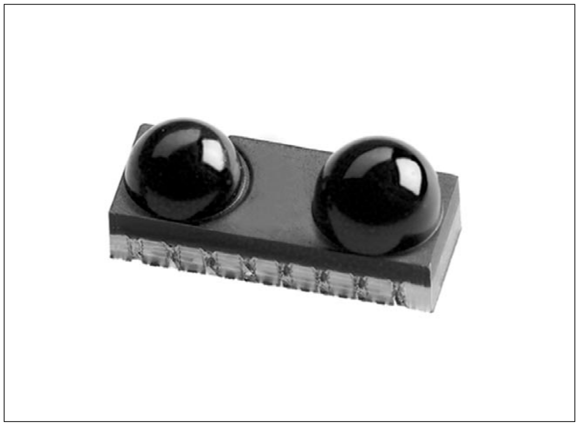
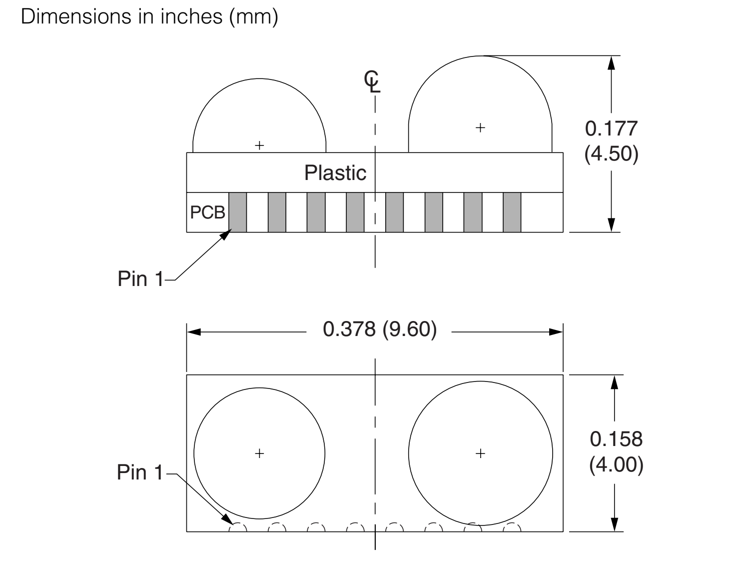
IRM1021

1.15 Mb/s Infrared Data Transceiver

Preliminary





FEATURES

- **Fully Compliant with IrDA Specification**
- **IrDA Data Rates 9.6 Kb/s to 1.152 Mb/s**
- **High Immunity to Fluorescent Light Noise**
- **Battery & Power Management Features:**
  - **Receive – 1.8 mA Typical**
  - **Shutdown – 10 nA Typical**
  - **Independent LED Anode Supply – up to 9.0 V DC**
  - **Wide Operating Voltage Range 2.4 V to 5.5 V**
  - **High V_{CC} Noise Rejection >100 mV_{P-P}**
- **Shutdown Tri-States Receiver Output and Disables TxD allowing Bus Interfacing**
- **Integrated Protection for Eye Safety— AC Coupled Transmit Input**
- **High DC Ambient Rejection—Operates Outdoors**
- **Receiver Latency Less <100 µs**
- **Slimline Package: H 4.0 mm x D 4.5 mm x L 9.6 mm**

DESCRIPTION

IRM1021 is an IrDA compliant 1.152 Mb/s infrared data transceiver. The IRM1021 consists of a PIN photodiode, an infrared LED and a custom ASIC, all attached to a printed circuit board. Its external shutdown (SD) feature cuts the current consumption to less that 0.01 µA . The transmit pulse is limited to 70µs, extending transmitter life and ensuring eye safety. The flat top surface is ideal for high speed pick-and-place manufacturing.

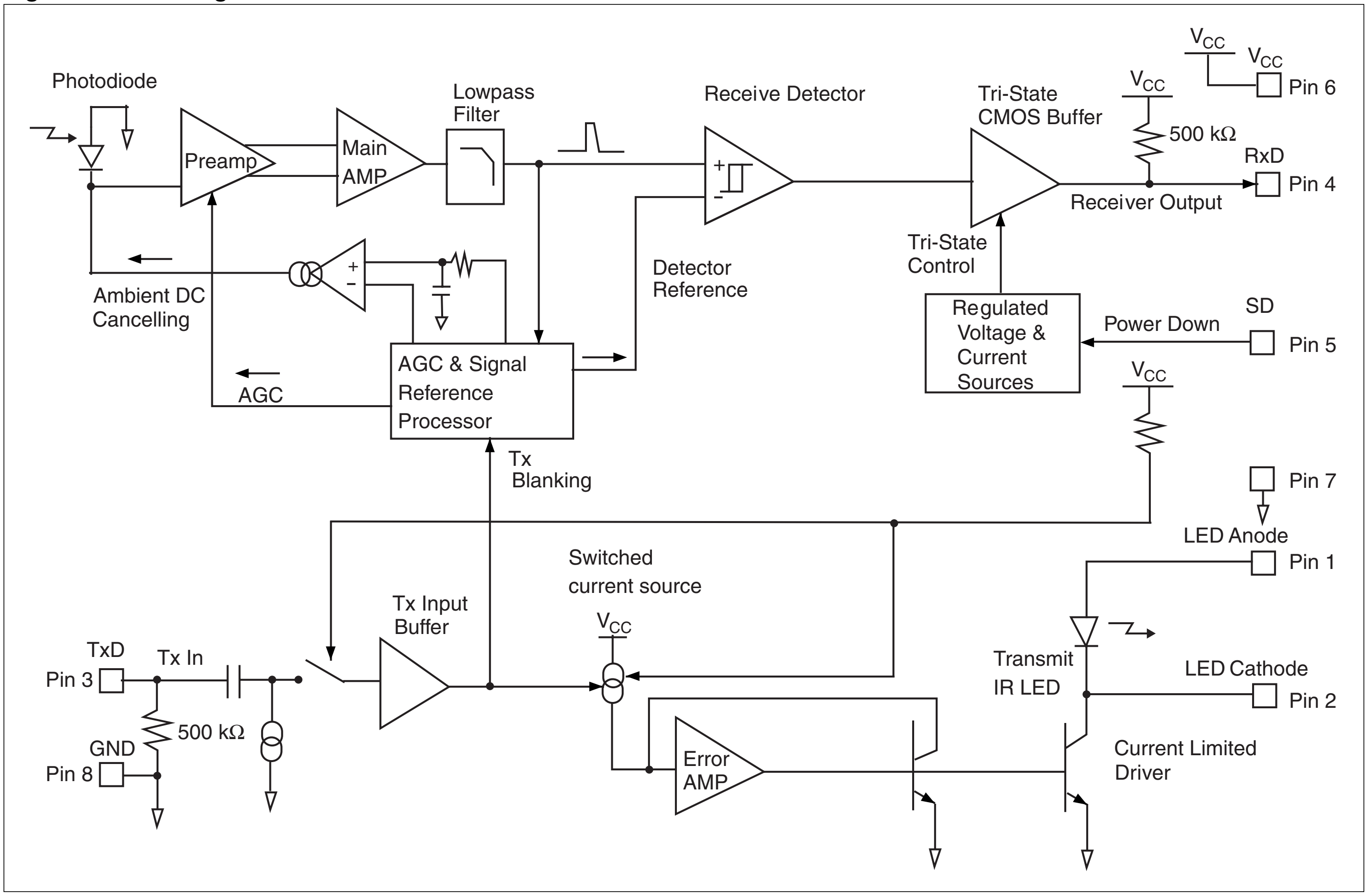
Absolute Maximum Ratings, T_A=25°C (except where noted)

Supply Voltage Range, all states, V_{CC} ....–0.5 to +7.0 V
LED Anode Voltage,
V_{CC}=0 to 5.5 V, not transmitting, V_{LEDA} ....–0.5 to +9.0 V
LED Anode Voltage,
V_{CC}=2.4 to 5.5 V, transmitting, V_{LEDA} .... –0.5 to V_{CC} +4.0 V
Input Current,
I_{CC} during transmit, V_{CC}=5.0 V, TxD=V_{CC} (peak) ....20 mA
Output RxD Current ....50 mA
Storage Temperature,
storage or reduced performance, T_S ....–40 to +100°C
Ambient Temperature, operating, T_A .... –25 to 85°C
Lead Solder Temperature, 230°C .... <10 s
IC Junction Temperature, T_J .... 125°C
Average IR LED Current, LED Anode=3.3 V, I_{LED} .... 100 mA
Repetitive Pulsed IR LED Current,
<10 µs, t_{on} <20%, LED Anode=3.3 V, $I_{LED(RP)}$ ....600 mA
Input Voltage: TxD, SD.. –0.5 to V_{CC}+0.5 V
RxD Voltage .... –0.5 to V_{CC} +0.5 V

Table 1. Pin Functions

Pin no.	Function	Pin no.	Function
1	IR LEDA	5	SD
2	IR LEDC	6	V_{CC}
3	TxD	7	GND
4	RxD	8	GND

Figure 1. Block Diagram



Theory of Operation

The IRM1021 Cast Slimline Infrared Data Transceiver, IrDT consists of a detector photodiode, an IR LED transmitter, an IC containing ambient light suppressor and Automatic Gain control circuitry (AGC).

The ambient light suppressor can cancel up to 10 mW/cm^2 at 5.0 V. This will typically allow operation in all but direct sunlight.

The receiver automatic gain control (AGC) circuit normalizes pulse width despite 120 dB signal range. The AGC also improves noise immunity while receiving a transmission by reducing gain so that noise less than 1/2 the peak signal height will not be detected.

Asserting shutdown high powers down the transceiver, and for bus multiplexing, tri-states the receiver output and disables TxD input.

In receive mode, the receiver output (RxD) which normally stays high, will go low for duration of the receive pulses. It is a push-pull CMOS driver capable of driving a standard CMOS or TTL load. No external pull-up or pull-down resistor is required.

In transmit mode, by asserting the TxD pin above 1.4 V will turn on IR LED transmitter. This pin has a 500 kΩ pulldown. At the LED Anode (pin 1) connect this pin to V_{CC} or unregulated power supply (not to exceed V_{CC} +4.0 V), through a resistor to set the proper LED current to reduce the thermal dissipation and to lower LED current.

Table 2. Slimline Truth Table

Inputs			Outputs	
SD	TxD	detector	RxD	LED
High	X=don’t care state	X=don’t care state	500 kΩ pull-up	Off
Low	High		Undefined	On
	Low	<0.4 μW/cm^2 (115 Kb/s) <1 μW/cm^2 (1 Mb/s)	High	Off
		>4 μW/cm^2 (115 Kb/s) >10 μW/cm^2 (1 Mb/s)	Low	

Electrical Characteristics

Table 3. Basic Operating Parameters, T_A=25°C (except where noted)

Parameter	Sym-	Min.	Typ.	Max.	Unit	Conditions
Supported IrDA Data Rate		9.6 K		1152	Kb/s	3/16 clock period or 1/4 clock >115 Kb/s
V_{CC} Voltage	V_{CC}	2.4		5.5	V	0 to 70°C V_{CC} to V_{SS}
Maximum LED Anode Voltage	V_{LEDA}			V_{CC}+4		V_{CC}=1.5 V to 5.5 V
I_{CC} Shut Down Current **(Note 1)**	I_{CC1}		0.01	1.0	µA	SD=V_{CC} V_{CC}=2.4 V to 5.5 V
I_{CC} Standby Current	I_{CC2}		1.4	2.5	mA	SD=0 V_{CC}=2.4 V to 5.0 V no signal
I_{CC} Receiving Current	I_{CC3}		1.8			SD=0, Vcc=5.0V, 1Mbps, 50% pulses 1µA
I_{CC} Transmitting Current, Saturated Driver (Average)	I_{CC4}		3.0	4.5		V_{CC}=5.0, LED I=400 mA

Table 4. I/O Parameters

Parameter	Sym-	Min.	Typ.	Max.	Unit	Conditions
TxD, SD input capacitance			3.0		pF	V_{CC}=2.4 V to 5.5 V
TxD Resistance		350	500	700	kΩ	TxD=V_{CC} V_{CC}=5.0 V
TxD, SD Input Threshold **(Note 1)**		1.0	1.4	1.8	V	V_{CC}=5.0 V
SD to RxD Tri-State		50			ns	V_{CC}=2.4 V to 5.0 V
SD to RxD Enable		20				V_{CC}=2.4 V to 5.0 V
RxD Output High	V_{OH}	3.5	4.0		V	V_{CC}=5.0 V I_{oh}=20 mA
RxD Output High		2.0	2.1			V_{CC}=2.4 V I_{oh}=3.0 mA
RxD Output Low	V_{OL}		0.7	1.2		V_{CC}=5.0 V I_{ol}=20 mA
RxD Output Low			0.2	0.4		V_{CC}=2.4 V I_{ol}=3.0 mA
RxD Short Circuit			48		mA	V_{CC}=5.0 V RxD=0 RxD=V_{CC}
RxD Short Circuit			10			V_{CC}=2.4 V RxD=0 RxD=V_{CC}
RxD to V_{CC} Tri-State Impedance		350	500	650	kΩ	SD=V_{CC} V_{CC}=5.0 V between RxD to V_{CC}
RxD Rise/Fall Time			7		ns	V_{CC}=5.0 V Load=15 pF
			18			V_{CC}=5.0 V Load=100 pF
			12			V_{CC}=2.4 V Load=15 pF
			30			V_{CC}=2.4 V Load=50 pF

Table 5. Receiver Parameters, T_A=25°C (except where noted)

Parameter	Sym-	Min.	Typ.	Max.	Unit	Conditions
Maximum Data Rate			1.15		Mb/s	200 ns 4.0 µW/cm^2 to 500 mW/cm^2
Receive 1/2 Angle		15			degrees	IrDA *Physical Layer* specification
Minimum Signal Detect Irradiance	E_{IHmin}	1.0	3.0		µW/cm^2	Bit error Rate=10^{-8} 217 ns pulse
Maximum Signal Detect Irradiance	E_{Emax}			500	mW/cm^2	Bit error Rate=10^{-8} 217 ns pulse
Maximum Signal Irradiance No detect				0.7	µW/cm^2	< 0.1 pulse per second detect, 20 kHz to 200 kHz square wave <100 ns rise/fall
Maximum DC Ambient Irradiance 5.0 V			30		mW/cm^2	V_{CC}=5.0 V
Maximum DC Ambient Irradiance 2.7 V			10			V_{CC}=2.4 V
AGC Attack Time **(Note 2)**			1.0	2.0	µs	4.0 µW/cm^2 to 500 mW/cm^2
AGC Settling **(Note 3)**			5.0	10.0	pulse	4.0 µW/cm^2 to 500 mW/cm^2 217ns pulse
AGC Decay Rate **(Note 5)**			44		dB/ms	Following AGC settling at 500 mW/cm^2
Transmit Receiver Latency **(Note 4)**	t_L		100	150	µs	0 to 3.0 mW/cm^2 DC ambient input

Table 5. Receiver Parameters, T_A=25°C (except where noted) (continued)

Parameter	Sym-	Min.	Typ.	Max.	Unit	Conditions
RxD Suppression Duration **(Note 6)**			50	100	µs	Following end of TxD pulse
Powerup Receiver Latency			100	150		0 to 2.5 mW/cm^2 DC ambient input
RxD pulse width		150		450	ns	1.162 Mbps
		1.2		5	µs	115 kbps
				30		9.6 kbps
RxD Jitter, Leading edge				120	ns	Between two pulse@1.152 Mbps

Table 6. Transmitter Output

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Maximum Data Rate			1.1		Mb/s	TxD pulse width=125 ns
TxD Radiant Intensity, Tx Mode High		100	170	500	mW/Sr	V_{CC}=5.0 V LEDA=3.3 V Tx High 10% duty cycle
			150			V_{CC}=2.7 V LEDA=3.3 V Tx High 10% duty cycle
			50			LEDA=1.8 V 10% duty cycle
TxD Radiant Intensity, Tx Mode Low			18			LEDA=3.3 V Tx Low 10% duty cycle
			16			LEDA=2.7 V Tx Low 10% duty cycle
TxD 1/2 Angle		15	20	30	degrees	IrDA *Physical Layer* specification
TxD Peak Wavelength		850	870	900	nm	I_F=500 mA
I_{LED} Limit, Tx High		385	500	650	mA	TxD=V_{CC} LED anode=3.3 V V_{CC}=2.7 to 5.0 V
I_{LED} Limit, Tx Low		40	50	70		TxD=V_{CC} LED anode=3.3 V V_{CC}=2.7 to 5.0 V
TxD V_{CC} dV/dt Rejection			5.0		V/µs	dV/dt for less than 20% change in TxD output

Note 1:
For Shut Down (SD) current to fall below 1.0 µA requires driving Shut Down (SD) to within 0.5 V of V_{CC} to ensure cutoff of the PMOS transistor of the input CMOS totem pole. In most applications this is not an issue if Shut Down (SD) is driven from a CMOS driver supplied from the same voltage supply.

Note 2:
"AGC Attack Time" is the time required for internal AGC (Automatic Gain Control) attenuation to rise to within 10% of final value.

Note 3:
"AGC Settling" is the number of pulses within 100 µs required for the output pulse width to settle to 90% of its final value.

Note 4:
"Near-far Receiver Latency" is the time required for the AGC and ambient correction circuits to return to maximum sensitivity (Far) following reception of a maximum (Near) signal or a change in ambient. "Transmit Receiver Latency" is commonly called "Receiver Latency" or "Transmitter Turnaround Time".

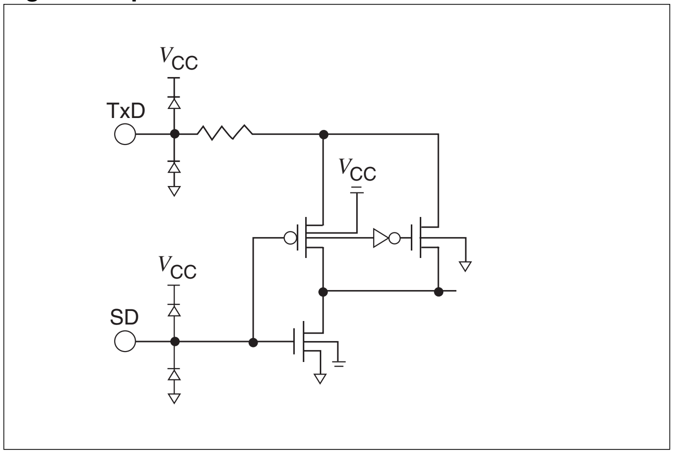
Note 5:
"AGC Decay Rate" is the rate at which the receiver gain increases following the cessation of signal input.

Note 6:
RxD is active while (TxD) transmit pulse is active.

Table 7. External Component

Parameter	Values							Unit
V_{LED} power supply	2	2.7	3.0	3.5	4.0	4.5	5.0	V
Resistor (R_0)	0	0	0	1.5	2.7	3.9	5.1	Ω

Figure 2. Input Schematics



A current limiting resistor should be used between the LED anode and V_{CC} (see Table 7 for recommended values).

Figure 3. Output Schematics

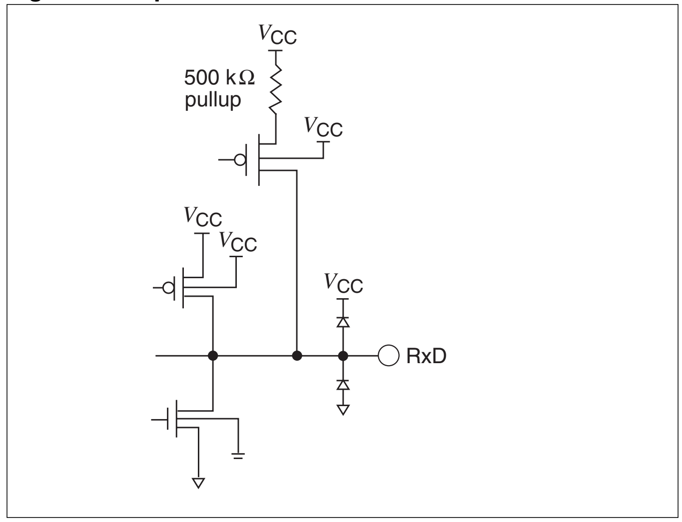


Figure 4. Infrared Reflow Soldering Profile

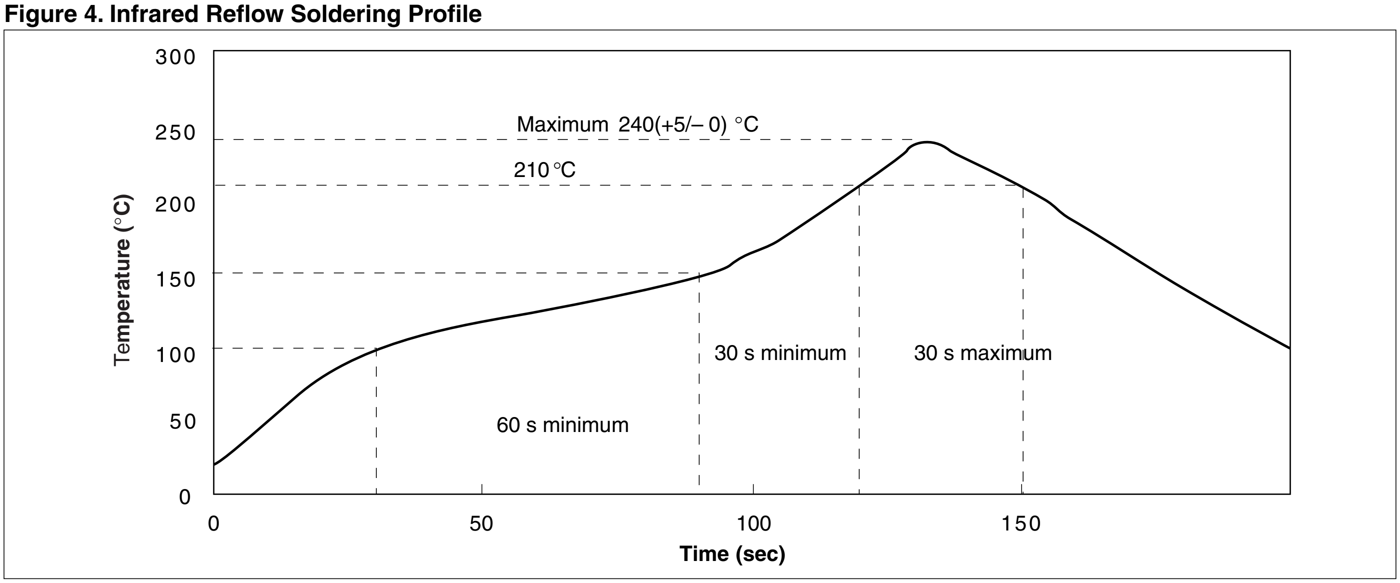


Figure 5. Super I/O (PC87108AVJE) to IRM1021

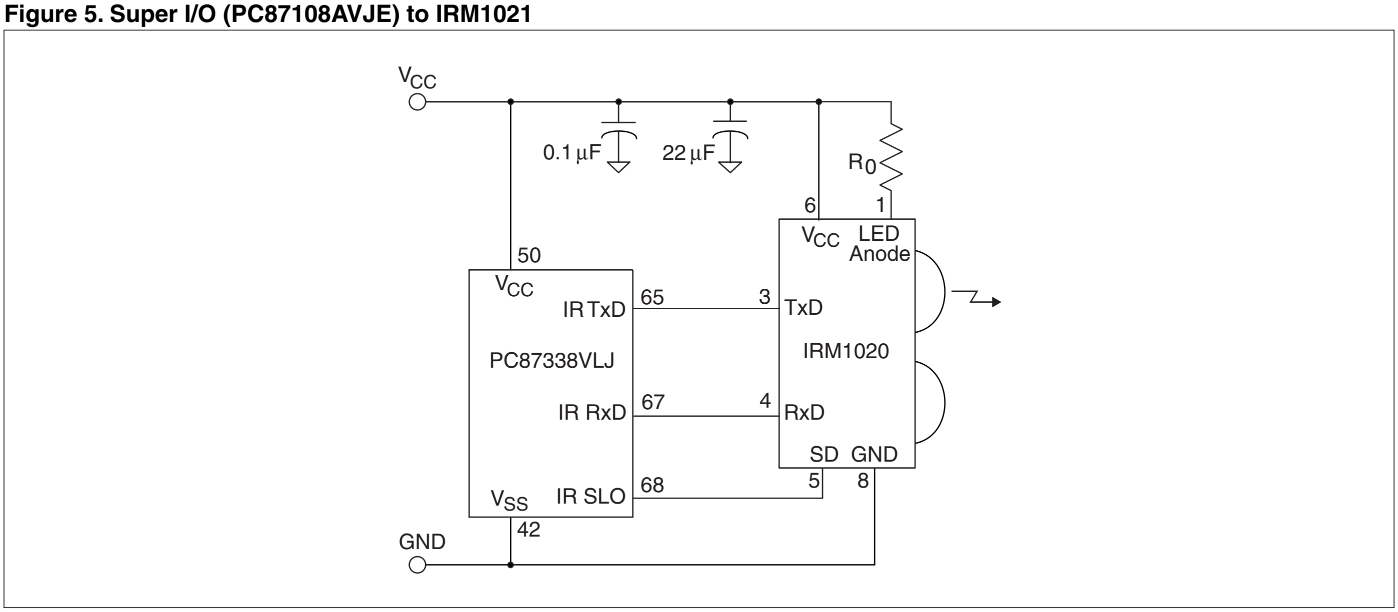


Figure 6. With Independent V_{LED} Power Supply

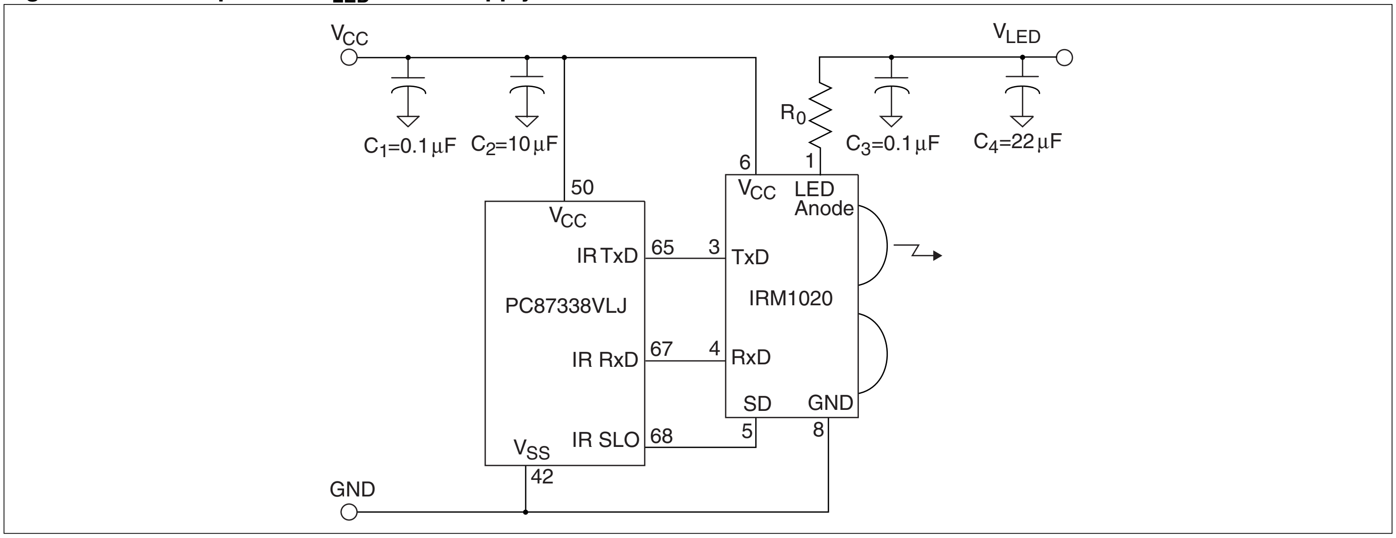


Table 8. Ordering Information

Part Number	Description	PCB Mounting Orientation
IRM1021	Integrated Transceiver—Side View	Packaged in Component Carrier Reel (1000/reel) for Side View Mounting on PCB
Tape Leader and Trailer is 400 mm minimum.		

Figure 7. Tape dimensions in Inches (mm)

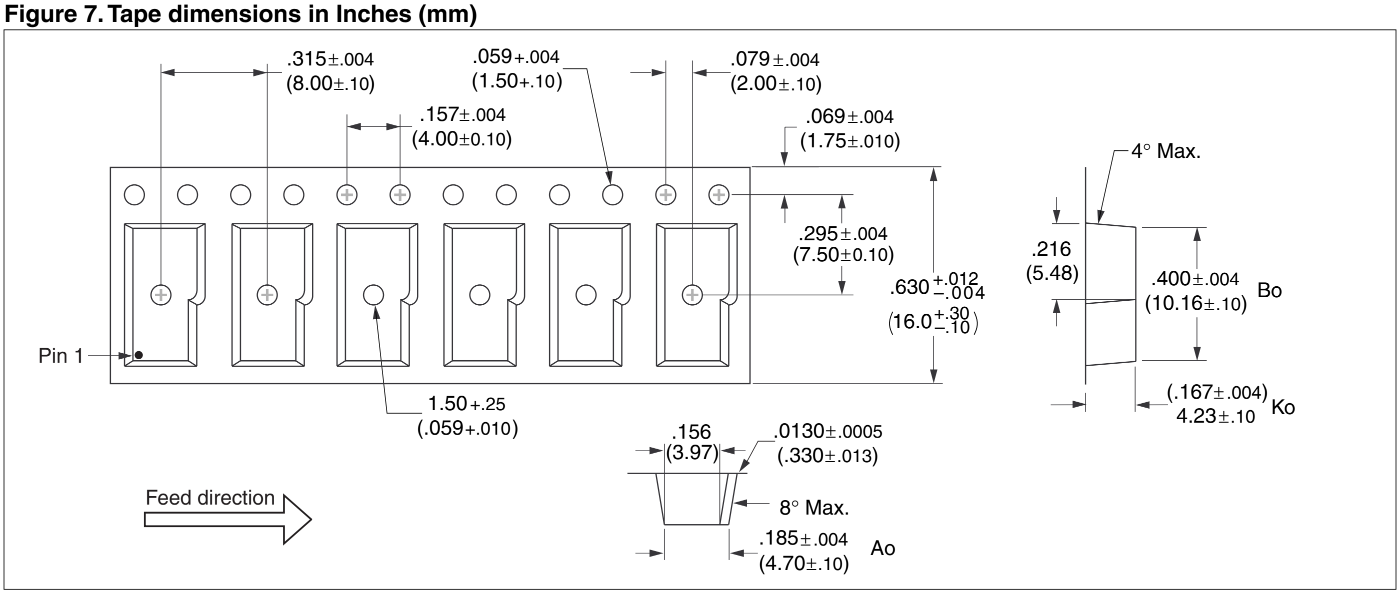


Figure 8. Reel Dimensions in Inches (mm)

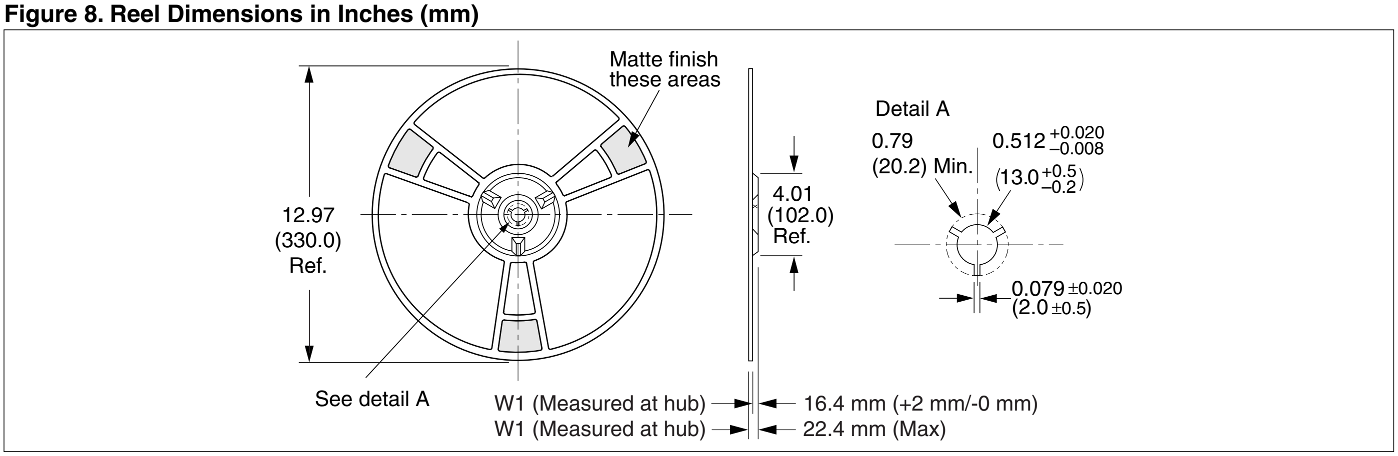
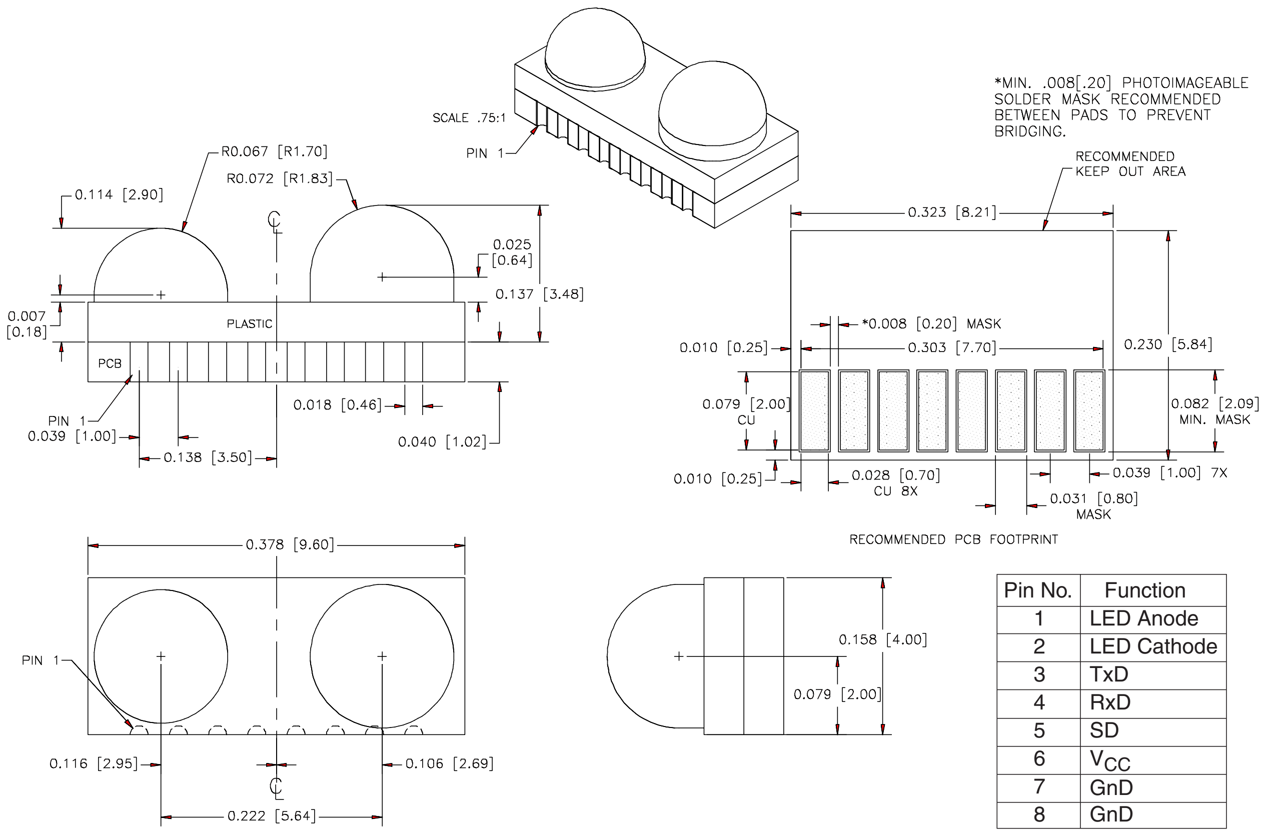


Figure 9. IRM1021 Detail Drawings With Optional Side View or Top View Mounting



Pin No.	Function
1	LED Anode
2	LED Cathode
3	TxD
4	RxD
5	SD
6	V_{CC}
7	GnD
8	GnD

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