reduce the power. **Auto** sets the power limit according to the CPU specifications. (Default: Auto)

☞ Core Current Limit (Amps)

Allows you to set a current limit for CPU Turbo mode. When the CPU current exceeds the specified current limit, the CPU will automatically reduce the core frequency in order to reduce the current. **Auto** sets the power limit according to the CPU specifications. (Default: Auto)

(Note) This item is present only when you install a CPU that supports this feature. For more information about Intel® CPUs' unique features, please visit Intel's website.

☞ **Intel(R) Turbo Boost Max Technology 3.0** (Note 1)
Enables or disables Intel® Turbo Boost Max Technology 3.0. Intel® Turbo Boost Max Technology 3.0 allows the system to identify the processor's best performance core and lets you manually direct the most critical workloads to it. You can even adjust the frequency of each core individually for performance optimization. Options are: Native Mode, Legacy. (Default: Native Mode)

☞ **Intel(R) Speed Shift Technology (Intel® Speed Shift Technology)** (Note 1)
Enables or disables Intel® Speed Shift Technology. Enabling this feature allows the processor to ramp up its operating frequency more quickly and then improves the system responsiveness. (Default: Enabled)

☞ **CPU Enhanced Halt (C1E)** (Note 1)
Enables or disables Intel® CPU Enhanced Halt (C1E) function, a CPU power-saving function in system halt state. When enabled, the CPU core frequency and voltage will be reduced during system halt state to decrease power consumption. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **C6/C7 State Support** (Note 1)
Allows you to determine whether to let the CPU enter C6/C7 mode in system halt state. When enabled, the CPU core frequency and voltage will be reduced during system halt state to decrease power consumption. The C6/C7 state is a more enhanced power-saving state than C3. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **Package C State Limit** (Note 1)
Allows you to specify the C-state limit for the processor. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **CPU Thermal Monitor** (Note 1)
Enables or disables Intel® Thermal Monitor function, a CPU overheating protection function. When enabled, the CPU core frequency and voltage will be reduced when the CPU is overheated. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **CPU EIST Function** (Note 1)
Enables or disables Enhanced Intel® Speed Step Technology (EIST). Depending on CPU loading, Intel® EIST technology can dynamically and effectively lower the CPU voltage and core frequency to decrease average power consumption and heat production. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **Energy Efficient Turbo** (Note 1)
Enables or disables the CPU power saving related settings.

☞ **Hardware Prefetcher**
Allows you to determine whether to enable hardware prefetcher to prefetch data and instructions from the memory into the cache. (Default: Auto)

☞ **Adjacent Cache Line Prefetch**
Allows you to determine whether to enable the adjacent cache line prefetch mechanism that lets the processor retrieve the requested cache line as well as the subsequent cache line. (Default: Auto)

☞ **Extreme Memory Profile (X.M.P.)** (Note 2)
Allows the BIOS to read the SPD data on XMP memory module(s) to enhance memory performance when enabled.

▸▸ Disabled	Disables this function. (Default)
▸▸ Profile1	Uses Profile 1 settings.
▸▸ Profile2 (Note 2)	Uses Profile 2 settings.

☞ **System Memory Multiplier**
Allows you to set the system memory multiplier. **Auto** sets memory multiplier according to memory SPD data. (Default: Auto)

(Note 1) This item is present only when you install a CPU that supports this feature. For more information about Intel® CPUs' unique features, please visit Intel's website.

(Note 2) This item is present only when you install a CPU and a memory module that support this feature.

☞ Memory Ref Clock
Allows you to manually adjust the memory reference clock. (Default: Auto)

☞ Memory Frequency (MHz)
The first memory frequency value is the normal operating frequency of the memory being used; the second is the memory frequency that is automatically adjusted according to the **System Memory Multiplier** settings.

▶ Advanced Memory Settings

☞ Extreme Memory Profile (X.M.P.) (Note), System Memory Multiplier, Memory Ref Clock, Memory Frequency(MHz)
The settings above are synchronous to those under the same items on the **Advanced Frequency Settings** menu.

☞ Memory Boot Mode (Note)
Provides memory detection and training methods.

▸▸ Auto	Lets the BIOS automatically configure this setting. (Default)
▸▸ Normal	The BIOS automatically performs memory training. Please note that if the system becomes unstable or unbootable, try to clear the CMOS values and reset the board to default values. (Refer to the introductions of the battery/clear CMOS jumper in Chapter 1 for how to clear the CMOS values.)
▸▸ Enable Fast Boot	Skip memory detection and training in some specific criteria for faster memory boot.
▸▸ Disable Fast Boot	Detect and train memory at every single boot.

☞ Memory Enhancement Settings
Provides several memory performance enhancement settings: Normal (basic performance), Relax OC, Enhanced Stability, and Enhanced Performance. (Default: Normal)

☞ Memory Timing Mode
Manual and **Advanced Manual** allows the **Memory Multiplier Tweaker**, **Channel Interleaving**, **Rank Interleaving**, and memory timing settings below to be configurable. Options are: Auto (default), Manual, Advanced Manual.

☞ Profile DDR Voltage
When using a non-XMP memory module or **Extreme Memory Profile (X.M.P.)** is set to **Disabled**, the value is displayed according to your memory specification. When **Extreme Memory Profile (X.M.P.)** is set to **Profile1** or **Profile2**, the value is displayed according to the SPD data on the XMP memory.

☞ Memory Multiplier Tweaker
Provides different levels of memory auto-tuning. (Default: Auto)

☞ Channel Interleaving
Enables or disables memory channel interleaving. **Enabled** allows the system to simultaneously access different channels of the memory to increase memory performance and stability. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ Rank Interleaving
Enables or disables memory rank interleaving. **Enabled** allows the system to simultaneously access different ranks of the memory to increase memory performance and stability. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

(Note) This item is present only when you install a CPU and a memory module that support this feature.

☞ **Channel A, B/C, D, E/F Memory Sub Timings**
This sub-menu provides memory timing settings for each channel of memory. The respective timing setting screens are configurable only when **Memory Timing Mode** is set to **Manual** or **Advanced Manual**. Note: Your system may become unstable or fail to boot after you make changes on the memory timings. If this occurs, please reset the board to default values by loading optimized defaults or clearing the CMOS values.

▶ **Advanced Voltage Settings**

▶ **Advanced Power Settings**

☞ **CPU Vcore Loadline Calibration**
Allows you to configure Load-Line Calibration for the CPU Vcore voltage. Selecting a higher level keeps the CPU Vcore voltage more consistent with what is set in BIOS under heavy load. **Auto** lets the BIOS automatically configure this setting and sets the voltage following Intel's specifications. (Default: Auto)

☞ **CPU Vcore Protection**
Allows you to set the over-current protection level for the CPU Vcore voltage. The adjustable range is from 150.0mV to 400.0mV. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **DDR CH(A/B/C) Voltage Protection**
Allows you to set the over-current protection level for Channels A, B, C memory voltage. The adjustable range is from 150.0mV to 400.0mV. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **DDR CH(D/E/F) Voltage Protection**
Allows you to set the over-current protection level for Channels D, E, F memory voltage. The adjustable range is from 150.0mV to 400.0mV. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **CPU Vcore Current Protection**
Allows you to set the over-current protection level for the CPU Vcore voltage. Select Standard, Low, Medium, High, Turbo, or Extreme which represents different level of over-current protection for the CPU Vcore voltage. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **DDR CH(A/B/C) Current Protection**
Allows you to set the over-current protection level for Channels A, B, C memory voltage. Select Standard, Low, Medium, High, Turbo, or Extreme which represents different level of over-current protection for the CPU Vcore voltage. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **DDR CH(D/E/F) Current Protection**
Allows you to set the over-current protection level for Channels D, E, F memory voltage. Selects Standard, Low, Medium, High, Turbo, or Extreme which represents different level of over-current protection for the CPU Vcore voltage. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **DDR VPP CH(A/B/C) Current Protection**
Allows you to set the over-current protection level for Channels A, B, C VPP memory voltage. Select Standard, Low, Medium, High, Turbo, or Extreme which represents different level of over-current protection for the CPU Vcore voltage. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **DDR VPP CH(D/E/F) Current Protection**
Allows you to set the over-current protection level for Channels D, E, F VPP memory voltage. SelectsStandard, Low, Medium, High, Turbo, or Extreme which represents different level of over-current protection for the CPU Vcore voltage. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ **CPU Vcore PWM Switch Rate**
Allows you to set the PWM frequency for the CPU Vcore voltage. The adjustable range is from 300.0KHz to 500.0KHz. (Default: Auto)

☞ **DDR CH(A/B/C) PWM Switch Rate**
Allows you to set the PWM frequency for Channels A, B, C memory. The adjustable range is from 300.0KHz to 500.0KHz. (Default: Auto)

☞ **DDR CH(D/E/F) PWM Switch Rate**
Allows you to set the PWM frequency for Channels D, E, F memory. The adjustable range is from 300.0KHz to 500.0KHz. (Default: Auto)

☞ **DDR VPP CH(A/B/C) PWM Switch Rate**
Allows you to set the PWM frequency for Channels A, B, C VPP memory The adjustable range is from 300.0KHz to 500.0KHz. (Default: Auto)

☞ **DDR VPP CH(D/E/F) PWM Switch Rate**
Allows you to set the PWM frequency for Channels D, E, F VPP memory The adjustable range is from 300.0KHz to 500.0KHz. (Default: Auto)

☞ **PWM Phase Control**
Allows you to automatically change the PWM phase according to the CPU load. The power-saving levels are (from lowest to highest): eXm Perf (Extreme Performance), High Perf (High Performance), Perf (Performance), Balanced, Mid PWR (Mid Power), and Lite PWR (Light Power). **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

▶ **CPU Core Voltage Control**
This section provides CPU voltage control options.

▶ **DRAM Voltage Control**
This section provides memory voltage control options.

▶ **PC Health Status**

☞ **Reset Case Open Status**

▸▸ Disabled	Keeps or clears the record of previous chassis intrusion status. (Default)
▸▸ Enabled	Clears the record of previous chassis intrusion status and the **Case Open** field will show "No" at next boot.

☞ **Case Open**
Displays the detection status of the chassis intrusion detection device attached to the motherboard **CI header**. If the system chassis cover is removed, this field will show "Yes", otherwise it will show "No". To clear the chassis intrusion status record, set **Reset Case Open Status** to **Enabled**, save the settings to the CMOS, and then restart your system.

☞ **CPU Vcore /CPU VRIN/Internal CPU Vcore/CPU VCCSA/CPU VCCIO/DRAM Channel A/B/C Voltage/DRAM Channel D/E/F Voltage/DDRVpp A/B/C/DDRVpp D/E/F/+3.3V/+5V/ PCH Core/+12V**
Displays the current system voltages.

▶ **Miscellaneous Settings**

☞ **PCIe Slot Configuration**
Allows you to set the operation mode of the PCI Express slots to Gen 1, Gen 2, or Gen 3. Actual operation mode is subject to the hardware specification of each slot. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

☞ 3DMark01 Enhancement

Allows you to determine whether to enhance some legacy benchmark performance. (Default: Disabled)

▶ Smart Fan 5 Settings

☞ Monitor

Allows you to select a target to monitor and to make further adjustment. (Default: CPU FAN)

☞ Fan Speed Control

Allows you to determine whether to enable the fan speed control function and adjust the fan speed.

- ⏩ Normal — Allows the fan to run at different speeds according to the temperature. You can adjust the fan speed with System Information Viewer based on your system requirements. (Default)
- ⏩ Silent — Allows the fan to run at slow speeds.
- ⏩ Manual — Allows you to control the fan speed in the curve graph.
- ⏩ Full Speed — Allows the fan to run at full speeds.

☞ Fan Control Use Temperature Input

Allows you to select the reference temperature for fan speed control.

☞ Temperature Interval

Allows you to select the temperature interval for fan speed change.

☞ Fan/Pump Control Mode

- ⏩ Auto — Lets the BIOS automatically detect the type of fan/pump installed and sets the optimal control mode. (Default)
- ⏩ Voltage — Voltage mode is recommended for a 3-pin fan/pump.
- ⏩ PWM — PWM mode is recommended for a 4-pin fan/pump.

☞ Fan/Pump Stop

Enables or disables the fan/pump stop function. You can set the temperature limit using the temperature curve. The fan or pump stops operation when the temperature is lower than the limit. (Default: Disabled)

☞ Temperature

Displays the current temperature of the selected target area.

☞ Fan Speed

Displays current fan/pump speeds.

☞ Flow Rate

Displays the flow rate of your water cooling system.

☞ Temperature Warning Control

Sets the warning threshold for temperature. When temperature exceeds the threshold, BIOS will emit warning sound. Options are: Disabled (default), 60°C/140°F, 70°C/158°F, 80°C/176°F, 90°C/194°F.

☞ Fan/Pump Fail Warning

Allows the system to emit warning sound if the fan/pump is not connected or fails. Check the fan/pump condition or fan/pump connection when this occurs. (Default: Disabled)

2-4 System



This section provides information on your motherboard model and BIOS version. You can also select the default language used by the BIOS and manually set the system time.

- **System Language**
  Selects the default language used by the BIOS.
- **System Date**
  Sets the system date. The date format is week (read-only), month, date, and year. Use <Enter> to switch between the Month, Date, and Year fields and use the <Page Up> or <Page Down> key to set the desired value.
- **System Time**
  Sets the system time. The time format is hour, minute, and second. For example, 1 p.m. is 13:00:00. Use <Enter> to switch between the Hour, Minute, and Second fields and use the <Page Up> or <Page Down> key to set the desired value.

2-5 BIOS



☞ **Bootup NumLock State**
Enables or disables Numlock feature on the numeric keypad of the keyboard after the POST. (Default: On)

☞ **Security Option**
Specifies whether a password is required every time the system boots, or only when you enter BIOS Setup. After configuring this item, set the password(s) under the **Administrator Password/User Password** item.

- ⏩ Setup — A password is only required for entering the BIOS Setup program.
- ⏩ System — A password is required for booting the system and for entering the BIOS Setup program. (Default)

☞ **Full Screen LOGO Show**
Allows you to determine whether to display the GIGABYTE Logo at system startup. **Disabled** skips the GIGABYTE Logo when the system starts up. (Default: Enabled)

☞ **Boot Option Priorities**
Specifies the overall boot order from the available devices. Removable storage devices that support GPT format will be prefixed with "UEFI:" string on the boot device list. To boot from an operating system that supports GPT partitioning, select the device prefixed with "UEFI:" string.
Or if you want to install an operating system that supports GPT partitioning such as Windows 10 64-bit, select the optical drive that contains the Windows 10 64-bit installation disk and is prefixed with "UEFI:" string.

☞ **Hard Drive/CD/DVD ROM Drive/Floppy Drive/Network Device BBS Priorities**
Specifies the boot order for a specific device type, such as hard drives, optical drives, floppy disk drives, and devices that support Boot from LAN function, etc. Press <Enter> on this item to enter the submenu that presents the devices of the same type that are connected. This item is present only if at least one device for this type is installed.

☞ **Fast Boot**
Enables or disables Fast Boot to shorten the OS boot process. **Ultra Fast** provides the fastest bootup speed. (Default: Disabled)

SATA Support

- All Sata Devices — All SATA devices are functional in the operating system and during the POST. (Default)
- Last Boot HDD Only — Except for the previous boot drive, all SATA devices are disabled before the OS boot process completes.

This item is configurable only when **Fast Boot** is set to **Enabled** or **Ultra Fast**.

VGA Support

Allows you to select which type of operating system to boot.

- Auto — Enables legacy option ROM only.
- EFI Driver — Enables EFI option ROM. (Default)

This item is configurable only when **Fast Boot** is set to **Enabled** or **Ultra Fast**.

USB Support

- Disabled — All USB devices are disabled before the OS boot process completes.
- Full Initial — All USB devices are functional in the operating system and during the POST.
- Partial Initial — Part of the USB devices are disabled before the OS boot process completes. (Default)

This item is configurable only when **Fast Boot** is set to **Enabled**. This function is disabled when **Fast Boot** is set to **Ultra Fast**.

PS2 Devices Support

- Disabled — All PS/2 devices are disabled before the OS boot process completes.
- Enabled — All PS/2 devices are functional in the operating system and during the POST. (Default)

This item is configurable only when **Fast Boot** is set to **Enabled**. This function is disabled when **Fast Boot** is set to **Ultra Fast**.

NetWork Stack Driver Support

- Disabled — Disables booting from the network. (Default)
- Enabled — Enables booting from the network.

This item is configurable only when **Fast Boot** is set to **Enabled** or **Ultra Fast**.

Redirection Support

Enables or disables this function.

Mouse Speed

Allows you to set the mouse cursor movement speed. (Default: 1 X)

Windows 8/10 Features

Allows you to select the operating system to be installed. (Default: Windows 8/10)

CSM Support

Enables or disables UEFI CSM (Compatibility Support Module) to support a legacy PC boot process.

- Enabled — Enables UEFI CSM. (Default)
- Disabled — Disables UEFI CSM and supports UEFI BIOS boot process only.

LAN PXE Boot Option ROM

Allows you to select whether to enable the legacy option ROM for the LAN controller. (Default: Disabled)
This item is configurable only when CSM Support is set to Enabled.

Storage Boot Option Control

Allows you to select whether to enable the UEFI or legacy option ROM for the storage device controller.

- Do not launch — Disables option ROM.
- Legacy — Enables legacy option ROM only.
- UEFI — Enables UEFI option ROM only. (Default)

This item is configurable only when **CSM Support** is set to **Enabled**.

Other PCI devices

Allows you to select whether to enable the UEFI or Legacy option ROM for the PCI device controller other than the LAN, storage device, and graphics controllers.

- Do not launch Disables option ROM.
- Legacy Enables legacy option ROM only.
- UEFI Enables UEFI option ROM only. (Default)

This item is configurable only when **CSM Support** is set to **Enabled**.

Administrator Password

Allows you to configure an administrator password. Press <Enter> on this item, type the password, and then press <Enter>. You will be requested to confirm the password. Type the password again and press <Enter>. You must enter the administrator password (or user password) at system startup and when entering BIOS Setup. Differing from the user password, the administrator password allows you to make changes to all BIOS settings.

User Password

Allows you to configure a user password. Press <Enter> on this item, type the password, and then press <Enter>. You will be requested to confirm the password. Type the password again and press <Enter>. You must enter the administrator password (or user password) at system startup and when entering BIOS Setup. However, the user password only allows you to make changes to certain BIOS settings but not all.

To cancel the password, press <Enter> on the password item and when requested for the password, enter the correct one first. When prompted for a new password, press <Enter> without entering any password. Press <Enter> again when prompted to confirm.

NOTE: Before setting the User Password, be sure to set the Administrator Password first.

2-6 Peripherals



☞ **PCH LAN Controller (LAN2)**
Enables or disables the onboard LAN function. (Default: Enabled)
If you wish to install a 3rd party add-in network card instead of using the onboard LAN, set this item to **Disabled**.

☞ **Wake on LAN Enable**
Enables or disables the wake on LAN function. (Default: Enabled)

☞ **OnBoard LAN Controller (LAN1)**
Enables or disables the onboard LAN function. (Default: Enabled)
If you wish to install a 3rd party add-in network card instead of using the onboard LAN, set this item to **Disabled**.

☞ **Above 4G Decoding**
Enables or disables 64-bit capable devices to be decoded in above 4 GB address space (only if your system supports 64-bit PCI decoding). Set to **Enabled** if more than one advanced graphics card are installed and their drivers are not able to be launched when entering the operating system (because of the limited 4 GB memory address space). (Default: Disabled)

☞ **LEDs in System Power On State**
Allows you to enable or disable motherboard LED lighting when the system is on.
- Off — Disables the selected lighting mode when the system is on.
- On — Enables the selected lighting mode when the system is on. (Default)

☞ **LEDs in Sleep, Hibernation, and Soft Off States**
Allows you to set the lighting mode of the motherboard LEDs in system S3/S4/S5 state.
This item is configurable when LEDs in System Power On State is set to On.
- Off — Disables the selected lighting mode when the system enters S3/S4/S5 state. (Default)
- On — Enables the selected lighting mode when the system enters S3/S4/S5 state.

▶ **Trusted Computing**
Enables or disables Trusted Platform Module (TPM).

☞ **Intel® VMD technology** (Note)
Enables or disables Intel® Volume Management Device (Intel® VMD) technology. (Default: Disabled)

▶ **PCH SATA Configuration**

☞ **SATA Controller**
Enables or disables the integrated SATA controllers. (Default: Enabled)

☞ **Configure SATA as**
Enables or disables RAID for the SATA controllers integrated in the Chipset or configures the SATA controllers to AHCI mode.

- ▸▸ RAID — Enables RAID for the SATA controller.
- ▸▸ AHCI — Configures the SATA controllers to AHCI mode. Advanced Host Controller Interface (AHCI) is an interface specification that allows the storage driver to enable advanced Serial ATA features such as Native Command Queuing and hot plug. (Default)

☞ **Support Aggressive Link Power Management**
Enables or disables the power saving feature, ALPM (Aggressive Link Power Management), for the Chipset SATA controllers. (Default: Enabled)

☞ **Port 0/1/2/3/4/5/6/7**
Enables or disables each SATA port. (Default: Enabled)

☞ **Hot plug**
Enables or disable the hot plug capability for each SATA port. (Default: Disabled)

☞ **Configured as eSATA**
Enables or disables support for external SATA devices.

☞ **Mechanical Presence Switch**
Allows you to determine whether to turn on the Mechanical Presence switch for the SATA device. This item is configurable only when Hot plug is enabled. (Default: Enabled)

▶ **Super IO Configuration**

☞ **Serial Port**
Enables or disables the onboard serial port. (Default: Enabled)

▶ **USB Configuration**

☞ **Legacy USB Support**
Allows USB keyboard/mouse to be used in MS-DOS. (Default: Enabled)

☞ **XHCI Hand-off**
Determines whether to enable XHCI Hand-off feature for an operating system without XHCI Hand-off support. (Default: Disabled)

☞ **USB Mass Storage Driver Support**
Enables or disables support for USB storage devices. (Default: Enabled)

☞ **Port 60/64 Emulation**
Enables or disables emulation of I/O ports 64h and 60h. This should be enabled for full legacy support for USB keyboards/mice in MS-DOS or in operating system that does not natively support USB devices. (Default: Enabled)

☞ **Mass Storage Devices**
Displays a list of connected USB mass storage devices. This item appears only when a USB storage device is installed.

(Note) This item is present only when you install a CPU that supports this feature. For more information about Intel® CPUs' unique features, please visit Intel's website.

☞ **NVMe Configuration**
Displays information on your NVME PCIe SSD if installed.

▶ **OffBoard SATA Controller Configuration**
Displays information on your PCIe SSD if installed.

☞ **Network Stack**
Disables or enables booting from the network to install a GPT format OS, such as installing the OS from the Windows Deployment Services server. (Default: Disabled)

☞ **Ipv4 PXE Support**
Enables or disables IPv4 PXE Support. This item is configurable only when Network Stack is enabled.

☞ **Ipv4 HTTP Support**
Enables or disables HTTP boot support for IPv4. This item is configurable only when Network Stack is enabled.

☞ **Ipv6 PXE Support**
Enables or disables IPv6 PXE Support. This item is configurable only when Network Stack is enabled.

☞ **Ipv6 HTTP Support**
Enables or disables HTTP boot support for IPv6. This item is configurable only when Network Stack is enabled.

☞ **IPSEC Certificate**
Enables or disables the Internet Protocol Security. This item is configurable only when Network Stack is enabled.

☞ **PXE boot wait time**
Allows you to configure how long to wait before you can press <Esc> to abort the PXE boot. This item is configurable only when Network Stack is enabled. (Default: 0)

☞ **Media detect count**
Allows you to set the number of times to check the presence of media. This item is configurable only when Network Stack is enabled. (Default: 1)

▶ **Intel(R) Gigabit Network Connection (LAN1)**
This sub-menu provides information on LAN configuration and related configuration options.

▶ **Intel(R) Ethernet Connection (LAN2)**
This sub-menu provides information on LAN configuration and related configuration options.

2-7 Power



☞ **Platform Power Management**
Enables or disables the Active State Power Management function (ASPM). (Default: Disabled)

☞ **PEG ASPM**
Allows you to configure the ASPM mode for the device connected to the CPU PEG bus. This item is configurable only when **Platform Power Management** is set to **Enabled**. (Default: Enabled)

☞ **PCH ASPM**
Allows you to configure the ASPM mode for the device connected to Chipset's PCI Express bus. This item is configurable only when **Platform Power Management** is set to **Enabled**. (Default: Enabled)

☞ **DMI ASPM**
Allows you to configure the ASPM mode for both CPU side and Chipset side of the DMI link. This item is configurable only when **Platform Power Management** is set to **Enabled**. (Default: Enabled)

☞ **AC BACK**
Determines the state of the system after the return of power from an AC power loss.
- ⏩ Always Off The system stays off upon the return of the AC power. (Default)
- ⏩ Always On The system is turned on upon the return of the AC power.
- ⏩ Memory The system returns to its last known awake state upon the return of the AC power.

☞ **Power On By Keyboard**
Allows the system to be turned on by a PS/2 keyboard wake-up event.
Note: To use this function, you need an ATX power supply providing at least 1A on the +5VSB lead.
- ⏩ Disabled Disables this function. (Default)
- ⏩ Password Set a password with 1~5 characters to turn on the system.
- ⏩ Keyboard 98 Press POWER button on the Windows 98 keyboard to turn on the system.
- ⏩ Any Key Press any key to turn on the system.

Power On Password

Set the password when **Power On By Keyboard** is set to **Password**.

Press <Enter> on this item and set a password with up to 5 characters and then press <Enter> to accept. To turn on the system, enter the password and press <Enter>.

Note: To cancel the password, press <Enter> on this item. When prompted for the password, press <Enter> again without entering the password to clear the password settings.

Power On By Mouse

Allows the system to be turned on by a PS/2 mouse wake-up event.

Note: To use this function, you need an ATX power supply providing at least 1A on the +5VSB lead.

- Disabled — Disables this function. (Default)
- Move — Move the mouse to turn on the system.
- Double Click — Double click on left button on the mouse to turn on the system.

Soft-Off by PWR-BTTN

Configures the way to turn off the computer in MS-DOS mode using the power button.

- Instant-Off — Press the power button and then the system will be turned off instantly. (Default)
- Delay 4 Sec. — Press and hold the power button for 4 seconds to turn off the system. If the power button is pressed for less than 4 seconds, the system will enter suspend mode.

Resume by Alarm

Determines whether to power on the system at a desired time. (Default: Disabled)

If enabled, set the date and time as following:

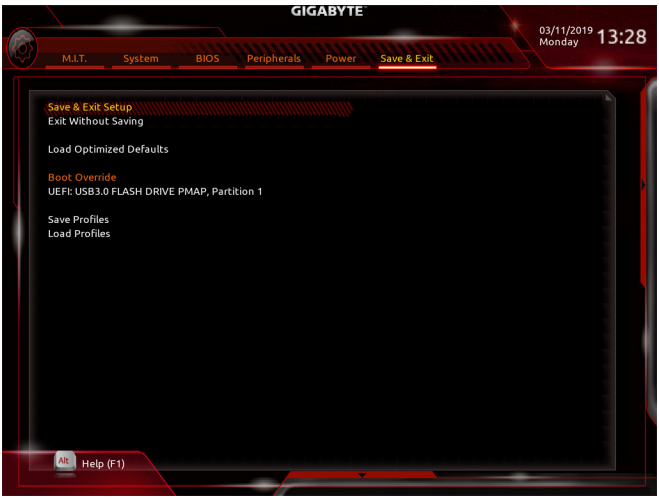
- Wake up day: Turn on the system at a specific time on each day or on a specific day in a month.
- Wake up hour/minute/second: Set the time at which the system will be powered on automatically.

Note: When using this function, avoid inadequate shutdown from the operating system or removal of the AC power, or the settings may not be effective.

Power Loading

Enables or disables dummy load. When the power supply is at low load, a self-protection will activate causing it to shutdown or fail. If this occurs, please set to **Enabled**. **Auto** lets the BIOS automatically configure this setting. (Default: Auto)

2-8 Save & Exit



Save & Exit Setup

Press <Enter> on this item and select **Yes**. This saves the changes to the CMOS and exits the BIOS Setup program. Select **No** or press <Esc> to return to the BIOS Setup Main Menu.

Exit Without Saving

Press <Enter> on this item and select **Yes**. This exits the BIOS Setup without saving the changes made in BIOS Setup to the CMOS. Select **No** or press <Esc> to return to the BIOS Setup Main Menu.

Load Optimized Defaults

Press <Enter> on this item and select **Yes** to load the optimal BIOS default settings. The BIOS defaults settings help the system to operate in optimum state. Always load the Optimized defaults after updating the BIOS or after clearing the CMOS values.

Boot Override

Allows you to select a device to boot immediately. Press <Enter> on the device you select and select **Yes** to confirm. Your system will restart automatically and boot from that device.

Save Profiles

This function allows you to save the current BIOS settings to a profile. You can create up to 8 profiles and save as Setup Profile 1~ Setup Profile 8. Press <Enter> to complete. Or you can select **Select File in HDD/FDD/USB** to save the profile to your storage device.

Load Profiles

If your system becomes unstable and you have loaded the BIOS default settings, you can use this function to load the BIOS settings from a profile created before, without the hassles of reconfiguring the BIOS settings. First select the profile you wish to load and then press <Enter> to complete. You can select **Select File in HDD/FDD/USB** to input the profile previously created from your storage device or load the profile automatically created by the BIOS, such as reverting the BIOS settings to the last settings that worked properly (last known good record).

Chapter 3 Appendix

3-1 Configuring a RAID Set

RAID Levels

	RAID 0	RAID 1	RAID 5	RAID 10
Minimum Number of Hard Drives	≥2	2	≥3	4
Array Capacity	Number of hard drives * Size of the smallest drive	Size of the smallest drive	(Number of hard drives -1) * Size of the smallest drive	(Number of hard drives/2) * Size of the smallest drive
Fault Tolerance	No	Yes	Yes	Yes

Before you begin, please prepare the following items:

- At least two SATA hard drives or SSDs. (Note) (To ensure optimal performance, it is recommended that you use two hard drives with identical model and capacity).
- Windows setup disk.
- Motherboard driver disk.
- A USB thumb drive.

Configuring the Onboard SATA Controller

A. Installing SATA hard drive(s) in your computer

Install the hard drives/SSDs in the Intel® Chipset controlled connectors on the motherboard. Then connect the power connectors from your power supply to the hard drives.

B. Configuring SATA controller mode in BIOS Setup

Make sure to configure the SATA controller mode correctly in system BIOS Setup.

Steps:

1. Turn on your computer and press <Delete> to enter BIOS Setup during the POST (Power-On Self-Test). Go to **Peripherals\PCH SATA Configuration**, make sure **SATA Controller** is enabled. To create RAID, set **Configure SATA** as to **RAID**.
2. In BIOS Setup, go to **BIOS** and set **CSM Support** to **Disabled**. Save the changes and exit BIOS Setup.
3. After the system reboot, enter BIOS Setup again. Then enter the **Peripherals\Intel(R) VROC SATA Controller** sub-menu.
4. On the **Intel(R) VROC SATA Controller** menu, press <Enter> on **Create RAID Volume** to enter the **Create RAID Volume** screen. Enter a volume name with 1~16 letters (letters cannot be special characters) under the Name item and press <Enter>. Then, select a RAID level. RAID levels supported include RAID 0, RAID 1, RAID 10, and RAID 5 (the selections available depend on the number of the hard drives being installed). Next, use the down arrow key to move to **Select Disks**.
5. Under Select Disks item, select the hard drives to be included in the RAID array. Press the <Space> key on the hard drives to be selected (selected hard drives are marked with "X"). Then set the stripe block size. The stripe block size can be set from 4 KB to 128 KB. Once you have selected the stripe block size, set the volume capacity.
6. After setting the capacity, move to **Create Volume**.
7. After completing, you'll be brought back to the **Intel(R) VROC SATA Controller** screen. Under **RAID Volumes** you can see the new RAID volume. To see more detailed information, press <Enter> on the volume to check for information on RAID level, stripe block size, array name, and array capacity, etc.



The BIOS Setup menus described in this section may differ from the exact settings for your motherboard. The actual BIOS Setup menu options you will see shall depend on the motherboard you have and the BIOS version.

(Note) Please note that a U.2 SSD cannot be used to create a RAID set with SATA hard drive(s).

Install the SATA RAID/AHCI driver and operating system
With the correct BIOS settings, you are ready to install the operating system.

Installing the Operating System
As some operating systems already include Intel® RAID/AHCI driver, you do not need to install separate RAID/AHCI driver during the Windows installation process. After the operating system is installed, we recommend that you install all required drivers from the motherboard driver disk using "Xpress Install" to ensure system performance and compatibility. If the operating system to be installed requires that you provide additional SATA RAID/AHCI driver during the OS installation process, please refer to the steps below:
1. Copy the **IRST** folder under **\Boot** in the driver disk to your USB thumb drive.
2. Boot from the Windows setup disk and perform standard OS installation steps. When the screen requesting you to load the driver appears, select **Browse**.
3. Then browse to the USB flash drive and select the location of the driver. The location of the driver is as follows: **\IRST\f6flpy-x64**
4. When a screen as shown, select **Intel Chipset SATA RAID Controller** and click **Next** to load the driver and continue the OS installation.

3-2 Configuring Intel® Virtual RAID on CPU (Intel® VROC)

System Requirements
1. An Intel® VROC Upgrade Key (purchased separately)
2. At least two Intel® NVMe SSDs (to ensure optimal performance, it is recommended that you use SSDs with identical model and capacity).

Intel® VROC Upgrade Key	Supported RAID Levels
No Key Installed	RAID 0
Standard Key	RAID 0, 1, 10
Premium Key	RAID 0, 1, 5, 10

A: Hardware Installation
Plug the Intel® VROC Upgrade Key into the VROC header on the motherboard and install the Intel® NVMe SSDs in PCIe slot(s).

To install the operating system onto the RAID array, make sure the Intel® NVMe SSDs are installed in the PCIe slots managed by the same VMD controller.
VMD1: PCIEX16_2, PCIEX8_3 (Note)
VMD2: PCIEX16_1, PCIEX8_1 (Note)
VMD3: PCIEX8_2, PCIEX8_4

(Note) The PCIEX8_1 slot shares bandwidth with the PCIEX16_1 slot and the PCIEX8_3 with PCIEX16_2. When PCIEX8_1/PCIEX8_3 is populated, PCIEX16_1/PCIEX16_2 operates at up to x8 mode.

B: Creating a RAID Array

Steps:

1. After the system starts, go to the BIOS Setup, and then go to **Peripherals\Intel® VMD technology\Intel® VMD for Volume Management Device on Socket 0**, make sure the VMD items for the PCIe slots you use are enabled. Refer to the table below:

BIOS Items	PCIe Slots
PStack 0	PCIEX16_2, PCIEX8_3
PStack 1	PCIEX16_1, PCIEX8_1
PStack 2	PCIEX8_2, PCIEX8_4

2. Depending on the PCIe slots used, set **Intel® VMD for Volume Management Device for PStackX** under **VMD Config for PStackX** to **Enabled**.
3. Set the **VMD port A~D** items that correspond to the PCIe slots you use to **Enabled**. (Note)
4. Go to **Peripherals\PCH SATA Configuration**, set **Configure SATA** as to **RAID**.
5. After the system reboots, enter BIOS Setup again. Then enter the **Peripherals\Intel(R) Virtual RAID on CPU** sub-menu. Press <Enter> on **All Intel VMD Controller**.
6. Press <Enter> on **Create RAID Volume** to enter the **Create RAID Volume** screen.
7. Enter a volume name with 1~16 letters (letters cannot be special characters) under the **Name** item and press <Enter>. Then, select a RAID level. (The selections available depend on the number of the hard drives and type of the Intel® VROC Upgrade Key being installed).
8. If the SSDs are installed to different VMDs, be sure to press the <Space> key on the **Enable RAID spanned over VMD Controllers** item to enable this function first. X means SSDs managed by different VMDs can be included in a RAID array but the RAID array can be used as a data drive only.
9. Under the **Select Disks** item, select the hard drives to be included in the RAID array. Press the <Space> key on the hard drives to be selected (selected hard drives are marked with "X").
10. Then set the stripe block size. The stripe block size can be set from 4 KB to 128 KB. Once you have selected the stripe block size, set the volume capacity. After setting the capacity, move to **Create Volume** and press <Enter> to begin.
11. After completing, you'll be brought back to the **Intel(R) Virtual RAID on CPU** screen. Under **Intel VROC Managed Volumes** you can see the new RAID volume.

C: Deleting the RAID Volume

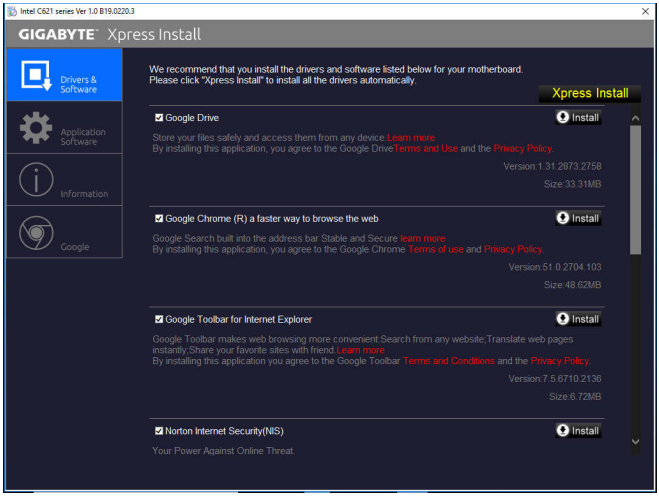
To delete a RAID array, press <Enter> on the volume to be deleted on the **Intel(R) Virtual RAID on CPU\Intel VROC Managed Volumes** screen. After entering the **RAID VOLUME INFO** screen, press <Enter> on Delete to enter the **Delete** screen. Press <Enter> on **Yes**.

(Note) If you enable the VMD port item that corresponds to the PCIe slot with the graphics card installed, the system may fail to boot.

3-3 Drivers Installation

- Before installing the drivers, first install the operating system.
- After installing the operating system, insert the motherboard driver disk into your optical drive. Click on the message "Tap to choose what happens with this disc" on the top-right corner of the screen and select "Run **Run**.exe." (Or go to My Computer, double-click the optical drive and execute the Run.exe program.)

"Xpress Install" will automatically scan your system and then list all of the drivers that are recommended to install. You can click the **Xpress Install** button and "Xpress Install" will install all of the selected drivers. Or click the arrow Install icon to individually install the drivers you need.



Please visit GIGABYTE's website for more troubleshooting information.

3-4 Debug LED Codes

Regular Boot

Code	Description
10	PEI Core is started.
11	Pre-memory CPU initialization is started.
12~14	Reserved.
15	Pre-memory North-Bridge initialization is started.
16~18	Reserved.
19	Pre-memory South-Bridge initialization is started.
1A~2A	Reserved.
2B~2F	Memory initialization.
31	Memory installed.
32~36	CPU PEI initialization.
37~3A	IOH PEI initialization.
3B~3E	PCH PEI initialization.
3F~4F	Reserved.
60	DXE Core is started.
61	NVRAM initialization.
62	Installation of the PCH runtime services.
63~67	CPU DXE initialization is started.
68	PCI host bridge initialization is started.
69	IOH DXE initialization.
6A	IOH SMM initialization.
6B~6F	Reserved.
70	PCH DXE initialization.
71	PCH SMM initialization.
72	PCH devices initialization.
73~77	PCH DXE initialization (PCH module specific).
78	ACPI Core initialization.
79	CSM initialization is started.
7A~7F	Reserved for AMI use.
80~8F	Reserved for OEM use (OEM DXE initialization codes).
90	Phase transfer to BDS (Boot Device Selection) from DXE.
91	Issue event to connect drivers.

Code	Description
92	PCI Bus initialization is started.
93	PCI Bus hot plug initialization.
94	PCI Bus enumeration for detecting how many resources are requested.
95	Check PCI device requested resources.
96	Assign PCI device resources.
97	Console Output devices connect (ex. Monitor is lighted).
98	Console input devices connect (ex. PS2/USB keyboard/mouse are activated).
99	Super IO initialization.
9A	USB initialization is started.
9B	Issue reset during USB initialization process.
9C	Detect and install all currently connected USB devices.
9D	Activated all currently connected USB devices.
9E~9F	Reserved.
A0	IDE initialization is started.
A1	Issue reset during IDE initialization process.
A2	Detect and install all currently connected IDE devices.
A3	Activated all currently connected IDE devices.
A4	SCSI initialization is started.
A5	Issue reset during SCSI initialization process.
A6	Detect and install all currently connected SCSI devices.
A7	Activated all currently connected SCSI devices.
A8	Verify password if needed.
A9	BIOS Setup is started.
AA	Reserved.
AB	Wait user command in BIOS Setup.
AC	Reserved.
AD	Issue Ready To Boot event for OS Boot.
AE	Boot to Legacy OS.
AF	Exit Boot Services.
B0	Runtime AP installation begins.
B1	Runtime AP installation ends.
B2	Legacy Option ROM initialization.
B3	System reset if needed.

Code	Description
B4	USB device hot plug-in.
B5	PCI device hot plug.
B6	Clean-up of NVRAM.
B7	Reconfigure NVRAM settings.
B8~BF	Reserved.
C0~CF	Reserved.

S3 Resume

Code	Description
E0	S3 Resume is started (called from DXE IPL).
E1	Fill boot script data for S3 resume.
E2	Initializes VGA for S3 resume.
E3	OS S3 wake vector call.

Recovery

Code	Description
F0	Recovery mode will be triggered due to invalid firmware volume detection.
F1	Recovery mode will be triggered by user decision.
F2	Recovery is started.
F3	Recovery firmware image is found.
F4	Recovery firmware image is loaded.
F5~F7	Reserved for future AMI progress codes.

Error

Code	Description
50~55	Memory initialization error occurs.
56	Invalid CPU type or speed.
57	CPU mismatch.
58	CPU self test failed or possible CPU cache error.
59	CPU micro-code is not found or micro-code update is failed.
5A	Internal CPU error.
5B	Reset PPI is failed.
5C~5F	Reserved.
D0	CPU initialization error.
D1	IOH initialization error.

Code	Description
D2	PCH initialization error.
D3	Some of the Architectural Protocols are not available.
D4	PCI resource allocation error. Out of Resources.
D5	No Space for Legacy Option ROM initialization.
D6	No Console Output Devices are found.
D7	No Console Input Devices are found.
D8	It is an invalid password.
D9~DA	Can't load Boot Option.
DB	Flash update is failed.
DC	Reset protocol is failed.
DE~DF	Reserved.
E8	S3 resume is failed.
E9	S3 Resume PPI is not found.
EA	S3 Resume Boot Script is invalid.
EB	S3 OS Wake call is failed.
EC~EF	Reserved.
F8	Recovery PPI is invalid.
F9	Recovery capsule is not found.
FA	Invalid recovery capsule.
FB~FF	Reserved.

Regulatory Statements

Regulatory Notices

This document must not be copied without our written permission, and the contents there of must not be imparted to a third party nor be used for any unauthorized purpose.
Contravention will be prosecuted. We believe that the information contained herein was accurate in all respects at the time of printing. GIGABYTE cannot, however, assume any responsibility for errors or omissions in this text. Also note that the information in this document is subject to change without notice and should not be construed as a commitment by GIGABYTE.

Our Commitment to Preserving the Environment

In addition to high-efficiency performance, all GIGABYTE motherboards fulfill European Union regulations for RoHS (Restriction of Certain Hazardous Substances in Electrical and Electronic Equipment) and WEEE (Waste Electrical and Electronic Equipment) environmental directives, as well as most major worldwide safety requirements. To prevent releases of harmful substances into the environment and to maximize the use of our natural resources, GIGABYTE provides the following information on how you can responsibly recycle or reuse most of the materials in your "end of life" product.

Restriction of Hazardous Substances (RoHS) Directive Statement

GIGABYTE products have not intended to add and safe from hazardous substances (Cd, Pb, Hg, Cr+6, PBDE and PBB). The parts and components have been carefully selected to meet RoHS requirement. Moreover, we at GIGABYTE are continuing our efforts to develop products that do not use internationally banned toxic chemicals.

Waste Electrical & Electronic Equipment (WEEE) Directive Statement

GIGABYTE will fulfill the national laws as interpreted from the 2012/19/EU WEEE (Waste Electrical and Electronic Equipment) directive. The WEEE Directive specifies the treatment, collection, recycling and disposal of electric and electronic devices and their components. Under the Directive, used equipment must be marked, collected separately, and disposed of properly.

WEEE Symbol Statement



The symbol shown below is on the product or on its packaging, which indicates that this product must not be disposed of with other waste. Instead, the device should be taken to the waste collection centers for activation of the treatment, collection, recycling and disposal procedure. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local government office, your household waste disposal service or where you purchased the product for details of environmentally safe recycling.

- When your electrical or electronic equipment is no longer useful to you, "take it back" to your local or regional waste collection administration for recycling.
- If you need further assistance in recycling, reusing in your "end of life" product, you may contact us at the Customer Care number listed in your product's user's manual and we will be glad to help you with your effort.

Finally, we suggest that you practice other environmentally friendly actions by understanding and using the energy-saving features of this product (where applicable), recycling the inner and outer packaging (including shipping containers) this product was delivered in, and by disposing of or recycling used batteries properly. With your help, we can reduce the amount of natural resources needed to produce electrical and electronic equipment, minimize the use of landfills for the disposal of "end of life" products, and generally improve our quality of life by ensuring that potentially hazardous substances are not released into the environment and are disposed of properly.

Battery Information

European Union—Disposal and recycling information
GIGABYTE Recycling Program (available in some regions)



This symbol indicates that this product and/or battery should not be disposed of with household waste. You must use the public collection system to return, recycle, or treat them in compliance with the local regulations.

United States of America, Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canada, Industry Canada (IC) Notices / Canada, avis d'Industry Canada (IC)

This Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

European Union (EU) CE Declaration of Conformity

This device complies with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility (2014/30/EU), Low-voltage Directive (2014/35/EU), RoHS directive (recast) (2011/65/EU).
This product has been tested and found to comply with all essential requirements of the Directives.

Warning

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

Contact Us

GIGA-BYTE TECHNOLOGY CO., LTD.
Address: No.6, Baoqiang Rd., Xindian Dist., New Taipei City 231, Taiwan
TEL: +886-2-8912-4000, FAX: +886-2-8912-4005
Tech. and Non-Tech. Support (Sales/Marketing) : https://esupport.gigabyte.com
WEB address (English): https://www.gigabyte.com
WEB address (Chinese): https://www.gigabyte.com/tw

- **GIGABYTE eSupport**

  To submit a technical or non-technical (Sales/Marketing) question, please link to:
  https://esupport.gigabyte.com

