

FR20DxIR

RedLink® Fiber Optic Receiver for Direct High Voltage Switching



Datasheet



DESCRIPTION

This Firecomms 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 kΩ Pull-Up resistor R_L .

Housed in non-conducting plastic the RedLink® receiver connector is blue. The housings are compatible with the Versatile Link style of fibre plug and are optimized for use with Plastic Optic Fibre (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 but can operate up to 5 MBd if required.

AVAILABLE OPTIONS

Table 1
ORDERING INFORMATION / PART NUMBERS

5 MBd Horizontal Package Inverting, TTL	FR20DHIR
5 MBd Vertical Package Inverting, TTL	FR20DVIR
5 MBd Tilted Package Inverting, TTL	FR20DWIR



FEATURES

- MOSFET output stage typically used to directly switch 12 V and 15 V thyristor gate devices.
- Optimized for data transmission 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
- 5 V TTL/CMOS compatible I/O for ease of design
- Integrated 1 kΩ Pull-Up resistor to Vcc (R_L)
- Low pulse width distortion
- Horizontal, Vertical and 30° Tilted options available
- Compatible with Versatile Link cables and connectors

APPLICATIONS

Table 2
APPLICATIONS

Application	Switching of 20 V, 18 V, 15 V and 12 V thyristor gate drivers. Direct switching of SCR's and IGBT's
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	Vcc
4	R_L Pull-Up resistor	R_L
5	Retaining Pin	GND
8	Retaining Pin	GND

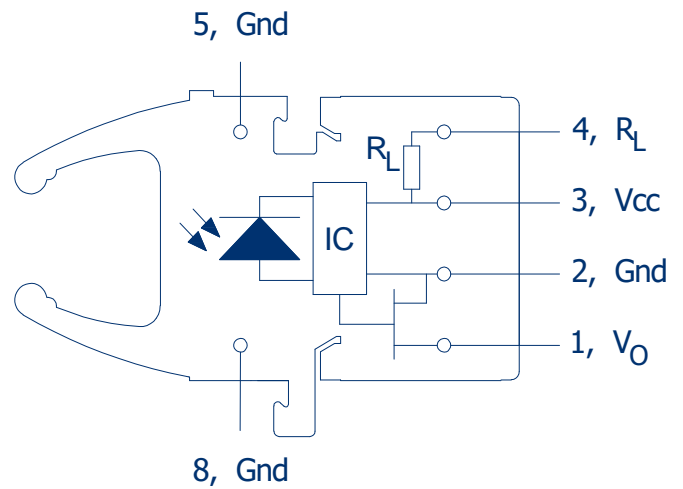


FIGURE 1
Receiver pin-out, top view

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. E362227
Storage Compliance	MSL	J-STD-020	2a (4-week floor life)
Restriction of Hazardous Substances Directive	RoHS	Directive 2011/65/EU	Certified compliant

RECOMMENDED APPLICATION CIRCUITS

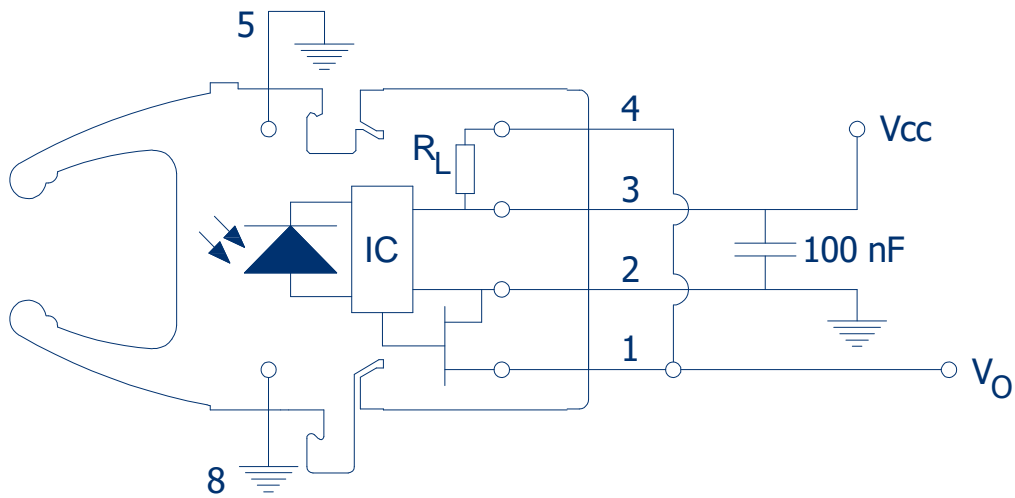


FIGURE 2
RedLink® Receiver standard 5 V and or 3.3 V operation using R_L Pull-Up resistor.
NOTE: R_L can only be connected to V_O when the maximum value at $V_O \leq V_{CC}$

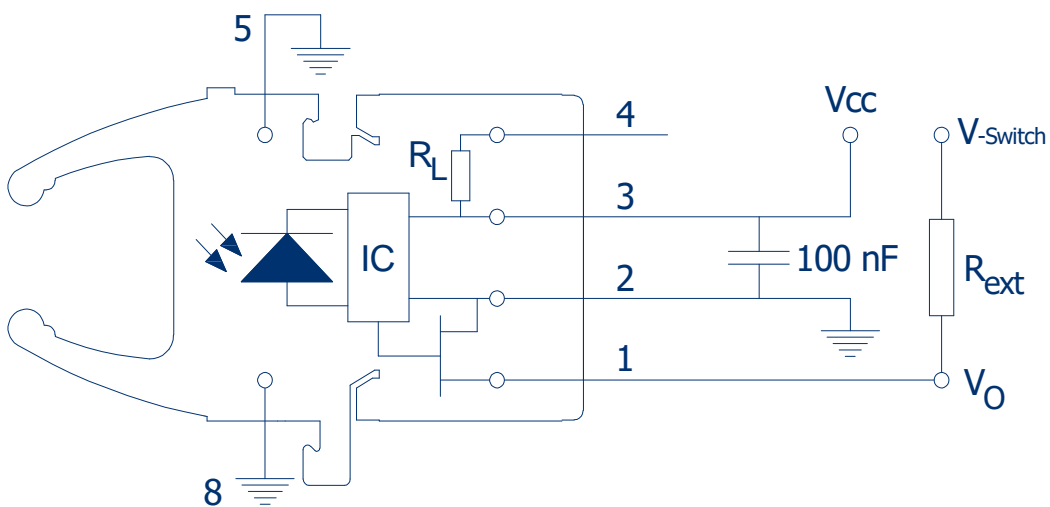


FIGURE 3
RedLink® Receiver interface circuit for High Voltage (up to 20 V) switching. V_{CC} can be 5 or 3.3 V. V_{Switch} is often used to switch for example 12 V and 15 V thyristor gates devices. NOTE: if $V_{Switch} > V_{CC}$ then R_L should not be connected to V_O .

SPECIFICATIONS

Table 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
2. The R_L pin can only be used when the maximum value of V_o does not exceed V_{cc} . The maximum V_{cc} voltage 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 .
3. 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	V_{cc}	-0.5	+5.5	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 ^[2]	V_{RL}	-0.5	V_{cc}	
Output Voltage	V_o	-0.5	20	V
External V_{Switch} Power Supply ^[3]	V_{Switch}	-0.5	20	V

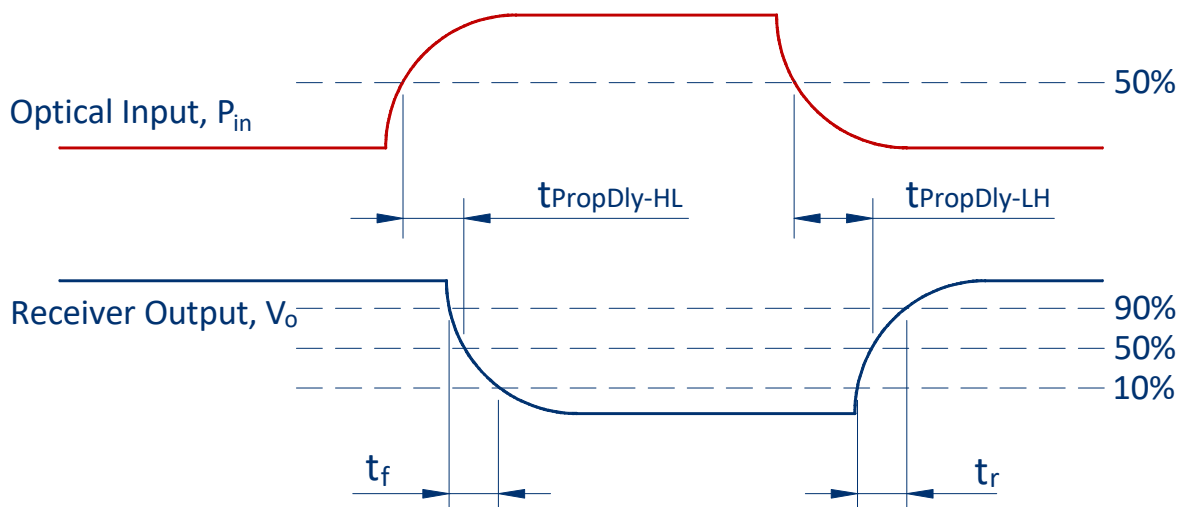


FIGURE 4
Receiver Propagation Delay and rise/fall time definitions

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 5 ns rise and fall time, 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 1mm core, step index, 0.5NA 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. $R_{ext} = 560$ Ω , $C_L = 22$ 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} .*

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		μ s	[1,2,3,4]
High Level Output Current	I_{OH}		0.5	100	μ A	$V_O = 20$ V, Received Power $< P_L$ maximum
Low Level Output Voltage	V_{OL}		44	75	mV	$I_O = 25$ mA, Received Power $> P_H$ minimum
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	30	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]

MECHANICAL DATA, HORIZONTAL

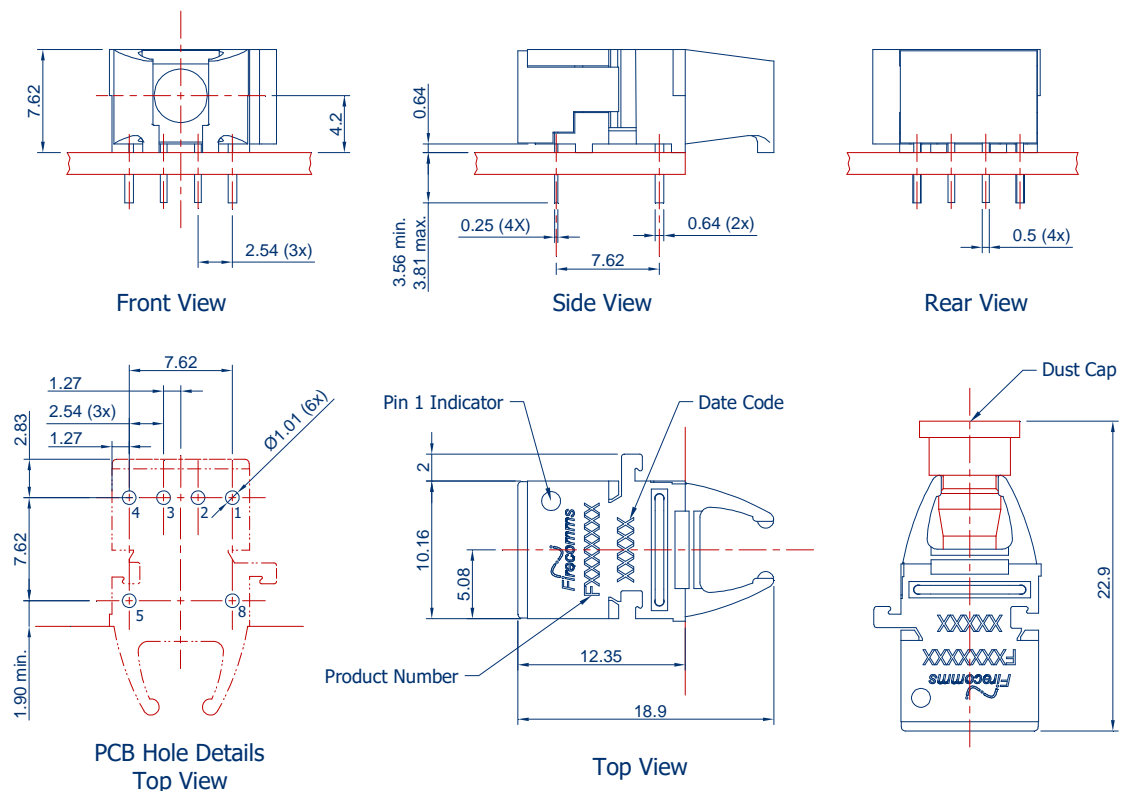


FIGURE 5
Mechanical dimensions of the horizontal receiver connectors and PCB footprint, which is a top view
General dimensional tolerance is ± 0.2 mm

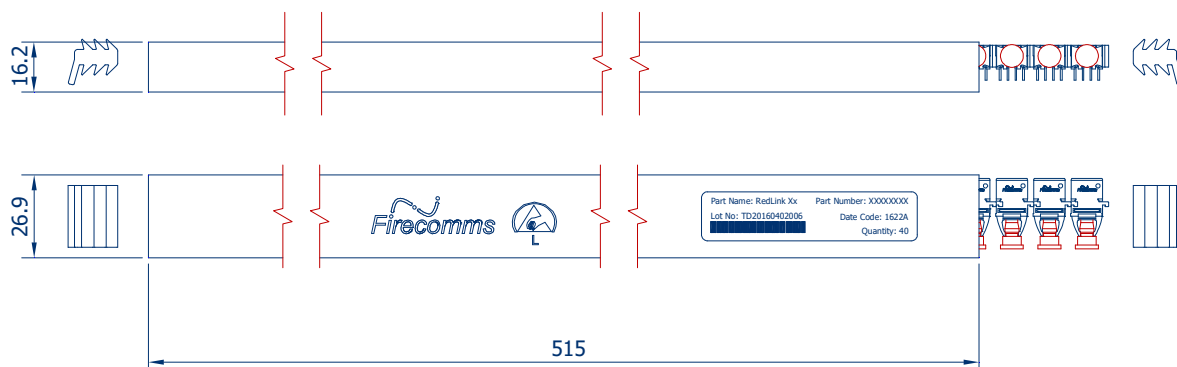


FIGURE 6
Packing tube for Firecomms Horizontal RedLink® Receivers

MECHANICAL DATA, VERTICAL

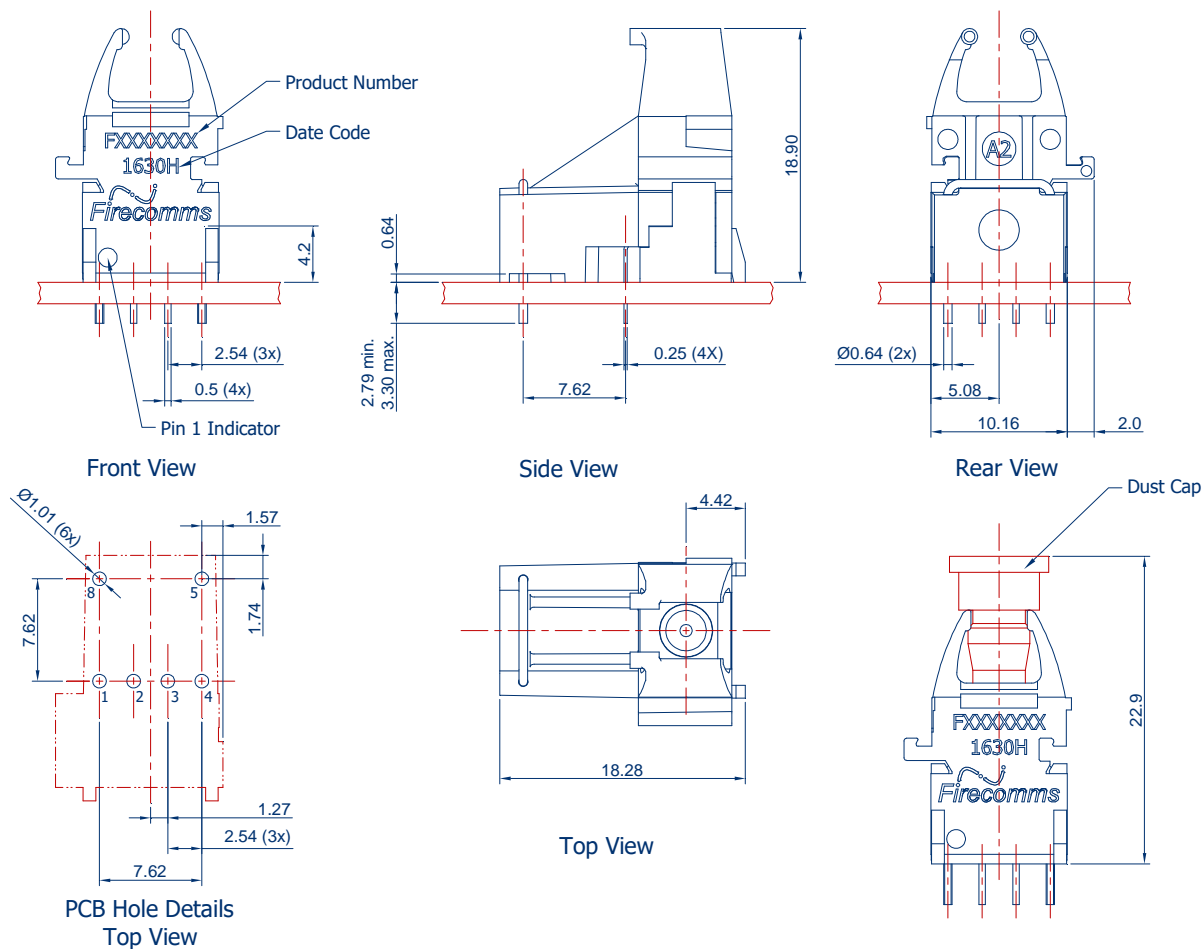


FIGURE 7
Mechanical dimensions of the vertical receiver connectors and PCB footprint, which is a top view
General dimensional tolerance is ± 0.2 mm

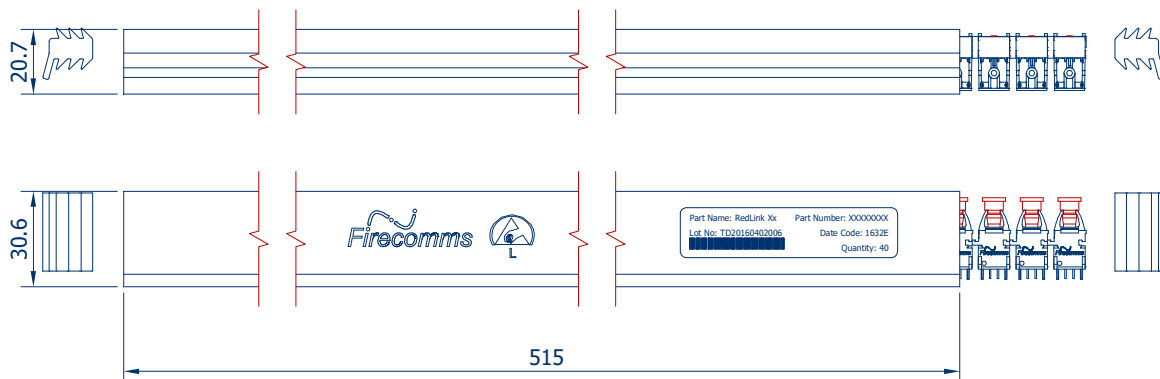


FIGURE 8
Packing tube for Firecomms Vertical RedLink® Receivers

MECHANICAL DATA, 30° TILTED

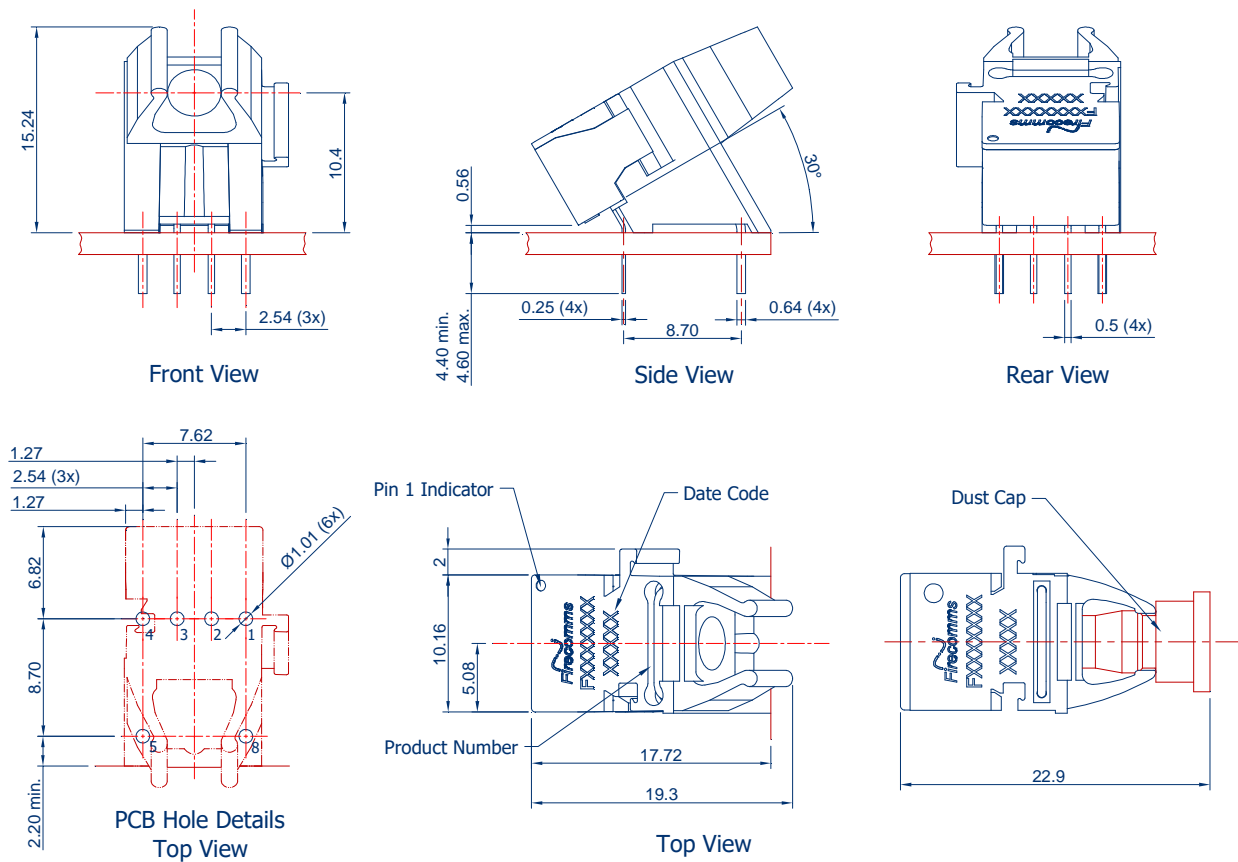


FIGURE 9
Mechanical dimensions of the tilted receiver connectors and PCB footprint, which is a top view
General dimensional tolerance is ± 0.2 mm

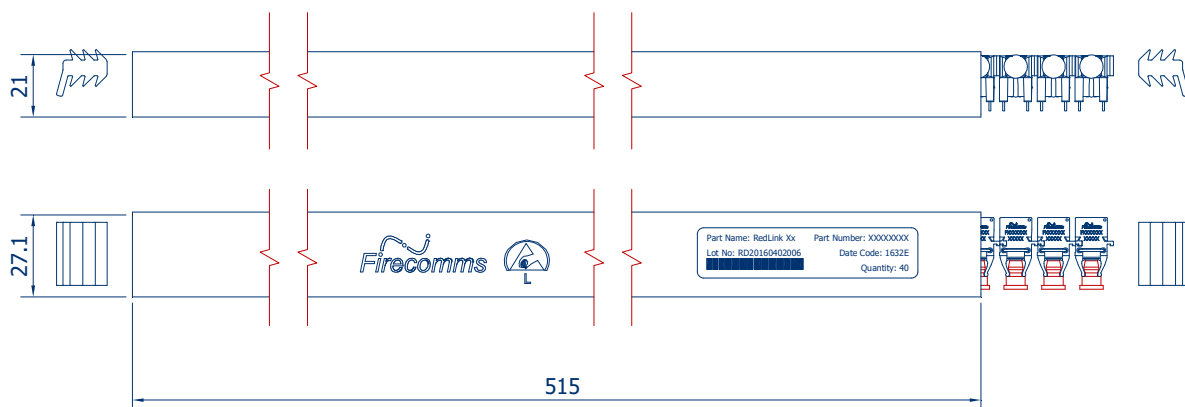


FIGURE 10
Packing tube for Firecomms Tilted RedLink® Receivers

PART HANDLING

The Firecomms high voltage RedLink® receiver devices are color coded blue. They are auto-insertable. They 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 based product are not permitted.

In the soldering process, non-halogenated water soluble fluxes are recommended. RedLink® products 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 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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