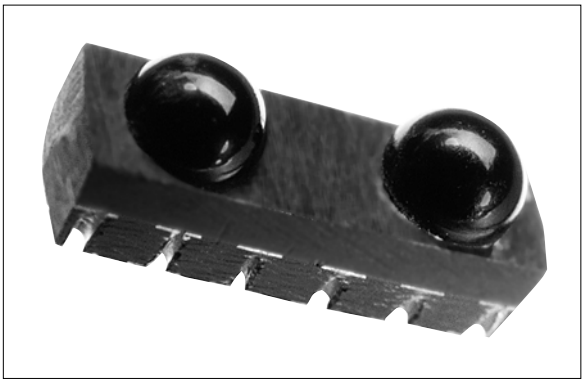
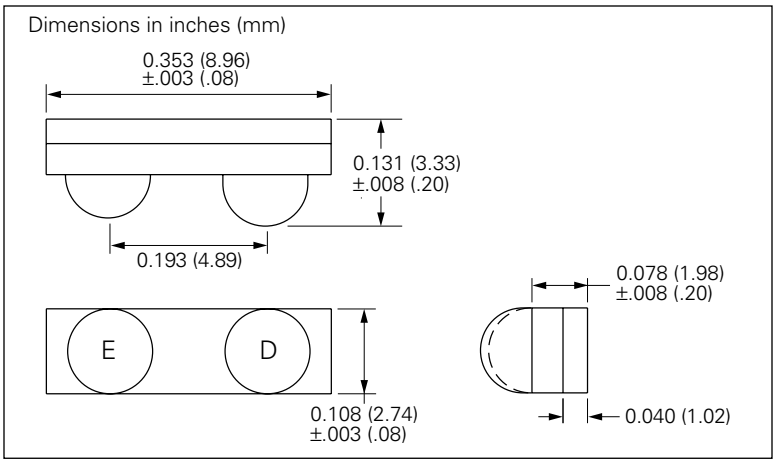
IRMS 5100

Microline, 1.15 Mb/s Data Transceiver

Preliminary





FEATURES

- **Compatible with IrDA *Physical Layer Specification 1.3***
- **Data Rates 9.6 Kb/s to 1.15 Mb/s**
- **Battery & Power Management Features:**
  - **Receive standby 470 µA Typical**
  - **Shutdown 10 nA Typical**
  - **Independent LED Anode Supply 2.7 V up to 9.0 V DC**
  - **Wide V_{CC} Voltage Range 2.7 V to 5.5 V**
  - **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) 8.86 mm**

Applications:

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

DESCRIPTION

The Infineon IRMS5100 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 5.5 V, not transmitting, V_{LEDA} ..... –0.5 to +9.0 V
LED Anode Voltage,
  V_{CC}=1.5 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 .....–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, $I_{LED(RP)}$ .....600 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

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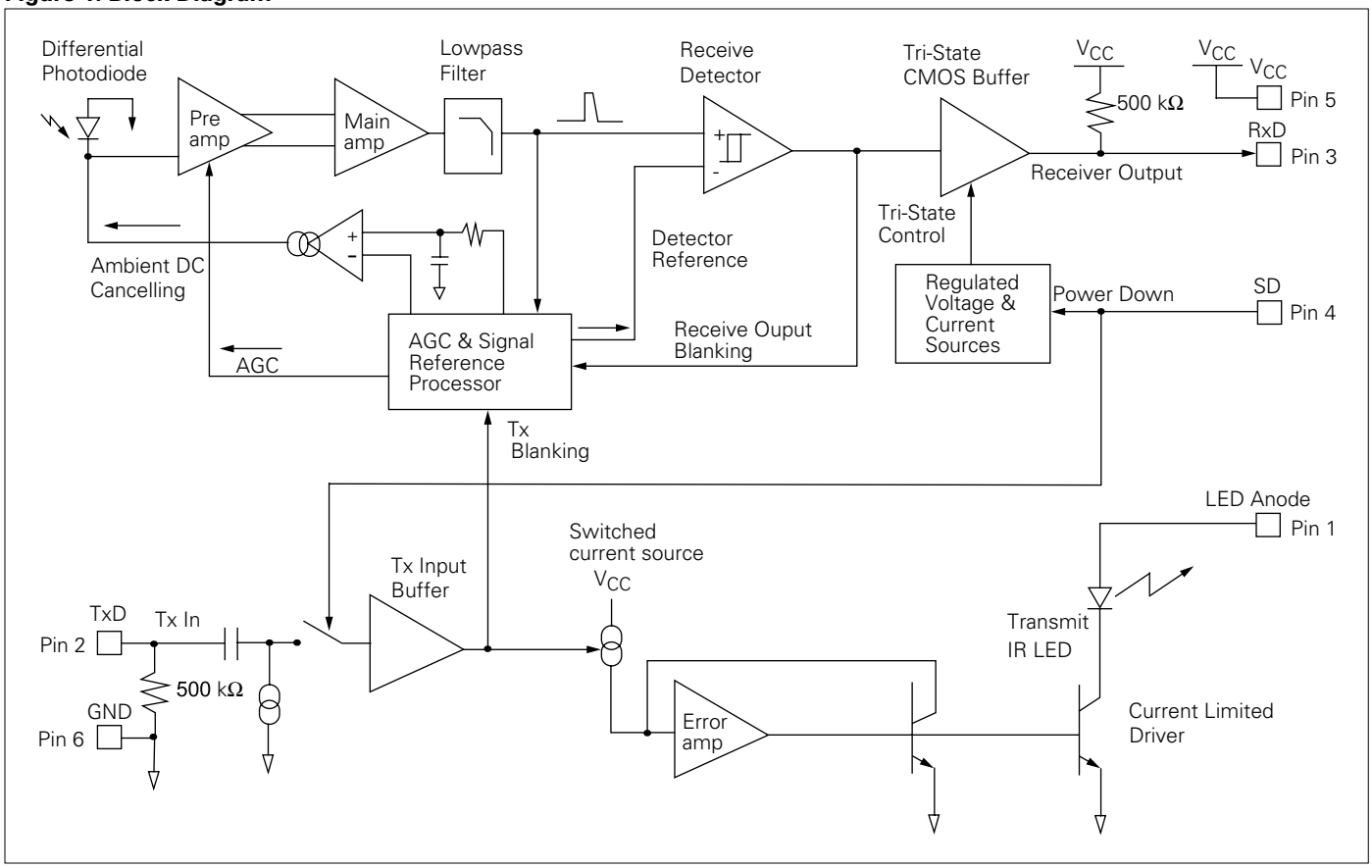
Figure 1. Block Diagram



Theory of operation

The IRMS5100 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 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 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 IRMS5100 Truth Table

Inputs				**Outputs**	
SD	V_{CC}	TxD	Detector	RxD	LED
High	2.4 to 5.5 V	X=don't care state	X=don't care state	500 kΩ pull-up	Off
Low	2.4 to 5.5 V	High		Undefined	On
	2.4 to 5.5 V	Low	<0.4 µW/cm^2 (115 Kb/s)	High	Off
	2.4 to 5.5 V		<1.0 µW/cm^2 (1 Mb/s)		
	2.4 to 5.5 V	Low	<4.0 µW/cm^2 (115 Kb/s)	Low	Off
	2.4 to 5.5 V		<10.0 µW/cm^2 (1 Mb/s)		

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	—	1152	Kb/s	3/16 clock period, or 1/4 clock >115 Kb/s
V_{CC} Voltage	V_{CC}	2.7	—	5.5	V	–25°C to +85°C, V_{CC} to V_{SS}
Maximum LED Anode Voltage	V_{LEDA}	—	—	V_{CC}+4	V	V_{CC}=2.7 V to 5.5 V
I_{CC} Shut Down Current **(Note 1)**	I_{CC1}	—	0.01	1.0	µA	SD=V_{CC}, V_{CC}=2.7 V to 5.5 V
I_{CC} Standby Current (Average)	I_{CC2}	375	470	585	µA	SD=0, V_{CC}=2.7 V no signal
I_{CC} Receiving Current (Average)	I_{CC3}	—	650	—	µA	4.0 µW/cm^2, 1.0 Mb/s, 15 pF load
I_{CC} Transmitting Current (Average)	I_{CC5}	—	3.0	4.5	mA	V_{CC}=5.0 V, I_{LED}=300 mA

Table 4. I/O Parameters

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
TxD, SD input capacitance	—	—	5.0	—	pF	V_{CC}=2.7 V to 5.5 V
TxD Input Impedence	—	350	500	650	kΩ	TxD=V_{CC}, V_{CC}=2.7 V to 5.5 V
TxD, SD Input Threshold **(Note 1)**	—	0.8	1.4	2.0	V	V_{CC}=2.7 V to 5.5 V
SD to RxD Tri-State	—	—	35	100	ns	V_{CC}=2.7 V to 5.5 V
SD to RxD Enable	—	—	90	200	ns	V_{CC}=2.7 V to 5.5 V
RxD Output High	V_{IH}	4.3	4.6	—	V	V_{CC}=5.0 V, I_{OH}=8.0 mA
RxD Output High	V_{IH}	1.5	1.7	—	V	V_{CC}=2.7 V, I_{OH}=2.0 mA
RxD Output Low	V_{IL}	—	0.22	0.4	V	V_{CC}=5.0 V, I_{OL} =8.0 mA
RxD Output Low	V_{IL}	—	0.17	0.3	V	V_{CC}=2.7 V, I_{OL}=2.0 mA
RxD Short Circuit	—	—	40	—	mA	V_{CC}=5.0 V, RxD=0, RxD=V_{CC}
RxD Short Circuit	—	—	8.0	—	mA	V_{CC}=2.7 V, RxD=0, RxD=V_{CC}
RxD to V_{CC} Tri-State Imp	—	350	500	650	kΩ	SD=V_{CC}, V_{CC}=2.7 V to 5.5 V
RxD Rise/Fall Time	t_r, t_f	12	18	27	ns	V_{CC}=5.0 V, Load=15 pF
RxD Rise/Fall Time	t_r, t_f	20	30	40	ns	V_{CC}=5.0 V, Load=50 pF
RxD Rise/Fall Time	t_r, t_f	24	36	55	ns	V_{CC}=2.7 V, Load=15 pF
RxD Rise/Fall Time	t_r, t_f	42	63	94	ns	V_{CC}=2.7 V, Load=50 pF

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

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Supported IrDA Data Rate	—	—	1.15	—	Mb/s	200 ns 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}	—	3	10	µW/cm^2	Bit error Rate=10^{-8}, 217 ns pulse
Maximum Signal Detect Irradiance	E_{Emax}	500	1000	—	mW/cm^2	Bit error Rate=10^{-8}, 217 ns pulse
Maximum Signal Irradiance No detect	—	—	—	0.3	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 2.4 V	—	—	10	—	mW/cm^2	V_{CC}=2.7 V
AGC Attack Time **(Note 2)**	—	—	300	1000	µs	E_e=4.0 µW/cm^2 to 500 mW/cm^2
AGC Settling **(Note 3)**	—	—	2.0	5.0	pulse	E_e=4.0 µW/cm^2 to 500 mW/cm^2 at 217 ns
AGC Decay Rate **(Note 5)**	—	—	44	—	dB/ms	Following AGC settling at 500 mW/cm^2
Transmit Receiver Latency **(Note 4)**	t_L	—	50	100	µs	0 to 3.0 mW/cm^2 DC ambient input
RxD Suppression Duration **(Note 7)**	—	—	50	100	µs	Following end of TxD pulse
Powerup Receiver Latency	—	—	50	100	µs	0 to 2.5 mW/cm^2 DC ambient input
First Pulse Width at RxD **(Note 8)**	—	150	500	900	ns	217 ns E_e=4.0 µW/cm^2 to 500 mW/cm^2 input

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

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Subsequent Pulse Width at RxD **(Note 8)**	—	150	217	400	ns	217 ns E_e=4.0 µW/cm^2 to 500 mW/cm^2 input
Small Ripple Power Supply Rejection **(Note 6)**	—	50	100	—	mV/µs	100 mV_{p-p} triangle wave on V_{CC}
Large Ripple Power Supply Rejection **(Note 6)**	—	100	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	—	—	1.15	1.15	Mb/s	—
TxD Radiant Intensity	—	80	150	500	mW/Sr	V_{CC}=5.0 V, LEDA-3.3 V, Tx High, 25% duty cycle
TxD 1/2 Angle	—	15	20	30	degrees	IrDA *Physical Layer* specification 1.3
TxD Peak Wavelength	—	850	880	900	nm	—
I_{LED} Limit, TX Standard	—	385	500	650	mA	TxD=V_{CC}, LED anode=3.3 V, V_{CC}=2.7 V to 5.5 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:

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.

Note 7:

RxD is suppressed (forced high) while (TxD) transmit pulse is active and for the indicated period following the end of the TxD pulse.

Note 8:

"First Pulse Width" specifies the width of the first pulse received after AGC has decayed to maximum sensitivity. "Subsequent Pulse Width" defines the width of subsequent pulses received within 100 µs of first pulse.

Figure 2. Timing Diagrams

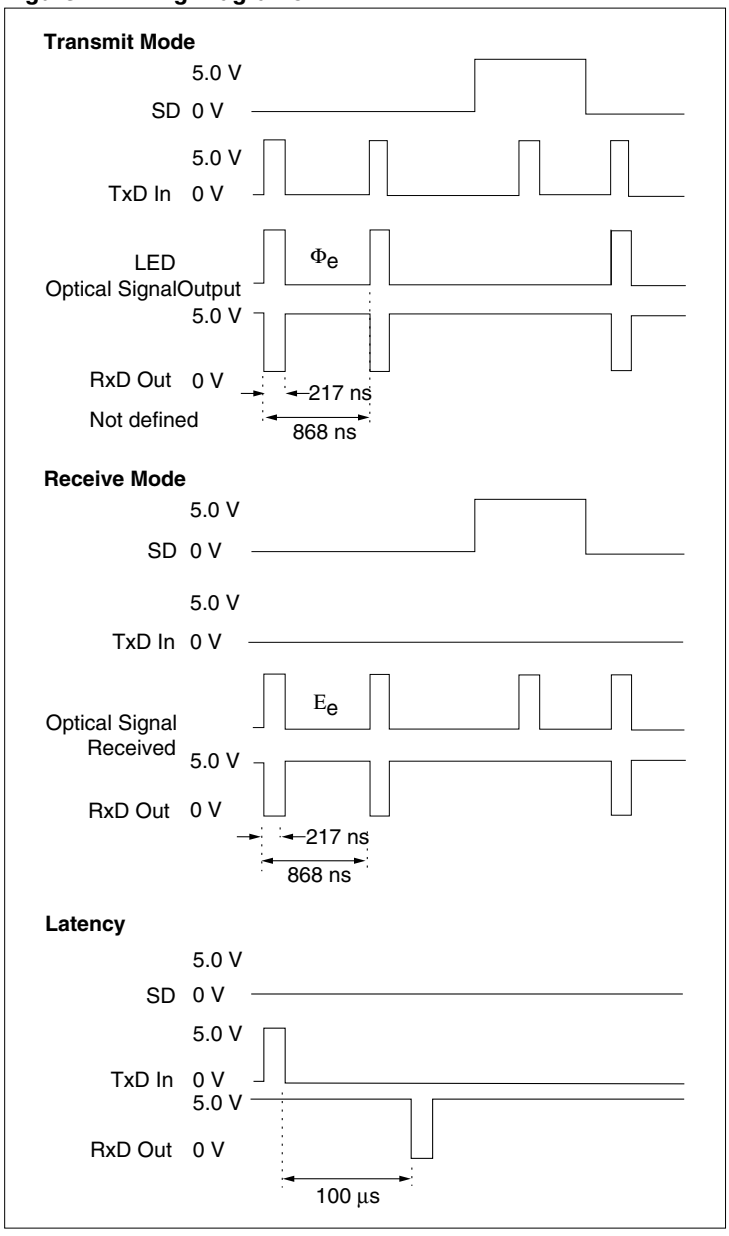


Figure 3. Input Schematics

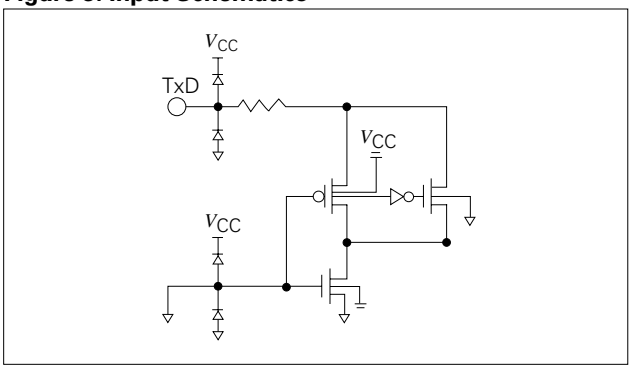


Figure 4. Output Schematics

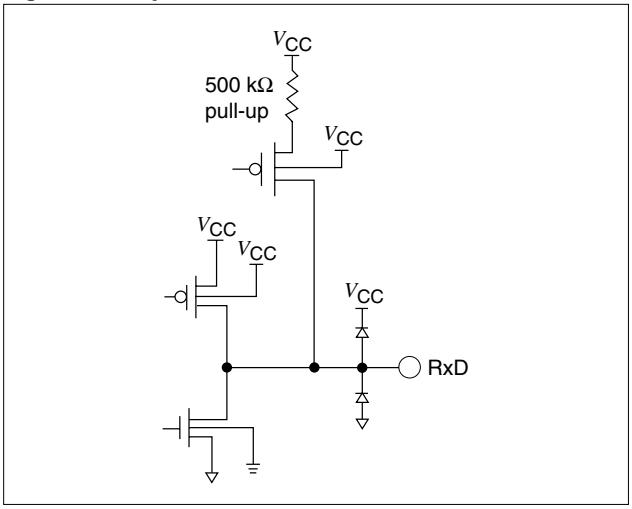
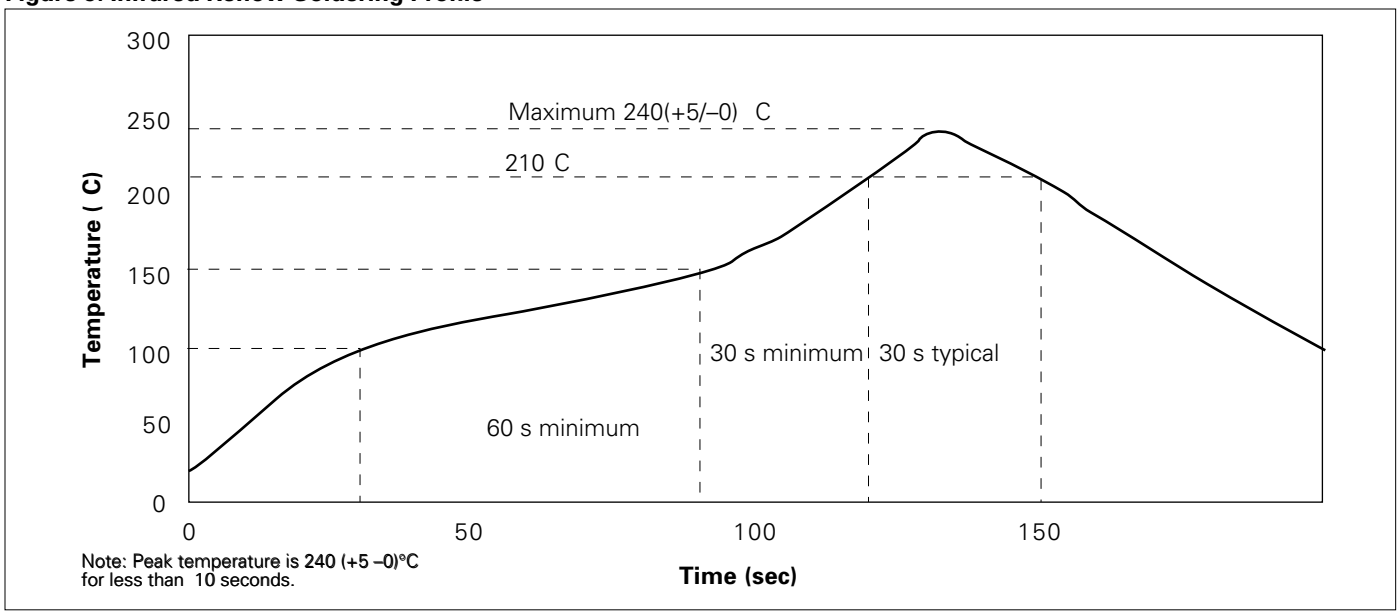


Figure 5. Infrared Reflow Soldering Profile



Interface Diagrams

Figure 6. Super I/O (PC87338VLJ) to IRMS5100

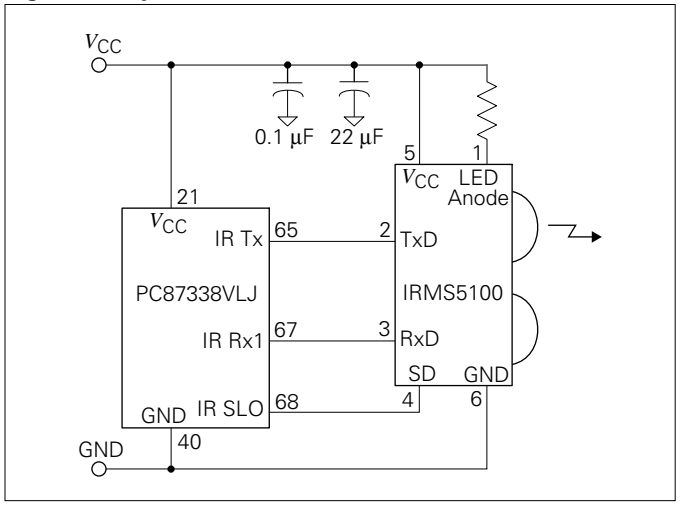


Figure 7. With independent V_{LED} power supply

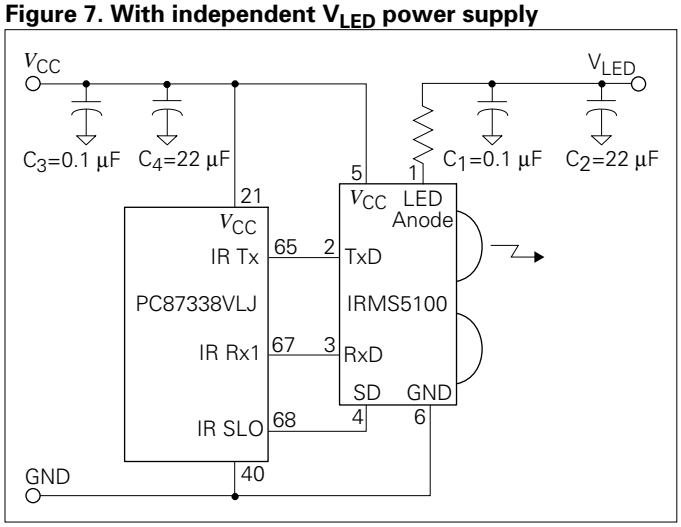


Table 7. External Component

Parameter	Values							Unit
V_{LED} power supply	2.0	2.7	3.0	3.5	4.0	4.5	5.0	V
Resistor (R_{LED})	0	0	0	1.2	2.7	3.9	5.1	Ω

Ordering Information

Part Number	Description	PCB Mounting Orientation
IRMS5100	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.		

Reel Dimensions in Inches (mm)

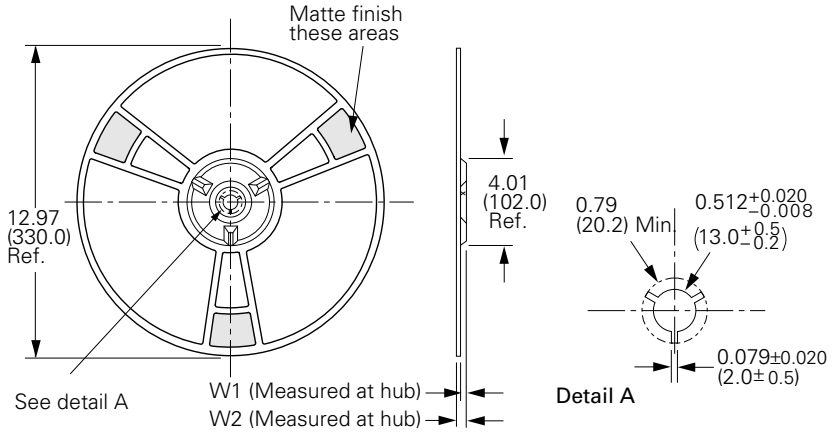
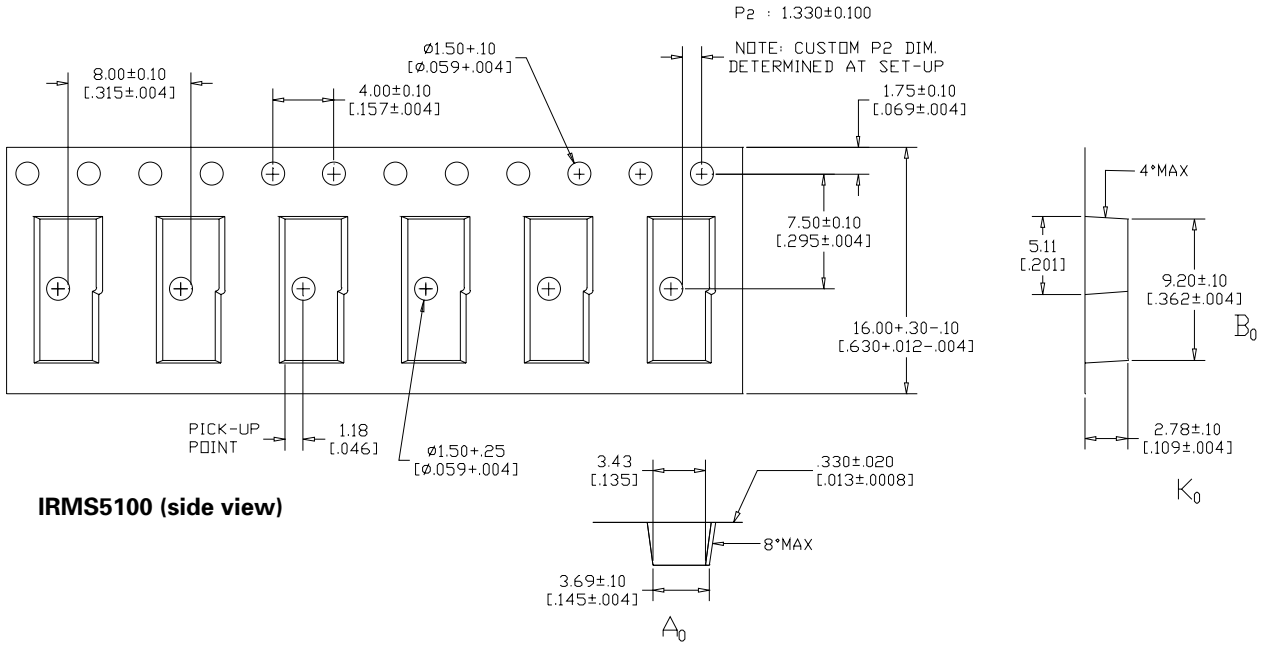
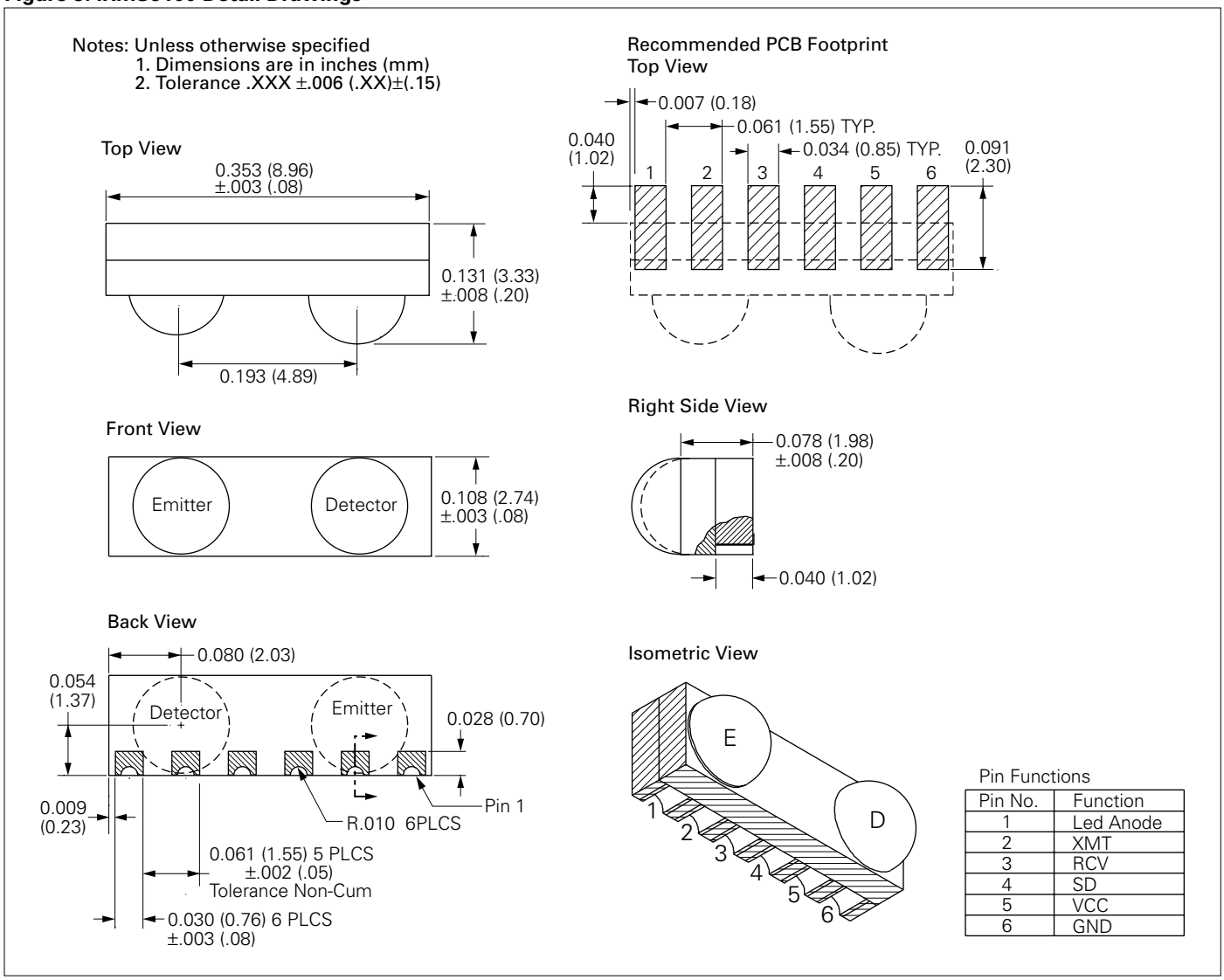


Figure 8. Tape dimensions in inches (mm)



IRMS5100 (side view)

Figure 9. IRMS5100 Detail Drawings



Pin Functions

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

MEMBER IrDA

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