

# SO-SFP-10GE-LR-HRX

SFP+, 10GBase-LR, 1310nm, SM, DDM, 70km, RX sensitivity -22 dBm

## OVERVIEW

The SO-SFP-10GE-LR-HRX series single-mode transceiver is small form factor pluggable module for serial optical data communications such as IEEE 802.3ae 10GBase-LR/LW. This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310nm multiple quantum-well DFB laser and is a Class 1 laser compliant according to international safety standard IEC-60825. The APD receiver is suitable for applications requiring extra high receiver sensitivity.

## PRODUCT FEATURES

- Operating data rate up to 11.1Gbps
- 1310nm DFB-LD transmitter
- APD receiver
- Distance up to 70km
- Single 3.3V power supply and TTL logic interface
- Duplex LC connector interface
- Hot-Pluggable
- Power dissipation < 1.0W
- Compliant with MSA SFP+ specification SFF-8431
- Compliant with IEEE 802.3ae 10GBASE-LR/LW
- Case operation temperature:
  - Standard: -5°C to 70°C
  - Industrial: -40°C TO +85°C

## APPLICATIONS

- 10GBASE-LR at 10.31Gbps
- 10GBASE-LW at 9.95Gbps
- Other optical links

## ORDERING INFORMATION

Part Number	Description
SO-SFP-10GE-LR-HRX	SFP+, 10GBase-LR, 1310nm, SM, DDM, 70km, RX sensitivity -22 dBm
SO-SFP-10GE-LR-HRX-I	SFP+, 10GBase-LR, 1310nm, SM, DDM, 70km, RX sensitivity -22 dBm, Ind.temp.

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## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Storage Temperature	TS	-40	+85	°C
Supply Voltage	VCC	-0.5	3.6	V
Input Voltage	Vin	-0.5	Vcc	V
Output Current	Io		50	mA

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit	
Case Operating Temperature	$T_c$	SO-SFP-10GE-LR- HRX		-5	+70	°C
		SO-SFP-10GE-LR- HRX-I		-40	+85	
Power Supply Voltage	Vcc	3.15	3.3	3.45	V	
Power Supply Current	Icc			300	mA	
Surge Current	ISurge			+30	mA	
Baud Rate		0.6		11.1	Gbps	

## PERFORMANCE SPECIFICATIONS – ELECTRICAL TRANSMITTER

Parameter	Symbol	Min	Typ	Max	Unit	Notes
CML Inputs(Differential)	$V_{IN}$	150		1200	mVpp	AC coupled inputs
Input AC Common Mode Voltage		0		25	mV	RMS
Input Impedance (Differential)	$Z_{IN}$	85	100	115	ohm	Rin > 100 kohms @ DC
Differential Input S-parameter	$S_{DD11}$			-10	dB	
Differential to Common Mode Conversion	$S_{DD11}$			-10	dB	
Tx_DISABLE Input Voltage – High		2		3.45	V	
Tx_DISABLE Input Voltage – Low		0		0.8	V	
Tx_FAULT Output Voltage – High		2		Vcc+0.3	V	Io = 400µA; Host Vcc
Tx_FAULT Output Voltage – Low		0		0.5	V	Io = -4.0mA

## PERFORMANCE SPECIFICATIONS – ELECTRICAL RECEIVER

Parameter	Symbol	Min	Typ	Max	Unit	Notes
CML Outputs (Differential)	$V_{out}$	350		700	mVpp	AC coupled outputs
Output AC Common Mode Voltage		0		15	mV	RMS
Output Impedance (Differential)	$Z_{out}$	90	100	110	ohm	
Differential Output S-parameter	$S_{D22}$			-10	dB	
Rx_LOS Output Voltage – High		2		Vcc+0.3	V	Io = 400µA; Host Vcc
Rx_LOS Output Voltage – Low		0		0.8	V	Io = -4.0mA
MOD_DEF ( 2:0 )	VoH	2.5			V	With Serial ID
	VoL	0		0.5	V	

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## OPTICAL AND ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit
9µm Core Diameter SMF			10		Km
Data Rate		0.6		11.1	Gbps

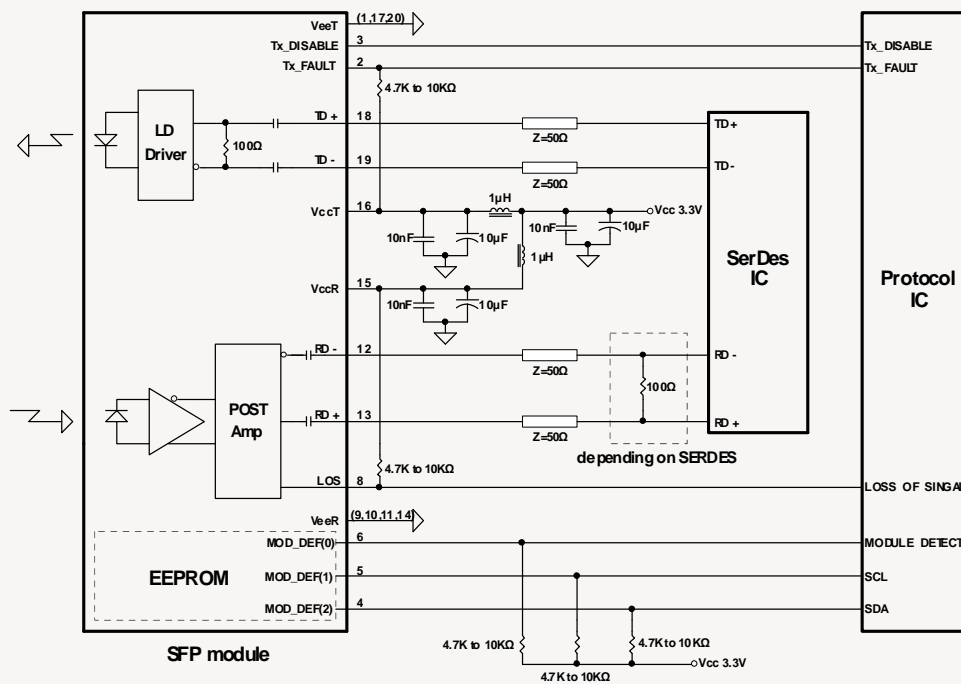
## OPTICAL AND ELECTRICAL CHARACTERISTICS TRANSMITTER

Parameter	Symbol	Min	Typ	Max	Unit
Centre Wavelength	$\lambda_c$	1270	1310	1355	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power	$P_{out}$	-8.2		+0.5	dBm
Extinction Ratio	$ER$	3.5			dB
Average Power of OFF Transmitter	$P_{off}$			-30	dBm
Side Mode Suppression Ratio	$SMSR$	30			dB
Transmitter Dispersion Penalty	$TDP$			3.2	dB
Input Differential Impedance	$Z_{IN}$	90	100	110	$\Omega$
TX Disable Assert Time	$t_{off}$			10	us
TX_DISABLE Negate Time	$t_{on}$			1	ms
TX_BISABLE time to start reset	$t_{reset}$	10			us
Time to initialize, include reset of TX_FAULT	$t_{init}$			300	ms
TX_FAULT from fault to assertion	$t_{fault}$			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

## OPTICAL AND ELECTRICAL CHARACTERISTICS RECEIVER

Parameter	Symbol	Min	Typ	Max	Unit
Centre Wavelength	$\lambda$	1260		1565	nm
Sensitivity	$P_{min}$			-20	dBm
Receiver Overload	$P_{max}$	-8			dBm
Optical Return Loss	$ORL$			-12	dB
LOS De-Assert	$LOSD$			-22	dBm
LOS Assert	$LOSA$	-34			dBm
LOS	High	2.0		VCC+0.3	V
	Low	0		0.8	

RECOMMENDED CIRCUIT SCHEMATIC



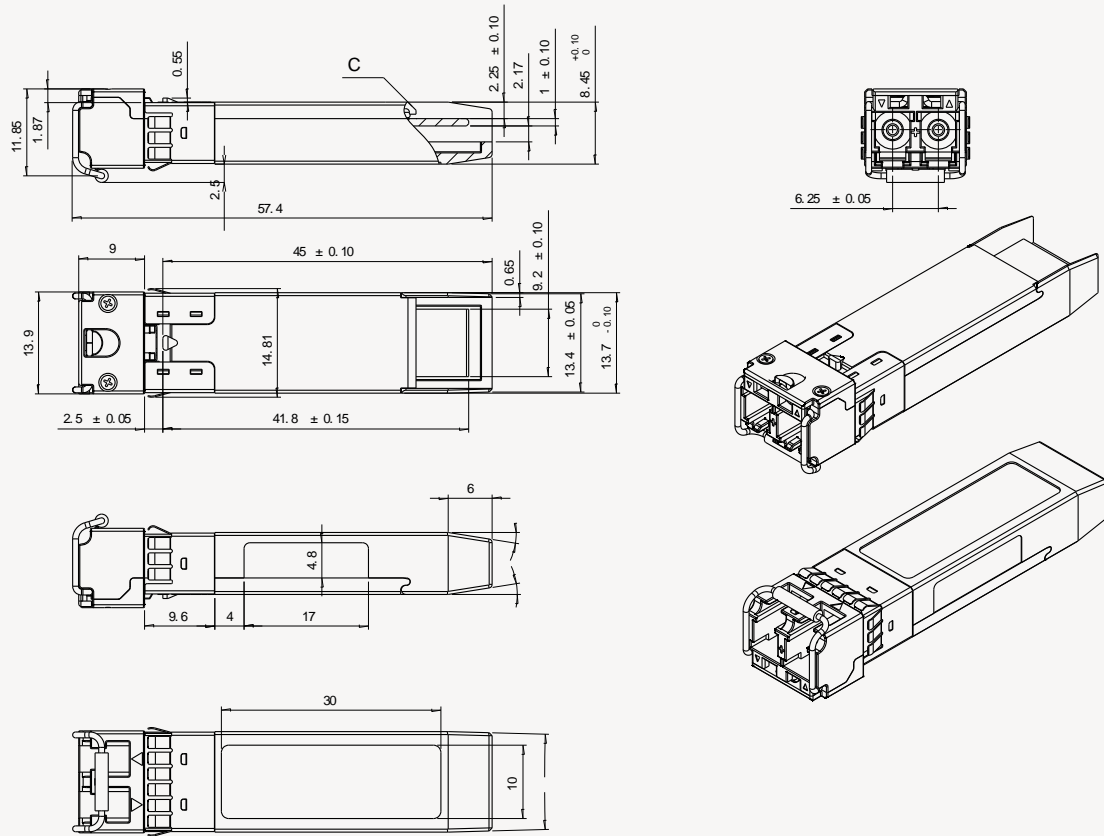
PIN FUNCTION DEFINITIONS

PIN	Signal Name	Description	PIN	Signal Name	Description
1	V <sub>EE</sub> T	Transmitter Signal Ground	11	V <sub>EE</sub> R	Receiver Signal Ground
2	TX_Fault	Transmitter Fault Indication. Logic "1" Output = Laser Fault. Logic "0" Output = Normal Operation	12	RD-	Inverse Receiver Data Out
3	TX_Disable	Logic "1" Input (or no connection) = Laser off, Logic "0" = Laser on.	13	RD+	Receiver Data Out
4	SDA	Modulation Definition 2 – Two wires serial ID Interface	14	V <sub>EE</sub> R	Receiver Signal Ground
5	SDL	Modulation Definition 1 – Two wires serial ID Interface	15	V <sub>CC</sub> R	Receiver Power – 3.3V±5%
6	MOD-ABS	Modulation Definition 0 – Ground in Module	16	V <sub>CC</sub> T	Transmitter Power – 3.3V±5%
7	RS0	RX Rate Select (LVTTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	17	V <sub>EE</sub> T	Transmitter Signal Ground
8	RX_LOS	Loss of Signal Out (OC).	18	TD+	Transmitter Data In
9	RS1	TX Rate Select (LVTTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	19	TD-	Inverse Transmitter Data In
10	V <sub>EE</sub> R	Receiver Signal Ground	20	V <sub>EE</sub> T	Transmitter Signal Ground

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MECHANICAL DRAWING



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