HARVATEK Surface Mount PLCC IC+RGB LEDs DataSheet
T35T3RGB-20C000112U1930

(Preliminary)

Features

- Support signal reshaping to pass control waveforms to next adjacent driver
- Cascading port transmission by dual-wire (clock and data) lines
- Built-in current regulator, three-way drive.
- Optional maximal drive current：20mA.
- 256-step gray-scale output to allow 16,777,216 color display
- 32-step dimming control
- Built-in oscillator 20MHz
- Maximum serial input data/clock frequency 15MHz
- Built-in power-on reset (2.6V)(@VDD=5V)
- Built-in brown-out reset
- Operating voltage 3.3~5.5V
- Support sleep and wake up mode for power-saving

Applications

- Decorative LED lighting
- Ambient lighting and full color strip for automotive

DISCLAIMER

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Life Support Policy

HARVATEK's products are not authorized for use as critical components in life support devices or systems without the express written approval of the President of HARVATEK or HARVATEK INTERNATIONAL. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Product Specifications

Item	Specification	Material	Quantity
Luminous Intensity (Iv)	R:450-1125 mcd G:1125-2850 mcd B:180-450 mcd IC@5V, RGB@20mA T_s= 25°C;Tolerance: ± 10%		
Dominant Wavelength (Wd)	R:615.0-630.0 nm G:520.0-535.0 nm B:460.0-475.0 nm IC@5V, RGB@20mA T_S= 25°C;Tolerance: ± 0.5 nm		
Applied voltage	5V_DC		
Resin	Clear	Silicone	
Carrier tape	EIA 481-1A specs	Conductive black tape	2000 ea/reel
Reel	EIA 481-1A specs	Conductive black	
Label	HT standard	Paper	
Packing bag	250x230mm	Aluminum laminated bag/ no-zipper	One reel per bag
Carton	HT standard	Paper	Non-specified

Others:

Each immediate box consists of 5 reels. The 5 reels may not necessarily have the same lot number or the same bin combinations of Iv, λ_D and Vf. Each reel has a label identifying its specification; the immediate box consists of a product label as well.

Note :This is shipped test conditions

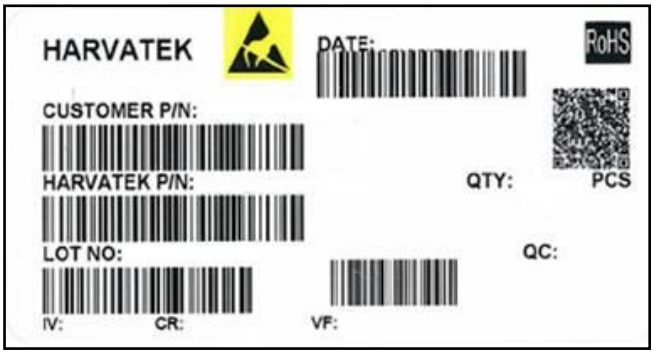
※Remarks: This product should be operated in forward bias. If a reverse voltage is continuously applied to the product, such operation can cause migration resulting in LED damage.

ATTENTION: Electrostatic Discharge (ESD) protection

The symbol to the left denotes that ESD precaution is needed. ESD protection for GaP and AlGaAs based chips is necessary even though they are relatively safe in the presence of low static-electric discharge. Parts built with AlGaInP, GaN, or/and InGaN based chips are **STATIC SENSITIVE devices**. ESD precaution must be taken during design and assembly.

If manual work or processing is needed, please ensure the device is adequately protected from ESD during the process.

Label Specifications



- **HARVATEK P/N:**

T 35T 3 RGB- 20C- 0001 12

Product	Package	Dice Q'ty	Color	Current	Series Number	Taping
LF	3.6(L)x3.5(W)x1.4(H) mm	3.TRI	RGB (Full Color)	20mA	X001~XZZZ	1.Taping style 2. Q'ty

- **Lot No.:**

1	2	3	4	5	6	7	8	9	10
E	1	A	1	A	2	2	L	1	2
Code 1 2		Code 3	Code 4	Code 5	Code 6	Code 7	Code 8	Code 9	Code 10
		Mfg. Year	Mfg. Month	Mfg. Date	Consecutive number		Special code		
Internal Tracing Code		2020-L 2021-M 2022-P 2023-Q … 2026-T 2027-V … 2030-Y 2031-Z …	1:Jan. 2:Feb. … A:Oct. B:Nov. C:Dec.	1:A 2:B 3:C … 26:Z 27:7 28:8 29:9 30:3 31:4	01~ZZ		000~ZZZ		

Product Features

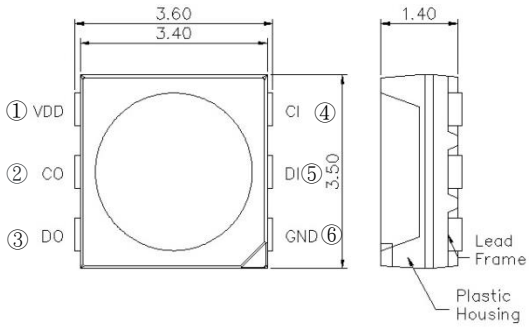
Electro-Optical Characteristics

Emitting Color	Material	Wavelength λ(nm)	I_V(mcd)	Test Condition 8bits	Viewing Angle $2\theta\frac{1}{2}$
		λ_D	Typical		
R	AlGaInP	620	730	R：[11111111]	120
G	InGaN	525.5	1637.5	G：[11111111]	120
B	InGaN	467.5	315	B：[11111111]	120

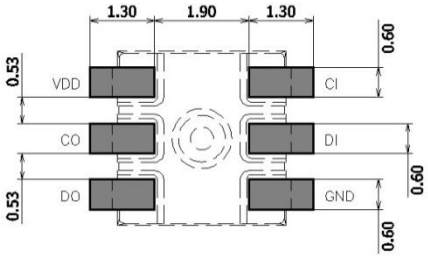
Package Outline Dimension and Recommended Soldering Pattern for Reflow Soldering

(Unit:mm Tolerance: +/-0.1)

Outline Dim.



Suggest Soldering Pattern



Soldering terminals may shift in the X,Y direction.

No.	Symbol	Function description
1	VDD	Supply voltage
2	CO	Clock output
3	DO	Data output
4	CI	Clock input
5	DI	Data input
6	GND	Ground

Absolute Maximum Ratings

(Temperature=25℃)

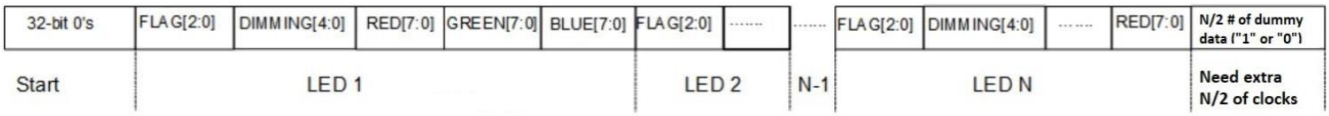
Characteristic	Symbol	Range	Units
Supply Voltage	V_{DD}	6.5	V
Total DC Current	IF	70	mA
Operating Temperature Range	T_{OPR}	-40~+85	℃
Storage Temperature Range	T_{STO}	-40~+85	℃

Electrical characteristics

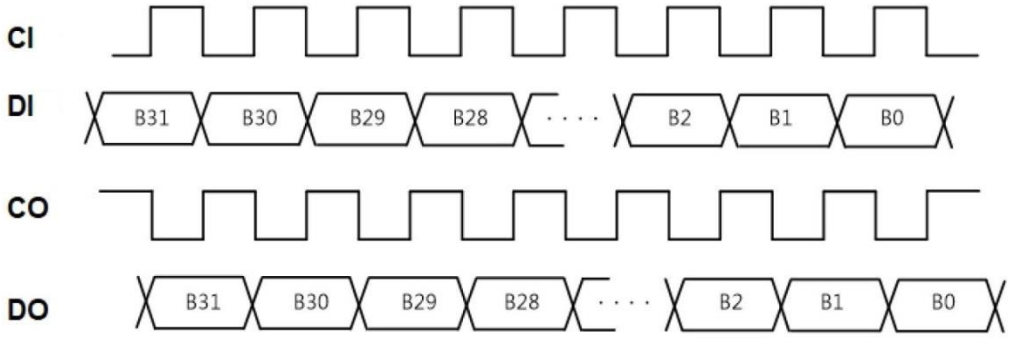
(Temperature=25℃)

Characteristic	Symbol	Limit			Units	Note
		Min.	Typ.	Max.		
Supply Voltage	V_{DD}	3.3	5.0	5.5	V	
Operation Current	I_{dyn}			1.5	mA	
Standby Current	I_{sleep}		1		μA	
Logic input control SDI/CKI						
Input High “H”	V_{IH}	2.7		V_{DD}+0.4	V	
Input High “L”	V_{IL}	-0.4		1.0	V	
CKI Frequency	C_{FREQ}			15	MHz	
SDI High pulse width	T_{CKH}	30			ns	
SDI Low pulse width	T_{CKL}	30			ns	
SDI to CKI setup	T_{SETUP}	10			ns	
SDI to CKI hold time	T_{HOLD}	5			ns	
Logic output SDO/CKO						
Output High “H”	V_{OH}	4.5			V	
Output Low “L”	V_{OL}			0.4	V	
Sink Current R/G/B						
R、G、B Sink Current	I_{SINK}	19	20	21	mA	

Cascading data structure



32 consecutive 0's denote the start of a command for the device. After receiving 32 0's, the device gets the following 32 bits as the received command, including FLAG, DIMMING, RED, GREEN and BLUE fields.



The serial command is transmitted with MSB first, DI is latched at the rising edge of CI clock. CO and DO are re-generated for the next device. CO is inverted from CI. When 32 consecutive 0's are encountered, the next 1 is expected to start a 32-bit command, i.e., FLAG[2:0]=111. When FLAG[2:0]=111, then DIMMING, RED, GREEN and BLUE fields are latched respectively.

While the current 32-bit command is got, the device passes remaining command bits to the next device.

FLAG [2:0] : 111 to start a 32-bit command

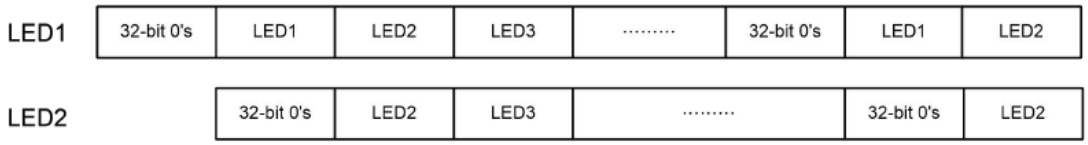
DIMMING [4:0] : 32-level current control for R/G/B drivers

RED [7:0] : 256 gray levels for red LED

GREEN [7:0] : 256 gray levels for green LED

BLUE [7:0] : 256 gray levels for blue LED

After the last one command is issued for the last LED (LED n), MCU should issue the extra N/2 numbers of clocks signal if there are N LED lamps totally connected in the strip to make sure the data transfer and display of the last one LED lamp is complete and correct.(the data for the extra N/2 # of clocks may be set as “0” or “1”)。



Sleep and power saving mode

The device supports the sleep/wake-up modes for power-saving purpose. In sleep mode, the built-in oscillator and associated circuitry will be disabled. The quiescent current of the device is approximately 1uA in the sleep mode.

Command Setup to enable sleep or wake up mode

When receiving 24-bit 0’s RGB data (that is RED[7:0]=8h00, GREEN [7:0]=8h00, BLUE [7:0]=8h00), in the meantime, both of the data in 3-bits’ flag and 5-bits’ DIMMING is 8h’A0’ (that is FLAG[2:0]=3b101 and DIMMING[4:0]=5b00000), the device will enter sleep mode.

The device will wake up from sleep mode once receiving the new data with the data of Flag[2:0], DIMMING[4:0] is not 8h"A0"; after wake-up, all sleeping circuits in the device return to normal working mode within 1ms. Since it takes 1ms for a sleeping the device returning to normal function mode, it is recommended for a host to wait for 1ms to send display data and command after issuing a wake-up command.

Sleep power-saving mode example:

32 bits 0	Flag[2:0]=3'b101	Dimming[4]=5'b00000	Blue[8'h00]	Green[8'h00]	Red[8'h00]	Sleep mode

Case 1:

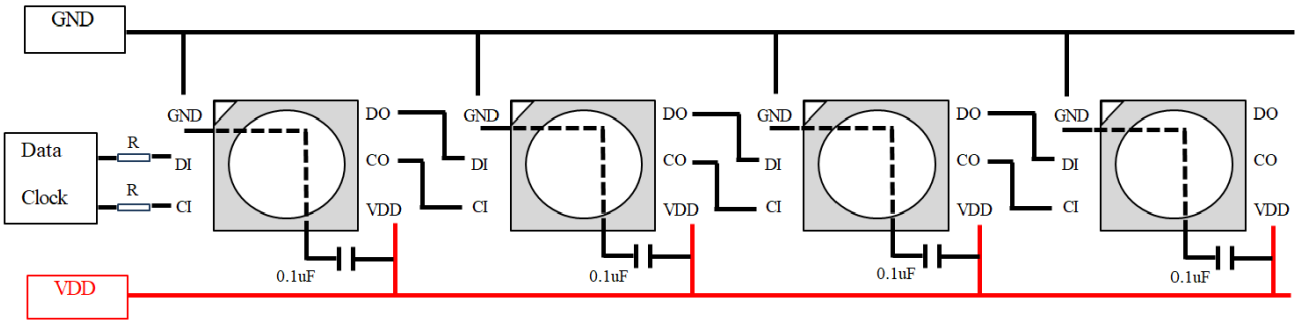
Lamp 1	Lamp 2	Lamp 3
1xx111118hFF8hFF8hFF	101000008h008h008h00	101000008h008h008h00
Normal mode	Sleep mode	Sleep mode

Case 2:

Lamp 1	Lamp 2	Lamp 3
1xx111118hFF8hFF8hFF	101000008h008h008h00	1xx111118h1F8h1F8h1F
Normal mode	Sleep mode	Normal mode

In case 2, while lamp2 is under sleep mode, in the following data transfer process, the state of lamp 2 will be not changed as long as the 32 bits data for lamp 2 is received with data of Flag[2:0]、DIMMING[4:0] being 8h"A0" . It means lamp2 will keep in sleep mode as well. In the situation, lamp2 can pass through the remaining data to lamp 3 (32bits) to change the display data of lamp 3. In other words, the sleeping chip is able to pass the data to the next chips.

Typical Circuit of an RGB LED strip application

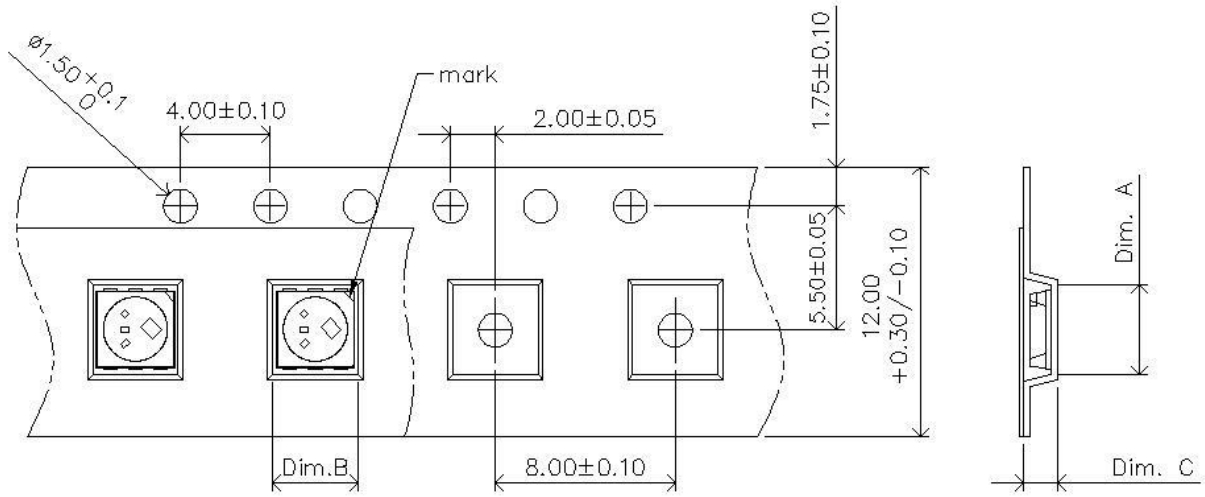


Precaution for Use

1. The chips should not be used directly in any type of fluid such as water, oil, organic solvent, etc.
2. When the LEDs are illuminating, the maximum ambient temperature should be first considered before operation.
3. LEDs must be stored in a clean environment. A sealed container with a nitrogen atmosphere is necessary if the storage period is over 3 months after shipping.
4. The LEDs must be used within 24 hrs after unpacked. Unused products must be repacked in an anti-electrostatic package, folded to close any opening and then stored in a dry and cool space.
5. The appearance and specifications of the products may be modified for improvement without further notice.
6. The LEDs are sensitive to the static electricity and surge. It is strongly recommended to use a grounded wrist band and anti-electrostatic glove when handling the LEDs. If a voltage over the absolute maximum rating is applied to LEDs, it will damage LEDs. Damaged LEDs will show some abnormal characteristics such as remarkable increase of leak current, lower turn-on voltage and getting unlit at low current.

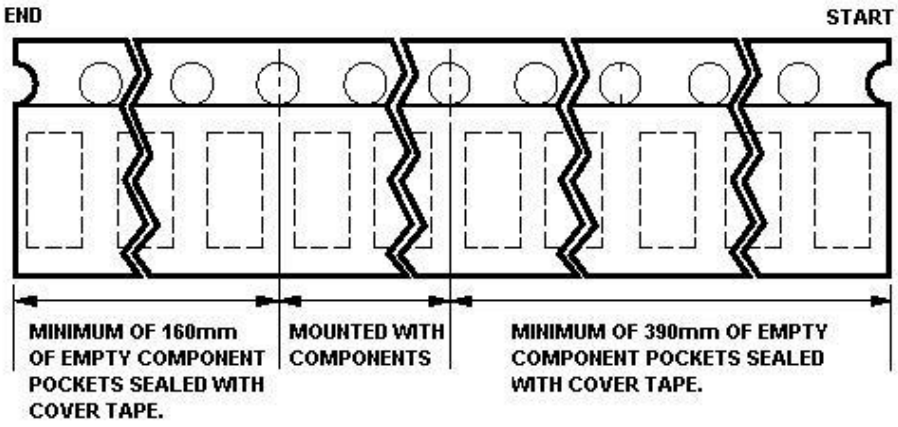
Packaging

Tape Dimension



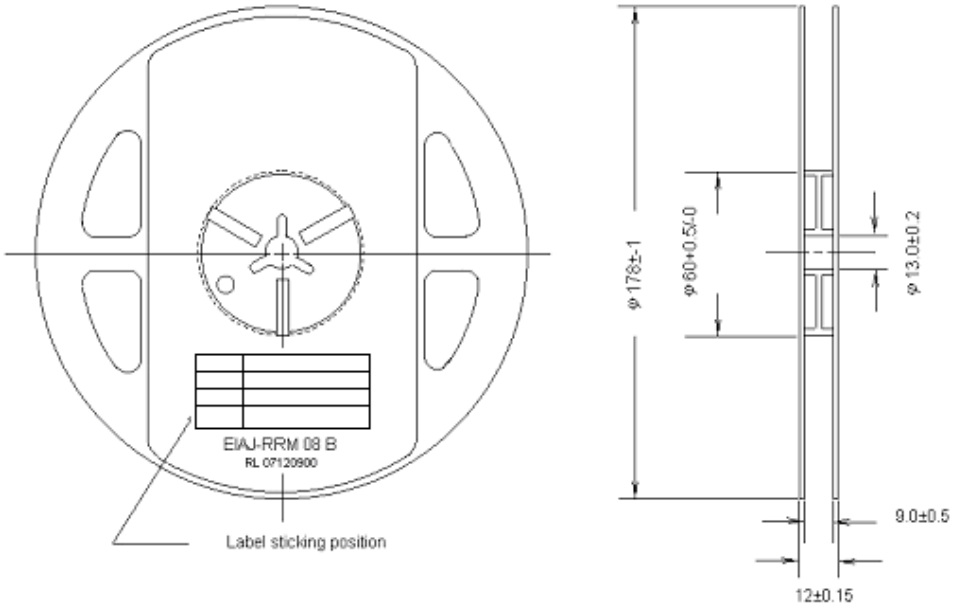
Dim. A	Dim. B	Dim. C	Q'ty/Reel
3.80±0.10	4.00±0.10	1.20±0.10	2000

Unit : mm



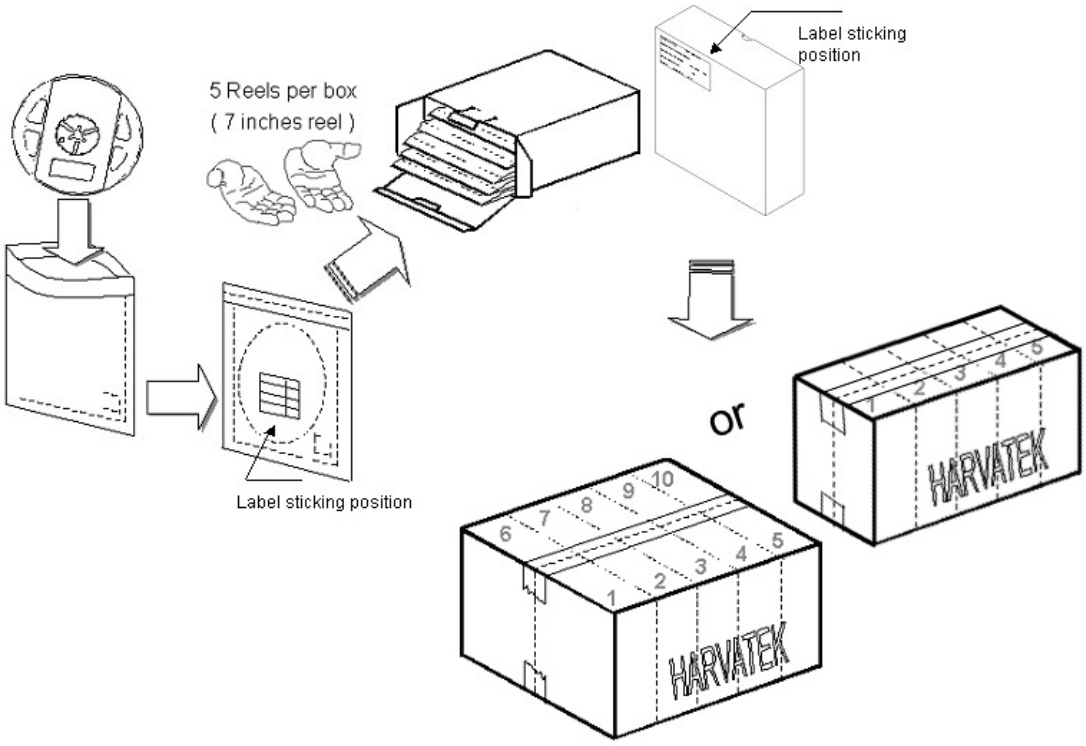
Reel

Dimension



Unit : mm

Packing



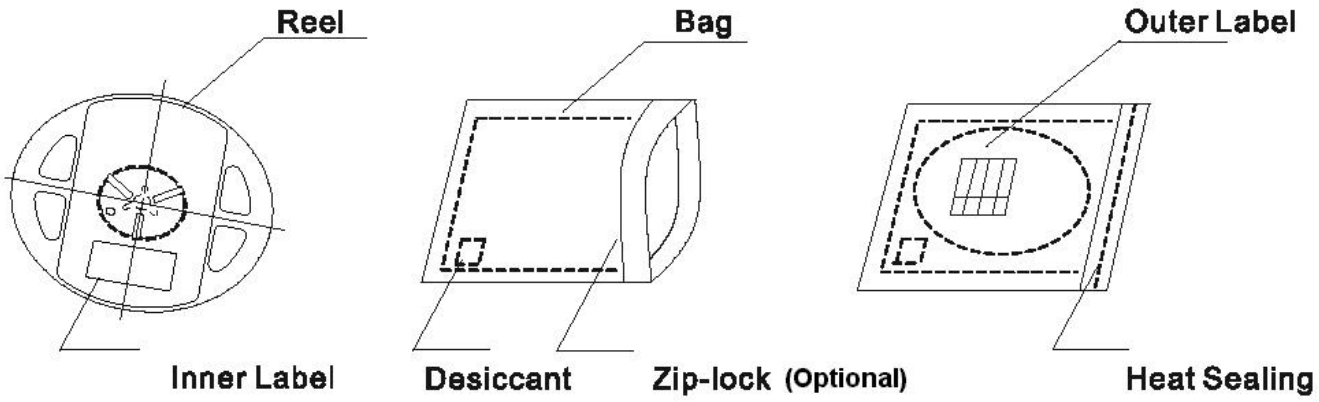
5 or 10 boxes per carton is available depending on shipment quantity.

Dry Pack

All SMD optical devices are **MOISTURE SENSITIVE**. Avoid exposure to moisture at all times during transportation or storage. Every reel is packaged in a moisture protected anti-static bag. Each bag is properly sealed prior to shipment.

Upon request, a humidity indicator will be included in the moisture protected anti-static bag prior to shipment.

The packaging sequence is as follows:



Baking

Baking before soldering is recommended when the package has been unsealed for 48 hours. The conditions are as followings:

1. 60±3℃×(12~24hrs)and<5%RH, taped reel type.
2. 100±3℃×(45min~1hr), bulk type.
3. 130±3℃×(15min~30min), bulk type.

Precautions

1. Avoid exposure to moisture at all times during transportation or storage.
2. Anti-Static precaution must be taken when handling GaN, InGaN, and AlGaInP products.
3. It is suggested to connect the unit with a current limiting resistor of the proper size. Avoid applying a reverse voltage beyond the specified limit.
4. Avoid operation beyond the limits as specified by the absolute maximum ratings.
5. Avoid direct contact with the surface through which the LED emits light.
6. If possible, assemble the unit in a clean room or dust-free environment.

Handling of Silicone Resin LEDs

Handling Indications

During processing, mechanical stress on the surface should be minimized as much as possible.

Sharp objects of all types should not be used to pierce the sealing compound.

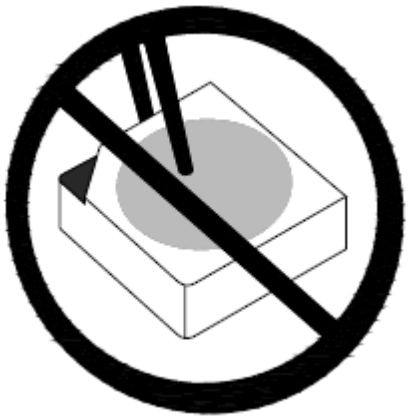


Figure 1

In general, LEDs should only be handled from the side. By the way, this also applies to LEDs without a silicone sealant, since the surface can also become scratched.

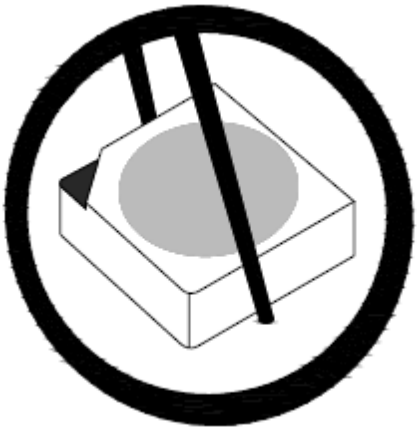


Figure 2

When populating boards in SMT production, there are basically no restrictions regarding the form of the pick and place nozzle, except that mechanical pressure on the surface of the resin must be prevented.

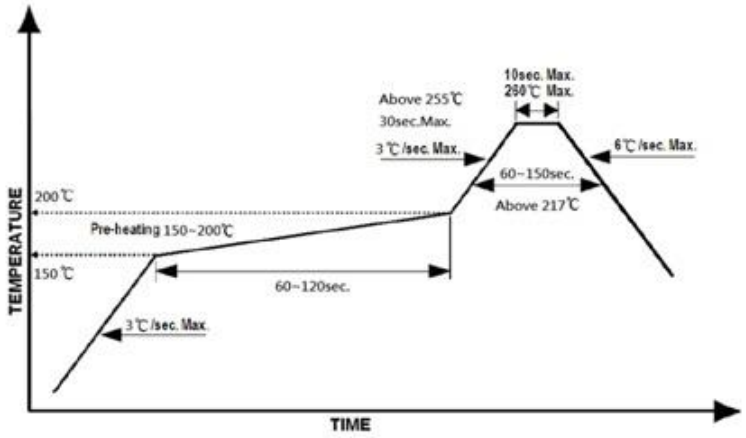
This is assured by choosing a pick and place nozzle which is large than LEDs reflector area.

Reflow Soldering

Recommend soldering paste specifications:

1. Operating temp.: Above 217℃, 60~150 sec.
2. Peak temp.:260℃ Max., 10sec Max.
3. Reflow soldering should not be done more than two times.
4. Never attempt next process until the component is cooled down to room temperature after reflow.
5. The recommended reflow soldering profile (measured on the surface of the LED terminal) is as following:

Lead-free Solder Profile



Reworking

- Rework should be completed within 5 seconds under 260 ^{O}C.
- The iron tip must not come in contact with the copper foil.
- Twin-head type is preferred.

Cleaning

Following are cleaning procedures after soldering:

- An alcohol-based solvent such as isopropyl alcohol (IPA) is recommended.
- Temperature x Time should be 50^{o}C x 30sec. or <30^{o}C x 3min
- Ultrasonic cleaning: < 15W/ bath; bath volume ≤ 1liter
- Curing: 100 ^{O}C max, <3min

Cautions of Pick and Place

- Avoid stress on the resin at elevated temperature
- Avoid rubbing or scraping the resin by any object.
- Electric-static may cause damage to the component. Please ensure that the equipment is properly grounded. Use of an ionizer fan is recommended.

Revise History

Rev.	Descriptions	Date	Page
1.0	Preliminary	04/21/2025	-
1.1	修改包裝示意圖	06/20/2025	-