

# 16G SFP+ Transceiver SR (KW3F01D)

## Hot Pluggable, Duplex LC, +3.3V 850nm VCSEL-LD



- ✧ 850nm VCSEL laser transmitter
- ✧ Duplex LC connector
- ✧ RoHS compliant
- ✧ 100m over 50/125µm MMF (50/125µm OM3)
- ✧ Metal enclosure, for lower EMI
- ✧ Single 3.3V power supply
- ✧ Operating temperature range: 0°C to 70°C
- ✧ RoHS compliant

### Features:

- ✧ Up to 14.025 Gb/s bi-directional data links
- ✧ Hot-pluggable SFP+ footprint
- ✧ Built-in digital diagnostic functions

### Applications:

- ✧ Tri-Rate 4.25/8.5/14.025 Gb/s Fibre Channel

### Description:

Kewefiber's KW3F01D SFP+ transceivers are designed for use in Fibre Channel links up to 14.025 Gb/s data rate over multimode fiber. They are compliant with FC-PI-5 Rev. 6.00, SFF-8472 Rev 11.0 and SFF-8081, and compatible with SFF-8432 and applicable portions of SFF-8431 Rev. 4.1.

The high performance 850nm VCSEL transmitter and high sensitivity PIN receiver provide superior performance for Ethernet applications at up to 100m links.

Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

The fully SFP compliant form factor provides hot pluggability, easy optical port upgrades and low EMI emission.

### ● Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	T <sub>S</sub>	-40		+85	°C
Case Operating Temperature	T <sub>A</sub>	0		70	°C
Maximum Supply Voltage	V <sub>cc</sub>	-0.5		4	V
Relative Humidity	RH	0		85	%

### ● Electrical Characteristics (T<sub>OP</sub> = 0 to 70 °C, V<sub>CC</sub> = 3.0 to 3.60 Volts)

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Supply Voltage	V <sub>cc</sub>	3.135		3.465	V	
Supply Current	I <sub>cc</sub>			300	mA	1
Power Consumption	P			1.5	W	
<b>Transmitter Section:</b>						
Input differential impedance	R <sub>in</sub>		100		Ω	2
Differential input voltage swing	V <sub>in,pp</sub>	90		800	mV	

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Transmit Disable Voltage	V <sub>D</sub>	2		V <sub>CC</sub>	V	3
Transmit Enable Voltage	V <sub>EN</sub>	V <sub>EE</sub>		V <sub>EE</sub> +0.8	V	
<b>Receiver Section:</b>						
Single ended data output swing	V <sub>out,pp</sub>	185		425	mV	4
LOS Fault	V <sub>LOS</sub> fault	2		V <sub>CC</sub> HOST	V	5
LOS Normal	V <sub>LOS</sub> norm	V <sub>EE</sub>		V <sub>EE</sub> +0.8	V	5
Power Supply Rejection	PSR	100			mV <sub>pp</sub>	6
Deterministic Jitter						

Note:

1. With established link. The total power dissipation could exceed 1W when the module is trying to establish link at operating case temperature below 25°C
2. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
3. Or open circuit.
4. Into 100 ohms differential termination.
5. LOS is an open collector output. Should be pulled up with 4.7k – 10kohms on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.
6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

● **Optical Parameters(T<sub>OP</sub> = 0 to 70°C, V<sub>CC</sub> = 3.00 to 3.60 Volts)**

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
<b>Transmitter Section:</b>						
Center Wavelength	λ <sub>t</sub>	840	850	860	nm	
RMS spectral width	λ <sub>RMS</sub>			0.59	nm	
Average Optical Power	P <sub>avg</sub>	-7.8		+2	dBm	1
Optical Power OMA	4.25Gb/s	P <sub>oma</sub>	-6.1		dBm	
	8.5Gb/s		-5.2			
	14.025Gb/s		-4.8			
Optical Rise/Fall Time @ 4.25Gb/s	t <sub>r</sub> / t <sub>f</sub>			90	ps	2
Transmitter Waveform and Dispersion Penalty, 8.5 Gb/s	TWDP			4.3	dB	3
Vertical Eye Closure Penalty						
14.025 Gb/s	CEVPQ					
<b>Receiver Section:</b>						
Center Wavelength	λ <sub>r</sub>	770		860	nm	
Average Receiver Power	R <sub>X</sub> MAX	0			dBm	
Receiver Stressed Sensitivity(OMA)	4.25Gb/s	Sen <sub>ST</sub>		-12.0	dBm	4
	8.5Gb/s		-11.2			
	14.025Gb/s		-10.5			
Optical Return Loss		12			dB	
Los Assert	LOS <sub>A</sub>	-30		-	dBm	
Los Dessert	LOS <sub>D</sub>			-13	dBm	

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Los Hysteresis	LOS <sub>H</sub>	0.5			dB	
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Notes:

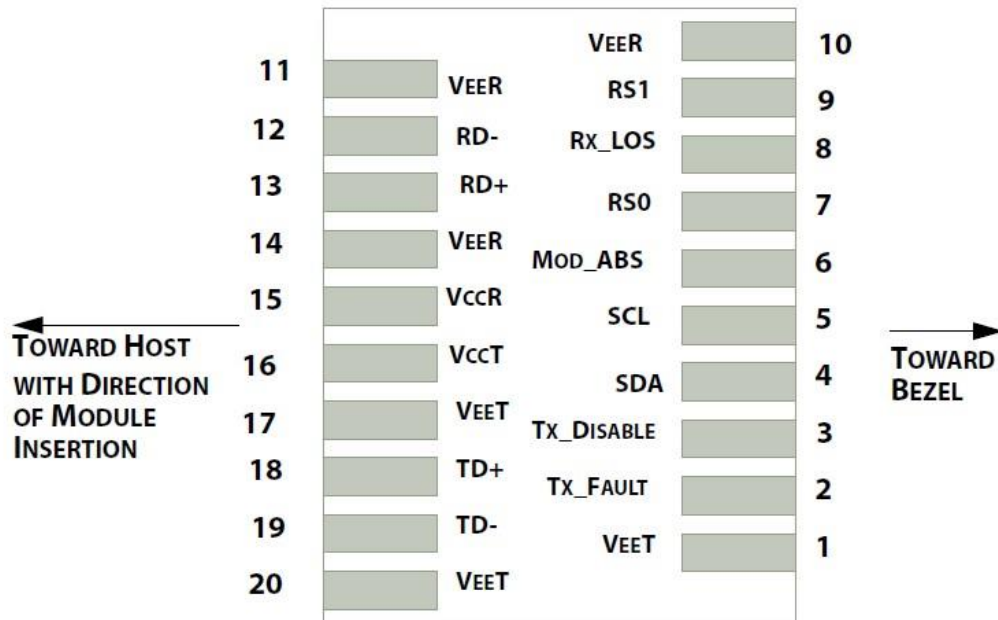
1. Class 1 Laser Safety limit per FDA/CDRH, and EN (IEC) 60825 laser safety standards.
2. Unfiltered, 20-80%. Complies with FC 1x and 2x eye mask when filtered
3. TWDP is calculated with a 1,0 equalizer and a 9.84 GHz Gaussian filter for the fiber simulation. Jitter values at  $\gamma_T$  and  $\gamma_R$  are controlled by TWDP and stress receiver sensitivity.
4. Unstressed Rx sensitivity

● **Timing Characteristics**

Parameter	Symbol	Min.	Typical	Max.	Unit
TX_Disable Assert Time	t_off			10	us
TX_Disable Negate Time	t_on			1	ms
Time to Initialize Include Reset of TX_FAULT	t_int			300	ms
TX_FAULT from Fault to Assertion	t_fault			100	us
TX_Disable Time to Start Reset	t_reset	10			us
Receiver Loss of Signal Assert Time	T <sub>A,RX_LOS</sub>			100	us
Receiver Loss of Signal Deassert Time	T <sub>d,RX_LOS</sub>			100	us
Rate-Select Change Time	t_ratesel			10	us
Serial ID Clock Time	t_serial-clock			100	kHz

● **Pin Assignment**

Diagram of Host Board Connector Block Pin Numbers and Name



● **Pin Function Definitions**

PIN	Symbol	Name / Description	Note
1	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault.	2

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### Hot Pluggable, Duplex LC, +3.3V 850nm VCSEL-LD

3	TDIS	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line (MOD-DEF2)	4
5	SCA	2-wire Serial Interface Clock (MOD-DEF1)	4
6	MOD_ABS	Module Absent, connected to VEET or VEER	4
7	RS0	Receiver Rate Select	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	5
9	RS1	Transmitter Rate Select (not used)	
10	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
11	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
15	V <sub>CCR</sub>	Receiver Power Supply	
16	V <sub>CCT</sub>	Transmitter Power Supply	
17	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1

#### Notes:

1. Circuit ground is internally isolated from chassis ground.
2. TFAULT is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to Vcc + 0.3V. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
3. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
4. Should be pulled up with 4.7k – 10kohms on host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
5. LOS is open collector output. Should be pulled up with 4.7k – 10kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## ● SFP Module EEPROM Information and Management

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP -8472. The serial ID information of the SFP modules and Digital Diagnostic Monitor parameters can be accessed through the I<sup>2</sup>C interface at address A0h and A2h.

The memory is mapped in Table 1.

Detailed ID information (A0h) is listed in Table 2.

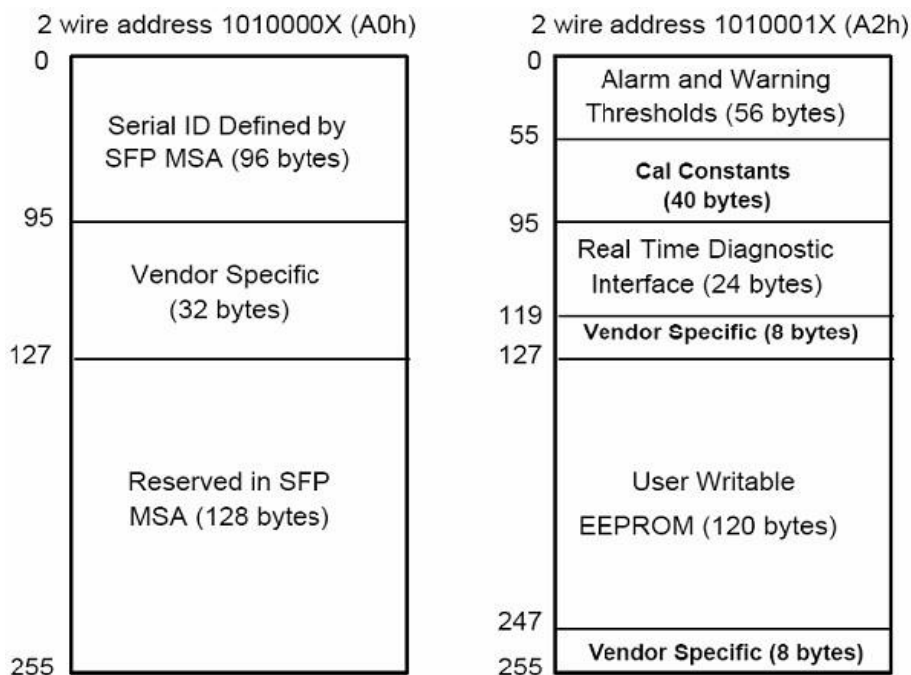
And the DDM specification is at address A2h.

For more details of the memory map and byte definitions, please refer to the SFF-8472, “Digital Diagnostic Monitoring Interface for Optical Transceivers”. The DDM parameters have been internally calibrated.

**Table 1.** Digital Diagnostic Memory Map (Specific Data Field Descriptions)

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**Table 2 - EEPROM Serial ID Memory Contents (A0h)**

Data Address	Length (Byte)	Name of Length	Description and Contents
<b>Base ID Fields</b>			
0	1	Identifier	Type of Serial transceiver (03h=SFP)
1	1	Reserved	Extended identifier of type serial transceiver (04h)
2	1	Connector	Code of optical connector type (07=LC)
3-10	8	Transceiver	Fibre Channel SR Multimode
11	1	Encoding	64B/66B
12	1	BR, Nominal	Nominal baud rate, unit of 100Mbps
13-14	2	Reserved	(0000h)
15	1	Length(9um)	Link length supported for 9/125um fiber, units of 100m
16	1	Length(50um)	Link length supported for 50/125um fiber, units of 10m
17	1	Length(62.5um)	Link length supported for 62.5/125um fiber, units of 10m
18	1	Length(Copper)	Link length supported for copper, units of meters
19	1	Reserved	
20-35	16	Vendor Name	SFP vendor name: OPWAY
36	1	Reserved	
37-39	3	Vendor OUI	SFP transceiver vendor OUI ID
40-55	16	Vendor PN	Part Number: "KW3F01D" (ASCII)
56-59	4	Vendor rev	Revision level for part number
60-62	3	Reserved	
63	1	CCID	Least significant byte of sum of data in address 0-62
<b>Extended ID Fields</b>			
64-65	2	Option	Indicates which optical SFP signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported)
66	1	BR, max	Upper bit rate margin, units of %
67	1	BR, min	Lower bit rate margin, units of %

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68-83	16	Vendor SN	Serial number (ASCII)
84-91	8	Date code	Kewei Fiber's Manufacturing date code
92-94	3	Reserved	
95	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)
Vendor Specific ID Fields			
96-127	32	Readable	Kewei Fiber specific date, read only
128-255	128	Reserved	Reserved for SFF-8079

### Digital Diagnostic Specifications

OP3F01D transceivers can be used in host systems that require either internally or externally calibrated digital diagnostics.

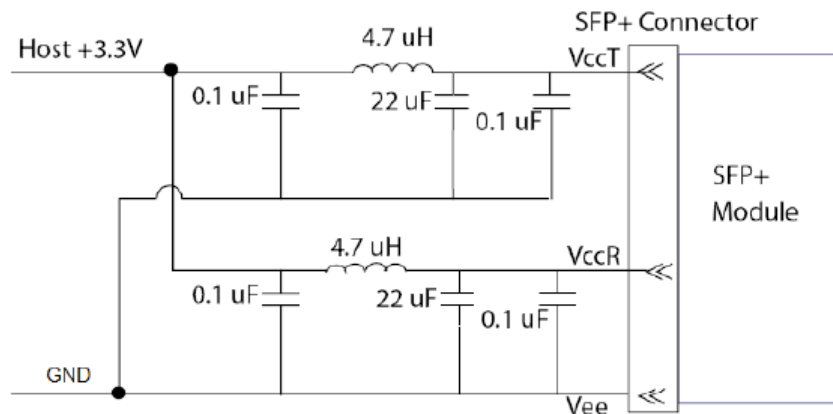
Parameter	Units	Accuracy
Transceiver temperature	°C	±5
Transceiver supply voltage	V	±3%
Transmitter bias current	mA	±10%
Transmitter output power	dBm	±3dB
Receiver average optical input power	dBm	±3dB

### Regulatory Compliance

The KW3F01D complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

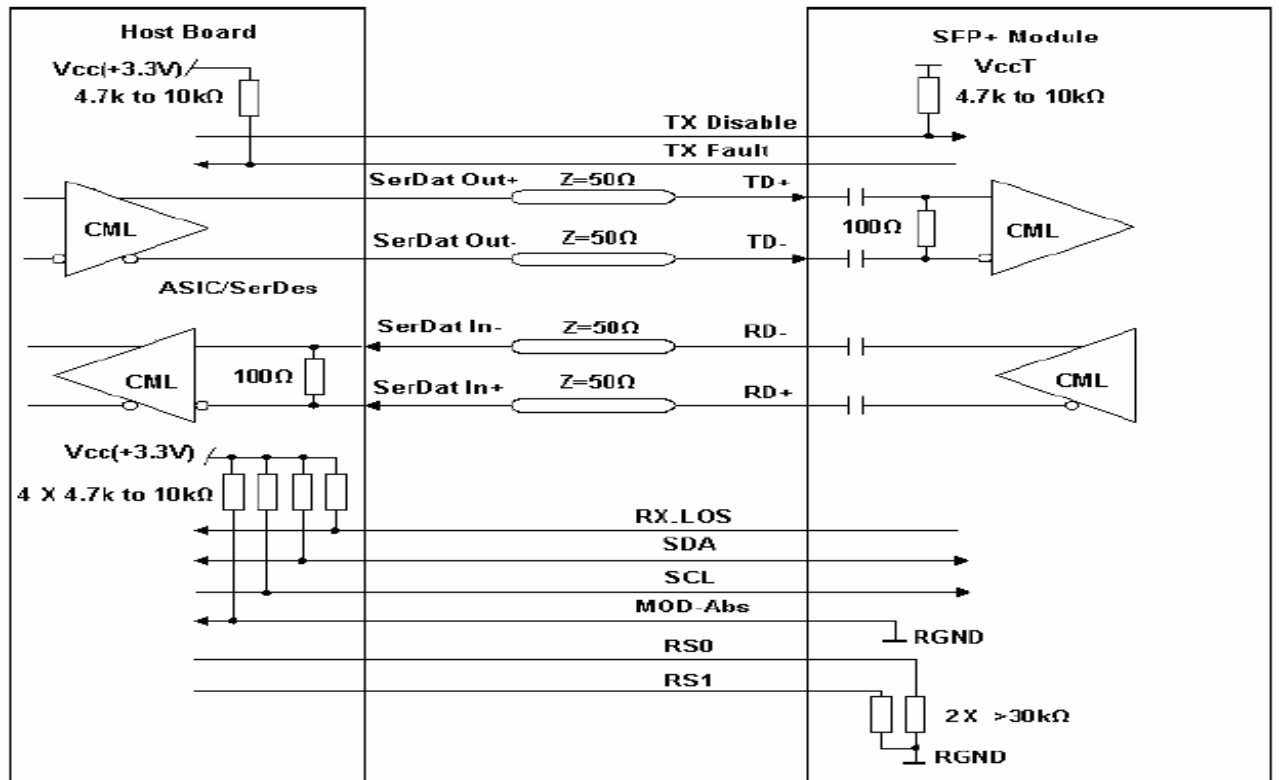
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>1000 V)
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2 GR-1089-CORE	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class 1 laser product.

### Recommended Circuit



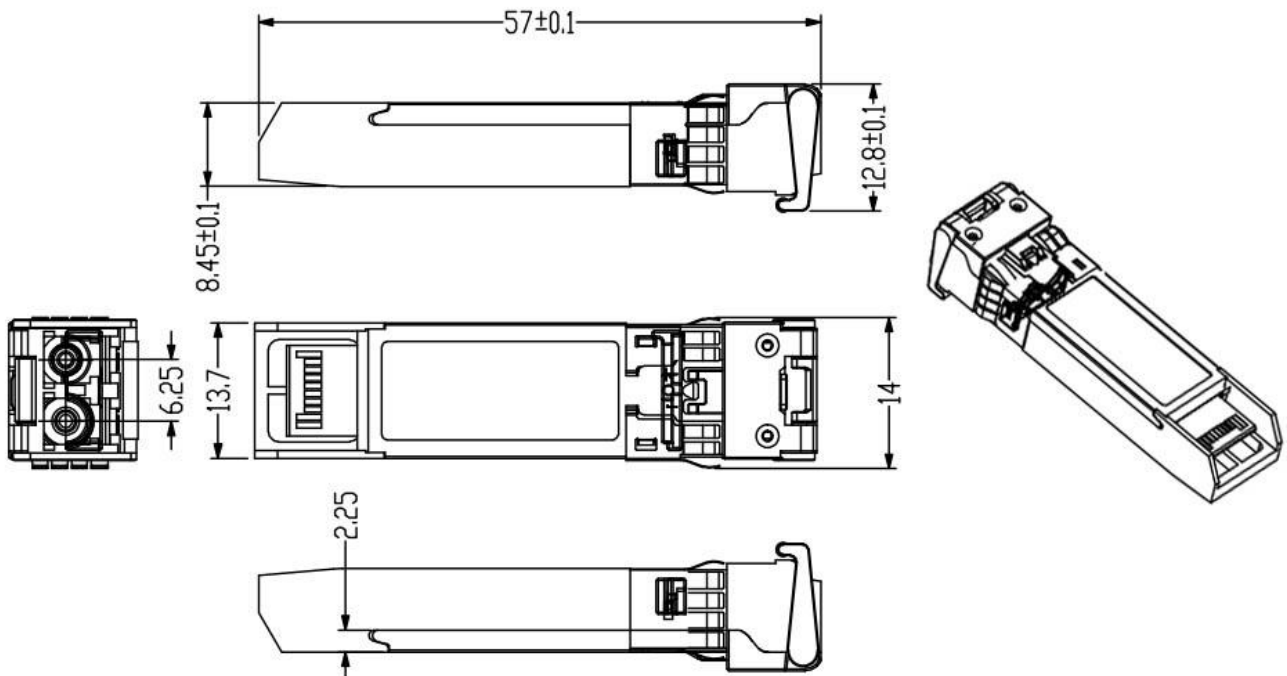
**Recommended Host Board Power Supply Circuit**

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**Recommended High-speed Interface Circuit**

● **Mechanical Dimensions:**



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