Cisco 10GBASE Dense Wavelength-Division Multiplexing SFP+ Modules

Use Dense Wavelength-Division Multiplexing (DWDM) SFP+ modules to integrate WDM transport directly into your Cisco 10 Gigabit Ethernet switches and routers.

Product overview

The Cisco 10GBASE DWDM SFP+ Modules (Figure 1) are fiber transceivers for a wide variety of Cisco switches, routers, and other equipment. They allow enterprises and service providers to provide scalable and easy-to-deploy 10-Gbps LAN and WAN services in their networks.

Figure 1. Cisco DWDM SFP+ Module

Features and benefits

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

- Smallest SFP+ module footprint in the industry
- Hot-swappable input/output device plugs into an Ethernet SFP+ port of a Cisco switch or router to link the port with the network
- Support for a “pay-as-you-grow” model for investment protection
- Digital optical monitoring capability for enhanced diagnostics and troubleshooting
- Supports the Cisco Quality Identification (ID) feature, which enables a Cisco switch or router to identify whether or not the module is an SFP+ module certified and tested by Cisco
Cisco DWDM-SFP10G-XX.XX modules

The Cisco DWDM-SFP10G-XX.XX suite of fixed wavelength, linear electrical interface, transceiver modules supports OTN data rates.

- Supports 10-Gigabit data rates from 9.9G to 11.1G (LAN, WAN, and OTU2/OTU2e) to accommodate different applications
- DWDM fixed module supports 40 non-tunable ITU 100-GHz wavelengths detailed in Table 5

Cisco DWDM-SFP10G-C module

The Cisco DWDM-SFP10G-C tunable transceiver module supports OTN data rates. The DWDM-SFP10G-C has a linear electrical interface receiver that requires EDC (electronic dispersion compensation) PHY on the host board.

- Supports 10-Gigabit data rates from 9.9G to 11.1G (LAN, WAN, and OTU2/OTU2e) to accommodate different applications
- DWDM tunable module supports 96 tunable ITU 50-GHz wavelengths
- 80km reach assuming fiber chromatic dispersion of 20 ps/(nm·km)
- Tunability enables minimized inventory and simplified, rapid deployment

Cisco DWDM-SFP10G-C-S module

The Cisco DWDM-SFP10G-C-S tunable transceiver modules is Ethernet only. The DWDM-SFP10G-C-S has a limiting electrical interface receiver, which does not require EDC PHY on the host board. The DWDM-SFP10G-C-S can be plugged into any SFP+ port.

- DWDM tunable module supports 96 tunable ITU 50-GHz wavelengths
- Reach of 70 km, assuming fiber chromatic dispersion of 20 ps/(nm·km)
- Tunability enables minimized inventory and simplified, rapid deployment

Platform support

The Cisco DWDM SFP+ modules are supported across a variety of Cisco switches, routers, and optical transport devices. For more details, refer to the Cisco transceivers compatibility matrix at:

https://tmgmatrix.cisco.com/home

Connectors and Cabling

- Equipment: standard SFP+ interface
- Network: dual LC/PC connector

Note: Only connections with patch cords with PC or UPC connectors are supported. Patch cords with APC connectors are not supported. All cables and cable assemblies used must be compliant with the standards specified in the standards section.
### Optical Parameters

Table 1 shows the main optical characteristics for the standard non-tunable Cisco DWDM SFP+ modules, DWDM-SFP10G-XX.XX.

**Table 1. Optical Parameters for DWDM SFP+, DWDM-SFP10G-XX.XX**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
<th>Notes and Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transmitter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Spectral width</td>
<td></td>
<td>0.2</td>
<td></td>
<td></td>
<td>nm</td>
<td>Full width, -20 dB from maximum, with resolution bandwidth (RBW) = 0.01 nm</td>
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<tr>
<td>Transmitter center wavelength</td>
<td></td>
<td>x - 100</td>
<td>x</td>
<td>x + 100</td>
<td>Pm</td>
<td>Refer to Table 2 for center wavelengths</td>
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<tr>
<td>Side-mode suppression ratio</td>
<td>SMSR</td>
<td>30</td>
<td></td>
<td></td>
<td>dB</td>
<td></td>
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<tr>
<td>Transmitter extinction ratio</td>
<td></td>
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<td></td>
<td></td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Transmitter optical output power</td>
<td>Pout</td>
<td>-1.0</td>
<td>3.0</td>
<td></td>
<td>dBm</td>
<td>Average power coupled into single-mode fiber</td>
</tr>
<tr>
<td><strong>Receiver</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receiver optical input wavelength</td>
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<td>1565</td>
<td>nm</td>
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<td>4.0</td>
<td></td>
<td></td>
<td>dBm</td>
<td></td>
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<td></td>
<td>dBm</td>
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**Receiver Power Performance**

<table>
<thead>
<tr>
<th>Performance at 10G LAN and 10G WAN Rates (NO-FEC Applications)</th>
<th>Units</th>
<th>Range</th>
<th>Notes and Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input power range</td>
<td>dBm</td>
<td>-7 to -23</td>
<td>At BER=1E-12, back-to-back, unamplified link</td>
</tr>
<tr>
<td>Input power range (dispersion-limited)</td>
<td>dBm</td>
<td>-7 to -20</td>
<td>At BER=1E-12, -500 to +1600 ps/nm chromatic dispersion, unamplified link</td>
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<tr>
<td>Input power range (dispersion- and noise-limited)</td>
<td>dBm</td>
<td>-7 to -17</td>
<td>At BER=1E-12, -500 to +1600 ps/nm chromatic dispersion, amplified link with min 27dB OSNR (0.1nm RBW)</td>
</tr>
</tbody>
</table>

**Performance at OTU2/OTU2e rates (FEC applications)**

| Input power range                                               | dBm   | -7 to -27 | At BER=1E-3 (pre-EFEC), back-to-back, unamplified link                                 |
| Input power range (dispersion-limited)                         | dBm   | -7 to -24 | At BER=1E-3 (pre-EFEC), -500 to +1300 ps/nm chromatic dispersion, unamplified link   |
| Input power range (dispersion- and noise-limited)             | dBm   | -7 to -17 | At BER=1E-3 (pre-EFEC), -500 to +1100 ps/nm chromatic dispersion, amplified link with min 16dB OSNR (0.1nm RBW) |
| Input power range (dispersion- and noise-limited)             | dBm   | -7 to -17 | At BER=1E-5 (pre-GFEC), -500 to +1100 ps/nm chromatic dispersion, amplified link with min 19dB OSNR (0.1nm RBW) |

*Up to 1600ps/nm chromatic dispersion is supported for fiber links between two Cisco DWDM SFP+ modules. For connections between a Cisco DWDM SFP+ module and a Cisco DWDM XENPAK, X2 or XFP module, limit chromatic dispersion to 1300ps/nm.*
Table 2 shows the main optical characteristics for the tunable linear interface Cisco DWDM SFP+ modules.

Table 2. Optical Parameters for Tunable linear electrical interface DWDM SFP+, DWDM-SFP10G-C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
<th>Notes and Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Spectral width</td>
<td></td>
<td></td>
<td>0.2</td>
<td></td>
<td>nm</td>
<td>Full width, -20 dB from maximum, with resolution bandwidth (RBW) = 0.01 nm</td>
</tr>
<tr>
<td>Transmitter center wavelength</td>
<td>x - 25</td>
<td>x</td>
<td>x + 25</td>
<td>pm</td>
<td></td>
<td>Refer to Table 3 for center wavelengths</td>
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<tr>
<td>Side-mode suppression ratio</td>
<td>SMSR</td>
<td>30</td>
<td></td>
<td></td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Transmitter extinction ratio</td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Transmitter optical output power</td>
<td>Pout</td>
<td>-1</td>
<td>3.0</td>
<td>dBm</td>
<td></td>
<td>Average power coupled into single-mode fiber</td>
</tr>
<tr>
<td>Receiver</td>
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<td></td>
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<td></td>
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<tr>
<td>Receiver optical input wavelength</td>
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<td>1570</td>
<td>nm</td>
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<td>dBm</td>
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<td>Receiver overload</td>
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<td>dBm</td>
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Receiver Power Performance

<table>
<thead>
<tr>
<th>Units</th>
<th>Range</th>
<th>Notes and Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance at 10G LAN and 10G WAN Rates (NO-FEC Applications)</td>
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<tr>
<td>Input power range</td>
<td>dBm</td>
<td>-7 to -23</td>
</tr>
<tr>
<td>Input power range (dispersion-limited)</td>
<td>dBm</td>
<td>-7 to -20</td>
</tr>
<tr>
<td>Input power range (dispersion- and noise-limited)</td>
<td>dBm</td>
<td>-7 to -18</td>
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Performance at OTU2/OTU2e Rates (FEC Applications)

<table>
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<tr>
<th>Units</th>
<th>Range</th>
<th>Notes and Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input power range</td>
<td>dBm</td>
<td>-7 to -27</td>
</tr>
<tr>
<td>Input power range (dispersion-limited)</td>
<td>dBm</td>
<td>-7 to -24</td>
</tr>
<tr>
<td>Input power range (dispersion- and noise-limited)</td>
<td>dBm</td>
<td>-7 to -18</td>
</tr>
<tr>
<td>Input power range (dispersion- and noise-limited)</td>
<td>dBm</td>
<td>-7 to -18</td>
</tr>
</tbody>
</table>

Note:
1. Parameters are specified over temperature and at end of life unless otherwise noted.
2. When shorter distances of single-mode fiber are used, an inline optical attenuator must be used to avoid overloading and damaging the receiver.
Table 3 shows the main optical characteristics for the tunable Cisco limiting interface DWDM SFP+ modules.

### Table 3. Optical Parameters for Tunable limiting electrical interface DWDM SFP+, DWDM-SFP10G-C-S.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
<th>Notes and Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral width</td>
<td></td>
<td>0.2</td>
<td></td>
<td></td>
<td>nm</td>
<td>Full width, -20 dB from maximum, with resolution bandwidth (RBW) = 0.01 nm</td>
</tr>
<tr>
<td>Transmitter center wavelength</td>
<td>x - 25</td>
<td>x</td>
<td>x + 25</td>
<td>pm</td>
<td></td>
<td>Refer to Table 4 for center wavelengths</td>
</tr>
<tr>
<td>Side-mode suppression ratio</td>
<td>SMSR</td>
<td>30</td>
<td></td>
<td></td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Transmitter extinction ratio</td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Transmitter optical output power</td>
<td>Pout</td>
<td>-1</td>
<td>3.0</td>
<td>dBm</td>
<td></td>
<td>Average power coupled into single-mode fiber</td>
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<td>Stimulated Brillouin Scattering (SBS) Threshold</td>
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<tr>
<td>Receiver optical input wavelength</td>
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<td>1525</td>
<td>1570</td>
<td>nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receiver damage threshold</td>
<td></td>
<td>4.0</td>
<td></td>
<td>dBm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receiver overload</td>
<td></td>
<td>-7.0</td>
<td></td>
<td>dBm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Receiver Power Performance</th>
<th>Units</th>
<th>Range</th>
<th>Notes and Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance at 10G LAN and 10G WAN Rates (NO-FEC Applications)</td>
<td>dBm</td>
<td>-7 to -24</td>
<td>At BER=1E-12, back-to-back, unamplified link</td>
</tr>
<tr>
<td>Input power range</td>
<td>dBm</td>
<td>-7 to -22</td>
<td>At BER=1E-12, -400 to 1400 ps/nm chromatic dispersion, unamplified link</td>
</tr>
<tr>
<td>Input power range (dispersion- and noise-limited)</td>
<td>dBm</td>
<td>-7 to -20</td>
<td>At BER=1E-12, -400 to 1400 ps/nm chromatic dispersion, amplified link with min 20dB OSNR (0.5nm RBW)</td>
</tr>
</tbody>
</table>

**Note:**
1. Parameters are specified over temperature and at end of life unless otherwise noted.
2. When shorter distances of single-mode fiber are used, an inline optical attenuator must be used to avoid overloading and damaging the receiver.

Table 4 shows the 96 DWDM ITU-50GHz channels to which the DWDM-SFP10G-C-S and DWDM-SFP10G-C devices can be tuned.

### Table 4. ITU 50-GHz Center Wavelengths and Channel Numbering for DWDM-SFP10G-C and DWDM-SFP10G-C-S

<table>
<thead>
<tr>
<th>Channel ID</th>
<th>Frequency (THz)</th>
<th>Wavelength (nm)</th>
<th>Channel ID</th>
<th>Frequency (THz)</th>
<th>Wavelength (nm)</th>
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<tbody>
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<td>1</td>
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<td>1566.72</td>
<td>49</td>
<td>193.75</td>
<td>1547.32</td>
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<tr>
<td>2</td>
<td>191.4</td>
<td>1566.31</td>
<td>50</td>
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<td>1546.92</td>
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<tr>
<td>3</td>
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<tr>
<td>4</td>
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<td>7</td>
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<td>Frequency (THz)</td>
<td>Wavelength (nm)</td>
<td>Channel ID</td>
<td>Frequency (THz)</td>
<td>Wavelength (nm)</td>
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* 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.
Dimensions
Dimensions (H x W x D): 8.5 x 13.4 x 56.5mm. Cisco SFP+ modules typically weigh 75 grams or less.

Environmental conditions and power requirements
- Commercial Operational Temperature range (COM): 0 to 70°C (32 to 158°F)
- Storage temperature range: -40 to 85°C (-40 to 185°F)
- The maximum power consumption per Cisco SFP+ module is 1.5W

Regulatory and standards compliance standards
- GR-20-CORE: Generic Requirements for Optical Fiber and Optical Fiber Cable
- GR-326-CORE: Generic Requirements for Single-Mode Optical Connectors and Jumper Assemblies
- GR-1435-CORE: Generic Requirements for Multifiber Optical Connectors
- SFP+ MSA SFF-8431
- IEEE 802.3: 10-Gigabit Ethernet
- ITU-T G.709: Interfaces for the Optical Transport Network
- ITU-T G.975: GFEC
- ITU-T G.975.1: EFEC
- ITU-T G.694.1: DWDM frequency grid
- Laser Class 1 (21CFR1040 and IEC 60825)

Warranty
- Standard warranty: 1 year
- Extended warranty (optional): Cisco SFP+ modules can be covered in a Cisco SMARTnet® Service support contract for the Cisco switch or router chassis

Ordering information
Table 5 provides the ordering information for Cisco SFP+ modules.

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**Next steps**

Learn more about Cisco 10GBASE DWDM SFP+ modules by contacting your Cisco sales representative.
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