Cisco Embedded Service 2020 Series Switches Hardware Technical Guide

Models: ESS-2020-CON, ESS-2020-NCP, ESS-2020-16TC-CON, ESS-2020-16TC-NCP

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This hardware technical guide provides a product description, specifications, and compliance information for the Cisco Embedded Service 2020 Series Switches.

Note The documentation set for this product strives to use bias-free language. For purposes of this documentation set, bias-free is defined as language that does not imply discrimination based on age, disability, gender, racial identity, ethnic identity, sexual orientation, socioeconomic status, and intersectionality. Exceptions may be present in the documentation due to language that is hardcoded in the user interfaces of the product software, language used based on RFP documentation, or language that is used by a referenced third-party product.

Contents

This guide is organized into the following sections:

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Overview

The Cisco ESS 2020 is an embedded Ethernet switch card family that conforms to the PC104 form factor board size. The compact design simplifies integration and offers system integrators the ability to use the Cisco ESS 2020 in a wide variety of applications. The Cisco ESS 2020 consists of a main board and an optional expansion board. Both the main board and the expansion board are available with Cisco-designed cooling plates, and are also available without the cooling plates for system integrators who want to design their own custom thermal solutions.

Table 1 provides the hardware product IDs and brief descriptions for the boards.

Table 1 Cisco ESS 2020 Models

Model	Description	Software Image
ESS-2020-CON	Embedded Service Switch Main Board (with conduction cooling plate), 2GE (copper or fiber), 8FE, console	LAN Lite Can upgrade to LAN Base
ESS-2020-NCP	Embedded Service Switch Main Board (no cooling plate), 2GE (copper or fiber), 8FE, console	LAN Lite Can upgrade to LAN Base
ESS-2020-16TC-CON	Embedded Service Switch Expansion Board (with conduction cooling plate), 16FE	
ESS-2020-16TC-NCP	Embedded Service Switch Expansion Board (no cooling plate), 16FE	

Note Refer to the Cisco ESS 2020 data sheet for a complete list of available product IDs.

Note When using the console connection, it is important to not press the break key too early during boot. You should only press the break key when the image begins to load (you will see pound signs). Failure to wait will not allow the break key to work.

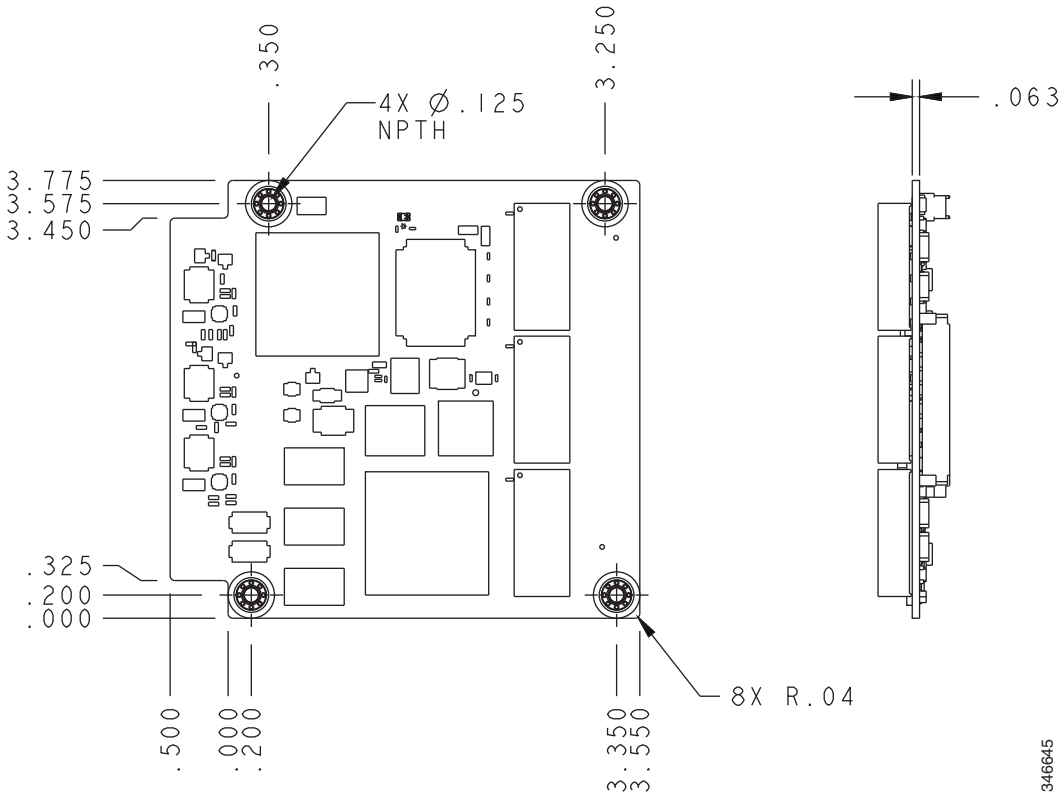
Audience

This guide is for system integrators who are integrating the Cisco ESS 2020 into a custom end product.

Main Board Layout and Dimensions

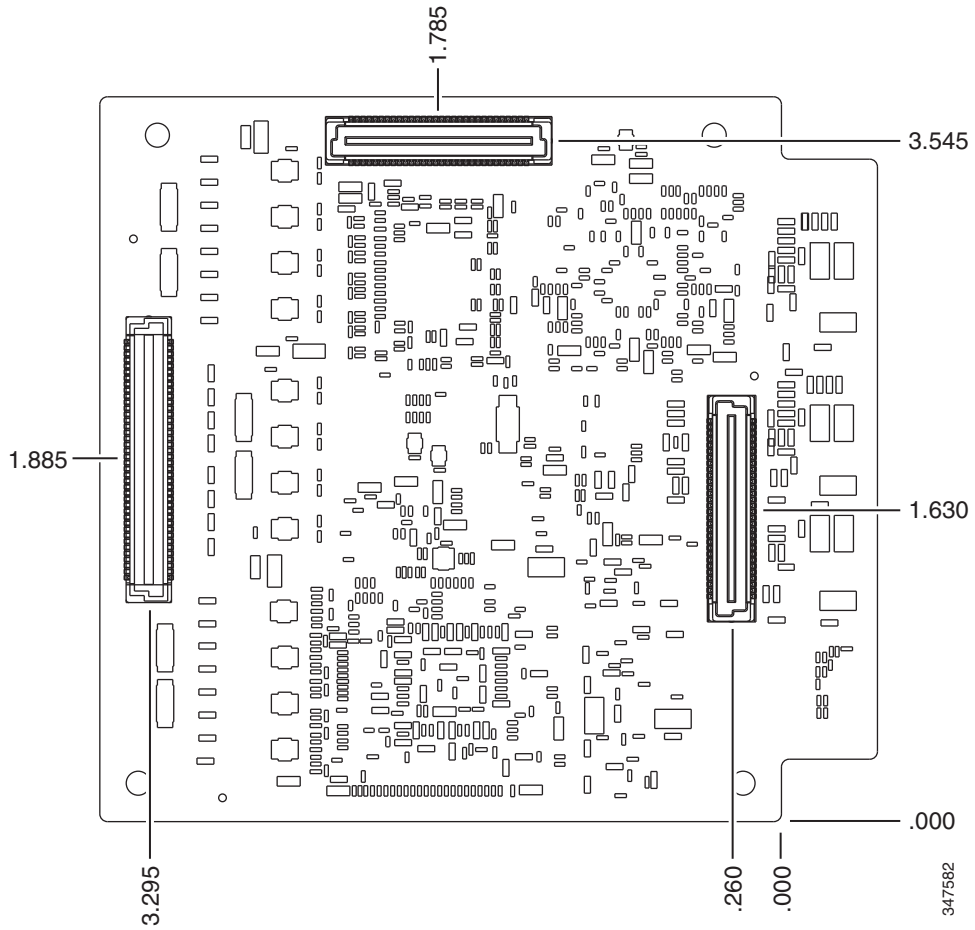
Figure 1 and Figure 2 show the layout and dimensions of the main board that is not equipped with the Cisco-designed cooling plate (ESS-2020-NCP).

Figure 1 ESS-2020-NCP (Main Board Without the Cooling Plate)—Top and Side Views



Note Dimensions in inches. Tolerances (unless otherwise stated): .XX +/- 0.010, .XXX +/- 0.005

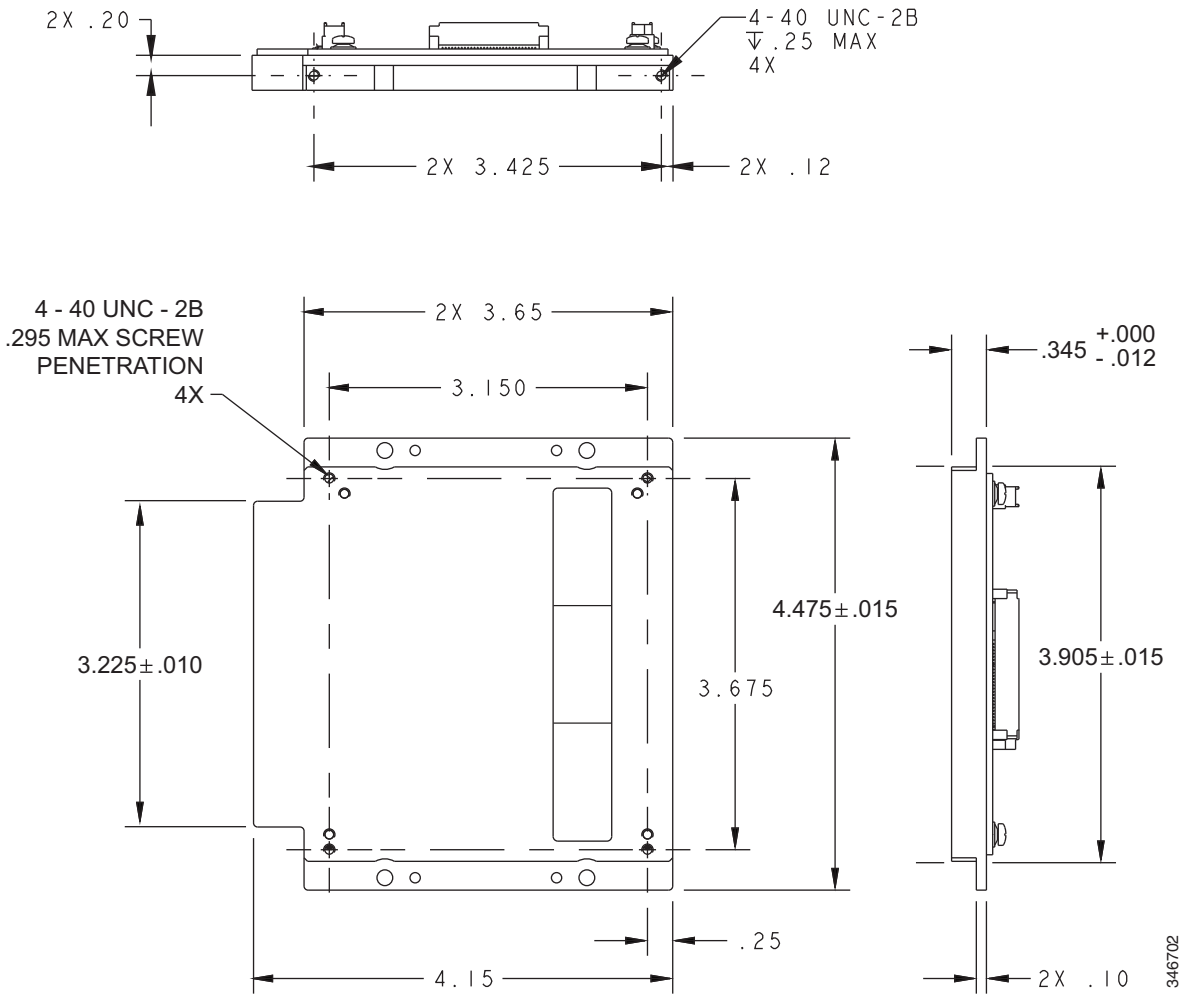
Figure 2 ESS-2020-NCP (Main Board Without Cooling Plate)—Bottom View



Note Dimensions in inches. Tolerances (unless otherwise stated): .XX +/- 0.010, .XXX +/- 0.005

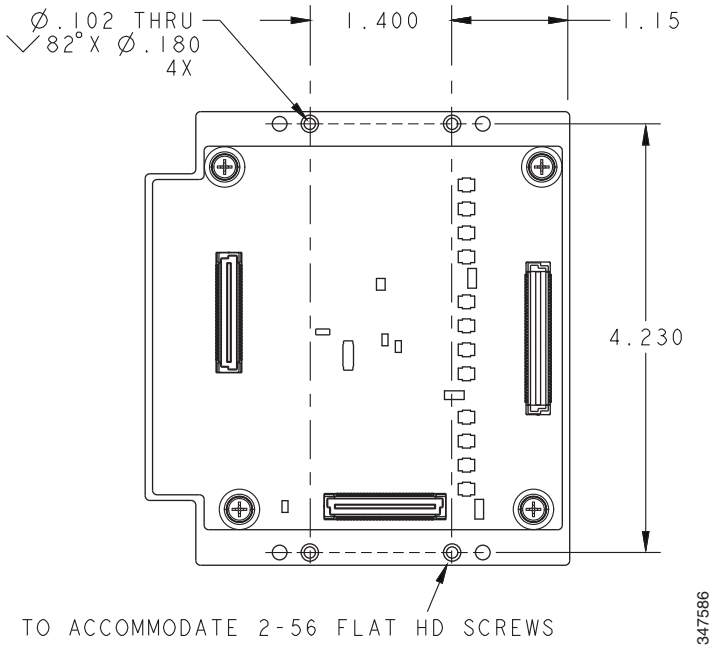
Figure 3 and Figure 4 show the layout and dimensions of the main board that is equipped with the Cisco-designed cooling plate (ESS-2020-CON).

Figure 3 ESS-2020-CON (Main Board with Cooling Plate) —Top and Side Views



Note Dimensions in inches. Tolerances (unless otherwise stated): .XX +/- 0.010, .XXX +/- 0.005

Figure 4 ESS-2020-CON (Main Board with Cooling Plate) —Bottom View



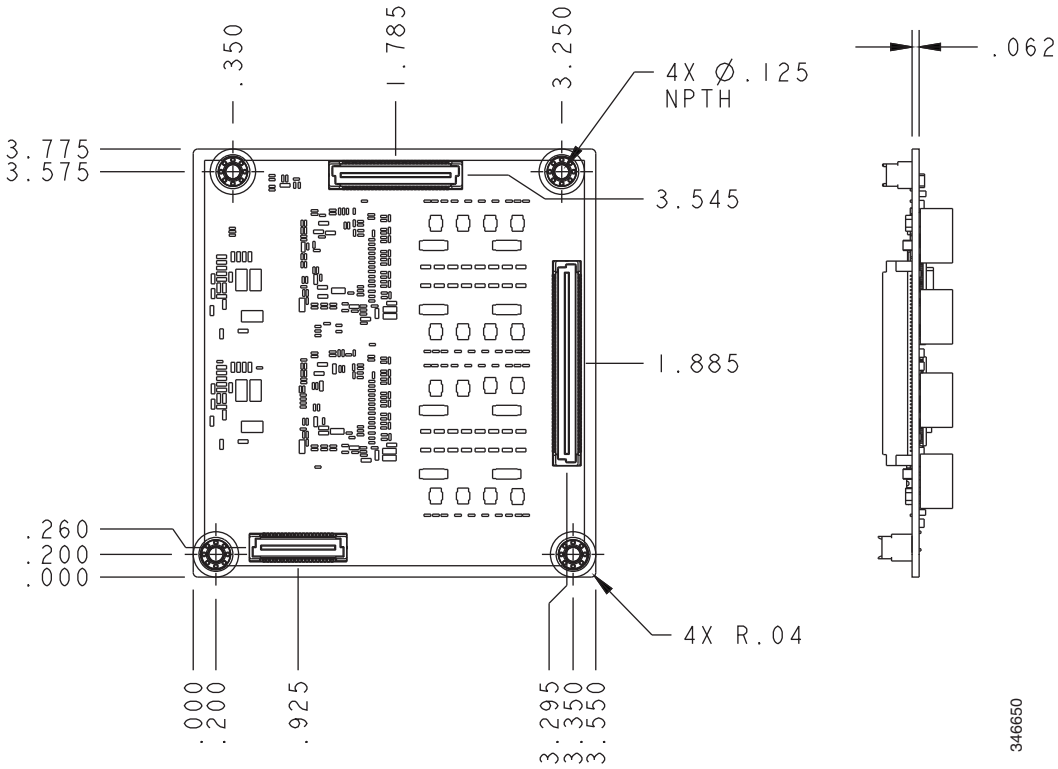
Note Dimensions in inches. Tolerances (unless otherwise stated): .XX +/- 0.010, .XXX +/- 0.005

Expansion Board Layout and Dimensions

Figure 5 and Figure 6 show the layout and dimensions of the expansion board that is not equipped with the Cisco-designed cooling plate (ESS-2020-16TC-NCP).

Note Compared to the PC104 specification, the corner mounting holes are mirrored. This design allows the expansion card to be mounted upside-down to an I/O board that is also mated to the base card in a "sandwich configuration." For more information, see Sandwich Configuration, page 38.

Figure 5 ESS-2020-16TC-NCP (Expansion Board Without Cooling Plate) — Bottom and Side View



Note Dimensions in inches. Tolerances (unless otherwise stated): .XX +/- 0.010, .XXX +/- 0.005

Figure 6 ESS-2020-16TC-NCP (Expansion Board Without Cooling Plate) — Top View

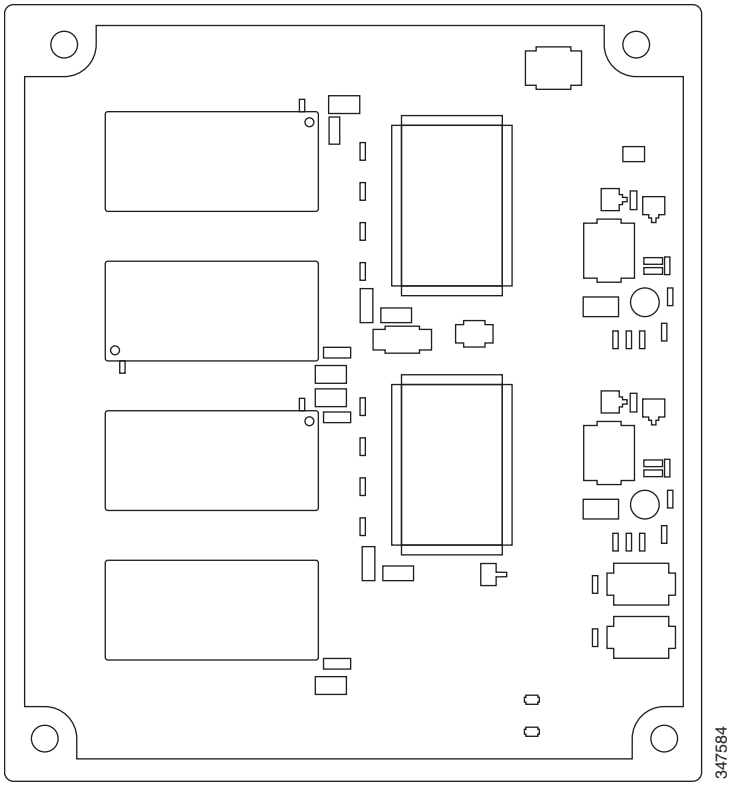
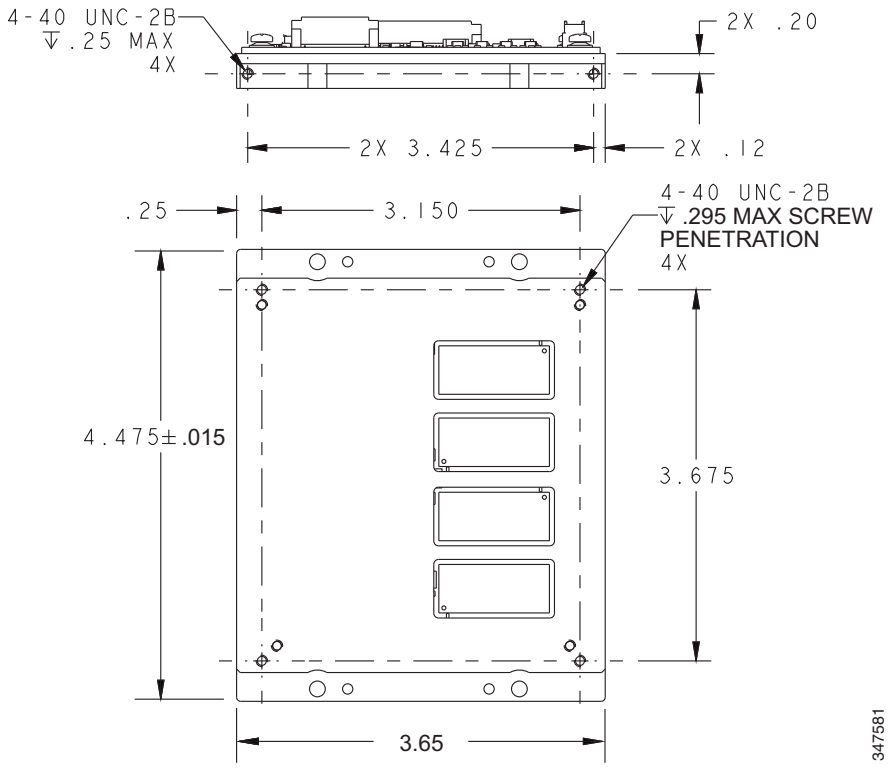


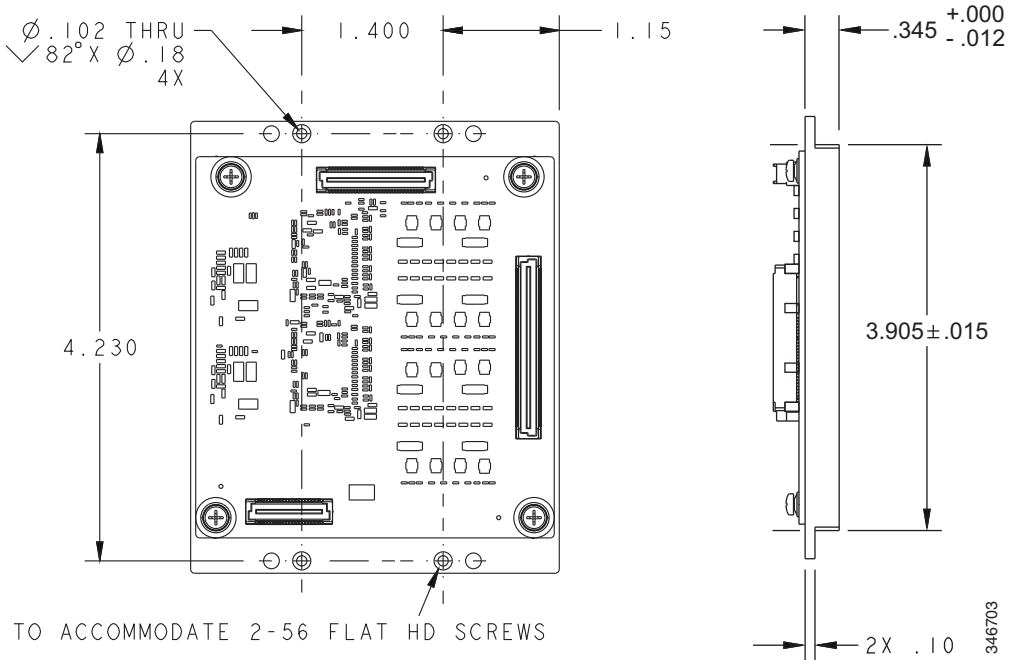
Figure 8 and Figure 7 show the layout and dimensions of the expansion board that is equipped with the Cisco-designed cooling plate (ESS-2020-16TC-CON).

Figure 7 ESS-2020-16TC-CON (Expansion Board with Cooling Plate)—Top and Side Views



Note Dimensions in inches. Tolerances (unless otherwise stated): .XX +/- 0.010, .XXX +/- 0.005

Figure 8 ESS-2020-16TC-CON (Expansion Board with Cooling Plate)—Bottom and Side View



Note Dimensions in inches. Tolerances (unless otherwise stated): .XX +/- 0.010, .XXX +/- 0.005

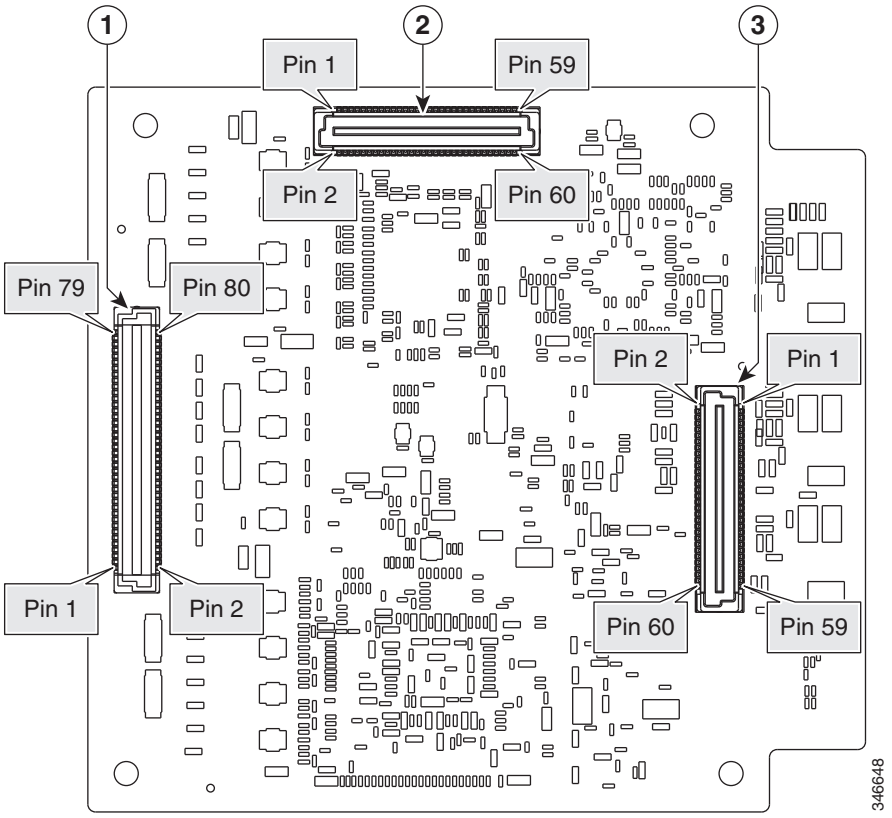
Interface Connectors

The main board and the expansion board each have three connectors that provide power and interface connections to external devices and to each other. All of the connectors belong to the Free Height family of connectors from TE Connectivity. Depending on the mating connector selected by the integrator, a stacking height of 7 mm, 11 mm, or 15 mm can be achieved. See the "Board to Board Connectors" section on page 24 for additional information on connector stacking height and selecting compatible connectors.

Main Board Interface Connectors

The locations and designations of the three main board interface connectors are shown in Figure 9.

Figure 9 ESS-2020 (Main Board) Connectors



1	P13 (Ethernet I/O connector). See Table 2 Cisco ESS-2020 (Main Board) Ethernet I/O Connector (P13) Pinout.
2	P22 (Port expansion connector). See Table 4 Cisco ESS-2020 (Main Board) and Cisco ESS-2020-16TC (Expansion Board) Port Expansion Connector (P22) Pinout.
3	P15 (Digital I/O, console, and power connector). See Table 3 Cisco ESS-2020 (Main Board) Digital I/O, Console, and Power Connector (P15) Pinout.

ESS-2020 (Main Board) Ethernet I/O Connector (P13)

The main board Ethernet I/O connector (P13) is a TE Connectivity 1-5179030-3 80-pin connector. Table 2 provides a pinout listing for the Ethernet I/O connector. See Figure 9 for the pin numbering convention.

Table 2 Cisco ESS-2020 (Main Board) Ethernet I/O Connector (P13) Pinout

Odd Pin Number	Signal Name		Even Pin Number	Signal Name
1	GND		2	NC (unused)
3	SFP_GE1/2_RX+		4	ETH_GE1/2_TRD0+
5	SFP_GE1/2_RX-		6	ETH_GE1/2_TRD0-
7	GND		8	ETH_GE1/2_TRD1+
9	SFP_GE1/2_TX+		10	ETH_GE1/2_TRD1-
11	SFP_GE1/2_TX-		12	ETH_GE1/2_TRD2+
13	GND		14	ETH_GE1/2_TRD2-
15	SFP_GE1/1_RX-		16	ETH_GE1/2_TRD3+
17	SFP_GE1/1_RX+		18	ETH_GE1/2_TRD3-
19	GND		20	NC (unused)
21	SFP_GE1/1_TX-		22	ETH_GE1/1_TRD0+
23	SFP_GE1/1_TX+		24	ETH_GE1/1_TRD0-
25	GND		26	ETH_GE1/1_TRD1+
27	NC (unused)		28	ETH_GE1/1_TRD1-
29	NC (unused)		30	ETH_GE1/1_TRD2+
31	Chassis_GND		32	ETH_GE1/1_TRD2-
33	Chassis_GND		34	ETH_GE1/1_TRD3+
35	Chassis_GND		36	ETH_GE1/1_TRD3-
37	NC (unused)		38	NC (unused)
39	NC (unused)		40	NC (unused)
41	ETH_FE1/7_TX-		42	ETH_FE1/8_TX-
43	ETH_FE1/7_TX+		44	ETH_FE1/8_TX+
45	ETH_FE1/7_RX-		46	ETH_FE1/8_RX-
47	ETH_FE1/7_RX+		48	ETH_FE1/8_RX+
49	NC (unused)		50	NC (unused)
51	ETH_FE1/5_TX-		52	ETH_FE1/6_TX-
53	ETH_FE1/5_TX+		54	ETH_FE1/6_TX+
55	ETH_FE1/5_RX-		56	ETH_FE1/6_RX-
57	ETH_FE1/5_RX+		58	ETH_FE1/6_RX+
59	NC (unused)		60	NC (unused)
61	ETH_FE1/3_TX-		62	ETH_FE1/4_TX-
63	ETH_FE1/3_TX+		64	ETH_FE1/4_TX+

Table 2 Cisco ESS-2020 (Main Board) Ethernet I/O Connector (P13) Pinout (continued)

Odd Pin Number	Signal Name		Even Pin Number	Signal Name
65	ETH_FE1/3_RX-		66	ETH_FE1/4_RX-
67	ETH_FE1/3_RX+		68	ETH_FE1/4_RX+
69	NC (unused)		70	NC (unused)
71	ETH_FE1/1_TX-		72	ETH_FE1/2_TX-
73	ETH_FE1/1_TX+		74	ETH_FE1/2_TX+
75	ETH_FE1/1_RX-		76	ETH_FE1/2_RX-
77	ETH_FE1/1_RX+		78	ETH_FE1/2_RX+
79	NC (unused)		80	NC (unused)

The following are guidelines for the P13 connector:

- The main board has Ethernet transformers for the copper Gigabit Ethernet 1/1-2 transmit/receive signal pairs (designated ETH_GE*). In 1000BASE-T mode, all pairs transmit and receive; for 10/100BASE-T, TRD0+/- typically transmits and TRD1+/- typically receives.
- Serial Gigabit Media Independent Interface (SGMII) signals are intended for connection to approved SFP transceivers. See Table 19 for a list of supported SFP transceivers.
- The Chassis_GND signal is not electrically connected to the GND signal on the main board. Chassis_GND is used as the termination for the center taps on the main board Ethernet magnetics. You should either connect or not connect these signals together as required for your specific application.
- The main board contains Ethernet transformers for all of the FastEthernet ports 1/1–8 transmit/receive pairs (signals designated ETH_FE*).

ESS-2020 (Main Board) Digital I/O, Console, and Power Connector (P15)

The digital I/O, console, and power connector (P15) is a TE Connectivity 7-5177986-2 60-pin connector. Table 3 provides a pinout listing for the connector. See Figure 9 for the pin numbering convention.

Table 3 Cisco ESS-2020 (Main Board) Digital I/O, Console, and Power Connector (P15) Pinout

Pins	Signal Name	Direction	Technology/ Threshold[1]	Description
1–4, 6	+3.3 VDC	—	PWR	—
5, 22, 24, 25	NC (unused)	—	—	—
7–12, 18–20, 27, 29–31, 34, 36, 46, 47, 53, 54, 59, 60	GND	—	GND	Ground.
13, 15, 17, 21, 23	+5 VDC	—	PWR	—
42, 43, 44, 45, 49, 51, 55, 57	Reserved			Leave these pins unconnected.
14	SFP_GE1/1 _I2C_SDA	I/O	3.3VLVTTL thresholds, OD, PU	I2C data signal intended for connection to MOD-DEF2 pin of standard SFP module connector corresponding to Gigabit Ethernet 1/1.[2]
16	SFP_GE1/2 _I2C_SDA	I/O	3.3VLVTTL thresholds, OD, PU	I2C data signal intended for connection to MOD-DEF2 pin of standard SFP module connector corresponding to GigabitEthernet 1/2.[2]
26	SFP_GE1/2 _TXFLT	I	3.3VLVTTL thresholds, PU	Transmit fault signal from standard SFP module corresponding to GigabitEthernet 1/2. • Logic low: Normal operation • Logic high: Laser fault detected
28	SFP_GE1/1 _TXDSBL	O	3.3VLVTTL thresholds	Transmit disable signal to standard SFP module corresponding to GigabitEthernet 1/1. • Logic low: Normal operation • Logic high: Disable SFP module transmitter
32	SFP_GE1/2 _TXDSBL	O	3.3VLVTTL thresholds	Transmit disable signal to standard SFP module corresponding to GigabitEthernet 1/2. • Logic low: Normal operation • Logic high: Disable SFP module transmitter

Table 3 Cisco ESS-2020 (Main Board) Digital I/O, Console, and Power Connector (P15) Pinout

Pins	Signal Name	Direction	Technology/ Threshold[1]	Description
33	SFP_GE1/1 _TXFLT	I	3.3VLVTTL thresholds, PU	Transmit fault signal from standard SFP module corresponding to GigabitEthernet 1/1. • Logic low: Normal operation • Logic high: Laser fault detected
35	SFP_GE1/1 _PRES_L	I	3.3VLVTTL thresholds, PU	SFP module presence signal intended for connection to MOD-DEF0 pin of standard SFP module connector corresponding to GigabitEthernet 1/1. • Logic low: Module present • Logic high: Module not present
37	SFP_GE1/2 _PRES_L	I	3.3VLVTTL thresholds, PU	SFP module presence signal intended for connection to MOD-DEF0 pin of standard SFP module connector corresponding to GigabitEthernet 1/2. • Logic low: Module present • Logic high: Module not present
38	SFP_GE1/1 _RXLOS	I	3.3VLVTTL thresholds, PU	Loss of signal indication from standard SFP module corresponding to GigabitEthernet 1/1. • Logic low: Normal operation • Logic high: Optical receive strength too low
39	LED_EXP_I 2C_SDA	I/O	3.3VLVTTL thresholds, OD, PU	I2C data signal intended for connection to LED GPIO expansion circuitry on integrator's design. Refer to "LED Definitions" section on page 25 for sample circuit diagram. This signal is also used for I2C connectivity to the expansion board (if present).[2]
40	SFP_GE1/2 _RXLOS	I	3.3VLVTTL thresholds, PU	Loss of signal indication from standard SFP module corresponding to GigabitEthernet 1/2. • Logic low: Normal operation • Logic high: Optical receive strength too low

Table 3 Cisco ESS-2020 (Main Board) Digital I/O, Console, and Power Connector (P15) Pinout

Pins	Signal Name	Direction	Technology/ Threshold[1]	Description
41	SFP_LED_I 2C_SCL	O	3.3 V LVTTL thresholds	I^2C clock signal intended for connection to MOD-DEF1 pin of standard SFP module connectors and to LED GPIO expansion circuitry. Buffer this signal as necessary for your design (depending on the number of loads and the layout). [3]
48	CONSOLE_ RTS	O	RS-232	Optional console port Request-to-Send signal. If not required, leave unconnected.
50	FACTORY_ DEFAULT_I NPUT_L	I	3.3 V LVTTL thresholds, PU	• Logic low: Initiate factory default process • Logic high: Normal operation
52	CONSOLE_ TXD	O	RS-232	Console port transmit data signal.
56	CONSOLE_ RXD	I	RS-232	Console port receive data signal.
58	CONSOLE_ CTS	I	RS-232	Optional console port Clear-to-Send signal. If not required, leave unconnected.

1. PU = Pull-up resistor present on board
   OD=Open drain implementation
2. Trace should be no longer than 12 inches in length.
3. Buffering should be used on this line if there are over 8 loads present or the trace length is over 8 inches. Buffering can be performed unidirectionally since none of the downstream devices support I^2C clock stretching. As an example, buffering could be done using a standard LVC245A device.

ESS-2020 (Main Board) Port Expansion Connector (P22)

The port expansion connector (P22) provides the interface between the main board and the expansion board. The connector is a TE Connectivity 7-5177986-2 60-pin connector. Table 4 provides a pinout listing for the port expansion connector on both the main board and the expansion board. See Figure 9 for the pin numbering convention.

Note If the expansion card is not used in your application, this connector does not need to be used. It can simply be left unconnected.

Table 4 Cisco ESS-2020 (Main Board) and Cisco ESS-2020-16TC (Expansion Board) Port Expansion Connector (P22) Pinout

Main Board P22 Connector Pin Number	Signal Name	Expansion Board P22 Connector Pin Number
1	EXP_CLK_125MHZ	1
2	GND	2
3	GND	3

Table 4 Cisco ESS-2020 (Main Board) and Cisco ESS-2020-16TC (Expansion Board) Port Expansion Connector (P22) Pinout (continued)

Main Board P22 Connector Pin Number	Signal Name	Expansion Board P22 Connector Pin Number
4	EXP_SYNC_P17_P24	4
5	EXP_TXD_P22	5
6	EXP_TXD_P24	6
7	EXP_TXD_P19	7
8	EXP_TXD_P23	8
9	EXP_TXD_P20	9
10	EXP_TXD_P21	10
11	EXP_TXD_P17	11
12	GND	12
13	EXP_TXD_P18	13
14	EXP_RXD_P19	14
15	GND	15
16	EXP_RXD_P21	16
17	EXP_RXD_P18	17
18	EXP_RXD_P24	18
19	EXP_RXD_P23	19
20	EXP_RXD_P22	20
21	EXP_RXD_P20	21
22	GND	22
23	EXP_RXD_P17	23
24	EXP_SYNC_P9_P16	24
25	GND	25
26	EXP_TXD_P15	26
27	EXP_RXD_P13	27
28	EXP_TXD_P16	28
29	EXP_TXD_P9	29
30	EXP_TXD_P13	30
31	EXP_RXD_P16	31
32	EXP_TXD_P14	32
33	EXP_RXD_P11	33
34	GND	34
35	GND	35
36	EXP_RXD_P15	36
37	EXP_RXD_P9	37

Table 4 Cisco ESS-2020 (Main Board) and Cisco ESS-2020-16TC (Expansion Board) Port Expansion Connector (P22) Pinout (continued)

Main Board P22 Connector Pin Number	Signal Name	Expansion Board P22 Connector Pin Number
38	EXP_TXD_P12	38
39	EXP_RXD_P12	39
40	EXP_TXD_P11	40
41	EXP_RXD_P10	41
42	EXP_TXD_P10	42
43	EXP_RXD_P14	43
44	GND	44
45	GND	45
46	EXP_IRQ_L	46
47	EXP_RESET_L	47
48	Reserved. Leave unconnected.[1]	48
49	EXP_TYPE0	49
50	Reserved. Leave unconnected.[1]	50
51	EXP_TYPE1	51
52	EXP_ENABLE	52
53	EXP_TYPE2	53
54	EXP_PWRGOOD	54
55	GND	55
56	The main board P22 connector pin 56 should be unconnected. The expansion board P22 connector pin 56 should be connected to the main board P15 connector, pin 39 (LED_EXP_I2C_SDA)[1]	56
57	EXP_MDIO	57
58	EXP_I2C_SCL	58
59	EXP_MDC	59
60	GND	60

1. You should connect all pins from the main board P22 connector and the expansion board P22 connector, except for pins 48, 50, and 56. No pull-up or pull-down resistors are required for the main board interconnect to the expansion board. All GND signals on each connector should connect to a common ground plane; not routed via a trace between the two connectors.

Table 5 provides the system integrator with notes about the signal groupings and the routing rules for signals on the P22 connector.

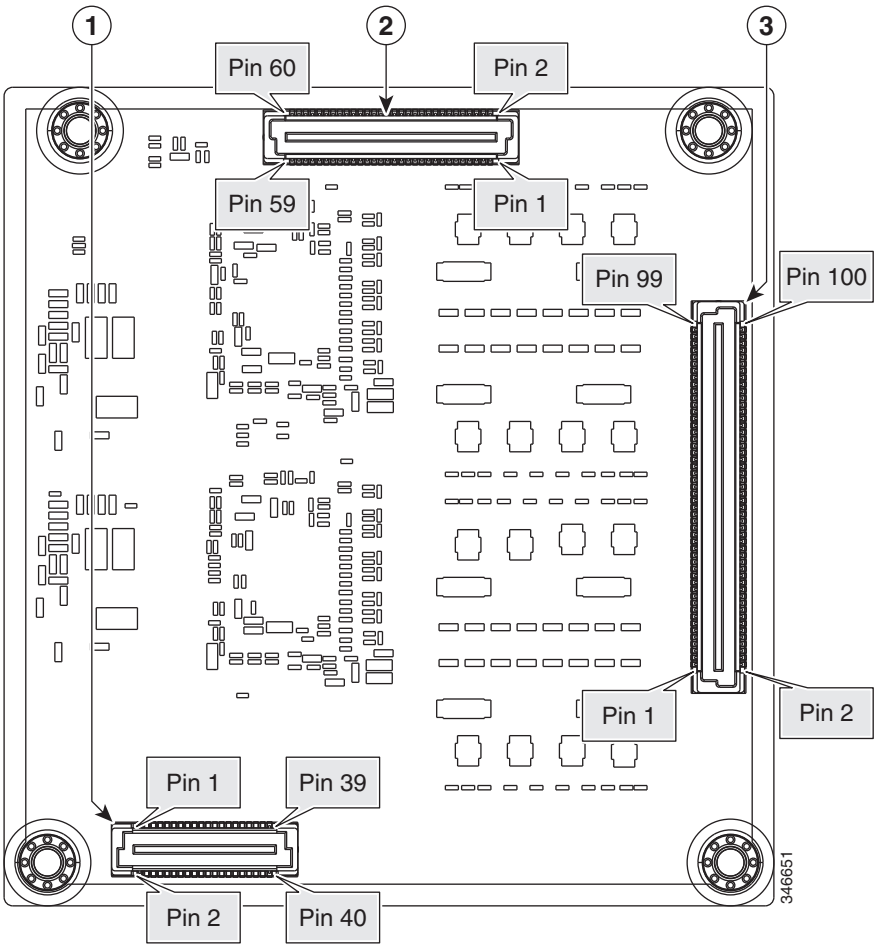
Table 5 P22 Connector Signal Integrator Notes

Signal Groupings	Description	Notes
EXP_CLK_125M	Serial Media Independent Interface (SMII) Clock signal from the main board to the expansion board.	These signals are considered high speed and are associated with the 125 MHz SMII bus between the main board and the expansion board. These signals should be routed according to the following rules: • All traces should be matched within 50 mils. • Trace length should be between 1 in (2.54 cm) and 3.5 in (8.89 cm), measured from the main board connector to the expansion board connector. • Traces should be routed over a continuous ground plane. • Trace impedance should be between 55–60 ohms.
EXP_SYNC_Px_Py	SMII sync signals from the main board to the expansion board.	
EXP_TXD_Px	SMII transmit serial data from the main board to the expansion board.	
EXP_RXD_Px	SMII receive serial data from the expansion board to the main board.	
EXP_IRQ_L	Interrupt signal from the expansion board to the main board.	—
EXP_RESET_L	Reset signal from the main board to the expansion board.	—
EXP_ENABLE	Power enable signal from the main board to the expansion board.	Used to synchronize expansion board power sequencing.
EXP_PWRGOOD	Power good indication from the main board to the expansion board.	Used to synchronize expansion board power sequencing.
EXP_I2C_x	I2C bus (clock and data)	—
EXP_MDx	PHY MDIO bus (clock and data)	—

ESS-2020-16TC (Expansion Board) Interface Connectors

The locations and designations of the three expansion board connectors are shown in Figure 10.

Figure 10 Cisco ESS-2020-16TC (Expansion Board) Connectors



1	P11 (power connector). See Table 7 Cisco ESS-2020-16TC (Expansion Board) Power Connector (P11) Pinout.
2	P22 (port expansion connector). See Table 4 Cisco ESS-2020 (Main Board) and Cisco ESS-2020-16TC (Expansion Board) Port Expansion Connector (P22) Pinout.
3	P10 (Ethernet I/O connector). See Table 6 Cisco ESS-2020-16TC (Expansion Board) Ethernet I/O Connector (P10) Pinout.

ESS-2020-16TC (Expansion Board) Ethernet I/O Connector (P10)

The expansion board Ethernet I/O connector (P10) is a TE Connectivity 7-5177986-4 100-pin connector. Table 6 provides a pinout listing for the connector. See Figure 10 for the pin numbering convention.

Table 6 Cisco ESS-2020-16TC (Expansion Board) Ethernet I/O Connector (P10) Pinout

Odd Pin Number	Signal		Even Pin Number	Signal
1, 3, 5, 7	Chassis_GND		2, 4, 6, 8	Chassis_GND
9, 11	Unused (NC)		10, 12	Unused (NC)
13	ETH_FE1/9_TX-		14	ETH_FE1/10_TX-
15	ETH_FE1/9_TX+		16	ETH_FE1/10_TX+
17	ETH_FE1/9_RX-		18	ETH_FE1/10_RX-
19	ETH_FE1/9_RX+		20	ETH_FE1/10_RX+
21	Unused (NC)		22	Unused (NC)
23	ETH_FE1/11_TX-		24	ETH_FE1/12_TX-
25	ETH_FE1/11_TX+		26	ETH_FE1/12_TX+
27	ETH_FE1/11_RX-		28	ETH_FE1/12_RX-
29	ETH_FE1/11_RX+		30	ETH_FE1/12_RX+
31	Unused (NC)		32	Unused (NC)
33	ETH_FE1/13_TX-		34	ETH_FE1/14_TX-
35	ETH_FE1/13_TX+		36	ETH_FE1/14_TX+
37	ETH_FE1/13_RX-		38	ETH_FE1/14_RX-
39	ETH_FE1/13_RX+		40	ETH_FE1/14_RX+
41	Unused (NC)		42	Unused (NC)
43	ETH_FE1/15_TX-		44	ETH_FE1/16_TX-
45	ETH_FE1/15_TX+		46	ETH_FE1/16_TX+
47	ETH_FE1/15_RX-		48	ETH_FE1/16_RX-
49	ETH_FE1/15_RX+		50	ETH_FE1/16_RX+
51	Unused (NC)		52	Unused (NC)
53	ETH_FE1/17_TX-		54	ETH_FE1/18_TX-
55	ETH_FE1/17_TX+		56	ETH_FE1/18_TX+
57	ETH_FE1/17_RX-		58	ETH_FE1/18_RX-
59	ETH_FE1/17_RX+		60	ETH_FE1/18_RX+
61	Unused (NC)		62	Unused (NC)
63	ETH_FE1/19_TX-		64	ETH_FE1/20_TX-
65	ETH_FE1/19_TX+		66	ETH_FE1/20_TX+
67	ETH_FE1/19_RX-		68	ETH_FE1/20_RX-
69	ETH_FE1/19_RX+		70	ETH_FE1/20_RX+
71	Unused (NC)		72	Unused (NC)

Table 6 Cisco ESS-2020-16TC (Expansion Board) Ethernet I/O Connector (P10) Pinout

Odd Pin Number	Signal		Even Pin Number	Signal
73	ETH_FE1/21_TX-		74	ETH_FE1/22_TX-
75	ETH_FE1/21_TX+		76	ETH_FE1/22_TX+
77	ETH_FE1/21_RX-		78	ETH_FE1/22_RX-
79	ETH_FE1/21_RX+		80	ETH_FE1/22_RX+
81	Unused (NC)		82	Unused (NC)
83	ETH_FE1/23_TX-		84	ETH_FE1/24_TX-
85	ETH_FE1/23_TX+		86	ETH_FE1/24_TX+
87	ETH_FE1/23_RX-		88	ETH_FE1/24_RX-
89	ETH_FE1/23_RX+		90	ETH_FE1/24_RX+
91, 93	Unused (NC)		92, 94	Unused (NC)
95, 97, 99	Chassis_GND		96, 98, 100	Chassis_GND

Note The expansion board contains Ethernet transformers for all of the Fast Ethernet transmit/receive pairs for ports 1/9 through 1/24 (signals designated ETH_FE*).

Note The Chassis_GND signal is not electrically connected to GND on the expansion card. Chassis_GND is used as the termination for the center taps on the Ethernet magnetics. You should either connect or not connect these signals together as needed for your specific application.

ESS-2020-16TC (Expansion Board) Power Connector (P11)

The expansion board power connector (P11) is a TE Connectivity 1-5179030-1 40-pin connector. Table 7 provides a pinout listing for the connector. See Figure 10 for the pin numbering convention.

Table 7 Cisco ESS-2020-16TC (Expansion Board) Power Connector (P11) Pinout

Pin Numbers	Signal Name
1, 3, 5, 7, 9,11, 13	+5 VDC
2, 4, 6, 8, 10, 12, 14	+3.3 VDC
15–20	Unused
21–40	GND

ESS-2020-16TC (Expansion Board) Port Expansion Connector (P22)

The port expansion connector provides the interface between the expansion board and the main board. The connector is a TE Connectivity 7-5177986-2 60-pin connector. Table 4 provides a pinout listing for the connector. See Figure 10 for the pin numbering convention.

Board to Board Connectors

Both the main board and the expansion board use the Free Height board-to-board connector family from TE Connectivity. Depending on the mating connector you select, a stacking height of 7 mm, 11 mm, or 15 mm can be achieved. Table 8 lists the board connectors and the mating connector options that are available to achieve specific stacking heights.

Table 8 Cisco ESS-2020 (Main Board) Connectors and Mating Connector Options

ESS-2020 Plug					Total Mated Height Desired (mm)[1]	Mating Receptacle			
Connector	TE Connectivity Part Number	Pins	Contact Plating	Height (mm)		TE Part Number	Contact Plating	Height (mm)	Delivery Method
P13	1-5179030-3	80	30µ" Au	3.2	15	5084618-3	30µ" Au	11.75	tape/reel
					15	5-6123212-3		11.75	tube
					11	7-5179180-3		7.75	tape/reel
					11	5084613-3		7.75	tube
					7	5353999-3		3.75	tape/reel
					7	6123000-3		3.75	tube
P15, P22	7-5177986-2	60	30µ" Au	3.2	15	5084618-2	30µ" Au	11.75	tape/reel
					15	5-6123212-2		11.75	tube
					11	7-5179180-2		7.75	tape/reel
					11	5084613-2		7.75	tube
					7	5353999-2		3.75	tape/reel
					7	6123000-2		3.75	tube

1. Offset distance between the ESS-2020 and motherboard, or other mating card.

Table 9 Cisco ESS-2020-16TC (Expansion Board) Connectors and Mating Connector Options

ESS-2020-16TC Plug					Total Mated Height Desired (mm)[1]	Mating Receptacle			
Connector	TE Connectivity Part Number	Pins	Contact Plating	Height (mm)		TE Part Number	Contact Plating	Height (mm)	Delivery Method
P11	1-5179030-1	40	30µ" Au	3.2	15	5084618-1	30µ" Au	11.75	tape/reel
					15	5-6123212-1		11.75	tube
					11	7-5179180-1		7.75	tape/reel
					11	5084613-1		7.75	tube
					7	5353999-1		3.75	tape/reel
					7	6123000-1		3.75	tube

Table 9 Cisco ESS-2020-16TC (Expansion Board) Connectors and Mating Connector Options

ESS-2020-16TC Plug					Total Mated Height Desired (mm)[1]	Mating Receptacle			
Connector	TE Connectivity Part Number	Pins	Contact Plating	Height (mm)		TE Part Number	Contact Plating	Height (mm)	Delivery Method
P22	7-5177986-2	60	30µ" Au	3.2	15 15 11 11 7 7	5084618-2 5-6123212-2 7-5179180-2 5084613-2 5353999-2 6123000-2	30µ" Au	11.75 11.75 7.75 7.75 3.75 3.75	tape/reel tube tape/reel tube tape/reel tube
P10	7-5177986-4	100	30µ" Au	3.2	15 15 11 11 7 7	5084618-4 5-6123212-4 7-5179180-4 5084613-4 5353999-4 6123000-4	30µ" Au	11.75 11.75 7.75 7.75 3.75 3.75	tape/reel tube tape/reel tube tape/reel tube

1. Offset distance between the ESS-2020-16TC and motherboard, or other mating card.

LED Definitions

LED functionality is provided by the main board through an I2C bus which you can connect to I2C General Purpose I/O (GPIO) expanders. You can select any combination of LEDs listed in Table 10 to implement; you are not required to implement all of the LEDs. Table 11 and Table 12 provide a listing of LED register bits for the system integrator.

Table 10 Available Cisco ESS-2020 Switch LED Functionality

LED	Color	Description
System	Off	System is not powered on.
	Flashing Green	POST in progress.
	Green	System is operating normally.
	Yellow	System fault detected.
Power	Off	Power is not present or unit failed memory test.
	Green	System is powered on.
Overtemperature	Off	Board temperature is within specified operating range.
	Yellow	Board temperature exceeding specified operating range.

Table 10 Available Cisco ESS-2020 Switch LED Functionality

LED	Color	Description
Port	Off	No link or the port was administratively shut down.
	Green	Link is present; no activity
	Flashing green	Activity. The port is sending or receiving data.
	Alternating green and yellow	Link fault. Error frames can affect connectivity. Errors such as excessive collisions, cyclic redundancy check (CRC), and alignment and jabber errors are monitored for link-fault indication.
	Yellow	Port is disabled
Factory default	Off	Normal operation.
	Flashing green	Factory default procedure has been initiated.
	Yellow	Factory default procedure has completed; switch is about to reboot.
	Green	Factory default procedure has completed.

Table 11 I2C GPIO Expanders

	Register Name (I2C Addr)			
Bit	**System Ctrl (0x40)**	**GE_Combo_Ctrl (0x42)**	**FE 1-8_Green_Ctrl (0x44)**	**FE 1-8_Yellow_Ctrl (0x46)**
7	N/A	GE1/2_RJ_Yel	FE1/1_Gr	FE1/1_Yel
6	PwrGood_Gr	GE1/2_RJ_Gr	FE1/2_Gr	FE1/2_Yel
5	System_Yel	GE1/2_SFP_Yel	FE1/3_Gr	FE1/3_Yel
4	System_Gr	GE1/2_SFP_Gr	FE1/4_Gr	FE1/4_Yel
3	FactoryDef_Yel	GE1/1_RJ_Yel	FE1/5_Gr	FE1/5_Yel
2	FactoryDef_Gr	GE1/1_RJ_Gr[1]	FE1/6_Gr	FE1/6_Yel
1	OverTemp_Yel	GE1/1_SFP_Yel	FE1/7_Gr	FE1/7_Yel
0	N/A	GE1/1_SFP_Gr	FE1/8_Gr	FE1/8_Yel

Table 12 I2C GPIO Expanders (Part 2)

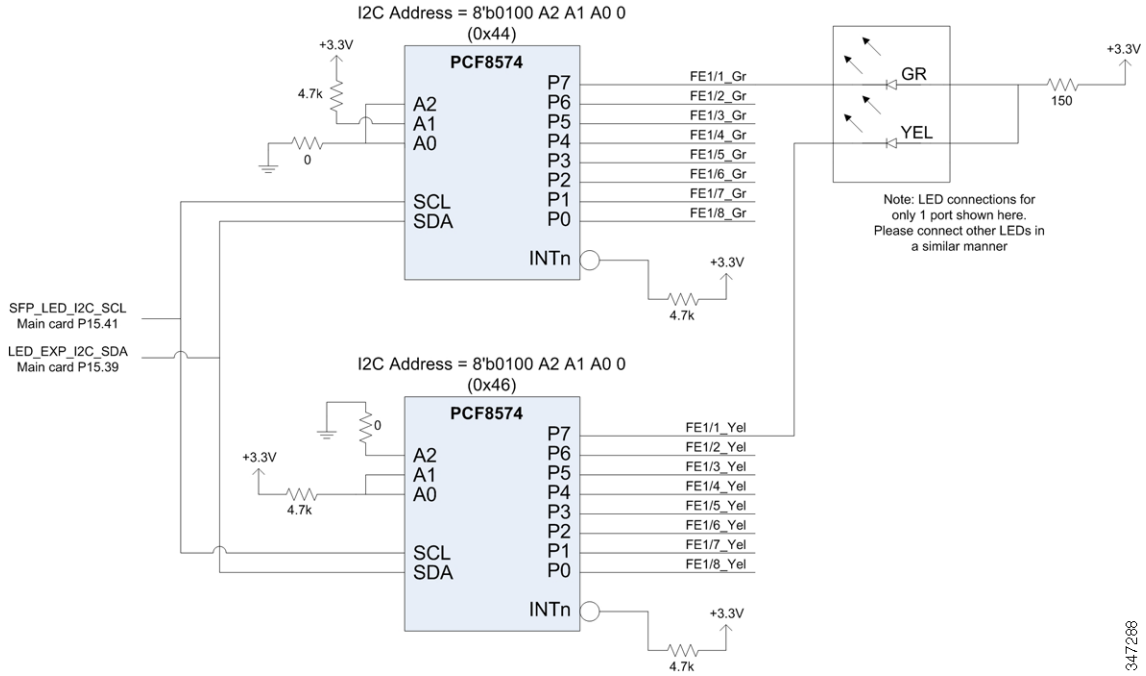
	Register Name (I2C Addr)			
Bit	**FE 9-16_Green_Ctrl (0x48)**	**FE 9-16_Yellow_Ctrl (0x4A)**	**FE 17-24_Green_Ctrl (0x4C)**	**FE 17-24_Yellow_Ctrl (0x4E)**
7	FE1/9_Gr	FE1/9_Yel	FE1/17_Gr	FE1/17_Yel
6	FE1/10_Gr	FE1/10_Yel	FE1/18_Gr	FE1/18_Yel
5	FE1/11_Gr	FE1/11_Yel	FE1/19_Gr	FE1/19_Yel
4	FE1/12_Gr	FE1/12_Yel	FE1/20_Gr	FE1/20_Yel
3	FE1/13_Gr	FE1/13_Yel	FE1/21_Gr	FE1/21_Yel
2	FE1/14_Gr	FE1/14_Yel	FE1/22_Gr	FE1/22_Yel

Table 12 I2C GPIO Expanders (Part 2) (continued)

	Register Name (I2C Addr)			
Bit	**FE 9-16_Green_Ctrl (0x48)**	**FE 9-16_Yellow_Ctrl (0x4A)**	**FE 17-24_Green_Ctrl (0x4C)**	**FE 17-24_Yellow_Ctrl (0x4E)**
1	FE1/15_Gr	FE1/15_Yel	FE1/23_Gr	FE1/23_Yel
0	FE1/16_Gr	FE1/16_Yel	FE1/24_Gr	FE1/24_Yel

Figure 11 shows an example of an LED driver circuit for use with the board.

Figure 11 Example LED Driver Circuit



Mechanical and Environmental Testing

The tests listed in Table 13 were successfully executed on the conduction-cooled models of the Cisco ESS-2020 and Cisco ESS-2020-16TC. These tests used a representative enclosure that conforms to the mounting and thermal mechanisms shown in Figure 12. Because this type of testing is highly dependent on factors such as the test enclosure design, the thermal solution, the front panel connectors, and the mounting, the following test results should only be used as a reference.

Table 13 Mechanical/Environmental Test Results

Temperature	
High and Low Temperature Cycle Stress (Operational)	High Temperature: 74°C (165°F) Low Temperature: -40°C (-40°F) Reference: MIL-STD-810F, Method 501.4, Procedure II and Method 502.4, Procedure II; SAE J1455 (Rev AUG94), Section 4.1.3
Thermal Shock (Non-Operational)	High Temperature: 85°C (185 °F) Low Temperature: -40°C (-40 °F) Cycle: 2 hours high temperature, 2 hours low temperature Test Period: 2 hour pre-soak at low temperature, followed by 5 cycles Repetition: 5 test periods Reference: MIL-STD-810F, Method 503.4; SAE J1455 (Rev AUG94), Section 4.1.3.2
High Temperature Component Thermal Test (Operational)	Method: Thermocouples on all critical/hot components at board level. Bring temperature of top center surface of thermal plate to 85°C (185 °F) and allow it to stabilize. Ensure that all components are within manufacturer thermal specifications.
Altitude	
Low Pressure/Altitude (Operational)	Altitude: 4,572m (15,000ft) Equivalent Absolute Pressure: 57.2 kPa (8.3 lbf/in^2) Temperature: -40°C (-40°F) to 74°C (165°F) Altitude Ramp Rate: 10m/s (max) Temperature Ramp Rate: 1.5°C (min) to 4.5°C (max) Reference: MIL-STD 810F, Method 500.4, Procedure II; SAE J1455 (Rev AUG94), Section 4.1.3.1
Low Pressure/Altitude (Non-Operational)	Altitude: 12.2km (40,000 ft) Equivalent Absolute Pressure: 18.6kPa (2.7lbf/in^2) Temperature: -40°C (-40°F) to 85°C (185°F) Altitude Ramp Rate: 10m/s (max) Temperature Ramp Rate: 1.5°C (min) to 4.5°C (max) Reference: MIL-STD-810F, Method 500.4; SAE J1455 (Rev AUG94), Section 4.1.3.1

Table 13 Mechanical/Environmental Test Results

Humidity	
Temperature & Humidity Cycle Stress (Non-Operational; Energized)	Humidity: 95% +/- 5% RH Pressure: 103.4 kPa (15 lbf in^2) Temperature: -40°C (-40°F) to 65°C (149°F) Cycle: One, 24 hour cycle Reference: SAE J1455 (Rev AUG94), Section 4.2.3
Active Temperature/Humidity 10 Day Soak (Non-Operational; Energized)	Temperature: -40°C (-40°F) to 65 °C (149 °F) Humidity: 95% +/- 5% RH Cycle: Ramp from 25°C to -40°C over 75 minute period, dwell at -40°C for 240 minutes, ramp to 65°C over 120 minute period, dwell at 65°C for 240 minutes (95% +/- 5% RH), ramp to 25°C over 45 minute period, dwell at 25°C for 120 minutes (50% +/- 5% RH) Repetition: 20 total cycles (10 days total) Reference: MIL-STD-810F, Method 507.4; SAE J1211 (Rev NOV78), Section 4.2.2; SAE J1455 (Rev AUG94), Section 4.2.3
Vibration	
Random Vibration (Operational)	Acceleration: 1.04g rms vertical, 0.204g rms transverse, 0.740g rms longitudinal Duration: 2 hours per axis Test orientation: 3 axes Reference: MIL-STD-810F, Method 514.5, Category 4
Shock	
Crash Hazard Shock (Non-Operational)	Acceleration: 75G Duration: 8-13ms Test orientation: 3 axes (positive and negative) Number of shocks: 2 shocks in each direction, 12 shocks total Reference: MIL-STD-810F, Method 516.5, Procedure V
Functional Shock (Operational)	Acceleration: 40G Duration: 15-23ms Test orientation: All 6 faces, in 3 perpendicular axes Reference: MIL-STD-810F, Method 516.5, Procedure I
Bench handling shock (tip) (Operational)	Test orientation: All four edges of each face to form 10° angle with bench top Reference: MIL-STD-810F, Method 516.5, Procedure VI

Factory Default Feature

To enable the factory default feature for the Cisco ESS-2020, the **service-declassify** command must be configured to one of the two enabled states. The factory default feature is disabled by default. Table 14 lists the settings and completion times for the factory default capability option.

Table 14 Settings and Completion Time for Factory Default Capability Options

Option	Action	Typical Completion Time
erase-config	Removes all configuration files from the device. This option leaves other non-configuration files intact.	Variable (less than 2 minutes)
erase-flash	Completely formats the flash filesystem. This also removes any IOS images present.[1]	Variable[2]

1. For the unit to function normally, the IOS needs to be reloaded by using xmodem from the bootloader prompt. Typical image load time is 20 to 25 minutes using a 115.2 kbaud console link (slower console links will increase the load time).
2. The erase time is between 12 and 14 minutes, depending on the flash memory vendor.

To initiate factory default, the signal FACTORY_DEFAULT_INPUT_L located on the main board connector P15, pin 50 must be grounded. While the process is executing, the FactoryDef_Gr LED flashes green. When the factory default process is complete, the FactoryDef_Yel LED lights indicating that the system is rebooting. The system stops at the bootloader prompt with the FactoryDef_Gr LED lit green indicating that the default procedure has successfully completed.

Note After the factory default procedure completes, there will be an empty file in the filesystem. This file is deleted the next time that IOS is booted.

eMMC is a managed NAND. This means that our embedded switch or router system does not interact with the flash memory directly. The flash controller presents a block-style interface to our system, and it handles the flash management (analogous to the Flash Translation Layer). Our embedded switch or router system cannot access the raw flash directly.

The JEDEC standard has commands that are supposed to remove data from the raw flash. In Cisco's implementation, the "Erase" and "Sanitize" commands are used. The eMMC standard JESD84-B51 defines "Sanitize" as follows:

> The Sanitize operation is a feature … that is used to remove data from the device according to Secure Removal Type. The use of the Sanitize operation requires the device to physically remove data from the unmapped user address space.

After the sanitize operation is completed, no data ***should exist*** in the unmapped host address space.

Note **Zeroization does NOT erase removable media such as SD Card and USB Storage. This media must be removed from the system and erased or destroyed using procedures that are outside the scope of this document.**

Important Notice about Zeroization

Zeroize does a very thorough wipe of all non-protected parts of the eMMC flash using the best technology designed by the flash manufacturer today and can do so using the push of a button without the need for a console, ssh, or management session of any kind. It is the integrator's and end user's responsibility to determine the suitability regardless of the CLI keyword used to enable the feature.

Note: While Cisco IOS and Cisco IOS-XE use the command line text of "declassify" in the command line interface (CLI) to enable the zeroize feature, in no way does this represent any specific endorsement or acknowledgment of a Government approved flash erasure methodology.

Declassification procedures are unique to each Government organization. Cisco solely provides the technical detail of the erasure operation here, not the policy distinction or any specific recommendation per classification.

Please refer to your respective Government Agency policies, procedures, and recommendations for the handling of sensitive data to see if this procedure meets with those requirements.

Overtemperature Detection

Both the main board and the expansion board have a temperature sensor mounted in the middle of the board. When the temperature sensor on either the main board or the expansion board detects a temperature exceeding the temperature threshold of 203°F (95°C), the overtemperature LED will illuminate.

Note Even though the overtemperature threshold has been exceeded and the overtemperature LED is lit, the boards will continue to operate, but damage to the components might occur.

The status of the temperature sensors can be reported from the Cisco ESS-2020 IOS CLI:

```
Switch# show environment all
SYSTEM TEMPERATURE is OK
System Temperature Value: 36 Degree Celsius
Extension Board Temperature Value: 32 Degree Celsius
```

Thermal Design Considerations

The following sections outline the methods for dealing with thermal issues and the mounting options involving the Cisco-designed conduction cooling plate.

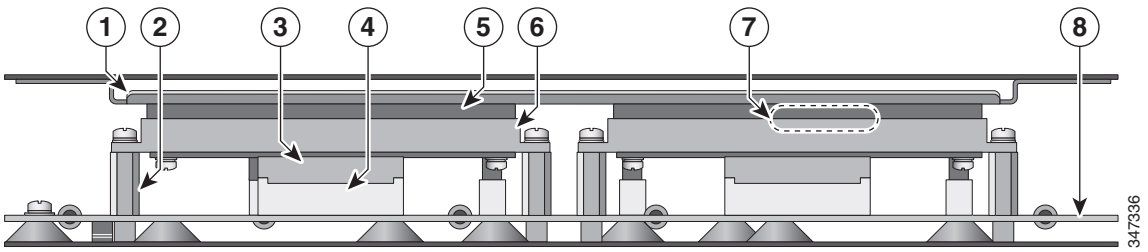
Models with Thermal Plate

As the Cisco ESS 2020 is intended for use in extreme environments, industrial temperature rated components are used. The models with a thermal plate (-CON) make integration easier by abstracting the component level thermal concerns. Cisco has already performed the thermal analysis at the component level so that the integrator need only be concerned with the thermal plate temperature. As a general rule, the thermal plate of the card needs to make contact with an adequate thermal mass to draw heat away from the card. This can be done in a number of ways. An example is shown in Figure 12.

In this example, the Cisco ESS 2020 transfers heat away from its thermal plate and into the enclosure wall by utilizing a “shelf” of metal. This shelf encompasses the entire Cisco ESS 2020 thermal plate surface. The same concept could be shown by interfacing the Cisco ESS 2020 thermal plate directly to the enclosure wall (via thermal interface material).

The important note is that the thermal plate temperature, as measured at the center of the top surface of the thermal plate, must not exceed 85° C. As long as this requirement is satisfied, all of the card's components will be within a safe operating temperature range on the high temperature side.

Figure 12 Example of Thermal Solution in an Enclosure



1	Shelf of metal carrying heat to enclosure wall	**5**	Thermal interface material
2	Mounting stand-off	**6**	Thermal plate
3	ESS-2020 plug board-to-board connector	**7**	Temperature reference point
4	Receptacle board-to-board connector	**8**	Motherboard example

Heat dissipation methods:

As a general rule, the thermal plate of the board needs to make contact with an adequate thermal mass to draw heat away from the board. There are many ways to achieve this goal.

Examples:

- Transfer heat away from the thermal plate and into the enclosure wall by utilizing a “shelf” of metal. The shelf encompasses the entire Cisco ESS 2020 thermal plate surface. This shelf is illustrated by item 1 in Figure 12.
- Mount the Cisco ESS 2020 thermal plate directly to the enclosure wall by using thermal interface material.
- Attach card retainers to the extended edges of the thermal plate. The board retainers would then make contact with a thermal mass or the enclosure where the heat from the Cisco ESS 2020 will be conducted. For more information, see Mounting Options for the Cisco-Designed Thermal Plate.

Models Without Thermal Plate

The Cisco ESS-2020 -NCP models are not equipped with a Cisco-designed thermal plate. These models are not intended to be operated without some type of thermal plate, or similar, solution. In the event that you intend to design a custom cooling solution, the following component-level thermal information is provided to assist in the effort. The thermally significant components of the main card are illustrated in Figure 13 and described in Table 15. The thermally significant components of the expansion card are illustrated in Figure 14 and described in Table 16.

Figure 13 Thermally Significant Components of Cisco ESS-2020 (Main Card)

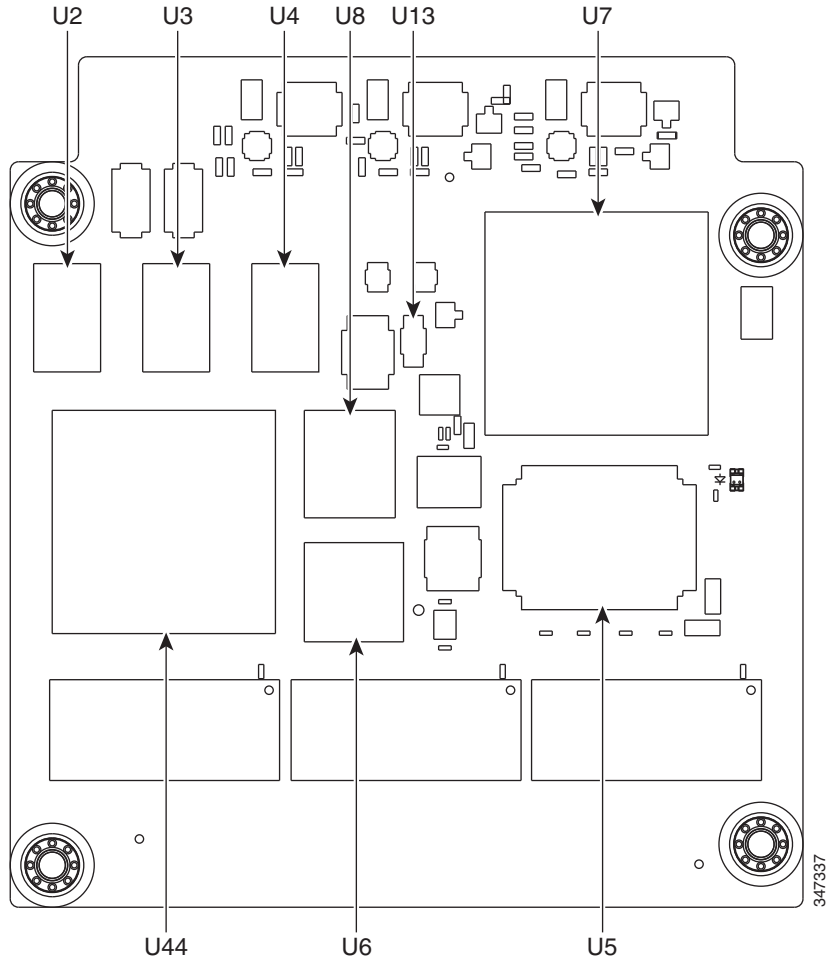


Table 15 Thermal Details for the Thermally Significant Components of Cisco ESS 2020 (Main Card)

	Thermal Design Power (in W)	Allowable junction temp (in degC)	Allowable case temp (in degC)	Package Characteristics		
				Package Type	Theta Jc (in degC/W)	Theta Jb (in degC/W)
U2, U3, U4	0.29 each	Not given	95	FBGA84	5.6	32.3
U8	0.1	Not given	Not given	FBGA64	-	-
U7	1.22	125	105	PBGA537	5.58	7.85
U5	1.23	125	105	MQFP128	29.74	1.75
U6	1.38	125	109	FBGA121	12.32	15.35
U44	1.32	120	100	EPBGA456	9.62	14.59

Note U13 is the Cisco ESS-2020 (main card) thermal sensor.

Figure 14 Thermally Significant Components of Cisco ESS-2020-16TC (Expansion Card)

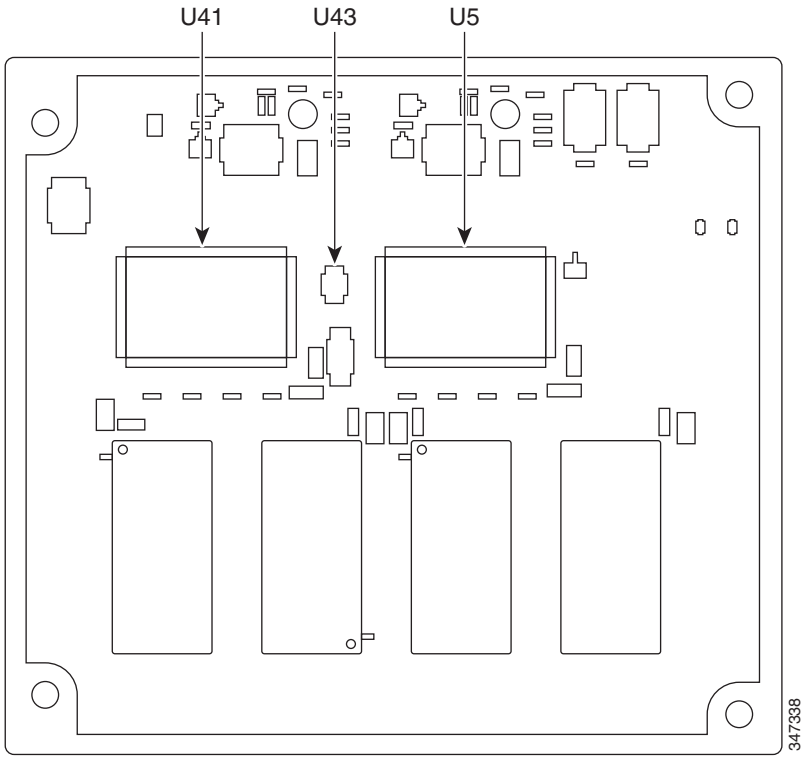


Table 16 Thermal Details for the Thermally Significant Components of Cisco ESS-2020-16TC (Expansion Card)

	Thermal Design Power (in W)	Allowable junction temp (in degC)	Allowable case temp (in degC)	Package Characteristics		
				Package Type	Theta Jc (in degC/W)	Theta Jb (in degC/W)
U5, U41	1.23	125	105	MQFP128	29.74	1.75

Note U43 is the Cisco ESS-2020-16TC (expansion card) thermal sensor.

Validating a Thermal Solution

To validate a thermal solution, monitor the thermal sensor of the Cisco ESS 2020 cards in a thermal chamber set to the desired maximum ambient operating temperature and with traffic running.

Each card has a single sensor located near the center of the card, which makes contact with the thermal plate using thermal interface material. The temperature of the sensors should be less than 90.5C. The **show environment all** command can be executed from the IOS prompt to monitor the thermal sensor temperatures

```
Switch# show environment all
    SYSTEM TEMPERATURE is OK
    System Temperature Value: 36 Degree Celsius
    Extension Board Temperature Value: 32 Degree Celsius
```

Mounting Options for the Cisco-Designed Thermal Plate

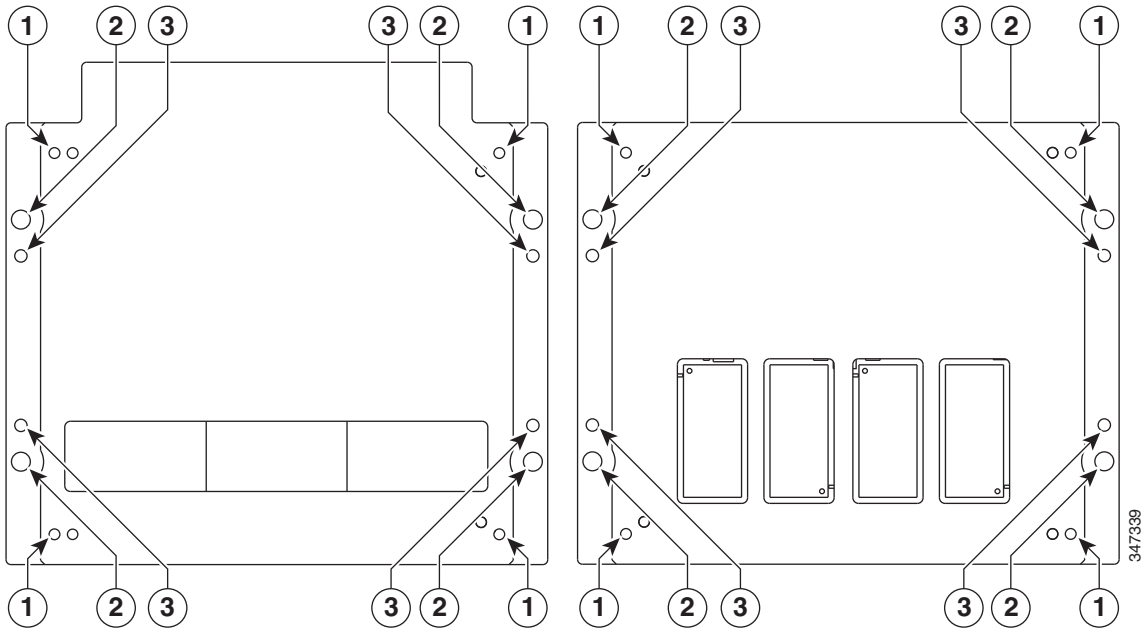
Several mounting options are viable for the –CON SKUs. One method is to use standoffs and screws through the mounting holes in the thermal plate "extensions" to retain the Cisco ESS-2020 boards to a motherboard. This method is shown in Figure 12. When using this method, the integrator must be certain to use a standoff height that is designed for the mated pair of I/O connectors that is chosen.

The integrator may also find it helpful to use threaded mounting holes in the top of the thermal plate to hold the card's thermal plate to an enclosure wall or even to a larger thermal plate. These threaded mounting holes are shown in Figure 15. This figure also shows the locations for connecting the cards to commercially available card retainers.

Figure 16 illustrates the card retainer mounting concept. These card retainers hold the board inside a chassis (via slots) and transfer heat away from the Cisco ESS-2020 thermal plate.

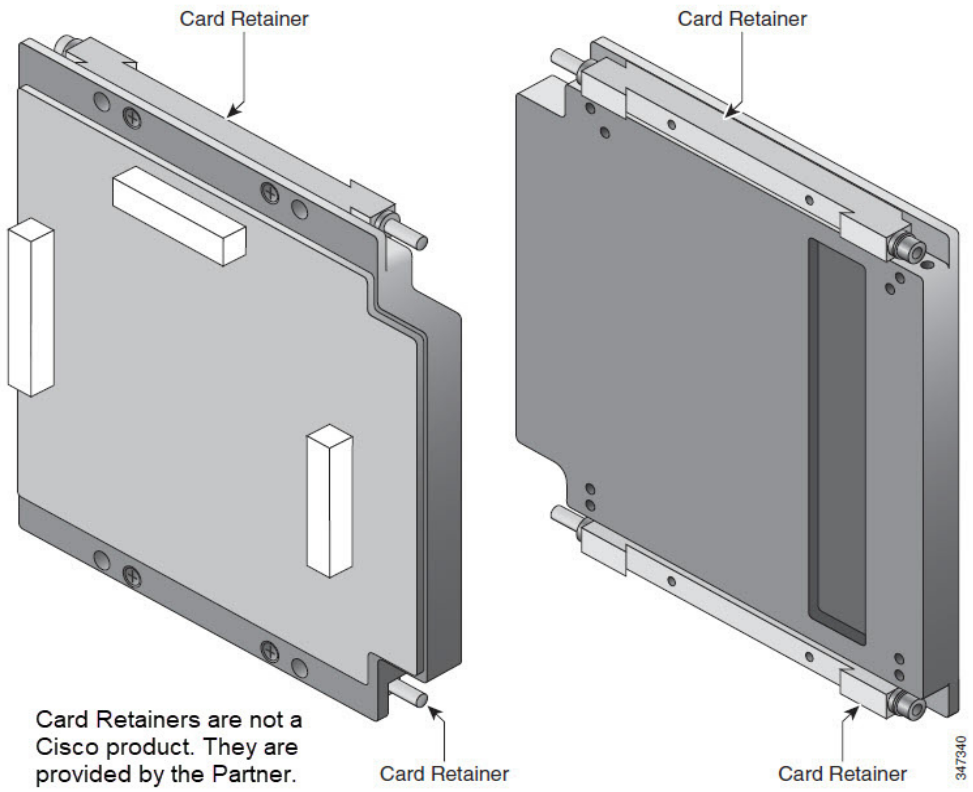
Note It is important to note that the card retainer is NOT orderable from Cisco.
In figure 16, the card retainer is provided by the Integrator.

Figure 15 Mounting Holes for the Cisco-Designed Thermal Plate (Main Card and Expansion Card)



1	Intended for connection to thermal mass	**2**	Intended for mounting to motherboard via standoffs and screws
3	Intended for mounting to card retainers		

Figure 16 Example of Card Retainer Attached to Cisco-Designed Thermal Plate



Specifications for card retainers:

The Cisco ESS-2020 thermal plate card retainer mounting features are intended for card retainers that conform to the following specifications. The recommended mounting hardware is 2-56 x 3/16-inch flat head machine screws, preferably with a nylon locking patch or Loctite to secure the hardware in place.

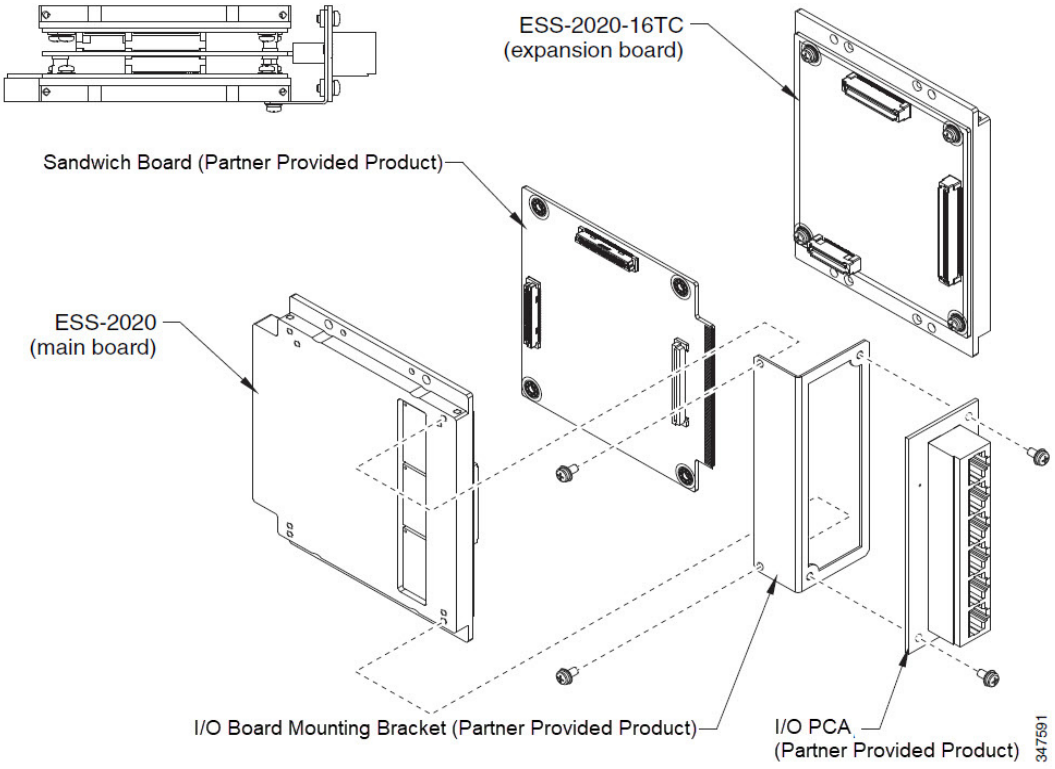
- Width: 0.225 inches
- Number of mounting holes: 2
- Mounting hole style: 2-56 threads
- Distance between mounting holes = 1.400 inches

Sandwich Configuration

The following figure shows a **conceptual** drawing of a Cisco ESS 2020 main board combined with a Cisco ESS 2020 expansion board with a “sandwich board” in the middle. All interconnects between the main board and the expansion board are via the sandwich board; also, all user I/O (Ethernet ports, console, etc.) is via the sandwich board.

Note It is important to note that the sandwich configuration is conceptual, and contains components that are NOT orderable from Cisco.
In figure 17, the I/O Board Mounting Bracket, I/O PCA, and the Sandwich Board are all components that are provided by the Integrator.

Figure 17 Sandwich Configuration



Product Specifications

Table 17 lists the product specifications for the Cisco ESS 2020.

Table 17 Product Specifications

Interface Support	
ESS-2020	2 GE (copper or fiber) 8 FE (copper) RS-232 console port
ESS-2020-16TC	16 FE
Memory[1]	
DRAM	256MB
Flash	64MB
Environmental	
Industrial-grade components	-40degF to +185degF (-40degC to +85degC) component local ambient temperature specifications
Operating temperature	• -40degF to +185degF (-40degC to +85degC) as measured at the center of the top surface of the –CON SKU thermal plate. • Temperature range of a completed solution depends on the enclosure thermal design characteristics used by the integrator. • If –NCP SKU is used, integrator is responsible for designing a thermal solution that meets the component level requirements provided in this document.
Non-Operating Temperature	-40degF to +185degF (-40degC to +85degC)
Operating altitude	15,000ft (4,572m)
Non-operating altitude	40,000ft (12,200m)
Humidity	95% +/- 5% RH
Hardware Specifications	
Input voltages	+5Vdc (+/- 5%) and +3.3Vdc (+/- 5%)
Total Power	Typical • ESS-2020 (base card): 6.5W • ESS-2020-16TC (expansion): 3.6W Maximum • ESS-2020 (base card): 8.0W • ESS-2020-16TC (expansion): 4.7W

Table 17 Product Specifications

Weight	ESS-2020-CON: 23.0 ounces ESS-2020-16TC-CON: 21.6 ounces ESS-2020-NCP: 2.3 ounces ESS-2020-16TC-NCP: 2.1 ounces
MTBF[2] (Mean Time Before Failure)	ESS-2020 (-CON and –NCP) • Ground, Fixed, Controlled: 1,899,080 (in hours) • Ground, Mobile: 474,770 (in hours) ESS-2020-16TC (-CON and –NCP) • Ground, Fixed, Controlled: 2,408,980 (in hours) • Ground, Mobile: 602,245 (in hours) ESS-2020 combined with ESS-2020-16TC (-CON and –NCP) • Ground, Fixed, Controlled: 1,136,670 (in hours) • Ground, Mobile: 284,168 (in hours)

1. All memory physically located on Cisco ESS-2020 main board.
2. Values were determined by using Cisco-adopted Telcordia spec SR-332 Issue 3, Sept. 2011 (Reliability Prediction Procedures for Electronic Equipment).

Power Requirements

Both the main board and the expansion board require +5 VDC and +3.3 VDC to operate. Table 18 lists the DC power requirements for the main board and the expansion board.

Table 18 Power Requirements for the Main Board and the Expansion board

Board	Power Requirements
Main board	
DC-input voltage rails	• +5 VDC (±5 percent) • +3.3 VDC (±5 percent)
DC-input current	• +5 VDC: 0.93 A (max), 0.76 A (typical) • +3.3 VDC: 1.00 A (max), 0.82 A (typical)
Power	• +5 VDC: 4.65 W (max), 3.80 W (typical) • +3.3 VDC: 3.30 W (max), 2.71 W (typical)
Expansion board	
DC-input voltage rails	• +5 VDC (±5 percent) • +3.3 VDC (±5 percent)
DC-input current	• +5 VDC: 0.80 A (max), 0.65 A (typical) • +3.3 VDC: 0.20 A (max), 0.10 A (typical)
Power	• +5 VDC: 4.00 W (max), 3.25 W (typical) • +3.3 VDC: 0.66 W (max), 0.33 W (typical)

Note There are no voltage rail-sequencing requirements. Power supply voltage rails can power-up or power-down in any order. Both +3.3 VDC and 5 VDC rails are required by the ESS-2020.

SFP Support

Both 100BASE-X and 1000BASE-X SFP transceivers are supported by the two main board combo ports. Table 19 lists the specific SFP transceivers and their characteristics.

Table 19 SFP Support for the Cisco ESS-2020

SFP Transceiver	Wavelength (nanometers)	Fiber Type	Core Size[1] (microns)	Modal Bandwidth	Cabling Distance
Industrial and Rugged SFPs (Operating temperature range: -40F to 185F (-40C to 85C))					
GLC-SX-MM-RGD	850	MMF	62.5	160	722 feet (220 m)
(1000BASE-SX)			62.5	200	902 feet (275 m)
			50	400	1640 feet (500 m)
			50	500	1804 feet (550 m)
			50	2000	3281 feet (1 km)
GLC-LX-SM-RGD	1310	MMF[2]	62.5	500	1804 feet (550 m)
(1000BASE-LX/LH)			50	400	1804 feet (550 m)
			50	500	1804 feet (550 m)
		SMF	G.652	—	32,810 feet (10 km)
GLC-FE-100LX-RGD	1310	SMF	G.652	—	32,810 feet (10 km)
(100BASE-LX10)					
GLC-FE-100FX-RGD	1310	MMF	62.5	160	6,562 feet (2 km)
(100BASE-FX)			62.5	200	
			50	400	
			50	500	
GLC-ZX-SM-RGD	1550	SMF	G.652	—	Approximately 70km (depending on link loss)
(1000BASE-ZX)					
Commercial SFPs (Operating temperature range: 32F to 158F (0C to 70C))					
GLC-BX-D[3]	TX 1490	SMF	G.652	—	32,810 feet (10 km)
(1000BASE-BX10-D)	RX 1310				
GLC-BX-U[3]	TX 1310	SMF	G.652	—	32,810 feet (10 km)
(1000BASE-BX10-U)	RX 1490				
CWDM-SFP	1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610	SMF	G.652	—	62 miles (100 km)

Table 19 SFP Support for the Cisco ESS-2020 (continued) (continued)

SFP Transceiver	Wavelength (nanometers)	Fiber Type	Core Size[1] (microns)	Modal Bandwidth	Cabling Distance
DWDM-SFP	1561.42, 1560.61, 1559.79, 1558.98, 1558.17, 1557.36, 1556.55, 1555.75, 1554.94, 1554.13, 1553.33, 1552.52, 1551.72, 1550.92, 1550.12, 1549.32, 1548.51, 1547.72, 1546.92, 1546.12, 1545.32, 1544.53, 1543.73, 1542.94, 1542.14, 1541.35, 1540.56, 1539.77, 1538.98, 1538.19, 1537.40, 1536.61, 1535.82, 1535.04, 1534.25, 1533.47, 1532.68, 1531.90, 1531.12, 1530.33	SMF	G.652	—	Distance is based on a guaranteed power budget of 25 dB
GLC-LH-SM[4]	1310	MMF[2]	62.5	500	1804 feet (550 m)
(1000BASE-LX/LH)			50	400	1804 feet (550 m)
		SMF	50	500	1804 feet (550 m)
			G.652	—	32,810 feet (10 km)
GLC-SX-MM[4]	850	MMF	62.5	160	722 feet (220 m)
(1000BASE-SX)			62.5	200	902 feet (275 m)
			50	400	1640 feet (500 m)
			50	500	1804 feet (550 m)
			50	2000	3281 feet (1 km)
Extended Temperature SFPs (Operating temperature range: 23F to 185F (-5C to 85C))					
SFP-GE-L	1310	MMF[2]	62.5	500	1804 feet (550 m)
(1000BASE-LX/LH)			50	400	1804 feet (550 m)
			50	500	1804 feet (550 m)
		SMF	G.652	—	32,810 feet (10 km)
SFP-GE-S	850	MMF	62.5	160	722 feet (220 m)
(1000BASE-SX)			62.5	200	902 feet (275 m)
			50	400	1640 feet (500 m)
			50	500	1804 feet (550 m)
			50	2000	3281 feet (1 km)
SFP-GE-Z	1550	SMF	G.652	—	Approximately 70km (depending on link loss)
(1000BASE-ZX)					
GLC-EX-SMD	1310	SMF	G.652	—	131,240 feet (40 km)
(1000BASE-EX)					

Table 19 SFP Support for the Cisco ESS-2020 (continued) (continued)

SFP Transceiver	Wavelength (nanometers)	Fiber Type	Core Size[1] (microns)	Modal Bandwidth	Cabling Distance
GLC-FE-100LX (100BASE-LX10)	1310	SMF	G.652	—	32,810 feet (10 km)
GLC-FE-100BX-D (100BASE-BX10-D)	TX 1550 RX 1310	SMF	G.652	—	32,810 feet (10 km)
GLC-FE-100BX-U (100BASE-BX10-U)	TX 1310 RX 1550	SMF	G.652	—	32,810 feet (10 km)
GLC-FE-100FX (100BASE-FX)	1310	MMF	62.5 62.5 50 50	160 200 400 500	6,562 feet (2 km)
GLC-FE-100EX[3] (100BASE-EX)	1310	SMF	G.652	—	131,240 feet (40 km)
GLC-FE-100ZX (100BASE-ZX)	1550	SMF	G.652	—	262,480 feet (80 km)
GLC-SX-MMD (1000BASE-SX)	850	MMF	62.5 62.5 50 50 50	160 200 400 500 2000	722 feet (220 m) 902 feet (275 m) 1640 feet (500 m) 1804 feet (550 m) 3281 feet (1 km)
GLC-LH-SMD (1000BASE-LX/LH)	1310	MMF[2] SMF	62.5 50 50 G.652	500 400 500 —	1804 feet (550 m) 1804 feet (550 m) 1804 feet (550 m) 32,810 feet (10 km)

1. G.652, listed under core size for single mode fiber (SMF), refers to ITU-T G.652 SMF as specified by the IEEE 802.3z standard.
2. A mode-conditioning patch cord is required at all times per IEEE specifications, regardless of the span length.
3. Version -02 or later
4. Version -03 or later

Regulatory Compliance and Safety Information

Statement 8000—Standards Compliance

The ESS 2020 and ESS 2020-16TC were installed in a representative chassis, tested, and shown to meet the standards listed in Table 20. Individual results will depend on final implementation. Formal compliance testing must be performed by the integrator in a fully assembled product.

Table 20 Standards Compliance

Specification	Description
Safety	• UL 60950-1 Recognized Component (R/C) • CSA22.2-No. 60950-1 • EN60950-1 • IEC60950-1
EMC	• FCC Part 15 Class A • ICES-003 Class A • EN55022 Class A • EN55024

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