SPS-43-48H-CP-CDF-SD

Features

- Class C+ GPON OLT transceiver
- Small Form Factor Pluggable, Simple SC Connector
- 2488 Mbps downstream Tx/1244 Mbps upstream Rx
- Fully ITU-T G.984.2 compliant
- High Power 1490nm DFB transmitter (+3dBm)
- High Sensitivity Burst Mode 1310 nm APD receiver (-30 dBm)
- Fast Burst Mode Digital acquire RSSI (300nS sampling time)
- 0 to 70°C case temperature operation
- Single 3.3V supply
- 20 km reach
- RoHS compliant (lead exemption)

General Parameters

Table 1 – General Operating Parameters

Parameter	Minimum	Typical	Maximum	Unit/Conditions
Operating Voltage, Vcc	3.135	3.3	3.465	V
Total Current, Icc	-	-	550	mA
Operating Temperature (case)	0	-	70	°C
Storage Temperature	-40	-	85	°C

Table 2 – General Optical Parameters

Parameter	Minimum	Typical	Maximum	Unit/Conditions
Back Reflection at 1490 nm	-	-	-20	dB
Back Reflection at 1310 nm	-	-	-20	dB
1490 nm to 1310 nm Crosstalk	-5	-	-45	dB

Functional Characteristics

The following tables list the performance specifications for the various functional blocks of the integrated optical transceiver module.

Table 3 – Transmitter Specifications (Optical)

Parameter	Minimum	Typical	Maximum	Unit	Notes
Average Optical Output Power, P_O	3	-	7.0	dBm	
Output Power at Transmit Off	-	-	-40	dBm	
Extinction Ratio (EOL)	8.2	-	-	dB	PRBS 2^{23}-1, NRZ, 50% duty cycle
Transmitter Output Eye	G.984.2 Figure 2				
Optical Rise and Fall Time	-	250	-	ps	20% to 80%
Center Wavelength, λ	1480	1490	1500	nm	
-20 dB Spectral Width	-	-	1	nm	
Side Mode Suppression Ratio (SMSR)	30	-	-	dB	
Bit Rate	-	2488	-	Mbps	
Tolerance to TX Back Reflection	-15	-	-	dB	1 dB degradation of Rx sensitivity

Table 4 – Transmitter Specifications (Electrical)

Parameter	Minimum	Typical	Maximum	Unit	Notes
Input Differential Impedance	80	100	120	Ω	
Single Ended Data Input Swing	200	-	800	mV	
Tx Disable (LVTTL)	2	-	Vcc	V	
Tx Enable (LVTTL)	0	-	0.8	V	
TX_Fail_High	2.4	-	Vcc	V	
TX_Fail_Normal	0	-	0.4	V	

Table 5 – Receiver Specifications (Optical)

Parameter	Minimum	Typical	Maximum	Unit	Notes
Operational Wavelength Range	1260	1310	1360	nm	
Data Rate (burst mode)	-	1244	-	Mbps	
Receiver Burst-Mode Sensitivity	-	-	-30	dBm	At 10^{-10} BER, PRBS 2^{23}-1, 20km fiber
Receiver Overload	-12	-	-	dBm	
Receiver Burst Mode Dynamic Range	15	20	-	dB	
Damage Threshold for Receiver	+5	-	-	dBm	
Maximum Reflectance of Receiver	-	-	-20	dB	

Table 6 – Receiver Specifications (Electrical)

Parameter	Minimum	Typical	Maximum	Unit	Notes
Differential Output Signal Amplitude	400	-	1600	mV	
Data Output Rise Time	-	250	-	Mbps	20% to 80%
Data Output Fall Time	-	250	-	ps	20% to 80%
Signal Detect Output HIGH	2.4	-	Vcc	V	
Signal Detect Output LOW	0	-	0.8	V	
Signal Detect Assert Time	-	-	100	ns	
Signal Detect De-assert Time	-	-	12.8	ns	

Table 7 – Digital RSSI Timing Specification

Parameter	Minimum	Typical	Maximum	Unit	Notes
RSSI Trigger Delay[a]	25	-	-	ns	
RSSI Sampling Time[a]	300	-	-	ns	
Internal I^2C Delay[a]	-	-	500	us	
Receiver Power DDM (RSSI) Error[b]	-	-	+/- 3	dB	

a) RSSI_ACQ input signal rising edge will trigger RSSI sampling, and falling edge will trigger internal digital RSSI information written to I^2C. It is recommended that host shall not trigger RSSI_ACQ input again until RSSI data is valid in I^2C from previous RSSI trigger.

b) RSSI DDM working range is between -12 to -32 dBm with accuracy of +/- 3dB. If the data pattern is at least 2^7-1 or longer, a minimum average of 8 times is strongly recommended to maintain the RSSI reading accuracy.

Pin Definitions

Refer to Table 8 for a description of the function of each I/O pin.

Table 8 - Module Pin Definitions

Pin Number	Label	Definition
1	Veet	Tx Ground
2	Tx_Fail (Tx_Fault)	Tx Fail Alarm. LVTTL Output Active High
3	Tx_DIS	Tx Disable. LVTTL input. Laser output is disabled when this pin is asserted high or left unconnected. Laser output is enabled when this pin is asserted low.
4	MOD_DEF (2)	2-Wire Serial Data I/O Pin.
5	MOD_DEF (1)	2-Wire Serial Clock Input.
6	MOD_DEF (0)	Internally Grounded
7	Reset	CMOS input. Assert “Reset” high at the end of previous burst, 2 bytes in duration
8	BRST_Det	LVTTL output. BRST_Det assert low when module receives “reset” signal, assert high when incoming burst is present.
9	RSSI_ACQ	RSSI acquire/hold LVTTL Input. Digital RSSI output through I2C
10	Veer	Rx Ground
11	Veer	Rx Ground
12	RXD-	Negative Data Output, LVPECL; DC coupled
13	RXD+	Positive Data Output, LVPECL; DC coupled
14	Veer	Rx Ground
15	Vcc_Rx	Rx Vcc
16	Vcc_Tx	Tx Vcc
17	Veet	Tx Ground
18	TXD+	Positive Data Input, LVPECL or CML (AC coupled; internally 100 ohms differential termination)
19	TXD-	Negative Data Input, LVPECLor CML (AC coupled; internally 100 ohms differential termination)
20	Veet	Tx Ground

Timing Diagram

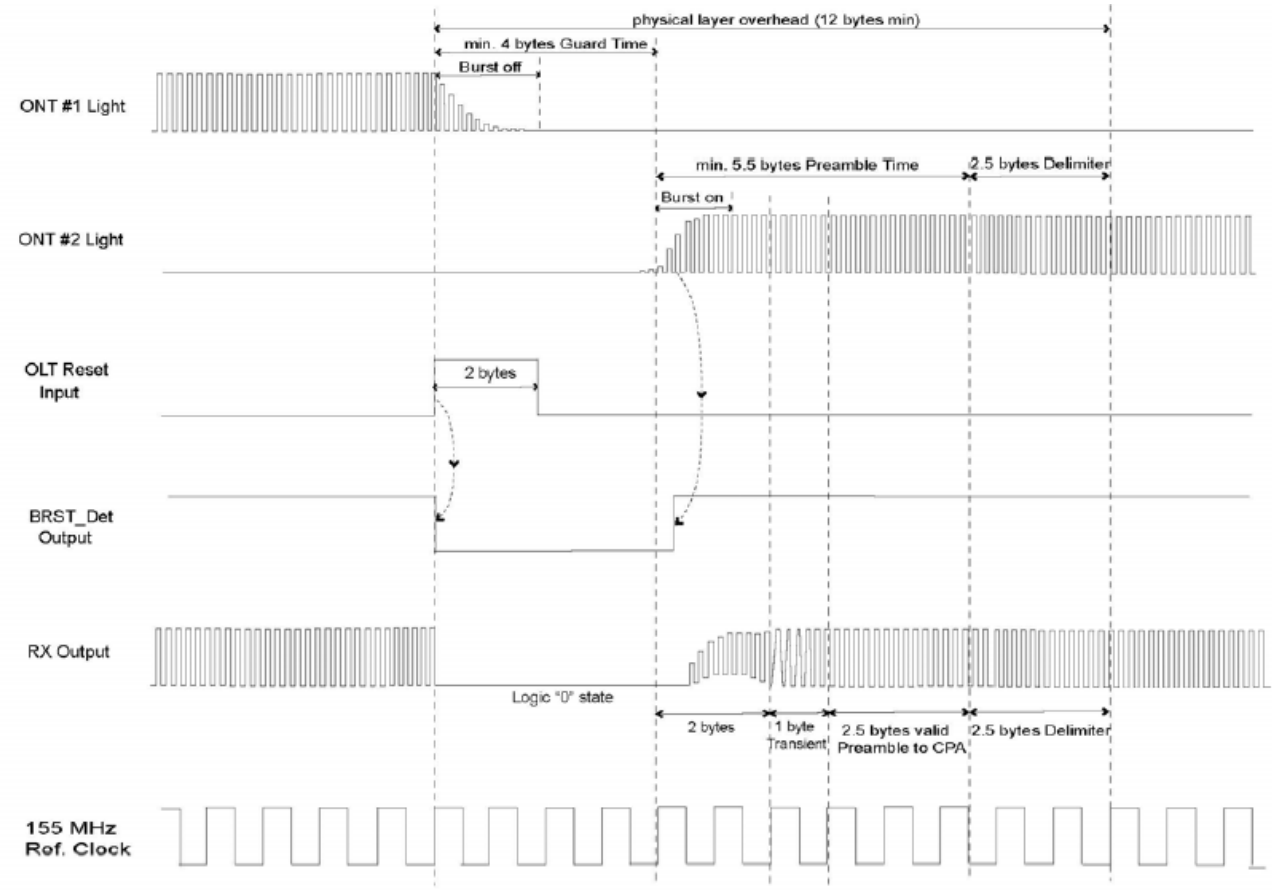


Figure 1. Timing Diagram

Digital RSSI Acquire/Hold Timing Specification

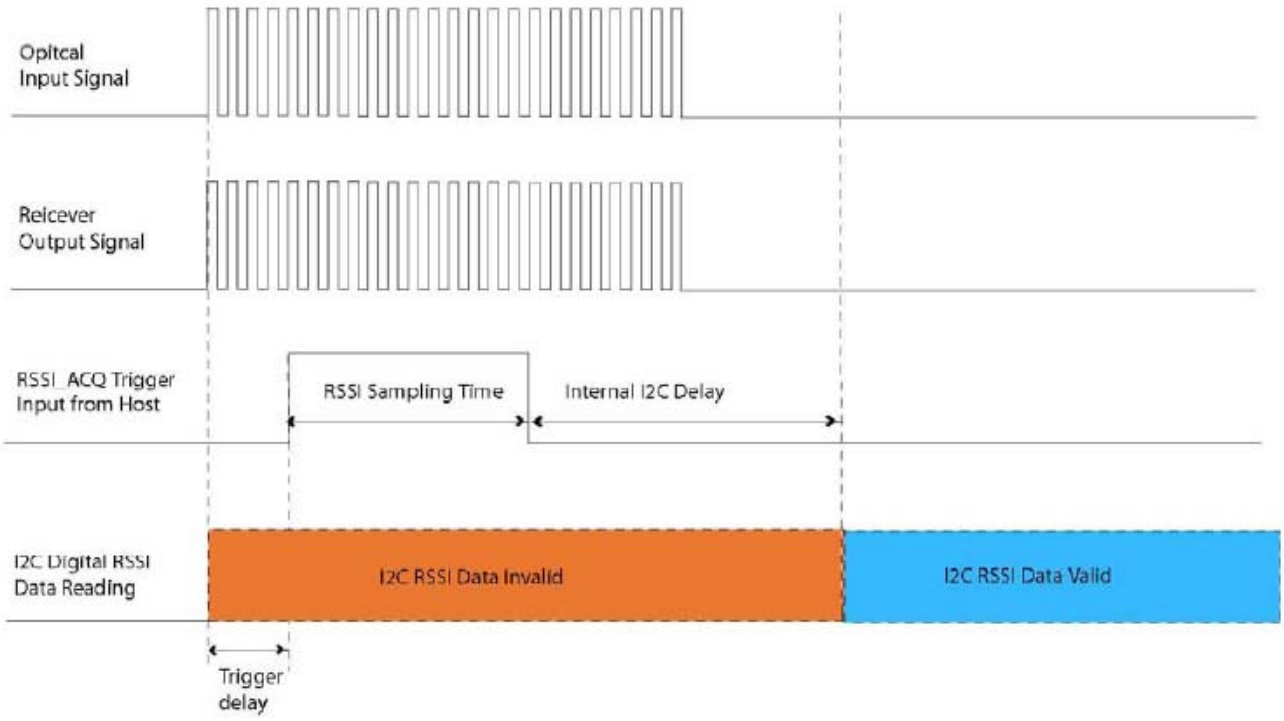


Figure 2. Digital RSSI Timing.

EEPROM Memory Map – Page A0h

Table 9 - I²C A0h Address

DEC Addr.	HEX Addr.	Field Size (bytes)	Name	Default Value	Description
0	00	1	Identifier	03h	SFP
1	01	1	Extended Identifier	04h	Function defined by serial ID
2	02	1	Connector	01h	SC receptacle
3	03	8	Transceiver	00 00 00 00 00 00 00 00h	Transceiver Code Field, not applicable
11	0B	1	Encoding	03h	NRZ encoding
12	0C	1	Nominal Bit Rate in 100 MBps	19h	2488.32 Mbps
13	0D	1	Reserved	00h	Reserved
14	0E	1	Length (9µ,km) in km	14h	20km
15	0F	1	Length (9µ,m) in 100m	C8h	20km
16	10	1	Length (50µ) in 10m	00h	Not Supported
17	11	1	Length (62.5µ) in 10m	00h	Not Supported
18	12	1	Length (Copper) in m	00h	Not Supported
19	13	1	Reserved	00h	Reserved
20	14	16	Vendor Name (ASCII)	"SOURCEPHOTONICS"	Vendor Name (ASCII)
36	24	1	Reserved	00h	Reserved
37	25	3	Vender IEEE Company ID	00 06 B5h	Source Photonics IEEE ID
40	28	16	Vendor Part Number (ASCII)	"SPS4348HCPCDFSD"	Vendor Part Number (ASCII)
56	38	4	Vendor Rev (ASCII)	31 20 20 20	Revision
60	3C	2	Laser Wavelength in nm	05 D2h	1490nm Tx Wavelength
62	3E	1	Reserved	00h	Reserved
63	3F	1	Check Code for Base ID Fields	xxh [1)]	Checksum from byte 0-62
64	40	2	Options	00 1Ch	TX_DIS, TX_Fault, SD
66	42	1	Upper Bit Rate Margin in %	00h	BR, Max not specified
67	43	1	Lower Bit Rate Margin in %	00h	BR, Min not specified
68	44	16	ALU Serial Number	"xxxxxxxxxxxxxxxx" [2)]	16 byte Serial number field

			(ASCII)		(ASCII)
84	54	8	Date Code	xx xx xx xx xx xx 20 20h	Year(2 bytes) month(2 bytes) day(2 bytes)
92	5C	1	Diagnostic Monitoring Type	58h	Ext Calibration, Average Power Measurement
93	5D	1	Enhanced Options	E0h	Optical Alarm/warning implemented Soft TX_DIS, TX_FAULT implemented
94	5E	1	SFF-8472 Compliance	02h	Compliance to SFF-8472 Rev 9.4
95	5F	1	Check Code for Extended ID Fields	xxh	Checksum from byte 64-69
96	60	30	Vendor Specific	“SPS-43-48H-CP-CDF-SD”	Vendor Part Number (ASCII)
126	7E	2	Vendor Specific	00 00h	Reserved
128	80	128	Reserved	00….00h	Reserved; return to 0

EEPROM Memory Map – Page A2h

Table10 - I²C A2h Address

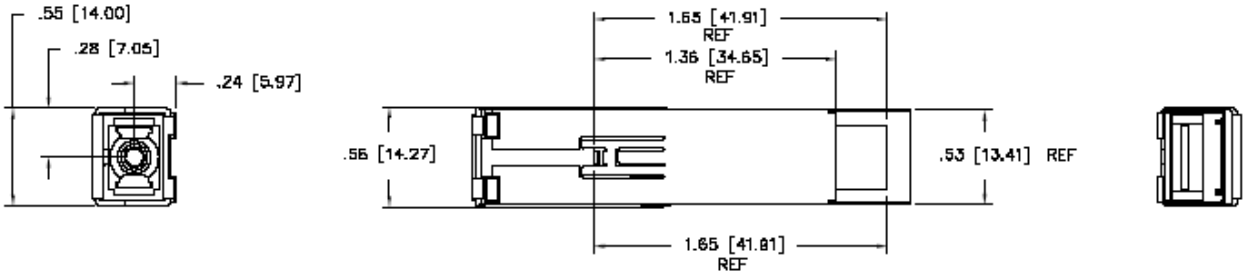
DEC Addr.	HEX Addr.	Field Size (bytes)	Name	Default Value	Description
0	00	2	Temp High Alarm	xx xxh	Temperature high alarm threshold
2	02	2	Temp Low Alarm	xx xxh	Temperature low alarm threshold
4	04	2	Temp High Warning	xx xxh	Temperature high warning threshold
6	06	2	Temp Low Warning	xx xxh	Temperature low warning threshold
8	08	2	Voltage High Alarm	94 70h	3.6V
10	0A	2	Voltage Low Alarm	6D 60h	3.0V
12	0C	2	Voltage High Warning	8C A0h	3.5V
14	0E	2	Voltage Low Warning	75 30h	3.1V
16	10	2	Bias High Alarm	83 81h	110mA
18	12	2	Bias Low Alarm	02 64h	2mA
20	14	2	Bias High Warning	77 8Ch	100mA
22	16	2	Bias Low Warning	03 96h	3mA
24	18	2	TX Power High Alarm	xx xxh	+7.5 dBm
26	1A	2	TX Power Low Alarm	xx xxh	+2.5dBm
28	1C	2	TX Power High Warning	xx xxh	+7.0dBm
30	1E	2	TX Power Low Warning	xx xxh	+3.0dBm
32	20	2	RX Power High Alarm	FF FFh	No alarm
34	22	2	RX Power Low Alarm	00 00h	No alarm
36	24	2	RX Power High Warning	FF FFh	No alarm
38	26	2	RX Power Low Warning	00 00h	No alarm
40	28	16	Reserved	00….000h	Reserved
56	38	4	RX_PWR(4) Calibration	xx xx xx xxh	4th order RSSI calibration coefficient
60	3C	4	RX_PWR(3) Calibration	xx xx xx xxh	3rd order RSSI calibration coefficient
64	40	4	RX_PWR(2) Calibration	xx xx xx xxh	2nd order RSSI calibration coefficient
68	44	4	RX_PWR(1) Calibration	xx xx xx xxh	1st order RSSI calibration coefficient
72	48	4	RX_PWR(0) Calibration	xx xx xx xxh	0th order RSSI calibration coefficient
76	4C	2	TX_I(Slope) Calibration	01 A3h	Slope for Bias calibration
78	4E	2	TX_I(Offset) Calibration	00 00h	Offset for Bias calibration
80	50	2	TX_PWR(Slope) Calibration	xx xxh	Slope for TX Power calibration
82	52	2	TX_PWR(Offset) Calibration	00 00h	Offset for TX Power calibration

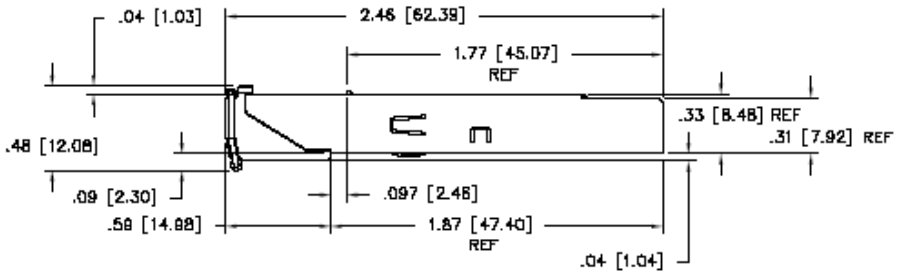
84	54	2	T(Slope) Calibration	01 00h	Slope for Temperature calibration
86	56	2	T(Offset) Calibration	xx xxh	Offset for Temperature calibration, in units of 256ths C
88	58	2	V(Slope) Calibration	01 00h	Slope for VCC calibration
90	5A	2	V(Offset) Calibration	00 00h	Offset for VCC calibration
92	5C	3	Reserved	00h	reserved
95	5F	1	Checksum	xxh	Checksum
96	60	2	Transceiver Temperature	xx xxh	Temperature in C/256
98	62	2	Supply Voltage	xx xxh	Vcc
100	64	2	TX Bias Current	xx xxh	BIASMON
102	66	2	TX Optical Output Power	xx xxh	Back facet monitor
104	68	2	RX Optical Input Power	xx xxh	RSSI
106	6A	2	Reserved	0000h	Reserved
108	6C	2	Reserved	0000h	Reserved
110	6E.7	1bit	TX_DIS State	x	Digital state of the TX Disable Input Pin.
	6E.6	1bit	Soft TX Disable	x	Read/write bit that allows software disable of laser.
	6E.5	1bit	Reserved.	0	Reserved.
	6E.4	1bit	Rate Select State	0	NOT SUPPORTED.
	6E.3	1bit	Rate Select	0	NOT SUPPORTED.
	6E.2	1bit	TX_FAULT	x	Digital state of the TX Fault Output Pin.
	6E.1	1bit	LOS	0	Digital state of the LOS Output Pin. NOT SUPPORTED
	6E.0	1bit	Data_ready_bar	x	Indicates transceiver has achieved power up and data is ready.
111	6F.7	1bit	Reserved	0	Reserved
	6F.6	1bit	Reserved	0	Reserved
	6F.5	1bit	Reserved	0	Reserved
	6F.4	1bit	Reserved	0	Reserved
	6F.3	1bit	Reserved	0	Reserved
	6F.2	1bit	INTERRUPT_NOT	x	Interrupt state (active low)
	6F.1	1bit	MODE_EN	0	TX FAULT pin enable
	6F.0	1bit	APD_SHUTDOWN	x	APD shut-down latch. Write 0 to clear condition
112	70.7	1bit	Temperature too high alarm	x	Temperature too high alarm
	70.6	1bit	Temperature too low	x	Temperature too low alarm

			alarm		
	70.5	1bit	VCC too high alarm	x	VCC too high alarm
	70.4	1bit	VCC too low alarm	x	VCC too low alarm
	70.3	1bit	BIASMON too high alarm	x	BIASMON too high alarm
	70.2	1bit	BIASMON too low alarm	x	BIASMON too low alarm
	70.1	1bit	BFMON too high alarm	x	BFMON too high alarm
	70	1bit	BFMON too low alarm	x	BFMON too low alarm
113	71.7	1bit	RSSI too high alarm	x	RSSI too high alarm
	71.6	1bit	RSSI too low alarm	x	RSSI too low alarm
	71.5	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.4	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.3	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.2	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.1	1bit	Reserved interrupt status bit	x	TX Fail went HIGH
	71	1bit	Reserved interrupt status bit	x	APD Shutdown event detected
114	72	1	Reserved	00h	Interrupt Mask for ISRC0
115	73	1	Reserved	00h	Interrupt Mask for ISRC1
116	74.7	1bit	Temperature too high warning	x	Temperature too high warning
	74.6	1bit	Temperature too low warning	x	Temperature too low warning
	74.5	1bit	VCC too high warning	x	VCC too high warning
	74.4	1bit	VCC too low warning	x	VCC too low warning
	74.3	1bit	BIASMON too high warning	x	BIASMON too high warning
	74.2	1bit	BIASMON too low warning	x	BIASMON too low warning
	74.1	1bit	BFMON too high warning	x	BFMON too high warning
	74	1bit	BFMON too low warning	x	BFMON too low warning
117	75.7	1bit	RX Power High Warning	x	RSSI too high warning
	75.6	1bit	RX Power Low Warning	x	RSSI too low warning
	75.5	1bit	Reserved	0	Reserved

	75.4	1bit	Reserved	0	Reserved
	75.3	1bit	Reserved	0	Reserved
	75.2	1bit	Reserved	0	Reserved
	75.1	1bit	Reserved	0	Reserved
	75.0	1bit	Reserved	0	Reserved
118	76	1	Reserved	00h	Interrupt Mask for ISRC2
119	77	1	Reserved	00h	Interrupt Mask for ISRC3
120	78	8	Vendor Specific	00 00 00 00 00 00 00 00h	Vendor Specific

Package Diagram





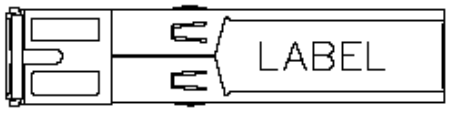


Table 11 - Device Handling/ESD Protection

The devices are static sensitive and may easily be damaged if care is not taken during handling. The following handling practices are recommended.	
1	Devices should be handled on benches with conductive and grounding surfaces.
2	All personnel, test equipment and tools shall be grounded.
3	Do not handle the devices by their leads.
4	Store devices in protective foam or carriers.
5	Avoid the use of non-conductive plastics, rubber, or silk in the area where the devices are handled
6	All modules shall be packaged in materials that are anti-static to protect against adverse electrical environments.
7	Avoid applications of any voltage higher than maximum rated voltages to this part. For proper operation, any VIN or VOUT should be constrained to the range GND ≤ (VIN or VOUT) ≤ VCC. Unused inputs must always be tied to an appropriate logic voltage (e.g. either GND or VCC). Unused outputs must be left open.

Warnings

Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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