

Cisco Industrial Temp 10GBASE Dense Wavelength-Division Multiplexing SFP+ Modules



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Use industrial temperature (iTemp) Dense Wavelength-Division Multiplexing (DWDM) SFP+ modules to integrate baseband digital DWDM transport into your R-PHY shelf blades, RPDs, or digital PICs.

Product overview

The Cisco® iTemp 10GBASE DWDM SFP+ Modules (Figure 1) are pluggable, temperature-hardened transceiver modules designed to deliver Remote PHY (R-PHY) capability in field or headend environments. They enable plug-and-play configuration of 10-Gbps Ethernet signals for simple configuration of R-PHY devices or shelves. There are 2 types of 10GBASE DWDM SFP+ modules, one tunable module and 3 reaches of fixed wavelength modules. The fixed wavelength modules have With 40 ITU C-band wavelengths and three different distance values available. The tunable module has 70km reach, and 100 50Ghz ITU C-band wavelengths it can be tuned to. Operators can control cost and wavelength assignments, and match link budgets in their fiber-deep networks. The standards-based SFP+ devices are compatible with existing passive filters and splitters, speeding deployments and minimizing service disruptions.



Figure 1.
Cisco DWDM SFP+ Module

Features and benefits

The Cisco iTemp 10GBASE Dense Wavelength-Division Multiplexing SFP+ Fixed Wavelength Modules offers the following features and benefits:

- Supports 10-Gigabit LAN PHY data rates (10.3125 Gbps) for IEEE Ethernet compatibility.
- Industrial temperature range of operation from -40°C to 85°C
- Hot-swappable transceiver plugs into remote PHY devices, converged broadband-8 (cBR-8) Digital Physical Interface Card (D-PIC), and a variety of Cisco switches or routers in common usage.
- Support for a pay-as-you-grow model for investment protection.
- Standard digital diagnostics capability for incorporation into network management systems.
- Multi-Source Agreement (MSA)-compliant physical form factor for compatibility with a broad range of available products.
- DWDM fixed-wavelength modules support International Telecommunication Union (ITU) 100-GHz spaced channels (ITU 20–ITU 59) Dispersion-tolerant link lengths without added dispersion compensation; up to 80 km supported.
- Supports the Cisco Quality Identification (ID) feature, enabling a Cisco switch or router to identify that the SFP+ module is tested and certified by Cisco.

The Cisco iTemp 10GBASE Dense Wavelength-Division Multiplexing SFP+ Tunable Module, DWDM-SFP10G-E-I offers the following features and benefits.

- The DWDM-SFP10G-E-I has a limiting electrical interface receiver, which does not require EDC PHY on the host board.
- The DWDM-SFP10G-E-I can be plugged into any SFP+ port.
- DWDM tunable wavelength module supports 100 tunable ITU 50GHz spaced channels.
- Reach of 70km, assuming fiber chromatic dispersion of 20ps/(nm*km).
- Tunability enables minimized inventory and simplified, rapid deployment.

Product specifications

Tables 1 through 3 describe the transmission and receiver characteristics in a 20 km link, with RPHY-S10G-20K-XXX fixed wavelength modules

Table 1. 20-km transmitter characteristics

Description	Unit	Minimum	Typical	Maximum	Notes
Launch power	dBm	-1		+3	
Extinction ratio	dB	7.5			
Wavelength λ_i	nm	1530.33		1561.42	ITU-20 to 59
Channel spacing	GHz		100		At End Of Life (EOL) over operating voltage and temperatures
Wavelength stability (after startup)	pm	$\lambda_i - 100$		$\lambda_i + 100$	
Side Mode Suppression Ratio (SMSR)	dB	30			
Crossing point	%	40		50	
Eye mask	%	10			
Maximum spectral width	pm			200	Modulated, full width, at -20dB, with RBW=0.01nm

Table 2. 20-km receiver characteristics

Description	Unit	Minimum	Maximum	Notes
Receiver wavelength range	nm	1529	1562	Covers ITU-20 to ITU-59
Receiver reflectance	dB		-27	
Maximum receiver input power	dBm	+3		Damage threshold

Table 3. 20-km link performance – no FEC application (10 GE LAN)

Condition	OSNR@0.5nm RBW (dB)		Receiver power range (dBm)		Notes
	Min	Max	Min	Max	
Power-limited link					
Back to back	25		-15	-1	At BER=1E-12, PRBS31, and 10 GE frame
Dispersion-limited link					
-200 ps/nm to 400 ps/nm	25		-14	-1	At BER=1E-12, PRBS31, and 10 GE frame

Tables 4 through 6 describe the transmission and receiver characteristics and link performance at 40 km with RPHY-S10G-40K-XXX fixed wavelength modules

Table 4. 40-km transmitter characteristics

Description	Unit	Min	Typical	Max	Notes
Launch power	dBm	-1		+3	
Extinction ratio	dB	8.2			
Wavelength λ_i	nm	1530.33		1561.42	ITU-20 to ITU-59
Channel spacing	GHz		100		At EOL over operating voltage and temperatures
Wavelength stability (after startup)	pm	$\lambda_i - 100$		$\lambda_i + 100$	
SMSR	dB	30			
Crossing point	%	40		50	
Eye mask	%	10			
Maximum spectral width	pm			200	Modulated, full width, at -20dB, with RBW=0.01nm

Table 5. 40-km receiver characteristics

Description	Unit	Min	Max	Notes
Receiver wavelength range	nm	1529	1562	Covers ITU-20 to ITU-59
Receiver reflectance	dB		-27	
Maximum receiver input power	dBm	+3		Damage threshold

Table 6. 40-km link performance – no FEC application (10 GE LAN)

Condition	OSNR@0.5nm RBW (dB)		Receiver power range (dBm)		Notes
	Min	Max	Min	Max	
Power-limited link					
Back to back	25		-23	-7	At BER=1E-12, PRBS31, and 10 GE frame
Dispersion-limited link					
-400 ps/nm to 800 ps/nm	25		-21	-7	At BER=1E-12, PRBS31, and 10 GE frame

Tables 7 through 9 describe the transmission and receiver characteristics and link performance at 80 km with RPHY-S10G-80K-XXX fixed wavelength modules

Table 7. 80-km transmitter characteristics

Description	Unit	Min	Typical	Max	Notes
Launch power (Limiting)	dBm	0	1	3	
Extinction ratio (Limiting)	dB	8.2			
Wavelength λ_i	nm	1530.33		1561.42	ITU-20 to ITU-59
Channel spacing	GHz		100		At EOL over operating voltage and temperatures
Wavelength stability (after startup)	pm	$\lambda_i - 100$		$\lambda_i + 100$	
SMSR	dB	30			
Crossing point	%	40		50	
Eye mask	%	10			
Maximum spectral width	pm			200	Modulated, full width, at -20dB, with RBW=0.01nm
SBS threshold (limiting)	dBm	+6			

Table 8. 80-km receiver characteristics

Description	Unit	Min	Max	Notes
Receiver wavelength range	nm	1529	1562	Covers ITU-20 to ITU-59
Receiver reflectance	dB		-27	
Maximum receiver input power	dBm	+3		Damage threshold

Table 9. 80-km link performance – no FEC application (10 GE LAN)

Condition	OSNR@0.5nm RBW (dB)		Receiver power range (dBm)		Notes
	Min	Max	Min	Max	
Power-limited link (limiting)					
Back to back	28		-23.5	-7	At BER=1E-12, PRBS31, and 10 GE frame
Dispersion-limited link					
-500 ps/nm to 1400 ps/nm	28		-21.1	-7	At BER=1E-12, PRBS31, and 10 GE frame

Notes:

1. Receiver optical filter bandwidth @-3dB for BER measurement shall be 0.4 nm.

Tables 10 through 11 describe the transmitter and receiver characteristics of DWDM-SFP10G-E-I Tunable Module.

Table 10. Optical Parameters for Tunable limiting electrical interface DWDM SFP+, DWDM-SFP10G-E-I.

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes and Conditions
Transmitter						
Spectral width				0.5	nm	Full width, -20 dB from maximum, with Resolution Bandwidth (RBW) = 0.01 nm
Transmitter wavelength stability after startup		x - 20	x	x + 20	pm	Refer to Table 11 for center wavelengths
Side-mode suppression ratio	SMSR	35			dB	
Transmitter extinction ratio		9			dB	
Transmitter optical output power	Pout	-1		3.0	dBm	Average power coupled into single-mode fiber

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes and Conditions
Stimulated Brillouin Scattering (SBS) Threshold		10			dBm	
Receiver						
Receiver optical input wavelength		1525		1570	nm	
Receiver damage threshold		5.0			dBm	
Receiver overload		-7.0			dBm	
Receiver Power Performance						
				Units	Range	Notes and Conditions
Performance at 10G LAN (NO-FEC Application)						
Input power range				dBm	-7 to -24	At BER=1E-12, back-to-back, unamplified link
Input power range (dispersion-limited)				dBm	-7 to -21	At BER=1E-12, -300 to 1400 ps/nm chromatic dispersion, unamplified link
Noise Limited Back to back1				dBm	-10 to -20	At BER=1E-12, -300 to, amplified link with min 19dB OSNR (0.5nm RBW)
Noise Limited Back to back 2				dBm	-7 to -18	At BER=1E-12, amplified link with min 17.5dB OSNR (0.5nm RBW)
Input power range (dispersion- and noise-limited)				dBm	-7 to -17	At BER=1E-12, -300 to 1400 ps/nm chromatic dispersion, amplified link with min 19dB OSNR (0.5nm RBW)

Table 11 shows the 100 DWDM ITU-50GHz channels to which the DWDM-SFP10G-E-I device can be tuned.

Table 11. ITU 50-GHz Center Wavelengths and Channel Numbering for DWDM-SFP10G-E-I

Channel ID	Frequency (THz)	Wavelength (nm)	Channel ID	Frequency (THz)	Wavelength (nm)
1	191.35	1566.72	51	193.85	1546.52
2	191.4	1566.31	52	193.9	1546.12
3	191.45	1565.90	53	193.95	1545.72
4	191.5	1565.50	54	194	1545.32
5	191.55	1565.09	55	194.05	1544.92
6	191.6	1564.68	56	194.1	1544.53

Channel ID	Frequency (THz)	Wavelength (nm)	Channel ID	Frequency (THz)	Wavelength (nm)
7	191.65	1564.27	57	194.15	1544.13
8	191.7	1563.86	58	194.2	1543.73
9	191.75	1563.45	59	194.25	1543.33
10	191.8	1563.05	60	194.3	1542.94
11	191.85	1562.64	61	194.35	1542.54
12	191.9	1562.23	62	194.4	1542.14
13	191.95	1561.83	63	194.45	1541.75
14	192	1561.42	64	194.5	1541.35
15	192.05	1561.01	65	194.55	1540.95
16	192.1	1560.61	66	194.6	1540.56
17	192.15	1560.20	67	194.65	1540.16
18	192.2	1559.79	68	194.7	1539.77
19	192.25	1559.39	69	194.75	1539.37
20	192.3	1558.98	70	194.8	1538.98
21	192.35	1558.58	71	194.85	1538.58
22	192.4	1558.17	72	194.9	1538.19
23	192.45	1557.77	73	194.95	1537.79
24	192.5	1557.36	74	195	1537.40
25	192.55	1556.96	75	195.05	1537.00
26	192.6	1556.55	76	195.1	1536.61
27	192.65	1556.15	77	195.15	1536.22
28	192.7	1555.75	78	195.2	1535.82
29	192.75	1555.34	79	195.25	1535.43
30	192.8	1554.94	80	195.3	1535.04
31	192.85	1554.54	81	195.35	1534.64
32	192.9	1554.13	82	195.4	1534.25
33	192.95	1553.73	83	195.45	1533.86

Channel ID	Frequency (THz)	Wavelength (nm)	Channel ID	Frequency (THz)	Wavelength (nm)
34	193	1553.33	84	195.5	1533.47
35	193.05	1552.93	85	195.55	1533.07
36	193.1	1552.52	86	195.6	1532.68
37	193.15	1552.12	87	195.65	1532.29
38	193.2	1551.72	88	195.7	1531.90
39	193.25	1551.32	89	195.75	1531.51
40	193.3	1550.92	90	195.8	1531.12
41	193.35	1550.52	91	195.85	1530.72
42	193.4	1550.12	92	195.9	1530.33
43	193.45	1549.72	93	195.95	1529.94
44	193.5	1549.32	94	196	1529.55
45	193.55	1548.91	95	196.05	1529.16
46	193.6	1548.51	96	196.1	1528.77
47	193.65	1548.11	97	196.15	1528.38
48	193.7	1547.72	98	196.2	1527.99
49	193.75	1547.32	99	196.25	1527.6
50	193.8	1546.92	100	196.3	1527.22

* The channel ID listed in this table is not necessarily aligned with the channel assignments used by the software of different platforms. Hence, ensure that you refer to the platform documentation before assigning the channels.

Physical and environmental characteristics

- Dimensions (H x W x D): 8.5 x 13.4 x 56.5 mm.
- Cisco SFP+ modules typically weigh 75 grams or less.
- Industrial operational case temperature range (IND): -40 to 85° C (-40 to 185° F).
- Storage temperature range: -40 to 85° C (-40 to 185° F).
- Optical connector is Duplex LC/PC.
- Bail color: 80/70 km - green, 40 km - red, 20 km - white.
- The maximum power consumption of DWDM-SFP10G-E-I is 2.3W.

Regulatory, safety, and standards compliance

- SFP+ MSA SFF-8431 (electrical).
- SFF-8432 improved pluggable form factor (mechanical).
- SFF-8472 diagnostic monitor interface for optical transceiver.
- IEEE 802.3: 10-Gigabit Ethernet.
- laser class 1 (21CFR1040 and IEC 60825).

Warranty

- Standard warranty: 1 year.
- Expedited replacement available via a Cisco SMARTnet® Service support contract.

Product ordering information

Table 12. Cisco iTemp 10GBASE DWDM SFP+ Fixed Wavelength Modules product identification listing

ITU	20-km parts	40-km parts	80-km parts
20	RPHY-S10G-20K-200=	RPHY-S10G-40K-200=	RPHY-S10G-80K-200=
21	RPHY-S10G-20K-210=	RPHY-S10G-40K-210=	RPHY-S10G-80K-210=
22	RPHY-S10G-20K-220=	RPHY-S10G-40K-220=	RPHY-S10G-80K-220=
23	RPHY-S10G-20K-230=	RPHY-S10G-40K-230=	RPHY-S10G-80K-230=
24	RPHY-S10G-20K-240=	RPHY-S10G-40K-240=	RPHY-S10G-80K-240=
25	RPHY-S10G-20K-250=	RPHY-S10G-40K-250=	RPHY-S10G-80K-250=
26	RPHY-S10G-20K-260=	RPHY-S10G-40K-260=	RPHY-S10G-80K-260=
27	RPHY-S10G-20K-270=	RPHY-S10G-40K-270=	RPHY-S10G-80K-270=
28	RPHY-S10G-20K-280=	RPHY-S10G-40K-280=	RPHY-S10G-80K-280=
29	RPHY-S10G-20K-290=	RPHY-S10G-40K-290=	RPHY-S10G-80K-290=
30	RPHY-S10G-20K-300=	RPHY-S10G-40K-300=	RPHY-S10G-80K-300=
31	RPHY-S10G-20K-310=	RPHY-S10G-40K-310=	RPHY-S10G-80K-310=
32	RPHY-S10G-20K-320=	RPHY-S10G-40K-320=	RPHY-S10G-80K-320=
33	RPHY-S10G-20K-330=	RPHY-S10G-40K-330=	RPHY-S10G-80K-330=
34	RPHY-S10G-20K-340=	RPHY-S10G-40K-340=	RPHY-S10G-80K-340=
35	RPHY-S10G-20K-350=	RPHY-S10G-40K-350=	RPHY-S10G-80K-350=
36	RPHY-S10G-20K-360=	RPHY-S10G-40K-360=	RPHY-S10G-80K-360=

ITU	20-km parts	40-km parts	80-km parts
37	RPHY-S10G-20K-370=	RPHY-S10G-40K-370=	RPHY-S10G-80K-370=
38	RPHY-S10G-20K-380=	RPHY-S10G-40K-380=	RPHY-S10G-80K-380=
39	RPHY-S10G-20K-390=	RPHY-S10G-40K-390=	RPHY-S10G-80K-390=
40	RPHY-S10G-20K-400=	RPHY-S10G-40K-400=	RPHY-S10G-80K-400=
41	RPHY-S10G-20K-410=	RPHY-S10G-40K-410=	RPHY-S10G-80K-410=
42	RPHY-S10G-20K-420=	RPHY-S10G-40K-420=	RPHY-S10G-80K-420=
43	RPHY-S10G-20K-430=	RPHY-S10G-40K-430=	RPHY-S10G-80K-430=
44	RPHY-S10G-20K-440=	RPHY-S10G-40K-440=	RPHY-S10G-80K-440=
45	RPHY-S10G-20K-450=	RPHY-S10G-40K-450=	RPHY-S10G-80K-450=
46	RPHY-S10G-20K-460=	RPHY-S10G-40K-460=	RPHY-S10G-80K-460=
47	RPHY-S10G-20K-470=	RPHY-S10G-40K-470=	RPHY-S10G-80K-470=
48	RPHY-S10G-20K-480=	RPHY-S10G-40K-480=	RPHY-S10G-80K-480=
49	RPHY-S10G-20K-490=	RPHY-S10G-40K-490=	RPHY-S10G-80K-490=
50	RPHY-S10G-20K-500=	RPHY-S10G-40K-500=	RPHY-S10G-80K-500=
51	RPHY-S10G-20K-510=	RPHY-S10G-40K-510=	RPHY-S10G-80K-510=
52	RPHY-S10G-20K-520=	RPHY-S10G-40K-520=	RPHY-S10G-80K-520=
53	RPHY-S10G-20K-530=	RPHY-S10G-40K-530=	RPHY-S10G-80K-530=
54	RPHY-S10G-20K-540=	RPHY-S10G-40K-540=	RPHY-S10G-80K-540=
55	RPHY-S10G-20K-550=	RPHY-S10G-40K-550=	RPHY-S10G-80K-550=
56	RPHY-S10G-20K-560=	RPHY-S10G-40K-560=	RPHY-S10G-80K-560=
57	RPHY-S10G-20K-570=	RPHY-S10G-40K-570=	RPHY-S10G-80K-570=
58	RPHY-S10G-20K-580=	RPHY-S10G-40K-580=	RPHY-S10G-80K-580=
59	RPHY-S10G-20K-590=	RPHY-S10G-40K-590=	RPHY-S10G-80K-590=

Table 13. Cisco iTemp 10GBASE DWDM SFP+ Tunable Wavelength ordering guide

Product Number	Description	ITU Channel
DWDM-SFP10G-E-I=	10GBASE-DWDM tunable SFP+, Limiting Interface 50Ghz ITU grid)	See Table 11

Cisco environmental sustainability

Information about Cisco’s environmental sustainability policies and initiatives for our products, solutions, operations, and extended operations or supply chain is provided in the “Environment Sustainability” section of Cisco’s [Corporate Social Responsibility](#) (CSR) Report.

Reference links to information about key environmental sustainability topics (mentioned in the “Environment Sustainability” section of the CSR Report) are provided in the following table:

Sustainability topic	Reference
Information on product material content laws and regulations	Materials
Information on electronic waste laws and regulations, including products, batteries, and packaging	WEEE compliance

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Document history

New or revised topic	Described In	Date
DWDM-SFP10G-C-I updated to DWDM-SFP10G-E-I	-	December 23, 2024
New PID DWDM-SFP-10G-C-I added	Table 13 Ordering guide	October 18, 2023