Cisco Smart SFP Network Interface Device

Product Overview

The Cisco® Smart Small Form-Factor Pluggable (SFP) Network Interface Device (NID) is a state-of-the-art 1310-nm, 1000BASE-LX, Gigabit Ethernet SFP transceiver that reduces the need for additional instrumentation. Smart SFP NID transceivers deploy smoothly inline into existing network devices. They provide remote points of testability, enabling performance-assured service delivery to let operators and service providers increase the value they get out of their existing network infrastructure.

Carrier Ethernet Enabler

Smart SFP NID transceivers enable a more efficient test and troubleshooting process by using RFC 2544 and Y.1564 as well as Y.1731 and RFC 5357 methodologies to support end-to-end performance monitoring in multiservice/multi-class-of-service (multi-CoS) environments. They measure key performance indicators such as network delay, jitter, and packet loss to help guarantee that service-level agreements (SLAs) are met. The probe also supports key service operations and maintenance capabilities, letting service providers easily verify service continuity and perform fault isolation.

Features and Benefits

- The Smart SFP NID transceivers turn network ports into service-assurance tools, enabling Ethernet operation, administration, and maintenance (OAM) for any 1 Gigabit Ethernet network
- They enable consistent test and performance-monitoring capabilities across mobile-backhaul networks without additional instrumentation
- The transceivers reduce complete equipment upgrades and service mean time to repair (MTTR) by simplifying test and troubleshooting procedures
- They are simple-to-use and easy-to-deploy
- The transceivers perform throughput, availability, frame loss, frame delay, and frame delay variation measurements
- Ability to activate test loopback (Layer 2 and Layer 3)
- The Smart SFP transceivers are fully compatible with RFC 2544 and Y.1564 test methodologies
- Inline performance monitoring uses Y.1731 and TWAMP-Light (RFC 5357)
- Ability to enable OAM 802.1ag for fault isolation

Applications

- Service activation and assurance for Ethernet mobile backhaul for third- and fourth-generation (3G and 4G, respectively) LTE and small cells
- Ethernet business-services SLA verification and assurance
- End-to-end performance monitoring
- Remote test and troubleshooting

Performance-Monitoring Features

- Inline performance monitoring
- Standards-based connectivity fault management (802.1ag) and performance monitoring (Y.1731, RFC 5357)
- Up-and-down maintenance endpoint (MEP) configuration
- Support for Y.1731 reflector and initiator modes on up to 10 Ethernet virtual connections (EVCs)
- Performance monitoring on up to 10 services
- Support for a TWAMP-Light reflector (RFC 5357) on multiple services and quality of service (QoS) concurrently
- Throughput, frame loss, frame delay, and frame delay variation measurements

Cisco Smart SFP NID transceivers are hot-pluggable with a 3.3V single power supply and a duplex-LC connector that provide a high-speed serial link at up to 1.25-Gbps signaling rates. They are compatible with the INF-8074i (SFP transceiver) standard. These transceivers offer an LC optical receptacle that is compatible with industry-standard LC connectors. The Cisco Smart SFP NID performs Ethernet OAM functions based on industry standards (802.1ag and Y.1731) including test turn-up automation, enhanced customer-premises-equipment (CPE) demarcation, and performance monitoring.

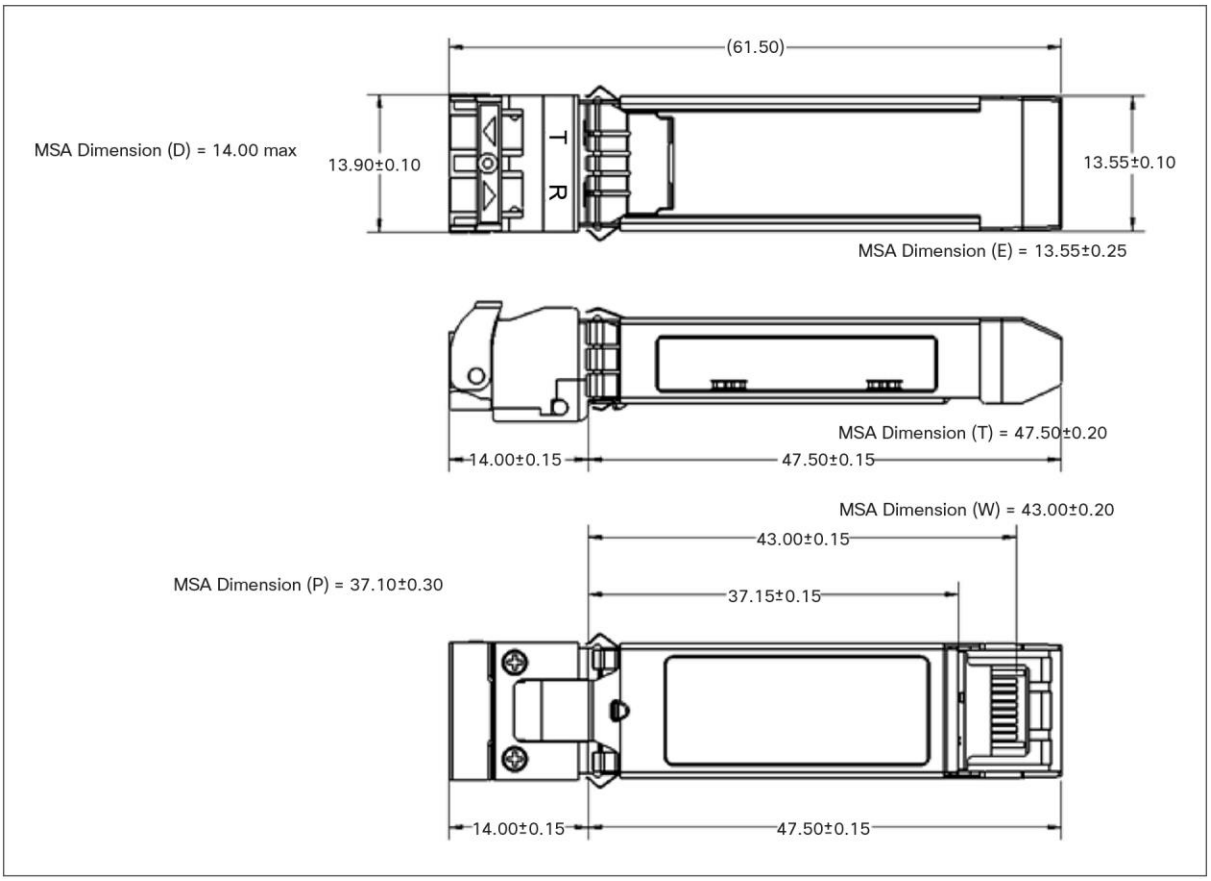
The transceivers consist of an optical assembly housing the transmitter and receiver and an electrical sub-assembly. All are packaged together with a top metal cover and bottom shield.

Cisco Smart SFP NID transceivers also support a digital diagnostic monitoring interface using a two-wire serial ID interface as defined in SFP MSA specification SFF-8472. You can monitor transceiver parameters including temperature, voltage, laser bias current, laser power, and receiver power. Alarms and warnings are provided when monitored parameters exceed predefined threshold values. Cisco Smart SFP NID transceivers also include a loss-of-signal-detect circuit, which provides a time-to-live (TTL) logic high output when it detects an unusable input optical signal level.

SFP Model Dimensions

Figure 1 shows a diagram of the transceivers with their dimensions.

Figure 1. Transceivers



Tables 1, 2, and 3 give regulatory compliance, specifications, and PIN definitions for the transceivers.

Table 1. Regulatory Compliance

Feature	Test Method	Performance
Safety		
Product safety	UL 60950-1	UL recognized component for United States and Canada
	CSA C22.2 No. 60950-1	
	EN 60950-1	TUV certificate
	IEC 60950-1	CB certificate
	Flame class V-0	Passes needle flame test for component flammability verification
	Low Voltage Directive 2006/95/EC	Certified to harmonized standards listed; Declaration of Conformity issued
Laser safety	EN 60825-1 and EN 60825-2	TUV certificate
	IEC 60825-1	CB certificate
	U.S. 21 CFR 1040.10	FDA/CDRH certified with accession number

Feature	Test Method	Performance
Electromagnetic Compatibility		
Radiated emissions	EMC Directive 2004/108/EC	Class B digital device with a minimum -6-dB margin to the limit when tested in a representative host Tested frequency range: 30 MHz to 40 GHz or 5th harmonic (5 times the highest frequency), whichever is less Good system EMI design practice is required to achieve system-class level B margins
	FCC rules 47 CFR Part 15	
	CISPR 22	
	AS/NZS CISPR22	
	EN 55022	
	ICES-003, Issue 5	
	VCCI regulations	
Immunity	EMC Directive 2004/108/EC	Certified to harmonized standards listed; Declaration of Conformity issued
	CISPR 24	
	EN 55024	
ESD	IEC/EN 61000-4-2	Exceeds requirements. Withstands discharges of ±8 kV contact, ±15 kV air
Radiated immunity	IEC/EN 61000-4-3	Exceeds requirements. Field strength of 10V/m from 10 MHz to 1 GHz. No detectable effect on transmitter/receiver performance between these limits
Restriction of Hazardous Substances (RoHS)		
RoHS	EU Directive 2011/65/EU	Compliant per the European Parliament Directive 2011/65/ and the Council of 8 June 2011 for restricted use of certain hazardous substances in electrical and electronic equipment (recast) A RoHS Certificate of Compliance (C of C) is available upon request The product may use certain RoHS exemptions

Table 2. Specifications

Parameter	Symbol	Minimum	Maximum	Unit
Absolute Maximum Ratings				
Storage temperature[1]	T_S	-40	95	°C
Relative humidity[2]	RH	5	95	%
Supply voltage	V_{CC}		4	V
Recommended Operating Conditions				
Controlled operating case temperature	T_{op}	-5	70	°C
Uncontrolled operating case temperature		-40	85	°C
Supply voltage	V_{CC}	3.135	3.465	V
Transmitter differential input voltage	VD	0.5	2.4	V
Transmit disable input voltage - Low[3]	TD_{LOW}	0.0	0.8	V
Transmit disable input voltage - High[3]	TD_{HI}	2.0	V_{CC}	V

[1] Case temperature

[2] Noncondensing

[3] Transmit disable input has a 4.7 to 10 kΩ pull-up to VCC inside the module

Parameter				Symbol	Min.	Typical	Max.	Unit
Electrical Characteristics								
Transmitter	TX fault output - High			$V_{oh,}$ TTL	2.0		V_{CC} + 0.3	V
	TX fault output - Low			V_{oh}, TTL	0.0		0.8	V
	Initialization time						500	ms
Receiver	Data output voltage swing			V_{Diff}	0.5		1.2	V
	Data output rise and fall times			t_r, t_f			130	ps
	Loss of signal detect output - High			V_{oh}, TTL	2.0		V_{CC} + 0.3	V
	Loss of signal detect output - Low			V_{oh}, TTL	0.0		0.8	V
Supply current and voltage	Voltage			V_{CC}	3.135		3.465	V
	Supply current	LX		I_{CC}			0.505	A
		EX/ZX					0.576	
	Power dissipation	LX	Controlled	Pwr		1.5	1.6	W
			Uncontrolled			1.6	1.7	W
		EX/ZX	Controlled			1.7	1.8	W
			Uncontrolled			1.8	1.9	W
LX Optical Characteristics (Over Specified Top Range, V_{CC}=+3.135 to +3.465V)								
Transmitter	Average optical output power			P_{OUT}	-11.0		-3.0	dBm
	Optical extinction ratio - GE			ER	9.0			dBm
	Optical modulation amplitude			OMA		124		µW
	Center wavelength			λ	1270		1360	nm
	Spectral width (-20 dB)						3.0	nm
	Optical rise/fall time			t_r, t_f			260	ps
	Relative intensity noise			RIN			-120	dB/Hz
Receiver	Optical input power (sensitivity) - GE			P_{IN}			-19	dBm
	Optical input power (saturation)			P_{IN}			1	dBm
	Operating center wavelength			λ	1265		1600	nm
	Return loss				12			dB
	Loss of signal - de-asserted			P_A			-20	
	Loss of signal - asserted			P_D	-30			
	Loss of signal - hysteresis			P_A-P_D	0.5		5.0	
EX 40 km, 1550 nm								
Transmitter	Average optical output power			P_{OUT}	-1.0		3.0	dBm
	Optical extinction ratio - GE			ER	9.0			dBm
	Optical center wavelength			λ	1500		1580	nm
	Spectral width (-20 dB)						1.0	nm
	Optical rise/fall time			t_r, t_f			260	ps
Receiver	Optical input power sensitivity - GE			P_{IN}			-22	dBm
	Optical input power (saturation)			P_{IN}			1.0	dBm
	Optical center wavelength			λ	1260		1620	nm
	Return loss				27			dB
ZX 80 km, 1550 nm								
Transmitter	Average optical output power			P_{OUT}	0		5.0	dBm
	Optical extinction ratio - GE			ER	9.0			dBm
	Optical center wavelength			λ	1500		1580	nm
	Spectral width (-20 dB)						1.0	nm
	Optical rise/fall time			t_r, t_f			260	ps

Parameter		Symbol	Min.	Typical	Max.	Unit
Receiver	Optical input power sensitivity - GE	P_{IN}			-23	dBm
	Optical input power (saturation)	P_{IN}			1.0	dBm
	Operating center wavelength	λ	1260		1620	nm
	Return loss		27			dB

Table 3. PIN Definitions

1	$V_{EE}T$	Transmit signal ground
2	Tx Fault	Transmit fault indication
3	Tx Disable	Transmit disable
4	MOD-DEF2	Module definition 2
5	MOD DEF1	Module definition 1
6	MOD DEF0	Module definition 0
7	Rate Select	Application select between full or reduced receiver bandwidth (not implemented)
8	LOS	Loss of signal
9	$V_{EE}R$	Receiver signal ground
10	$V_{EE}R$	Receiver signal ground
11	$V_{EE}R$	Receiver signal ground
12	RD-	Received data inverted differential output
13	RD+	Received data non-inverted differential output
14	$V_{EE}R$	Receiver signal ground
15	$V_{CC}R$	+3.3 V Receiver power supply
16	$V_{CC}T$	+3.3 V Transmitter power supply
17	$V_{EE}T$	Transmitter signal ground
18	TD+	Transmitter data non-inverted differentiated input
19	TD-	Transmitter data inverted differential input
20	$V_{EE}T$	Transmitter signal ground

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Printed in USA C78-734249-00 05/15