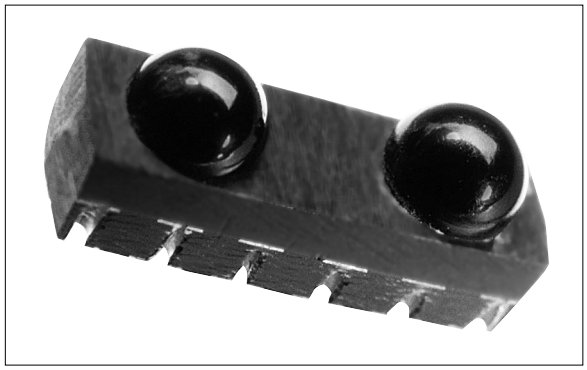
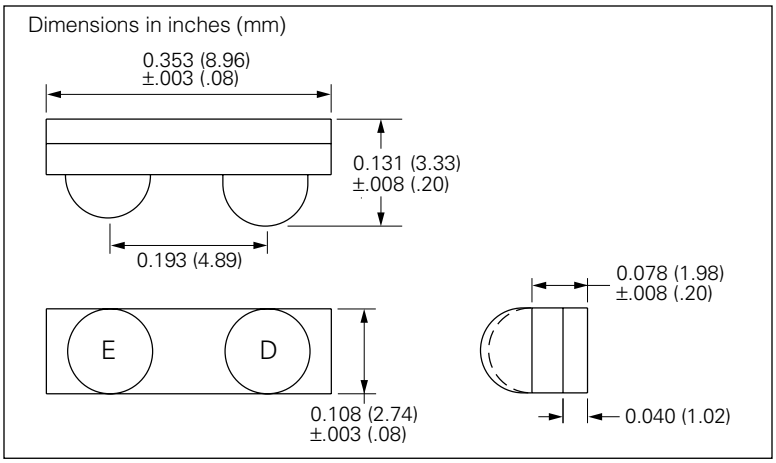
IRM5000 Series

Microline, 115 Kb/s Data Transceiver





FEATURES

- **Compliant with IrDA *Physical Layer Specification 1.3***
- **SIR Data Rates 2.4 Kb/s to 115 Kb/s**
- **High EMI Immunity, Eliminates the Need for Shielding**
- **Battery & Power Management Features:**
  - **Low standby current - 110 µA Typical**
  - **Shutdown - 2 nA Typical**
  - **Independent LED Anode Supply—2.7 V up to 9.0 V DC**
  - **Wide V_{CC} Voltage Range 2.4 V to 5.0 V, operable at 1.8 V at room temperature**
  - **V_{CC} Noise Rejection >100 mV_{p-p}**
- **Shutdown Tri-States Receiver Output and Disables TxD Allowing Bus Interfacing**
- **Provides Integrated Protection for Eye Safety**
- **High Immunity to Fluorescent Light Noise**
- **High DC Ambient Rejection**
- **Receiver Latency Less than 100 µs**
- **Microline Packaging**
  - **(H) 2.74 mm x (D) 3.33 mm x (L) 8.96 mm**

Applications:

- **Ideal for Battery Operated Hand-held Products**
- **PDAs, PCS Phones, Calculators, Isolated Medical Instruments, Infrared ID or Key Systems**

DESCRIPTION

The Vishay IRM5000 is an IrDA compliant infrared data transceiver featuring state of the art BiCMOS circuitry. The Shut Down (SD) feature cuts current consumption to typically less than 0.01 µA. The Shut Down (SD) mode disables the transmit input and tri-states the receiver output. The transmit input is AC coupled, limiting transmit pulse duration to 70 µs, preventing transmitter damage. This also provides integrated protection for eye safety.

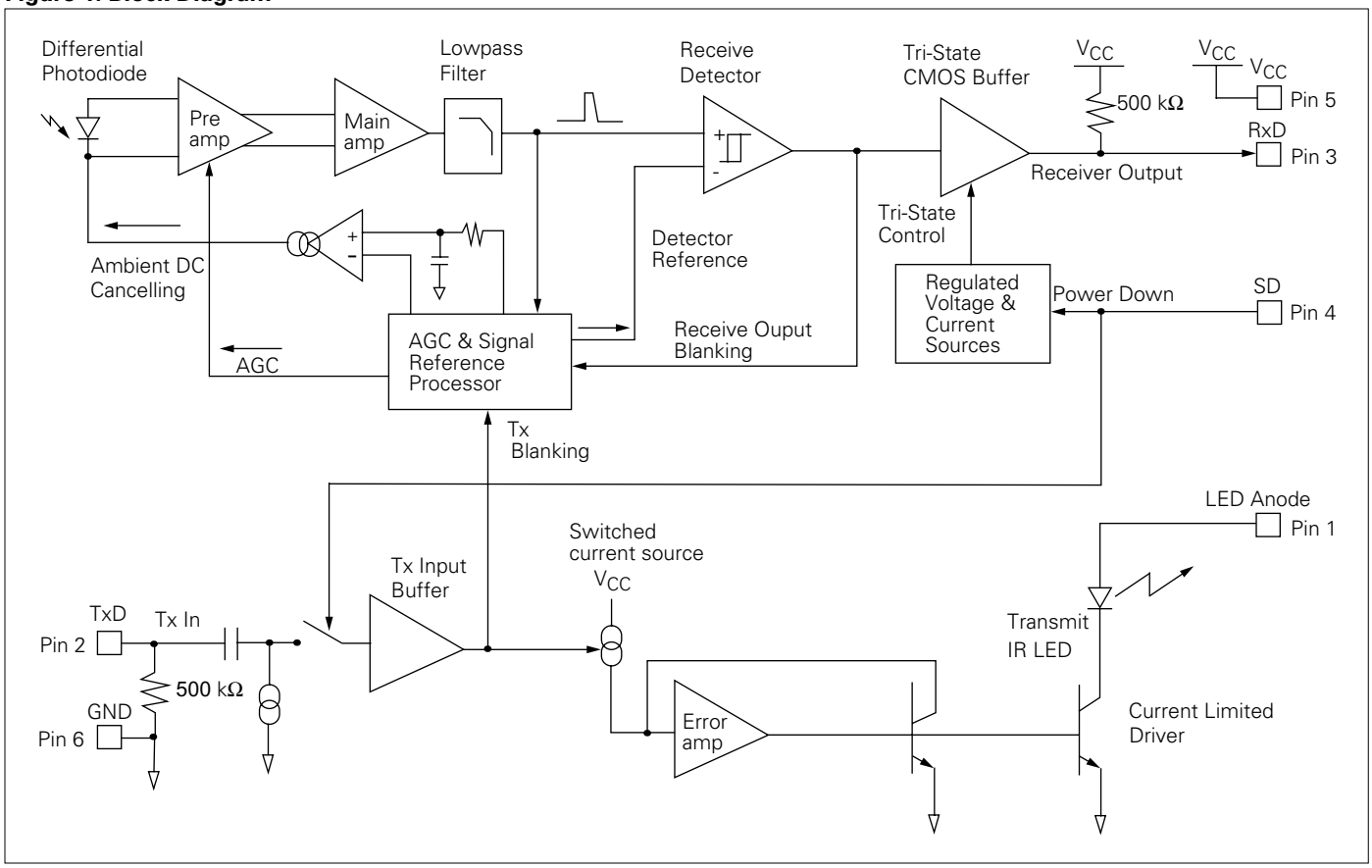
Absolute Maximum Ratings, T_A=25°C (except where noted)

Supply Voltage Range, all states, V_{CC} ..... –0.5 to +7.0 V
LED Anode Voltage,
V_{CC}=0 to 5.0 V, not transmitting, V_{LEDA} ..... –0.5 to +9.0 V
LED Anode Voltage,
V_{CC}=1.5 to 5.0 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 ..... 20 mA
Storage Temperature,
storage or reduced performance, T_S ..... –25 to +85°C
Ambient Temperature, operating, T_A ..... –25 to +85°C
Lead Solder Temperature, 240°C ..... <10 s
Average IR LED Current, I_{LED} ..... 100 mA
Repetitive Pulsed IR LED Current,
<10 µs, t_{on} <20%, LED Anode=3.3 V, $I_{LED(RP)}$ ..... 500 mA
Input Voltage: TxD, Shut Down (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	4	SD
2	TxD	5	V_{CC}
3	RxD	6	GND

Figure 1. Block Diagram



Theory of operation

The IRM5000 Microline Infrared Data Transceiver consists of a detector photodiode, an IR LED transmitter, an IC containing ambient light suppressor and Automatic Gain control circuitry (AGC).

The AGC in the IC is to keep the system output constant by varying the gain to accommodate a wide range of input signals. It also provides noise immunity in the high noise ambient environment.

For normal operation of the transmit and receiver modes, the Shut Down (SD) pin should be held low. It is recommended that this pin be connected to GND if Shut Down (SD) feature is not used.

In receive mode, the receiver output (RxD) which normally stays high, will go low for duration of the received 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 transit mode, by asserting the TxD pin above $^1/_2\ V_{CC}$ will turn on IR LED transmitter. LED Anode (pin 1) can be connected to V_{CC} or an unregulated power supply (not to exceed V_{CC} + 4.0 V). It is recommended that a resistor be connected in serial to set the proper LED current to reduce the thermal dissipation and to lower LED current when V_{LED} is greater than 3.3 V.

Table 2. Microline IRM5000 Truth Table

Inputs				Outputs	
SD	V_{CC}	TxD	Detector	RxD	LED
High	2.4 to 5.0 V	X=don't care state	X=don't care state	500 kΩ pull-up	Off
Low	2.4 to 5.0 V	High		Undefined	On
	2.4 to 5.0 V	Low	<0.4 μW/cm^2	High	Off
	2.4 to 5.0 V		<4.0 μW/cm^2	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	—	2.4	—	115.2	Kb/s	1.63 µs or 3/16 clock period
V_{CC} Voltage	V_{CC}	2.4	—	5.0	V	–25°C to +85°C, V_{CC} to V_{SS}
Maximum LED Anode Voltage	V_{LEDA}	—	—	V_{CC}+4	V	V_{CC}=2.4 V to 5.0 V
I_{CC} Shut Down Current **(Note 1)**	I_{CC1}	—	0.01	1.0	µA	SD=V_{CC}, V_{CC}=2.7 V to 5.0 V
I_{CC} Standby Current (Average)	I_{CC2}	—	110	—	µA	SD=0, V_{CC}=2.7 V no signal
I_{CC} Receiving Current (Average)	I_{CC3}	—	120	—	µA	V_{CC}=2.7, E=40W/m^2
I_{CC} Transmitting Current (Average)	I_{CC5}	—	1.7	2.5	mA	V_{CC}=2.7 V to 3.3 V, No LED resistor V_{LED}=3.0 V DC

Table 4. I/O Parameters

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
TxD, SD input capacitance	—	—	5.0	—	pF	V_{CC}=2.4 V to 5.0 V
TxD Input Impedence	—	—	500	—	kΩ	TxD=V_{CC}, V_{CC}=2.4 V to 5.0 V
TxD, SD Input Threshold **(Note 1)**	—	0.8	1.4	2.0	V	V_{CC}=2.4 V to 5.0 V
SD to RxD Tri-State	—	—	35	100	ns	V_{CC}=2.4 V to 5.0 V
SD to RxD Enable	—	—	90	200	ns	V_{CC}=2.4 V to 5.0 V
RxD Output High	V_{OH}	—	4.3	—	V	V_{CC}=5.0 V, I_{OH}=4.0 mA
RxD Output High	V_{OH}	—	1.7	—	V	V_{CC}=2.4 V, I_{OH}=1.0 mA
RxD Output Low	V_{OL}	—	0.7	—	V	V_{CC}=5.0 V, I_{OL} =4.0 mA
RxD Output Low	V_{OL}	—	0.3	—	V	V_{CC}=2.4 V, I_{OL}=1.0 mA
RxD Short Circuit	—	—	25	—	mA	V_{CC}=5.0 V, RxD=0, RxD=V_{CC}
RxD Short Circuit	—	—	4.0	—	mA	V_{CC}=2.4 V, RxD=0, RxD=V_{CC}
RxD to V_{CC} Tri-State Imp	—	—	500	—	kΩ	SD=V_{CC}, V_{CC}=2.0 V to 5.0 V
RxD Rise/Fall Time	t_r, t_f	—	35	—	ns	V_{CC}=5.0 V, Load=15 pF
RxD Rise/Fall Time	t_r, t_f	—	60	—	ns	V_{CC}=2.0 V, Load=15 pF

Table 5. Receiver Parameters, T_A=25°C

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Supported IrDA Data Rate	—	2.4	—	115.2	Kb/s	1.63 µs with E_e=4.0 µW/cm^2 to 500 mW/cm^2
Receive 1/2 Angle	—	15	20	30	degrees	IrDA *Physical Layer* specification
Minimum Signal Detect Irradiance	E_{IHmin}	—	2.0	4.0	µW/cm^2	Bit error Rate=10^{-8}, 1.63 µs pulse
Maximum Signal Detect Irradiance	E_{Emax}	—	500	—	mW/cm^2	Bit error Rate=10^{-8}, 1.63 µs pulse
Maximum Signal Irradiance No detect	—	—	—	0.3	µW/cm^2	< 0.1 pulse per second detect, 20 kHz—200 kHz square wave <100 ns rise/fall
Maximum DC Ambient Irradiance 5.0 V	—	—	10	—	mW/cm^2	V_{CC}=5.0 V
Maximum DC Ambient Irradiance 2.4 V	—	—	2.5	—	mW/cm^2	V_{CC}=2.4 V
Transmit Receiver Latency **(Note 2)**	t_L	—	50	100	µs	0 to 3.0 mW/cm^2 DC ambient input
Powerup Receiver Latency	—	—	100	150	µs	0 to 2.5 mW/cm^2 DC ambient input
Small Ripple Power Supply Rejection **(Note 3)**	—	—	100	—	mV/µs	100 mV_{p-p} triangle wave on V_{CC}
Large Ripple Power Supply Rejection **(Note 3)**	—	—	200	—	mV/ms	1.0 V_{p-p} triangle wave on V_{CC}

Table 6. Transmitter Output

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Maximum Data Rate	—	—	—	115.2	Kb/s	TxD pulse width=1.63 µs
TxD Radiant Intensity	—	40	70	230	mW/Sr	5.1 Ω LED resistor, 5.0 V LED supply
TxD 1/2 Angle	—	15	20	30	degrees	IrDA *Physical Layer* specification 1.3
TxD Peak Wavelength	—	850	870	900	nm	—
Radiant 50% Pulse Width, TX High/Low	—	1.51	1.61	1.71	µs	TxD=1.63 µs, I_{LED}=330 mA, V_{CC}=5.0 V
Optical Rise/Fall Time, TX High or Low	—	—	30	600	ns	TxD=1.63 µs, V_{CC}=5.0 V
I_{LED} Limit, TX Standard	—	250	350	400	mA	TxD=V_{CC}, LED anode=3.3 V, V_{CC}=5.0 V

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 cut-off 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:

"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 Turn-around Time".

Note 3:

The receiver V_{CC} power supply rejection is significantly better for small ripple of less than 100 mV_{p-p} than for larger values. For ripple of more than 100 mV_{p-p}, internal circuits can maintain operating headroom provided that the slew rate is significantly slower. Typically, these specifications allow operation without an external filter from either switching supplies with less than 50 mV_{p-p} ripple or unregulated supplies with less than 1.0 V_{p-p} of 120 Hz ripple.

Figure 2. Timing Diagrams

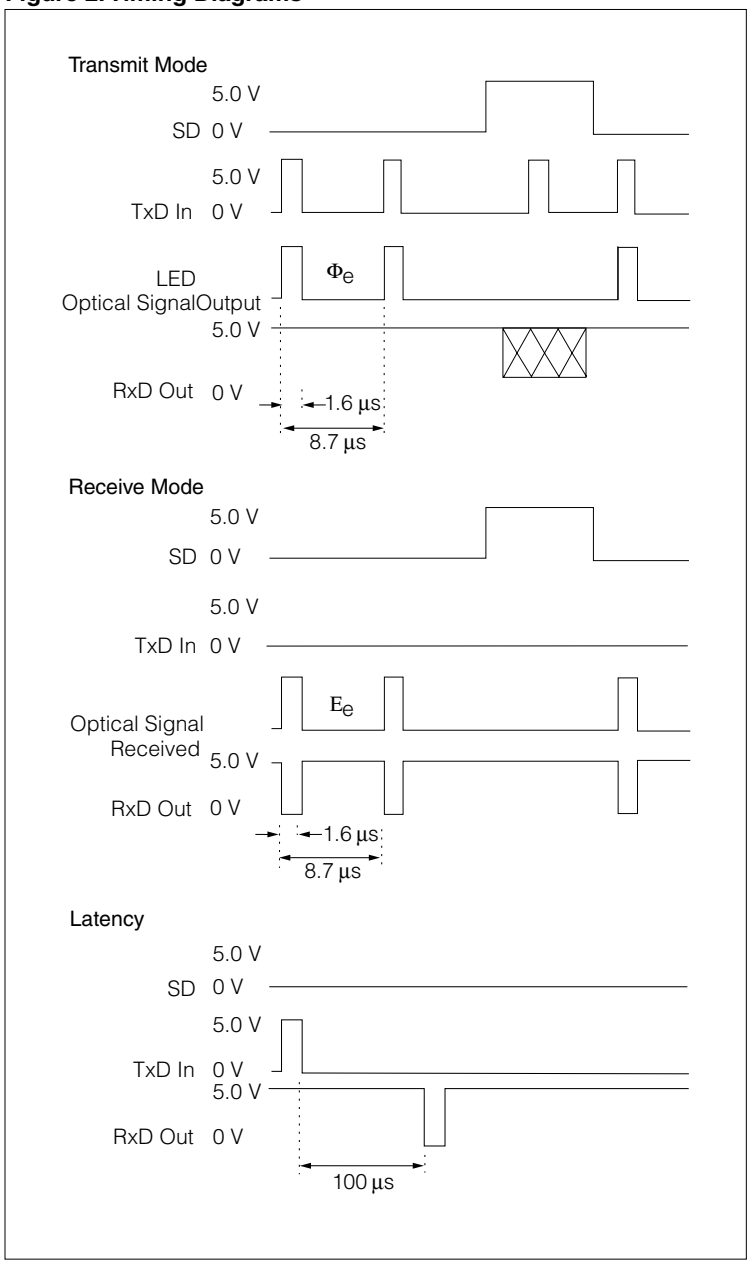


Figure 3. Input Schematics

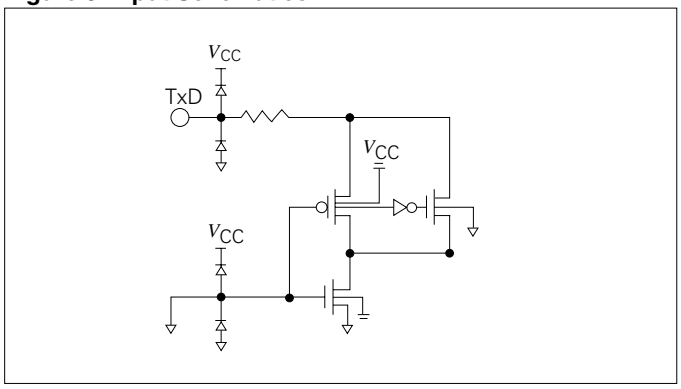


Figure 4. Output Schematics

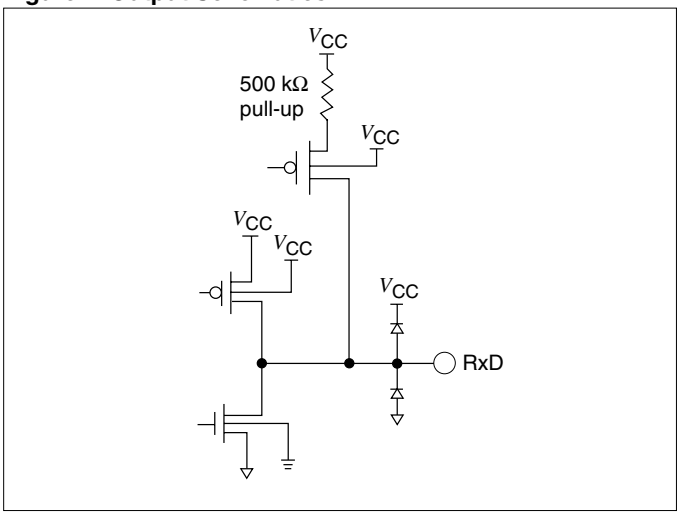
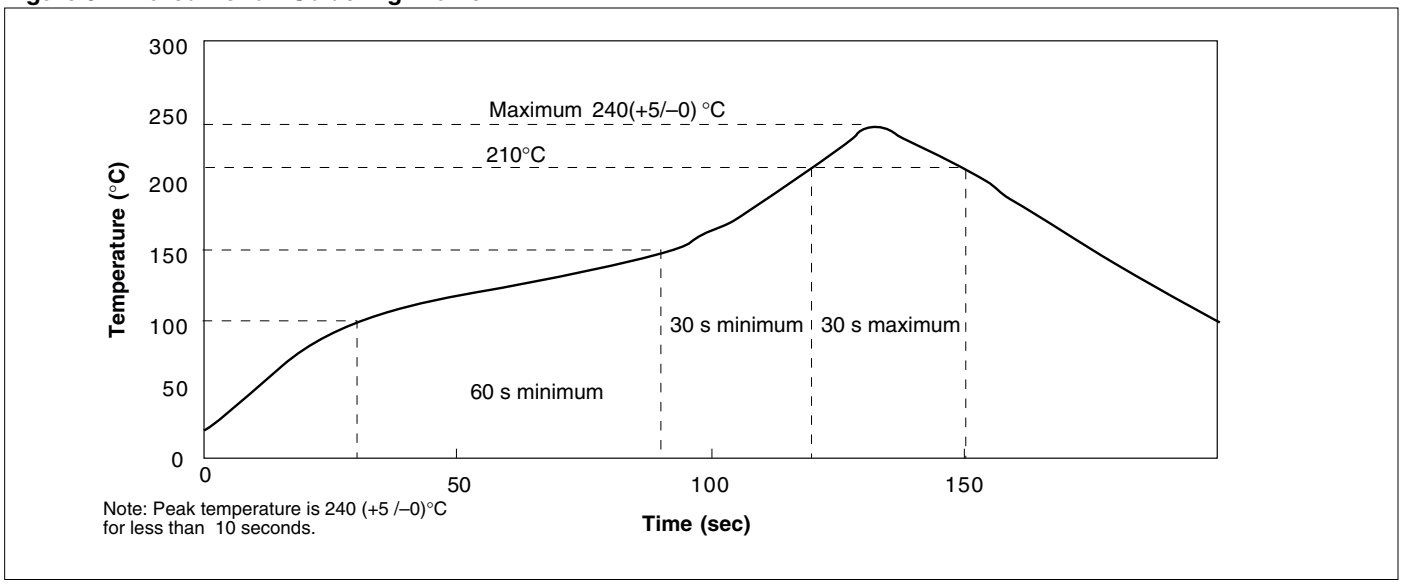


Figure 5. Infrared Reflow Soldering Profile



Interface Diagrams

Figure 6. Super I/O (PC87338VLJ) to IRM5000

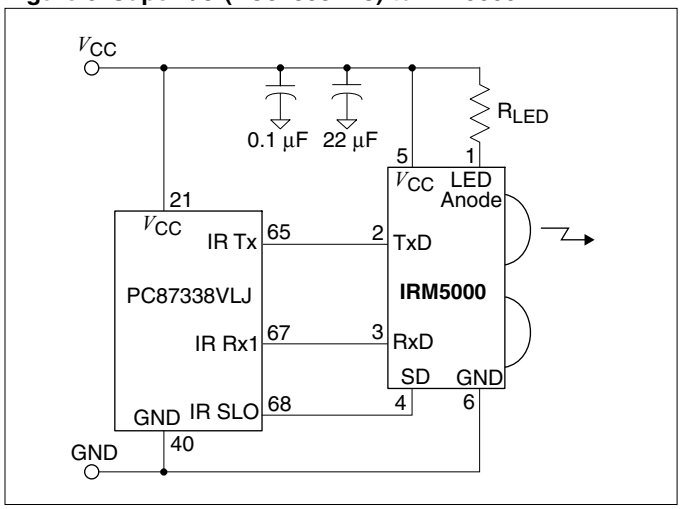


Figure 7. With independent V_{LED} power supply

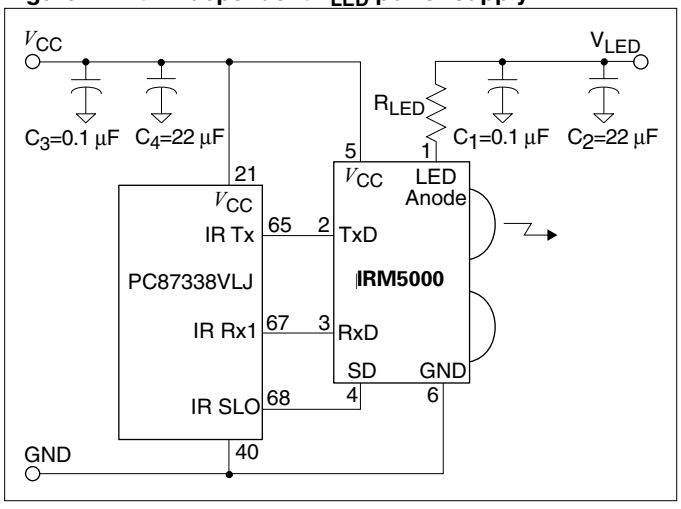


Table 7. External Component

Parameter	Values						Unit
V_{LED} power supply	2.7	3.0	3.3	4.0	4.5	5.0	V
Resistor (R_{LED})	0	0	0	2.2	5.6	6.8	Ω

Table 8. Ordering Information

Part Number	Description	PCB Mounting Orientation
IRM5000	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 8. Reel Dimensions in Inches (mm)

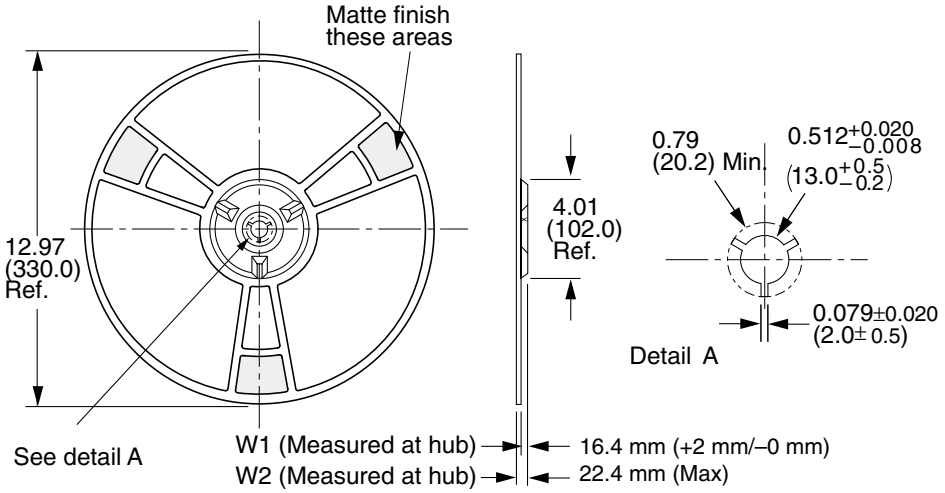


Figure 9. Tape dimensions in inches (mm)

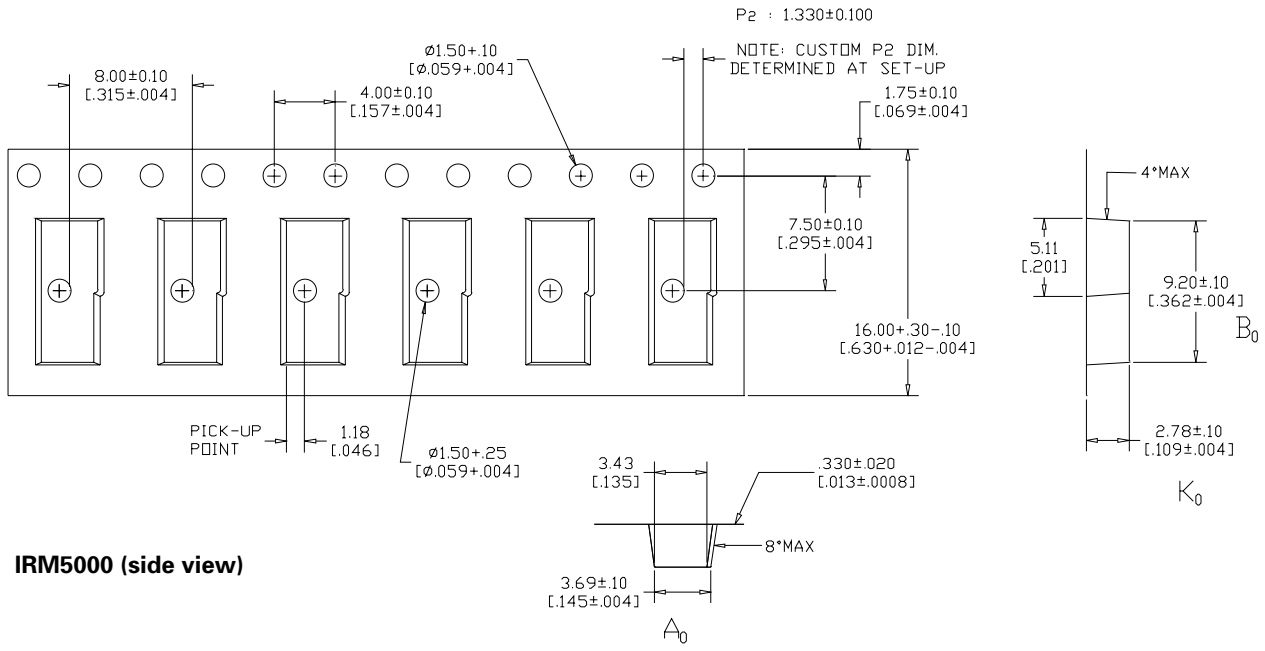
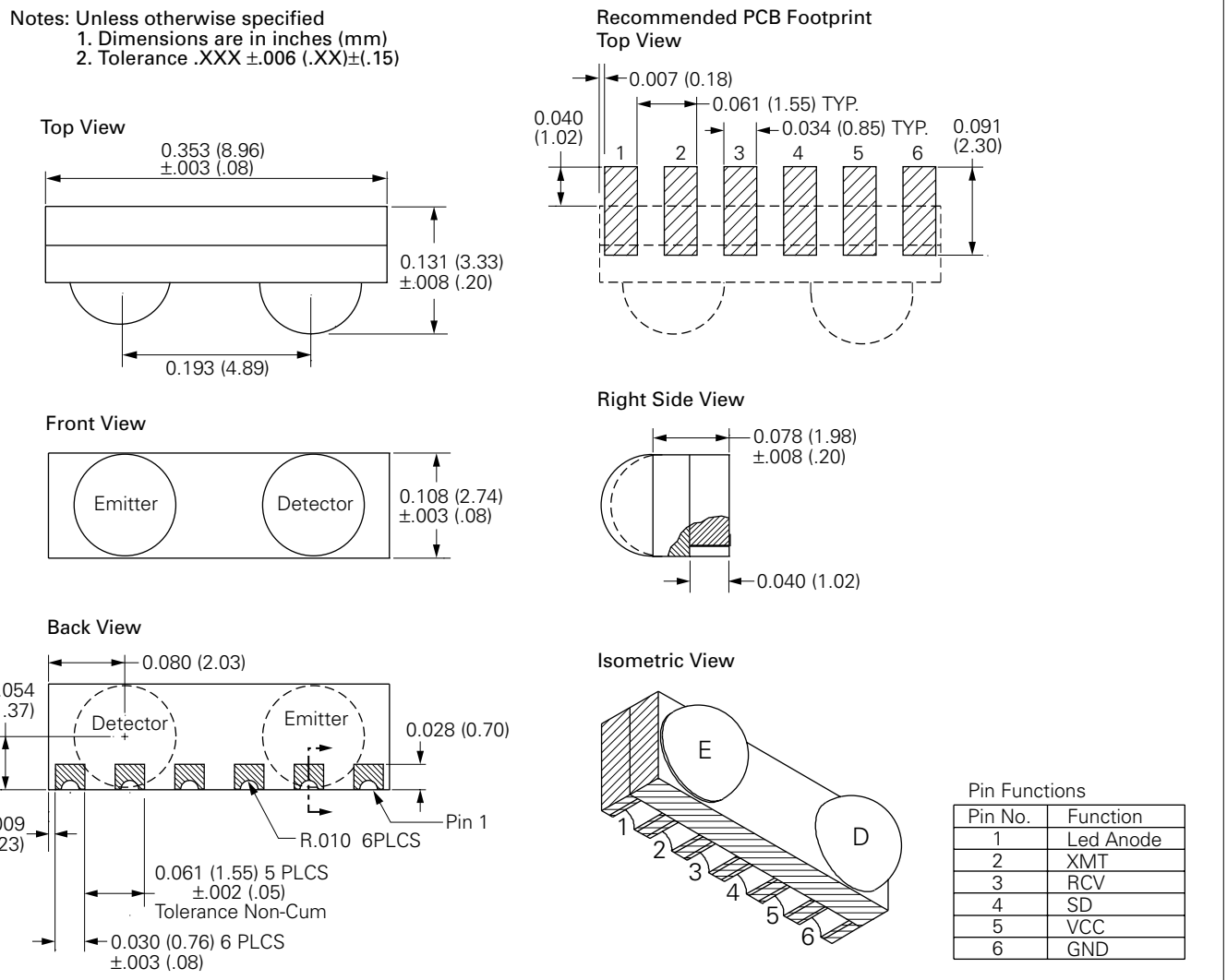


Figure 10. IRM5000 Detail Drawings



Pin Functions

Pin No.	Function
1	Led Anode
2	XMT
3	RCV
4	SD
5	VCC
6	GND

MEMBER IrDA

Infrared Data Association