

## Technical Data Sheet

### Infrared Data Transceiver Module

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#### **TM4201/TR2**

#### **Features**

- Compliant to IrDA 1.2 (Up to 115.2kbps)
- SMD Side View Soldering
- 2.4 to 5.5 V Wide Operating Voltage Range
- Lowest Power Consumption  
55  $\mu$  A Receiver Mode, 1  $\mu$  A Shutdown
- Only 30mA IRED Peak current During Transmission
- Fewest External Components
- Internal Current Control
- High EMI Immunity
- Receiver Output Tri-State



#### **Descriptions**

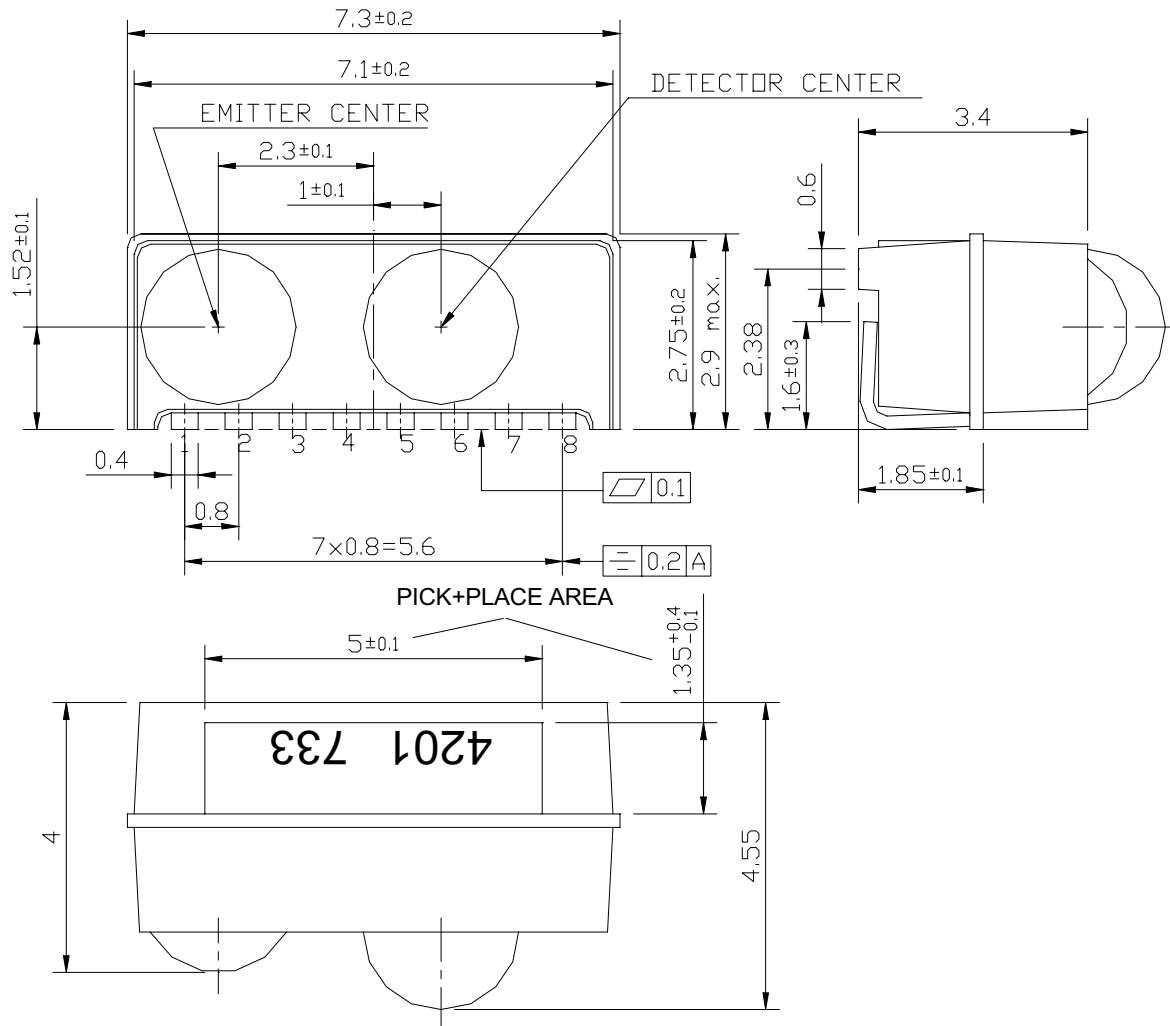
The TM4201/TR2 is a low-power infrared transceiver module compliant to the IrDA 1.2 standard for serial infrared (SIR) data communication, supporting IrDA speeds up to 115.2kbps. The transceiver integrated a infrared emitter diode (IRED), a photo PIN diode and a low-power analog control IC in a single 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**

- Mobile Phones, Pagers, PDAs
- Handheld Battery Operated Equipment

## Package Dimensions



**Notes:** 1.All dimensions are in millimeters.

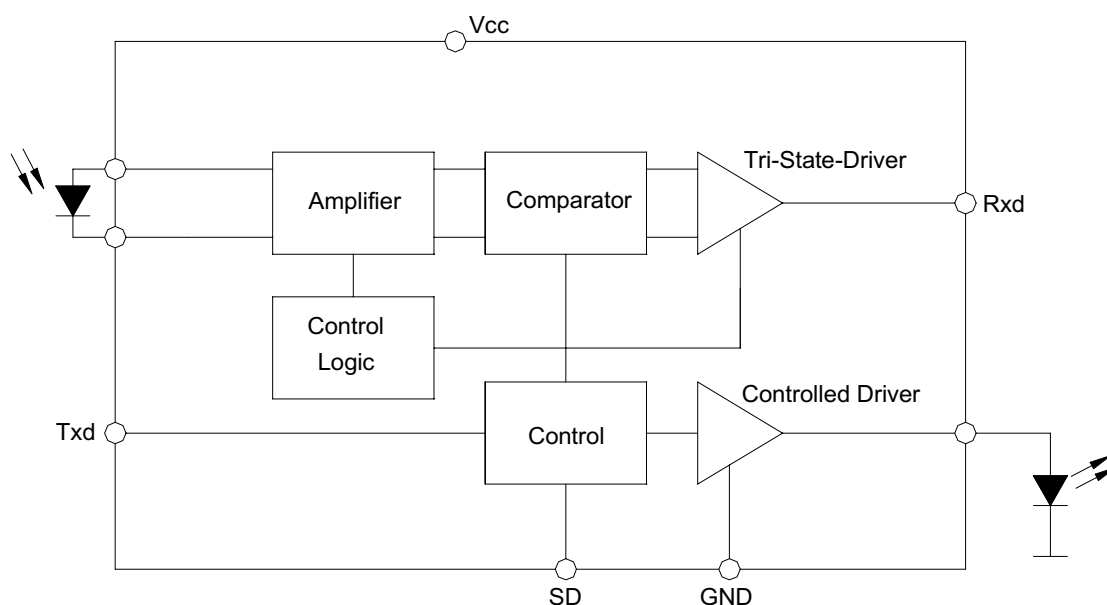
## Device Selection Guide

Transmitter		Receiver		$\lambda$ p	Operating Voltage(Vcc)	Data Rate
Distance	Angle $2\theta$ 1/2	Distance	Angle $2\theta$ 1/2			
>1.0m	+/-15	>1.0m	+/-30	880~900nm	2.4~5.5V	2.4~115.2Kpbs

## Order Information

Part Number	Qty Reel	Description
TM4201/TR2	2250	Oriented in carrier tape for side view in mounting

### Functional Block Diagram



## Pin Description

Pin Number	Function	Description	I/O	Active
1	IREG GND	Ground, IRED cathode		
2	IREG GND	Ground, IRED cathode		
3	Rxd	Received data, Tri-state, floating in shutdown mode	O	LOW
4	Vcc	Supply voltage		
5	GND	Ground		
6	GND	Ground		
7	Txd	Transmit data	I	HIGH
8	SD	Shutdown	I	HIGH

**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	$0V \leq V_{cc} \leq 6V$	$V_{cc}$	-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		$I_{IRED} (DC)$			125	mA
Repetitive Pulsed IRED Current	$t < 90 \mu s, t_{on} < 20\%$	$I_{IRED} (RP)$			500	mA
Transmitter Data Input Voltage		$V_{Txd}$	-0.5		$V_{cc}+0.5$	V
Receiver Data Output Voltage		$V_{Rxd}$	-0.5		$V_{cc}+0.5$	V
Virtual Source Size	Method: (1-1/e) encircled energy	d		2		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

Tamb=25°C, Vcc=2.7V to 5.5V unless otherwise noted.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
<b>Transceiver</b>						
Supply Voltage	(Operational Down to 2.0V)	Vcc	2.4		5.5	V
Supply Current	Vcc=2.4V to 5.5V, Ee=0 Receive Mode	Is		50	80	mA
	Vcc=2.4V to 5.5V, 10klx Sunlight Receive Mode	Is		70	90	mA
	Shutdown Mode(Entire Temp. Range) (Room Temp. 20°C)	ISshdown		0.02	1 10	$\mu$ A nA
IRED Peak Current Transmitting	Vcc=5.5V	Istr		30	36	mA
	Vcc=2.4V			26	30	mA
Transceiver Power On Settling Time		T <sub>PON</sub>		50		Ms

## Opto-electronic Characteristics

Tamb=25°C, Vcc=2.7V to 5.5V unless otherwise noted.

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
<b>Receiver</b>						
Minimum Detection Threshold Irradiance	$ \alpha  \leq \pm 15^\circ$ Vcc=2.0V~5.5V	Ee, min		35	70	mW/m <sup>2</sup>
Maximum Detection Threshold Irradiance	$ \alpha  \leq \pm 90^\circ$ , Vcc=5V	Ee, max	3300	5000		mW/m <sup>2</sup>
	$ \alpha  \leq \pm 90^\circ$ , Vcc=3V	Ee, max	8000	15000		mW/m <sup>2</sup>
Logic LOW Receiver Input Irradiance		Ee, max, min			4	mW/m <sup>2</sup>
Output Voltage-Rxd	Active, C=15pF, R=2.2k $\Omega$	V <sub>OL</sub>		0.5	0.8	V
	Non-active, C=15pF, R=2.2k $\Omega$	V <sub>OH</sub>	Vcc-0.5			V
Output Current-Rxd	V <sub>OL</sub> <0.8V	I <sub>OL</sub>			4	mA
Rise Time-Rxd	C=15pF, R=2.2k $\Omega$	t <sub>r(Rxd)</sub>	20		200	ns
Fall Time-Rxd	C=15pF, R=2.2k $\Omega$	t <sub>f(Rxd)</sub>	20		200	ns
Pulse Width-Rxd Output	Input pulse width=1.41 $\mu$ s to 3/16 of bit length, 2.4 kbit/s	t <sub>p</sub>	1.4		20	$\mu$ s
Pulse Width-Rxd Output	Input pulse width=1.41 $\mu$ s to 3/16 of bit length, 115.2 kbit/s	t <sub>p</sub>	1.4		8	$\mu$ s
Output Delay Time (Rxd), Leading Edge Optical Input to Electrical Output	Output Level = 0.5Vcc @40 mW/m <sup>2</sup>	t <sub>dt</sub>		1	2	$\mu$ s
Jitter, Leading Edge of Output Signal	Over a Period of 10 bit, 115.2 kbit/s	t <sub>i</sub>			1	$\mu$ s
Output Delay Time (Rxd), Trailing Edge	Output Level = 0.5Vcc @40 mW/m <sup>2</sup>	t <sub>dt</sub>			6.5	$\mu$ s
Latency		t <sub>L</sub>		100	200	$\mu$ s

Device NO:DTM-420-102

**Opto-electronic Characteristics**

Tamb=25°C, Vcc=2.7V to 5.5V unless otherwise noted.

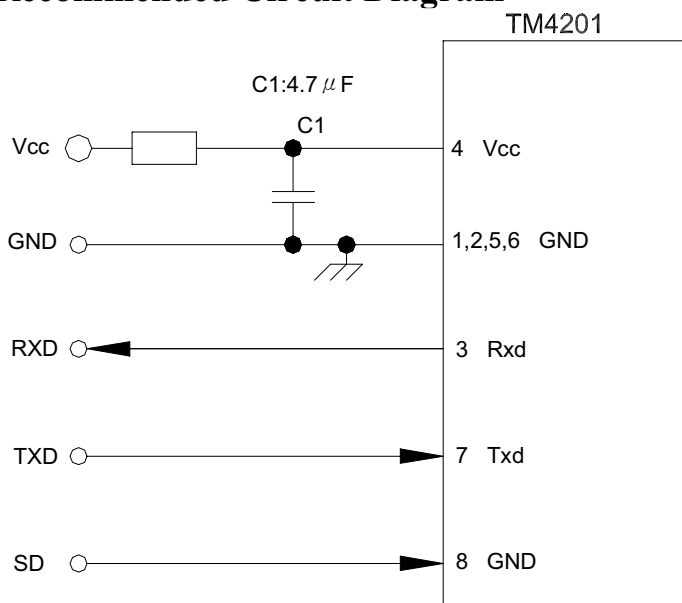
Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
<b>Transmitter</b>						
Logic Low Transmitter Input Voltage		$V_{IL} (Txd)$	0		0.8	V
Logic HIGH Transmitter Input Voltage		$V_{IH} (Txd)$	2.4		Vcc	V
Controlled Current	$I_e = 4 \sim 28 \text{ mW/Sr in }  \alpha  \leq \pm 15^\circ$ Vcc= 2.4 to 5.5 V	$I_F$	25	30	35	mA
Output Radiant Intensity	$I_F = 25 \text{ mA to } 35 \text{ mA}$ Current Controlled 20% duty cycle	$I_e$	4	8	28	mW/sr
Peak Wavelength of Emission		$\lambda_p$	880		900	nm
Half-Width of Emission Spectrum				60		nm
Optical Rise Time, Fall Time		$t_{ropt}$ $t_{fopt}$		200		ns
Output Radiant Intensity	Logic Low Level				0.04	$\mu \text{ W/sr}$
Optical Overshoot					25	%
Rising Edge Peak-to-Peak Jitter	Over a Period of 10 bits, Independent of Information content				0.2	$\mu \text{ s}$

## Application Hints

The TM4201/TR2 does not need any external components when operated at a “clean” power supply. In a more noisy ambient it is recommended to add a capacitor and a resistor of  $1\Omega$  to  $10\Omega$  for noise suppression. A combination of a tantalum with a ceramics capacitor will be most efficient.

## Recommended Circuit Diagram



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

Figure 1. Recommended Application Circuit.

Table 1. Recommended Application Circuit Components

Component	Recommended Value
C1	4.7 $\mu$ F

## Shut down

To shut down the TM4201/TR2 into a standby mode the SD pin has to be set active.

## Latency

The receiver is in specified conditions after the defined latency. In a UART related application after that time (typically 50  $\mu$ s) the receiver buffer of the UART must be cleared. Therefore the transceiver has to wait at least the specified latency after receiving the last bit before starting the transmission to be sure that the corresponding receiver is in a defined state.

## Recommended SMD Pad Layout

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

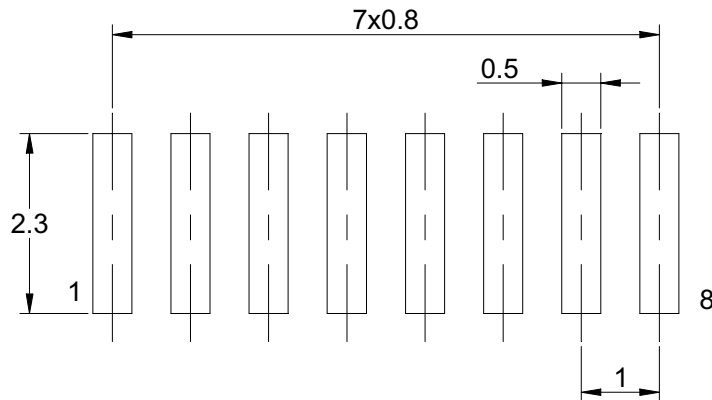


Figure 2. Pad Layout

Transceiver leads to be soldered symmetrically on pads

## Recommended Solder Profile

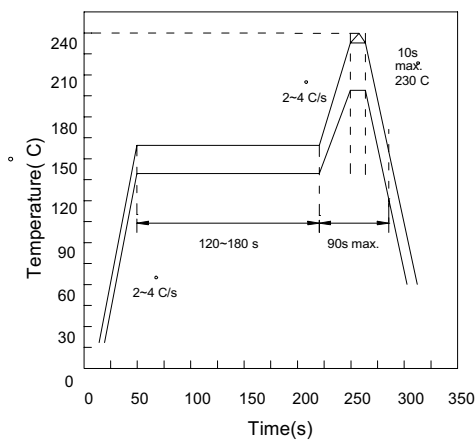


Figure 9. Recommended Solder Profile

## Current Derating Diagram

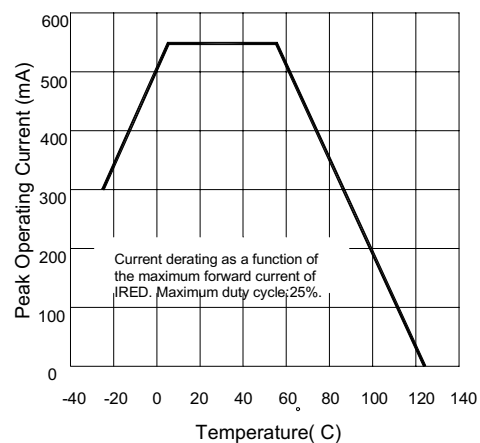
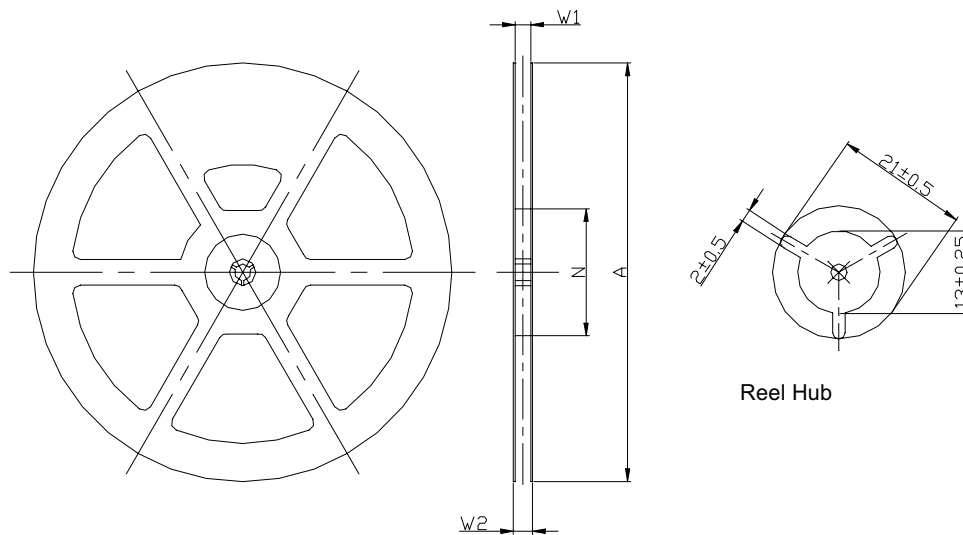


Figure 10. Current Derating Diagram



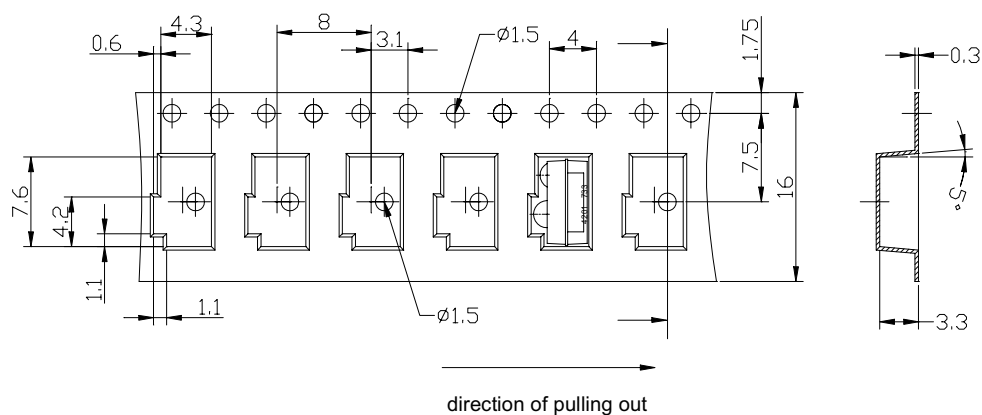
## Taping and Packing Information

### Shape of Reel and Dimensions

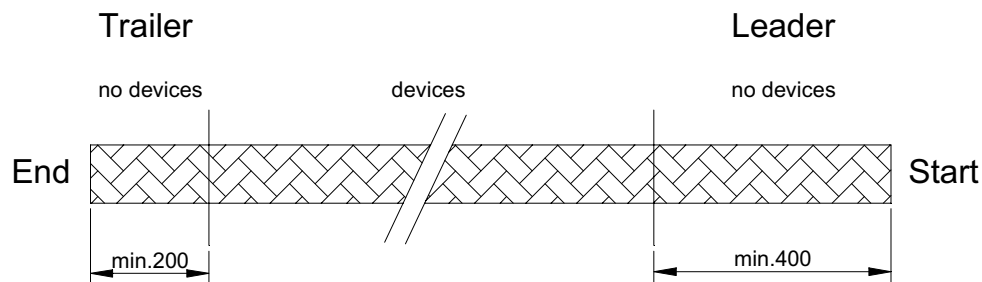


Version	Tape Width	A	N	W1	W2max
C	24	330± 1	100± 1.5	24.4± 2	30.4

## Tape Dimensions



### Leader and Trailer



### Quantity

TM4201/TR2    2250 pcs. per reel

### Cover Tape Peel Strength

According to IEC 286

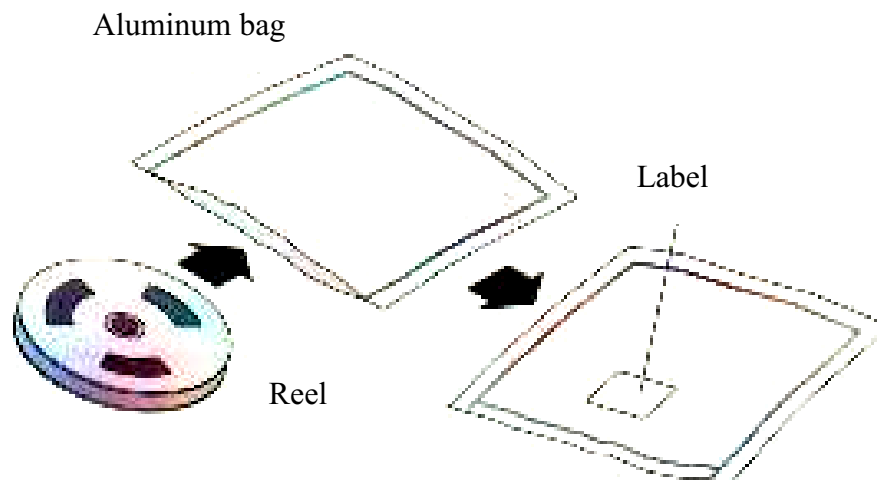
0.1 to 1.3N

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.

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**Device NO:DTM-420-102**