

## Cisco CRS 1-Port OC-768C/STM-256C DPSK+ Tunable WDMPOS Interface Module

The Cisco<sup>®</sup> CRS-1 Carrier Routing System is the first carrier router offering continuous system operation, unprecedented service flexibility, and system longevity. The Cisco CRS-1 is powered by Cisco IOS<sup>®</sup> XR Software – a unique self-healing, distributed operating system designed for always-on operation while scaling system capacity up to 92 Tbps. The innovative system architecture combines the Cisco Silicon Packet Processor, the first programmable 40-Gbps application-specific integrated circuit (ASIC), with the Cisco Service Separation Architecture for unprecedented service flexibility and speed to service. The Cisco CRS-1 marks a new era in carrier IP communications by powering the foundation for network and service convergence today while protecting investments for decades to come.

This data sheet provides detailed product specifications for an important element of the Cisco IP-over-DWDM solution, the Cisco CRS-1 1-Port OC-768c/STM-256c Tunable WDMPOS (Wavelength Division Multiplexing Packet over SONET/SDH) Interface Module (Figure 1). The module helps service providers to increase efficiencies, improve reliability, and reduce operational and capital costs by eliminating expensive and bulky optical transponder equipment, even as video-based applications rapidly increase traffic in their DWDM networks. The module connects directly into any DWDM network and provides up to 40 Gbps of data throughput across existing 10-Gbps DWDM systems. The module is completely tunable across the C band across every other wavelength on the ITU 50-GHz grid. It includes an integrated tunable dispersion compensator (TDC) while offering a robust tuning range. It supports high-gain Enhanced Forward Error Correction (EFEC), extending reach up to 2000 kilometers (km) without requiring signal regeneration. For more information about the Cisco CRS-1 or about other interfaces available for the Cisco CRS-1, visit: <http://www.cisco.com/go/crs>.

**Figure 1.** Cisco CRS-1 1-Port OC-768C/STM-256C DPSK+ Tunable WDMPOS Interface Module



## Product Specifications

Table 1 gives specifications of the Cisco CRS-1 1-Port OC-768c/STM-256c DPSK+ Tunable WDMPOS Interface Module.

**Table 1.** Product Specifications

| Feature  | Description   |
|--|---|
| <b>Chassis Compatibility</b>                             | Compatible with all current Cisco CRS-1 and CRS-3 line-card chassis   |
| <b>Software Compatibility</b>                            | Cisco IOS XR Software Release 3.6 or later for CRS-1<br>Cisco IOS XR Software Release 4.0.0 or later for CRS-3  |
| <b>Protocols</b>   | <ul style="list-style-type: none"> <li>• Packet over SONET/SDH (POS)</li> <li>• RFC 1619/2615, Point-to-Point Protocol (PPP) over SONET/SDH</li> <li>• RFC 1662, PPP in High-Level Data Link Control (HDLC)-like framing</li> <li>• RFC 2615, PPP over SONET/SDH</li> <li>• HDLC</li> </ul>   |
| <b>Port Density</b>                                      | One 1-port OC-768c/STM-256c DPSK+ Tunable WDMPOS interface per physical layer interface module (PLIM)   |
| <b>POS Feature Summary</b>                               | <ul style="list-style-type: none"> <li>• Supports a maximum transmission unit (MTU) of up to 9188 bytes</li> <li>• Layer 2 encapsulations: HDLC and PPP; no subinterface support</li> <li>• Alarm reporting: Loss of signal (LOS), loss of frame (LOF), line alarm indicator signal (LAIS), line remote defect indicator (LRDI), path alarm indicator signal (PAIS), loss of pointer (LOP), path remote defect indicator (PRDI), signal failure (SF), signal degrade (SD)</li> <li>• Signal failure (SF) and signal degrade (SD) alarms are based on monitoring B2 errors with a user-configurable threshold crossing.</li> <li>• Error counts: B1, B2, B3, Line FEBE (REI-L) and Path FEBE (REI-P)</li> <li>• Threshold crossing alerts (TCAs) for B1, B2, and B3 with user-configurable threshold</li> <li>• Local (internal) or loop-timed (recovered from network)</li> <li>• Local Stratum 3 clock accuracy over full operating temperature</li> <li>• Pointer activity monitoring: Counters for NEWPTR (arbitrary change in pointer value), PSE (positive stuff event), and NSE (negative stuff event)</li> <li>• Local (diagnostic) and line (network) loopback</li> <li>• <math>1 + x^{43}</math> self-synchronous scrambler</li> </ul> |
| <b>Optical Transport Network (G.709) Feature Summary</b> | <ul style="list-style-type: none"> <li>• ITU G.709</li> <li>• Alarm reporting: Loss of Signal (LOF), Loss of OTN Frame (LOF), Loss of OTN Multiframe (LOM), OTU alarm indication signal (OTU-AIS), OTU backward defect indication (OTU-BDI), ODU alarm indication signal (ODU-AIS), ODU open connection indication (ODU-OCI), ODU locked (ODU-LCK), ODU backwards defect indication (ODU-BDI), ODU payload type identifier mismatch (ODU-PTIM), OTU signal fail (OTU_SF_BER) and OTU signal degrade (OTU_SD_BER)</li> <li>• OTU_SF_BER and OTU_SD_BER alarms are based on monitoring OTU BIP errors with a user-configurable threshold crossing</li> <li>• Error counts: OTU BIP, OTU BEI, ODU BIP, and ODU BEI</li> <li>• Threshold crossing alerts (TCAs) for OTU BIP errors (SM-TCA) and ODU BIP errors (PM-TCA) with user-configurable threshold</li> <li>• Local (internal) and line (network) loopback</li> </ul>   |
| <b>Forward Error Correction Feature Summary</b>          | <ul style="list-style-type: none"> <li>• FEC Type: G.975.1 I.4</li> <li>• High gain enhanced FEC code</li> <li>• FEC statistics for pre-FEC BER, Q, Q Margin, corrected errors (EC) and uncorrected words (UC)</li> </ul>   |
| <b>Optical Feature Summary</b>                           | <ul style="list-style-type: none"> <li>• Line rate 42.8 Gbps +/-4.6 ppm</li> <li>• Duplex LC faceplate optical connector</li> <li>• Integrated tunable dispersion compensator (TDC) offering a robust tuning range of +/-700ps/nm</li> <li>• Full C-band tunable laser</li> <li>• Configurable Tx optical power (-19 dBm to +1 dBm)</li> <li>• Tx and Rx optical power monitoring</li> <li>• Optical power monitoring accuracy +/-1 dB</li> </ul>   |
| <b>Reliability and Availability</b>                      | <ul style="list-style-type: none"> <li>• Online insertion and removal (OIR) without affecting system traffic</li> </ul>   |
| <b>Network Management</b>                                | <ul style="list-style-type: none"> <li>• Cisco IOS XR Software command-line interface (CLI)</li> <li>• Simple Network Management Protocol (SNMP)</li> <li>• Extensible Markup Language (XML) interface</li> <li>• CraftWorks Interface (CWI)</li> </ul>   |

| Feature                         | Description   |
|---------------------------------|---|
| <b>Physical Dimensions</b>      | <ul style="list-style-type: none"> <li>• Occupies one PLIM slot</li> <li>• Weight: 8.6 lb (3.9 kg)</li> <li>• Height: 20.6 in. (52.32 cm)</li> <li>• Depth: 11.2 in. (28.4 cm)</li> <li>• Width: 1.8 in. (4.57 cm)</li> </ul>   |
| <b>Power</b>                    | 150W  |
| <b>Environmental Conditions</b> | <ul style="list-style-type: none"> <li>• Storage temperature: –40 to 70°C (–40 to 158°F)</li> <li>• Operating temperature: <ul style="list-style-type: none"> <li>◦ Normal: 5 to 40°C (41 to 104°F)</li> <li>◦ Short-term: –5 to 50°C (23 to 122°F)</li> </ul> </li> <li>• Relative humidity: <ul style="list-style-type: none"> <li>◦ Normal: 5 to 85%</li> <li>◦ Short-term: 5 to 90% but not to exceed 0.024 kg water/kg of dry air</li> </ul> </li> </ul> <p>Short-term refers to a period of not more than 96 consecutive hours and a total of 360 hours but not more than 15 instances in 1 year.</p> |

## Approvals and Compliance

Table 2 gives standards compliance information and Table 3 provides additional specifications for the Cisco CRS-1 1-Port OC-768c/STM-256c DPSK+ Tunable WDMPOS Interface Module.

**Table 2.** Compliance and Agency Approvals

| Feature  | Description   |
|--|---|
| <b>Safety Standards</b>                            | <ul style="list-style-type: none"> <li>• UL/CSA/IEC/EN 60950-1</li> <li>• IEC/EN 60825 Laser Safety</li> <li>• ACA TS001</li> <li>• AS/NZS 60950</li> <li>• FDA—Code of Federal Regulations Laser Safety</li> </ul>   |
| <b>EMI</b>   | <ul style="list-style-type: none"> <li>• FCC Class A</li> <li>• ICES 003 Class A</li> <li>• AS/NZS 3548 Class A</li> <li>• CISPR 22 (EN55022) Class A</li> <li>• VCCI Class A</li> <li>• BSMI Class A</li> <li>• IEC/EN 61000-3-2: Power Line Harmonics</li> <li>• IEC/EN 61000-3-3: Voltage Fluctuations and Flicker</li> </ul>  |
| <b>Immunity (Basic Standards)</b>                  | <ul style="list-style-type: none"> <li>• IEC/EN-61000-4-2: Electrostatic Discharge Immunity (8-kV contact, 15-kV air)</li> <li>• IEC/EN-61000-4-3: Radiated Immunity (10V/m)</li> <li>• IEC/EN-61000-4-4: Electrical Fast Transient Immunity (2-kV power, 1-kV signal)</li> <li>• IEC/EN-61000-4-5: Surge AC Port (4-kV CM, 2-kV DM)</li> <li>• IEC/EN-61000-4-5: Signal Ports (1 kV)</li> <li>• IEC/EN-61000-4-5: Surge DC Port (1 kV)</li> <li>• IEC/EN-61000-4-6: Immunity to Conducted Disturbances (10 Vrms)</li> <li>• IEC/EN-61000-4-8: Power Frequency Magnetic Field Immunity (30A/m)</li> <li>• IEC/EN-61000-4-11: Voltage Dips, Short Interruptions, and Voltage Variations</li> </ul> |
| <b>ETSI and EN</b>                                 | <ul style="list-style-type: none"> <li>• EN300 386: Telecommunications Network Equipment (EMC)</li> <li>• EN55022: Information Technology Equipment (Emissions)</li> <li>• EN55024: Information Technology Equipment (Immunity)</li> <li>• EN50082-1/EN-61000-6-1: Generic Immunity Standard</li> </ul>   |
| <b>Network Equipment Building Standards (NEBS)</b> | <p>This product is designed to meet the following requirements (qualification in progress):</p> <ul style="list-style-type: none"> <li>• SR-3580: NEBS Criteria Levels (Level 3)</li> <li>• GR-1089-CORE: NEBS EMC and Safety</li> <li>• GR-63-CORE: NEBS Physical Protection</li> </ul>  |

## Additional Specifications

**Table 3.** Additional Specifications: DWDM Line Interface<sup>1</sup>

| Parameter   | DWDM line interface  |
|---|--|
| Connector type  | LC   |
| Target distance   | 2000 km (dependant on network configuration)   |
| <b>Transmitter</b>  |  |
| Power range   | -19.0 to 1.0 dBm   |
| Wavelength range  | Full tunable from 1528.77 nm to 1563.86 nm across every other wavelength on the ITU 50-GHz grid. For example:<br>1OC768-DPSK/C: 196.10THz, 196.00THz, 195.90THz, 195.80THz,...,191.70THz<br>1OC768-DPSK/C-O: 196.05 THz, 195.95 THz, 195.85 THz, 195.75THz,...,191.75THz |
| Wavelength stability  | +/-1.5 GHz   |
| Optical signal-to-noise ratio                                 | 45 dB  |
| SBS threshold   | 15 dBm   |
| Optical Bandwidth (FWHM) (Max)                                | 30 GHz   |
| <b>Receiver</b>   |  |
| P (RMax) (minimum overload)                                   | 5 dBm  |
| Chromatic dispersion tolerance (1 dB penalty)                 | -700 to +700 ps/nm   |
| PMD tolerance (1dB penalty)                                   | 2.3 ps, 1 X 10 <sup>-5</sup> outage probability  |
| OSNR (back to back) (0.5nm Res. BW)                           | 7.4dB (1 X 10 <sup>-15</sup> Post FEC BER)   |
| <b>Single-channel optical link (without DWDM)<sup>3</sup></b> |  |
| Fiber type  | G.652 (SMF), G.653 (DSF) and G.655 (NZ-DSF)  |
| Sensitivity (over dark fiber)                                 | -27 dBm (1 X 10 <sup>-15</sup> Post FEC BER) <sup>4</sup>  |
| Link Budget (no amplification)                                | 28 dB  |
| Optical path penalty  | 1 dB   |
| Path length   | 80 km (G.652/G.655); 100 km (G.653) <sup>5</sup>   |
| <b>Miscellaneous</b>  |  |
| Optical power monitoring                                      | Tx and Rx, ±1 dB accuracy  |

1) All specifications are worse-case for operational life of product.

2) Must change RxLOS threshold default from -19.5 dBm to -23.5 dBm.

3) Please contact your Cisco representative for the Application Note on 40 Gbps single-channel CRS-1 interconnection extending to 80 km and beyond.

4) Must change default RxLOS to -30 dBm or less, wavelength set to a channel between 7 and 14 (1531.116 nm and 1533.858 nm)

5) Proper system design required; network may require Dispersion Compensating Units

## Ordering Information

To place an order, contact your local Cisco representative or visit the Ordering page on <http://www.cisco.com>. Use the ordering information in Table 4.

**Table 4.** Ordering Information

| Product Part Number | Product Name  |
|---------------------|---|
| 1OC768-DPSK/C       | Cisco CRS-1 1-Port OC-768/STM-256c DPSK+ (C-band) DWDM PLIM |
| 1OC768-DPSK/C-O=    | Cisco CRS-1 1xOC768 (C-band) DPSK+ DWDM PLIM (Offset TDC)   |

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## For More Information

For more information about the Cisco CRS-1 1-Port OC-768c/STM-256c DPSK+ Tunable WDMPOS Interface Module, contact your local Cisco representative or visit: <http://www.cisco.com/go/crs>.



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