



## Technical Data Sheet

### Infrared Data Transceiver Module

Preliminary

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#### TM3600/TR2

#### Features

- Excellent Fluorescent noise immunity and very high EMI immunity
- Shutdown disables transmit input and tri-states receiver output with a 500K ohm pullup.
- Wide Operating Voltage Range from 2.4 to 5.5 Volts
- IrED Operating Voltage Range from 2.4 to  $V_{cc}+4$  Volts
- Small Surface Mount Package:
  - L12.2mm \* W5.1mm \* H4.0mm
- 2.4kbps to 4Mbps data rates IrDA compliant
- Programmable current limit transmitter:
  - 70us pulse width limiting
- Dual Selects High speed (4M)/Low speed mode:
  - Control Pin (BC) Select
  - By TXD clocking with SD
- Few External Components Required

#### Descriptions

The TM3600/TR2 is a new generation of low cost, multi-mode IrDA module in small surface mount package. The operating voltage can range from 2.4 to 5.5 Volts and IrED supply voltage can arrive  $V_{cc}+4$  Volts. This module supports data rates speed up to 4Mbps and compliant to the IrDA 1.3. The transmitter input is AC coupled, limiting transmitter pulse duration to 70 us, preventing transmitter damage and continuous IrED output.

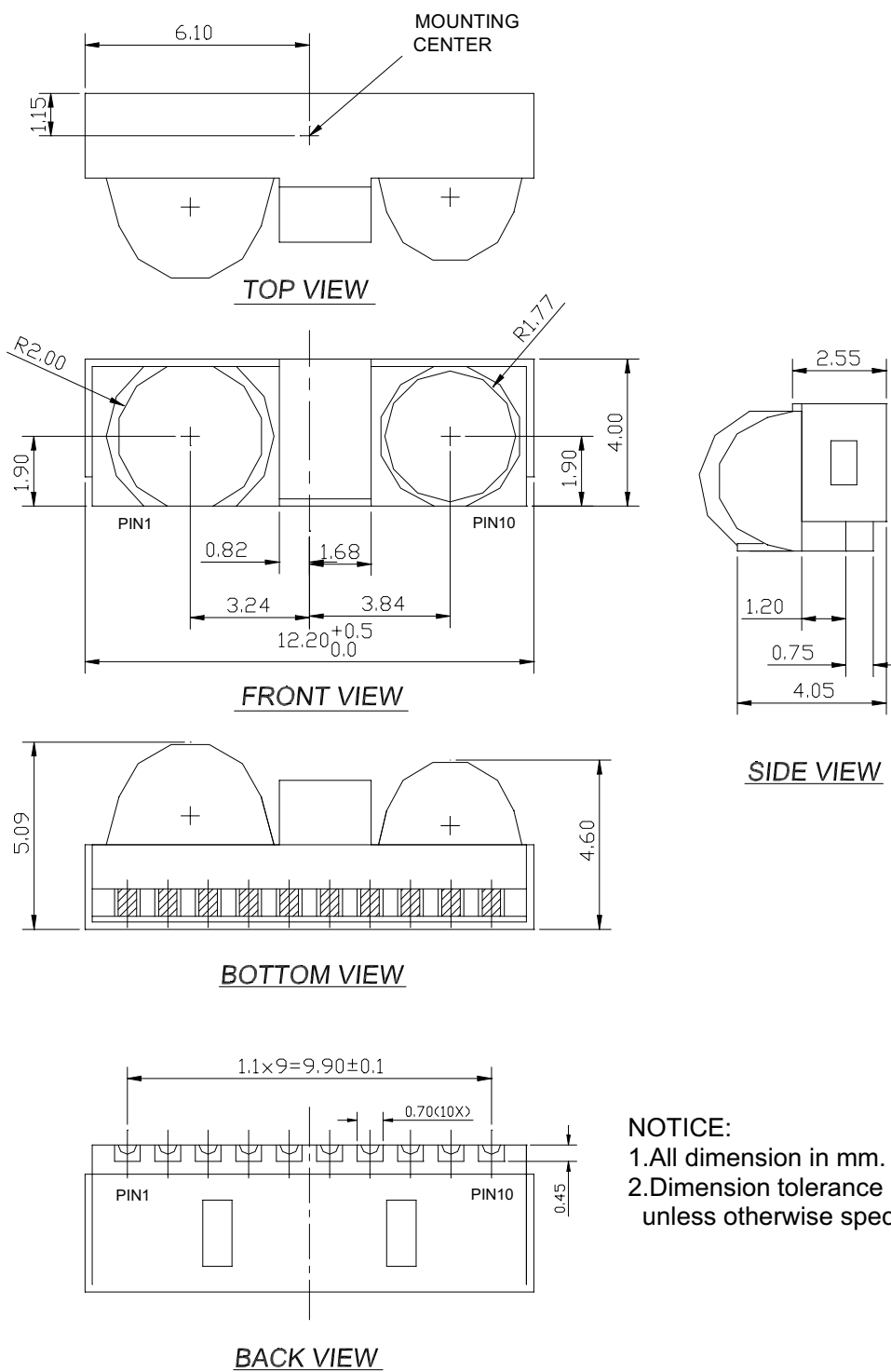
#### Applications

- Notebook
- Digital Still and Video Cameras
- Cellular Phones, Pagers, Smart Phones
- PDA, Printers
- PCs

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Device NO:DTM-360-001

## Package Dimensions

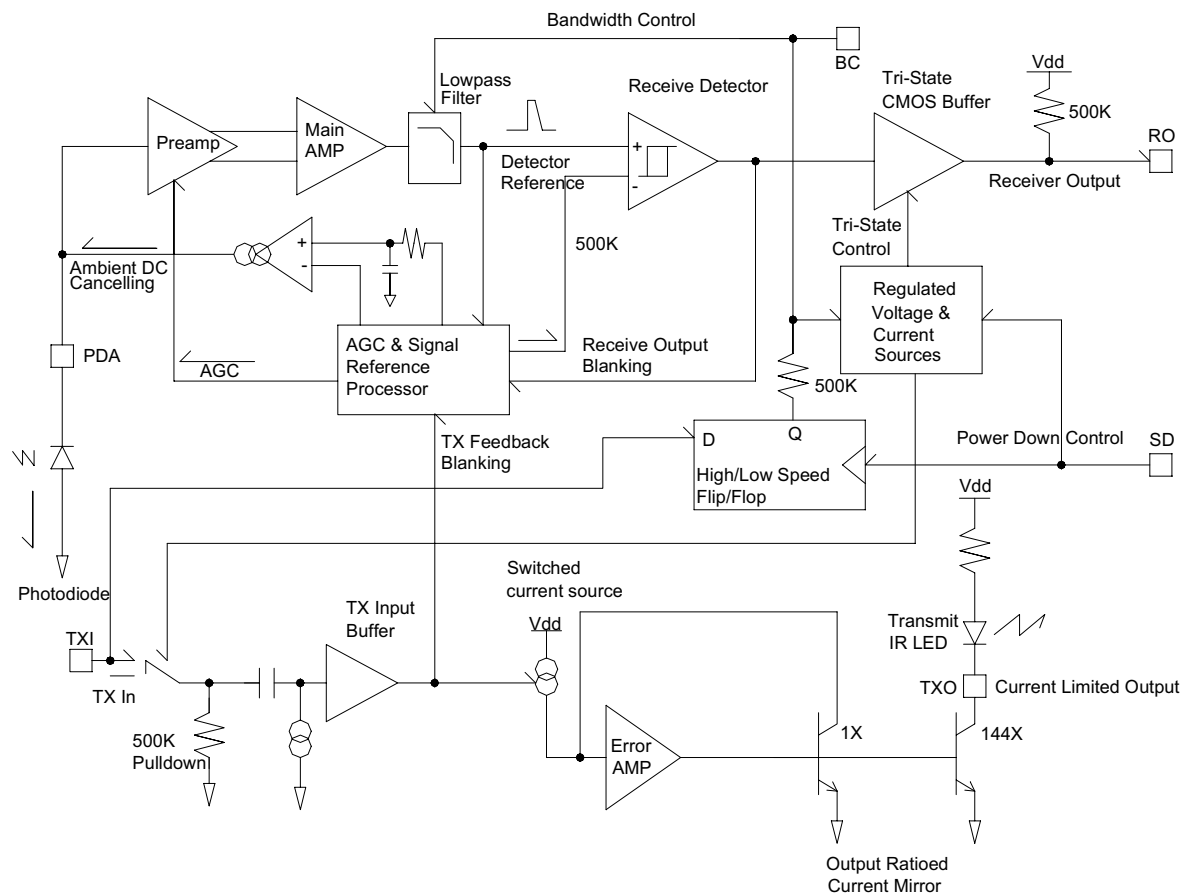


**NOTICE:**

- 1.All dimension in mm.
- 2.Dimension tolerance is  $\pm 0.20\text{mm}$  unless otherwise specified

**Device Selection Guide**

Mode	Transmitter		Receiver		$\lambda$ p	Operating Voltage (Vcc)	Data Rate
	Distance	Angle $2\theta$ 1/2	Distance	Angle $2\theta$ 1/2			
High Power	>1.0m	+/-15	>1.0m	+/-30	850~900 nm	2.4~5.5 Volts	2.4K~4M bps

**Functional Block Diagram**


**Pin Descriptions**

Pin	Symbol	Function	Description	I/O	Active
1	Vcc	Supply Voltage	Note 1		
2	AGND	Analog Ground	Note 2		
3	BC	Bandwidth Control	The control of high/low speed mode. Note 3		
4	SD	Shut Down	Note 4		High
5	NC	No Connection			
6	NC	No Connection			
7	GND	GND			
8	RXD	Receiver Data Output	Note 5	O	Low
9	TXD	Transmitter Data Input	Note 6	I	High
10	VLEDA	IrED Anode	Note 7		

Note 1: Receiver power supply 2.4 to 5.5 Volts. Power supply noise in 5KHz to 5MHz range must be less than 50mV peak, if greater than 5MHz it must be less than 10mV peak. Higher power supply noise may cause spurious receive output.

Note 2: Due to high di/dt(100mA/ns) transmit IrED currents returning on this pin, it is recommended that good high frequency capacitive decoupling be provided within 1cm the package between the IrED anode supply and AGND.

Note 3: The speed control logic through a 500K ohm resistor. The BC pin can be directly strapped high to force high speed mode or low to force low speed mode.

Note 4: Has 500K ohm pull-up. Asserting this pin above 1.4V causes the device to shut down. The trailing edge of shut down (enable) is used to clock the TXI input into the high/low speed mode control D flip flop. Current consumption in shut down mode is less than 1uA(if driven to more than Vcc-0.5V). Shut down gates off the transmitter input and tri-states the receiver output (RO) to full sensitivity.

Note 5: Normally high, goes low for duration of receive pulse. Output is a CMOS driver providing rail to rail operation.

Note 6: Asserting this pin turns on transmitter. Has 500K ohm pull down. This input is capacitive coupled to limit transmit pulse width to about 70usec and is gated by the shutdown function. The transmit pulse rise time must be faster than 1 usec.

Note 7: This is a constant 600mA (current sink). The output can be allowed to saturated and output current can be limited by addition of resistor in series with the IrED. When using IrED anode supplies above 3.3V a series resistor should be used to reduce thermal IR drop across the transmitter driver.

### Absolute Maximum Ratings (Ta=25°C)

Reference point Pin GND unless otherwise noted.

Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	All States	V <sub>CC</sub>	-0.5		7	V
IrED Supply Voltage	SD=0, TXD=V <sub>CC</sub>	V <sub>LEDA</sub>	-0.5		V <sub>CC</sub> +4	V
	V <sub>CC</sub> =0~7V, TXD=0	V <sub>LEDA</sub>	-0.5		9	V
Receiver Data Output	All States	RXD	-0.5		V <sub>CC</sub> +0.5	V
Transmitter Data Input	All States	TXD	-0.5		V <sub>CC</sub> +0.5	V
Shut Down	All States	SD	-0.5		V <sub>CC</sub> +0.5	V
Operating Temperature Range		T <sub>amb</sub>	-25		+85	°C
Storage Temperature Range		T <sub>stg</sub>	-40		+85	°C
Soldering Temperature	See Recommended Solder Profile			-	245	°C
Average IrED Current		I <sub>IrED</sub> (DC)			100	mA
Repetitive Pulsed IrED Current	t<50 μs, t <sub>on</sub> <20%	I <sub>IrED</sub> (RP)			700	mA

### Electrical Characteristics

T<sub>amb</sub>=25°C, V<sub>CC</sub>=2.4V to 5.5V unless otherwise noted.

Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
<b>Transceiver</b>						
Supply Voltage	Receive Mode Transmit Mode, R2=3.9Ω	V <sub>CC</sub>	2.4		5.5	V
Supply Current Pin V <sub>CC</sub> (Reecive Mode)	V <sub>CC</sub> =5.0V, SD=0, HSM*1: 4Mbps	I <sub>CC1</sub> (Rx)		2.3		mA
	V <sub>CC</sub> =2.4V, SD=0, HSM*1: 4Mbps	I <sub>CC2</sub> (Rx)		1.75		mA
	V <sub>CC</sub> =2.4V, SD=0, LSM*2: No input	I <sub>CC3</sub> (Rx)		1.4		mA
Supply Current Pin V <sub>CC</sub> (avg) (Transmit Mode)	I <sub>IrED</sub> =400mA (at IrED Anode Pin) V <sub>CC</sub> =5V	I <sub>CC</sub> (Tx)		12		mA
Shut Down Current Pin SD	SD=V <sub>CC</sub> =2 to 5.5V	I <sub>SD</sub>		0.01	1	uA
Transmit Receiver Latency		T <sub>TRL</sub>		50	100	uA
Transceiver Power On Setting Time		T <sub>PON</sub>		100	150	us

\*1 HSM: High Speed Mode

\*2 LSM: Low Speed Mode

**I/O Parameters**

Tamb=25°C, Vcc=2.4V to 5.5V unless otherwise noted.

Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

Parameters	Test Conditions	Min.	Typ.	Max.	Unit
TXD, SD input capacitance	Vcc=2.4 to 5.5V	-	1	-	pF
TXD pull down	TXD=Vcc, Vcc=5V	-	500	-	Kohm
TXD Min. Setup	Vcc=2.4 to 5V, Referenced to SD Negative clocking edge	-	27	40	ns
TXD Min. Hold Time for Mode Change	Vcc=2.4 to 5V, Referenced to SD Negative clocking edge	10	-2	-	ns
TXD input Threshold	Vcc=5V, 125ns input pulse	1	1.4	1.8	V
TXD input Threshold	Vcc=2.4V, 125ns input pulse	0.7	1.0	1.3	V
SD transmit enable setup	Vcc=2.4 to 5V	20	-	-	ns
SD to TXD input disable& RXD tri-state	Vcc=2.4 to 5V	50	-	-	ns
SD pull up	SD=0, Vcc=5V	-	500	-	Kohm
SD input Threshold	Vcc=5V	1.6	1.9	2.2	V
SD input Threshold	Vcc=2.4V	0.8	1.1	1.4	V
RXD Output High	Vcc=5V, Ioh=20mA	3.5	4.0	-	V
RXD Output High	Vcc=2.4V, Ioh=3mA	2.0	2.1	-	V
RXD Output Low	Vcc=5V, Iol=20mA	-	0.7	1.2	V
RXD Output Low	Vcc=2.4V, Iol=3mA	-	0.2	0.4	V
RXD Short Circuit	Vcc=5V, RXD=0, RXD=Vcc	-	48	-	mA
RXD Short Circuit	Vcc=2.4V, RXD=0, RXD=Vcc	-	10	-	mA
RXD to Vcc Tri-state	SD=Vcc, Vcc=5V, Measured between RXD to Vcc	-	500	-	Kohm
RXD Rise/Fall Time	Vcc=5V, Load=15pF	-	7	-	ns
RXD Rise/Fall Time	Vcc=2.4V, Load=15pF	-	12	-	ns

**Opto-electronic Characteristics**

Tamb=25°C, Vcc=2.4V to 5.5V unless otherwise noted.

Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
<b>Receiver</b>						
Date rate		-	2.4K	-	4M	bps
Logic High Input Irradiance	Bit error rate=10 <sup>-8</sup>	E <sub>IHmin</sub> (FIR)	10	-	-	uW/cm <sup>2</sup>
		E <sub>IHmin</sub> (MIR)	10	-	-	uW/cm <sup>2</sup>
		E <sub>IHmin</sub> (SIR)	4.0	-	-	uW/cm <sup>2</sup>
Logic High Input Irradiance	In band irradiance maximum	E <sub>IHmax</sub>	-	-	500	mW/cm <sup>2</sup>
Minimum Detection Threshold	4.0Mbps	E <sub>Emin</sub>	-	4.0	-	uW/cm <sup>2</sup>
Logic Low Input Irradiance	Ambient interference pulsed	E <sub>IL</sub>	-	-	0.4	uW/cm <sup>2</sup>
Power up Latency	0 to 10mW/cm <sup>2</sup> ambient input	-	-	50	150	us
Transmit Latency (turn around)	0 to 10mW/cm <sup>2</sup> ambient input	-	-	30	100	us
Power supply Rejection < 5MHz	<0.1 pulse per second spurious output	-	-	50	-	mVpp
Power supply Rejection > 5MHz	<0.1 pulse per second spurious output	-	-	25	-	mVpp
Output Pulse Width at RXD (4Mbps)	125ns, 40uW/cm <sup>2</sup> input, load=15pF, measured at 1.4V	-	110	125	140	ns
Output Pulse Width at RXD (1.152Mbps)	217ns, 40uW/cm <sup>2</sup> input, load=15pF, measured at 1.4V	-	120	215	400	ns
Output Pulse Width at RXD (115.2Kbps)	1.63us, 40uW/cm <sup>2</sup> input, load=15pF, measured at 1.4V	-	1.4	1.63	2.5	us
Output Pulse Width at RXD (9.6Kbps)	19.5us, 40uW/cm <sup>2</sup> input, load=15pF, measured at 1.4V	-	1.4	6	22	us
<b>Transmitter</b>						
Transmit Delay	125ns pulse, Vcc=5.0V	-	-	15	-	ns
Pulse Width Limit	TXD pulse>100us, 5.0V pulse	-	50	70	100	us
IrED Operating Current limit	TXD=Vcc, V <sub>LEDA</sub> =Vcc=5.0V, Averaged over 125ns pulse	I <sub>IrED</sub>	510	600	650	mA
	TXD=Vcc, V <sub>LEDA</sub> =Vcc=3.0V, Averaged over 125ns pulse	I <sub>IrED</sub>	310	450-	550	mA
Logic LOW Transmitter Input Voltage		V <sub>IL</sub>	0	-	0.8	V
Logic HIGH Transmitter Input Voltage		V <sub>IH</sub>	2.0	-	Vcc+0.5	V
Output Radiant Intensity	Vcc=2.7V, no resistor	I <sub>e</sub>	100	170	400	mW/sr
Angle of Half Intensity		2 θ <sub>1/2</sub>	30	-	-	°
Peak Wavelength of Emission	I <sub>F</sub> =20mA DC	λ <sub>p</sub>	850	870	900	nm
Half-Width of Emission Spectrum	I <sub>F</sub> =20mA DC	Δ λ	-	40	-	nm

Device NO:DTM-360-001

## Mode Switching

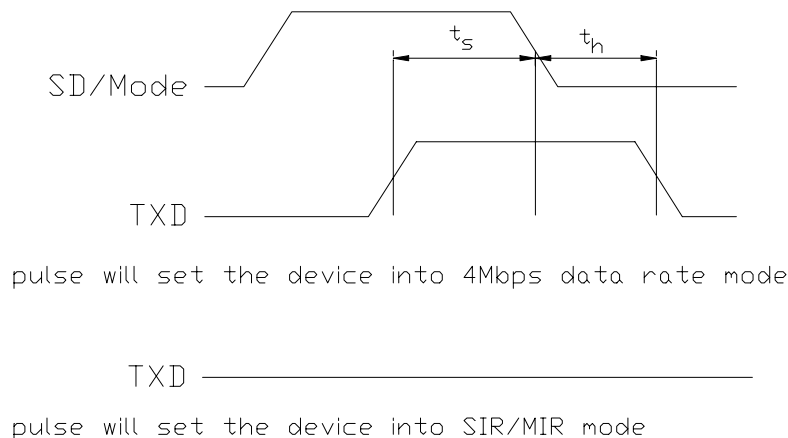
Normally the TM3600 series initializes in the SIR/MIR mode upon power up. Switching the module to FIR can be achieved as follows:

### Switching to FIR Mode

- Bring Shut Down (SD)/Mode pin to a logic “High” status.
- Bring TXD input to a logic “High” status. Wait for  $t_s \geq -40\text{ns}$ .
- Bring Shut Down (SD)/Mode pin to a logic “Low” status. The negative transition of this pulse will set the module mode to (4Mbps) data rate by reading the state of TXD.
- Bring TXD to a logic “Low” after waiting for  $t_h \geq 90\text{ns}$ .

### Switching to SIR/MIR Mode

- Bring Shut Down (SD)/Mode pin to a logic “High” status.
- Bring TXD input to a logic “Low” status. Wait for  $t_s \geq -40\text{ns}$
- Bring Shut Down (SD)/Mode pin to a logic “Low” status. The negative transition of this pulse will set the module mode to (115.2Kbps) data rate by reading the state of TXD.





## Recommended External Components

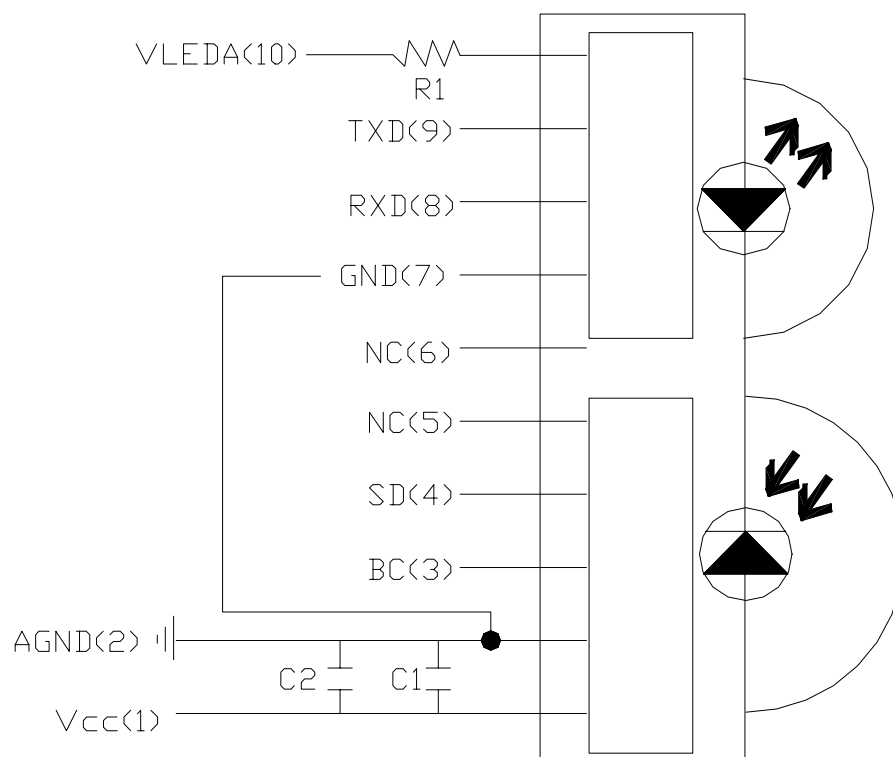
Component	Recommended Value	
C1	0.1uF, Ceramic	0.22uF, Ceramic
C2	5uF, Tantalum	10uF, Aluminum

C2 is optional for the same supply voltage of  $V_{CC}$  and  $V_{LEDA}$

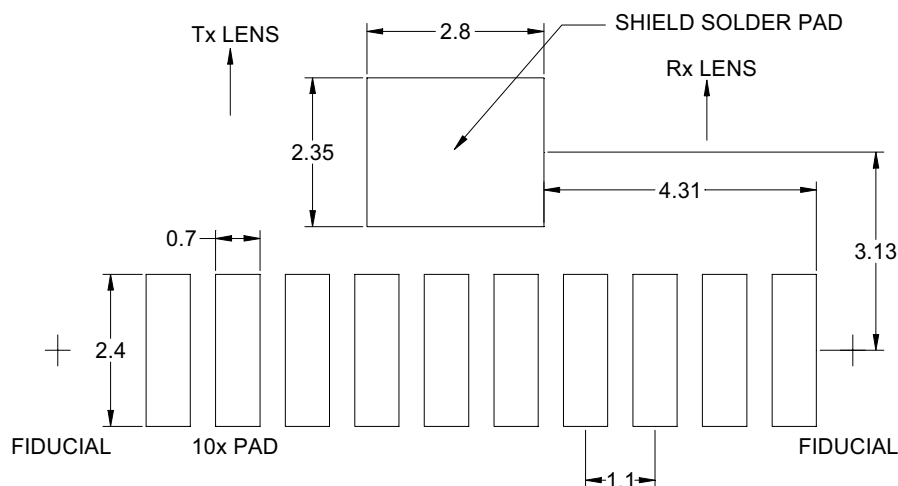
## Recommended R1 Values for different $V_{LEDA}$

Parameter	Values							Unit
$V_{LEDA}$ Power Supply	2.4	2.7	3.0	3.5	4.0	4.5	5.0	V
Resistor	0	0	0	1.2	2.7	3.9	5.1	Ohm

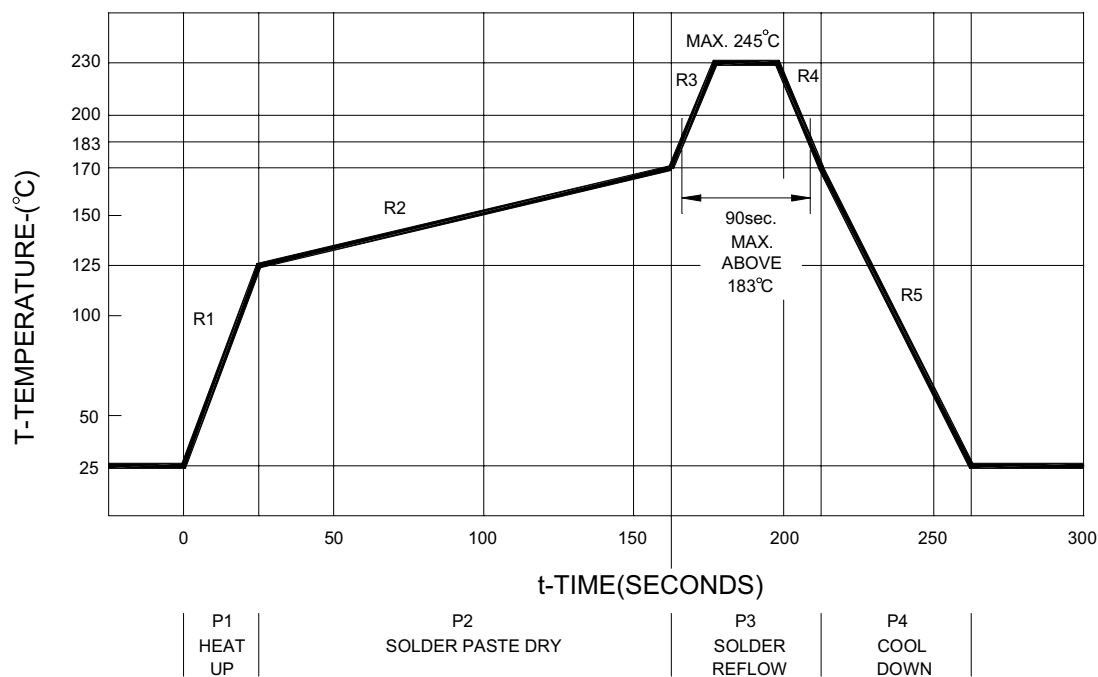
## Application Circuit



## Recommended SMD Pad Layout



## Recommended Solder Profile



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Device NO:DTM-360-001