

## 10Gbps SFP+ 850nm 300m Multi-Mode Optical Transceiver

### KY-SFP-10G85-3M

#### Features

- Operating data rate up to 10.3Gbps
- 850nm VCSEL Transmitter
- Distance up to 300m @50 / 125 um MMF
- Single 3.3V Power supply and TTL Logic Interface
- Duplex LC Connector Interface, Hot Pluggable
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with IEEE 802.3ae 10GBASE-SR/SW
- Power Dissipation < 1.0W
- Dispersion tolerance up to 40ps/nm over G.651
- Built-in Digital Diagnostic Function
- Operating Temperature  
Standard: 0°C to +70°C  
Extended: -20°C to +85°C  
Industrial: -40°C to +85°C



#### Applications

- 10GBASE-SW at 9.953Gbps
- 10GBASE-SR at 10.3125Gbps
- OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s
- CPRI rates 9.830 Gb/s, 7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s
- Other Optical Link

#### Description

The KY-SFP-10G85-3M series multi-mode transceiver is SFP+ module for duplex optical data communications such as 10GBASE-SR and 10GBASE-SW. It is with the SFP+ 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I2C. This module is designed for multi-mode fiber and operates at a nominal wavelength of 850 nm.

The transmitter section uses a Vertical Cavity Surface Emitted Laser (VCSEL) and is a Class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated GaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

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## Specifications

**Table 1 - Absolute Maximum Ratings**

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V <sub>cc</sub>	-0.5	3.6	V
Storage Temperature	T <sub>s</sub>	-40	+85	°C
Input Voltage	V <sub>in</sub>	-0.5	V <sub>cc</sub>	V
Output Current	I <sub>o</sub>	-	50	mA

**Table 2 - Recommended Operating Conditions**

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	Standard	T <sub>c</sub>	0	70	° C
	Extended	T <sub>c</sub>	-20	85	°C
	Industrial	T <sub>c</sub>	-40	85	° C
Power Supply Voltage	V <sub>CC</sub>	3.15	3.3	3.45	V
Power Supply Current	I <sub>CC</sub>			300	mA
Surge Current	I <sub>Surge</sub>			+30	mA
Baud Rate		0.6		10.3	Gbps

**Table 3 - Performance Specifications – Electrical**

Parameter	Symbol	Min	Typical	Max	Unit	Notes
<b>Transmitter</b>						
CML Inputs(Differential)	V <sub>in</sub>	150		1200	mVpp	AC coupled inputs
Input Impedance (Differential)	Z <sub>in</sub>	85	100	115	ohms	R <sub>in</sub> > 100 kohms@ DC
Tx_DISABLE Input Voltage - High		2		V <sub>cc</sub> +0.3	V	
Tx_DISABLE Input Voltage - Low		0		0.8	V	
Tx_FAULT Output Voltage - High		2		V <sub>cc</sub> +0.3	V	I <sub>o</sub> = 400μA; Host V <sub>cc</sub>
Tx_FAULT Output Voltage - Low		0		0.5	V	I <sub>o</sub> = -4.0mA
<b>Receiver</b>						
CML Outputs (Differential)	V <sub>out</sub>	350		700	mVpp	AC coupled outputs
Output Impedance (Differential)	Z <sub>out</sub>	85	100	115	ohms	

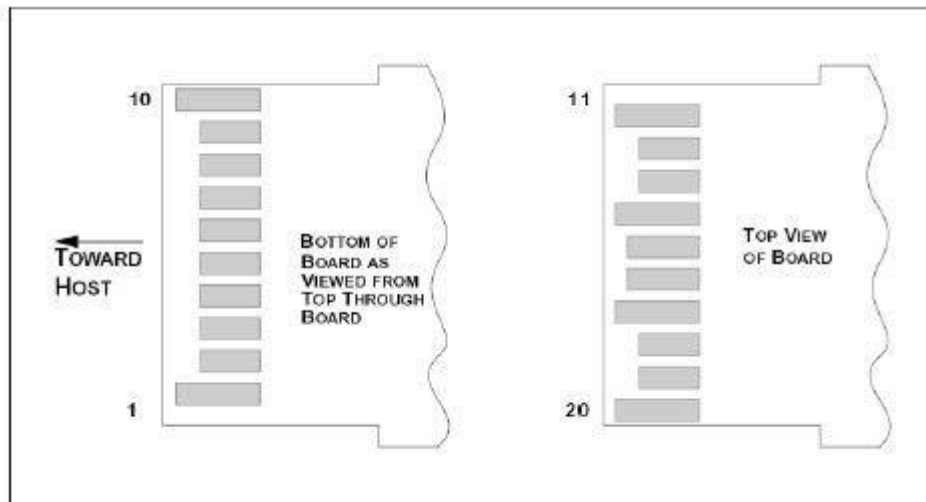
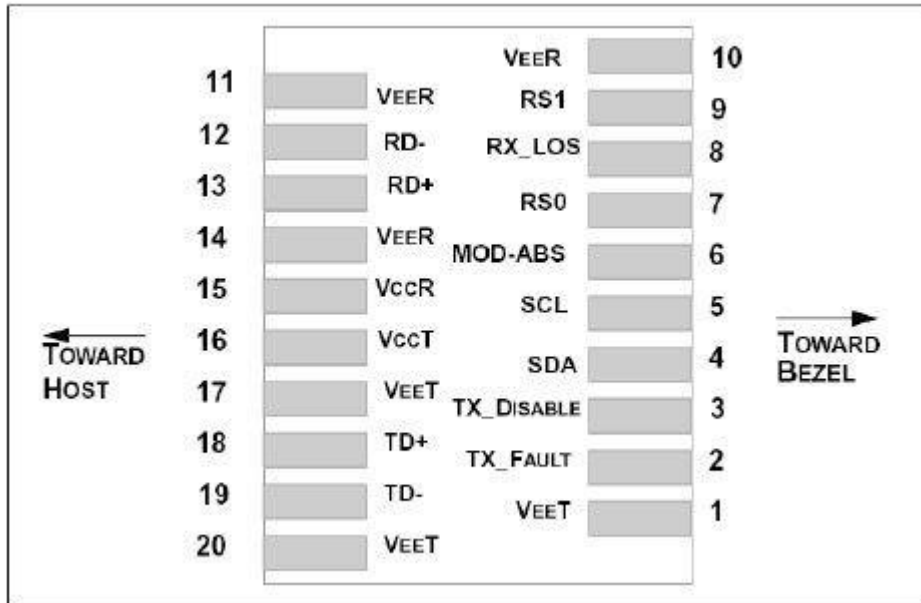
Rx_LOS Output Voltage - High		2		V <sub>cc</sub> +0.3	V	I <sub>o</sub> = 400μA; Host V <sub>cc</sub>
Rx_LOS Output Voltage - Low		0		0.8	V	I <sub>o</sub> = -4.0mA
MOD_DEF ( 2:0 )	VoH	2.5			V	With Serial ID
	VoL	0		0.5	V	

**Table 4- Optical and Electrical Characteristics**

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
50 / 125 um MMF	-	300	-	-	m	
Data Rate	-	0.6	-	10.3	Gbps	
<b>Transmitter</b>						
Center Wavelength	$\lambda_c$	840	850	860	nm	
Spectral Width (RMS)	$\Delta\lambda$	-	-	0.45	nm	
Average Optical Power	P <sub>out</sub>	-6	-	-1	dBm	
Extinction Ratio	ER	3.0	5.0	-	dB	
Output Optical Eye				-	dB	
Transmitter Dispersion Penalty	TDP	-	-	3.9	dB	
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	$\Omega$	
TX_Disable Assert Time	t <sub>off</sub>	-	-	10	us	
TX_DISABLE Negate Time	t <sub>on</sub>	-	-	1	ms	
TX_BISABLE time to start reset	t <sub>reset</sub>	10	-	-	us	
Time to initialize, include	t <sub>init</sub>			200	ms	
TX_FAULT from fault to assertion	t <sub>fault</sub>	-	-	100	us	
Total Jitter	TJ	-	-	0.28	UI(p-p)	
Data Dependant Jitter	DDJ	-	-	0.1	UI(p-p)	
Uncorrelated Jitter	UJ	-	-	0.023	RMS	
<b>Receiver</b>						
Center Wavelength	$\lambda_c$	840	850	860	nm	
Receiver Sensitivity	P <sub>min</sub>	-	-	-11.1	dBm	
Output Differential Impedance	R <sub>IN</sub>	90	100	110	$\Omega$	
Receiver Overload	P <sub>max</sub>	-1	-	-	dBm	<b>1</b>
Optical Return Loss	ORL	-	-	-12	dB	
LOS De-Assert	LOS <sub>D</sub>	-	-	-12.5	dBm	
LOS Assert	LOS <sub>A</sub>	-25	-	-	dBm	
LOS Hysteresis	-	0.5	-	-	dB	
LOS	High	-	2.0	-	V <sub>CC</sub> +0.3	-
	Low	-	0	-	0.8	-

**Note 1:** Measured with a PRBS 2<sup>31</sup>-1 test pattern @ 10.3125Gbps, BER ≤ 10<sup>-12</sup>

## SFP+ Transceiver Electrical Pad Layout



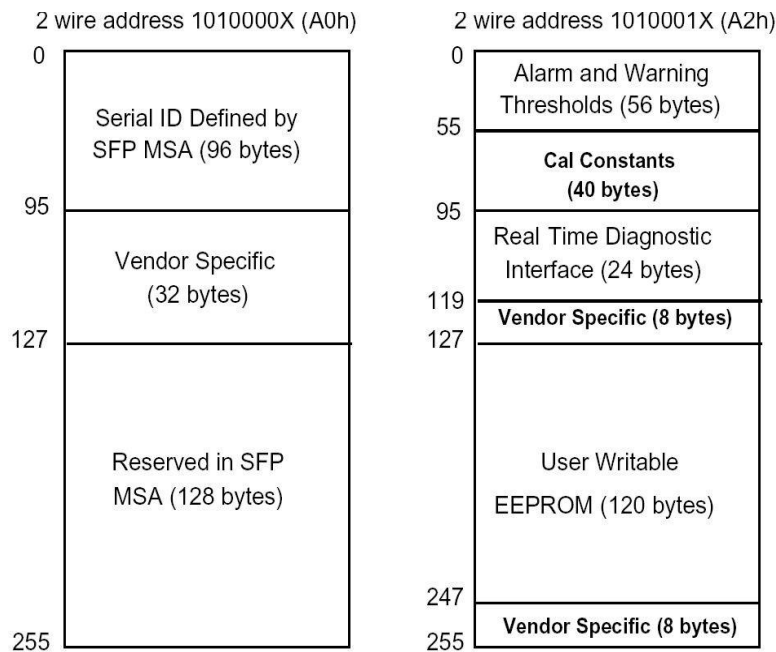
**Table 5 – Diagnostics Specification**

Parameter	Range	Unit	Accuracy	Calibration
Temperature	0 to +70	°C	±3°C	Internal / External
Voltage	3.0 to 3.6	V	±3%	Internal / External
Bias Current	0 to 100	mA	±10%	Internal / External
TX Power	0 to +5	dBm	±3dB	Internal / External
RX Power	-23 to -3	dBm	±3dB	Internal / External

## Digital Diagnostic Memory Map

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA).

The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring. The digital diagnostic memory map specific data field defines as following.



## Pin Function Definitions

Pin	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TX Disable	Transmitter Disable	3	Note 2, Module disables on high or open
4	MOD_DEF(2)	Serial Data Signal	3	2-wire Serial Interface Data Line. Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	3	2-wire Serial Interface Clock. Note 3
6	MOD_DEF(0)	TTL Low	3	Note 3
7	RS0	RX Rate Select (LVTTTL).	3	Rate Select 0, optionally controls SFP+ module receiver. This pin is pulled low to VeeT with a >30K resistor.
8	LOS	Loss of Signal	3	Note 4
9	RS1	TX Rate Select (LVTTTL)	1	Rate Select 1, optionally controls SFP+ module transmitter. This pin is pulled low to VeeT with a >30K resistor
10	VeeR	Receiver ground	1	Note 5

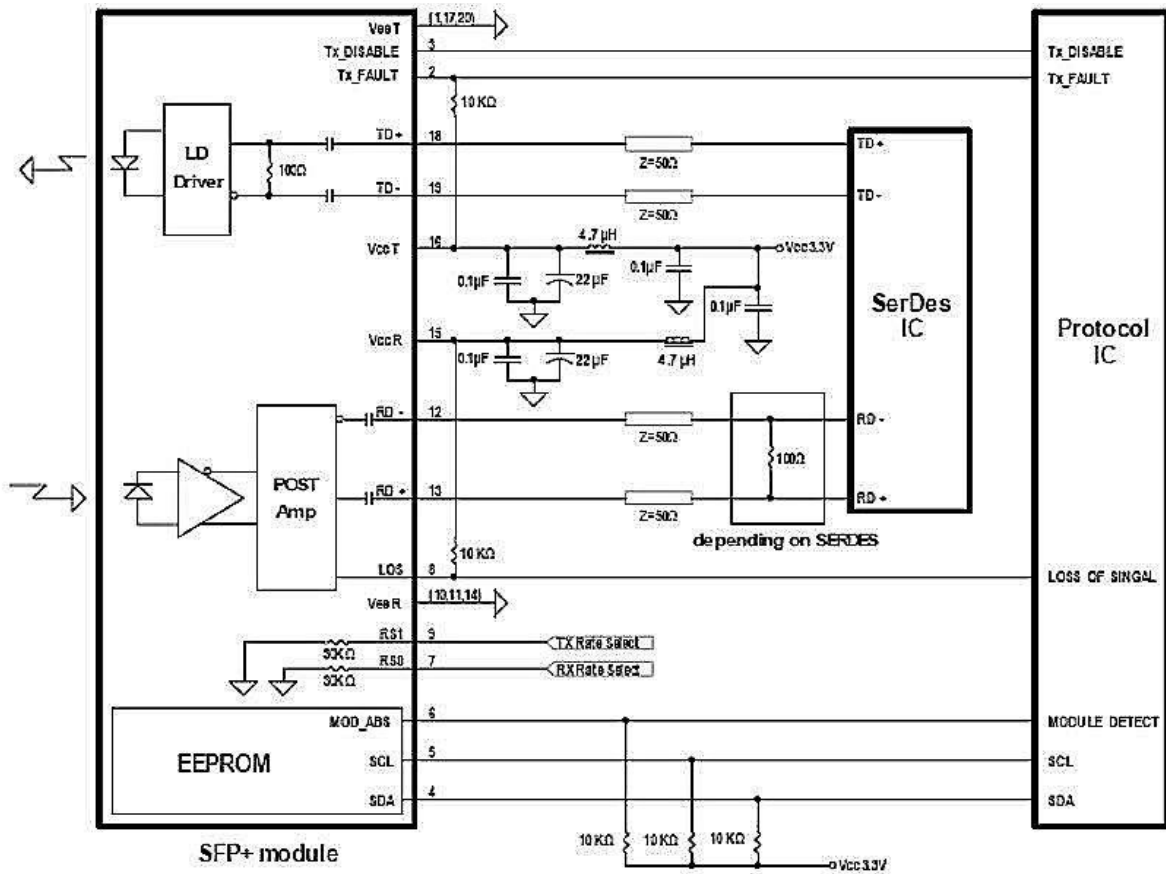
11	VeeR	Receiver ground	1	Note 5
12	RD-	Inv. Received Data Out	3	Note 6
13	RD+	Received Data Out	3	Note 6
14	VeeR	Receiver ground	1	Note 5
15	VccR	Receiver Power	2	3.3V ± 5%, Note 7
16	VccT	Transmitter Power	2	3.3V ± 5%, Note 7
17	VeeT	Transmitter Ground	1	Note 5
18	TD+	Transmit Data In	3	Note 8
19	TD-	Inv. Transmit Data In	3	Note 8
20	VeeT	Transmitter Ground	1	Note 5

**Notes:**

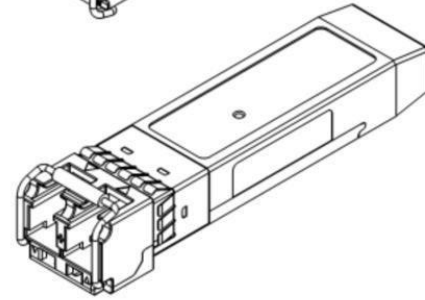
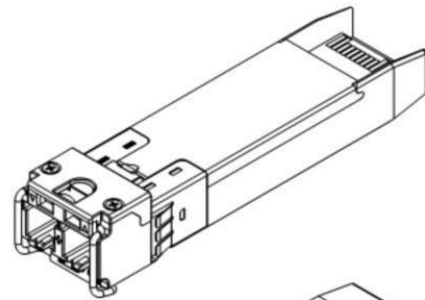
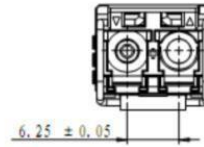
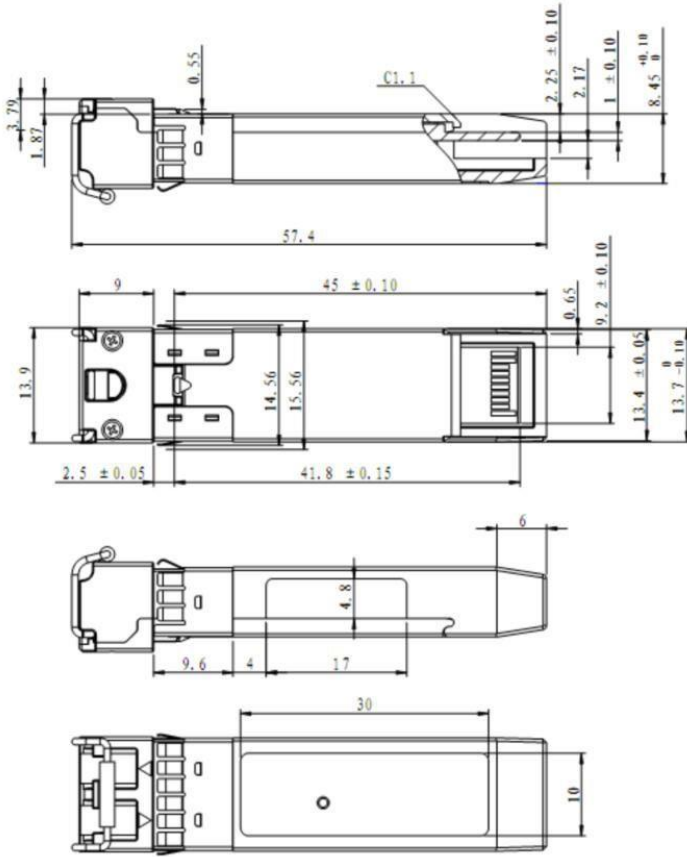
Plug Seq.: Pin engagement sequence during hot plugging.

- TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT/R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.
- TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7K~10KΩ resistor. Its states are:  
Low (0 – 0.8V): Transmitter on  
(>0.8, < 2.0V): Undefined  
High (2.0 – 3.465V): Transmitter Disabled  
Open: Transmitter Disabled
- Mod-Def 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be VccT or VccR.  
Mod-Def 0 is grounded by the module to indicate that the module is present  
Mod-Def 1 is the clock line of two wire serial interface for serial ID  
Mod-Def 2 is the data line of two wire serial interface for serial ID
- LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor. Pull up voltage between 2.0V and VccT/R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.
- The module signal ground contacts, VeeR and VeeT, should be isolated from the module case.
- RD-/+: These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 370 and 700 Mv differential (185 –350 Mv single ended) when properly terminated.
- VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP+ connector pin. Maximum supply current is 300mA. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP+ input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP+ transceiver module will result in an inrush current of no more than 30Ma greater than the steady state value. VccR and VccT may be internally connected within the SFP+ transceiver module.
- TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 150 – 1200 Mv (75 – 600Mv single-ended), though it is recommended that values between 150 and 1200 Mv differential (75 – 600Mv single-ended) be used for best EMI performance.

## Recommended Interface Circuit



## Mechanical Dimensions





## Ordering Information

Part No.	Data Rate (Gbps)	Wavelength (nm)	Connector Type	Transmission Distance	Operating case temperature (°C)	Digital Diagnostics
KY-SFP-10G85-3M	≤10.3	850	LC	300m	0 to +70	Yes

Addresses, phone number and fax number also have been listed at [www.kayainstruments.com](http://www.kayainstruments.com).

Please e-mail us at [info@kayainstruments.com](mailto:info@kayainstruments.com) or call us for assistance.

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