HARVATEK Surface Mount PLCC IC+RGB LEDs DataSheet
T35W3BRG-11C0001X1U1930

(Preliminary version)

Features

- I2C communication protocol and cascading capability.
- Share the MCU with the existing MCU-controlled devices.
- Built-in current regulator, RGB three-way drive.
- Maximal channel-drive-current: 11mA.
- 256-step gray-scale output to allow 16,777,216 color display.
- 16-step/2-mode global brightness control.
- Built-in breathing mode. MCU send the signal once and device can then continuously perform the breathing-lighting effect.
- Dynamic power-saving feature
- Operating voltage 3.3~5.5V

Applications

- Decorative LED lighting
- LED indicator

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:180-715 mcd G:285-1125 mcd B:75-450 mcd IC@5V, RGB@11mA T_s= 25°C;Tolerance: ± 10%		
Dominant Wavelength (Wd)	R:615.0-630.0 nm G:515.0-535.0 nm B:460.0-475.0 nm IC@5V, RGB@11mA T_S= 25°C;Tolerance: ± 0.5 nm		
Applied voltage	5V_DC		
Resin	Clear	Silicone	
Carrier tape	EIA 481-1A specs	Conductive black tape	1000
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

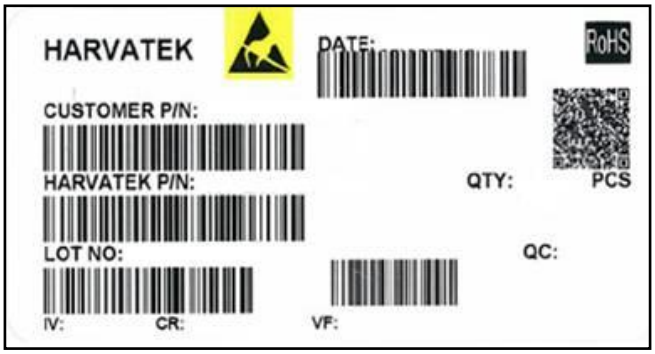
※Remarks: This product should be operated in forward bias. If a reverse voltage is continuously applied to the product, such operation can cause migration resulting in LED damage.

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 35W 3 BRG- 11C- 0001 X1

Product	Package	Dice Q'ty	Color	Current	Series Number	Taping
LF	3.5(L)x3.4(W)x1.47(H) mm	3.TRI	BRG (Full Color)	11mA	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		

Specifications Range

■Luminous Intensity (Iv) :

Color	Bin code	Spec. Range
R	R1	180-285 mcd
	R2	285-450 mcd
	R3	450-715 mcd
G	G1	285-450 mcd
	G2	450-715 mcd
	G3	715-1120 mcd
B	B1	72-112 mcd
	B2	112-180 mcd
	B3	180-285 mcd
	B4	285-450 mcd

Note: It maintains a tolerance of ±10% on luminous intensity

■Wavelength :

Color	Bin code	Spec. Range
R	A	615-620 nm
	B	620-625 nm
	C	625-630 nm
G	A	515-520 nm
	B	520-525 nm
	C	525-530 nm
	D	530-535 nm
B	AA	460-465 nm
	AB	465-470 nm
	AC	470-475 nm

Note: It maintains a tolerance of ± 0.5nm on Wavelength Bin

Product Features

Electro-Optical Characteristics

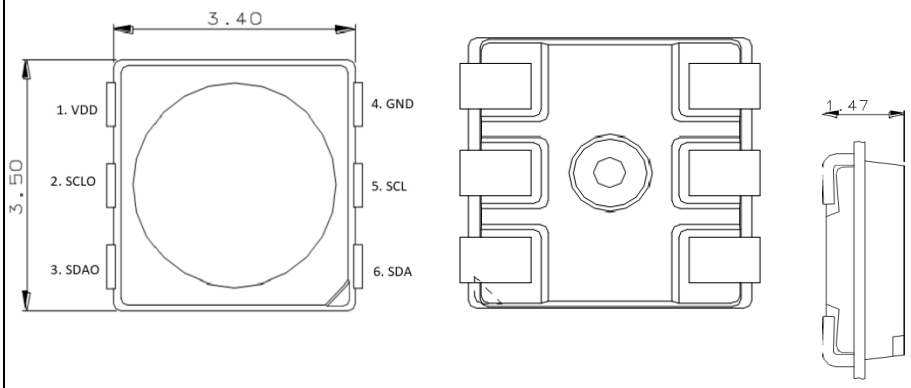
($T_{Soldering}$, 25 °C)

Emitting Color	Material	Wavelength λ_D (nm)	I_V(mcd)	Test Condition 8bits	Viewing Angle $2\theta\frac{1}{2}$
		Typical	Typical		
R	AlGaInP	624	368	R：[1111 1111]	120
G	InGaN	523	715	G：[1111 1111]	120
B	InGaN	470	285	B：[1111 1111]	120

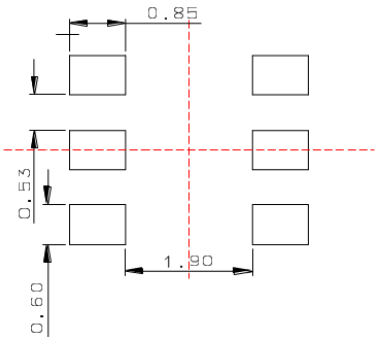
Package Outline Dimension and Recommended Soldering Pattern for Reflow Soldering

(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	SCLO	SCL output
3	SDAO	SDA output
4	GND	Ground
5	SCL	SCL input
6	SDA	SDA input

Absolute Maximum Ratings

(Temperature=25℃)

Parameter	Symbol	Range	Units
Supply Voltage	V_{DD}	7.0	V
Total DC Current	IF	40.0	mA
Operating Temperature Range	T_{OPR}	-20~+85	℃
Storage Temperature Range	T_{STO}	-40~+85	℃
ESD Voltage	V_{ESD}	2	kV

Electrical characteristics

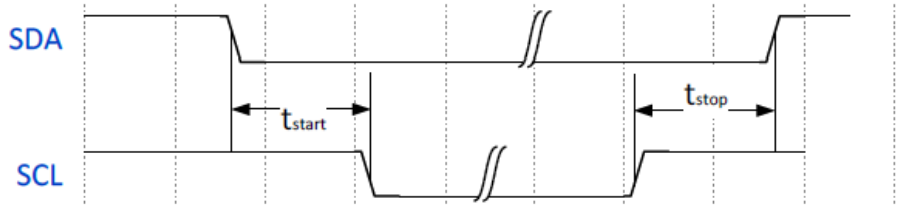
(unless otherwise specified, Temperature=25°C & V_{DD}=5.0V)

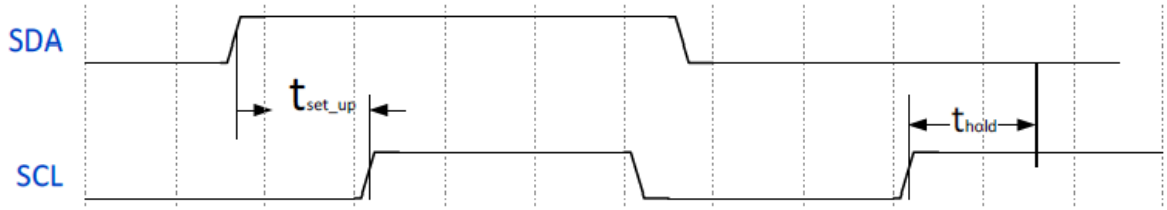
Characteristic	Symbol	Min.	Typ.	Max.	Units	Condition
Supply Voltage	V_{DD}	3.3	5.0	5.5	V	-
IC Stanby Current	I_{DD_stb}	---	0.8	---	mA	VDD=5V, Reg[7:0]=8'h80
IC Sleep Mode Current	I_{DD_sleep}	---	0.2	---	mA	VDD=5V, Reg[7:0]=8'h88
Voltage Input High "H"	V_{IH}	V_{DD}*0.8	---	V_{DD}+0.5	V	-
Voltage Input High "L"	V_{IL}	-0.4	---	V_{DD}*0.2	V	-
First Device SCL/SDA Pull-up resistance	R_{IN}	---	2.2k	---	Ω	-
SDAO/SCLO Output Current	I_{OH} / I_{OL}	--- / ---	2.0 / 2.0	--- / ---	mA / mA	
Output High "L"	V_{OL}			0.4	V	IOL=4mA
Sink Current / Ch	I_{SINK}	10.45	11	11.55	mA	

Dynamic characteristics

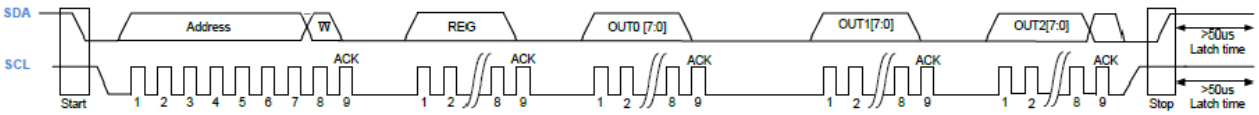
(VDD =5V，Temperature=25℃)

Parameter	Symbol	Min.	Typ.	Max.	Units
Serial-clock frequency	F_{scl}	---	---	400	kHz
Hold time (repeated) START condition	t_{start}	---	0.6	---	μs
STOP condition setup time	t_{stop}	---	0.6	---	μs
Data setup time	t_{set_up}	---	100	---	ns
Data hold time	t_{hold}	---	100	---	ns





Communication protocol



The device uses the I2C communication protocol, requiring a Start signal to initiate communication. Data transmission consists of the following sequence: data is transmitted as shown in the diagram, with register buffers OUT0[7:0], OUT1[7:0], and OUT2[7:0]. The chip's address is 7’b0010101.

OUT0：Blue color LED light.

OUT1：Red color LED light.

OUT2：Green color LED light

The device features two built-in control modes:

a. 8-bit PWM mode and

b. Breathing mode.

When the register buffer's Bit[2:0]=3’b000, it is set to PWM display mode; when the buffer's Bit[2:0] is not equal to 3’b000, it operates in breathing mode. The output currents for channels OUT2, OUT1, and OUT0 are determined based on the data in register buffer's Bit[7:4].

Initial value of the register buffer

7	6	5	4	3	2	1	0
1	0	0	0	0	0	0	0

Function

REG [Bit]	Function Description
7:4	Current Gain Adjustment (GBC) Includes two current gain modes: GBC MODE1 and GBC MODE2.
3	Sleep Mode ： 0: Normal Mode 1: Sleep Mode, Channels Closed
2	OUT2 Output Mode Setting ： 0: OUT2 PWM Mode 1: OUT2 Breathing Mode
1	OUT1 Output Mode Setting ： 0: OUT1 PWM Mode 1: OUT1 Breathing Mode
0	OUT0 Output Mode Setting ： 0: OUT0 PWM Mode 1: OUT0 Breathing Mode

Global Brightness Control (GBC)

The device features a built-in 16-level adjustable current gain function, which is set via bits [7:4] in the register buffer. It includes two current gain modes: GBC MODE1 and GBC MODE2, each with 8 adjustable levels. Table 1 shows the current levels for GBC MODE 1 corresponding to levels 1 to 8. Table 2 shows the current levels for GBC MODE 2 corresponding to levels 9 to 16. The initial value of GBC is set to 4’d8.

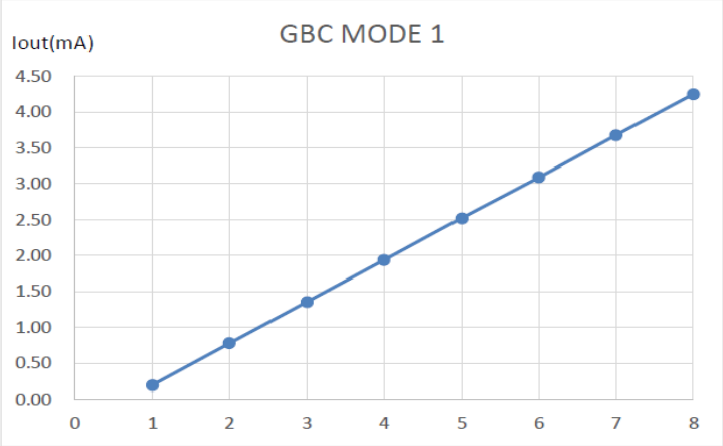


Table 1

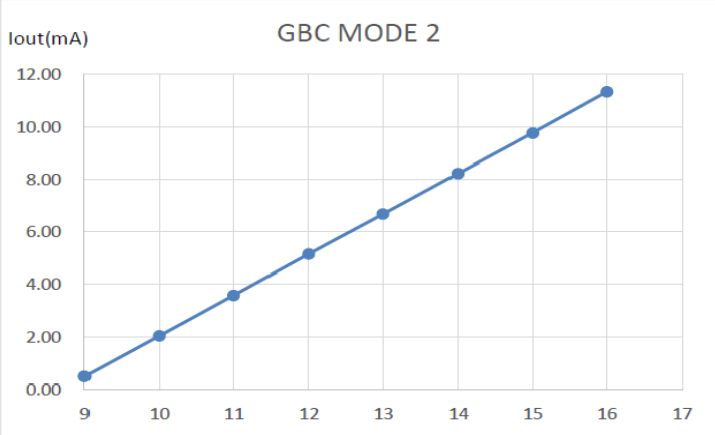


Table2

PWM mode

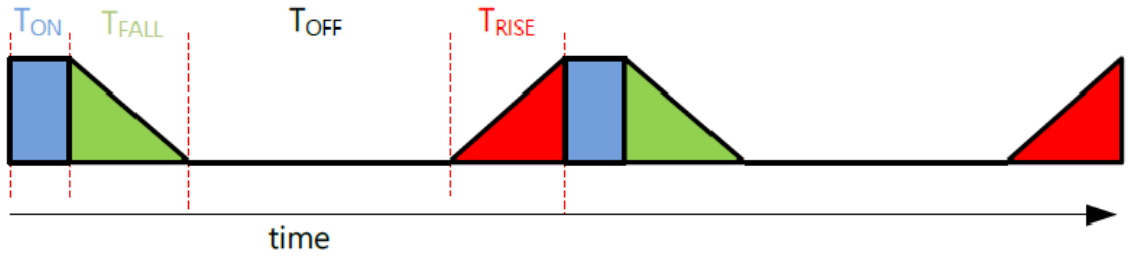
When device switches to 8-bit PWM mode, OUT0[7:0] controls the grayscale of OUT0, OUT1[7:0] controls the grayscale of OUT1, and OUT2[7:0] controls the grayscale of OUT2. Until new grayscale data is written into device, the chip will repeatedly display the grayscale values stored internally.

Breathing mode

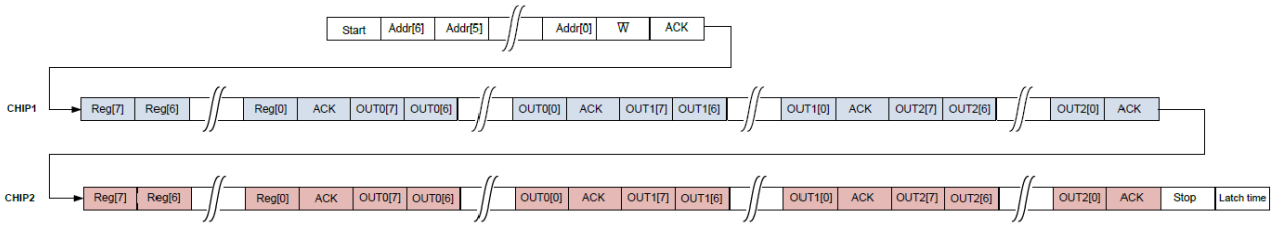
When device switches to breathing mode, OUT0[7:0] determines the on time (T_{ON}) of the breathing light, OUT1[7:0] determines the rise time (T_{RISE}) and fall time (T_{FALL}) of the breathing light, and OUT2[7:0] determines the off time (T_{OFF}) of the breathing light.

Parameter	Function Description
OUT0[7:0]	Breathing light TON Time 1111_1111 : Maximum (2.68sec)
OUT1[7:0]	Breathing light TFALL Time and TRISE Time 1111_1111 : Maximum (2.68sec)
OUT2[7:0]	Breathing light TOFF Time 1111_1111 : Maximum (2.68sec)

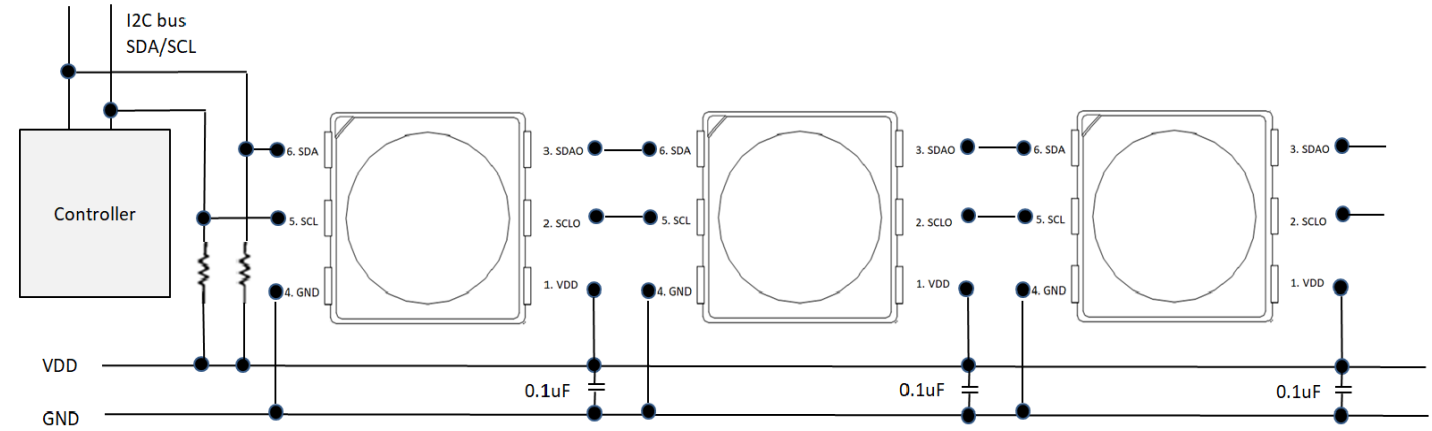
The breathing light operates as follows: brightest (TON) → gradually dims → fully off (TOFF) → gradually brightens, continuously cycling through this sequence.



Example of Data Transmission with Two Chips in Series



Typical Circuit of an RGB LED strip application

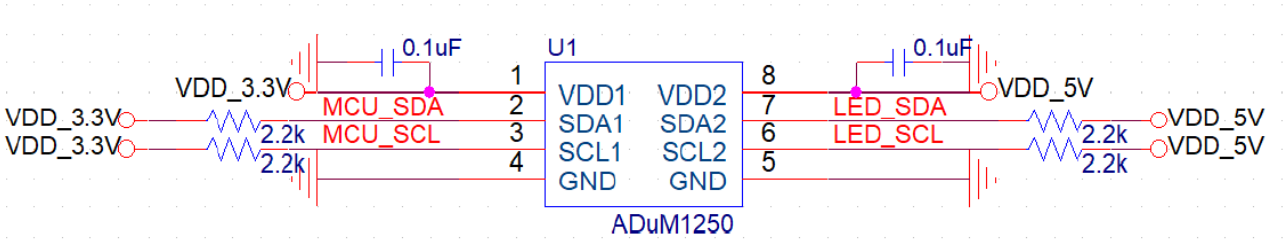


Note 1: Please add pull-up resistors on SCL/SDA lines between the controller and the first chip to ensure proper signal reception by the chip.

Note 2: It is essential to connect a decoupling capacitor between the chip's VDD pin and ground to ensure normal operation. The recommended value for this decoupling capacitor is 0.1uF.

Note 3: Since I2C communication is bidirectional and operates between 3.3V and 5V, it is recommended to use a digital isolator such as the ADuM1250 between the first IC and MCU SDA/SCL lines.

Reference circuit is as follows.

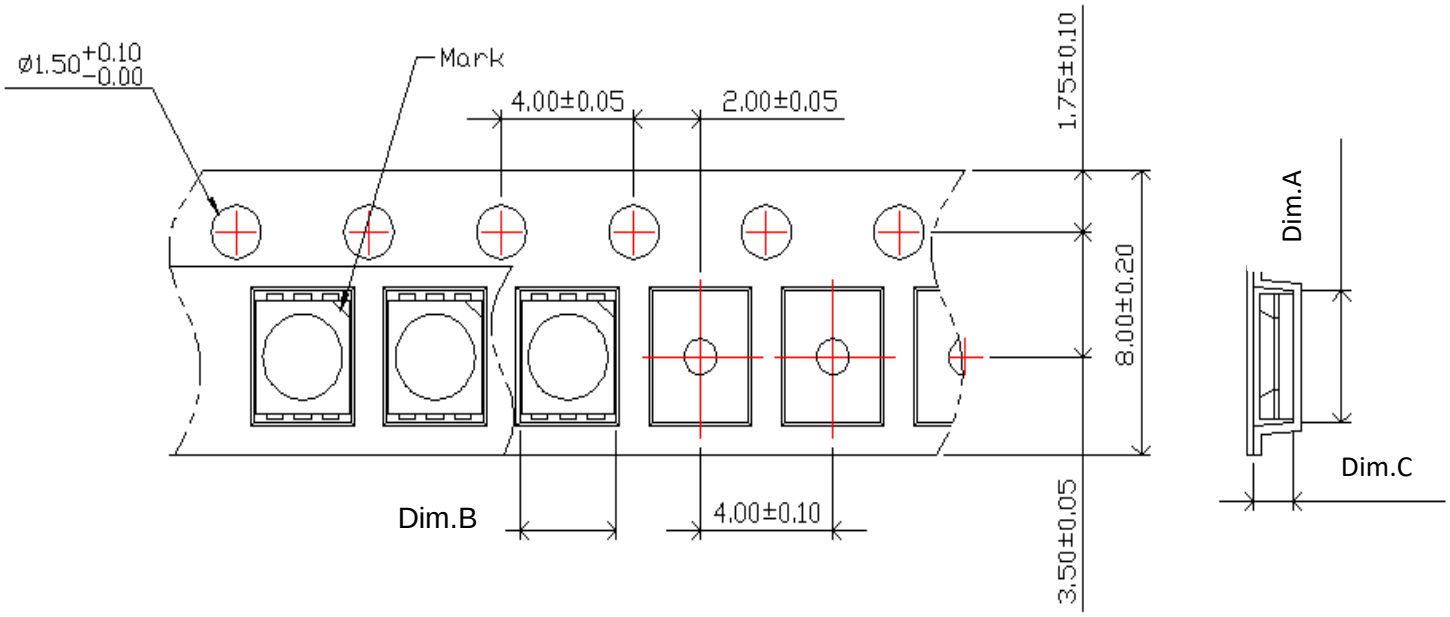


Precaution for Use

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 72hrs 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.

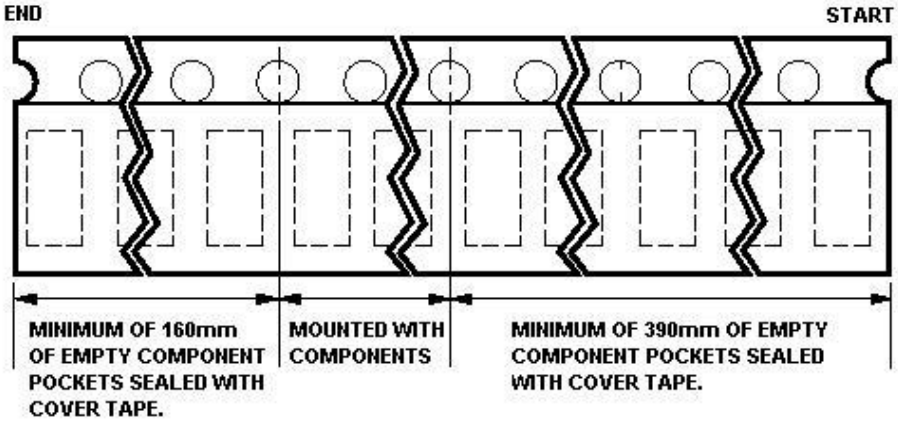
Packaging

Tape Dimension



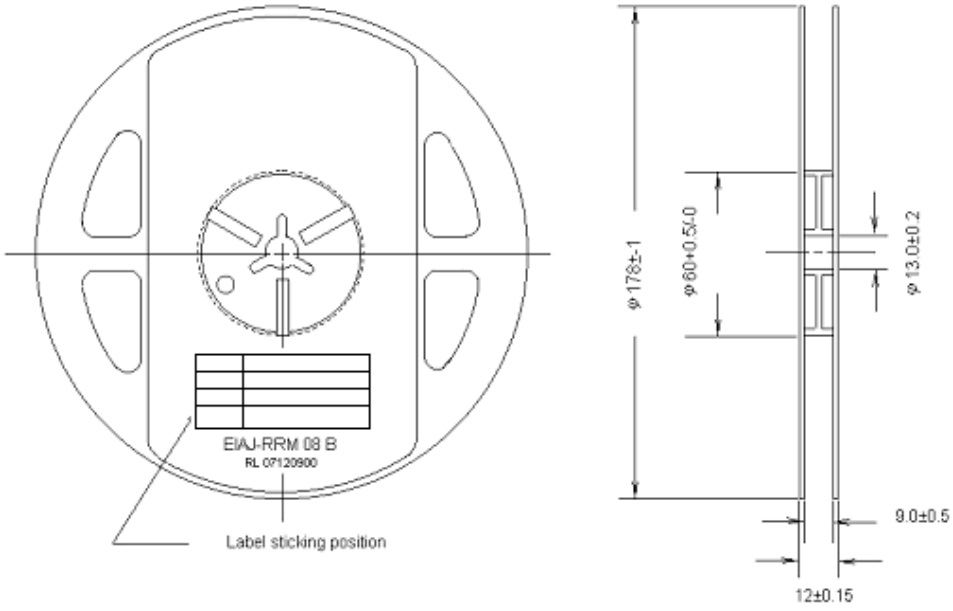
Dim. A	Dim. B	Dim. C	Q'ty/Reel
3.75±0.10	3.80±0.10	1.70±0.10	1000

Unit : mm



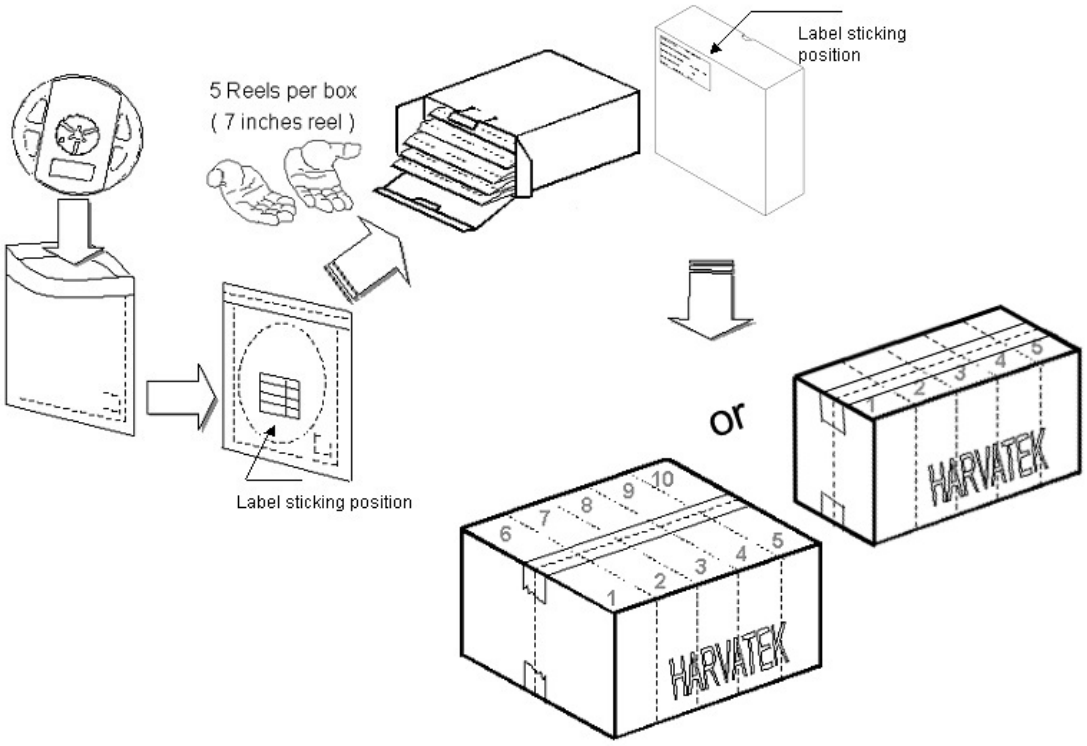
Reel

Dimension



Unit : mm

Packing



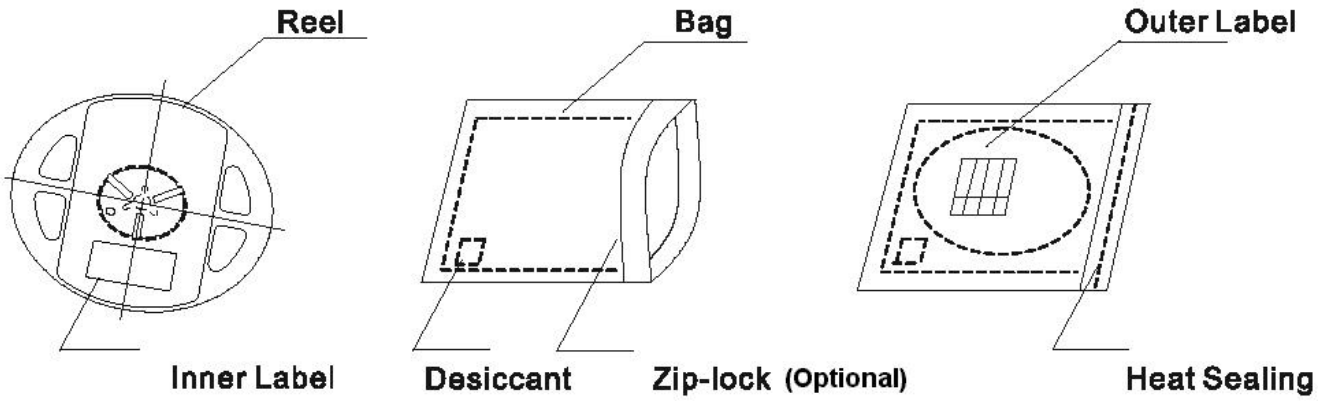
5 or 10 boxes per carton is available depending on shipment quantity.

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.

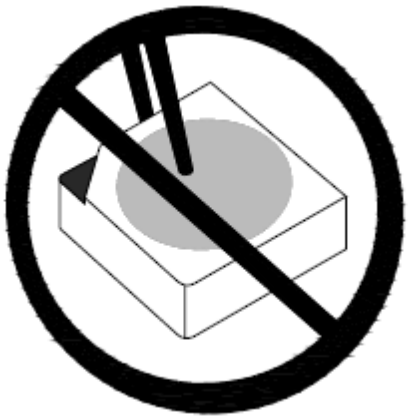


Figure 1

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.

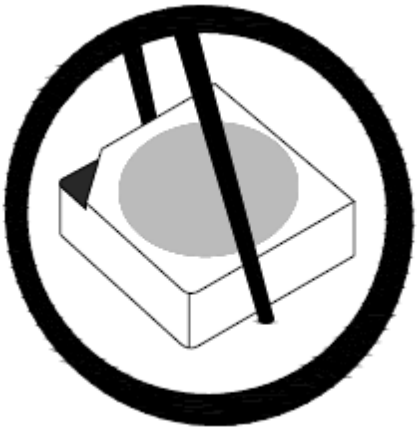


Figure 2

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.

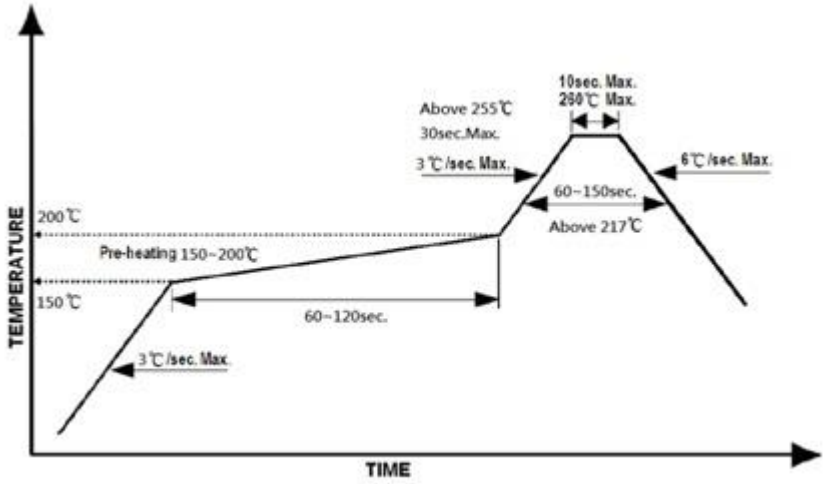
This is assured by choosing a pick and place nozzle which is large than LEDs reflector area.

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.
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Revise History

Rev.	Descriptions	Date	Page
-	-	02/19/2025	-