



Technical Data Sheet

Infrared Data Transceiver Module

TM4400/TR2

Features

- Compliant to IrDA 1.2 (Up to 115.2kbps)
- 2.7 to 5.5 V Wide Operating Voltage Range
- Low-Power Consumption (1.3 mA Supply Current)
- Power Sleep Mode Through Vcc1/SD Pin (5 nA Sleep Current)
- Long Range (Up to 3.0 m at 115.2kbps)
- Directly Interfaces with Various Super I/O and Controller Devices and Telefunken's TOIM3000 and TOIM3232 I/Os
- Built-In EMI Protection-No External Shielding Necessary
- Few External Components Required



Descriptions

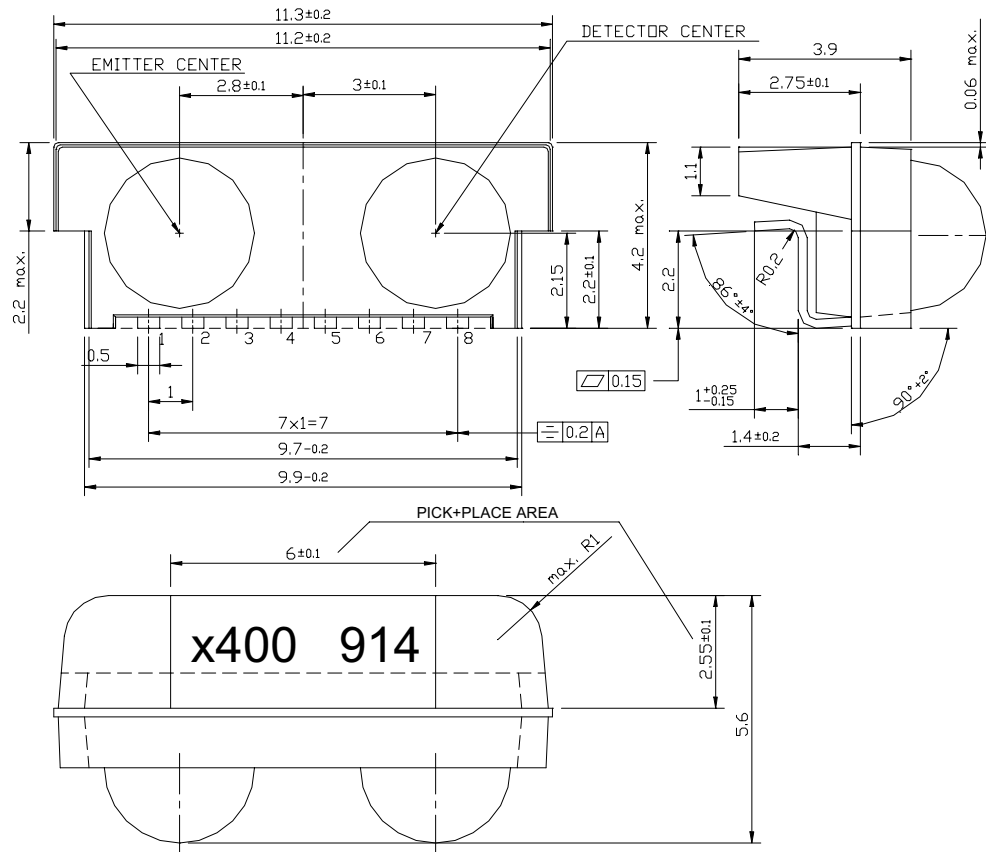
The TM4400/TR2 is a low-power infrared transceiver module compliant to the IrDA 1.2 standard for serial infrared (SIR) data communication, supporting IrDA speeds up to 115.2kbps. The transceiver integrated a infrared emitter diode (IRED), a photo PIN diode and a low-power analog control IC in a single package.

The transceivers are capable of directly interfacing with a wide variety of I/O chips that perform the pulse-width modulation/demodulation function, including Telefunken's TOIM3000/TOIM3232. At a minimum, a current-limiting resistor in series with the infrared emitter and a Vcc bypass capacitor are the only external components required to implement a complete solution.

Applications

- Notebook Computers, Desktop PCs, Palmtop Computers (Win CE, Palm PC), PDAs
- Digital Still and Video Cameras
- Printers, Fax Machines, Photocopiers, Screen Projectors

Device NO:DTM-440-002



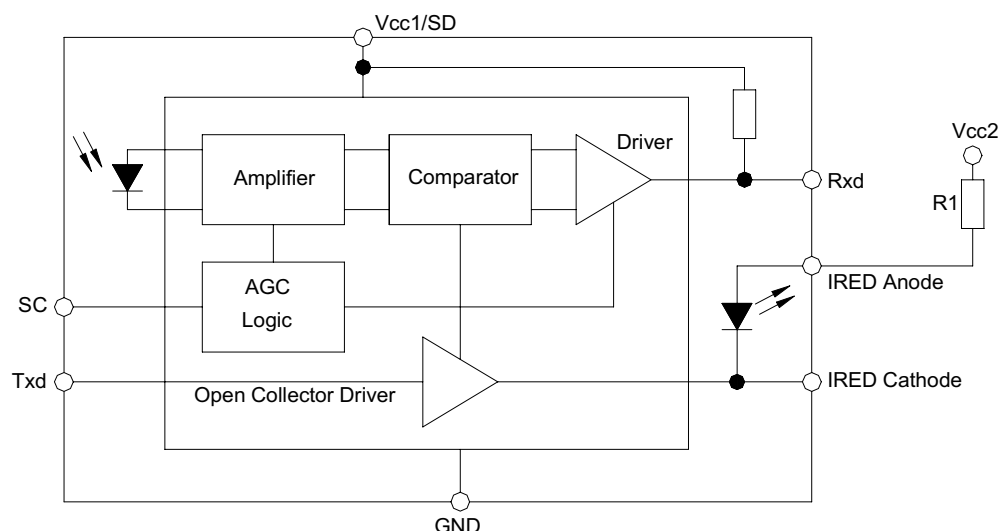
Package Dimensions

Notes: 1.All dimensions are in millimeters.

Device Selection Guide

Transmitter		Receiver		λ p	Operating Voltage(Vcc)	Data Rate
Distance	Angle2 θ 1/2	Distance	Angle 2 θ 1/2			
>1.0m	+/-15	>1.0m	+/-30	880~900nm	2.7~5.5V	2.4~115.2Kpbs

Functional Block Diagram



Pin Description

Pin Number	Function	Description	I/O	Active
1	IRED Anode	IRED anode, should be externally connected to Vcc2 through a current control resistor		
2	IRED Cathode	IRED cathode, internally connected to driver transistor		
3	Txd	Transmit Data Input	I	High
4	Rxd	Received Data Output, open collector. No external pull-up or pull-down resistor is required (20k Ω resistor internal to device). Pin is inactive during transmission.	O	Low
5	NC	Do not connect		
6	Vcc1/SD	Supply Voltage / Shutdown		
7	SC	Sensitivity control	I	High
8	GND	Ground		

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 Range	$0V \leq V_{cc2} \leq 6V$	V _{cc1}	-0.5		6	V
	$0V \leq V_{cc1} \leq 6V$	V _{cc2}	-0.5		6	V
Input Currents	For all Pins, except IRED Anode Pin				10	MA
Output Sink Current					25	MA
Power Dissipation	See Derating Curve	P _D			200	MW
Junction Temperature		T _J			125	°C
Ambient Temperature Range (Operating)		T _{amb}	-25		+85	°C
Storage Temperature Range		T _{stg}	-25		+85	°C
Soldering Temperature	See Recommended Solder Profile			215	240	°C
Average IRED Current		I _{IRED} (DC)			100	MA
Repetitive Pulsed IRED Current	$t < 90 \mu s$, $t_{on} < 20\%$	I _{IRED} (RP)			500	MA
IRED Anode Voltage		V _{IRED A}	-0.5		6	V
Transmitter Data Input Voltage		V _{Txd}	-0.5		V _{cc1} +0.5	V
Receiver Data Output Voltage		V _{Rxd}	-0.5		V _{cc1} +0.5	V
Virtual Source Size	Method: (1-1/e) encircled energy	d	2.5	2.8		Mm
Maximum Intensity for Class 1 Operation of IEC825-1 or EN60825-1 (worst case IrDA SIR pulse pattern*)	EN60825, 1997				400	mW/sr

Electrical Characteristics

T_{amb}=25°C, V_{cc}=2.7V 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
Transceiver						
Supply Voltage	Receive Mode Transmit Mode, R2=47Ω (see Recommended Application Circuit)	V _{cc1}	2.7 2.0		5.5 5.5	V V
Supply Current Pin V _{cc1} (Receive Mode)	V _{cc1} =5.5V V _{cc2} =2.7V	I _{cc1} (Rx)		1.3 1.0	2.5 1.5	mA mA
Supply Current Pin V _{cc1} (avg) (Transmit Mode)	I _{IREDA} =210mA (at IRED Anode Pin) V _{cc1} =5.5V V _{cc2} =2.7V	I _{cc1} (Tx)		5.0 3.5	5.5 4.5	mA mA
Leakage Current of IR Emitter, IRED Anode Pin	V _{cc1} =OFF, T _{XD} =LOW, V _{cc2} =6V, T=25 to 85°C	I _L (IREDA)		0.005	0.5	MA
Transceiver Power On Settling Time		T _{PON}		50		Ms

Opto-electronic Characteristics

T_{amb}=25°C, V_{cc}=2.7V 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
Receiver						
Minimum Detection Threshold Irradiance	BER=10 ⁻⁸ (IrDA Specification)					
	$\alpha = \pm 15^\circ$, SIR Mode, SC=LOW	E _e		20	35	mW/m ²
	$\alpha = \pm 15^\circ$, SIR Mode, SC=HIGH	E _e	6	10	15	mW/m ²
Maximum Detection Threshold Irradiance	$\alpha = \pm 90^\circ$, SIR Mode, V _{cc1} =5V	E _e	3.3	5		kW/m ²
	$\alpha = \pm 90^\circ$, SIR Mode, V _{cc1} =3V	E _e	8	15		kW/m ²
Logic LOW Receiver Input Irradiance	SC=HIGH or LOW	E _e			4	mW/m ²
Output Voltage-Rxd	Active, C=15pF, R=2.2kΩ	V _{OL}		0.5	0.8	V
	Non-active, C=15pF, R=2.2kΩ	V _{OH}	V _{cc} -0.5			V
Output Current-Rxd		I _{OL}		4		MA
Rise Time-Rxd	C=15pF, R=2.2kΩ	t _r (Rxd)	20		1400	Ns
Fall Time-Rxd	C=15pF, R=2.2kΩ	t _f (Rxd)	20		200	Ns
Pulse Width-Rxd Output	Input pulse width=1.6 μs, 115.2 kbit/s	t _{PW}	1.41		8	Ms
Jitter, Leading Edge of Output Signal	Over a Period of 10 bit, 115.2 kbit/s	t _i			2	Ms
Latency		t _L		100	500	Ms

TM4400/TR2

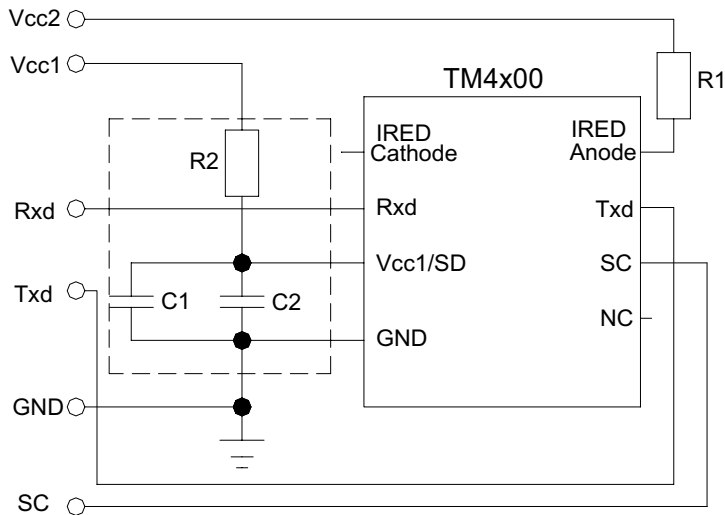
Opto-electronic Characteristics

Tamb=25°C, Vcc=2.7V 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
Transceiver						
IRED Operating Current	IRED Operating Current can be adjusted by Variation of R1. Current Limiting Resistor is in Series to IRED: R1=14Ω, Vcc2=5.0V	I _{IRED}		0.2	0.28	A
Logic LOW Transmitter Input Voltage		V _{IL} (Txd)	0		0.8	V
Logic HIGH Transmitter Input Voltage		V _{IH} (Txd)	2.4		Vcc1+0.5	V
Output Radiant Intensity	In Agreement with IEC825 Eye Safety Limit, if Current Limiting Resistor is in Series to IRED: R1=14Ω, Vcc2=5.0V, α=± 15°	I _e	45	140	200	MW/sr
	Txd Logic LOW Level	I _e			0.04	MW/sr
Angle of Half Intensity		a				°
Peak Wavelength of Emission		λ _p	880		900	Nm
Half-Width of Emission Spectrum				60		Nm
Optical Rise Time, Fall Time		t _{ropt} t _{fopt}		200	600	Ns
Optical Overshoot					25	%
Rising Edge Peak-to-Peak Jitter of Optical Output Pulse	Over a Period of 10 bits, Independent of Information content				0.2	μs

Recommended Circuit Diagram



Note: Outlined components are optional depending on the quality of the power supply.

Figure 3. Recommended Application Circuit.

Table 1. Recommended Application Circuit Components

Component	Recommended Value
C1	4.7 μ F, Tantalum
C2	0.1 μ F, Ceramic
R1	14 Ω , 0.25W (recommended using two 7 Ω , 0.125W resistors in series)
R2	47 Ω , 0.125W

R2, C1 and C2 are optional and dependent on the quality of the supply voltage Vcc1 and injected noise. An unstable power supply with dropping voltage during transmission may reduce sensitivity (and transmission range) of the transceiver.

Selection of current limit resistor

R1 is used for controlling the current through the IR emitter. For increasing the output power of the IRED, the value of the resistor should be reduced. Similarly, to reduce the output power of the IRED, the value of the resistor should be increased. For typical values of R1 (see figures 4 and 5), e.g. for IrDA compliant operation ($V_{CC2}=5V \pm 5^\circ$), a current control resistor of 14Ω is recommended. The upper drive current limitation is dependent on the duty cycle and is given by the absolute maximum ratings on the data sheet and the eye safety limitations given by IEC825-1.

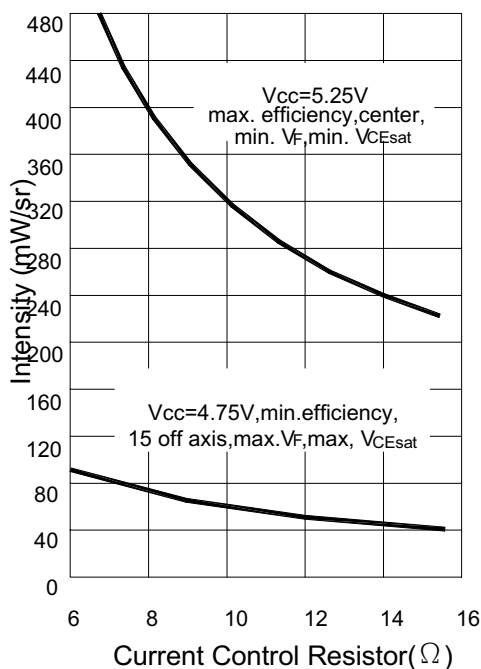


Figure 4. I_e vs. R1

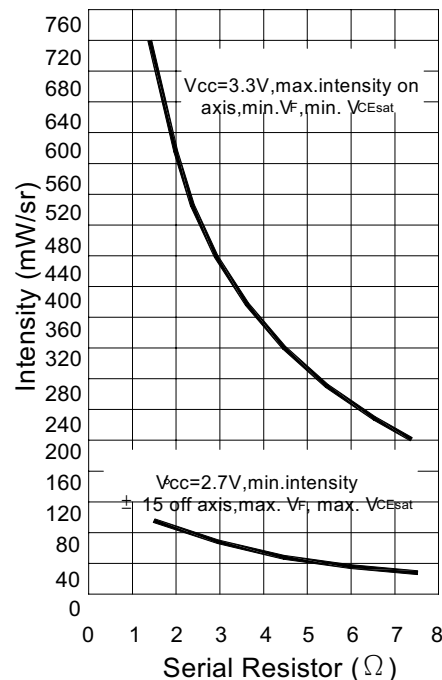


Figure 5. I_e vs. R1

Sensitivity Control (SC)

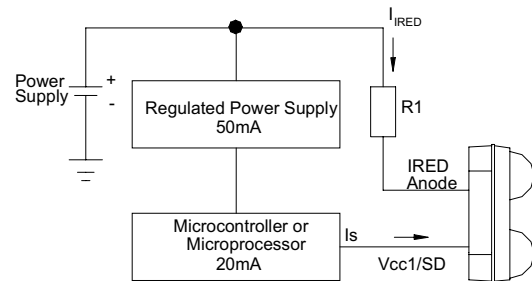
The sensitivity control (SC) pin allows the minimum detection irradiance threshold of the transceiver to be lowered when set to a logic HIGH. Lowering the irradiance threshold increases the sensitivity to infrared signals and increases transmission range up to 3 meters. However, setting the Pin SC to transmission errors due to an increased sensitivity to fluorescent light disturbances. It is recommended to set the Pin SC to logic LOW or left open if the increased range is not required or if the system will be operation in bright ambient light.

The guide pins on the side-view and top-view packages are internally connected to ground but should not be connected to the system ground to avoid ground loops. They should be used for mechanical purposes only and should be left floating.

Shutdown

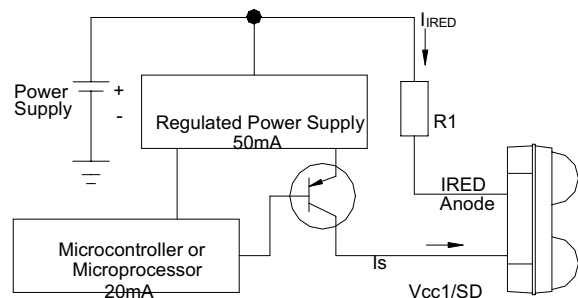
The internal switch for the IRED in Telefunken SIR transceivers is designed to be operated like an open collector driver. Thus, the Vcc2 source can be an unregulated power supply while only a well regulated power source with a supply current of 1.3 mA connected to Vcc1/SD is needed to provide power to the remainder of the transceiver curcuiy in receive mode. In transmit mode, this current is slightly higher (approximately 4 mA average at 3V supply current) and the voltage is not required to be kept as stable as in receive mode. A voltage drop of Vcc1 is acceptable down to about 2.0V when buffering the voltage directly from the Pin Vcc1 to GND see figure 3).

This configuration minimizes the influence of high current surges from the IRED on the internal analog control circuitry of the transceiver and the application circuit. Also board space and cost savings can be achieved by eliminating the additional linear regulator normally needed for the IRED's high current requirements.



TM4100(Note:Typical Values Listed)
Receive Mode
@5V: $I_{RED}=210mA, I_s=1.3mA$
@2.7V: $I_{RED}=210mA, I_s=1.0mA$
Transmit Mode
@5V: $I_{RED}=210mA, I_s=5mA$ (Avg.)
@2.7V: $I_{RED}=210mA, I_s=3.5mA$ (Avg.)

Figure 6.



TM4100(Note:Typical Values Listed)
Receive Mode
@5V: $I_{RED}=210mA, I_s=1.3mA$
@2.7V: $I_{RED}=210mA, I_s=1.0mA$
Transmit Mode
@5V: $I_{RED}=210mA, I_s=5mA$ (Avg.)
@2.7V: $I_{RED}=210mA, I_s=3.5mA$ (Avg.)

Figure 7.

The transceiver can be very efficiently shutdown by keeping the IRED connected to the power supply Vcc2 but switching off Vcc1/SD. The power source to Vcc1/SD can be provided directly from a microcontroller (see figure 6). In shutdown, current loss is realized only as leakage current through the current limiting resistor to the IRED (typically 5 nA). The settling time after switching Vcc1/SD on again is approximately 50 μs . Telefunken's TOIM3232 interface circuit is designed for this shutdown feature. The Vcc_SD, S0 or S1 outputs on the TOIM3232 can be used to power the transceiver with the necessary supply current.

If the microcontroller or the microprocessor is unable to drive the supply current required by the transceiver, a low-cost SOT23 pnp transistor can be used to switch voltage on and off from the regulated power supply (see figure 7). The additional component cost is minimal and saves the system designer additional power supply costs.

Recommended SMD Pad Layout

The leads of the device should be soldered in the center position of the pads.

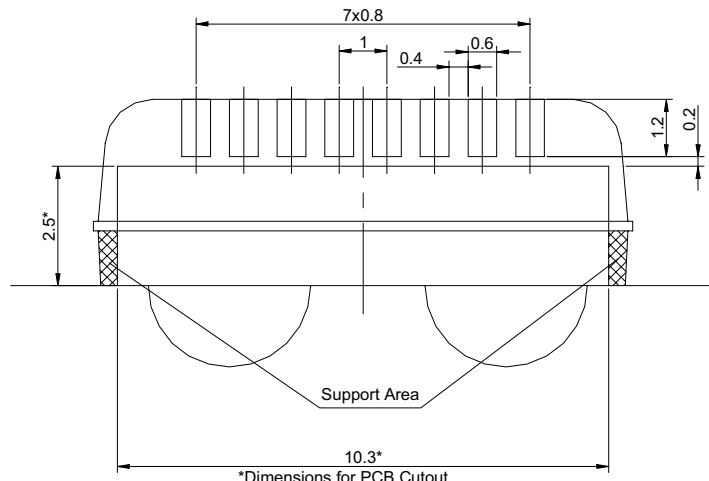


Figure 8. TM4400 (Dracula)

Note: Leads of the device should be at least 0.3mm within the ends of the pads.

Recommended Solder Profile

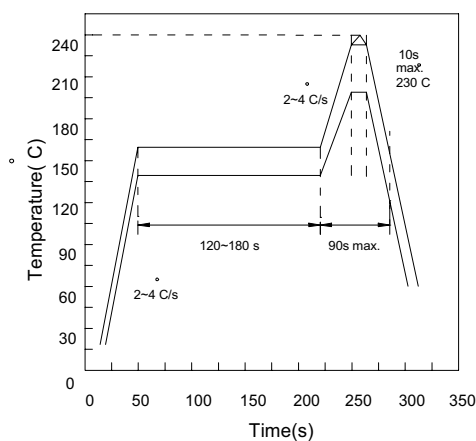


Figure 9. Recommended Solder Profile

Current Derating Diagram

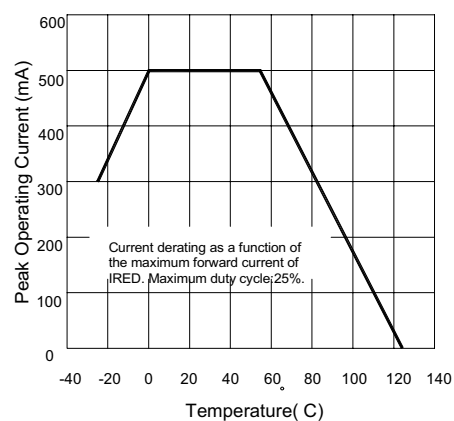
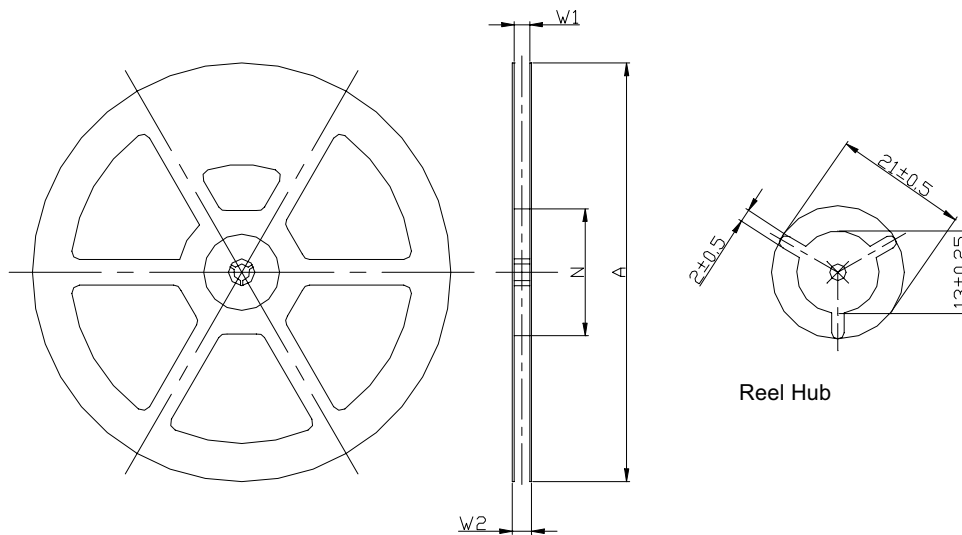


Figure 10. Current Derating Diagram

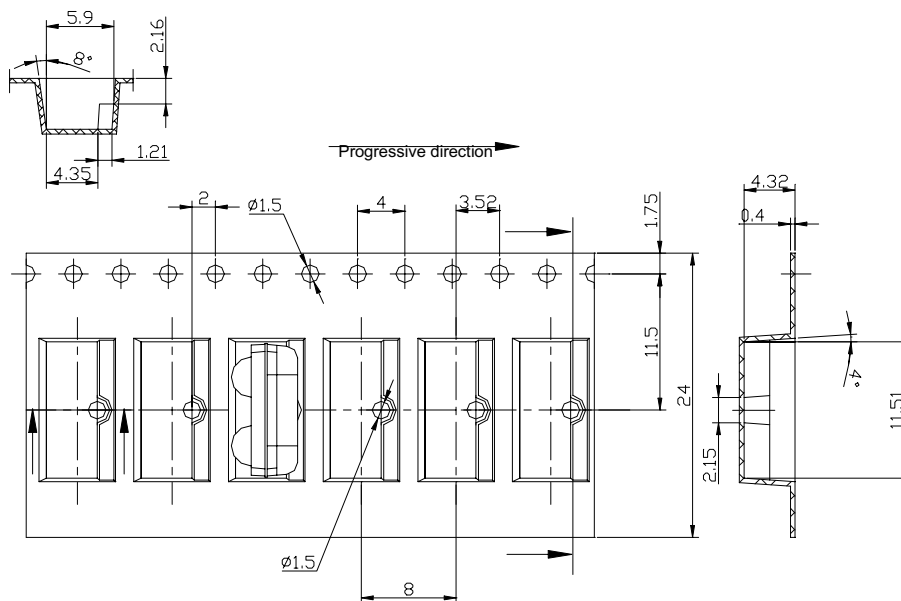
Taping and Packing Information

Shape of Reel and Dimensions

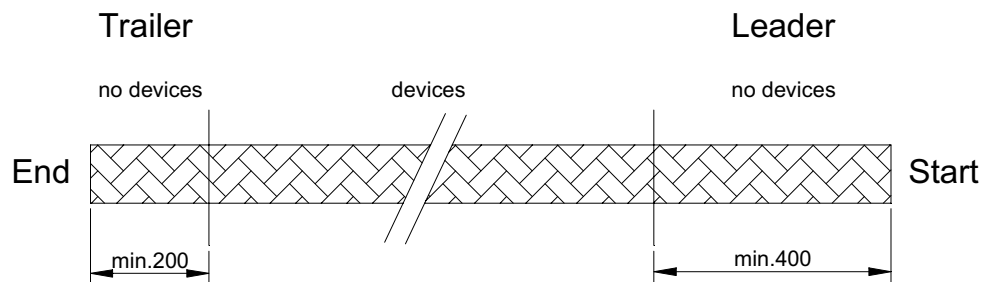


Version	Tape Width	A	N	W1	W2max
C	24	330± 1	100± 1.5	24.4± 2	30.4

Tape Dimensions



Leader and Trailer



Quantity

TM4400/TR2 1000 pcs. per reel

Cover Tape Peel Strength

According to IEC 286

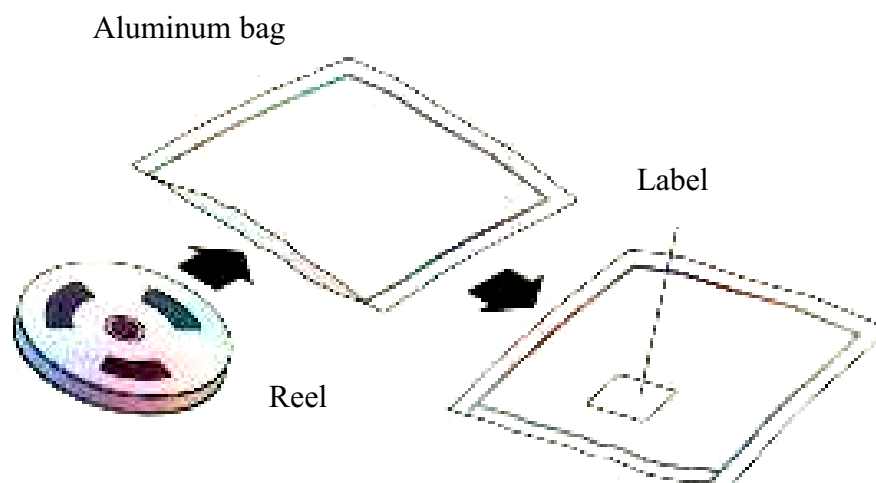
0.1 to 1.3N

300± 10%mm/min

165° -180° peel angle

Damp Proof Packing

The reel is packed in a damp proof aluminum bag to protect the devices from absorbing moisture during transportation and storage.



Recommended Method of Storage

Dry box storage is recommended as soon as the aluminum bag has been opened to prevent moisture absorption. The following conditions should be observed, if dry boxes are not available:

- Storage temperature 10°C to 30°C
- Storage humidity $\leq 60\%RH$ max.

After more than 72hours under these conditions moisture content will be too high for reflow soldering.

In case of moisture absorption, the devices will recover to the former condition by drying under the following condition:

192 hours at 40°C+5°C/-0°C and 5% RH(dry air/nitrogen) or

96 hours at 60°C+5°C and <5% RH for all device containers or

24 hours at 125°C+5°C not suitable for reel or tubes.

ESD Precaution

Proper storage and handling procedures should be followed to prevent ESD damage to the devices especially when they are removed from the Antistatic Shielding Bag. Electro-Static Sensitive Devices warning labels are on the packing.

EVERLIGHT ELECTRONICS CO., LTD.

Office: No 25, Lane 76, Sec 3, Chung Yang Rd,
Tucheng, Taipei 236, Taiwan, R.O.C

Tel: 886-2-2267-2000, 2267-9936

Fax: 886-2267-6244, 2267-6189, 2267-6306

<http://www.everlight.com>

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