

# SFP28-25G-ER

25Gbps SFP28 Transceiver, Single Mode, 40km Reach



## Product Features

- ❖ Supports up to 25.78Gbps bit rates
- ❖ Hot-pluggable SFP+ footprint
- ❖ Up to 40km for SMF transmission
- ❖ Compliant with SFP+ MSA and SFF-8472 with duplex LC receptacle
- ❖ Compatible with RoHS
- ❖ Single +3.3V power supply
- ❖ Real Time Digital Diagnostic Monitoring

- ❖ Operating case temperature:  
Standard: 0 to +70°C

## Applications

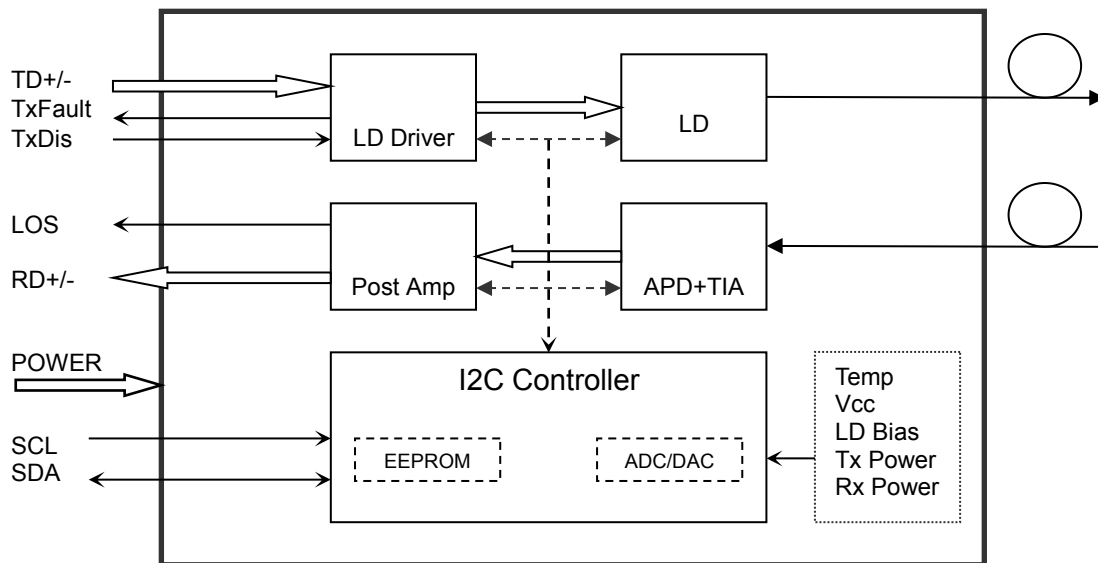
- ❖ 25GBASE-ER

## Description

The SFP28 transceivers are high performance, cost effective modules supporting data rate of 25.78Gbps and 40km transmission distance with SMF.

The transceiver consists of three sections: a EML laser transmitter, a APD photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit. All modules satisfy class I laser safety requirements.

The transceivers are compatible with SFP Multi-Source Agreement and SFF-8472 digital diagnostics functions.



**Transceiver functional diagram**

## Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Storage Temperature	$T_s$	-40	-	+85	°C	
Relative Humidity	$R_H$	5		95	%	
Power Supply Voltage	$V_{CC}$	-0.3	-	+4.0	V	
Signal Input Voltage	$V_{SI}$	$V_{CC}-0.3$	-	$V_{CC}+0.3$	V	

## Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Case Operating Temperature	$T_{case}$	0		70	°C	
Power Supply Voltage	$V_{CC}$	3.14	3.3	3.47	V	
Power Supply Current	$I_{CC}$	-		600	mA	
Data Rate	BR		25.78		Gbps	TX Rate/ RX Rate
Transmission Distance	TD		40		km	
Coupled Fiber	Single Mode Fiber					9/125um SMF

## Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Note
<b>Transmitter</b>						
Centre Wavelength	$\lambda_c$	1295		1310	nm	
Average Launched Power	$P_o$	0		+6.0	dBm	
Average Launched Power(Laser Off)	$P_{off}$	-	-	-30	dBm	
Spectrum Bandwidth(-20dB)	$\Delta\lambda$	-	-	1	nm	
Side-Mode Suppression Ratio	SMSR	30	-	-	dB	
Transmitter and Dispersion Penalty	TDP			1	dB	
Extinction Ratio	ER	6		-	dB	
Output Eye Mask	Compliant with IEEE 802.3cc					2
<b>Receiver</b>						
Input Optical Wavelength	$\lambda_{IN}$	1272.55	-	1310.19	nm	
Receiver Sensitivity-AVG	$P_{Sens}$			-19	dBm	1
Receiver Sensitivity-OMA	$P_{Sens-OMA}$			-18.2	dBm	1
Input Saturation Power (Overload)	$P_{SAT}$	-4	-	-	dBm	1
Receiver Reflectance				-26	dB	
Los Of Signal Assert	$P_A$	-30	-	-	dBm	
Los Of Signal De-assert	$P_D$	-	-	-20	dBm	
LOS -Hysteresis	$P_{Hys}$	0.5			dB	

**Note:**

1. BER $\leq$ 5x10<sup>-5</sup>

## Electrical Interface Characteristics

### High Speed Electrical Interface Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
<b>Transmitter</b>						
Differential Input Swing	$V_{in(pp)}$	190		700	mV	
Differential Input Return Loss (Min)	$RL_{d(f)}$	9.5 - 0.37f, $0.01 \leq f < 8$			dB	
		4.75 - 7.4log10(f/14), $8 \leq f < 19$				
Differential to Common Mode Input Return Loss (Min)	$RL_{dc(f)}$	22-20(f/25.78), $0.01 \leq f < 12.89$			dB	
		15-6(f/25.78), $12.89 \leq f < 19$				
Differential Termination Mismatch	$T_m$	-	-	10	%	
Eye Width	$E_w$	-	-	0.46	UI	
Applied Pk-Pk Sinusoidal Jitter	$P_{pj}$	Per IEEE 802.3bm				
Eye Height	$E_h$	-	95	-	mV	
Dc Common Mode Voltage	$DC_v$	-350	-	2850	mV	
<b>Receiver</b>						
Differential Data Output Swing	$V_{out(pp)}$	300	-	850	mV	
Eye Width	$E_w$	0.57	-	-	UI	
Vertical Eye Closure	$V_{ec}$	-	-	5.5	dB	
Differential Output Return Loss (Min)	$RL_{d(f)}$	9.5 - 0.37f, $0.01 \leq f < 8$			dB	
		4.75 - 7.4log10(f/14), $8 \leq f < 19$				
Common To Differential Mode Conversion Return Loss (Min)	$RL_{dc(f)}$	22-20(f/25.78), $0.01 \leq f < 12.89$			dB	
		15-6(f/25.78), $12.89 \leq f < 19$				
Differential Termination Mismatch	$T_m$	-	-	10	%	
Transition Time, 20% To 80%	$T_r/T_f$	12	-	-	ps	20%~80%

## LOW Speed Electrical Interface Characteristics

Parameter	Symbol	Min.	Typical	Max	Unit	Note
<b>Transmitter</b>						
Transmitter Fault Output-High	$V_{FaultH}$	2	-	$V_{cc}+0.3$	V	
Transmitter Fault Output-Low	$V_{FaultL}$	0	-	0.8	V	
Transmitter Disable Voltage- High	$V_{DisH}$	2	-	$V_{cc}+0.3$	V	
Transmitter Disable Voltage- Low	$V_{DisL}$	0	-	0.8	V	
<b>Receiver</b>						
LOS Output Voltage-High	$V_{LOSH}$	2	-	$V_{cc}+0.3$	V	
LOS Output Voltage-Low	$V_{LOSL}$	0	-	0.8	V	

## Timing and Electrical

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate Time	$t_{on}$			1	ms
Tx Disable Assert Time	$t_{off}$			10	$\mu s$
Time To Initialize, including Reset of Tx Fault	$t_{init}$			300	ms
Tx Fault Assert Time	$t_{fault}$			100	$\mu s$
Tx Disable To Reset	$t_{reset}$	10			$\mu s$
LOS Assert Time	$t_{loss\_on}$			100	$\mu s$
LOS De-assert Time	$t_{loss\_off}$			100	$\mu s$
Serial ID Clock Rate	$f_{serial\_clock}$		100	400	KHz
MOD_DEF (0:2)-High	$V_H$	2		$V_{cc}$	V
MOD_DEF (0:2)-Low	$V_L$			0.8	V

## Diagnostics

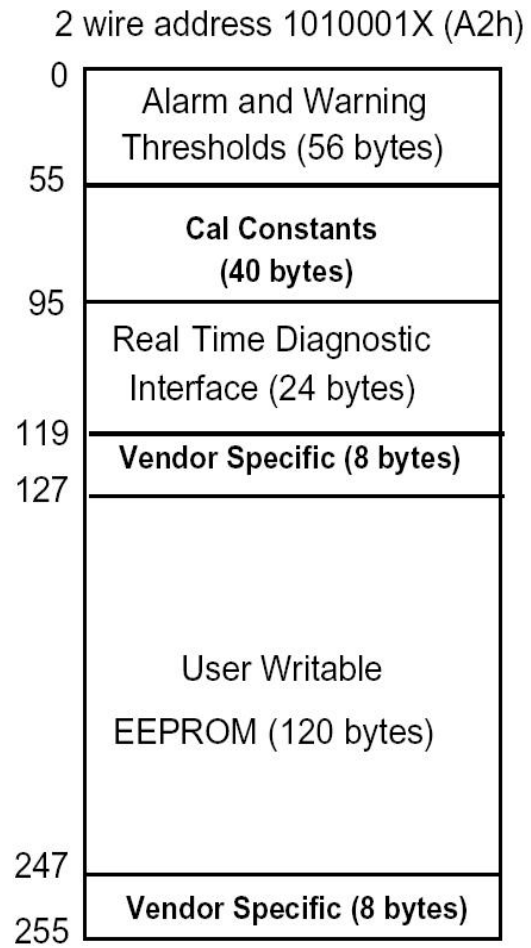
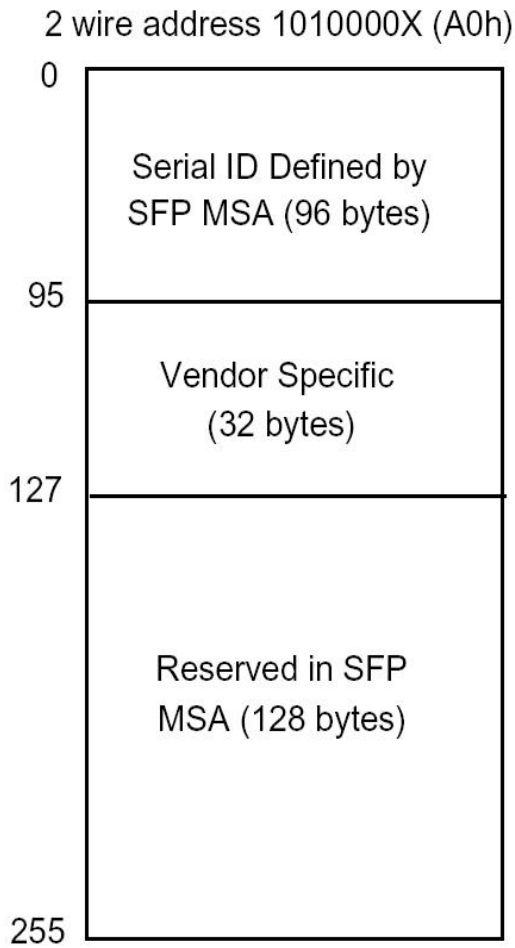
Parameter	Range	Unit	Accuracy	Calibration
Temperature	0 to 70	°C	±3°C	Internal
Voltage	3.0 to 3.6	V	±3%	Internal
Bias Current	0 to 100	mA	±10%	Internal
TX Power	0 to 6	dBm	±3dB	Internal
RX Power	-19 to -4	dBm	±3dB	Internal

## 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).

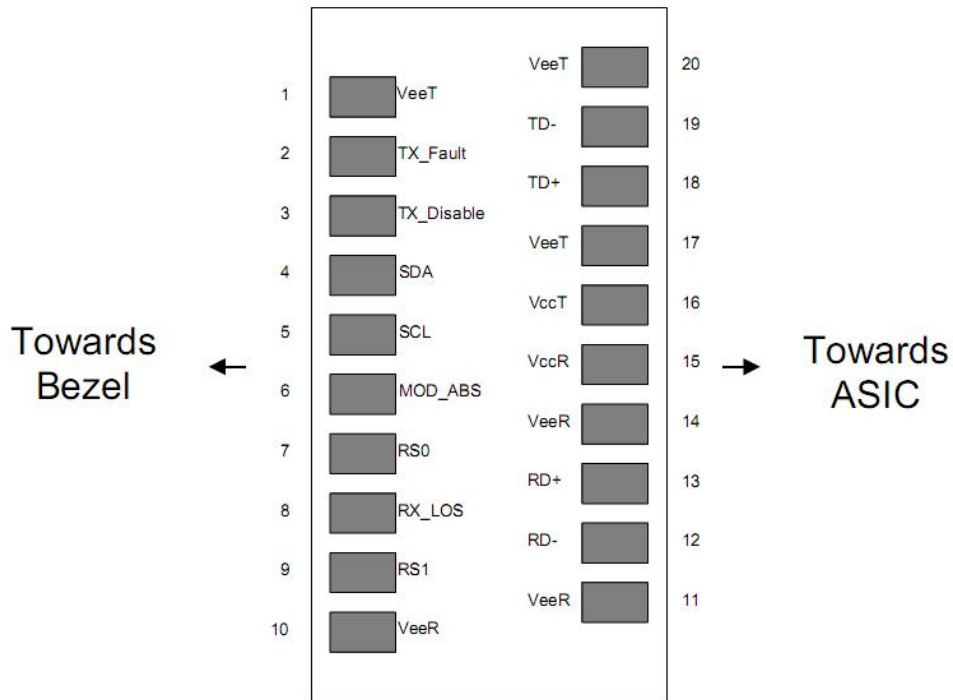
The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

The digital diagnostic memory map specific data field defines as following.





## Pin Descriptions



Pin	Signal Name	Description	Plug Seq.	Notes
1	V <sub>EET</sub>	Transmitter Ground	1	
2	TX_FAULT	Transmitter Fault Indication	3	Note 1
3	TX_DISABLE	Transmitter Disable	3	Note 2
4	SDA	SDA Serial Data Signal	3	
5	SCL	SCL Serial Clock Signal	3	
6	MOD_ABS	Module Absent. Grounded within the module	3	
7	RS0	Not Connected	3	
8	LOS	Loss of Signal	3	Note 3
9	RS1	Not Connected	3	
10	V <sub>EER</sub>	Receiver ground	1	
11	V <sub>EER</sub>	Receiver ground	1	
12	RD-	Inv. Received Data Out	3	Note 4

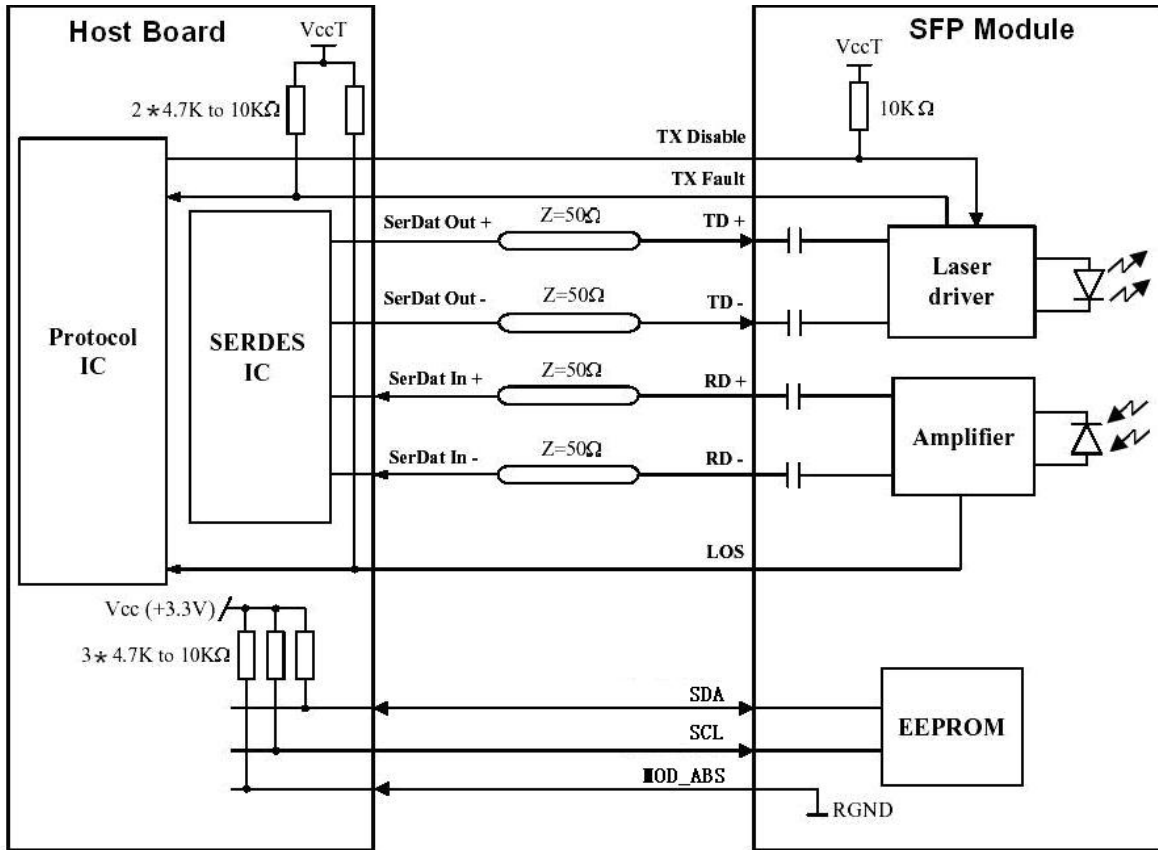
13	RD+	Received Data Out	3	Note 4
14	V <sub>EER</sub>	Receiver ground	1	
15	V <sub>CCR</sub>	Receiver Power Supply	2	
16	V <sub>CCT</sub>	Transmitter Power Supply	2	
17	V <sub>EET</sub>	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 5
19	TD-	Inv. Transmit Data In	3	Note 5
20	V <sub>EET</sub>	Transmitter Ground	1	

**Notes:**

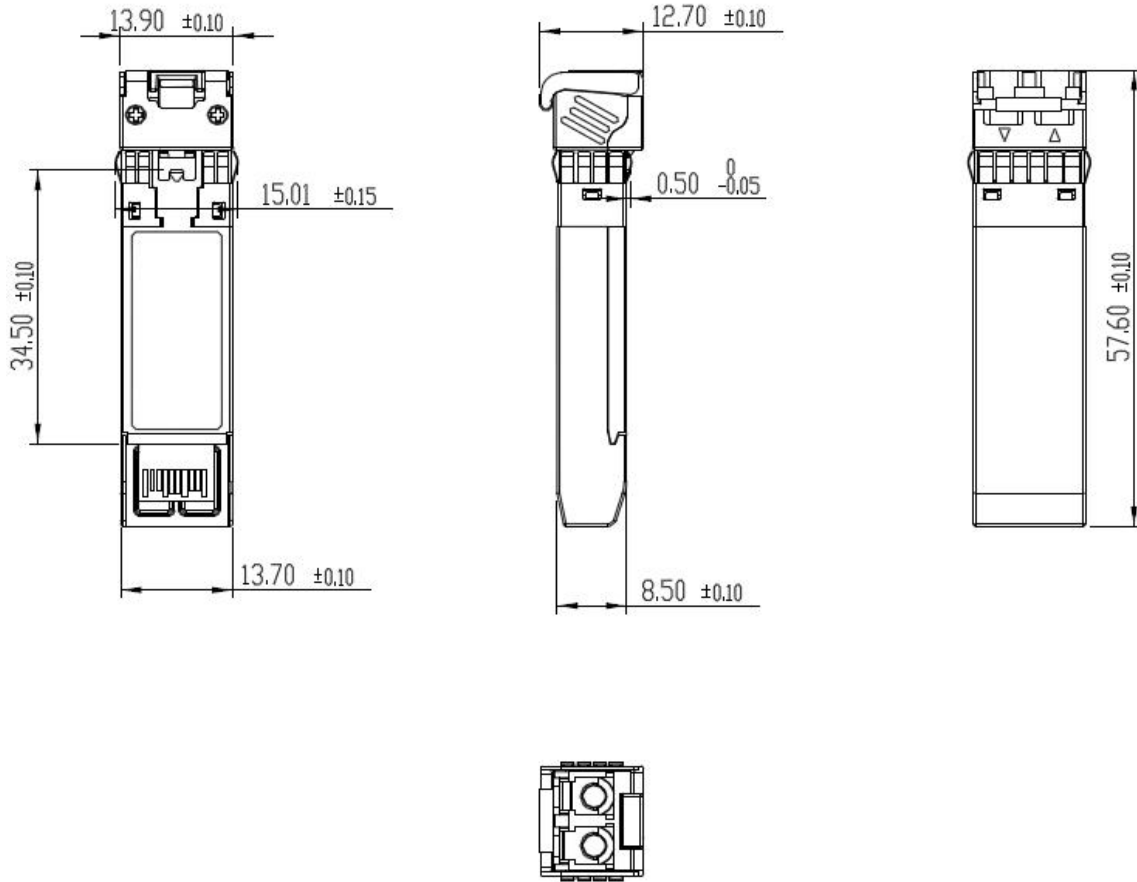
Plug Seq.: Pin engagement sequence during hot plugging.

- 1) TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
- 2) Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
- 3) LOS is open collector output. Should be pulled up with 4.7k~10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
- 4) RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100Ω (differential) at the user SERDES.
- 5) TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

## Recommended Interface Circuit



## Mechanical Dimensions



## Ordering Information

Part Number	Product Description
SFP28-25G-ER	1310nm, 25.78Gbps, LC, 40km, 0°C~+70°C, with DDM