

FR05DxDR

RedLink® Fiber Optic Receiver for up to 20 V Voltage Switching

Datasheet



DESCRIPTION

Firecomms FR05DxDR RedLink® receiver is based on a fully integrated photodiode with TIA, limiting amplifier and a MOSFET open drain output to handle switching of voltages in the range from 3 to 20 V (e.g. 3.3, 5, 12, 15 V). The part also includes an optional 1 k Ω pull-up resistor RL.

Housed in non-conducting plastic the RedLink® receiver connector is blue. The housings are compatible with the Versatile Link style of fiber plug and are optimised for use with Plastic Optic Fiber (POF).

The receiver operates over the industrial temperature range of -40 °C to +85 °C supporting many industrial applications where reliable command and control response is required in electrically harsh environments.

The receiver is typically used at low switching speeds where 12 V and 15 V power electronic devices are being switched at kHz speeds

FEATURES

- MOSFET output stage typically used to switch 12 V and 15 V thyristor gate devices
- Optimised for data rates from DC to 5 MBd
- Industrial temperature range -40 °C to +85 °C
- Flame retardant (UL 94 V-0) connector housings
- Fully integrated photodiode, TIA and limiting amplifier in a single IC
- Integrated 1 k Ω pull-up resistor to V_{CC} (R_L)
- Low pulse width distortion
- Horizontal, Vertical and 30° Tilted options
- Compatible with Versatile Link cables and connectors

AVAILABLE OPTIONS

Table 1
ORDERING INFORMATION / PART NUMBERS

5 MBd Horizontal Package Inverting, Open Drain	FR05DHDR
5 MBd Vertical Package Inverting, Open Drain	FR05DVDR
5 MBd Tilted Package Inverting, Open Drain	FR05DWDR

APPLICATIONS

Table 2
APPLICATIONS

Application	Switching of 20 V, 18 V, 15 V and 12 V thyristor gate drivers. SCR and IGBT switching
Distance	50 meters Step Index (SI) POF in typical operating conditions 30 meters in worst case conditions
Speed	DC to 5 MBd (depending on series resistance and load capacitance)

SPECIFICATIONS

Table 3
RECEIVER PIN DESCRIPTION

Pin	Name	Symbol
1	RECEIVER OUTPUT	V_o
2	RECEIVER GROUND	GND
3	RECEIVER VCC	V_{CC}
4	R_L PULL-UP RESISTOR	R_L
5	RETAINING PIN	GND
8	RETAINING PIN	GND

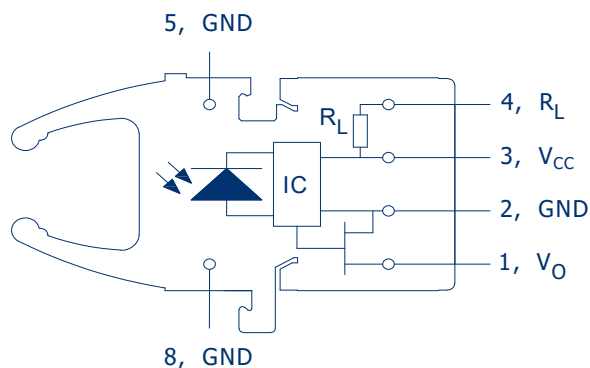


FIGURE 1
Receiver pin-out, top view

GENERAL OPERATION

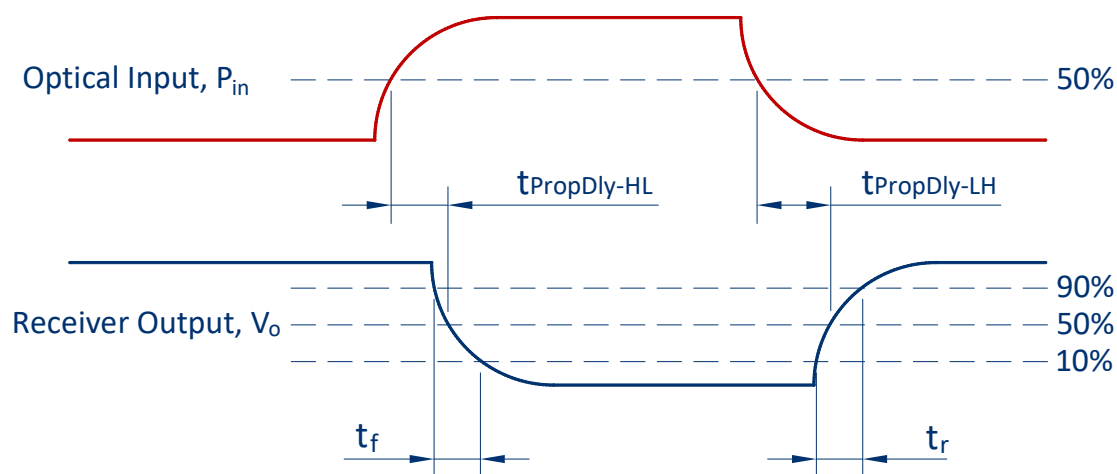


FIGURE 2
Receiver propagation delay and rise/fall time definitions

RECOMMENDED APPLICATION CIRCUITS

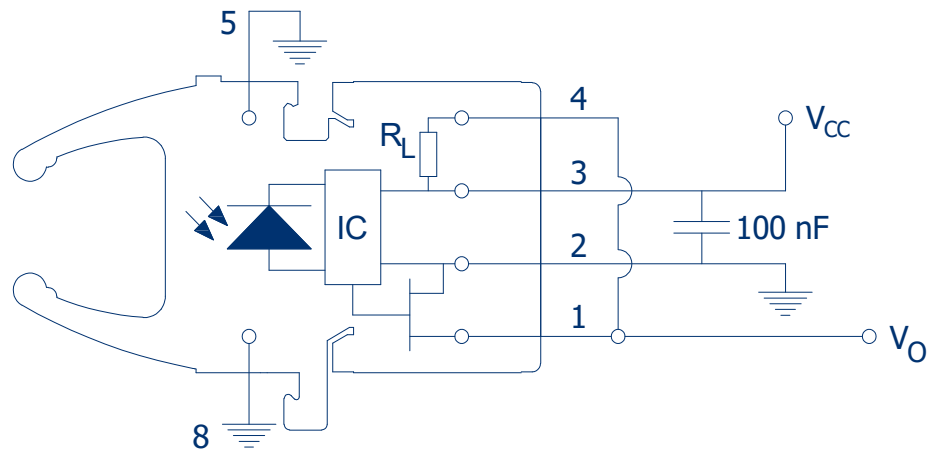


FIGURE 3

RedLink® Receiver standard 5 V and or 3.3 V operation using R_L pull-up resistor

NOTE: R_L can only be connected to V_O when the maximum value at $V_O \leq V_{CC}$

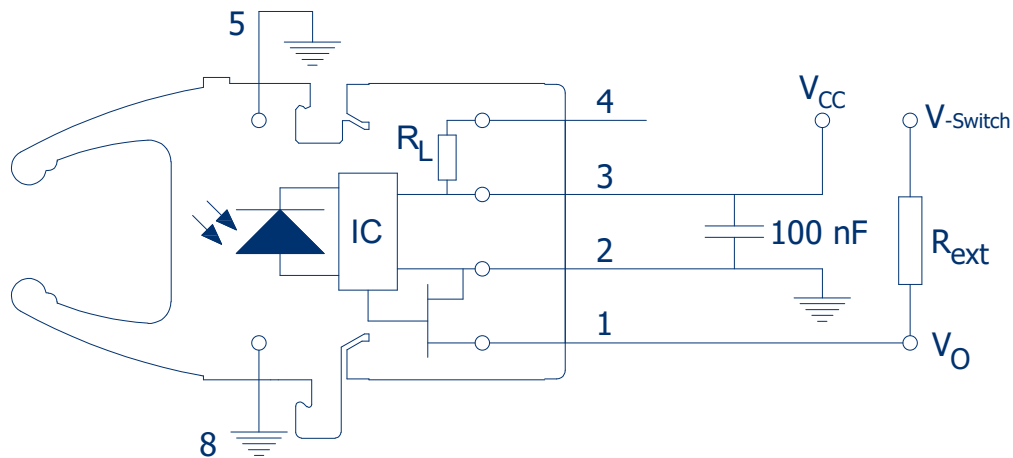


FIGURE 4

RedLink® Receiver interface circuit for High Voltage (up to 20 V) switching. V_{CC} can be 5 or 3.3 V. V_{Switch} is often used to switch for example 12 V and 15 V thyristor gates devices

NOTE: if $V_{Switch} > V_{CC}$ then R_L should not be connected to V_O

SPECIFICATIONS

Table 4
REGULATORY COMPLIANCE

Parameter	Symbol	Standard	Level
Electrostatic Discharge, Human Body Model (contact ESD)	HBM	Mil-STD-883	Level 2 (2 kV)
UL Certification	UL	60950-1	Files 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
3. The R_L pin can only be used when the maximum value of V_O does not exceed the maximum operating condition V_{CC} . The maximum operating condition V_{CC} is 5.5 V. For example, if V_O switches between 0 and 5 V and V_{CC} is equal to 5 V then R_L can be connected to V_O . However, if V_{CC} is 3.3 V and V_O switches between 0 and 5 V then R_L cannot be connected to V_O .
4. V_{Switch} is the External Power Supply for the external Pull-Up resistor R_{ext} . The maximum allowed voltage that can be switched is 20 V.

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	°C
Supply Voltage ^[2]	V_{CC}	-0.5	+7	V
Rx Output Current (maximum drain source current)	I_{FDC}		±25	mA
Storage Compliance	MSL		2a	J-STD-020
Maximum Output Power	P_{OD}		40	mW
R_L Pull-up Voltage ^[3]	V_{RL}	-0.5	V_{CC}	V
Output Voltage	V_O	-0.5	20	V
External V_{Switch} Power Supply ^[4]	V_{Switch}	-0.5	20	V

SPECIFICATIONS

Table 6
RECEIVER ELECTRICAL AND OPTICAL CHARACTERISTICS

Test Conditions:

1. Wake up Delay is the delay from when $V_{CC} > 2.75$ V to when the output will respond correctly to optical input.
2. Test data was validated using a transmitter with an emission wavelength between 635 and 680 nm with 5 ns rise and fall times, over the full temperature range of -40 °C to +85 °C, and over the full supply rail voltage options of 5 V and 3.3 V $\pm 10\%$ and over the optical received power range P_H to 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 ambient +25 °C.
3. Optical signal is delivered over 1 mm core, step index, 0.5 NA POF.
4. Measured in the interface circuit for high voltage, over the V_{CC} and V_{Switch} range 4.5 V to 5.5 V, ambient temperature range -40 °C to 85 °C, received optical power $P_H = -1$ to -20 dBm, at 5 Mbps. $R_{ext} = 560 \Omega$, $C_L = 22$ pF, R_L pin o/c.
5. R_L cannot be connected to V_O when V_O is used to switch a voltage greater than V_{CC} .
6. 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}	10.5	13	16	mA	[2,3,4]
Wake Up Delay	$t_{power-on}$		40		μs	[1,2,3,4]
High Level Output Current (Received Power < P_L maximum)	I_{OH}		0.5	100	μA	$V_O = 20$ V
Low Level Output Voltage (Received Power > P_H minimum)	V_{OL}		44	<div>75</div> <div>125</div>	mV	<div>$V_{CC} = 5$ V $\pm 10\%$ $I_O = 25$ mA</div> <div>$V_{CC} = 3.3$ V $\pm 10\%$ $I_O = 25$ mA</div>
Optical Power High	P_H	-20		+2	dBm	[2,3]
Optical Power Low	P_L			-40	dBm	[2,3]
Data Rate		DC		5	MBd	Min-UI = 200 ns, Max f = 2.5 MHz
Output Rise Time (10% - 90%)	t_r	20	40	50	ns	[2,3,4]
Output Fall Time (90% - 10%)	t_f		3	10	ns	[2,3,4]
Pulse Width Distortion	PWD	-40		40	ns	[2,3,4]
Propagation Delay Low-to-High	$t_{PropDly_LH}$			80	ns	[2,3,4]
Propagation Delay High-to-Low	$t_{PropDly_HL}$			65	ns	[2,3,4]
Supply Voltage	V_{CC}	2.97		5.5	V	
External V_{Switch} Power Supply	V_{Switch}	2.97		20	V	$I_{O-max} = 25$ mA
Output Current	I_O			25	mA	Maximum DC value
Internal Pull-Up Resistor to V_{CC}	R_L	0.7	1	1.5	k Ω	[5]
Optical Sensitivity Range	λ_R	400		900	nm	[6]

MECHANICAL DATA, HORIZONTAL

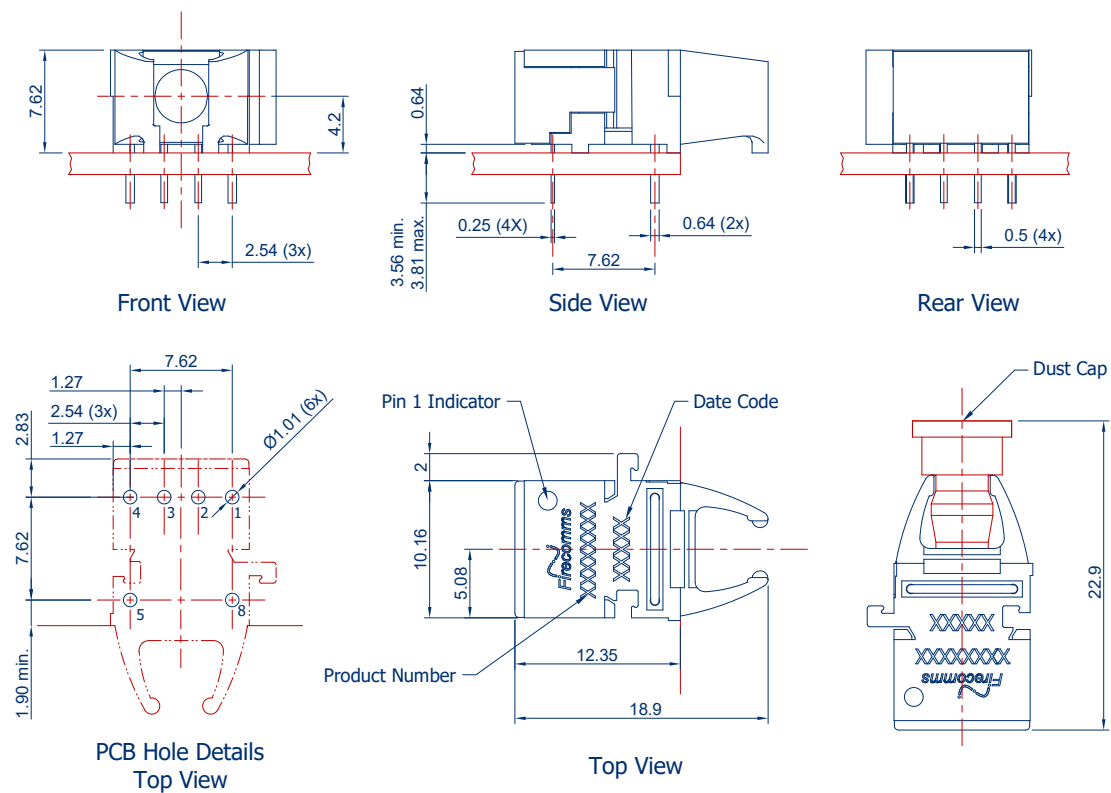


FIGURE 5
Mechanical dimensions of RedLink® horizontal connectors and PCB footprint, which is a top view
General dimensional tolerance is ± 0.2 mm

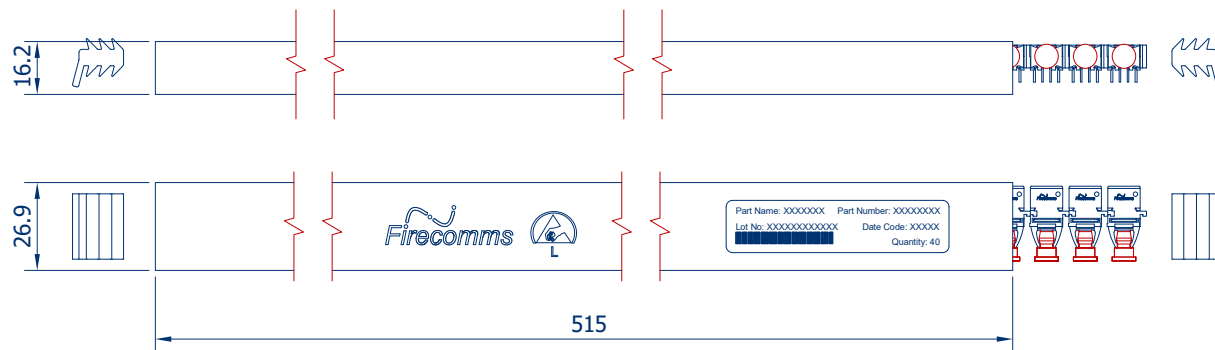


FIGURE 6
Packing tube for Firecomms RedLink® horizontal connectors

MECHANICAL DATA, VERTICAL

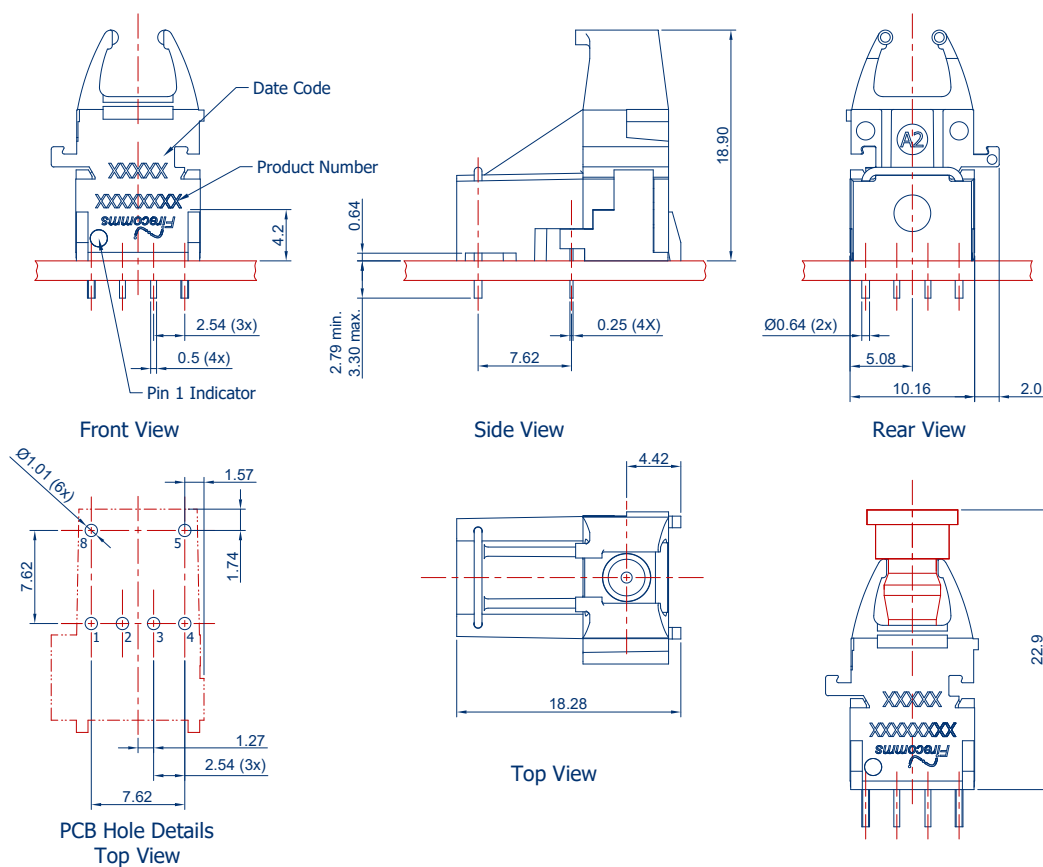


FIGURE 7
Mechanical dimensions of RedLink® vertical connectors and PCB footprint, which is a top view
General dimensional tolerance is ± 0.2 mm

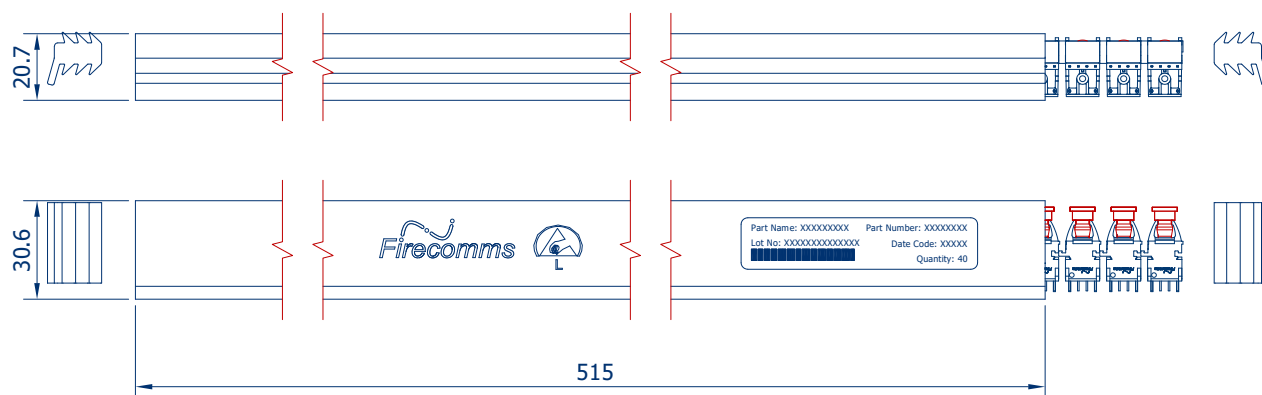


FIGURE 8
Packing tube for Firecomms RedLink® vertical connectors

MECHANICAL DATA, 30° TILTED

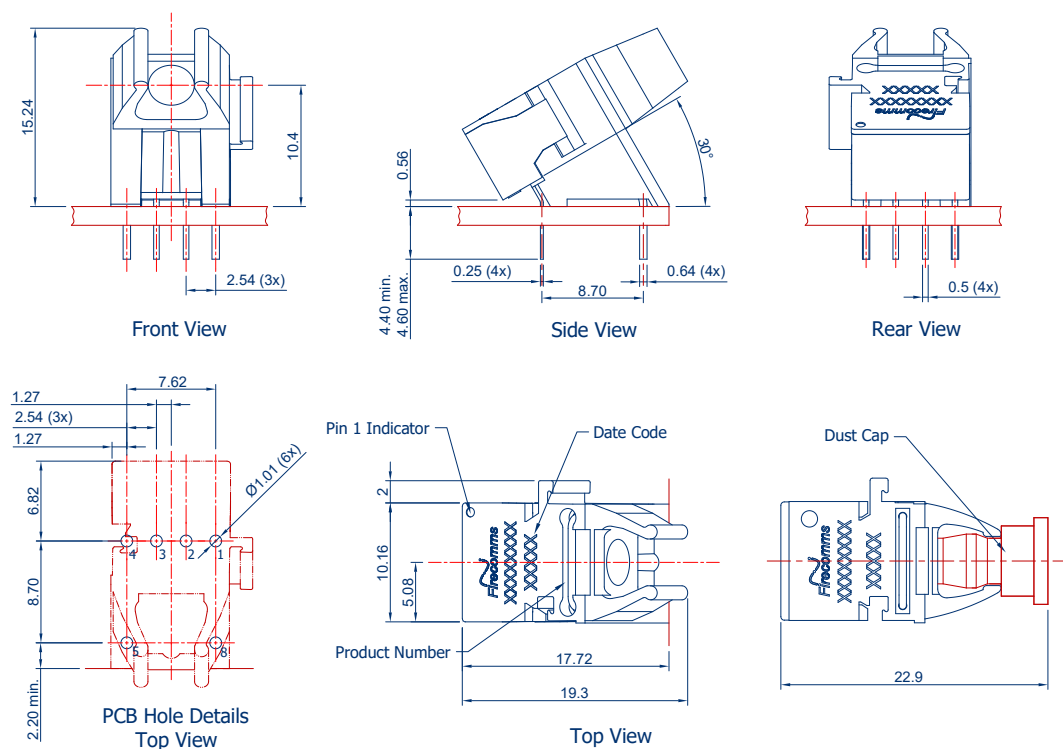


FIGURE 9
Mechanical dimensions of RedLink® tilted connectors and PCB footprint, which is a top view
General dimensional tolerance is ± 0.2 mm

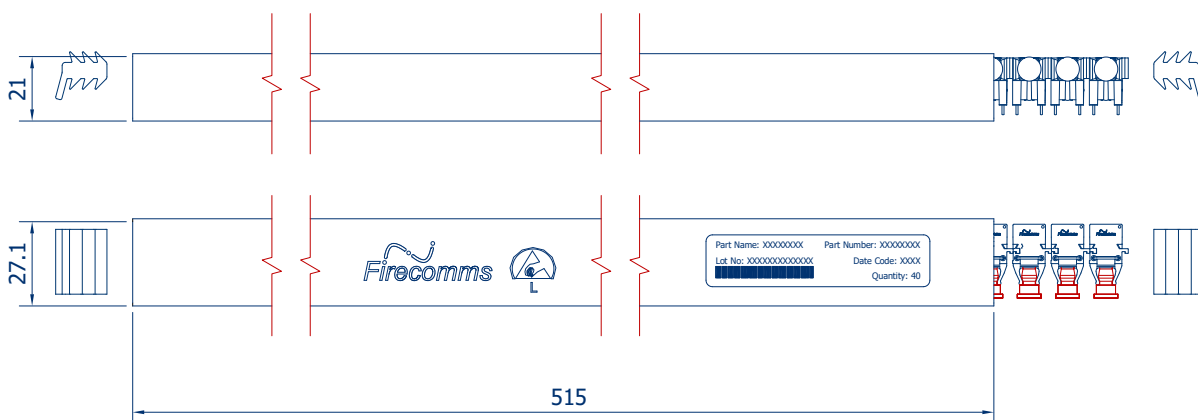


FIGURE 10
Packing tube for Firecomms RedLink® tilted connectors

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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