

FB1M2KPR

Industrial Ethernet Fiber Optic OptoLock® Transceiver

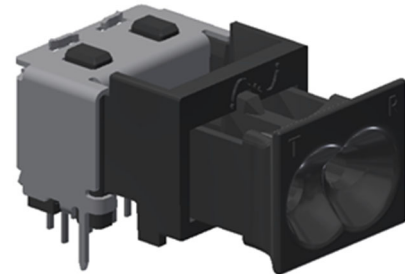
Data Sheet



Firecomms Industrial OptoLock® transceiver has a small form factor housing which combines a pair of Firecomms fiber optic components to provide instant termination for bare Plastic Optical Fiber (POF). As this POF port significantly simplifies the optical connection, it reduces maintenance time for industrial equipment.

This OptoLock® transceiver carries a pair of Fast Ethernet Fiber Optic Transceivers (FOTs) designed to provide Ethernet data links over POF in industrial environments. The FOTs are compatible with LVPECL which is the standard bus for a Fast Ethernet physical layer interface IC supporting the IEEE 100Base-FX standard. The interface circuit is simple AC coupling to the PHY's data pins. Signal detect on the RX provides a link on/off diagnostic for the PHY and can be used for power saving.

OptoLock® is protected by U.S. patents 7,597,485 and 7,905,665, Chinese patents 101501545 A and 102135650 B and other international patents.



FEATURES

- Simple low-cost termination solution for 2.2 mm jacketed POF cables without a plug
- Compatible with IEEE 802.3u Fast Ethernet over fiber 100Base-FX data communications standard
- Compatible with Ethernet PHYs supporting 100Base-FX
- Resonant Cavity LED (RCLED) at red 650 nm with small emission aperture suitable for POF
- Integrated CMOS driver IC for RCLED
- High sensitivity CMOS receiver IC and PIN diode for one-step light to digital conversion
- Integrated optics to efficiently focus and direct light
- -40° to +85°C operating range
- RoHS compliant

AVAILABLE OPTIONS

Table 1
ORDERING INFORMATION / PART NUMBER

Industrial Ethernet OptoLock® Transceiver, 2.2 mm POF, Black	FB1M2KPR
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APPLICATIONS

Table 2
APPLICATIONS

Application	Industrial Networking
Standard	IEEE 802.3 (100Base-FX)
Distance	50 meters Step Index POF ^[1]
Speed	125 Mbps

Note: 1. Depending on the installation conditions

SPECIFICATIONS

Table 3
TRANSCEIVER PIN DESCRIPTION

Pin	Name	Symbol
Transmitter		
1	EMI Shield ^[1]	GND
2	Signal Input (Negative)	TD-
3	Signal Input (Positive)	TD+
4	Ground Pin ^[1]	GND
5	DC Power Input Pin 3.3 V	Vcc
6	Ground Pin ^[1]	GND
Receiver		
7	DC Power Input Pin 3.3 V	Vcc
8	Ground Pin ^[1]	GND
9	Signal Detect Output	SD
10	Data Output (Negative)	RD-
11	Data Output (Positive)	RD+
12	EMI Shield ^[1]	GND

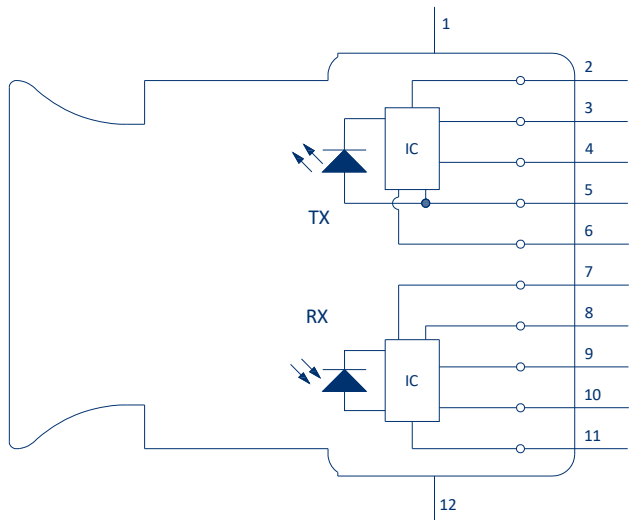


FIGURE 1
Transceiver pin-out, top view

1. NB: EMI Shield ground pins must be connected to the signal ground plane on the PCB. This is important to prevent cross-talk between TX and RX and also to shield the FOT's from external EMI/EMC and ESD

Table 4
REGULATORY COMPLIANCE

Parameter	Symbol	Standard	Level
Storage Compliance	MSL	J-STD-020E	2a (4-week floor life)
Restriction of Hazardous Substances Directive	RoHS	Directive 2011/65/EU	Certified compliant
Eye Safety		IEC 60825-1	LED Class 1

RECOMMENDED APPLICATION CIRCUIT

Figure 2 is the general interface circuit. Each Ethernet PHY manufacturer recommends a termination configuration for its own design. Examples of the most commonly used PHYs are given in the Firecomms Ethernet Application Note.

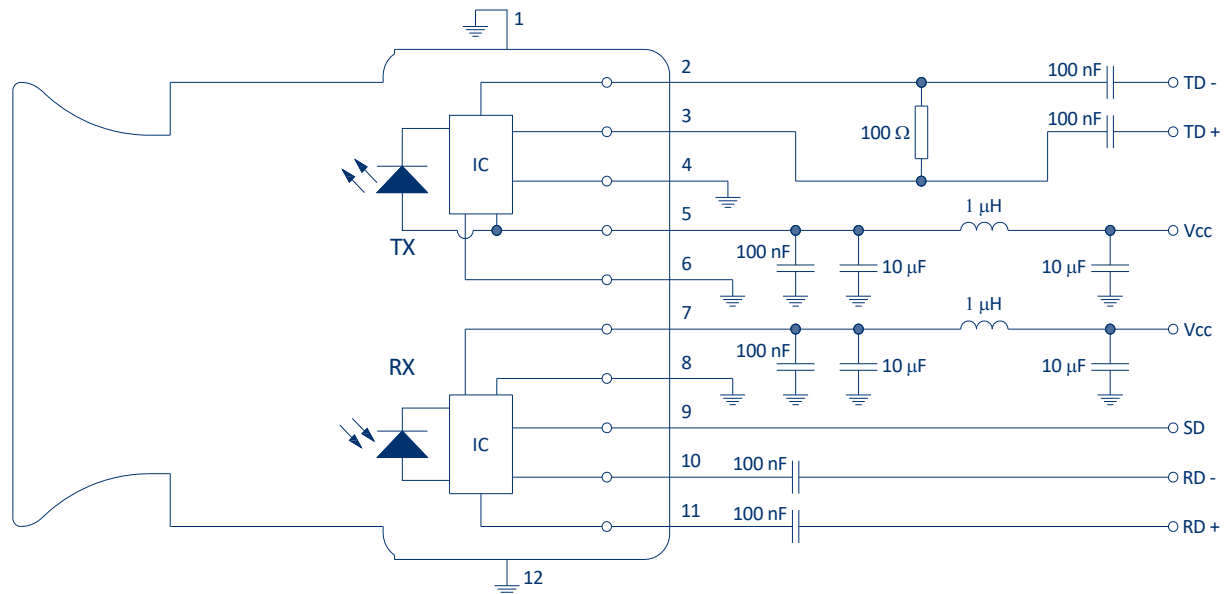


FIGURE 2

Recommended application circuit schematic to AC couple to an Ethernet PHY

Notes:

1. The transmitter (TX) and receiver (RX) are electrically shielded from each other to prevent crosstalk. To be effective this shield must be grounded
2. Both GND pins of the TX FOT must be connected to GND (they are not connected internally).
3. Power line capacitors should be located as close as possible to the FOT's DC power PINS.
4. The data lines are impedance-matched differential pairs. The PCB layout for these tracks must comply to IEEE standards for high-speed data and impedance matching.
5. Note: The RD + and RD - are already terminated with a 100 Ω resistor internally at the output stage.

ELECTRONIC BLOCK DIAGRAM

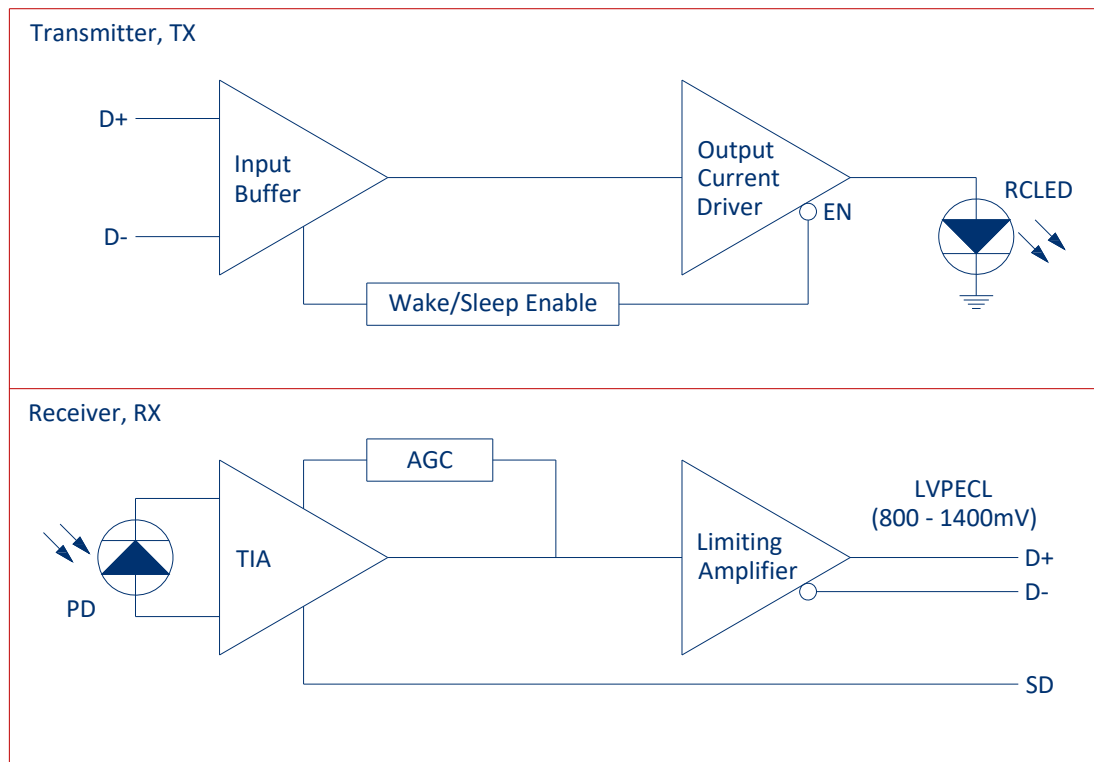


FIGURE 3
Electronic block diagrams of the TX and RX fiber optic transceivers

SPECIFICATIONS

Table 5
ABSOLUTE MAXIMUM RATINGS

These are the absolute maximum ratings at or beyond which the component can be expected to be damaged

Notes:

1. 260 °C for 10 seconds, one time only, at least 2.2 mm away from lead root

Parameter	Symbol	Minimum	Maximum	Unit
Storage Temperature	T_{stg}	-40	+85	°C
Operating Temperature	T_{op}	-40	+85	°C
Soldering Temperature ^[1]	T_{sld}		+260 ^[1]	°C
Supply Voltage	V_R	-0.5	4.5	V
Receiver Optical Overload	P_{OL}		0	dBm

SPECIFICATIONS

Table 6
TRANSMITTER ELECTRICAL AND OPTICAL CHARACTERISTICS

Parameter	Symbol	Min	Typical	Max	Unit	Test Condition
DC Supply Voltage	V _{CC}	3.0	3.3	3.6	V	
Operating Current Consumption	I _{CC}	30	37	52	mA	
Data Rate		10		125	Mbps	
Data Input Capacitance	C _{IN}			5	pF	
Data Input Resistance (Single-Ended)	R _{IN}		5		kΩ	
Input Common-Mode Range	V _{IN-BIAS}	GND+0.8		V _{CC} -0.8	V	
Input Voltage Swing	V _{IN-SWING}	100		1200	mV	
Minimum Differential Voltage Swing to Ensure Wake-Up	Wake-up Input	50			mV	
Wake-Up Time Delay			5	80	μs	
Optical Power OFF Delay		0.02		20	μs	
Peak Wavelength	λ _{peak}	640	660	670	nm	
Spectral Bandwidth (FWHM)	Δλ	18	24	27	nm	
Average Optical Power	P	-10	-5.5	-1.5	dBm	[3]
Optical Rise Time (20 % - 80 %)	t _R	0.5	1.3	3.1	ns	
Optical Fall Time (80 % - 20 %)	t _F	0.4	0.5	0.75	ns	
Optical Modulation Amplitude	OMA	160	590	1250	μW	
Open Eye Width	T _{eye}	6.5	7.4	7.9	ns	

Table 7
RECEIVER ELECTRICAL AND OPTICAL CHARACTERISTICS

Test Conditions:

1. Test data was validated over the full temperature range of -40 °C to +85 °C, and over the supply range of 3 V to 3.6 V
2. Test data represents operation at the maximum data rate of 100 Mbps using a PRBS7 test pattern (8B/10B encoding, 250 MBd) unless otherwise stated
3. Optical power was coupled from a minimum 0.5 m length of 1 mm diameter core and 0.5 NA step index POF

Parameter	Symbol	Min	Typical	Max	Unit	Test Condition
DC Supply Voltage	V _{cc}	3.0	3.3	3.6	V	
Operating Current Consumption	I _{cc}	35	43	50	mA	
Output Impedance Between D and <u>D</u>	R _{Diff}		100		Ohm	
Offset Common Mode Voltage	V _{ocm}		1.41		V	
Output Differential Voltage Swing		800	1150	1400	mV	
Receivable Optical Power Sensitivity			-26	-24	dBm	
Maximum Allowed Optical Power				0	dBm	
Rise Time (10 % - 90 %)			1.6	3.4	ns	
Fall Time (90 % - 10 %)			1.6	3.4	ns	
Signal Detect Assert/De-Assert time	T _{SD}	0.1	0.3	0.6	us	
Signal Detect Optical Assert Level	P _{SD-AS}	-32	-27	-24	dBm	
Signal Detect Optical De-Assert Level	P _{SD-DAS}	-32	-28	-25	dBm	
Signal Detect Voltage High	V _{SDH}	2.4	3.0	3.6	V	
Signal Detect Voltage Low	V _{SDL}	0.0	0.05	0.1	V	
Open Eye Width	EW	5.7	7.4	7.9	ns	

MECHANICAL DATA

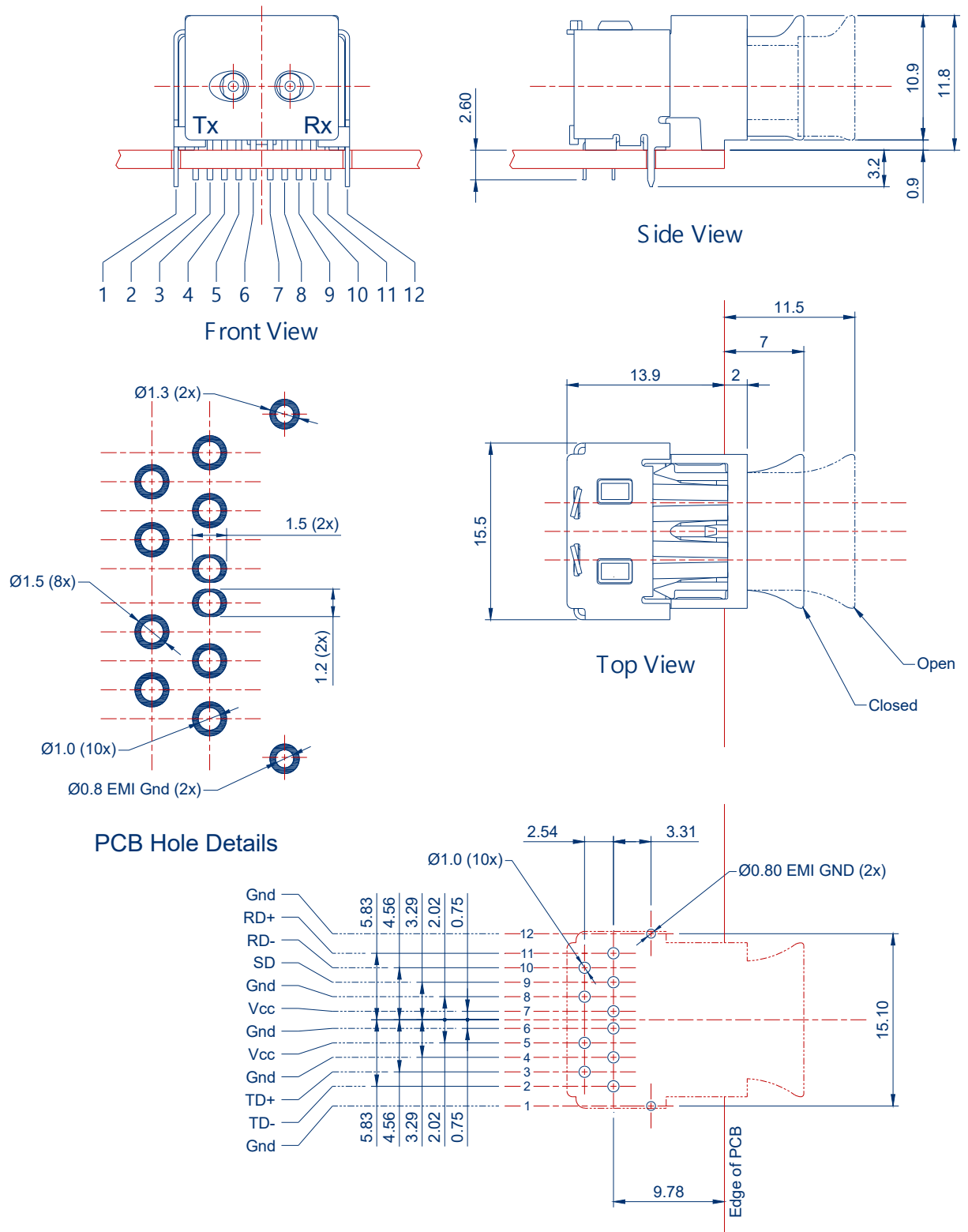


FIGURE 4

Mechanical dimensions of the product, and PCB footprint, which is a top view

General dimensional tolerance is ± 0.2 mm

NOTE: For PCB layout extra care is required with pin 6 and pin 7. On the PCB top and bottom metal they require a non-circular pad. The VIA's are standard plated circular through holes, however, the VIA top and bottom solder pad areas are non-circular 1.2 mm wide and 1.5 mm long oval shapes.

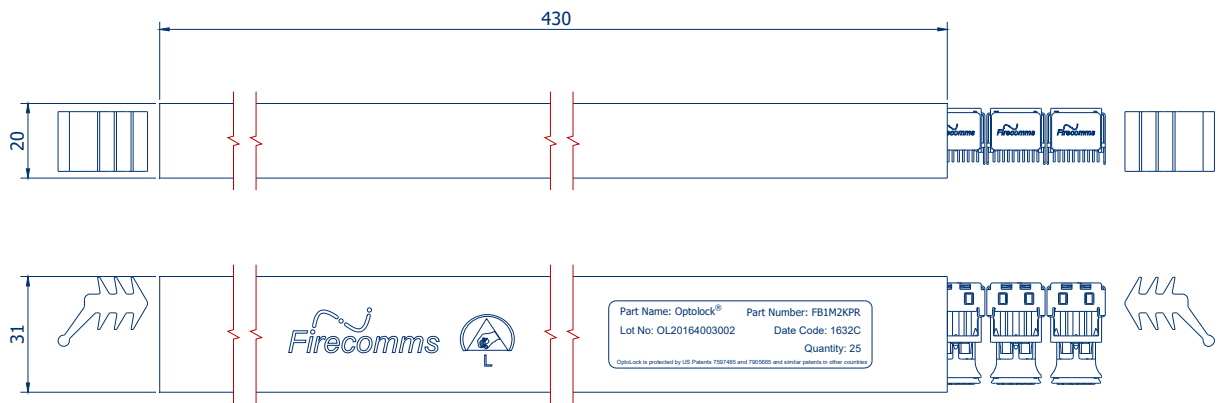


FIGURE 5
Packing tube for Firecomms FB1M2KPR OptoLock® Transceivers

PART HANDLING

The transceivers are tested for handling in static-controlled assembly processes (HBM). Cleaning, degreasing and post solder washing should be carried out using standard solutions compatible with both plastics and the environment. For example, recommended solutions for degreasing are alcohols (methyl, isopropyl and isobutyl). Acetone, ethyl acetate, phenol or similar solution based products are not permitted.

In the soldering process, non-halogenated water soluble fluxes are recommended. These components are not suitable for use in reflow solder processes (infrared/vapor-phase reflow). The dust plug should remain in place during soldering, washing and drying processes to avoid contamination of the active optical area of each connector.

The Moisture Sensitivity Level (MSL) classification of this device is 2a according to JEDEC J-STD-020E. The shelf life of an unopened MBB (Moisture Barrier Bag) is 24 months at < 40 °C and < 90 % R.H. Once the Moisture Barrier Bag is opened the devices can be either

- a) Stored in normal factory conditions < 30 °C and < 60 % R.H. for a maximum of 672 hours (4 Weeks) prior to soldering.
- b) Stored at < 10 % R.H. (Dry Cabinet).

PACKING INFORMATION

Components are packed in PVC anti-static tubes in moisture barrier bags. Bags should be opened only in static-controlled locations, and standard procedures should be followed for handling moisture sensitive components

Components per Tube	25
Tube Length	430 mm
Tube Height	20 mm
Tube Depth	31 mm
Tubes per Bag	10
Bags per Inner Carton	1
Inner Carton Length	588 mm
Inner Carton Width	147mm
Inner Carton Height	84 mm
Weight per Inner Carton, Complete	1.80 kg
Components per Inner Carton	250
Inner Cartons per Outer Carton	4
Outer Carton Length	600 mm
Outer Carton Width	310 mm
Outer Carton Height	195 mm
Weight per Outer Carton, Complete	7.53 kg
Components per Outer Carton	1,000

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