

# FR50MxxR

## DC-50 MBd RedLink® Fibre Optic Receiver

### Datasheet



### DESCRIPTION

Firecomms DC-50 MBd RedLink® receiver is a fully integrated photodiode and receiver IC. The receiver is housed in a miniature package to interface to plug-terminated lengths of Plastic Optic Fiber (POF) or 200 µm Plastic Clad Silica (PCS) fiber. When paired with the appropriate transmitter, the receiver is 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 rails and can tolerate ± 10 % supply variation.

The receiver is a robust optical to electrical receiver with integrated pulse width distortion minimisation circuitry for reliable data transmission. The receiver features a push-pull TTL compatible CMOS output. It is available in inverting and non-inverting options.

### AVAILABLE OPTIONS

Table 1

#### ORDERING INFORMATION / PART NUMBERS

50 MBd Horizontal Package Non-Inverting	FR50MHNR
50 MBd Horizontal Package Inverting	FR50MHIR
50 MBd Vertical Package Non-Inverting	FR50MVNR
50 MBd Vertical Package Inverting	FR50MVIR
50 MBd 30° Tilted Package Non-Inverting	FR50MWNR
50 MBd 30° Tilted Package Inverting	FR50MWIR

### FEATURES

- Ideal for use with POF or PCS fiber
- Optimised for data rates from DC to 50 MBd
- Industrial Temperature Range -40 °C to +85 °C
- Dual 5 V and 3.3 V power supply with 10 % rail tolerance
- RoHS compliant and flame retardant (UL 94 V-0)
- Inverting and Non-Inverting options
- Horizontal Vertical and 30° Tilted options
- Push Pull TTL Compatible CMOS output
- Ultra-low pulse width distortion to limit pulse distortion from burst mode data
- Compatible with Versatile Link cables and connectors

### APPLICATIONS

Table 2  
APPLICATIONS

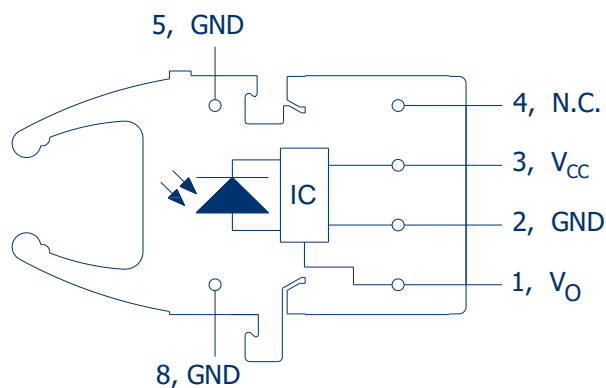
<b>Application</b>	Automation and Industrial Control. Serial Communications. Voltage Isolation.
<b>Standard</b>	Serial RS232, RS485, CAN-Bus, Modbus, PROFIBUS
<b>Distance</b>	50 meters Step Index POF <sup>[1]</sup> 300 meters with 200 µm PCS fiber <sup>[1]</sup>
<b>Speed</b>	DC to 50 MBd

Note: 1. Depending on the installation conditions

## SPECIFICATIONS

**Table 3**  
**RECEIVER PIN DESCRIPTION**

Pin	Name	Symbol
1	RECEIVER OUTPUT	$V_O$
2	RECEIVER GROUND	GND
3	RECEIVER VCC	$V_{CC}$
4	NO CONNECT <sup>(a)</sup>	NC
5	RETAINING PIN <sup>(b)</sup>	GND
8	RETAINING PIN <sup>(b)</sup>	GND

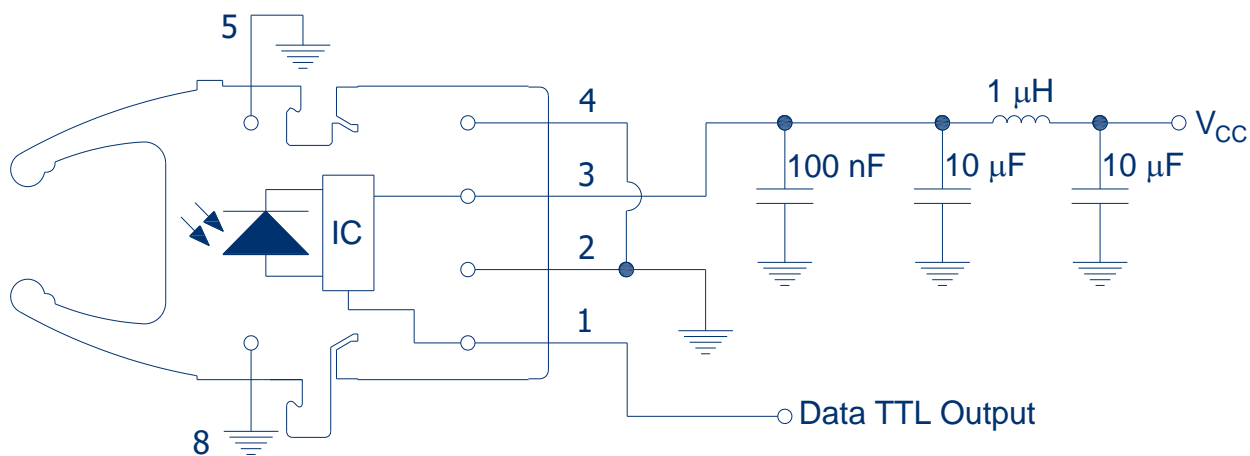


**FIGURE 1** Receiver pin-out, top view

**NOTE:**

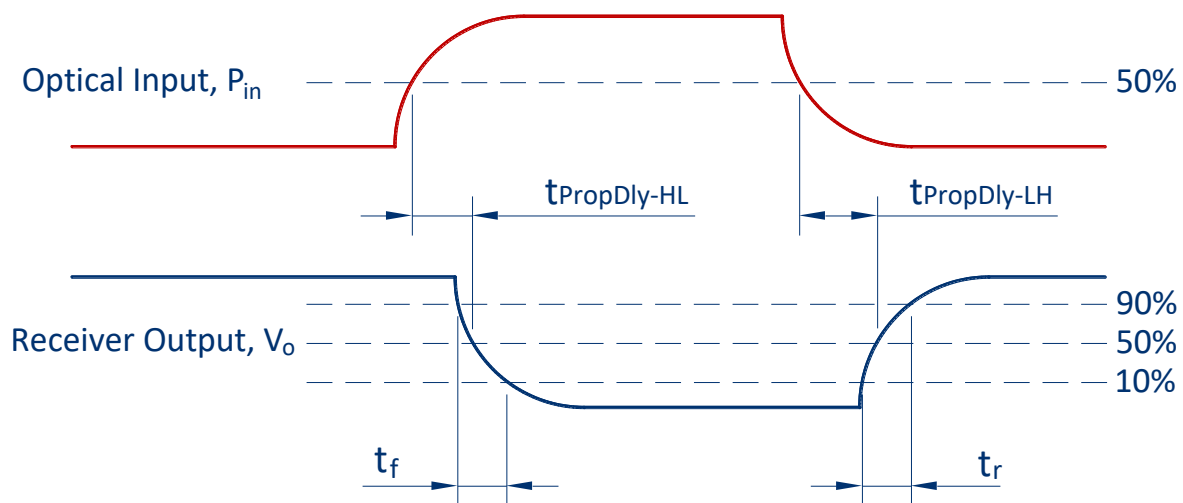
- a) Pin 4 is electrically isolated internally. Pin 4 may be externally connected to pin 1 for board layout compatibility with existing designs. Otherwise, it is recommended pin 4 be grounded as in Figure 2
- b) Pins 5 and 8 are only used for mounting and retention purposes. Connect to ground

## RECOMMENDED APPLICATION CIRCUIT

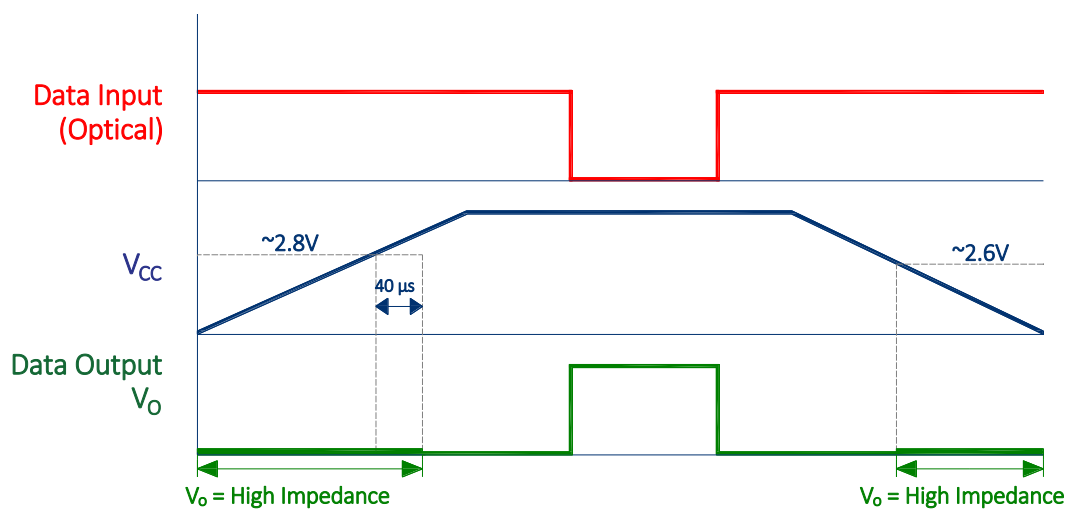


**FIGURE 2** RedLink® receiver application circuit

## GENERAL OPERATION FOR INVERTING RECEIVER



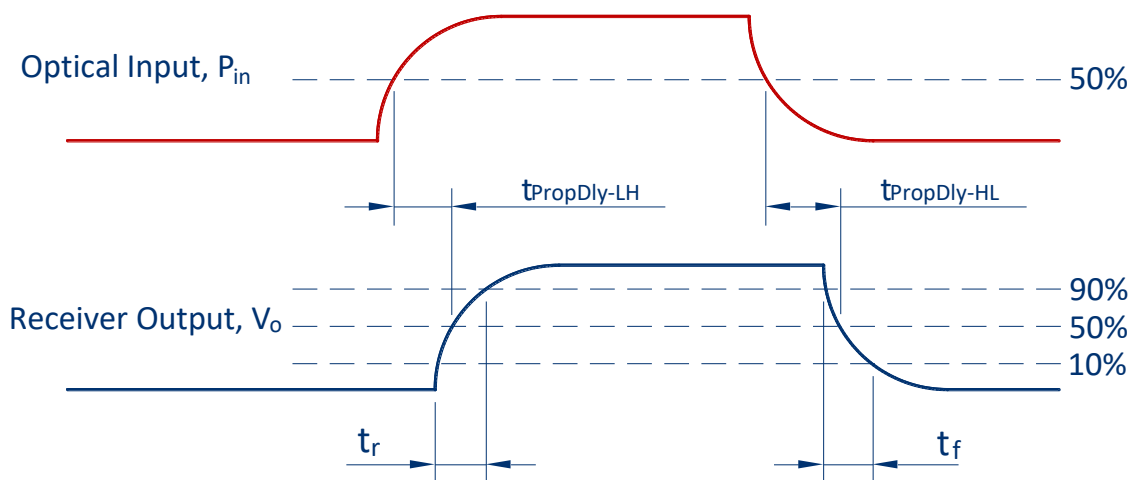
**FIGURE 3**  
Receiver propagation delay and rise/fall time definitions for an inverting receiver output



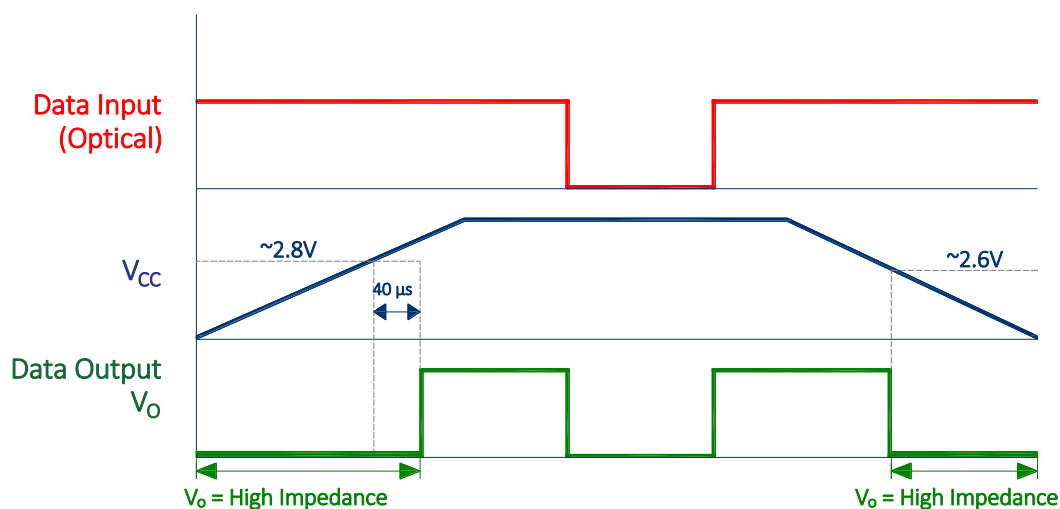
**FIGURE 4**  
Inverting receiver output operation during power cycling

Operation of the Inverting parts FR50MxxIR during power up, power down or power reset is illustrated above. During power up as  $V_{CC}$  rises to approximately 2.8 V, the output  $V_o$  is in a high impedance state. Within 40  $\mu$ s of  $V_{CC}$  reaching 2.8 V the output  $V_o$  will change to the correct logic state which in the diagram above is logic low as there is light present and the output is inverted relative to the light input. On power down once  $V_{CC}$  drops below approximately 2.6 V then  $V_o$  changes immediately to a high impedance state.

## GENERAL OPERATION FOR NON-INVERTING RECEIVER



**FIGURE 5**  
Receiver propagation delay and rise/fall time definitions for a non-inverting receiver output



**FIGURE 6**  
Non-Inverting receiver output operation during power cycling

Operation of the Non-Inverting parts FR50MxxNR during power up, power down or power reset is illustrated above. During power up as  $V_{CC}$  rises to approximately 2.8 V, the output  $V_o$  is in a high impedance state. Within 40  $\mu s$  of  $V_{CC}$  reaching 2.8 V the output  $V_o$  will change to the correct logic state which in the diagram above is logic high as there is light present and the output is non-inverting. On power down once  $V_{CC}$  drops below approximately 2.6 V then  $V_o$  changes immediately to a high impedance state.

## SPECIFICATIONS

**Table 4**  
**REGULATORY COMPLIANCE**

Parameter	Symbol	Standard	Level
Electrostatic Discharge, Human Body Model (contact ESD)	HBM	Mil-STD-883	Level 2 (4 kV)
Radiated Emissions Immunity	Vm <sup>-1</sup>	IEC 61000-4-3	15 Vm <sup>-1</sup>
UL Certification	UL	60950-1	File No. E362227
Storage Compliance	MSL	J-STD-020	2a (4 week floor life)
Restriction of Hazardous Substances Directive	RoHS	Directive 2011/65/EU Incl. Amendment 2015/863	Certified compliant

**Table 5**  
**ABSOLUTE MAXIMUM RATINGS**

*These are the absolute maximum ratings at or beyond which the FOT can be expected to be damaged. These ratings are stress ratings only.*

**Notes:**

1. 260°C for 10 seconds, one time only, at least 2.2 mm away from lead root
2. Applying conditions above absolute maximum ratings is destructive to the device. Functional operation of the device at conditions between maximum operating conditions (5.5 V) and absolute maximum ratings is not implied. Extended exposure to stresses above recommended operating conditions will have an effect on device reliability

Parameter	Symbol	Minimum	Maximum	Unit
Storage Temperature	T <sub>stg</sub>	-40	+85	°C
Operating Temperature	T <sub>op</sub>	-40	+85	°C
Soldering Temperature <sup>[1]</sup>	T <sub>slid</sub>		+260	°C
Receiver Supply Voltage <sup>[2]</sup>	V <sub>cc</sub>	-0.5	+7	V
Receiver Output Current	I <sub>o</sub>	-16	+16	mA

## SPECIFICATIONS

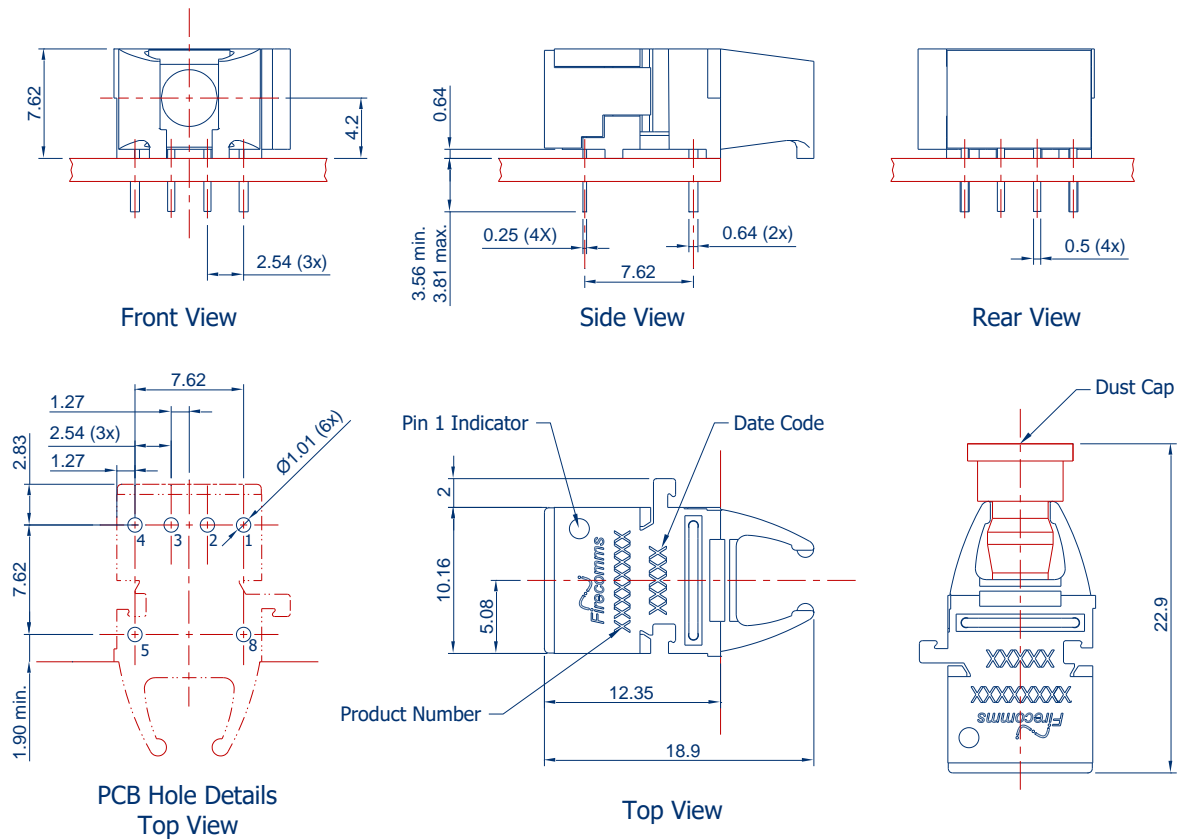
**Table 6**  
**RECEIVER ELECTRICAL AND OPTICAL CHARACTERISTICS**

*Test Conditions:*

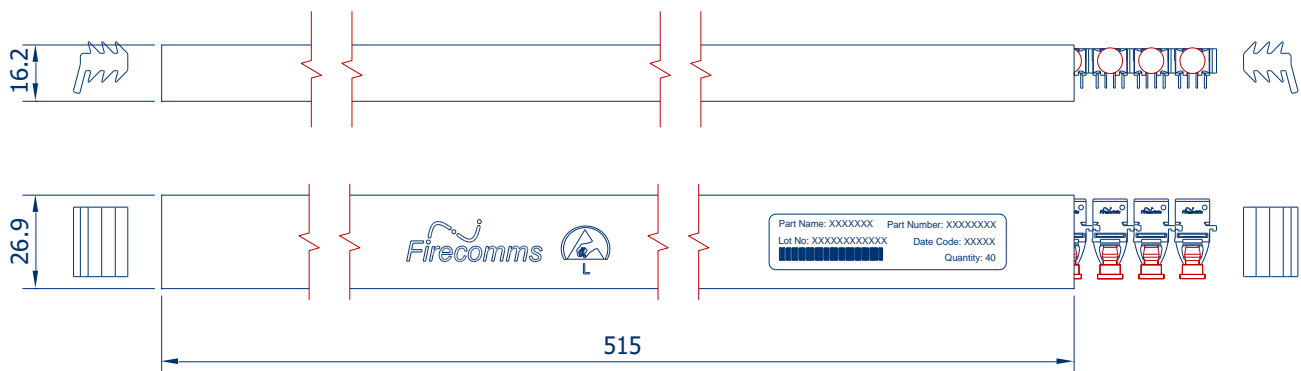
1. *Wake up Delay is the delay from  $V_{CC} > 2.75$  V to when the output will respond correctly to optical input. Output is held in tristate before this time*
2. *Test data was validated using a transmitter with an emission wavelength between 635 and 680 nm, with a 5ns rise and fall time, over the full temperature range of -40 °C to +85 °C, over both supply rail voltage options of 5 V and 3.3 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 °C*
3. *Optical signal from the recommended Transmitter circuit.*
4. *Testing in the recommended receiver circuit ( $R_L = 50$  k $\Omega$ ,  $C_L(\text{total}) = 15$  pF).*
5. *PWD for Optical Input of 50 MBd, NRZ 2<sup>7</sup>-1 (PRBS7) data, resulting in a BER  $\leq 10^{-9}$ .*
6. *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 ns the PWD will be less. If data rate < 1 MBd, then the pulse width distortion = PWD 1st to 3rd pulse.*
7. *The performance of the receiver as given in Table 6 has been characterized for transmitters operating between 635 and 680 nm. The receiver will nevertheless respond to optical sources operating from the visible to near infra-red regions although the precise performance may differ from that given in Table 6 depending upon the precise wavelength and rise/fall time characteristics of the optical source used.*

Parameter	Symbol	Min	Typical	Max	Unit	Test Condition
Supply Current	$I_{CC}$		20	25	mA	[2,3,4]
Wake Up Delay (power up)	$t_{\text{power-on}}$		40		$\mu$ s	[1]
High Level Output Voltage	$V_{OH}$	$V_{CC} - 0.05$		$V_{CC}$	V	$I_{OH\text{-max}} = 40$ $\mu$ A, [2]
Low Level Output Voltage	$V_{OL}$	0		0.05	V	$I_{OL\text{-max}} = 1.6$ mA, [2]
Optical Power High (OPH)	$P_H$	-22		+2	dBm	[2,3]
Optical Power Low (OPL)	$P_L$			-40	dBm	[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 for $P_H$ range -20 to + 2 dBm	PWD	-4		+4	ns	[2,3,4,5]
Pulse Width Distortion for $P_H$ range -20 to -22 dBm	PWD	-6		+6	ns	[2,3,4,5]
Pulse Width Distortion 1 <sup>st</sup> to 3 <sup>rd</sup> pulse	$PWD_{\text{init}}$	-7		+14	ns	[2,3,4,5,6]
Propagation Delay	$t_{\text{PropDly-HL}}$			50	ns	[2,3,4]
	$t_{\text{PropDly-LH}}$			50	ns	[2,3,4]
Optical Sensitivity Range	$\lambda_R$	400		900	nm	[7]

## MECHANICAL DATA, HORIZONTAL

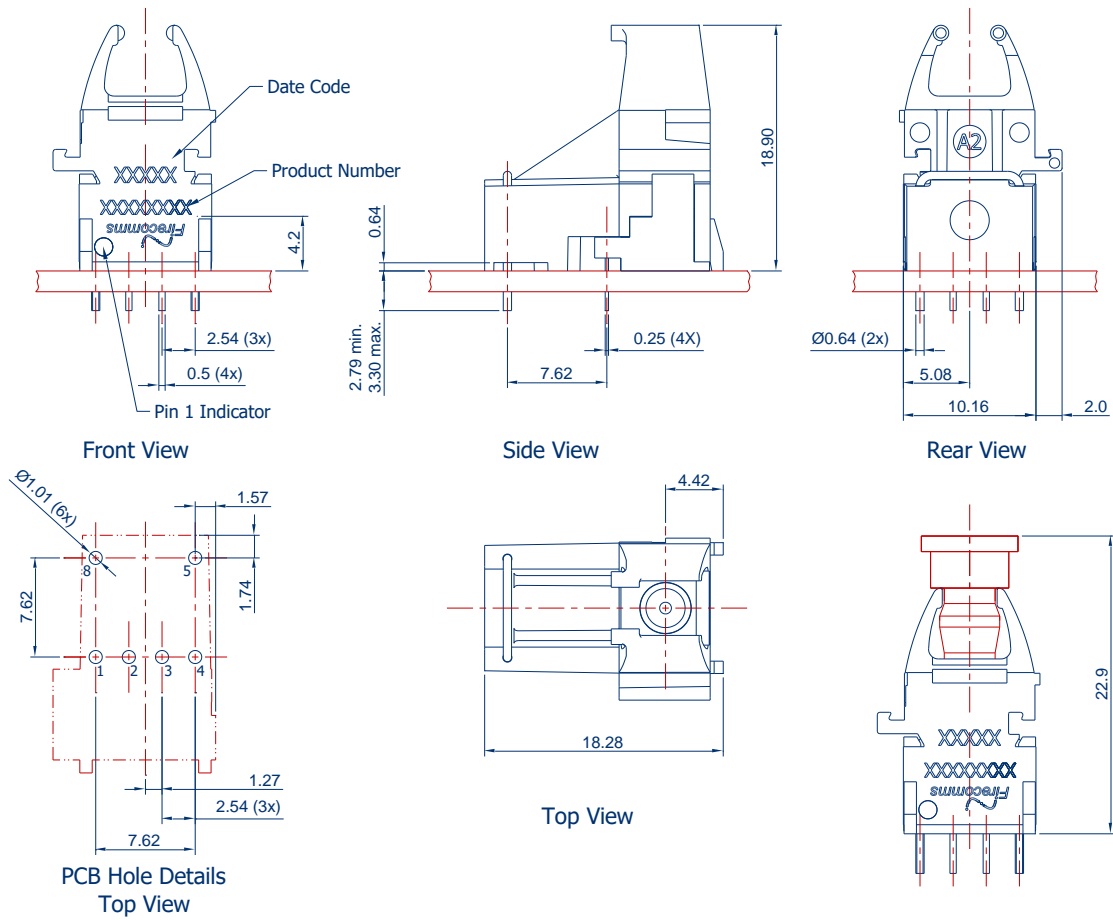


**FIGURE 7**  
 Mechanical dimensions of RedLink® horizontal connectors and PCB footprint, which is a top view  
 General dimensional tolerance is  $\pm 0.2$  mm

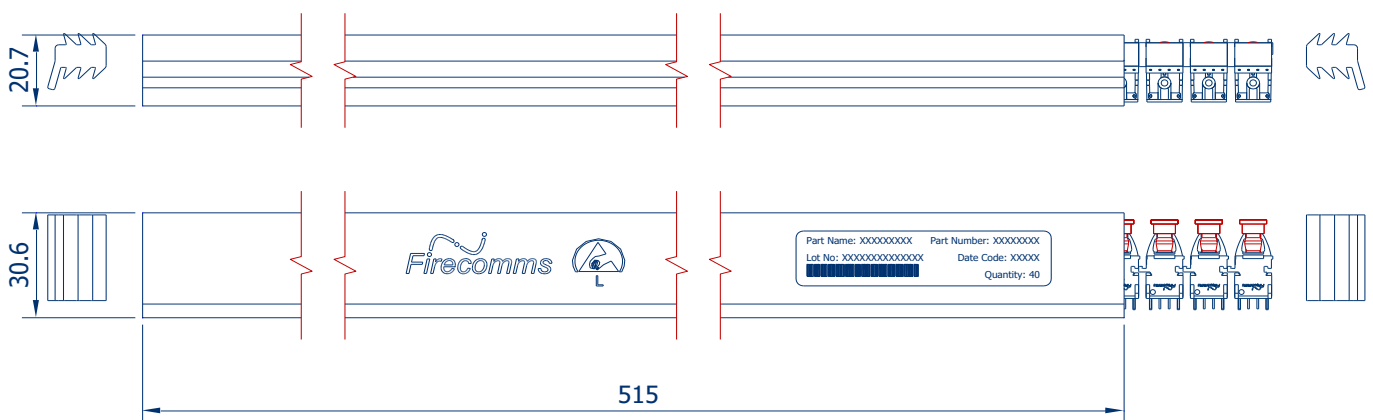


**FIGURE 8**  
 Packing tube for Firecomms RedLink® horizontal connectors

**MECHANICAL DATA, VERTICAL**



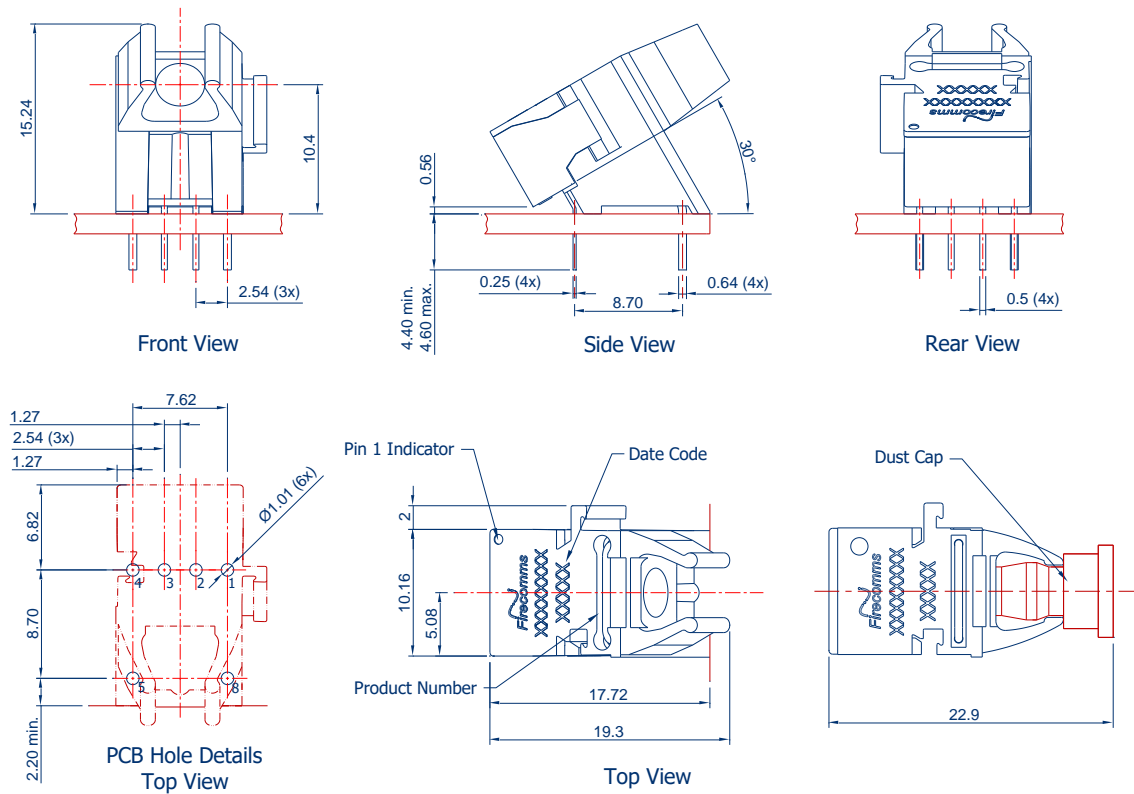
**FIGURE 9**  
 Mechanical dimensions of RedLink® vertical connectors and PCB footprint, which is a top view  
 General dimensional tolerance is  $\pm 0.2$  mm



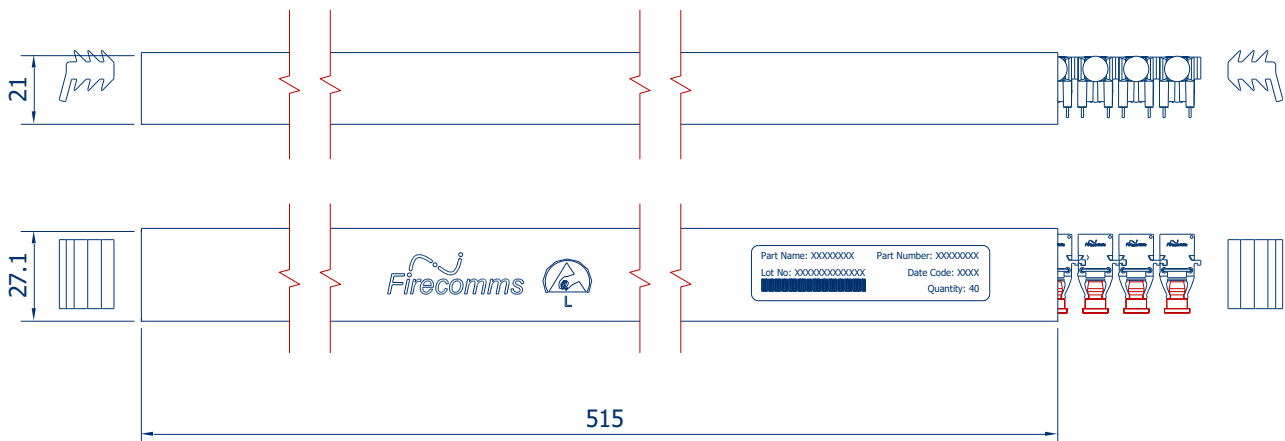
**FIGURE 10**  
 Packing tube for Firecomms RedLink® vertical connectors



## MECHANICAL DATA, 30° TILTED



**FIGURE 11**  
**Mechanical dimensions of RedLink® tilted connectors and PCB footprint, which is a top view**  
 General dimensional tolerance is  $\pm 0.2$  mm



**FIGURE 12**  
**Packing tube for Firecomms RedLink® tilted connectors**

## **PART HANDLING**

Firecomms RedLink® connectors are auto-insertable and tested for handling in static-controlled assembly processes (Human Body Model - 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. RedLink® 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 part.

The Moisture Sensitivity Level (MSL) classification of this device is 2a according to JEDEC J-STD-020.

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 and in moisture barrier bags. Bags should be opened only in static-controlled locations, and standard procedures should be followed for handling moisture sensitive components.

**Table 7**  
**PACKING INFORMATION**

	Horizontal	Vertical	Tilted
Components per Tube	40	40	40
Tube Length	515 mm	515 mm	515 mm
Tube Height	16.2 mm	20.7 mm	21 mm
Tube Depth	26.9 mm	30.6 mm	27.1 mm
Tubes per Bag	5	5	5
Bags per Inner Carton	1	1	1
Inner Carton Length	630 mm	630 mm	630 mm
Inner Carton Width	70 mm	70 mm	70 mm
Inner Carton Height	105 mm	105 mm	105 mm
Weight per Inner Carton, Complete	0.77 kg	0.92 kg	0.92 kg
Components per Inner Carton	200	200	200
Inner Cartons per Outer Carton	10	10	10
Outer Carton Length	650 mm	650 mm	650 mm
Outer Carton Width	235 mm	235 mm	235 mm
Outer Carton Height	376 mm	376 mm	376 mm
Weight per Outer Carton, Complete	8.13 kg	9.60 kg	9.60 kg
Components per Outer Carton	2,000	2,000	2,000

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