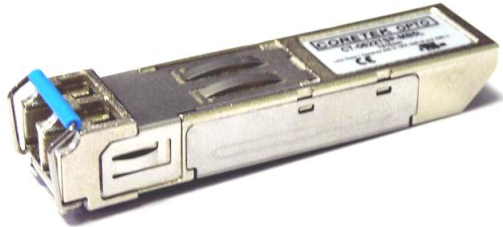
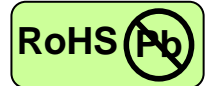


2 Mb/s IEEE C37.94 Single Mode Transceiver



SFP, Duplex LC Connector, 1310 nm FP LD for Single Mode Fiber, RoHS Compliant
Digital Diagnostics Functions, Extended Operating Temperature from -40 to +85°C



Features

- 1310 nm FP LD
- Data Rate: 2 Mb/s, NRZ
- Single +3.3 V Power Supply
- RoHS Compliant and Lead-free
- AC/AC Differential Electrical Interface
- Compliant with Multi-Source Agreement (MSA) Small Form Factor Pluggable (SFP)
- Compliant with SFF-8472 Digital Diagnostic Monitoring Interface
- Duplex LC Connector
- Compatible with IEEE C37.94 / IEC 62843 Standard

Applications

- IEEE C37.94 / IEC 62843
- Single Mode Fiber Links
- Optical-Electrical Interface Conversion

Description

The CT-0155TSP-MB5L-E 2M from Coretek Opto Corp. is the high performance and cost-effective module for serial optical data communication applications specified for 2 Mb/s. It operates with +3.3 V power supply. The module is intended for single mode fiber, operates at a nominal wavelength of 1310 nm and complies with Multi-Source Agreement (MSA) Small Form Factor Pluggable (SFP). Each module is integrated digital diagnostics functions via an I²C serial interface.

The module is a duplex LC connector transceiver designed to provide an IEEE C37.94 / IEC 62843 link for 2 Mb/s intermediate reach applications. The characteristics are performed in accordance with Telcordia Specification GR-468-CORE.

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

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 laser based single mode transceiver is a CLASS 1 LASER PRODUCT, Hazard level 1. It complies with IEC 60825-1 Ed.2: 2007-03 and FDA performance standards for laser products (21 CFR 1040.10 and 1040.11) except for deviations pursuant to Laser Notice 50, dated June 24, 2007.

2 Mb/s IEEE C37.94 Single Mode Transceiver



Product Information

Model Number	Operating Voltage & SD Output	Distance	LD Type & Wavelength	Output Power	Sensitivity
CT-0155TSP-MB5L-E 2M	3.3 V TTL AC/AC	20 km	1310 nm FP	-19 ~ -11 dBm	≤ -34 dBm

ABSOLUTE MAX RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT	NOTE
Storage Temperature	T_S	-40	85	$^{\circ}\text{C}$	
Supply Voltage	V_{CC}	0	6	V	

OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Case Operating Temperature	T_C	-40		85	$^{\circ}\text{C}$	
Supply Voltage	V_{CC}	3.1		3.5	V	
Data Input Voltage Swing	V_{ID}	400		1600	mV	

ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	MAX	UNIT	NOTE
Transmitter					
Transmitter Supply Current	I_{CCT}		200	mA	
Tx_Disable Input Voltage - Low	V_{IL}	0	0.8	V	
Tx_Disable Input Voltage - High	V_{IH}	2.0	V_{CC}	V	
Tx_Fault Output Voltage - Low	V_{OL}	0	0.8	V	
Tx_Fault Output Voltage - High	V_{OH}	2.0	V_{CC}	V	
Receiver					
Receiver Supply Current	I_{CCR}		100	mA	
Receiver Data Output Differential Voltage	V_{OD}	0.4	1.3	V	
Rx_LOS Output Voltage - Low	V_{OL}	0	0.8	V	
Rx_LOS Output Voltage - High	V_{OH}	2.0	V_{CC}	V	
MOD_DEF (1) , MOD_DEF (2) - Low	V_{IL}	-0.6	$V_{CC} \times 0.3$	V	
MOD_DEF (1) , MOD_DEF (2) - High	V_{IH}	$V_{CC} \times 0.7$	$V_{CC} + 0.5$	V	

TRANSMITTER ELECTRO-OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNIT	NOTE
Optical Output Power	P_o	-19		-11	dBm	1
Extinction Ratio	ER	12			dB	2
Center Wavelength	λ_c	1270	1310	1350	nm	
Spectral Width (RMS)	$\Delta \lambda$			3	nm	
Optical Rise time (10%-90%)	t_r			10	ns	
Optical Fall time (10%-90%)	t_f			10	ns	
Output Eye		Compliant with ITU recommendation G.957				

2 Mb/s IEEE C37.94 Single Mode Transceiver



RECEIVER ELECTRO-OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNIT	NOTE
Maximum Input Optical Power	P_{max}	-3			dBm	3
Receiver Sensitivity	P_{min}			-34	dBm	3
Operating Wavelength	λ	1100		1600	nm	
Loss of Signal - Asserted	P_A	-45			dBm	
Loss of Signal - Deasserted	P_D			-33	dBm	
Loss of Signal - Hysteresis	$P_D - P_A$	0.5			dB	

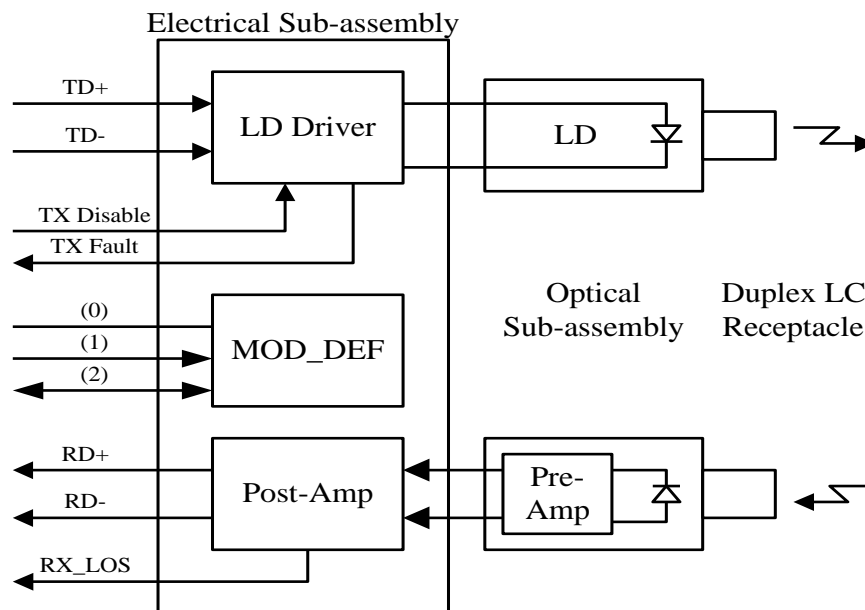
Notes:

1. Measured average power coupled into 9/125 μm single mode fiber.
2. Optical eye settings are adjusted at 155 Mb/s using an OC-12 Bessel Thomson filter and adjusting the crossing level between 15-20%. Final test is at 155 Mb/s using an OC-3 Bessel Thomson filter.
3. Measured with 2^7-1 PRBS at $\text{BER} < 10^{-10}$

TIMING CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNIT	NOTE
TX_DISABLE Assert Time	t_{off}			10	μs	
TX_DISABLE Negate Time	t_{on}			1	ms	
Time to initialize, include reset of TX_FAULT	t_{init}			300	ms	
TX_FAULT from fault to assertion	t_{fault}			100	μs	
TX_DISABLE time to start reset	t_{reset}	10			μs	
Receiver Loss of Signal Assert Time (off to on)	t_{A,RX_LOS}			100	μs	
Receiver Loss of Signal Assert Time (on to off)	t_{D,RX_LOS}			100	μs	

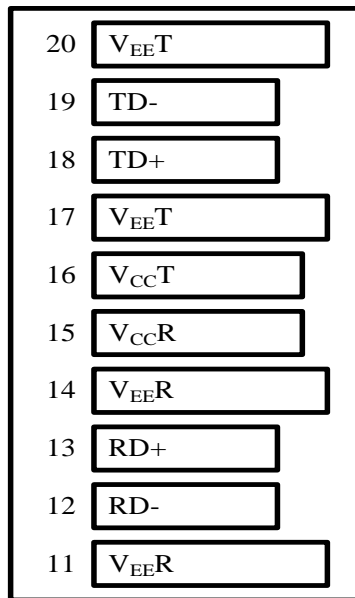
BLOCK DIAGRAM OF TRANSCEIVER



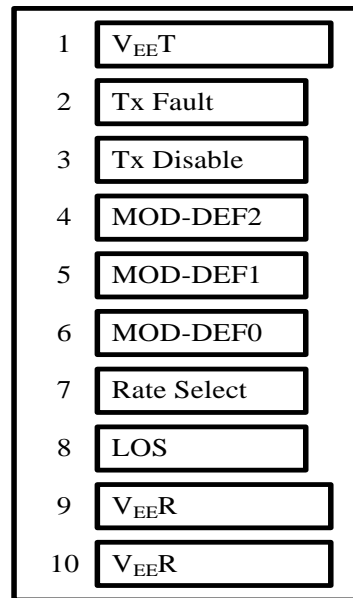
2 Mb/s IEEE C37.94 Single Mode Transceiver



PIN OUT DIAGRAM OF TRANSCEIVER



Top of Board



Bottom of Board (As Viewed through Top of Board)

PIN OUT TABLE

Pin	Symbol	Functional Description
1	V _{ee} T	Transmitter Ground
2	TX Fault	Transmitter Fault Indication
3	TX Disable	Transmitter Disable – Module disables on high or open
4	MOD-DEF(2)	Module Definition 2 – Two wire serial ID interface
5	MOD-DEF(1)	Module Definition 1 – Two wire serial ID interface
6	MOD-DEF(0)	Module Definition 0 – Grounded in module
7	Rate Select	Not Connected
8	LOS	Loss of Signal
9	V _{ee} R	Receiver Ground
10	V _{ee} R	Receiver Ground
11	V _{ee} R	Receiver Ground
12	RD-	Inverse Received Data Out
13	RD+	Received Data Out
14	V _{ee} R	Receiver Ground
15	V _{cc} R	Receiver Power
16	V _{cc} T	Transmitter Power
17	V _{ee} T	Transmitter Ground
18	TD+	Transmitter Data In
19	TD-	Inverse Transmitter Data In
20	V _{ee} T	Transmitter Ground

2 Mb/s IEEE C37.94 Single Mode 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	03	SFP
01	1	Ext. Identifier	04	MOD4
02	1	Connector	07	LC
03 ~ 10	8	Transceiver Codes	00 00 00 00 00 00 00 00	
11	1	Encoding	03	NRZ
12	1	BR, Nominal	01	
13	1	Reserved	00	
14	1	Length (SMF)-km	14	20 km
15	1	Length (SMF)-100 m	C8	20 km
16	1	Length (50 μm, OM2)	00	
17	1	Length (62.5 μm, OM1)	00	
18	1	Length (copper)	00	
19	1	Reserved	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	Reserved	00	
37 ~ 39	3	OUI Code	00 00 00	
40 ~ 55	16	Vendor PN	43 54 30 31 35 35 54 53 50 4D 42 35 4C 45 32 4D	CT0155TSPMB5LE2M
56 ~ 59	4	Vendor Rev	30 30 30 32	0002
60 ~ 61	2	Wavelength	05 1E	1310 nm
62	1	Reserved	00	
63	1	CC BASE	XX	Check sum
64 ~ 65	2	Options	00 1A	LOS, TX_FAULT and TX_DISABLE
66	1	BR max	00	
67	1	BR min	00	
68 ~ 83	16	Vendor SN	xxxxxxxxxxxxxxxx	
84 ~ 91	8	Date code		

2 Mb/s IEEE C37.94 Single Mode Transceiver



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		

EEPROM

讀取

Connect Type	SFP - LC
Fiber Type	Single-mode
TX Wavelength	1310
Baud Rate	
Vendor OUI	00:00:00
Vendor Name	CORETEK
Vendor PN	CT0155TSPMB5LE2M
Vendor Rev	0001
Vendor SN	GF0118QB5S0001
Date Code	171106

讀取

```

000~015 0 03 04 07 00 00 00 00 00 00 00 03 01 00 14 C8
016~031 1 00 00 00 00 43 4F 52 45 54 45 4B 20 20 20 20
032~047 2 20 20 20 20 00 00 00 00 43 54 30 31 35 35 54 53
048~063 3 50 4D 42 35 4C 45 32 4D 30 30 30 31 05 1E 00 2C
064~079 4 00 1A 00 00 47 46 30 31 31 36 51 42 35 53 30 30
080~095 5 30 31 20 20 31 37 31 31 30 36 20 20 68 90 01 F4
096~111 6 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
112~127 7 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
128~143 8 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
    
```

2 Mb/s IEEE C37.94 Single Mode Transceiver



Table 2 - EEPROM Serial ID Memory Contents (A2h)

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
00 ~ 07	8	Temperature Alarm/Warning (°C)	6E 00 D8 00 64 00 DD 00	Alarm_H/L : 110/-40 Warning_H/L : 100/-35
08 ~ 15	8	Voltage Alarm/Warning (V)	8C A0 75 30 88 B8 79 18	Alarm_H/L : 3.6/3 Warning_H/L : 3.5/3.1
16 ~ 23	8	Bias Current Alarm/Warning (mA)	9C 40 03 E8 88 B8 07 D0	Alarm_H/L : 80/2 Warning_H/L : 70/4
24 ~ 31	8	Tx Power Alarm/Warning (dBm)	03 E8 00 64 03 1A 00 7E	Alarm_H/L : -10/-20 Warning_H/L : -11/-19
32 ~ 39	8	Rx Power Alarm/Warning (dBm)	18 A6 00 03 13 94 00 04	Alarm_H/L : -2/-35 Warning_H/L : -3/-34
96 ~ 97	2	Measure Temperature		Internally measure module Temperature
98 ~ 99	2	Measure Vcc		Internally measure supply voltage in transceiver.
100~101	2	Measure TX Bias		Internally measure TX Bias Current
102~103	2	Measure TX Power		Measure TX output power
104~105	2	Measure RX Power		Measure RX output power

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.

Figure 3.1: Digital Diagnostic Memory Map

Specific Data Field Descriptions

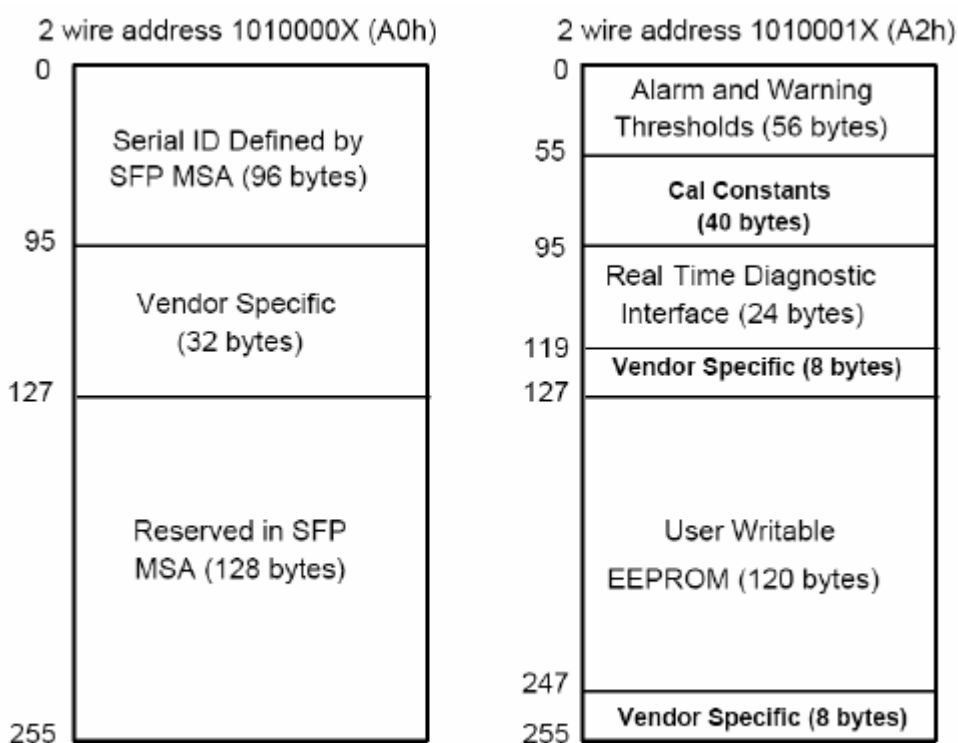


Figure 1, EEPROM Memory Map Specific Data Field Descriptions

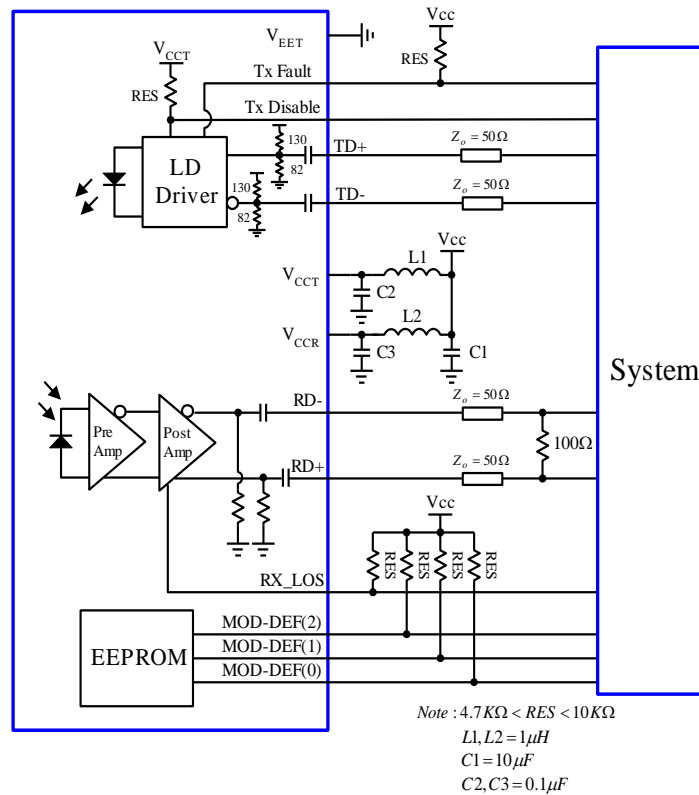
Table 3 - Monitoring Specification

Parameter	Range	Accuracy	Calibration
Temperature	-40°C to 85°C	±3°C	Internal
Voltage	3.0 to 3.6 V	±3%	Internal
Bias Current	0 to 70 mA	±10%	Internal
TX Power	-19 to -11 dBm	±3 dB	Internal
RX Power	-30 to -3 dBm	±3 dB	Internal

2 Mb/s IEEE C37.94 Single Mode Transceiver

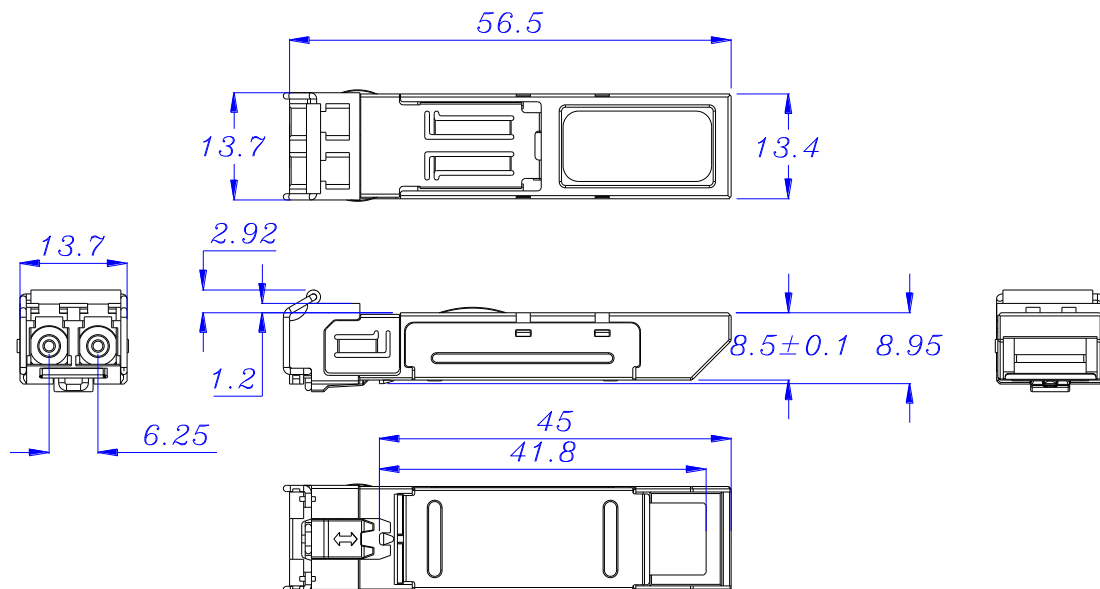


RECOMMENDED CIRCUIT SCHEMATIC



MECHANICAL DIMENSIONS

Units in mm



All dimensions are ± 0.2 mm unless otherwise specified.

2 Mb/s IEEE C37.94 Single Mode Transceiver



REVISION HISTORY

Formulate (Revise) Record		
M/D/Y	Version	Description
10/02/2014	A1	Initial version.
09/18/2015	A2	Added notes for testing of extinction ratio.
11/06/2017	A3	Updated EEPROM table (vendor part number without "-"). Updated distance to 20 km.
29/01/2019	B	Change the specification of optical output power according to IEEE C37.94 version 2017

Claim:

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