

FE50MKIR FE50MKNR

DC-50 Fiber Optic OptoLock Transceiver

Preliminary Data Sheet



DESCRIPTION

The Firecomms DC-50 MBd OptoLock[®] transceiver consists of a highly reliable Resonant Cavity Light Emitting Diode (RCLED) with integrated driver IC as a visible optical transmitter and a receiver with a fully integrated photodiode and receiver IC. They are housed in Firecomms patented OptoLock[®] for fast simple termination of Plastic Optic Fiber (POF). They are capable of delivering 50 Mbps digital signals over fiber and operate in the temperature range of -40 °C to +85 °C. The device can operate from 5 V or 3.3 V DC power supply rails and can tolerate +/-10 % supply variation.

The transmitter contains a red wavelength RCLED with fully integrated precision driver IC, designed to provide a communication link over POF. The RCLED in this transceiver is a highly reliable visible incoherent light source requiring low operating current. The use of intrinsically eye-safe, visible light simplifies link set-up and testing. The transmitter has a non-inverting output.

The receiver is a robust optical to electrical receiver with integrated pulse width distortion minimization circuitry for reliable data transmission. The receiver features a push-pull TTL compatible CMOS output. The receiver is available in inverting and non-inverting options with an RSSI function for link health status.

AVAILABLE OPTIONS

Table 2
ORDERING INFORMATION / PART NUMBERS

DC-50 Mb Optolock Non-Inverting Tx, Inverting Rx	FE50MKIR
DC-50 Mb Optolock Non-Inverting Rx, Non-Inverting Rx	FE50MKNR



FEATURES

- Visible RCLED at red wavelength (650 nm)
- Optimized for data transmission from DC to 50 MBd
- Industrial temperature range -40 °C to +85 °C
- Push Pull TTL Compatible CMOS output
- Dual 5 V and 3.3 V power supply with +/- 10 % supply rail tolerance
- RoHS compliant and flame retardant
- (UL 94 V-0) connector housings
- Ultra-low pulse width distortion to limit pulse distortion from burst mode data
- RSSI output function from receiver

APPLICATIONS

Table 1
APPLICATIONS

Application	Automation and Industrial Control. Serial Communications. Voltage Isolation.
Standard	Serial RS232, RS485, CAN-Bus, MODBUS, Profibus
Distance	50 meters Step Index POF ^[1]
Speed	DC to 50 MBd

Note: 1. Depending on the installation conditions

SPECIFICATIONS

Table 3
TRANSCEIVER PIN DESCRIPTION

Pin	Name	Symbol
Transmitter		
1	EMI Shield ^[1]	GND
2	Data Input (TTL)	V _{in}
3	Ground	GND
4	Ground	GND
5	V _{cc} (5/3.3 V)	V _{cc}
6	V _{cc} (5/3.3 V)	V _{cc}
Receiver		
7	V _{cc} (5/3.3 V)	V _{cc}
8	V _{cc} (5/3.3 V)	V _{cc}
9	Ground	GND
10	Data Output	V _o
11	RSSI	RSSI
12	EMI Shield ^[1]	GND

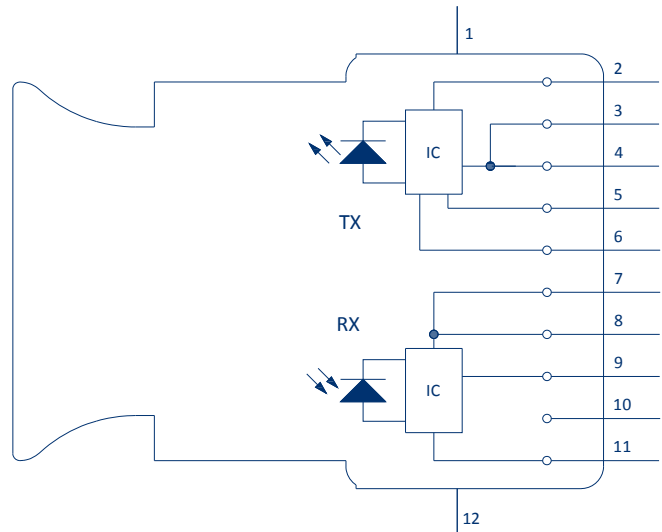


FIGURE 1
Transceiver pin-out, top view

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
Electrostatic Discharge, Human Body Model (contact ESD)	HBM	Mil-STD-883	Level 2 (4 kV)
UL Certification	UL	60950-1	Files No. Pending
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 CIRCUIT

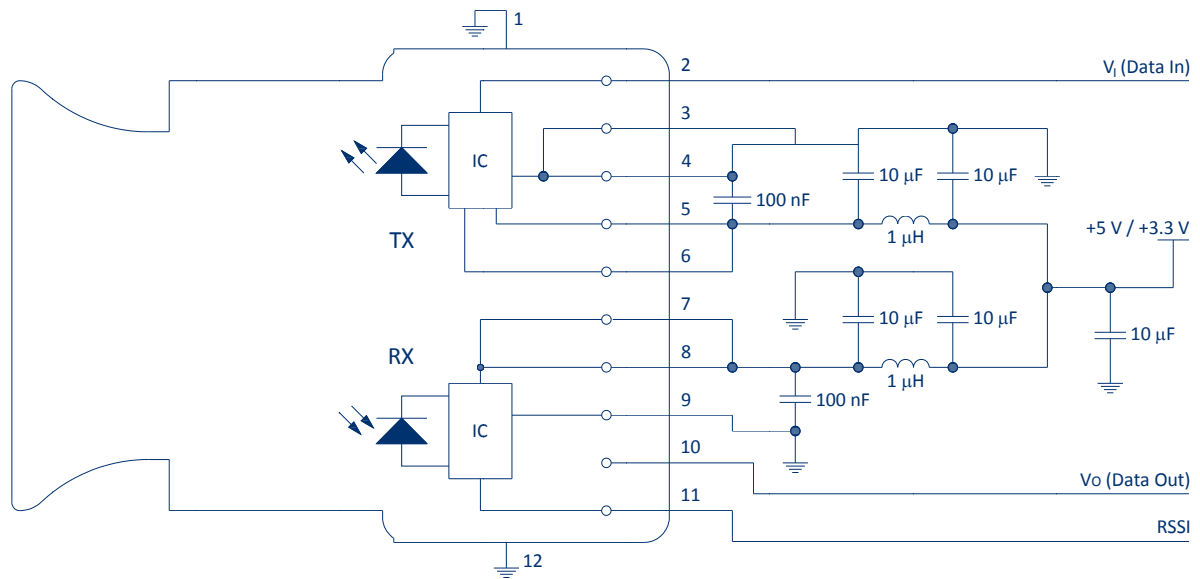


FIGURE 2
Recommended application circuit

RSSI

This OptoLock transceiver provides a Receive Signal Strength Indicator (RSSI) output from its 50 MBd receiver. This tells the user the Average Optical Power (AOP) currently present on the optical link. This measurement provides a health status that can be communicated to the wider network. To measure RSSI, place a resistor (R_L) to ground to generate V_{RSSI} . V_{RSSI} is an analogue voltage equal to Average Optical Power. This output must go into a sensor input.

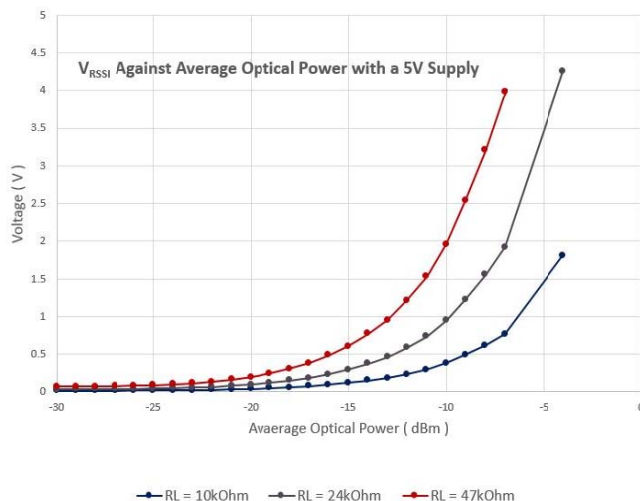


FIGURE 3
5V supply: V_{RSSI} Post Op-Amp V's Optical Power (dBm)

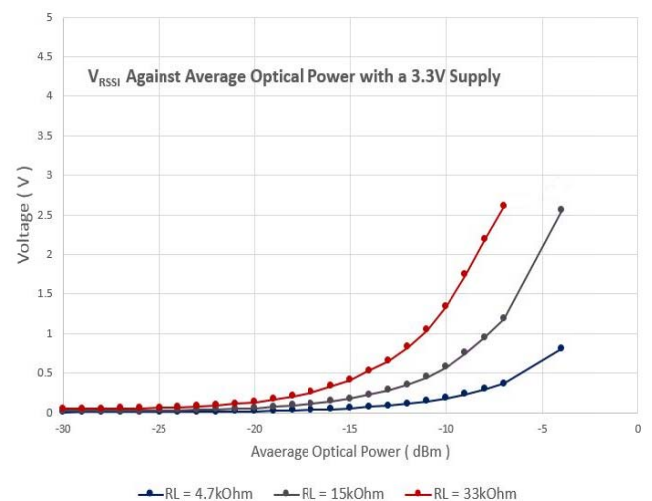


FIGURE 4
3.3V supply: V_{RSSI} Post Op-Amp V's Optical Power (dBm)

SPECIFICATIONS

Table 5
ABSOLUTE MAXIMUM RATINGS

These are the absolute maximum ratings at or beyond which the FOT 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 [1]	T _{op}	-40	+85	°C
Soldering Temperature [1]	T _{sld}		+260 ^[1]	°C
Supply Voltage (TX, RX)	V _{cc}	-0.5	5.5	V
TX Input Voltage (Data in)	V _{IN}	-0.5	5.5	V
RX Output Current	I _o	-16	+16	mA

SPECIFICATIONS

Table 6
TRANSMITTER ELECTRICAL AND OPTICAL CHARACTERISTICS

Test Conditions:

1. Test data was validated over the full temperature range of -40 °C to +85 °C, and over both power supply rail options of 5 V and 3.3 V \pm 10%. Typical data out is at 25 °C, with 50 Mbps PRBS data and 3.3 V Supply
2. Output power levels are for peak (not average) optical output levels. For 50% duty cycle data, peak optical power is twice the average optical power
3. Electrical input pulse width is determined at 1.5 V and dV/dt between 1 V and 2 V shall not be less than 1 V/ns.
4. Emission Wavelength (centroid) $\lambda_c = \sum P_i \lambda_i / \sum P_i$. (Ref: EIA/TIA std. FOTP-127/6.1, 1991)
5. Spectral Width Root Mean Squared (RMS) $\lambda_{RMS} = (\sum P_i (\lambda_i - \lambda_c)^2 / \sum P_i)^{1/2}$. (Ref: EIA/TIA std. FOTP-127/6.3, 1991)
6. Wake Up Delay is the time from valid power up to valid data output, at 5 V or 3.3 V \pm 10%, with input data at 50% duty cycle

Parameter	Symbol	Min	Typical	Max	Unit	Test Condition
Supply Current	I _{CC}		21 @ 3.3 V 22 @ 5 V	35	mA	[1]
Input Voltage - Low	V _{IL}	-0.3		0.8	V	[1]
Input Voltage - High	V _{IH}	2.0		V _{CC} + 0.25	V	[1]
Data Input Capacitance	C _{in}			7	pF	
Data Input Resistance	R _{in}	10			MΩ	
Output Power	P _{High}	-6		0	dBm	[1,2]
Emission Wavelength (centroid)	λ _c	640	650	670	nm	[4]
Spectral Width (RMS)	λ _{RMS}			30	nm	[5]
Optical Rise time	t _r		1.6	5	ns	[1] (20 %-80 %)
Optical Fall time	t _f		1	2	ns	[1] (20 %-80 %)
Propagation Delay Low-to-High	t _{PropDly_LH}	23	29	37	ns	[1]
Propagation Delay High-to Low	t _{PropDly_HL}	23	29	37	ns	[1]
TX Pulse Width Distortion	PWD	-3.0		+3.0	ns	[1,4]
Wake Up Delay (power up)	t _{power-on}		20		μs	[6]

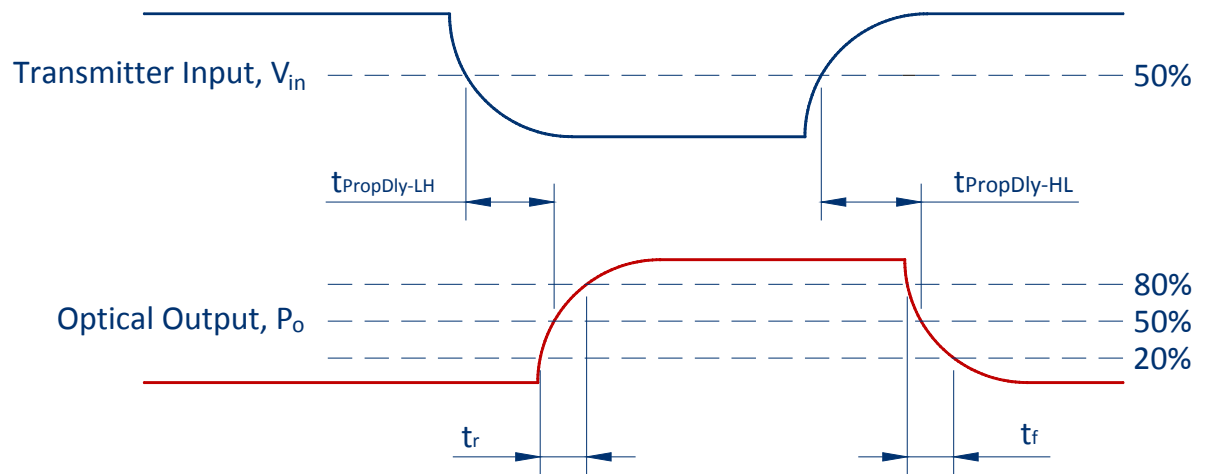


FIGURE 5
Transmitter Propagation Delay and rise/fall time definitions

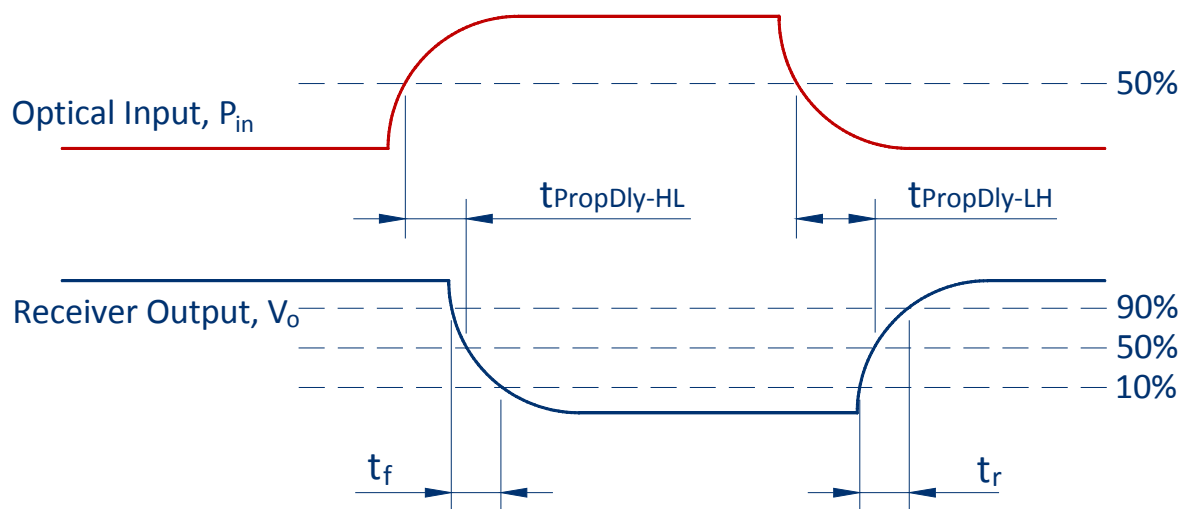


FIGURE 6
Receiver Propagation Delay and rise/fall time definitions

Table 7
RECEIVER ELECTRICAL AND OPTICAL CHARACTERISTICS

Test Conditions:

1. Wake up Delay is the delay from $V_{CC} > 2.75\text{ V}$ to when the output will respond correctly to optical input. Output is held in tristate before this time.
2. Test data was validated over the full temperature range of $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$, and over both supply rail voltage options of 5 V and $3.3\text{ V} \pm 10\%$ and over the input optical received power as specified by P_H and P_L . Input power levels are for peak (not average) optical input levels. For 50% duty cycle data, peak optical power is twice the average optical power. Data referred to as typical are rated at $+25\text{ }^{\circ}\text{C}$.
3. Testing in the recommended receiver circuit ($R_L = 50\text{ k}\Omega$, $C_L(\text{total}) = 15\text{ pF}$)
4. Optical signal from the recommended Transmitter circuit.
5. PWD for Optical Input of 50 MBd, NRZ 27-1 (PRBS7) data, resulting in a $BER \leq 10^{-9}$. PWD for 1st to 3rd pulse is characterized with minimum Optical Input pulse width of 20 ns, with the 1st pulse being the worst case. For pulses $> 20\text{ ns}$ the PWD will be less. If data rate $< 1\text{ MBd}$, then the pulse width distortion = PWD 1st to 3rd pulse.
6. Pins 1 and 12 are used for mounting and retaining purposes. It is required that pins 1 and 12 be connected to ground

Parameter	Symbol	Min	Typical	Max	Unit	Test Condition
Supply Current	I_{CC}		20	24	mA	[2,3,4]
Wake Up Delay (power up)	$t_{\text{power-on}}$		40		μs	[1]
High Level Output Voltage	V_{OH}	$V_{CC} - 0.05$		V_{CC}	V	$I_{OH-\text{max}} = 40\text{ }\mu\text{A}$, [2]
Low Level Output Voltage	V_{OL}	0		0.05	V	$I_{OL-\text{max}} = 1.6\text{ mA}$, [2]
Optical Power High	P_H	-22		+2	dBm	1 mm POF, [2,3]
Optical Power Low	P_L			-40	dBm	1 mm POF, [2,3]
Data Rate		DC		50	MBd	Min UI = 20 ns, Max f = 25 MHz
Output Rise Time (10/90%)	t_r			5	ns	[2,3,4]
Output Fall Time (10/90%)	t_f			5	ns	[2,3,4]
Pulse Width Distortion	PWD	-6		+6	ns	[2,3,5]
Pulse Width Distortion 1st to 3rd pulse	PWD_{init}	-6		+12	ns	[2,3,6]
Propagation Delay	$t_{\text{PropDly-HL}}$			40	ns	[2,3,5,6]
	$t_{\text{PropDly-LH}}$			40	ns	[2,3,5,6]

MECHANICAL DATA

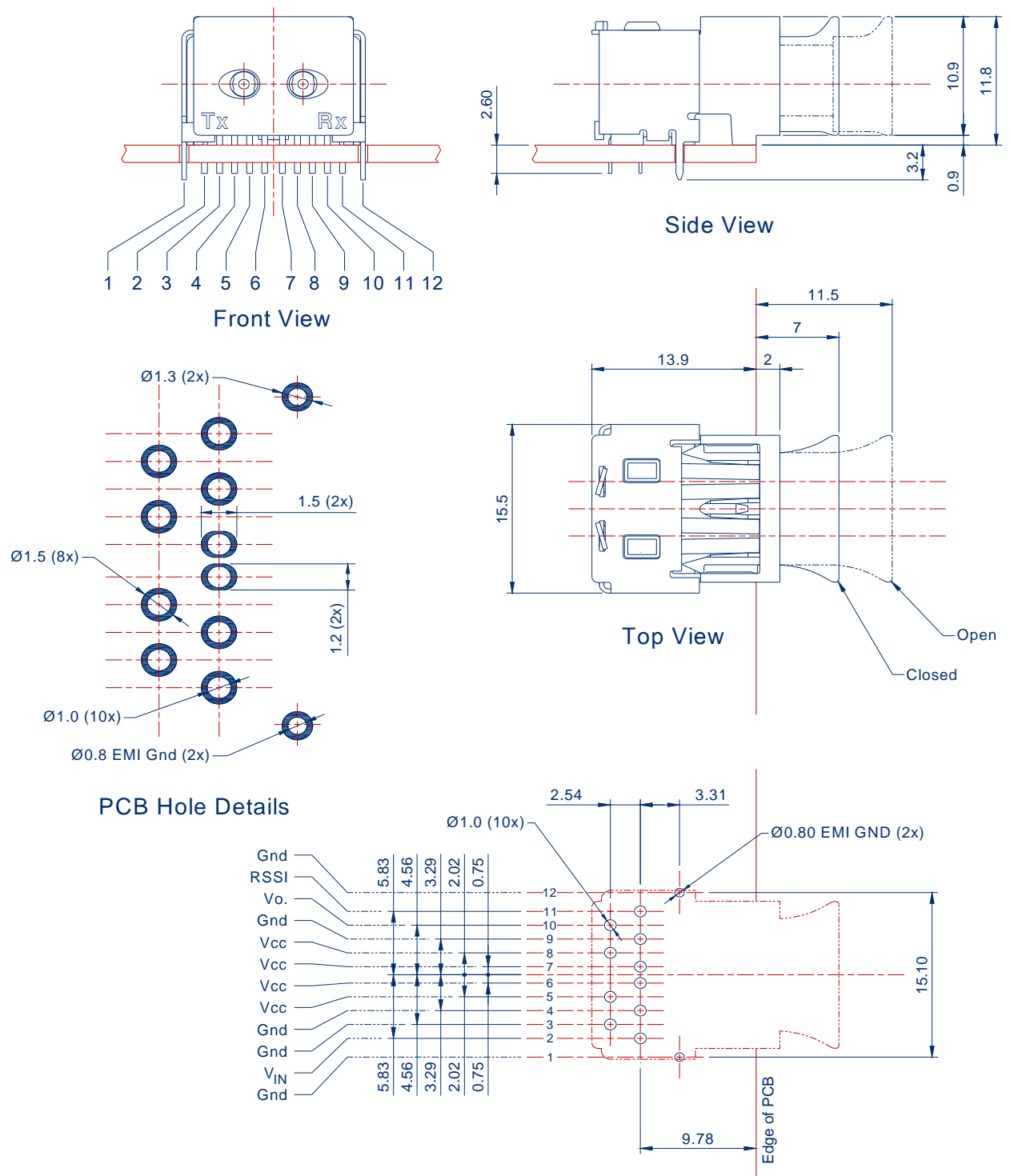


FIGURE 7

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.

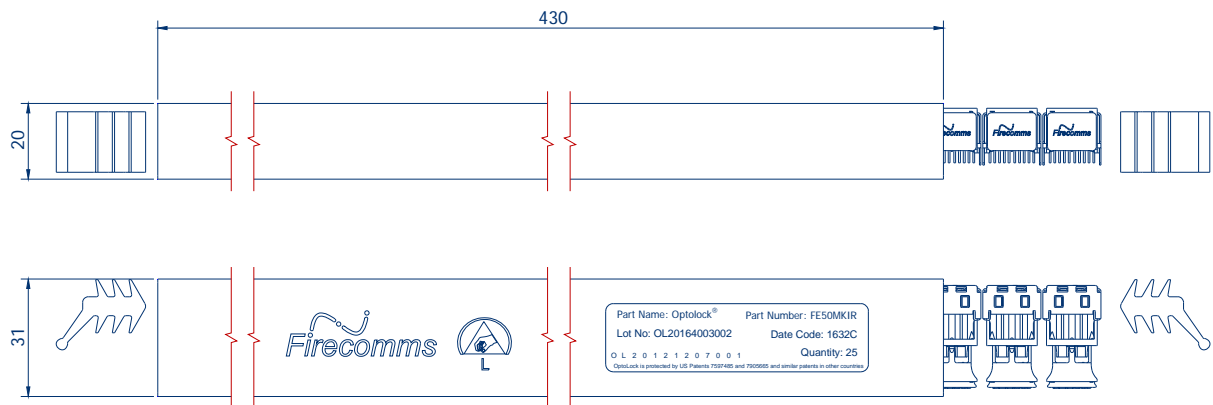


FIGURE 8
Packing tube for Firecomms FE50MKIR OptoLock® Transceivers

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 connectors 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

- Stored in normal factory conditions < 30 °C and < 60 % R.H. for a maximum of 672 hours (4 Weeks) prior to soldering.
- 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 Width	31 mm
Tube Height	20 mm
Tubes per Bag	10
Bags per Inner Carton	1
Inner Carton Length	588 mm
Inner Carton Width	147 mm
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	1000

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