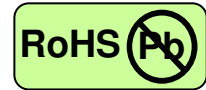


125 Mb/s SC-RJ Transceiver



2x6 SFF, SC-RJ Connector, 1 mm POF and 200 μ m HCS, RoHS Compliant



Features

- 650 nm LED
- Multi-rate: 10-125 Mb/s, NRZ
- Single +3.3 V Power Supply
- RoHS Compliant and Lead-free
- PECL Differential Electrical Interface
- Compliant with Multi-Source Agreement (MSA) Small Form Factor (SFF) 2x6 Footprint
- SC-RJ Connector
- TX Optical Output Power Squelch Enabled
- Compliant with SFF-8472 Digital Diagnostic Monitoring Interface
- Eye Safety
Designed to meet LED Class 1

Applications

- Fast Ethernet
- FDDI
- Multi-mode fiber links
- Optical-Electrical Interface Conversion

Description

The CT-0125NPF-R41C-E series from Coretek Opto Corp. are the high performance and cost-effective modules for serial optical data communication applications specified for data rates of 125 Mb/s. It operates with +3.3 V power supply. The module is intended for multi-mode fiber, operates at a nominal wavelength of 650 nm and complies with Multi-Source Agreement (MSA) Small Form Factor (SFF) 2x6 foot print. Each module consists of a transmitter optical subassembly, a receiver optical subassembly and an electrical subassembly. All of them are housed in a plastic package and the combination produces a reliable component. The module is a transceiver with SC-RJ connector designed for use in Fast Ethernet (100 Mb/s) or Ethernet (10 Mb/s) over 50 meters POF and 100 meters HCS fiber.

EMC

Most equipment utilizing high-speed transceivers will be required to meet the following requirements:

- 1) FCC in the United States
- 2) CENELEC EN55022 (CISPR 22) in Europe
- 3) EN 61000-6-4 (September 2011)

To assist the customer in managing the overall equipment EMC performance, the transceivers have been designed to satisfy FCC class B limits and provide good immunity to radio-frequency electromagnetic fields.

Eye Safety

This LED based multi-mode transceiver is an AEL Class 1 product. It complies with IEC 60825-1 (+A11).

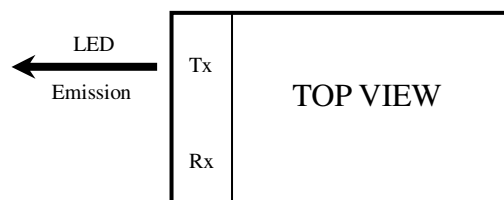
AEL CLASS 1 LED PRODUCT

To meet LED safety requirements the transceiver shall be operated within the Absolute Maximum Ratings.

Note: All adjustments have been made at the factory prior to shipment of the devices. No maintenance or alteration to the device is required. Tampering with or modifying the performance of the device will result in voided product warranty.

LED Emission Data

Wavelength	: 650 nm
Maximum total output power (as defined by IEC : 7 mm aperture at 14 mm distance)	: 0.394 mW / -4 dBm
Beam divergence (full angle) / NA (half angle)	: 17.5° / 0.15 rad



Required Labels

IEC : "Class 1 LED Product"

FDA : "Complies with 21 CFR 1040.10 and 1040.11"

125 Mb/s SC-RJ Transceiver



Product Information:

Model Number	Operating Voltage & SD Output	Distance	Wavelength
CT-0125NPF-R41C-E	3.3 V PECL AC/DC	50 m 0.5NA POF 100 m 0.37NA HCS	650 nm

ABSOLUTE MAX RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT	NOTE
Storage Temperature	T _S	-40	85	°C	
Supply Voltage	V _{CC}	-0.5	4	V	
Lead Soldering Temperature/Time	T _{SOLD}		260	°C	10 sec on lead
Data Input Voltage	---	-0.5	V _{CC}	V	

OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Case Operating Temperature	T _C	-40		85	°C	
Supply Voltage	V _{CC}	2.97		3.63	V	
Supply Current	I _{CC}			220	mA	

ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	MAX	UNIT	NOTE
Transmitter					
Differential Input Voltage	V _D	0.4	1.6	V	
TTL Transmit Disable Input Voltage – Low	V _{IL}		0.8	V	
TTL Transmit Disable Input Voltage – High	V _{IH}	V _{CC} -1.3	V _{CC}	V	
Receiver					
Data Output Voltage – Low	V _{OL} -V _{CC}		-1.63	V	1
Data Output Voltage – High	V _{OH} -V _{CC}		-0.99	V	1
Data Output Voltage Swing	V _{OH} -V _{OL}	0.4	0.8	V	
Data Output Rise Time	t _r	0.35	2.2	ns	
Data Output Fall Time	t _f	0.35	2.2	ns	
Duty Cycle Distortion	DCD	-1	+1	ns	
Data Dependent Jitter (rise/fall)	DDJ		1.5	ns	
Random Jitter	RJ		0.2	ns	
Signal Detect Output Voltage – Low	V _{OL} -V _{CC}	-1.810	-1.63	V	1
Signal Detect Output Voltage – High	V _{OH} -V _{CC}	-1.025	-0.99	V	1

125 Mb/s SC-RJ Transceiver



TRANSMITTER ELECTRO-OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNIT	NOTE
Average Launched Power (1mm POF, NA=0.5)	P _o	-12	-8	-2	dBm	
Average Launched Power (200um HCS, NA=0.37)	P _o	-14	-10	-4	dBm	
Optical Modulation Amplitude (POF)	OMA	-10		-0.5	dBm	
Optical Modulation Amplitude (HCS)	OMA	-12		-3.5	dBm	
Duty Cycle Distortion Contributed by the Transmitter	DCD	-1		+1	ns	Peak to peak
Random Jitter Contributed by the Transmitter	RJ			0.2	ns	Peak to peak
Center Wavelength	λ_c	635	650	660	nm	2
Spectral Width (RMS)	$\Delta\lambda$			17	nm	2
Optical Rise time (10%-90%)	t _r			6.5	ns	
Optical Fall time (10%-90%)	t _f			6.5	ns	
Overshoot				40	%	

RECEIVER ELECTRO-OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNIT	NOTE
Input Optical Power Maximum, OMA (POF)	P _{max}			+1	dBm	
Input Optical Power Maximum, OMA (HCS)	P _{max}			-3	dBm	
Unstressed receiver sensitivity, OMA (POF)	OMA	-23			dBm	3
Unstressed receiver sensitivity, OMA (HCS)	OMA	-26.8			dBm	3
Operating Wavelength	λ	635	650	660	nm	
Signal Detect – Asserted	P _A			2	dB	4
Signal Detect – Deasserted	P _D			5	dB	4
Signal Detect – Hysteresis	P _A – P _D	1.5		3	dB	

Notes:

1. These outputs are compatible with 10K, 10KH, 100K ECL and PECL inputs.
2. Measured at the chip level in the axial direction.
3. Measured with PRBS 2⁷-1 at BER<2.5X10⁻¹⁰
4. Signal Detect Asserted and De-asserted levels are indicated as dB below unstressed receiver sensitivity level for either POF or HCS

Timing characteristics

PARAMETER	SYMBOL	MIN	MAX	UNIT	NOTE
TX_DISABLE assert time	t_off		10	μs	5
TX_DISABLE negate time	t_on		1	ms	6
Time to initialize	t_init		100	ms	7
RX_SD assert time	t_sd_on		100	μs	8
RX_SD de-assert time	t_sd_off		100	μs	9
Analog parameter data ready	t_data		1000	ms	10
Serial bus hardware ready	t_serial		300	ms	11
Write cycle time	t_write		10	ms	12
Software TX_DISABLE assert time	t_off_soft		100	ms	
Software TX_DISABLE negate time	t_on_soft		100	ms	
Software RX_SD assert time	t_sd_on_soft		100	ms	
Software RX_SD de-assert time	t_sd_off_soft		100	ms	
Serial ID clock rate	f_serial_clock		400	kHz	

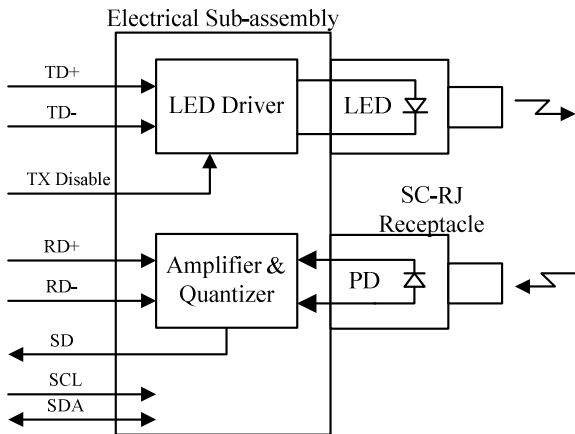
Notes:

5. Time from rising edge of TX_DISABLE to when the optical output falls below 10% of nominal.
6. Time from falling edge of TX_DISABLE to when the optical output rises above 90% of nominal.
7. Time from Power on or falling edge of TX_DISABLE to when the modulated optical output rises above 90% of normal.
8. Time from valid optical signal to RX_SD assertion.
9. Time from loss of optical signal to RX_SD de-assertion.
10. From power on to data ready bit asserted. Data ready indicates analog monitoring circuitry is operational.
11. Time from power on until module is ready for data transmission over the serial bus (reads or writes over A0h and A2h)
12. Time from stop bit to completion of 1-8 byte write command.

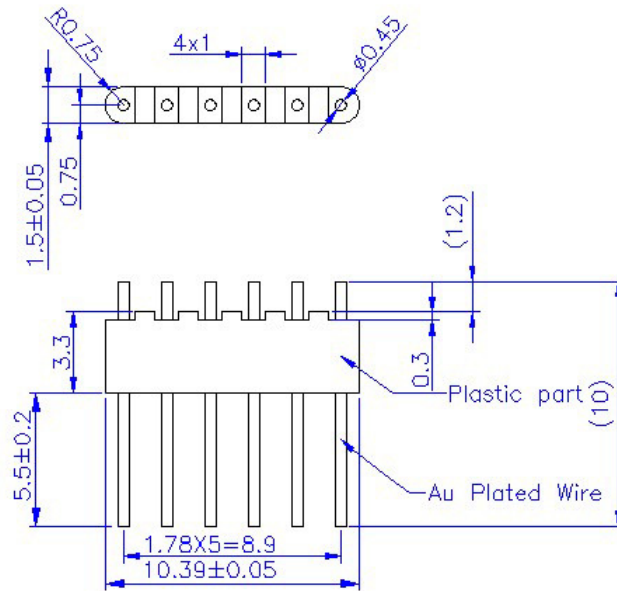
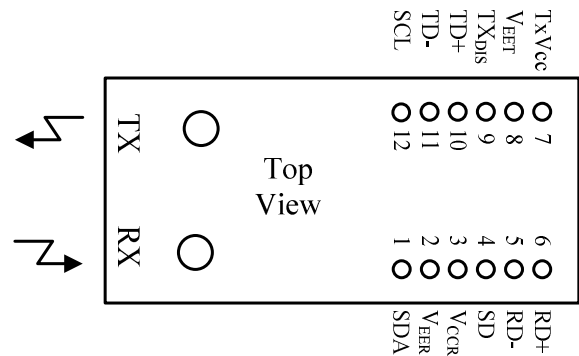
125 Mb/s SC-RJ Transceiver



BLOCK DIAGRAM OF TRANSCEIVER



PIN OUT DIAGRAM OF TRANSCEIVER



1. PIN Material: Brass (C2700) / Gold Flash, Halogen Free

PIN OUT TABLE

Pin	Symbol	Functional Description
Mounting Posts		The mounting posts are provided for transceiver mechanical attachment to the circuit board. They should not be connected to the circuit ground but can be connected to the chassis ground.
1	SDA	Serial I ² C Data "4.7k-10k ohm pull up on host board"
2	V _{EEER}	Receiver Signal Ground
3	V _{CCR}	Receiver Power Supply
4	SD	Signal Detect is a LVPECL output. A high level indicates a received optical signal
5	RD-	Receiver Data Inverted Differential Output
6	RD+	Receiver Data Non-inverted Differential Output
7	V _{CCT}	Transmitter Power Supply
8	V _{EET}	Transmitter Signal Ground
9	TX _{DIS}	Transmitter Disable"internally pulled up 8.2k ohm. High = Transmitter off"
10	TD+	Transmitter Data Non-inverted Differential Input
11	TD-	Transmitter Data Inverted Differential Input
12	SCL	Serial I ² C Clock "4.7k-10k ohm pull up on host board"

Digital Diagnostic Memory Map

Specific Data Field Descriptions

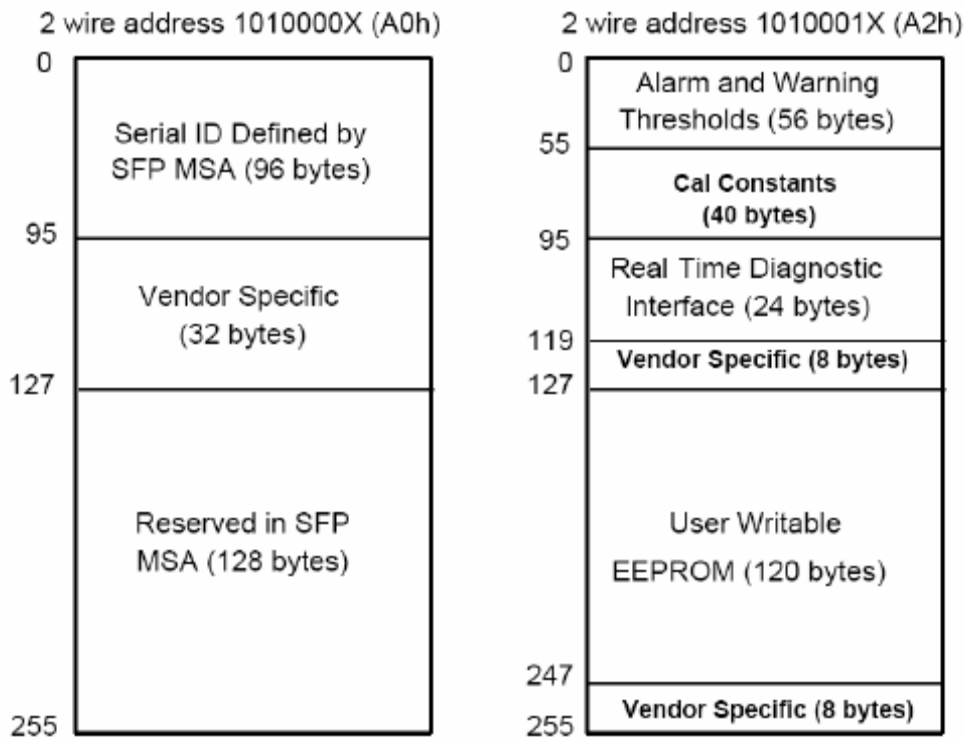


Figure 1, EEPROM Memory Map Specific Data Field Descriptions

125 Mb/s SC-RJ Transceiver



EEPROM Serial ID Memory Contents

Table 1 – EEPROM Serial ID Memory Contents (A0h)

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
00	1	Identifier	00	
01	1	Ext. Identifier	00	
02	1	Connector	00	
03 ~ 10	8	Transceiver Codes	00 00 00 00 00 00 00 00	
11	1	Encoding	00	
12	1	BR, Nominal	00	
13	1	Reserved	00	
14	1	Length (SMF)-km	00	
15	1	Length (SMF)-100m	00	
16	1	Length (50 μm, OM2)	00	
17	1	Length (62.5 μm, OM1)	00	
18	1	Length (copper)	00	
19	1	Length (50 μm, OM3)	00	
20 ~ 35	16	Vendor Name	43 4F 52 45 54 45 4B 20 20 20 20 20 20 20 20 20	CORETEK
36	1	Unallocated	00	
37 ~ 39	3	OUI Code	00 00 00	No OUI Code
40 ~ 55	16	Vendor PN	43 54 2D 30 31 32 35 4E 50 46 2D 52 34 31 43 45	CT-0125NPF-R41CE
56 ~ 59	4	Vendor Rev	20 20 20 20	
60 ~ 61	2	Wavelength	02 8A	650 nm
62	1	Reserved	00	
63	1	CC BASE	XX	Check sum
64 ~ 65	2	Options	00 14	
66	1	BR max	00	
67	1	BR min	00	
68 ~ 83	16	Vendor SN	xxxxxxxxxxxxxxxx	
84 ~ 91	8	Date code		
92	1	Diagnostic Monitoring Type	68	
93	1	Enhanced Options	90	
94	1	SFF-8472	01	Rev 9.3 of SFF-8472 Compliance
95	1	CC BASE	XX	Check sum
96 ~ 127	32	Vendor Specific		

Digital Diagnostic Monitoring Interface (2-Wire Address A2h)

Alarm and Warning Thresholds (2 Wire Address A2h)

Address	# Bytes	Name of Field	HE	Real Value	Uni
00-01	2	Temp High Alarm [1]	73 00	115°C	Degree C
02-03	2	Temp Low Alarm [1]	D8 00	-40°C	Degree C
04-05	2	Temp High Warning [1]	69 00	105°C	Degree C
06-07	2	Temp Low Warning [1]	DD 00	-35°C	Degree C
08-09	2	Voltage High Alarm [2]	98 58	3.9	V
10-11	2	Voltage Low Alarm [2]	69 78	2.7	V
12-13	2	Voltage High Warning [2]	8D CC	3.63	V
14-15	2	Voltage Low Warning [2]	74 04	2.97	V
16-17	2	Bias High Alarm [3]	75 30	60	mA
18-19	2	Bias Low Alarm [3]	03 E8	2	mA
20-21	2	Bias High Warning [3]	75 30	60	mA
22-23	2	Bias Low Warning [3]	03 E8	2	mA
24-25	2	Tx Power High Alarm [4]	1B 66	-1.54	dBm
26-27	2	Tx Power Low Alarm [4]	00 D3	-16.75	dBm
28-29	2	Tx Power High Warning [4]	17 89	-2.2	dBm
30-31	2	Tx Power Low Warning [4]	01 B2	-13.6	dBm
32-33	2	Rx Power High Alarm [5]	FF B7	8.16	dBm
34-35	2	Rx Power Low Alarm [5]	00 01	-40.0	dBm
36-37	2	Rx Power High Warning [5]	FF DC	8.16	dBm
38-39	2	Rx Power Low Warning [5]	00 01	-40.0	dBm
40	1	Rx OMA Margin L alarm	08	1.6	dB
41	1	Rx OMA Margin L warning	12	3.6	dB
42-55	14	Reserved			
56-94	29	Note [6]			
55	1	Checksum	XX		

Calibration Constants (2 Wire Address A2h)

Address	# Bytes	Name of Field	HEX	Description
56-59	4	Rx_PWR (4)	00 00 00 00	Set to zero for "internally calibrated" devices
60-63	4	Rx_PWR (3)	00 00 00 00	Set to zero for "internally calibrated" devices
64-67	4	Rx_PWR (2)	00 00 00 00	Set to zero for "internally calibrated" devices
68-71	4	Rx_PWR (1)	3F 80 00 00	Set to 1 for "internally calibrated" devices
72-75	4	Rx_PWR (0)	00 00 00 00	Set to zero for "internally calibrated" devices
76-77	2	Tx_I (Slope)	01 00	Set to 1 for "internally calibrated" devices
78-79	2	Tx_I (Offset)	00 00	Set to zero for "internally calibrated" devices
80-81	2	Tx_PWR (Slope)	01 00	Set to 1 for "internally calibrated" devices
82-83	2	Tx_PWR (Offset)	00 00	Set to zero for "internally calibrated" devices
84-85	2	T (Slope)	01 00	Set to 1 for "internally calibrated" devices
86-87	2	T (Offset)	00 00	Set to zero for "internally calibrated" devices
88-89	2	V (Slope)	01 00	Set to 1 for "internally calibrated" devices
90-91	2	V (Offset)	00 00	Set to zero for "internally calibrated" devices
92-94	3	Reserved	00 00 00	Reserved
95	1	Checksum	XX	Checksum of bytes 0 – 94

A/D Value (2 Wire Address A2h)

Address	# Bytes	Name of Field	Description
96-97	2	Temperature (MSB, LSB) [1]	Internally measured module temperature
98-99	2	Supply Voltage (MSB, LSB) [2]	Internally measured supply voltage in module
100-101	2	Tx Bias Current (MSB, LSB) [3]	Internally measured Tx Bias current
102-103	2	Tx Optical Power (MSB, LSB) [4]	Internally measured Tx Optical Power
104-105	2	Rx Received Power (MSB, LSB) [5]	Internally measured Rx input power
106	1	Rx OMA Margin [7]	Internally measured Rx OMA Margin
107-109	3	Reserved	

Note:

- Temperature (Temp) is decoded as a 16-bit signed twos complement integer in increments of 1/256°C
- Supply Voltage (Vcc) is decoded as a 16-bit unsigned integer in increments of 100 μ V
- LED bias current (Tx Bias) is decoded as a 16-bit unsigned integer in increments of 2 μ A
It is defined as operating DC bias current mapped equally to Tx Optical Power
- Transmitted average optical power (Tx Pwr) is decoded as a 16-bit unsigned integer in increments of 0.1 μ W
- Receiver average optical power (Rx Pwr) is decoded as a 16-bit unsigned integer in increments of 0.1 μ W
- Bytes 56-94 are not intended for use with CT-0125NPF-R41C-E, but had been sent to default values per SFF-8472
- Received OMA margin is decoded as an 8-bit signed twos complement integer in increments of 0.2 dB
Received OMA margin = Receiver Input Power (OMA) – Receiver Sensitivity (OMA)

Status Bits and Alarm/Warning Flag Bits (2 Wire Address A2h)

Address	Bit	Name	Description
110	7	TX Disable State	Digital state of Tx disable (1) and enabled (0)
110	6	Soft TX Disable	Read/write bit that allows software disable of Tx Writing 1 to disable Tx
110	5	Reserved	
110	4-2	Not supported	
110	1	Signal Detect State	Digital state of SD output pin. 1=optical signal detected 0=no optical signal detected
110	0	Data_Ready_Bar	Indicate transceiver is powered and real time sense data is ready(0=ready)
112	7	Temp High Alarm	Set when internal temperature exceeds high alarm level
112	6	Temp Low Alarm	Set when internal temperature is below low alarm level
112	5	Vcc High Alarm	Set when internal supply voltage exceeds high alarm level
112	4	Vcc Low Alarm	Set when internal supply voltage is below low alarm level
112	3	TX Bias High Alarm	Set when TX Bias current exceeds high alarm level
112	2	TX Bias Low Alarm	Set when TX Bias current is below low alarm level
112	1	TX Power High Alarm	Set when TX Power exceeds high alarm level
112	0	TX Power Low Alarm	Set when TX Power is below low alarm level
113	7	RX Power High Alarm	Set when Received Power exceeds high alarm level
113	6	RX Power Low Alarm	Set when Received Power is below low alarm level
113	5	RX OMA Margin Alarm	Set when Received Rx OMA Margin exceeds low alarm level
113	4-0	Reserved	
116	7	Temp High Warning	Set when internal temperature exceeds high warning level
116	6	Temp Low Warning	Set when internal temperature is below low warning level
116	5	Vcc High Warning	Set when internal supply voltage >high warning level
116	4	Vcc Low Warning	Set when internal supply voltage < low warning level
116	3	TX Bias High Warning	Set when TX Bias current exceeds high warning level
116	2	TX Bias Low Warning	Set when TX Bias current is below low warning level
116	1	TX Power High Warning	Set when TX Power exceeds high warning level
116	0	TX Power Low Warning	Set when TX Power is below low warning level
117	7	RX Power High Warning	Set when Received Power exceeds high warning level
117	6	RX Power Low Warning	Set when Received Power is below low warning level
117	5	RX OMA Margin Warning	Set when Received Rx OMA Margin exceeds low Warning level
117	4-0	Reserved Warning	

Monitoring Specification

The digital diagnostic monitoring interface also defines another 256-byte memory map in EEPROM, which makes use of the 8 bit address 1010001X (A2h). Please see Figure 1. For detail EEPROM information, please refer to the related document of SFF-8472 Rev 9.5. The monitoring specification of this product is described in Table 3.

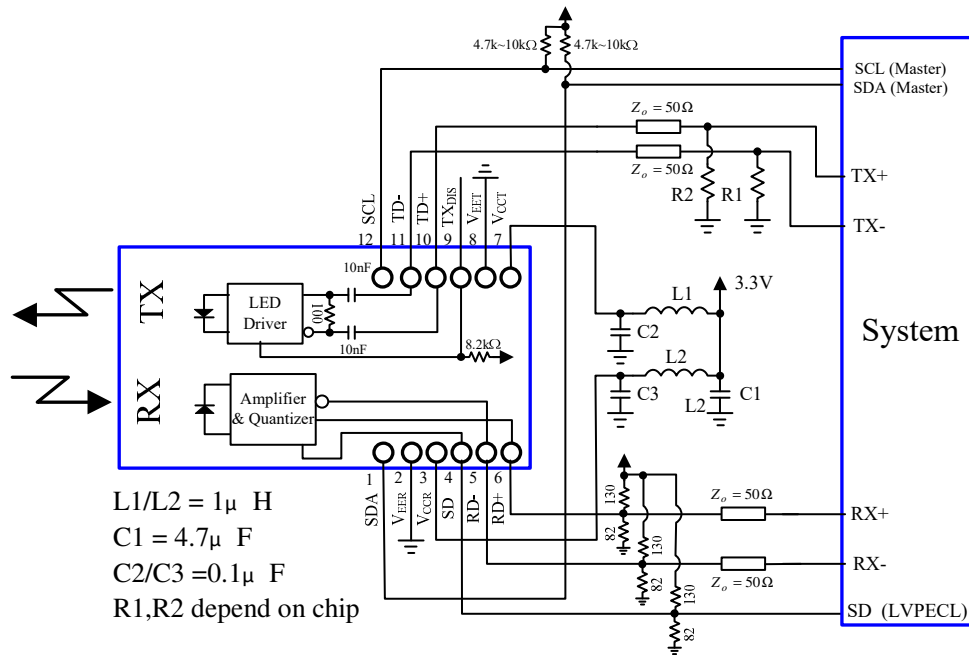
Table 3 – Monitoring Accuracy Specification

Parameter	Min.	Note
Transceiver internal Temperature	±5°C	Valid from -40°C to 85°C case temperature
Transceiver internal Voltage	±0.1 V	Valid over 2.97 V ~ 3.63 V
Transceiver LED Bias Current	3 mA	
Transmitted average optical output power TX Power – POF	±3 dB	Coupled into 1 mm plastic optical fiber
Transmitted average optical output power TX Power – HCS	±3 dB	Coupled into 200 μm hard clad silica fiber
Received average optical input Power- POF	±1.5 dB	Coupled from 1 mm plastic optical fiber
Received average optical input Power- HCS	±1.5 dB	Coupled from 200 μm hard clad silica fiber
Received OMA margin – POF	±1.5 dB	Coupled into 1mm plastic optical fiber Valid over Rx OMA Margin Range: 0 to 3 dB
	±2.5 dB	Coupled into 1mm plastic optical fiber Valid over Rx OMA Margin Range: 3 to 6 dB
	±3 dB	Coupled into 1mm plastic optical fiber Valid over Rx OMA Margin Range: ≥6 dB
Received OMA margin – HCS	±1.5 dB	Coupled into 200μm hard clad silica fiber Valid over Rx OMA Margin Range: 0 to 3 dB
	±2.5 dB	Coupled into 200μm hard clad silica fiber Valid over Rx OMA Margin Range: 3 to 6 dB
	±3 dB	Coupled into 1mm plastic optical fiber Valid over Rx OMA Margin Range: ≥6 dB

125 Mb/s SC-RJ Transceiver

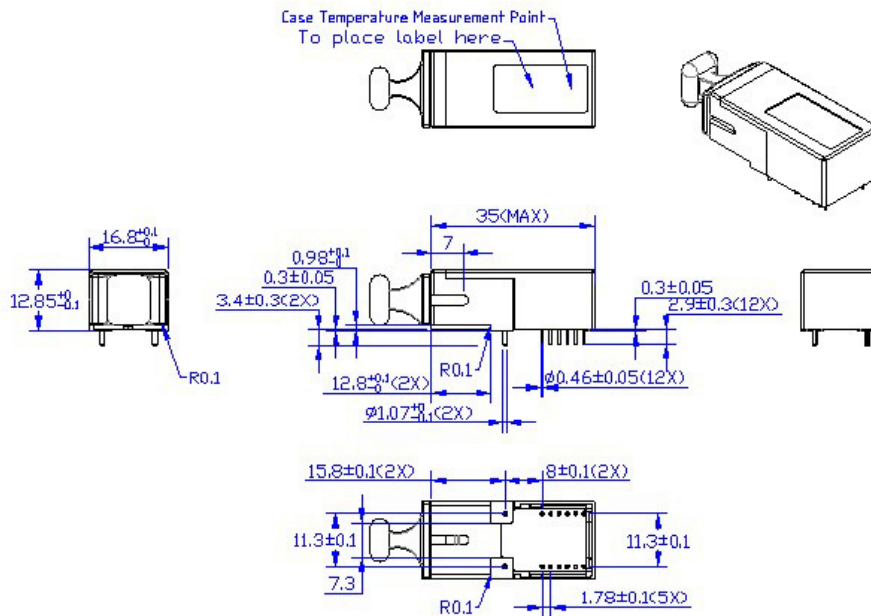


RECOMMENDED CIRCUIT SCHEMATIC



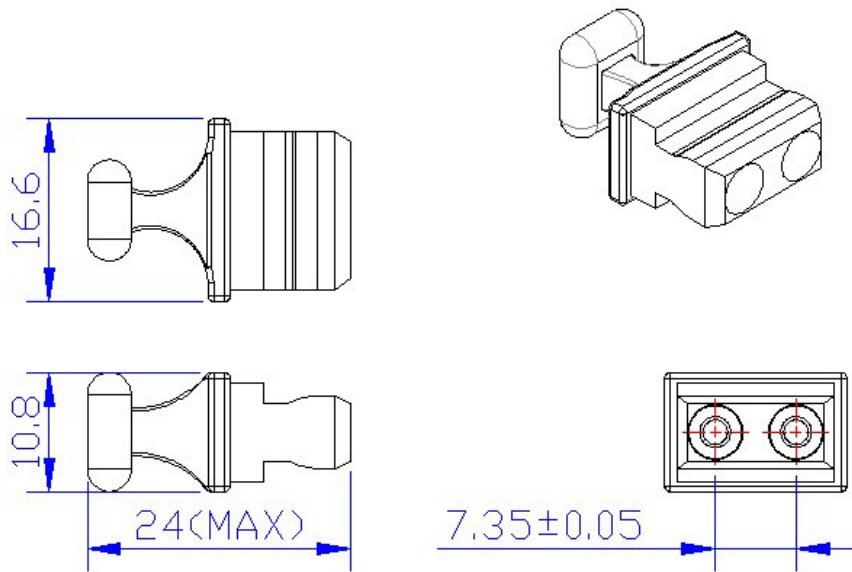
MECHANICAL DIMENSIONS

Units in mm



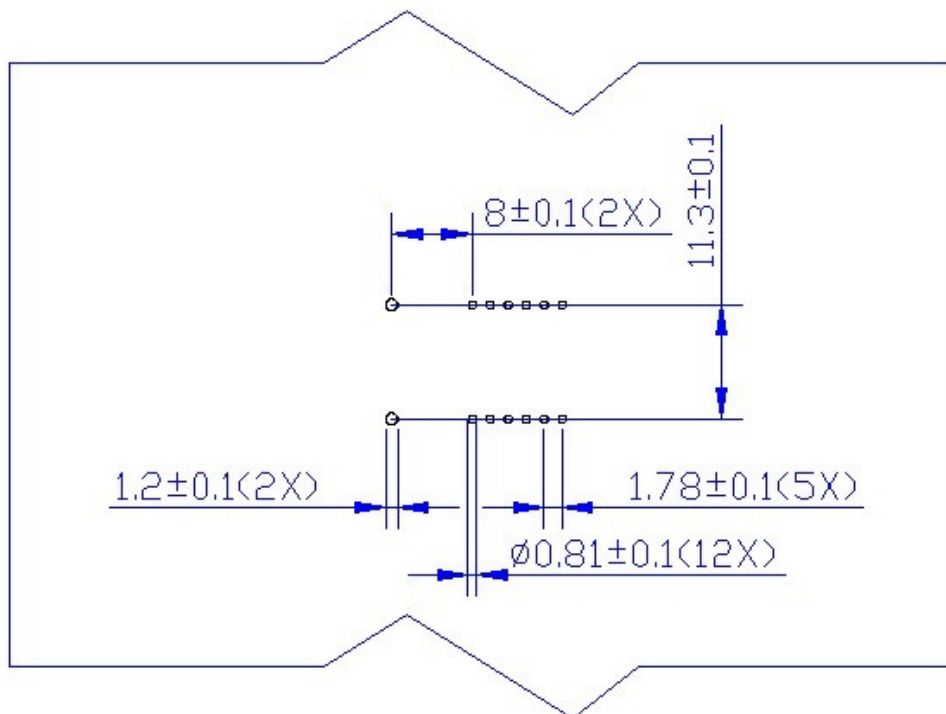
All dimensions are $\pm 0.2\text{mm}$ unless otherwise specified.

DUST PLUG DIMENSIONS



RECOMMENDED SFF HOST BOARD LAYOUT

Units in mm



REVISION HISTORY

Formulate (Revise) Record		
D/M/Y	Version	Description
10/01/2014	A1	Initial version
17/04/2014	A2	Update Tx output power range
30/04/2015	A3	Update DDMI
20/10/2016	A4	Update product photo
20/12/2016	A5	Update mechanical drawing
09/06/2017	A6	Update description concerning squelch

Claim:

CORETEK Opto Corp. reserves the right to make changes in the specification described hereinafter without prior notice.