**MiniSIR2®**
**MiniSIR2-1®**
**MiniSIR2-2®**

# SIRComm® MiniSIR2® 115.2kbps IrDA®1.0 Transceiver Module

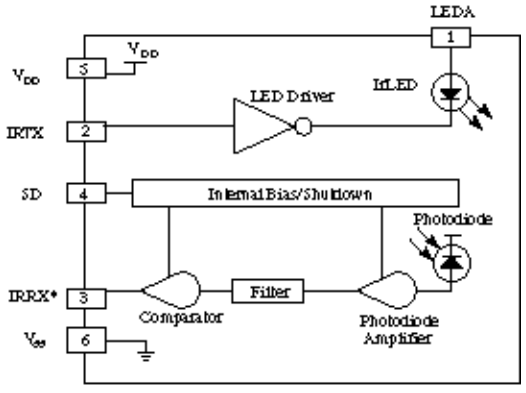
## GENERAL DESCRIPTION

Novalog's MiniSIR2 115.2kbps IrDA 1.0 – compliant miniature transceiver module is the world's smallest, most integrated, lowest power consumption IrDA 1.0 device in the industry. MiniSIR2 is compliant to the Infrared Data Association's (IrDA) 1.0 standard as well as compatible with Sharp ASK/DASK and Consumer IR (TV Remote) modes. These features make MiniSIR2 ideal for all handheld, battery operated, small form-factor devices where power and space are critical factors.

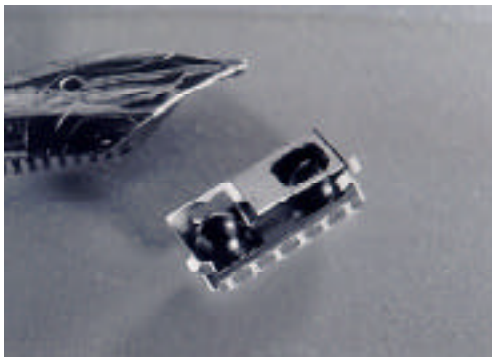
MiniSIR2 integrates an analog receiver with on-chip LED power MOSFET driver transistor, LED, photodiode and a voltage filtering capacitor. Because of this high level of integration, only one external device is required. MiniSIR2 also integrates a metal shield for superior performance in high EMI environments.

MiniSIR2 is a second generation, enhanced performance version of the original MiniSIR and is identical in size and form-factor. A shutdown feature has been added which lowers supply current from 120µA to 1nA in SD mode. Pin 4 controls this SD feature, whereas in the original MiniSIR, pin 4 is the control pin for voltage selection. This control pin is not required on MiniSIR2 because of its wide voltage range. Other enhancements include an extended operating temperature range, greater immunity to input signal overload and ambient light such as sunlight and fluorescent light, and the option of operating the LED from a different supply voltage than $V_{DD}$ to optimize system power utilization.

MiniSIR2 meets the European CENELEC EN60825-1 & IEC TC76825-1 standards for "Class 1" certification which applies to all products designed with LEDs.



MiniSIR2 Block Diagram



## FEATURES

- Compliant to IrDA 1.0 H/W Specifications…
  Data Rate: 9600bps to 115.2kbps
  Range: 0 Meter to 1 Meter (Minimum)
- Sharp ASK/DASK and Consumer IR Compatible
- 2.5V to 5.5V Supply Operation
- 120µA Supply Current
- 1nA Shutdown Current (Typical), 1µA (Maximum)
- Extended Operating Temperature Range… -25°C to +85°C
- Three package options: MS2 (Large Shield)
  MS2-1 (Small Shield)
  MS2-2 (Without Shield)
- Miniature Leadless SMT Package…Two Package Options
  L 9.9 mm x W 4.2 mm x H 4.0 mm (with shield)
  L 9.97 mm x W 3.73 mm x H 4.07 mm (with shield)
- Supplied on Tape & Reel for Auto Insertion…
  1,000 Pieces per Reel
- Requires Only One External Device…
  A Current Limiting Resistor
- Ultra-Low System Receiver Latency…
- IRRX* Output Disabled During Transmit
- Input Open Circuited & Output Tri-stated at SD…
  Allows Option for Complete Shutdown
- Option of Using Higher Supply Voltage for the LED than $V_{DD}$
- Internal Limiting of Transmitter On Time…
  Integrated AC Coupling on IRTX Inputs
  No External AC Coupling Device Required
- Meets All European Eye Safety Emission Levels.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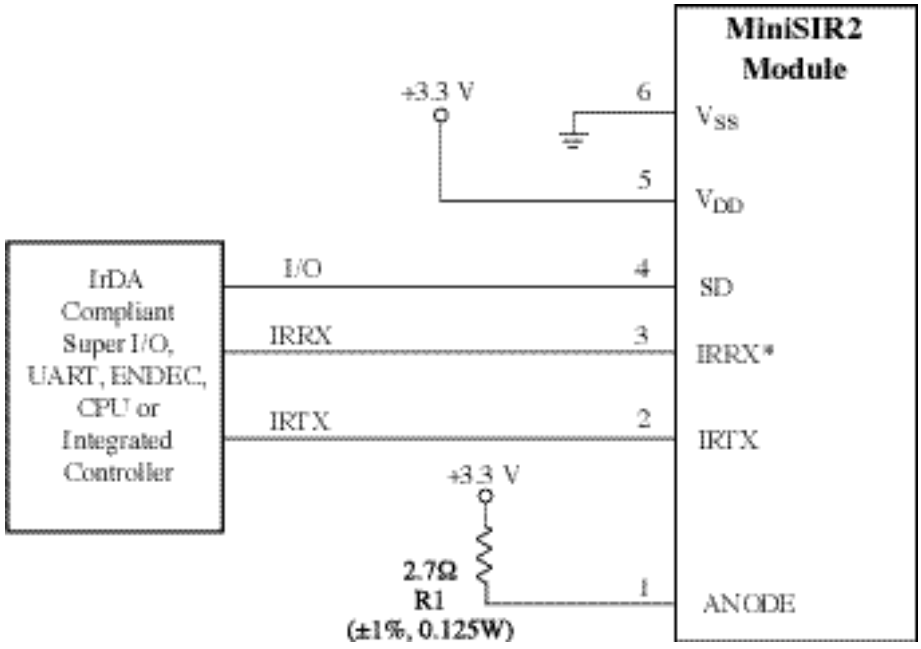
## MiniSIR2 TYPICAL APPLICATION CIRCUIT




## PIN DESCRIPTION

| PIN | NAME | FUNCTION | I/O | ACTIVE |
|---|---|---|---|---|
| 1 | ANODE | IrLED Anode | O | Low |
| 2 | IRTX | Transmitter Input | I | High |
| 3 | IRRX* | Receiver Output | O | Low |
| 4 | SD | Enables SD Mode | I | High |
| 5 | $V_{DD}$ | Positive Power Supply | I | --- |
| 6 | $V_{SS}$ | Ground | I | --- |

## ABSOLUTE MAXIMUM RATINGS

$V_{DD}$ ..... - 0.3V to + 6.0V
Voltage at $V_{SELECT}$ and IRTX (respect to GND) ..... - 0.3V to $V_{DD}$ +.3V
Operating Temperature Range ..... - 25°C to + 85°C
Storage Temperature Range ..... - 30°C to + 90°C

*Stress beyond "Absolute Maximum Ratings" may cause damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may permanently affect device reliability.*

## MiniSIR2 ELECTRICAL & OPTICAL CHARACTERISTICS

*$2.5 \leq V_{DD} \leq 5.5V$ ($T_A$ =Full Temperature Range, unless otherwise noted)*

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Supply Current ($I_{DD}$) @3.0V, T=25°C | No Received Data, Transmitter Off | | 120 | 170 | µA |
| Shutdown Current ($I_{SD}$) | SD = "$V_{DD}$" | | 0.01 | 1 | µA |
| **TRANSMITTER** | | | | | |
| Radiant Intensity ($I_E$)(-15° to +15°) | LED Peak $I_F$ Current = 300mA, IRTX Logic "High" | 46 | | 100 | mW/sr |
| Radiant Intensity | IRTX Logic "Low" | | | 0.3 | µW/sr |
| Angle of Half Intensity | | | 20 | | ° |
| Optical Rise/Fall Time | | | 40 | | ns |
| Peak Wavelength | | 850 | 875 | 900 | nm |
| Optical Bandwidth | $I_F$ = 50 mA | | 40 | | nm |
| Optical Overshoot | | | | 3 | % |
| **RECEIVER** | | | | | |
| Detection Threshold Irradiance | | | 2.5 | 3.5 | µW/cm² |
| Overload Irradiance | | 500 | | | mW/cm² |
| Half Angle (Photodiode) | | | 35 | | ° |
| Sunlight Ambient Rejection | No Modulation | 500 | | | µW/cm² |
| Receiver Peak Sensitivity Wavelength | | | 880 | | nm |
| **DIGITAL INPUT/OUTPUT** | | | | | |
| Input High (Logic 1) Voltage, $V_{IH}$ | IRTX, SD | $0.6V_{DD}$ | | $V_{DD}$ + 0.5V | V |
| Input Low (Logic 0) Voltage, $V_{IL}$ | IRTX, SD | -0.5 | | 0.2 $V_{DD}$ | V |
| Output High (Logic 1) Voltage, $V_{OH}$ | IRRX* = -250µA@ 2.5V | 2.2 | | | V |
| Output Low (Logic 0) Voltage, $V_{OL}$ | IRRX* = 1.0mA | | | 0.4 | V |
| Output Leakage (IRRX*, Anode) | SD = "1" | -1 | | +1 | µA |
| Input Leakage | SD, IRTX = "0" | -1 | | +1 | µA |
| Input Current | IRTX = "1", SD ="0" | 4 | | 100 | µA |
| **AC PARAMETERS** | ($C_{LOAD}$ = 25 pF) | | | | |
| Recovery Delay from Shutdown to Full Sensisitivity ($T_{RECOVERY}$) | SD="1" → "0" | | | 200 | µs |
| Delay to Shutdown ($SD_D$) | SD="0" → "1" | | | 200 | µs |
| IRRX* Rise/Fall Time ($T_R$/$T_F$) | $V_{DD}$ = 2.5-5.5V | | 100 | | ns |
| Pulse Width ($T_W$) (IRRX*) | 1.6 µs Input Pulse, Irradiance = 4µW/cm² | 1 | | 2.5 | µs |
| Pulse Jitter ($T_J$) (IRRX*) | Irradiance = 3.5µW/cm² - 500mW/cm² | | | 400 | ns |
| Pulse Delay ($T_D$) (IRRX*) | Irradiance = 3.5µW/cm² - 500mW/cm² | | | 1.8 | µs |
| IrLED Maximum Pulse Width | IRTX="1" > 200µs | 18 | | 150 | µs |
| Receiver Latency ($T_L$) | | | 17 | 50 | µs |

## MODE SWITCHING

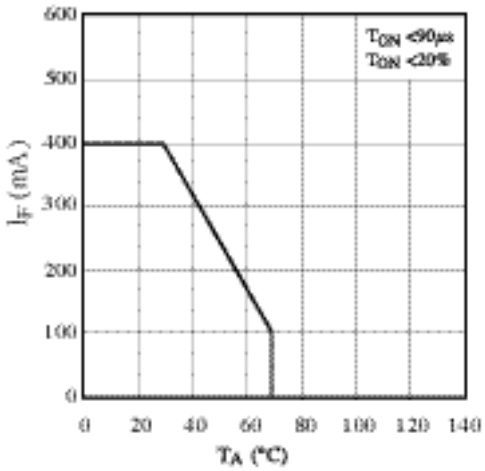
***Set to Shutdown Mode***

1. Set the SD input to logic "High"
2. MiniSIR2 shutdown mode is now enabled, IRRX* output is tri-stated and IRTX input is open circuited

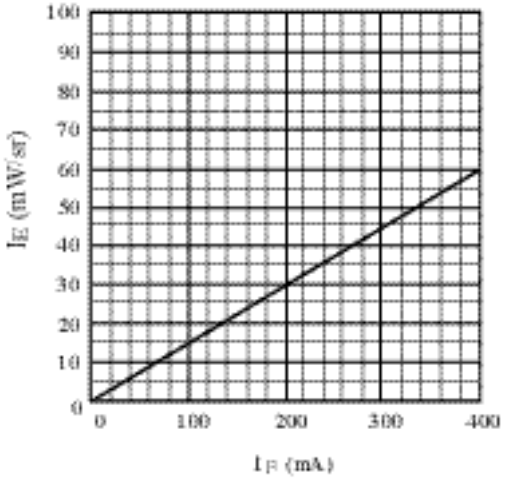
***Reset from Shutdown***

1. When MIniSIR2 is in Shutdown mode, set the SD input to a logic "Low"
2. BW = 9.6kbps - 115.2 kbps mode is now enabled

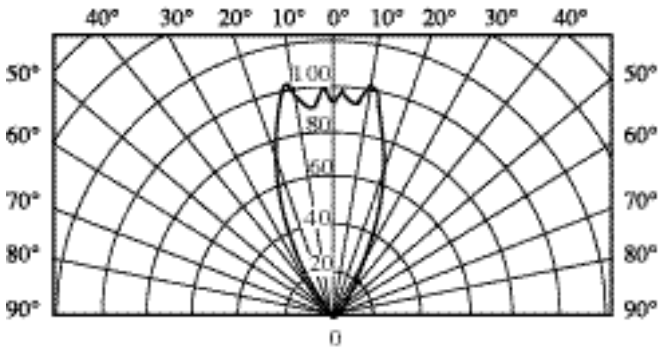
$I_F$ MAX vs. $T_A$ Characteristics



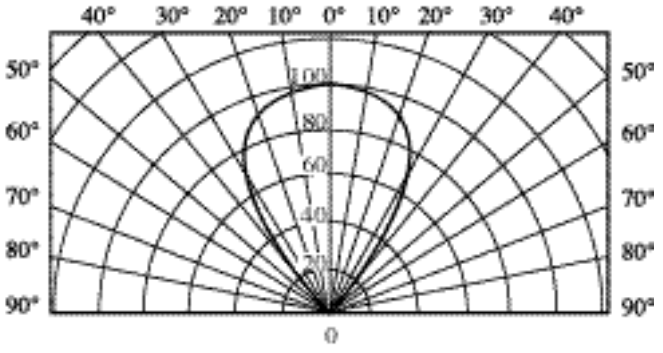

$I_F$ vs. $I_E$ Characteristics (-15° to + 15°)



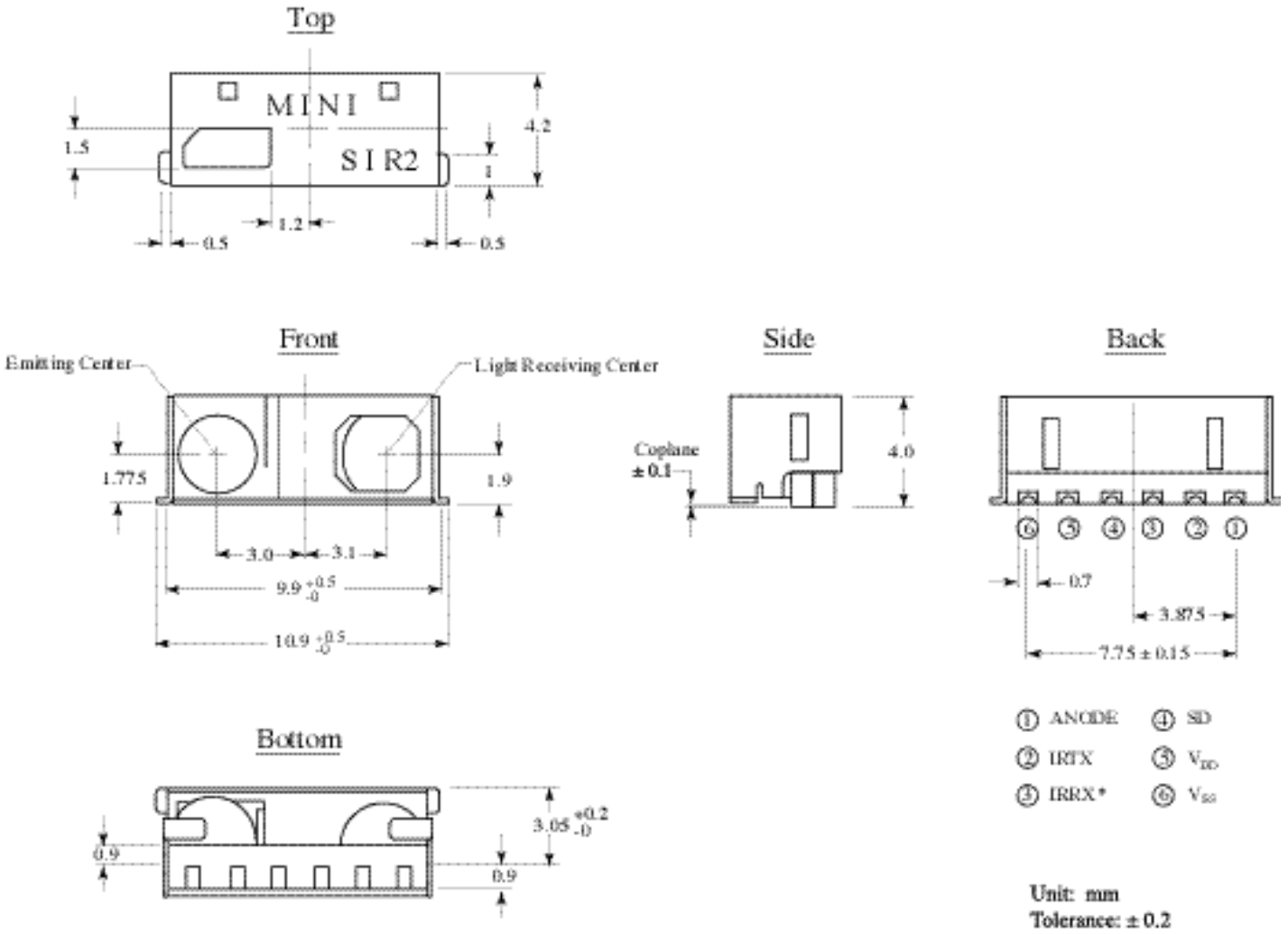

Directive Characteristics (Emitting)

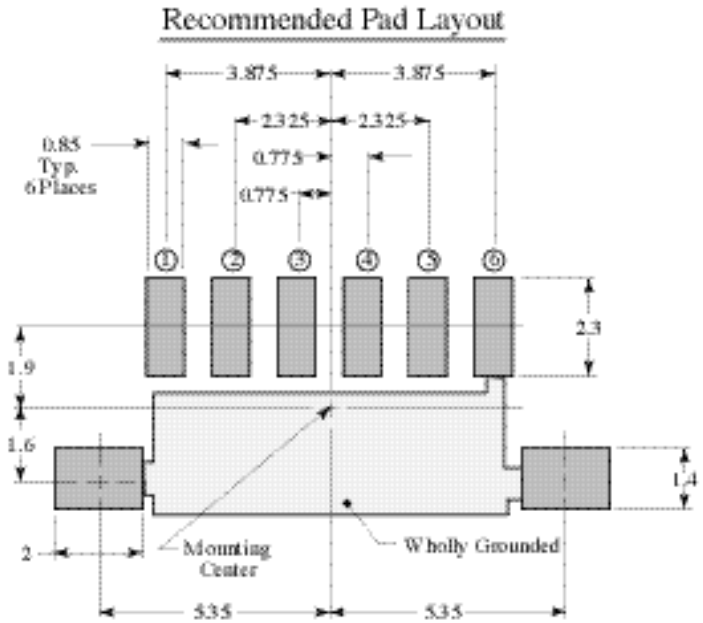



Directive Characteristics (Receiving)



## MiniSIR2 OUTLINE DRAWINGS




**MiniSIR2**
Overall Dimensions With Shield
L 9.9 mm x W 4.2 mm x H 4.0 mm
L 0.40 inch x W 0.17 inch x H 0.16 inch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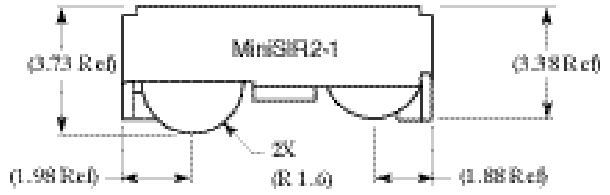
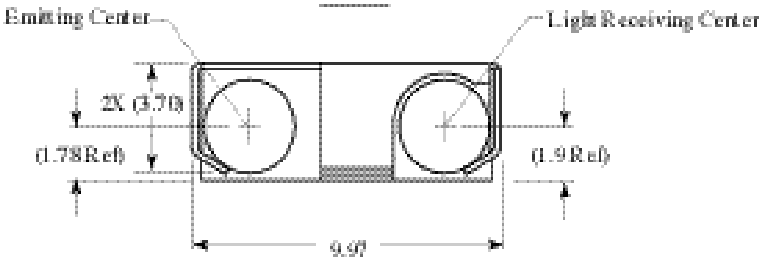
## MiniSIR2-1 OUTLINE DRAWINGS

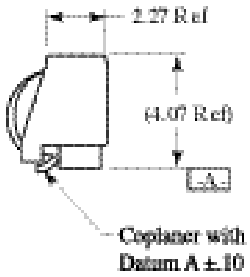
Top



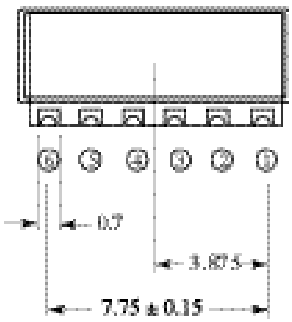

Front




Side

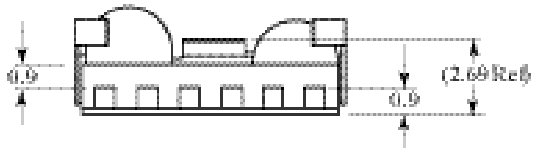



Back



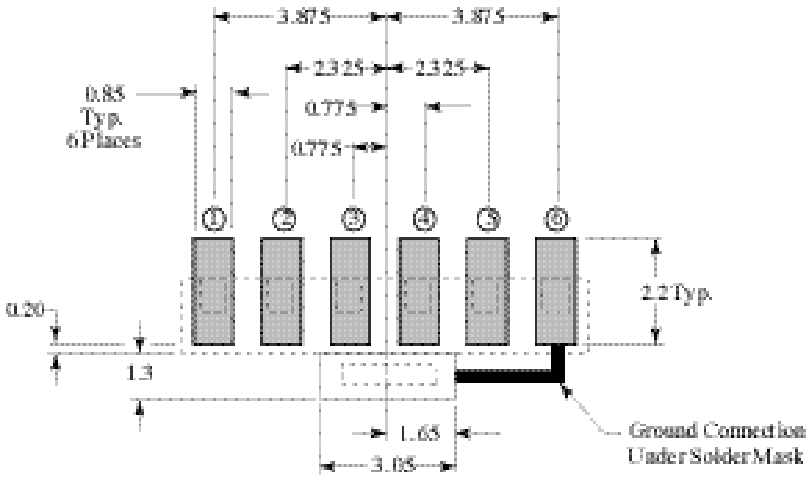

| | |
|---|---|
| ① ANODE | ④ SD |
| ② IRTX | ⑤ $V_{DD}$ |
| ③ IRRX * | ⑥ $V_{SS}$ |

Bottom




Unit: mm
Tolerance: ± 0.2

Recommended Pad Layout




**MiniSIR2-1**
Overall Dimensions With Shield
L 9.97 mm x W 3.73 mm x H 4.07 mm
L 0.40 inch x W 0.15 inch x H 0.16 inch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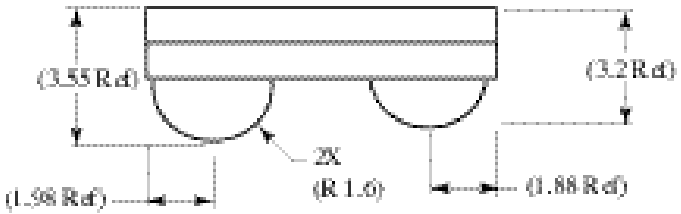
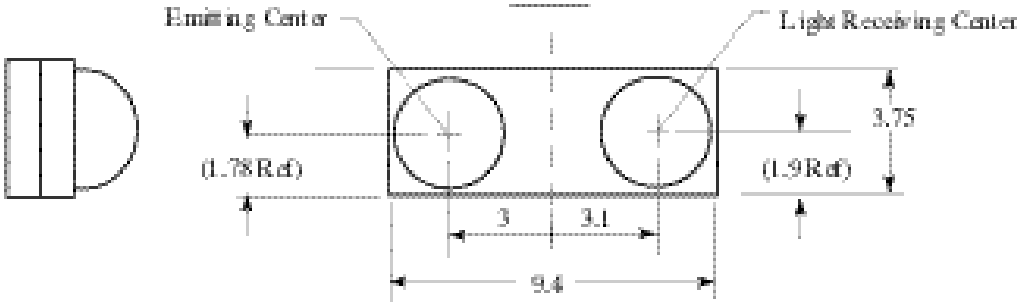
**MiniSIR2-2 OUTLINE DRAWINGS**
**(Unshielded)**

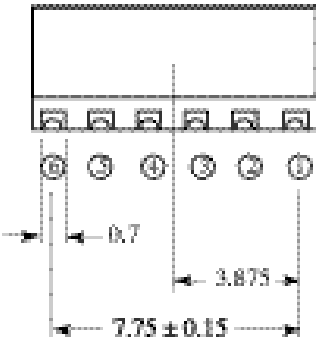
Top



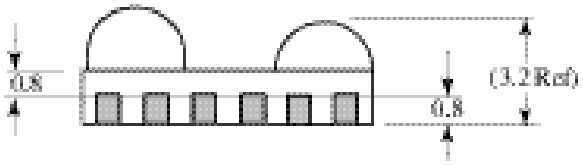

Front




Back



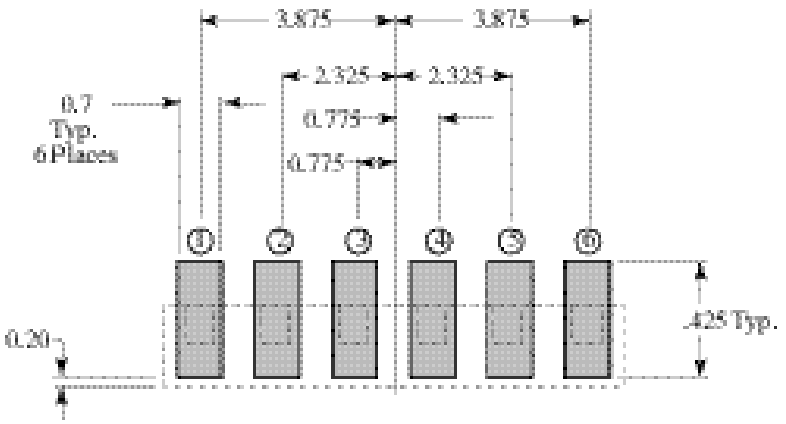

Bottom




| | |
|---|---|
| ① ANODE | ④ SD |
| ② IRTX | ⑤ $V_{LED}$ |
| ③ IRRX * | ⑥ $V_{CC}$ |

Unit: mm
Tolerance: ± 0.2

Recommended Pad Layout





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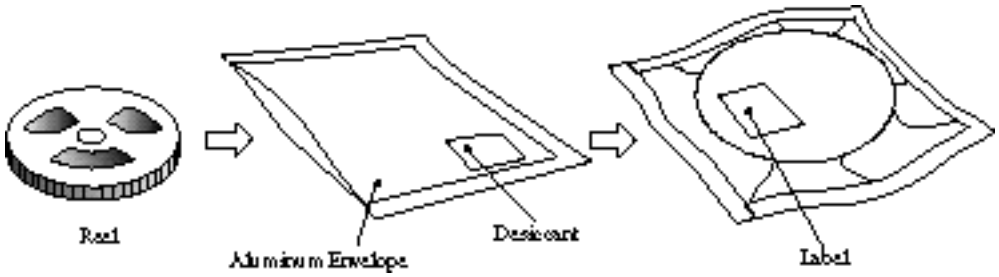
## Moisture Proof Packing

In order to avoid moisture absorption during transportation and storage, MiniSIR2 reels are packed in aluminum envelopes which contain a desiccant with a humidity indicator. The indicator color changes from blue to pink as moisture is absorbed.




## Storage

To avoid moisture absorption, MiniSIR2 reels should remain in the original, unopened moisture proof packing. Parts should be soldered within 24 hours after unpacking. Reels that have been unpacked, but will not be soldered within 24 hours, should be stored in a desiccator.

## Baking

Parts that have been stored over 6 months or unpacked over 24 hours should be baked under the following guidelines:

**Reels**

- 60°C for 48 hours or more

**Loose Parts**

- 100°C for 4 hours or more
  or
- 125°C for 2 hours or more
  or
- 150°C for 1 hour or more

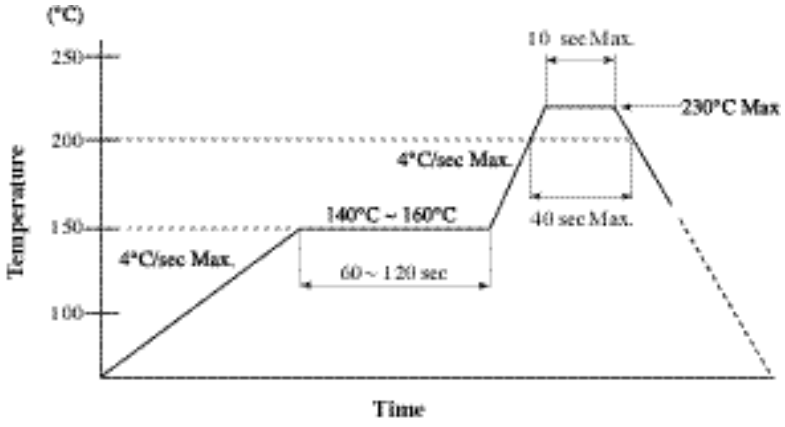
## MiniSIR2, 2-1, 2-2 SOLDERING AND CLEANING RECOMMENDATIONS

### Reflow Soldering

1. Reflow soldering paste is recommended:

   Melting temperature : 178°C ~ 192°C
   Composition: Sn ... 63% Pb ... 37%

2. Recommended thickness of metal mask is between 0.2mm and 0.25mm for screen printing.
3. The temperature profile at the top surface of MiniSIR2, shown below, is recommended.




### Manual Soldering

1. Use 63/37 or silver solder.
2. Use a soldering iron of 25W or smaller. Adjust the temperature of the soldering iron below 300°C.
3. Finish soldering within 3 seconds.
4. Handle only after MiniSIR2 has cooled off.

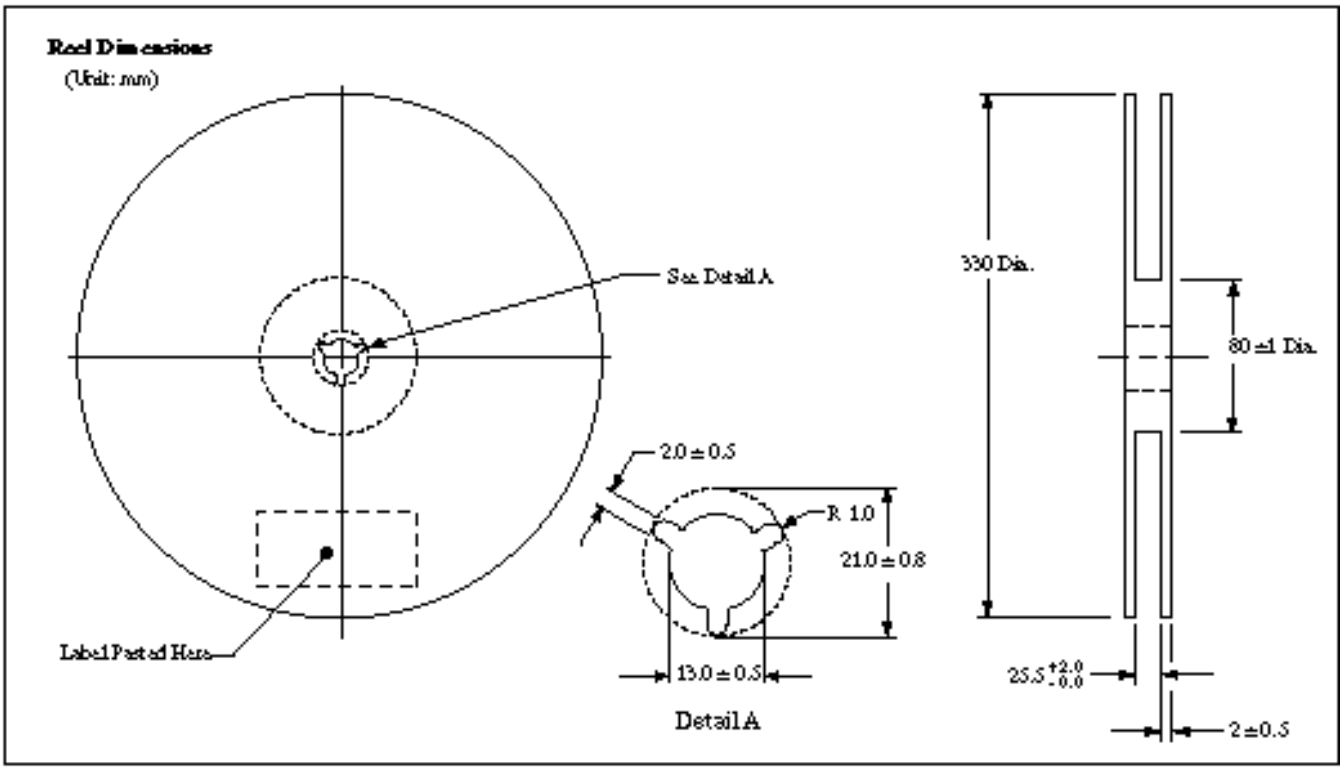
### Cleaning

Perform cleaning after soldering under the following conditions:

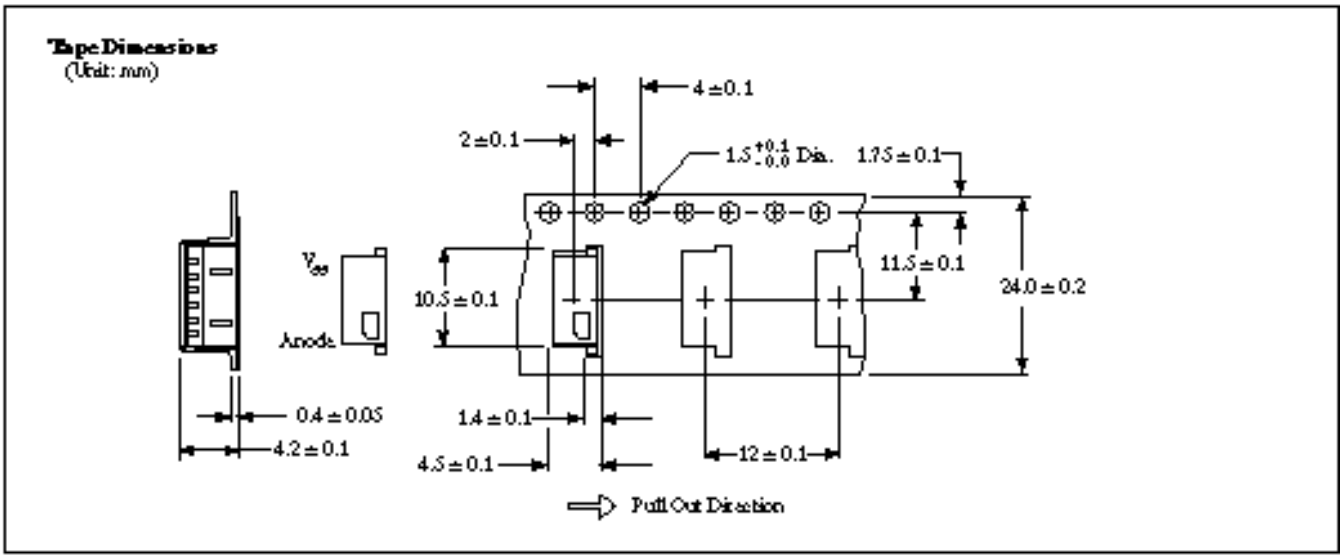
- Cleaning agent: Alcohol.
- Temperature and time: 30 seconds below 50°C or 3 minutes below 30°C.
- Ultrasonic cleaning: Below 20W.

## MiniSIR2 TAPING SPECIFICATIONS (IN ACCORDANCE WITH JIS C 0806)

**Reel Dimensions**
(Unit: mm)

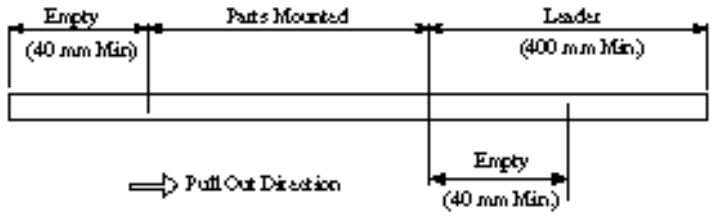



**Tape Dimensions**
(Unit: mm)




**Tape Configuration**
(Unit: mm)

**Quantity**
1,000 Pieces per Reel





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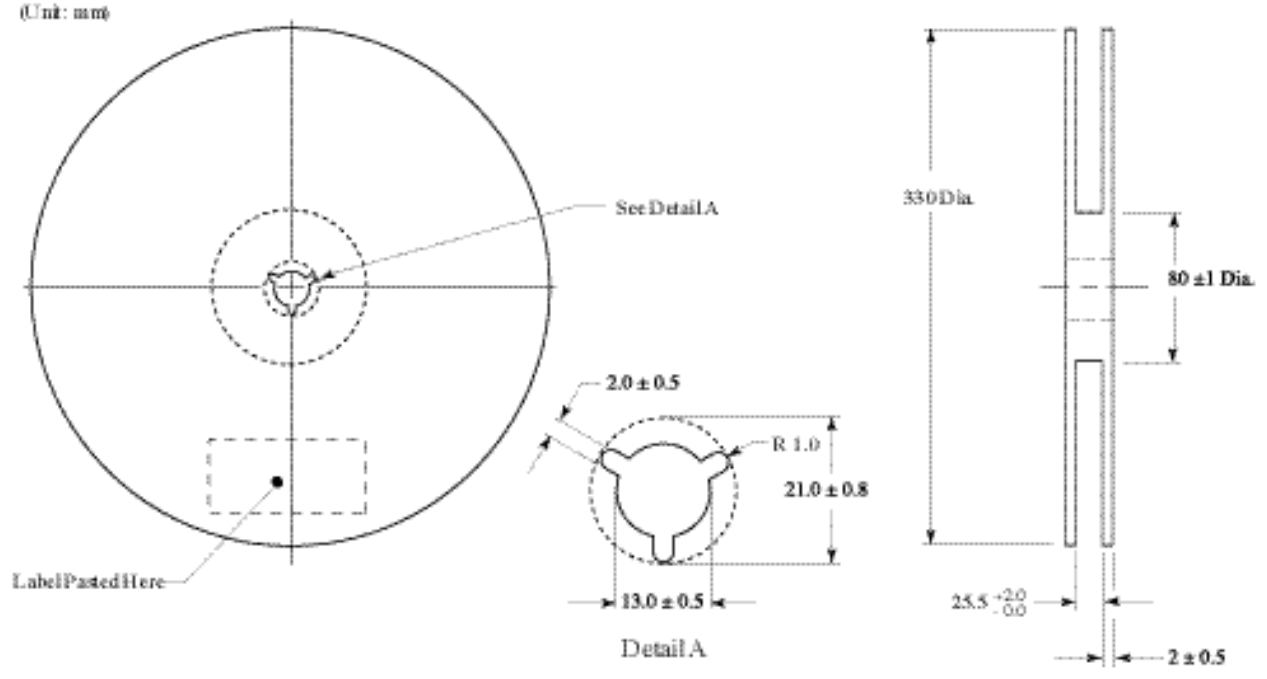
## MiniSIR2-1, 2-2 TAPING SPECIFICATIONS (IN ACCORDANCE WITH JIS C 0806)

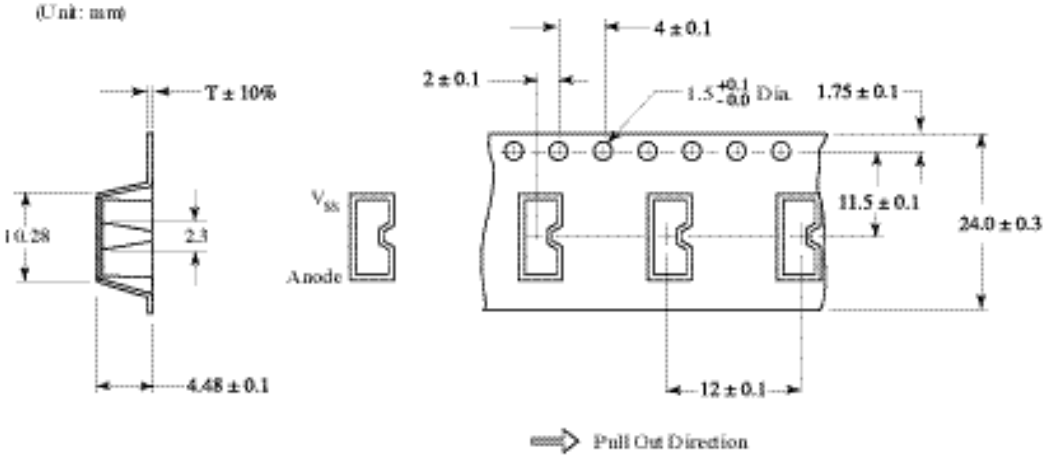
**Reel Dimensions**

(Unit: mm)




**Tape Dimensions (MiniSIR2-1)**

(Unit: mm)

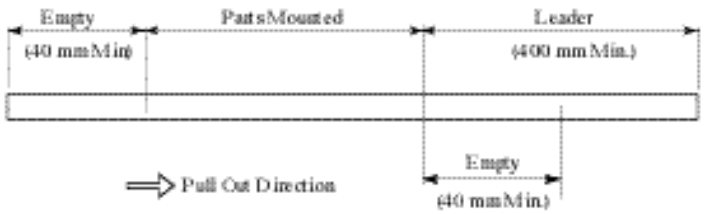



**Tape Configuration**

(Unit: mm)

**Quantity**

1,000 Pieces per Reel





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## MiniSIR2 EVALUATION BOARD APPLICATION NOTE

MiniSIR2 evaluation boards are available to easily verify performance, quality and reliability. To request boards, please contact Novalog or our local representative. The MS2 evaluation board may also be used to verify MS2-1 or MS2-2 operation.

### Demonstrates IR Data Link using MiniSIR2 115.2kbps IrDA-Compliant Miniature Transceiver Module

- Confirms Pulse Width, Data Rate, Range and Angle

### "MiniSIR2-EV1" Evaluation Board

- 3.3V Supply (for 5V conversion, see schematic notes, page 12)
- A current limiting resistor (R1) value of 2.7Ω is used for 3.3V operation
- Transmit current draw is approximately 300mA peak
- A 10µF stabilizing capacitor (C1) has been mounted to protect against an unstable supply voltage to the LED and to protect against noisy environments, both of which may occur in laboratory conditions

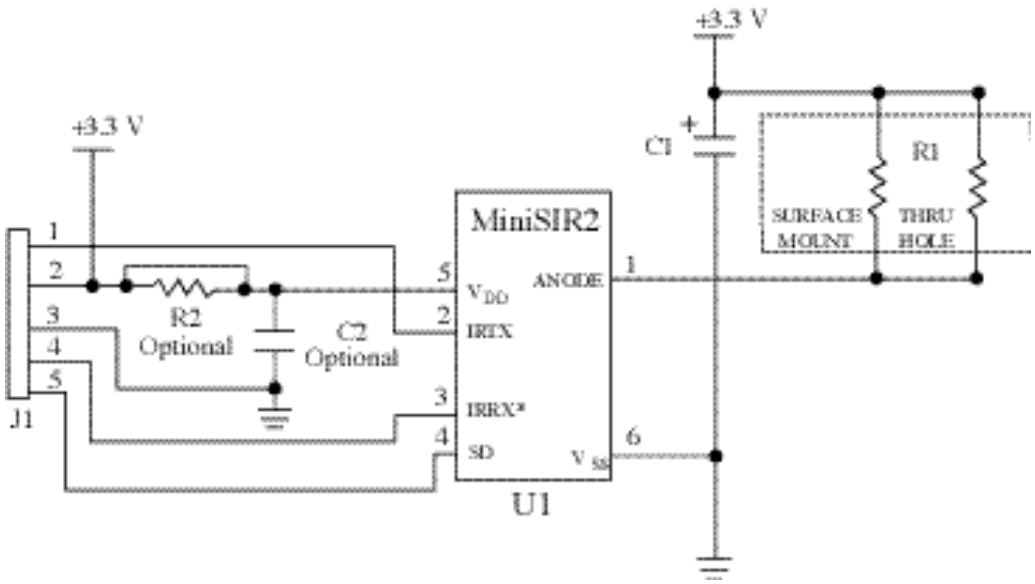
### Pin Out

- Pin 1: IRTX (brown)
- Pin 2: $V_{DD}$ (red)
- Pin 3: $V_{SS}$ (orange)
- Pin 4: IRRX* (yellow)
- Pin 5: SD (green)

### Required Laboratory Equipment

- Power Supply - preferably one per board to lessen crosstalk noise
- Oscilloscope - to monitor IRRX* Output
- Pulse Generator - set at 1.6µs pulse @ 115kHz with a period of 8.7 µs, to drive IRTX Input

## MiniSIR2 EVALUATION BOARD SCHEMATIC AND PARTS LIST




Notes:

- In noisy environments or when long cables are used, C2 and R2 are recommended. In this case, trace shorting R2 must be cut.

For Conversion to 5V Operation:

- R1 must be removed and a 8.2Ω, 1/4-W through-hole resistor installed.

| QTY | PARTCODE | DESIGNATOR | MANUFACTURER | DESCRIPTION |
|---|---|---|---|---|
| 1 | ECS-TOJY106R | C1 | Panasonic | SMT 10 µF Tantalum Capacitor - Size A |
| 1 | ERJ-6GEYJ101V | R2 (Optional) | Panasonic | 100 Ohm Resistor - Size 0805 |
| 1 | 53047 - 0510 | J1 | Molex | 5 Pin Connector |
| 1 | MiniSIR2 | U1 | Novalog | IrDA-Compliant Transceiver Module |
| 1 | ECU-V1H104KBW | C2 (Optional) | Panasonic | SMT .1 µF Ceramic Capacitor - Size 1206 |
| 1 | 263 - 2.7 | R1 | Xicon | SMT 2.7 Ohm, 1/8 Resistor - Size 1206 |

### IrLED Current Limiting Resistor Selection:

MiniSIR2's IrLED radiant intensity is proportional to the forward current through the IrLED. For most applications the selection of the IrLED current limiting resistor can be made from the table shown below. Resistor composition should be non-inductive (not wire wound).

| $V_{DD}$ (volts) | 2.7 | | | 3.0 | | | 3.3 | | | 5.0 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Communication Range (meters) | .25 | .5 | 1 | .25 | .5 | 1 | .25 | .5 | 1 | .25 | .5 | 1 |
| Current Limiting Resistor (Ω) ±2% | 62 | 13 | 0.5 | 75 | 16 | 2.0 | 91 | 20 | 2.7 | 160 | 43 | 8.2 |
| Transmit Current (mA, peak) | 20 | 75 | 300 | 20 | 75 | 300 | 20 | 75 | 300 | 20 | 75 | 300 |

Very low power operation can be achieved by trading operating distance for lower IrLED drive current. In this situation, the IrLED drive current can be reduced with an expected corresponding reduction in link operational distance per the following equation:

$$\mathbf{D = (I_F \div 0.3A)^{0.5} \bullet (1\ Meter)}$$

### Using Split Power Supplies

In some applications it may be desirable or necessary to run the IrLED from a higher voltage power source than the rest of the electronics. Figure 1 illustrates a typical application using split supplies. In this application the unregulated supply is used for the high current required by the IrLED which minimizes the power loss in the voltage regulator. Another example when split supplies are required is when the voltage of the module power supply is so low that it is impossible to get the desired current to flow in the IrLED.

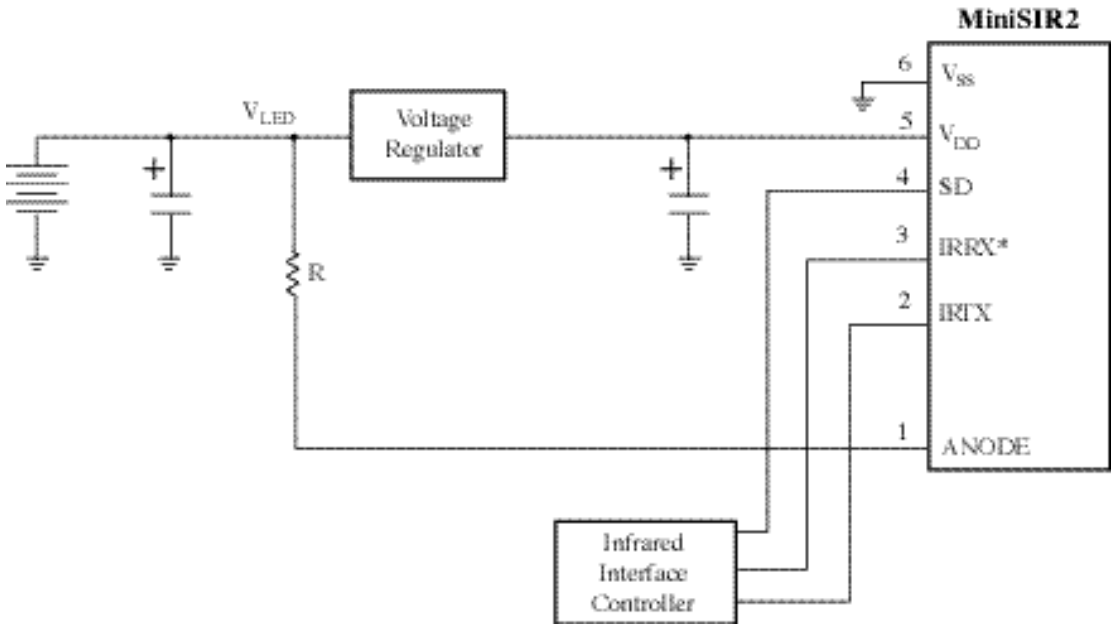



**Figure 1 - Typical System Using Split Supplies**

MiniSIR2 permits the use of an IrLED supply voltage as high as 6 volts while the module supply voltage can be as low as 2.5 volts.

When the IrLED supply voltage, $V_{LED}$, is different than the module supply voltage, $V_{DD}$, the IrLED resistor value "R" must be calculated based on the value of both supplies. $V_{DD}$ determines how hard the FET is turned on, so the resistance of the FET, $R_{FET}$, must be determined using Figure 2.

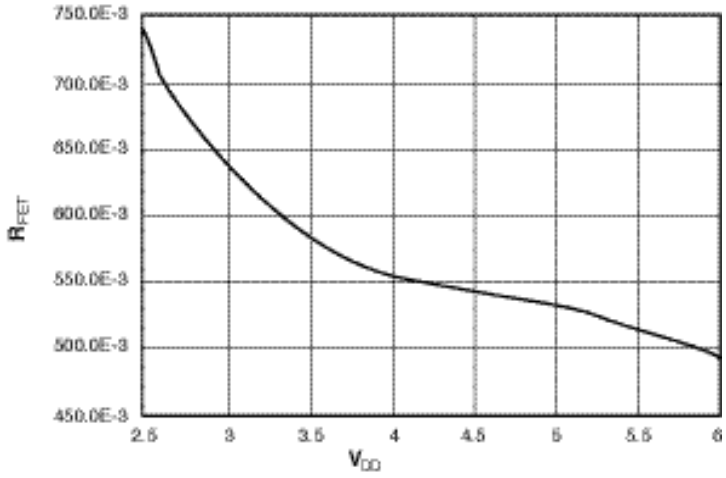



**Figure 2 - FET Resistance - $R_{FET}$**

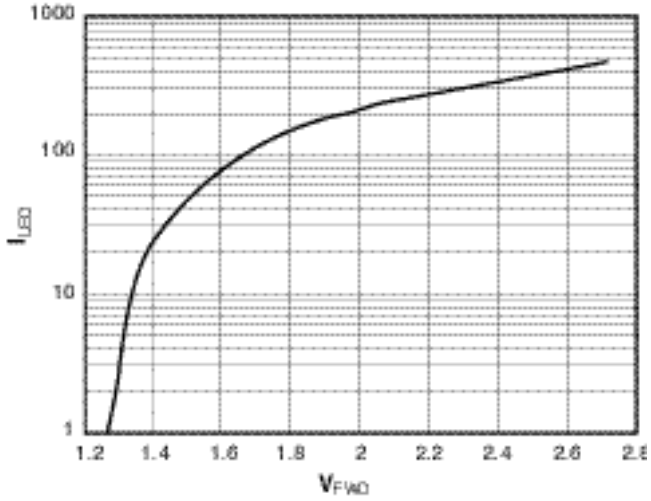



**Figure 3 - IrLED Forward Voltage Drop - $L_{LED}$**

The voltage drop across the IrLED, $V_{FWD}$, can be determined using Figure 3. Once these values have been determined, the resistor value for any desired IrLED current, $I_{LED}$, can be calculated based on the following equation:

$$R = \frac{V_{LED} - V_{FWD} - (R_{REF} + 0.4) * I_{LED}}{I_{LED}}$$

Of course this equation can also be used when $V_{DD} = V_{LED}$.

### Internally Limited Transmitter on Time

In many applications, the device controlling the infrared interface (Super I/O, UART, etc.), powers up with the IRTX pin asserted in the high state. This can cause the IrLED to be driven until the software gets around to deactivating this bit. This may take a long time especially if the software does not accomplish this until the user wishes to actually use the IrDA port. When the IrLED is left on for long periods, it may be damaged. MiniSIR2 eliminates this problem without the use of external capacitors and resistors, as are so often required, by internally limiting the transmitter pulse width. No matter how long the IRTX input remains in the active high state the IrLED will only be driven for 18 to 150 µs maximum

### IrLED Voltage Filtering

When MiniSIR2 is mounted on a motherboard, IrLED voltage filtering is not usually required. However, if MiniSIR2 is operated at very low voltages, mounted on a daughter board, located where highly resistive or inductive connections to the supply ($V_{DD}$ or $V_{SS}$) are used, or located in a noisy environment, then IrLED voltage filtering is recommended. Use of IrLED voltage filtering reduces the effects of circuit/wiring inductance and insures that power is correctly delivered to the IrLED. The recommended filtering consists of a low ESR 10, uF capacitor connected from $V_{DD}$ to $V_{SS}$, and located close to the IrLED current limiting resistor or IrLED anode when anode is connected to $V_{DD}$. IrLED filtering also reduces the amount of noise in the motherboard caused by the large switching currents in the IrLED.

### Input Voltage Filtering

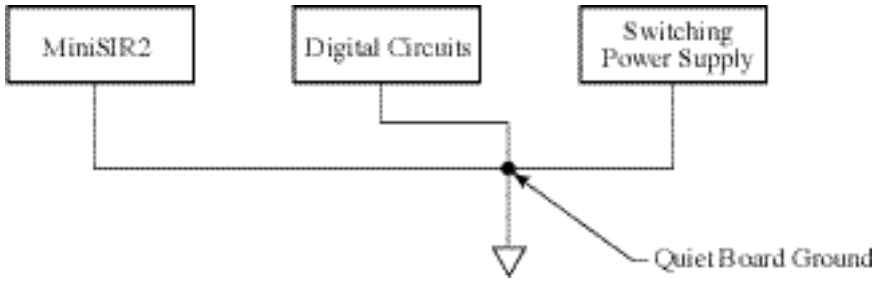
An input voltage filtering capacitor has been integrated internally to MiniSIR2. Therefore, external resistor-capacitor filters are not required, making the MiniSIR2 the lowest total system cost of any IrDA solution. ,

### Designs Requiring Longer Range

A second IrLED may be added in series with the IrLED anode input in 5.0V applications only. The IrLED current limiting resistor should be chosen to limit peak current to approximately 300mA.

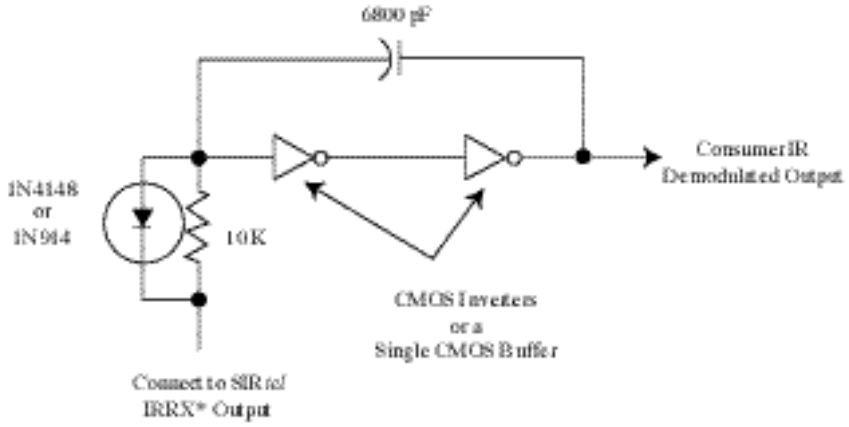
### EMI Immunity

MiniSIR2 has excellent EMI immunity when board layout is implemented with a ground plane under the MiniSIR2 and extending approximately 1 cm in every direction around the module. This ground plane should be maximized with any unused board space filled with ground metal. Unused board space is defined as PC board area not used for other connections or traces. The tabs on the EMI shield should be soldered to the ground plane. This ground plane should have a very low impedance connection to a clean and “noiseless” system ground node for optimum receiver performance. The use of single point grounding techniques is recommended as shown in the figure below.



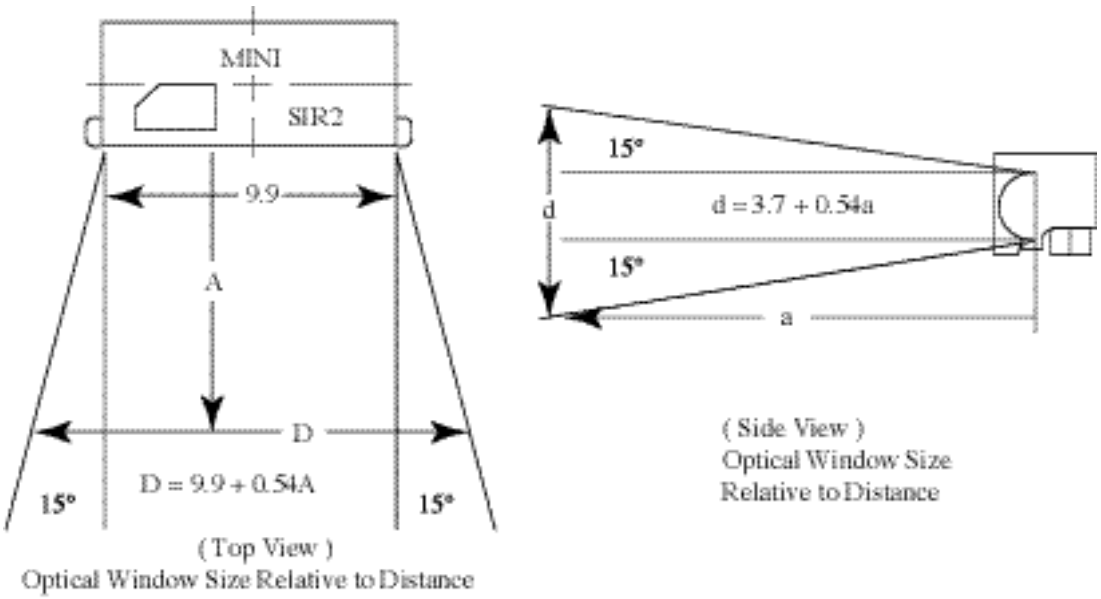
## Consumer IR (TV Remote) Demodulator

A low cost consumer IR demodulator can be implemented using MiniSIR2's IRRX* output. A buffer with standard CMOS input thresholds works best, however, CMOS TTL threshold inputs can also be used.




## MiniSIR2 Optical Port Design

The figure below shows details for correctly positioning MiniSIR2 with respect to the system optical port. One recommended optical port window material (Lexan 101, 141 or 920A) can be obtained from General Electric Plastics (U.S.A.) Tel: 1-800-845-0600 or Fax: 1-413-448-7731. The dye used for the optical port should be IR transmissant above 625 nm. Violet #21051, etc. or Green 31142 (which appears black) is recommended. A detailed selection guide is provided on the Novalog website in the "Application Notes" secton.




***Notes:***

1. *Dimensions shown in mm.*
2. *Improved receiver performance in the presence of ambient light can be attained by indenting MiniSIR2 into the system box by a few millimeters.*
3. *MiniSIR2 should be located a minimum of 0.5cm behind the IR transparent window.*

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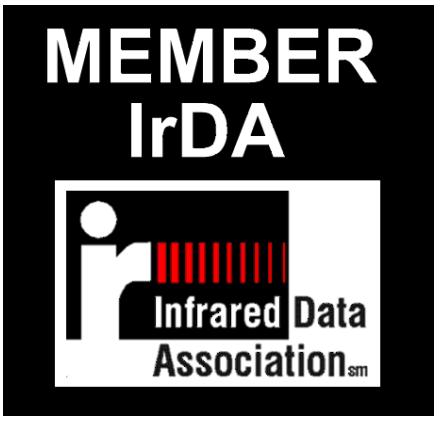




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