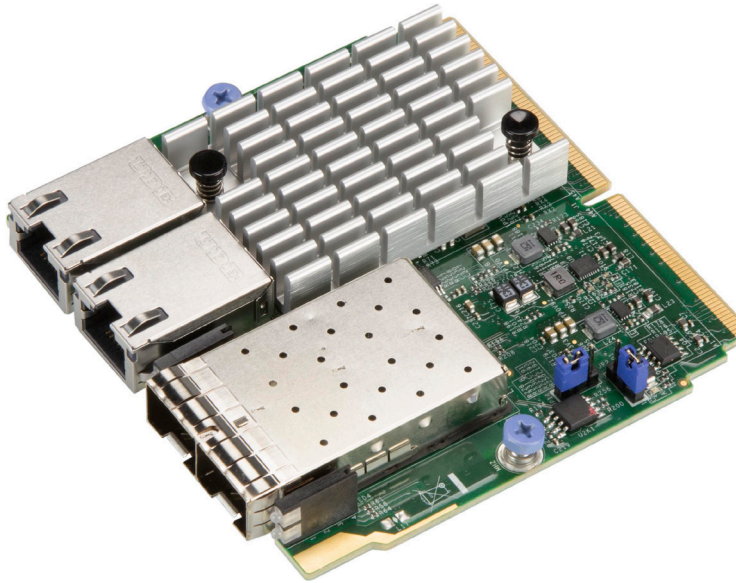
AOC-MTG-i2T2S
AOC-MTG-i2T2SM



User's Guide

Revision 1.0a

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User's Guide Revision 1.0a

Release Date: August 30, 2021

Printed in the United States of America

Preface

About this User's Guide

This user's guide is written for system integrators, IT technicians, and knowledgeable end users. It provides information for the installation and use of the AOC-MTG-i2T2S(M) add-on card.

About this Add-on Card

The Supermicro® AOC-MTG-i2T2S(M) is one of the most flexible and scalable 4-port 10Gb network solutions in the market. Based on the Intel® X710-TM4 controller, it is designed to support a mixed network interface – two RJ45 and two SFP+ connectors, with performance enhancing features and power management technologies. With SIOM form factor, this controller fulfills the needs of flexible networking options in a small footprint and allows capability to monitor the system remotely through built-in NC-SI feature.

An Important Note to the User

All images and layouts shown in this user's guide are based upon the latest PCB Revision available at the time of publishing. The card you have received may or may not look exactly the same as the graphics shown in this user's guide.

Returning Merchandise for Service

A receipt or copy of your invoice marked with the date of purchase is required before any warranty service will be rendered. You can obtain service by calling your vendor for a Returned Merchandise Authorization (RMA) number. When returning the motherboard to the manufacturer, the RMA number should be prominently displayed on the outside of the shipping carton, and the shipping package is mailed prepaid or hand-carried. Shipping and handling charges will be applied for all orders that must be mailed when service is complete. For faster service, you can also request a RMA authorization online (http://www.supermicro.com/RmaForm/).

This warranty only covers normal consumer use and does not cover damages incurred in shipping or from failure due to the alternation, misuse, abuse, or improper maintenance of products.

During the warranty period, contact your distributor first for any product problems.

Conventions Used in the User's Guide

Pay special attention to the following symbols for proper system installation and to prevent damage to the system or injury to yourself:

Warning: Important information given to ensure proper system installation or to prevent damage to the components or injury to yourself.

Note: Additional information given to differentiate between various models or provides information for correct system setup.

Naming Convention

Character	Representation	Options
1st	Product Family	AOC: Add On Card
2nd	Form Factor	S: Standard, P: Proprietary, C: MicroLP, M: Super IO Module (SIOM), MH: SIOM Hybrid
3rd	Product Type/Speed	G: GbE (1Gb/s), TG: 10GbE (10Gb/s), 25G: 25GbE (25Gb/s), 40G: 40GbE (40Gb/s), 50G: 50GbE (50Gb/s), 100G: 100GbE (100Gb/s), IBE: EDR IB (100Gb/s), IBF: FDR IB (56Gb/s), IBQ: QDR IB (40Gb/s), HFI: Host Fabric Interface
4th	Chipset Model (Optional)	N: Niantec (82599), P: Powerville (i350), S: Sageville (X550), F: Fortville (XL710/X710), L: Lewisburg (PCH)
5th	Chipset Manufacturer	i: Intel, m: Mellanox, b: Broadcom
6th	Number of Ports	1: 1 port, 2: 2 ports, 4: 4 ports
7th	Connector Type (Optional)	S: SFP+/SFP28, T: 10GBase-T, Q: QSFP+, C: QSFP28
8th	2nd Controller/Connector Type (Optional)	G: 1x GbE RJ45, 2G: GbE 2x RJ45, S: 1x 10G SFP+, T: 10GBase-T, 2T: 2x 10GBase-T

SMC Networking Add-on Cards

Model	Type	Form Factor	Interface	Controller	Connection	Dimension (w/o Brackets) (L x H)	Power (W)
AOC-SGP-i2	GbE	Standard LP	PCI-E x4	Intel® i350 AM2	2 RJ45 (1Gb/port)	3.9" (99mm) x 2.73" (69mm)	3.5
AOC-SGP-i4	GbE	Standard LP	PCI-E x4	Intel® i350 AM4	4 RJ45 (1Gb/port)	3.9" (99mm) x 2.73" (69mm)	5
AOC-STG-i2T	10GbE	Standard LP	PCI-E x8	Intel® X540-AT2	2 RJ45 (10GBase-T)	5.9" (150mm) x 2.73" (69mm)	13
AOC-STGS-i1T	10GbE	Standard LP	PCI-E x4	Intel® X550-AT	1 RJ45 (10GBase-T)	5.9" (150mm) x 2.73" (69mm)	9
AOC-STGS-i2T	10GbE	Standard LP	PCI-E x4	Intel® X550-AT2	2 RJ45 (10GBase-T)	5.9" (150mm) x 2.73" (69mm)	11
AOC-STG-b2T	10GbE	Standard LP	PCI-E x8	Broadcom® BCM57416	2 RJ45 (10GBase-T)	5.6" (142mm) x 2.73"(69mm)	13.1
AOC-STG-i4T	10GbE	Standard LP	PCI-E x8	Intel® XL710-BM1	4 RJ45 (10GBase-T)	5.9" (149mm) x 2.73"(69mm)	15.5
AOC-STGN-i1S	10GbE	Standard LP	PCI-E x8	Intel® 82598EN	1 SFP+ (10Gb/port)	4.0" (102mm) x 2.73" (69mm)	10
AOC-STGN-i2S	10GbE	Standard LP	PCI-E x8	Intel® 82599ES	2 SFP+ (10Gb/port)	4.0" (102mm) x 2.73" (69mm)	11.2
AOC-STGF-i2S	10GbE	Standard LP	PCI-E x8	Intel® X710-BM2	2 SFP+ (10Gb/port)	5.19" (132mm) x 2.73" (69mm)	5.6
AOC-STG-b4S	10GbE	Standard LP	PCI-E x8	Broadcom® BCM57840S	4 SFP+ (10Gb/port)	5.4" (137mm) x 2.73" (69mm)	14
AOC-STG-i4S	10GbE	Standard LP	PCI-E x8	Intel® XL710-BM1	4 SFP+ (10Gb/port)	5.9" (150mm) x 2.73" (69mm)	8
AOC-S25G-m2S	25GbE	Standard LP	PCI-E x8	Mellanox® CX-4 LX	2 SFP28 (25Gb/port)	5.6" (142mm) x 2.713" (69mm)	8.7
AOC-S25G-b2S	25GbE	Standard LP	PCI-E x8	Broadcom® BCM57414	2 SFP28 (25Gb/port)	5.6" (142mm) x 2.713" (69mm)	5.2
AOC-S25G-i2S	25GbE	Standard LP	PCI-E x8	Intel® XXV710	2 SFP28 (25Gb/port)	6.1" (155mm) x 2.713" (69mm)	7.2
AOC-S40G-i1Q	40GbE	Standard LP	PCI-E x8	Intel® XL710-BM1	1 QSFP+ (40Gb/port)	5.9" (150mm) x 2.73" (69mm)	6.5
AOC-S40G-i2Q	40GbE	Standard LP	PCI-E x8	Intel® XL710-BM2	2 QSFP+ (40Gb/port)	5.9" (150mm) x 2.73" (69mm)	7
AOC-S100G-m2C	100GbE	Standard LP	PCI-E x16	Mellanox® CX-4 EN	2 QSFP28 (100Gb/port)	6.6" (168mm) x 2.73" (69mm)	16.3
AOC-CGP-i2	GbE	MicroLP	PCI-E x4	Intel® i350 AM2	2 RJ45 (1Gb/port)	4.45" (113mm) x 1.54" (39mm)	4
AOC-CTG-i1S	10GbE	MicroLP	PCI-E x8	Intel® 82599EN	1 SFP+ (10Gb/port)	4.85" (123mm) x 1.54" (39mm)	10
AOC-CTG-i2S	10GbE	MicroLP	PCI-E x8	Intel® 82599ES	2 SFP+ (10Gb/port)	4.85" (123mm) x 1.54" (39mm)	11
AOC-CTG-i2T	10GbE	MicroLP	PCI-E x8	Intel® X540-AT2	2 RJ45 (10GBase-T)	4.8" (123mm) x 2.75" (77mm)	13
AOC-CTGS-i2T	10GbE	MicroLP	PCI-E x4	Intel® X550-AT2	2 RJ45 (10GBase-T)	4.45" (113mm) x 1.54" (39mm)	12
AOC-C25G-m1S	25GbE	MicroLP	PCI-E x8	Mellanox® CX-4 Lx EN	1 SFP28 (28Gb/port)	4.45" (113mm) x 1.54" (39mm)	8.5

Model	Type	Form Factor	Controller	Connection	Dimension (w/o Brackets) (L x H)	Power (W)
AOC-MGP-i2	GbE	SIOM	Intel® i350 AM2	2 RJ45 (1Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	3.7
AOC-MGP-i4	GbE	SIOM	Intel® i350 AM4	4 RJ45 (1Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	4.4
AOC-MTGN-i2S	10GbE	SIOM	Intel® 82599ES	2 SFP+ (10Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	7.2
AOC-MTG-i4S	10GbE	SIOM	Intel® XL710-BM1	4 SFP+ (10Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	7
AOC-MTG-b2T	10GbE	SIOM	Broadcom® BCM57416	2 RJ45 (10GBase-T)	3.622" (92mm) x 3.428" (87.08mm)	11
AOC-MTG-i2T	10GbE	SIOM	Intel® X550-AT2	2 RJ45 (10GBase-T)	3.622" (92mm) x 3.428" (87.08mm)	13
AOC-MTG-i4T	10GbE	SIOM	2x Intel® X550-AT2	4 RJ45 (10GBase-T)	3.622" (92mm) x 3.428" (87.08mm)	26
AOC-MHIBF-m1Q2G	FDR IB GbE	SIOM	Mellanox® ConnectX-3 Pro Intel® i350	1 QSFP (56Gb/port) 2 RJ45 (1Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	9
AOC-MHIBF-m2Q2G	FDR IB GbE	SIOM	Mellanox® ConnectX-3 Pro Intel® i350	2 QSFP (56Gb/port) 2 RJ45 (1Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	11
AOC-MHIBE-m1CG	EDR IB GbE	SIOM	Mellanox® ConnectX-4 VPI Intel® i210	1 QSFP28 (100Gb/port) 1 RJ45 (1Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	19
AOC-MH25G-b2S2G	25GbE	SIOM	Broadcom® BCM57414 Intel® i350	2 SFP28 (25Gb/port) 2 RJ45 (1Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	9
AOC-MH25G-m2S2T	25GbE	SIOM	Mellanox® ConnectX-4 Lx EN Intel® X550-AT2	2 SFP28 (25Gb/port) 2 RJ45 (10GBase-T)	3.622" (92mm) x 3.428" (87.08mm)	25
AOC-M25G-m4S	25GbE	SIOM	Mellanox® ConnectX-4 Lx EN	4 SFP28 (25Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	20
AOC-M25G-i2S	25GbE	SIOM	Intel® XXV710	2 SFP28 (25Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	11.8
AOC-MHFI-i1C	Omni-Path	SIOM	Intel® OP HFI ASIC (Wolf River WFR-B)	1 QSFP28 (100Gb/port)	3.622" (92mm) x 3.428" (87.08mm)	15

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Table of Contents

Chapter 1

Overview

1-1 Overview

Congratulations on purchasing your add-on card from an acknowledged leader in the industry. Supermicro products are designed with the utmost attention to detail to provide you with the highest standards in quality and performance. For product support and updates, please refer to our website at http://www.supermicro.com/products/nfo/networking.cfm#adapter.

1-2 Key Features

The key features of this add-on card include the following:

- Super I/O Module (SIOM) Form Factor
- Intel® X710-TM4 Ethernet controller
- Quad 10Gbps ports: two RJ45 and two SFP+ connectors
- Network Virtualization Offloads: VXLAN and NVGRE
- Energy Efficient Ethernet (EEE)
- Intel® Ethernet Flow Director
- Data Plane Developer Kit for efficient packet processing (DPDK)
- Asset Management Features with thermal sensor
- NC-SI for Remote Management
- Supports RJ45 Category-6 and 6A cables
- Supports both Direct Attach Copper and Fiber Cables
- RoHS compliant 6/6 

1-3 Specifications

General

- Super I/O Module (SIOM) Form Factor
- Intel® X710-TM4 Ethernet controller
- Quad 10Gbps ports: two RJ45 and two SFP+ connectors

Networking Features

- IEEE 802.3ad, 802.1AX Link Aggregation
- IEEE 1588 Time Stamping
- IEEE 802.1Q VLAN
- MSI and MSI-X support
- Intel® Flow Director
- Jumbo Frames (up to 9.5KB)
- IEEE 802.3x Flow Control
- Teaming support
- Checksum Offload (IPv4/IPv6, SCTP, TCP, UPD, Tx/Rx)

Virtualization Features

- Support for Virtual Machine Device Queues (VMDq)
- Single-Root I/O Virtualization (SR-IOV)
- VLAN
- Network Virtualization Stateless Offload: VXLAN, NVGRE
- GENEVE

Management Features

- Asset Management support on Supermicro® platforms
- NC-SI for remote management
- PXE remote boot
- iSCSI remote boot

Power Savings

- ACPI compliant power management
- PCI Express Active State Power Management (ASPM)
- Energy Efficient Ethernet (IEEE 802.3az)

OS Support

- Windows® Server
- Linux RHEL
- Linux SLES
- Linux Ubuntu
- Linux CentOS
- FreeBSD
- VMware

Cable Support

- SFP+ direct attach twin-axial copper cables up to 7m
- Fiber-optic cables (with required optional SFP+ transceivers)
- RJ-45 Category-6 up to 55m; Category-6A up to 100m

Power Consumption

- Maximum power consumption: 10 W

Operating Conditions

- Storage temperature: -40°C to 70°C (-40°F to 158°F)
- Storage humidity: 90% non-condensing relative humidity at 35ºC

Physical Dimensions

- Card PCB dimensions: 92mm (3.62in) x 87.1mm (3.43in) (W x D)

Supported Platforms

- Supermicro® motherboards with Super I/O Module slot
- Supermicro® server systems with Super I/O Module slot (See SIOM Compatibility Matrix online)

  http://www.supermicro.com/support/resources/AOC/AOC_Compatibility_SIOM.cfm

Please note that this product is sold only as part of an integrated solution with Supermicro® server systems.

Available SKUs

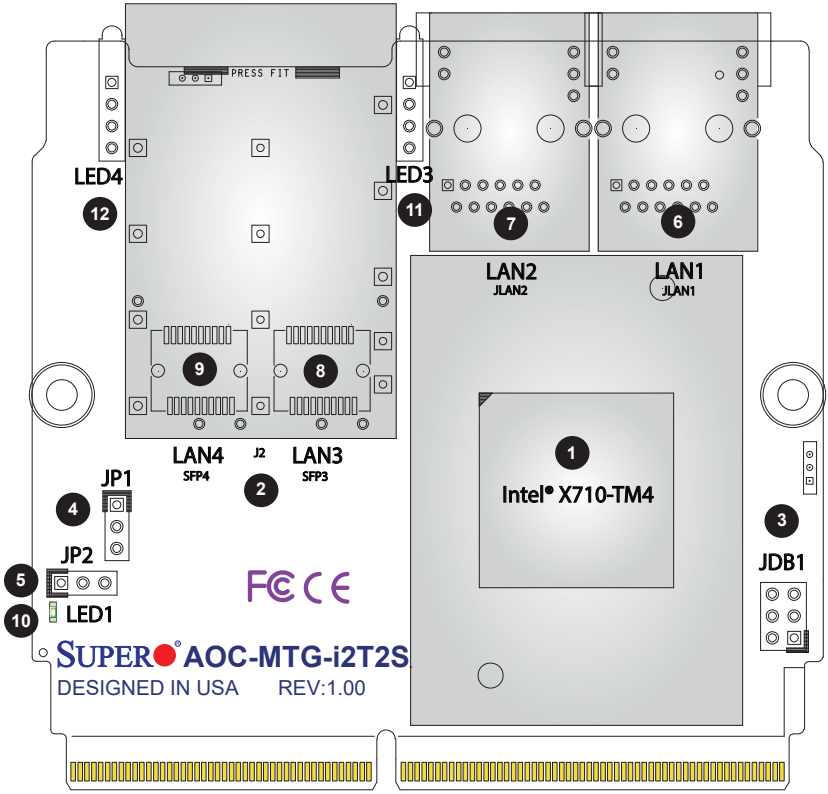
Product Part Number	Bracket Included	Description
AOC-MTG-i2T2S	BKT-0112L	4-port 10GbE adapter with a swappable bracket for 2U+ chassis (Storage Systems)
AOC-MTG-i2T2SM	BKT-0113L	4-port 10GbE adapter with an internal bracket for 1U chassis (Twin Systems)

Chapter 2

Hardware Components

2-1 Add-On Card Image and Layout

AOC-MTG-i2T2S(M) Image



AOC-MTG-i2T2S(M) Layout

2-2 Major Components

The following major components are installed on the AOC-MTG-i2T2S(M):

AOC-MTG-i2T2S(M) Major Components		
No	**Component Name**	**Definition**
1	Intel® X710-TM4	Ethernet Controller
2	J2	Header
3	JDB1	Connector
4	JP1	1-2: Normal operation
		2-3: Set EC i2c address to 0x30
5	JP2	1-2: Enable standby power
		2-3: Disable standby power (default)
6	LAN1 (JLAN1)	RJ45 10Gbps port
7	LAN2 (JLAN2)	RJ45 10Gbps port
8	LAN3 (SFP3)	SFP+ connector port
9	LAN4 (SFP4)	SFP+ connector port
10	LED1	Overheat LED
11	LED3	SFP+ LAN3 Port LED
12	LED4	SFP+ LAN4 Port LED

2-3 LAN Ports and LAN LED Indicators

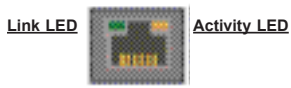
LAN Ports

There are four LAN ports on the AOC-MTG-i2T2S(M). These LAN ports support connection speeds of 10Gbps. Use a direct-attach RJ45 type LAN cable.

AOC-MTG-i2T2S(M) Image

LAN Port LED Indicators

Each LAN port has two LEDs to indicate speed and data activity. Refer to the table below for LED color and definition.



LAN Port Link LED (Left) LED State	
LED Color	Definition
Green	10 Gbps
Yellow	1 Gbps
Yellow	100 Mbps

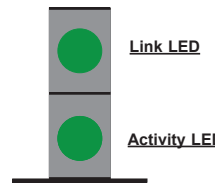
LAN Port Activity LED (Right) LED State		
LED Color	Status	Definition
Off	Off	No Connection
Green	Solid	Link
Green	Flashing	Active

SFP+ Ports

Two SFP+ 10Gb adapter ports are located on the add-on card. Connect a DAC Twin Axial cable or an LC Fiber-Optic cable to the ports to provide Gigabit Ethernet communication. Refer to the add-on card layout on Page 2-2 for the location of the SFP+ port.

SFP+ Port LEDs

There are two LEDs located to the sides of the dual SFP ports to indicate the link speed and activity of each port. A 10Gb connection is indicated by a solid or blinking green LED. A 1Gb connection is indicated by a solid or blinking yellow LED. See the table at right for more information.



SFP+ Port LEDs		
LED	**Color**	**Definition**
Activity	Blinking Green	Activity
Link	Solid Green	10Gb/s Link Speed
	Solid Yellow	1Gb/s Link Speed

2-4 Jumpers and Connectors

Explanation of Jumpers

To modify the operation of the add-on card, a jumper can be used to choose between optional settings. A jumper creates shorts between two pins to change the function of the connector. Pin 1 is identified with a square solder pad on the printed circuit board. See the add-on card layout on page 2-2 for the jumper locations.

Note: On two-pin jumpers, "Closed" means the jumper is on and "Open" means the jumper is off the pins.

Overheat LED

An overheat LED at LED1 displays a warning if the add-on card is overheating. See the table below for the LED status.

Overheat LED Status	
State	Definition
Solid	Overheat

Chapter 3

Installation

3-1 Static-Sensitive Devices

Electrostatic Discharge (ESD) can damage electronic components. To avoid damaging your add-on card, it is important to handle it very carefully. The following measures are generally sufficient to protect your equipment from ESD.

Precautions

- Use a grounded wrist strap designed to prevent static discharge.
- Touch a grounded metal object before removing the add-on card from the antistatic bag.
- Handle the add-on card by its edges only; do not touch its components.
- Put the add-on card back into the antistatic bags when not in use.
- For grounding purposes, make sure that your system chassis provides excellent conductivity between the power supply, the case, the mounting fasteners and the add-on card.

Unpacking

The add-on card is shipped in antistatic packaging to avoid static damage. When unpacking your component or system, make sure you are static protected.

Note: To avoid damaging your components and to ensure proper installation, always connect the power cord last, and always unplug it before adding, removing or changing any hardware components.

3-2 Before Installation

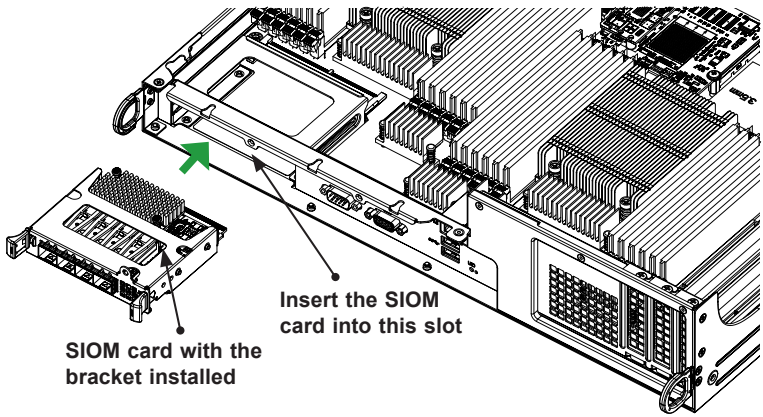
Before you install the add-on card, follow the instructions below.

1. Power down the system.
2. Unplug the power cord.
3. Use industry-standard anti-static equipment such as gloves or a wrist strap and follow the precautions on page 3-1 to avoid damage caused by ESD.
4. Familiarize yourself with the server, motherboard, and/or chassis documentation.
5. Confirm that your operating system includes the latest updates and hotfixes.

3-3 Installing the Add-on Card

Follow the steps below to install the add-on card into your system.

1. Remove the server cover and, if any, set aside any screws for later use.
2. Remove the add-on card slot cover. If the slot cover has a screw, place it aside for later use.
3. Position the add-on card in front of the SIOM slot and gently push in both sides of the card until it slides into the slot.



Note: This add-on card does not support hot plug. Please turn off the AC power and remove the power cord from the wall socket before you install or remove the add-on card.

4. Secure the add-on card to the chassis. If required, use the screw that you previously removed.

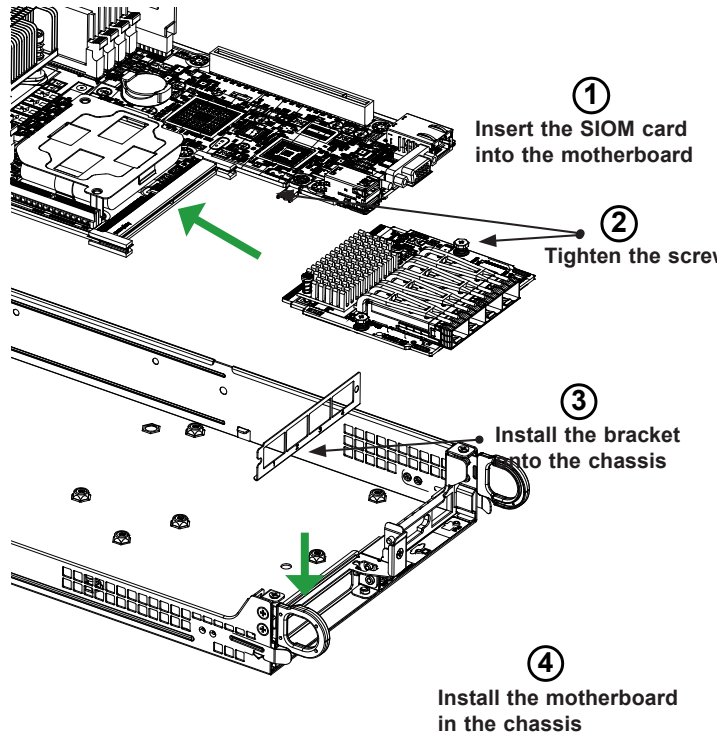
5. Attach any necessary external cables to the add-on card.

6. Replace the system cover.

7. Plug in the power cord and power up the system.

3-4 Installing the Add-on Card (Internal)

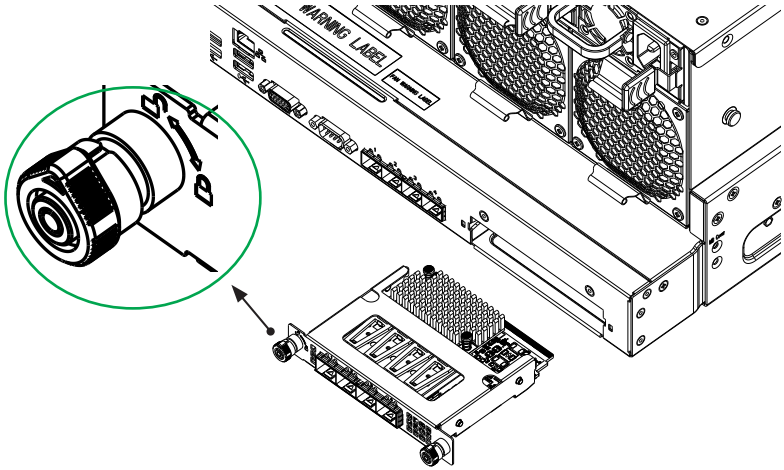
Follow this step to install the add-on card if your system does not support a swappable bracket. Insert the SIOM card in the motherboard and then install the motherboard in the chassis. An internal bracket comes with the SIOM card 1U chassis SKU. It needs to be installed onto the chassis.



Note: It is recommended that the SIOM card installation above be completed by a system integrator or the manufacturer.

3-5 Installing the Add-on Card (Swappable Bracket)

Follow the steps below to install the add-on card into your system that supports a swappable bracket. The add-on card must be installed in the swappable bracket before it can be installed in the your system



1. Install the add-on card into the swappable bracket.

2. Position the add-on card in front of the SIOM slot and gently push in both sides of the card until it slides into the slot.

3. Once the card is in the slot, push both knobs in and turn to the right to lock the card in the system. The left knob has the unlock/lock symbols next to it. To ensure that the add-on is locked, make sure that the knob position indicator is pointing to the lock symbol.

3-6 Installing Drivers on Windows

Follow the steps below to install the drivers for Windows. Download the drivers from the Supermicro FTP site at ftp://ftp.supermicro.com/Networking_Drivers/.

1. Run CDR-NIC.

2. When the SUPERMICRO window appears, click on the computer icon next to the product model.

3. Click on INSTALL DRIVERS AND SOFTWARE.

4. Follow the prompts to complete the installation.

3-7 Installing Drivers on Linux

Follow the steps below to install the drivers for Linux.

Build a Binary RPM Package

1. Download the driver from the Supermicro CDR-NIC LAN driver CD or ftp://ftp.supermicro.com/Networking_Drivers/CDR-NIC_1.62_for_Add-on_NIC_Cards/Intel/LAN/PRO40GB/LINUX. Due to the continuous development of the Linux kernel, the drivers are updated more often than the bundled releases. The latest driver can be found on http://downloadcenter.intel.com.

2. Choose the Intel driver package from LAN/PRO40GB/LINUX.

3. Copy the driver to the directory of your choice. For example:

   ```
   /home/username/i40e
   ```

   or

   ```
   /usr/local/src/i40e
   ```

4. Untar/unzip archive, where <x.x.x> is the version number for the driver tar file:

   ```
   tar zxf i40e-x.x.x.tar.gz
   ```

5. Change to the driver sic directory, where <x.x.x> is the version number for the driver tar:

   ```
   cd i40e-x.x.x/src/
   ```

   ```
   make install
   ```

This will install the Linux driver to your system. For more driver installation information, please refer to the Intel Support Website.

3-8 Installing Drivers on FreeBSD

Follow the instructions below to install the drivers to a FreeBSD system, where <x.x.x> is the driver version as indicated in the name of the driver tar file.

Note: You must have kernel sources installed in order to compile the driver module.

1. Download the driver from the Supermicro CDR-NIC LAN driver CD or ftp://ftp.supermicro.com/Networking_Drivers/CDR-NIC_1.62_for_Add-on_NIC_Cards/Intel/LAN/PRO40GB/FreeBSD. Due to the continuous development of the Linux kernel, the drivers are updated more often than the bundled releases. The latest driver can be found on http://downloadcenter.intel.com.
2. Move the base driver tar file to the directory of your choice. For example, use home/username/ixl or usr/local/src/ixl.
3. Untar/unzip the archive:

```
tar xfz ixl-x.x.xtar.gz
```

4. To install man page:

```
cd ixl-x.x.x

gzip -c ixl.4 /usr/share/man/man4/ixl.4.gz
```

5. To load the driver onto running system:

```
cd ixl-x.x.x/src

make load
```

6. To assign an IP address to the interface, enter the following:

```
ifconfig ix<interface_num> <IP_address>
```

7. Verify that the interface works. Enter the following, where <IP_address> is the IP address for another machine on the same subnet as the interface that is being tested::

```
ping <IP_address>
```

8. If you want the driver to load automatically when the system is booted:

```
cd ixl-x.x.x/src

make

make install
```

9. Edit /boot/loader.conf, and add the following line:

```
ixl_load="YES"
```

or

compile the driver into the kernel (see item 10)

Edit /etc/rc.conf, and create the appropriate ifconfig_ixl<interface_num> entry:

```
ifconfig_ix<interface_num>
```

Example usage:

```
ifconfig_ix0="inet 192.168.10.1 netmask 255.255.255.0"
```

Note: For assistance, see the ifconfig main page.

10. If you want to compile the driver into the kernel, enter:

FreeBSD 7 or later:

```
cd ixl-x.x.x/src

cp *.[ch] /user/src/sys/dev/ixl

cp Makefile.kernel /usr/src/sys/modules/ixl/Makefile
```

Edit the kernel configuration file (i.e., GENERIC or MYKERNEL) in /usr/src/sys/i386/conf (replace "i386" with the appropriate system architecture if necessary, and ensure the following line is present:

```
device ixl
```

Compile and install the kernel. The system must be rebooted for the kernel updates to take effect. For additional information on compiling the kernel, consult the FreeBSD operating system documentation.

Notes

(Disclaimer Continued)

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