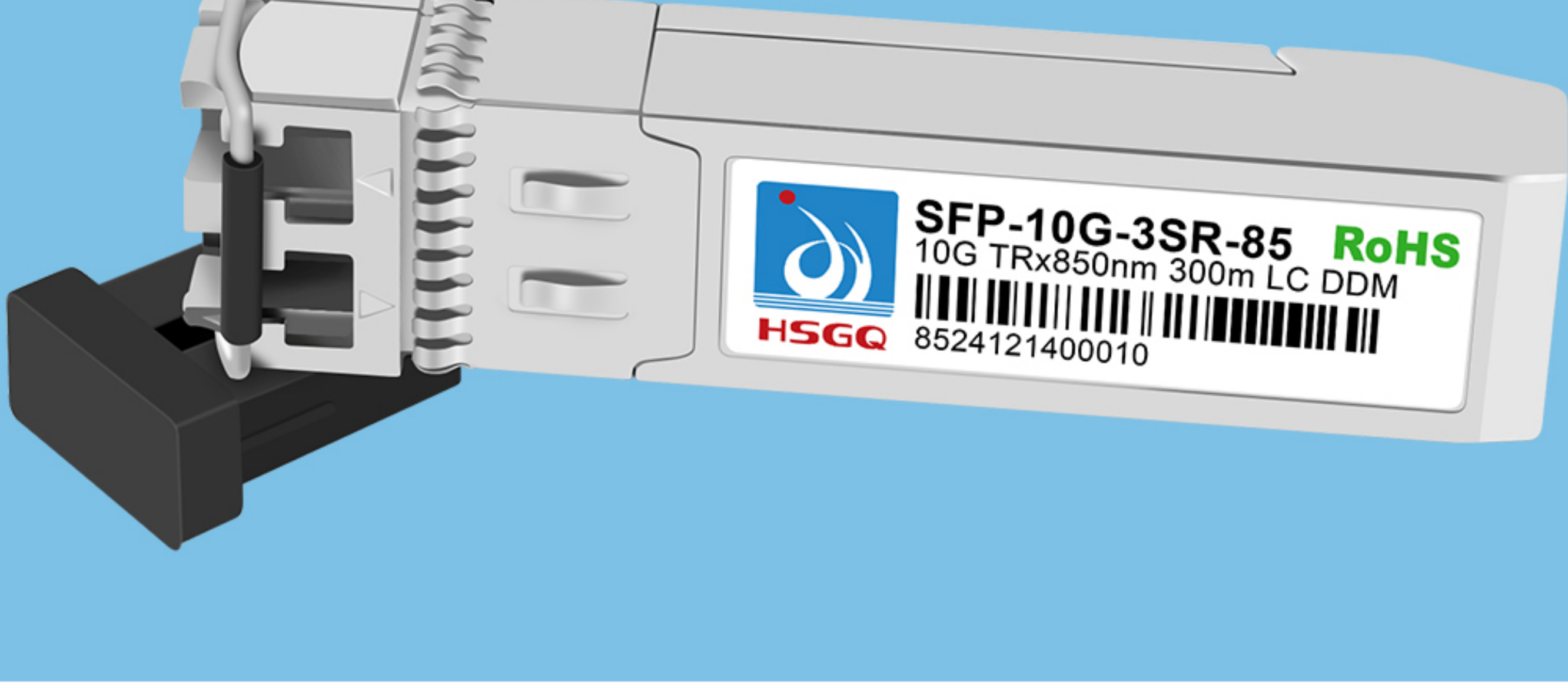




HSGQ-SFP-10G-3SR-85



Product Features

- Compliant with 802.3ae 10GBASE-SR 10Gb/s optical interface
- Compliant with SFF-8431 electrical interface for enhanced 8.5G and 10G Small Form-Factor Pluggable Modules (SFP+)
- 850nm VCSEL laser and PIN photodetector
- Compliant with SFF-8472 Digital Diagnostics Monitoring Interface (DDMI)
- RoHS compliant
- Fully metal enclosure for low EMI
- Advanced firmware enables storage of customer-specific encryption information in the transceiver
- Cost-effective SFP+ solution enabling higher port density and greater bandwidth
- Operating Case Temperature: Standard: 0 ~ +70°C; Extend: -20 ~ +85°C; Industrial: -40 ~ +85°C

General Description

This 850 nm VCSEL 10G SFP+ optical transceiver supports transmission and reception over distances up to 300 meters on 50/125 μ m or 62.5/125 μ m multimode fiber (MMF).

The electrical interface of the SFP+ SR module complies with the SFI (Serial Front Panel Interface) electrical specifications. The differential impedance of the transmitter input and receiver output is 100 ohms. Internal AC coupling is employed on the data lines. The module provides differential termination and minimizes differential-to-common mode conversion to ensure high-quality signal termination and low EMI. SFI typically supports improved FR4 materials for traces longer than 200 mm, or standard FR4 for lengths up to approximately 150 mm when using a connector.

The transmitter converts 10 Gbit/s serial CML electrical data into serial optical data compliant with the 10GBASE-SR standard. It features an open collector-compatible Transmit Disable (Tx_Dis) function. A logic "1" or an unconnected state on this pin disables the laser transmitter, while a logic "0" enables normal operation. The transmitter includes an internal Automatic Power Control (APC) loop to maintain constant optical output power despite variations in supply voltage and temperature. A Transmit Fault (Tx_Fault) output is provided, which is an open drain/collector signal indicating laser fault conditions related to operation or safety. When Tx_Fault is asserted high, it indicates that the module's transmitter has detected a fault. This pin should be pulled up to Vcc_Host with a 4.7 k Ω to 10 k Ω resistor. Tx_Disable is a module input pin. When asserted high or left open, the transmitter output shall be disabled. This pin should be pulled up to VccT with a 4.7 k Ω to 10 k Ω resistor.

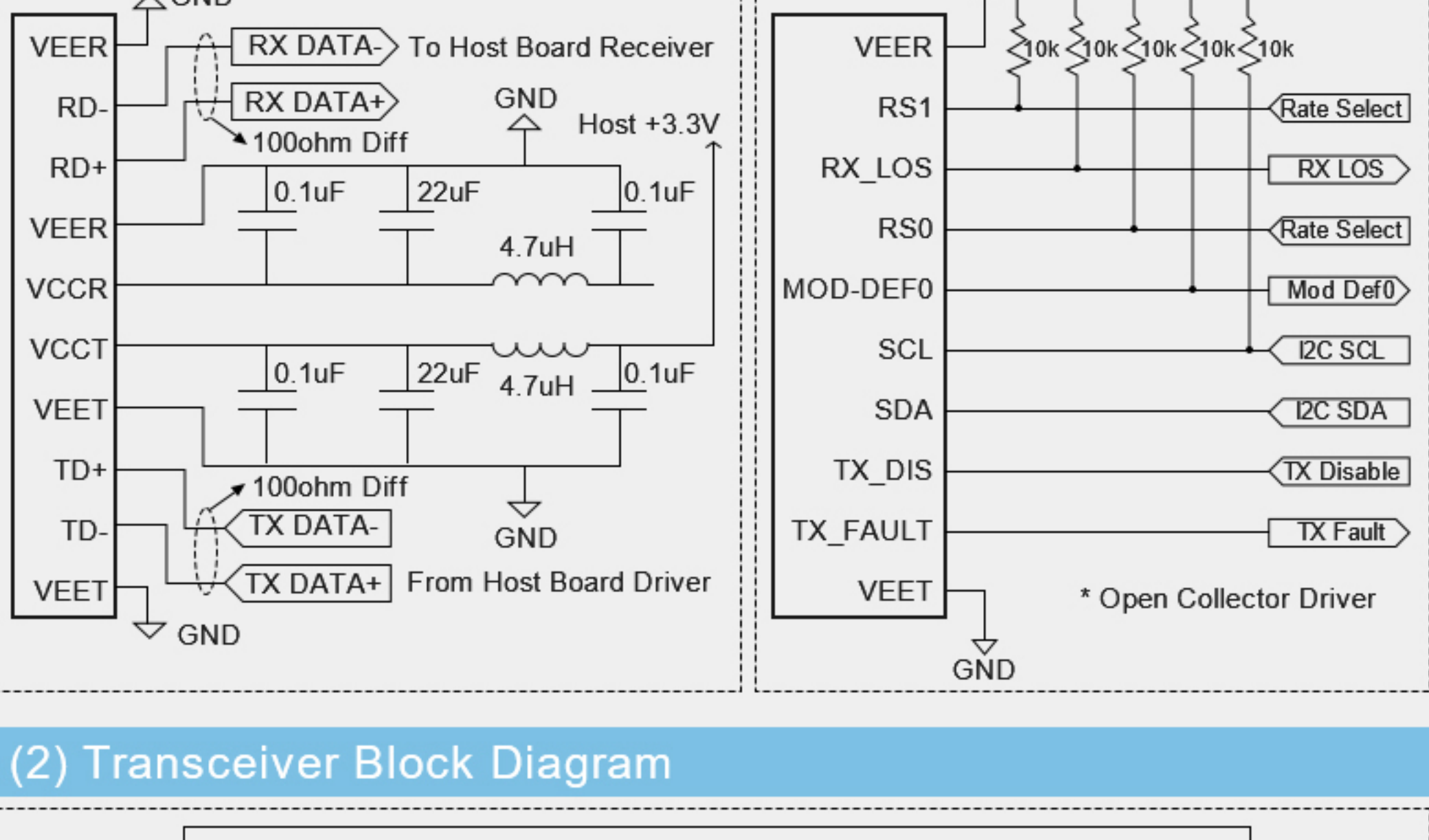
The receiver converts 10 Gbit/s serial optical data into serial PECL/CML electrical data. An open collector-compatible Receiver Loss of Signal (Rx_LOS) output is provided. When asserted high, it indicates that the received optical power is below the level defined in the applicable standard. The Rx_LOS pin is an open drain/collector output and should be pulled up to Vcc_Host using a 4.7 k Ω to 10 k Ω resistor or an active pull-up circuit. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as an early indicator to the host system that the received signal strength is below the specified threshold. This typically points to a disconnected cable, damaged fiber, or a disabled, faulty, or powered-off transmitter at the remote end.

Product Applications

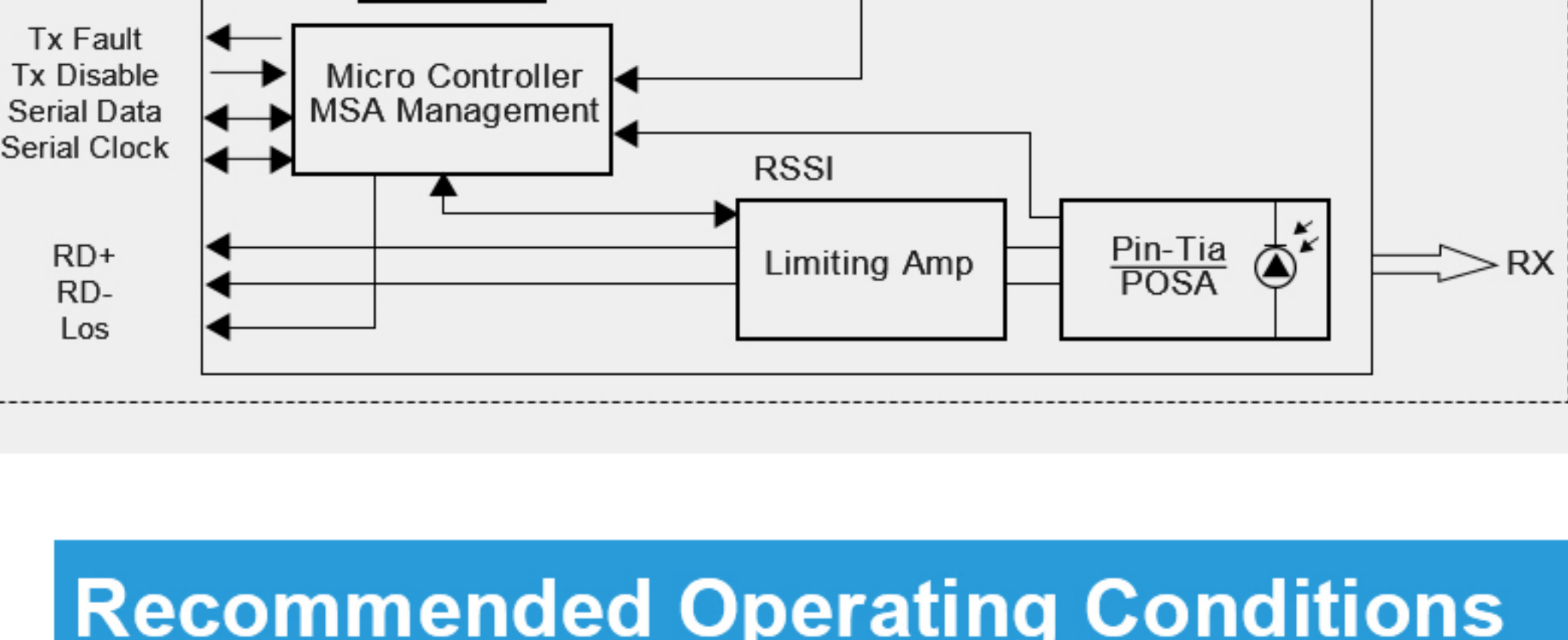
- High-speed Storage Area Networks (SANs)
- Computer cluster cross-connects
- Custom high-speed data links
- 10 Gigabit Ethernet (10GbE) storage, 8G Fibre Channel
- Inter-rack connections

Fiber Type	850nm (MHzkm)	Transmission Distance (m)
Range (m)	160	2 ~ 26
	200	2 ~ 33
50 μ mmmf	400	2 ~ 66
	500	2 ~ 82
	2000	2 ~ 300

(1) Proposed Application Diagram



(2) Transceiver Block Diagram



Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Storage Temperature	Ts	-40	+85	°C
Operating Case Temperature	Tc	0	+70	°C
		-40	+85	°C
Relative Humidity	RH	5	95	%
Power Supply Voltage	Vcc-VEE	0	+3.6	V
RX Input Average Power	Pmax		0	dBm

Note:
1. Exceeding any of these values may cause immediate damage to the device

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Storage Temperature	Ts	-40		+85	°C
Operating Case Temperature	Tc	0		+70	°C
		-40		+85	°C
Power Supply Voltage	Vcc	3.135	3.3	3.465	V
Data Rate	DR		10.3125		Gbps

Unless otherwise specified, the electrical and optical characteristics are maintained under the recommended operating conditions.

Optical Specification

Transmitter							Receiver						
Parameter	Symbol	Min	Typical	Max	Unit	Remark	Parameter	Symbol	Min	Typical	Max	Unit	Remark
Center Wavelength	λ_c	840	850	860	nm		Wavelength	λ_c	840	850	860	nm	
RMS Spectral Width	Pm			Note 1	dB		Sensitivity	RSNS			-11.1	dBm	
Average Output Optical Power	Po	-6.5		-1	dBm		Sensitivity (OMA)	/			-7.5	dBm	
OMA Optical Modulation Amplitude (OMA)	Poma			Note 1	dBm		Loss of Signal (LOS) Assert		-30		-12	-12	
Extinction Ratio	ER	3.5		3.9	dB		Overload	Pin			-1	dBm	
Transmitter Dispersion Penalty (TDP)	/			-128	dB	12dB reflection	Reflectance	R			-12	dB	
Relative Intensity Noise (RIN)	RIN			12	dB/Hz		Unless otherwise specified, the following optical characteristics are defined under the recommended operating conditions.						
Optical Return Loss Tolerance	RL				dB								

Note: 1. A trade-off can be made between spectral width, center wavelength, and minimum OMA, as shown in the table below.

Center Wavelength (nm)	RMS Spectral Width (nm)									
	0.05	0.05~0.1	0.1~0.15	0.15~0.2	0.2~0.25	0.25~0.3	0.3~0.35	0.35~0.4	0.4~0.45	
840 ~ 842	-4.2	-4.2	-4.1	-4.1	-3.9	-3.8	-3.5	-3.2	-2.8	
842 ~ 844	-4.2	-4.2	-4.2	-4.1	-3.9	-3.8	-3.6	-3.3	-2.9	
844 ~ 846	-4.2	-4.2	-4.2	-4.1	-4	-3.8	-3.6	-3.3	-2.9	
846 ~ 848	-4.3	-4.2	-4.2	-4.1	-4	-3.8	-3.6	-3.3	-2.9	
848 ~ 850	-4.3	-4.2	-4.2	-4.1	-4	-3.8	-3.6	-3.3	-3	
850 ~ 852	-4.3	-4.2	-4.2	-4.1	-4	-3.8	-3.6	-3.4	-3	
852 ~ 854	-4.3	-4.2	-4.2	-4.1	-4	-3.9	-3.7	-3.4	-3.1	
854 ~ 856	-4.3	-4.3	-4.2	-4.1	-4	-3.9	-3.7	-3.4	-3.1	
856 ~ 858	-4.3	-4.3	-4.2	-4.1	-4	-3.9	-3.7	-3.5	-3.1	
858 ~ 860	-4.3	-4.3	-4.2	-4.2	-4.1	-3.9	-3.7	-3.5	-3.2	

Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Remark
Operating Data Rate	/		10.3125		Gbps	

Transmitter						
Single-Ended Output Voltage Tolerance		-0.3		4	V	
Common Mode Voltage	/	15			mV	
Differential Input Voltage	VI	180		800	mV	
Tx Fault	VoL	-0.3		0.4	V	0.7mA
Data Dependent Jitter	DDJ			0.1	UI	
Total Jitter	TJ			0.28	UI	

Unless otherwise specified, the following optical characteristics are defined under the recommended operating conditions.

Parameter	Symbol	Min	Typical	Max	Unit	Remark
Power Consumption	/		600	800	mW	

Receiver						
Single-Ended Output Voltage Tolerance	/	-0.3		4	V	
Differential Output Voltage	VO	300		850	mV	
Rise and Fall Time (20%~80%)	Tr-Tf	30			ps	
Total Jitter	TJ			0.7	UI	
Deterministic Jitter	DJ			0.42	UI	

Digital Diagnostic Specifications

Unless otherwise specified, the following optical characteristics are defined under the recommended operating conditions.

Parameter	Symbol	Min	Max	Unit	Remark
Temperature Sensor Absolute Error	DMI_Temp	-3	3	°C	Operating Temperature
TX Power Monitor Absolute Error	DMI_TX	-3	3	dB	
RX Power Monitor Absolute Error	DMI-RX	-3	3	dB	-1 ~ -12dBm
Supply Voltage Monitor Absolute Error	DMI_VCC	-0.08	0.08	V	over the full operating range
Bias Current Monitor	DMI_lbias	-10%	10%	mA	

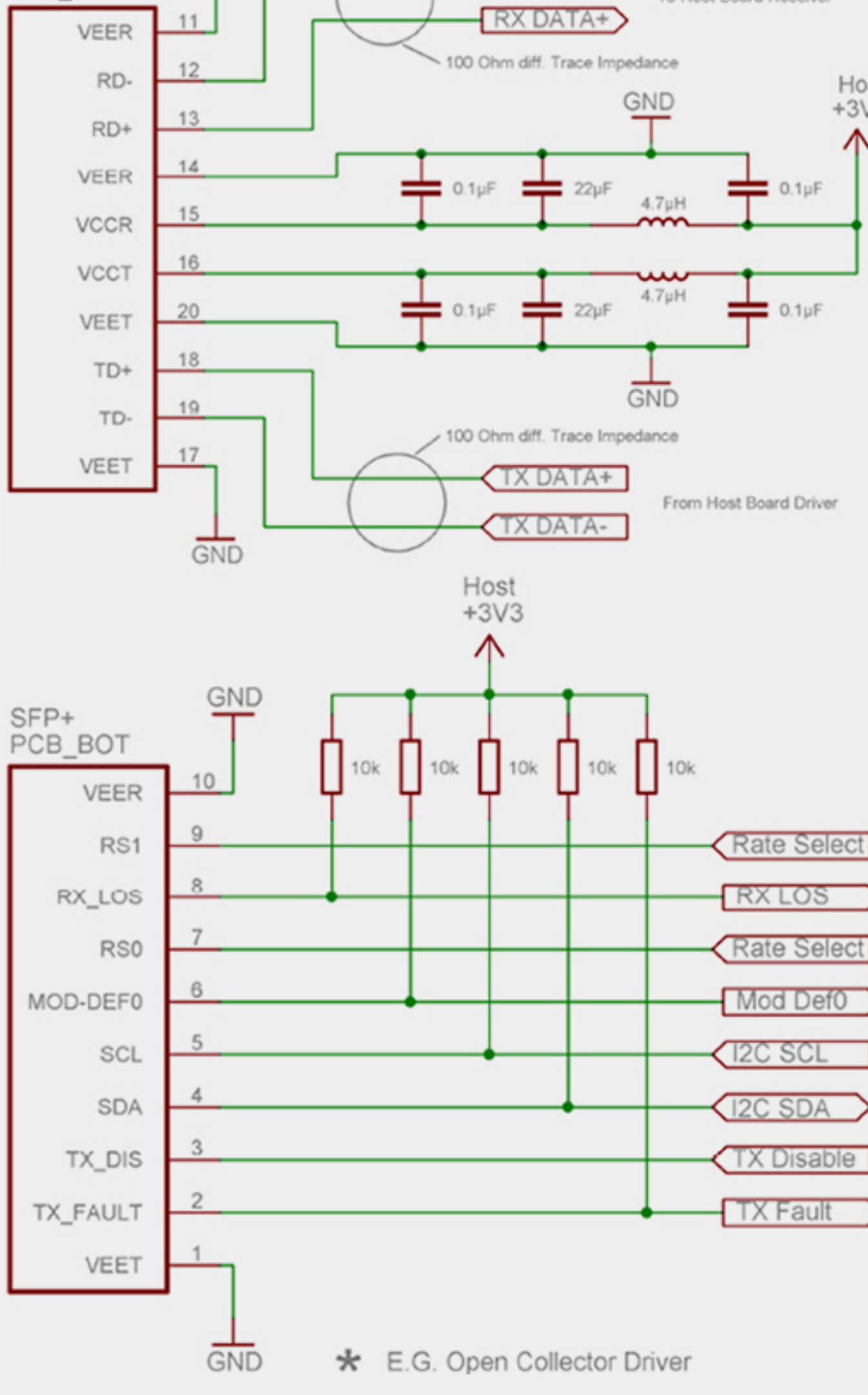
Control and Status I/O Timing Characteristics

Parameter	Symbol	Min	Max	Unit	Condition	Remark
Time from Control Signal Deassertion to Invalid State	t_off		10	μ S		Time from Tx Disable Assert (High) to Optical Output below 10% of nominal value
Tx Disable Assert Time	t_on		1	ms		Time from Tx Disable Deassert (Low) to Optical Output above 90% of nominal value
Module Initialization Time	t_init		300	ms		TX Fault Time from Power-On or Tx Disable Negation to Tx Fault Reset
Tx Fault Assert Time	t_fault		100	μ S		Time from Fault Condition to Tx Fault Activation
Disable Transmitter Output	t_reset	10		μ S		Minimum Tx Disable Assert Time Required to Reset Tx Fault
LOS Recovery Indication	t_loss_on		100	μ S		Time from LOS Condition to LOS Assert
LOS Deassert Time	t_loss_off		100	μ S		Time from LOS Clear Condition to LOS Deassert
Rate Select Change Time	t_ratesel		10	μ S		Time from Rate Select Input Transition to Receiver Bandwidth Conforming to Specified Standard
Serial ID Clock Rate	t_serial_clock		100	kHz		

Pin Definition

Pin	Name	Description	Note
1	VEET	Transmitter Ground	Note 1
2	TX FAULT	Transmitter Fault Indication	
3	TX DISABLE	Transmitter Disable	
4	SCL	2-Wire Serial Interface Clock	Note 2
5	SDA	2-Wire Serial Interface Data	
6	MOD_DEF(0)	Module Absent Indicator (Internally Grounded in Module)	
7	RSO	Receiver Rate Select	Note 1
8	RX_LOS	Receiver Loss of Signal	
9	RS1	Transmitter Rate Select (Not Used)	
10	VEER	Receiver ground	Note 1
11	VEER	Receiver ground	
12	RD-	Inv. Received Data Out	
13	RD+	Received Data Out	Note 1
14	VEER	Receiver ground	
15	VccR	Receiver Power Supply 3.3V	
16	VccT	Transmitter Power Supply 3.3V	Note 1
17	VEET	Transmitter Signal Ground	
18	TD+	Transmitter Data Input	
19	TD-	Inverted Transmitter Data Input	Note 1
20	VEET	Transmitter Signal Ground	

- Note:
1. The module ground pins (GND) are isolated from the module case.
2. They should be pulled up to a voltage between 3.15V and 3.45V on the host board with a resistor in the range of 4.7K to 10K ohms



For more information, please visit: <http://www.hsgq.com>

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