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APPROVAL SHEET

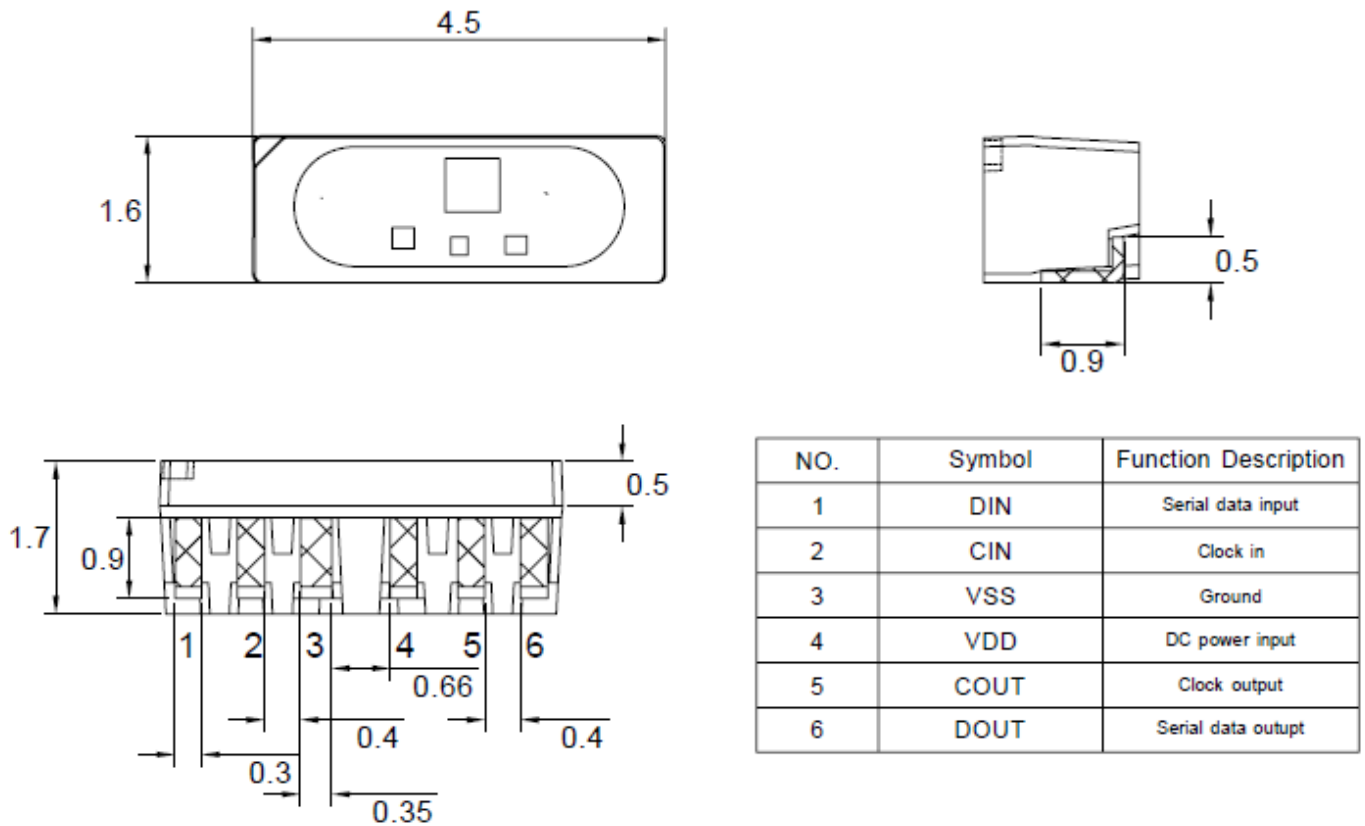
Part No: **BB4516A-C3A**

NOTE : Green Part

MAKER			CUSTOMER	
				
R&D	QA	Sales	Checked	Approved
				

Prepared	Checked	Approved
Rachel Lee	Sky Lin	Kenneth Wu

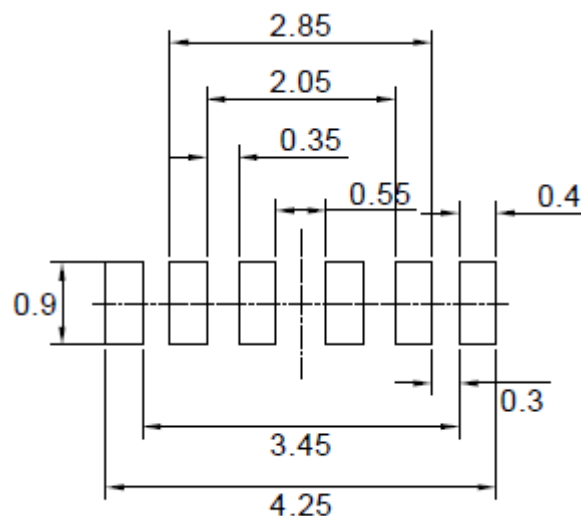
Package Dimensions



Note : 1. All dimension are in millimeter tolerance is $\pm 0.2\text{mm}$ unless otherwise noted.

2. Specifications are subject to change without notice.

Recommended Soldering Pad Dimensions



Note : The tolerances unless mentioned is $\pm 0.1\text{mm}$, Angle $\pm 0.5^\circ$. Unit=mm.

Absolute Maximum Ratings

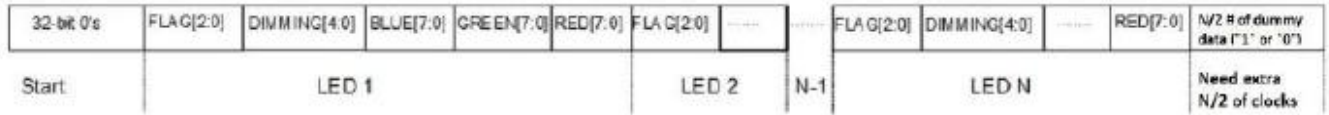
(Ta=25°C, VDD=5V, VSS=0)

Parameter	Symbol	Ratings	UNIT
Supply Voltage	VDD	6.5	V
Operating Temperature	T _{opr}	-40~ +85	°C
Storage Temperature	T _{stg}	-40~ +85	°C

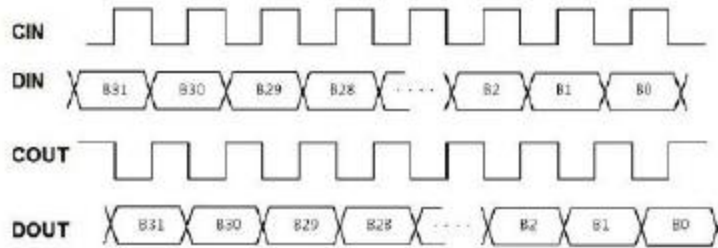
Typical Electrical & Optical Characteristics (Ta=25°C)

Items	Symbol	Min.	Typ.	Max.	UNIT	CONDITION
Supply Voltage	VDD	3.3	5	5.5	V	
Operation Current	I _{oc}	-	-	1.5	mA	VDD=5V RGB off
Standby Current	I _{sleep}	-	1	-	uA	
Logic input control DIN/CIN						
Input High "H"	V _{IH}	2.7	-	VDD +0.4	V	
Input Low "L"	V _{IL}	-0.4	-	1.0	V	
CIN Frequency	CFREQ	-	-	15	MHz	
CIN High pulse width	T _{ckH}	30	-	-	ns	
CIN Low pulses width	T _{ckL}	30	-	-	ns	
DIN to CIN setup	T _{setup}	10	-	-	ns	
DIN to CIN hold time	T _{Hold}	5	-	-	ns	
Logic output DOUT/COU						
Output High "H"	V _{OH}	4.5	-	-	-	4mA@VDD=5V
Output Low "L"	V _{OL}	-	-	0.4 VDD	V	4mA@VDD=5V

Command Set

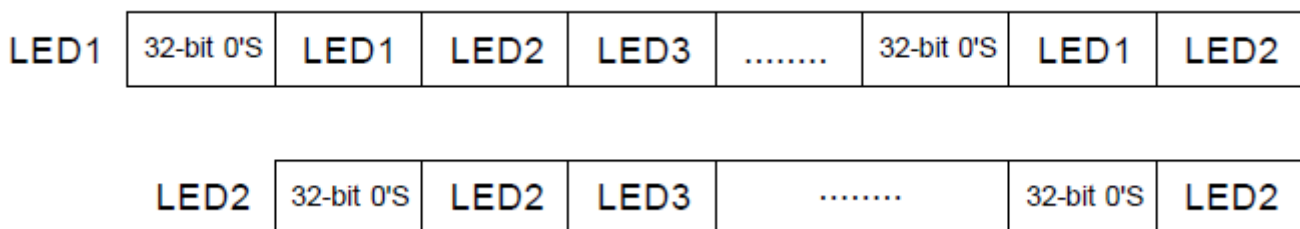


32 consecutive 0's denote the start of a command for an RGB LED. After receiving 32 0's, LED gets the following 32 bits as the received command, including FLAG, DIMMING, BLUE, GREEN and RED fields.



The serial command is transmitted with MSB first, DIN is latched at the rising edge of CIN clock. COUT and DOUT are re-generated for the next RGB LED. COUT is inverted from CIN. 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, BLUE, GREEN and RED fields are latched respectively.

while the current 32-bit command is got, LED passes remaining command bits to the next RGB 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") °



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

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

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

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

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

Sleep and power saving mode

LED 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 LED is approximately 1uA(typ.)

Command Setup to enable sleep or wake up mode

When receiving 24-bit 0's BGR data (that is BLUE[7:0]=8h00, G[7:0]=8h00, R[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), LED will enter sleep mode.

LED 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 LED return to normal working mode within 1ms. Since it takes 1ms for a sleeping LED 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
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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 lamp2 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.

Electrical Optical Characteristics at Ta=25°C

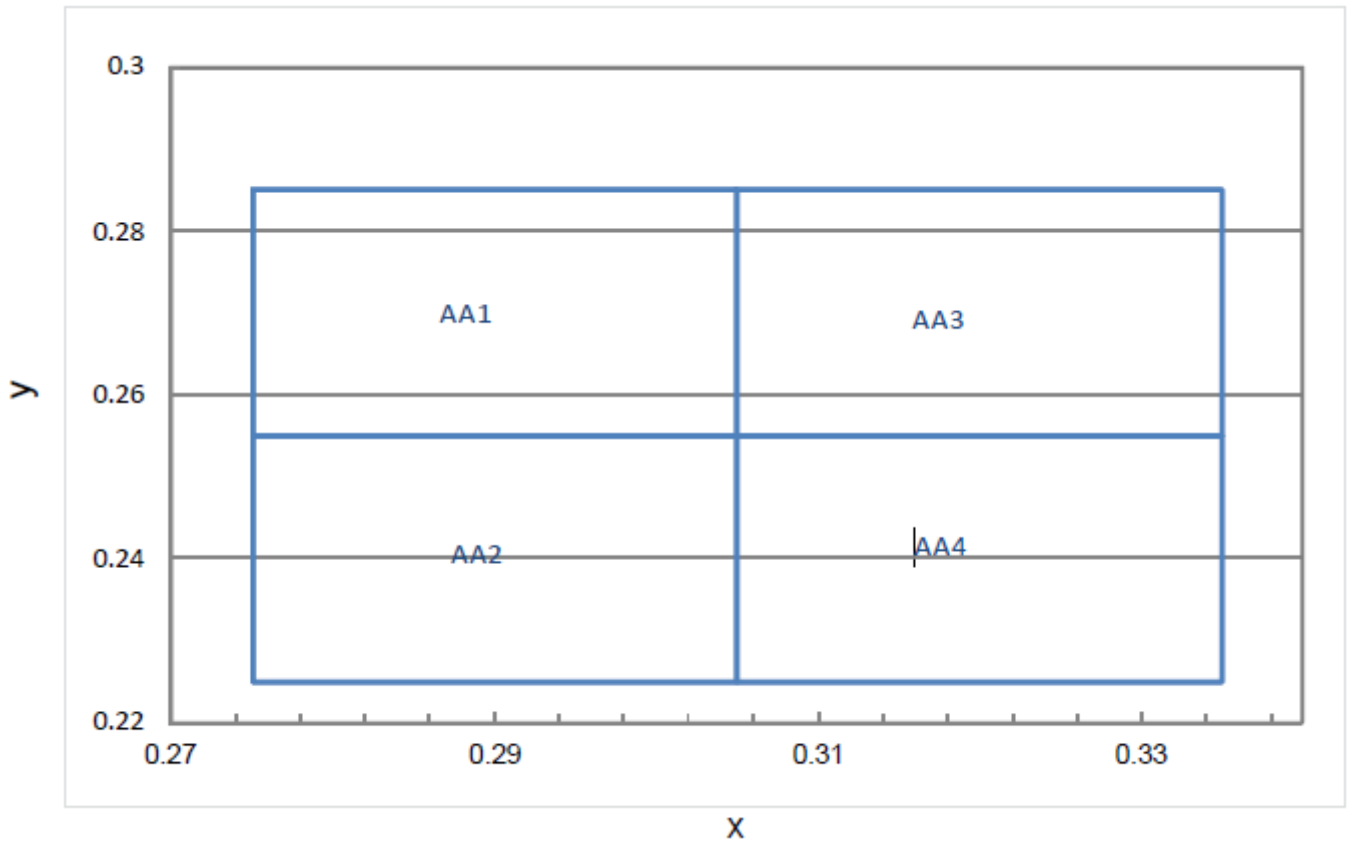
Items	Symbol	Min.	Typ.	Max.	UNIT	CONDITION	
Luminous Intensity	Iv	1680	-	3250	mcd	VDD = 5 V	
Dominant Wavelength	λD	R	-	622	-		nm
		G	-	522	-		
		B	-	466	-		
Viewing Angle	2θ 1/2	-	120	-	deg		

- 1.The luminous intensity data did not including ±15% testing tolerance.
- 2.The dominant wavelength data did not including ±1nm testing tolerance.

Luminous Intensity Classification

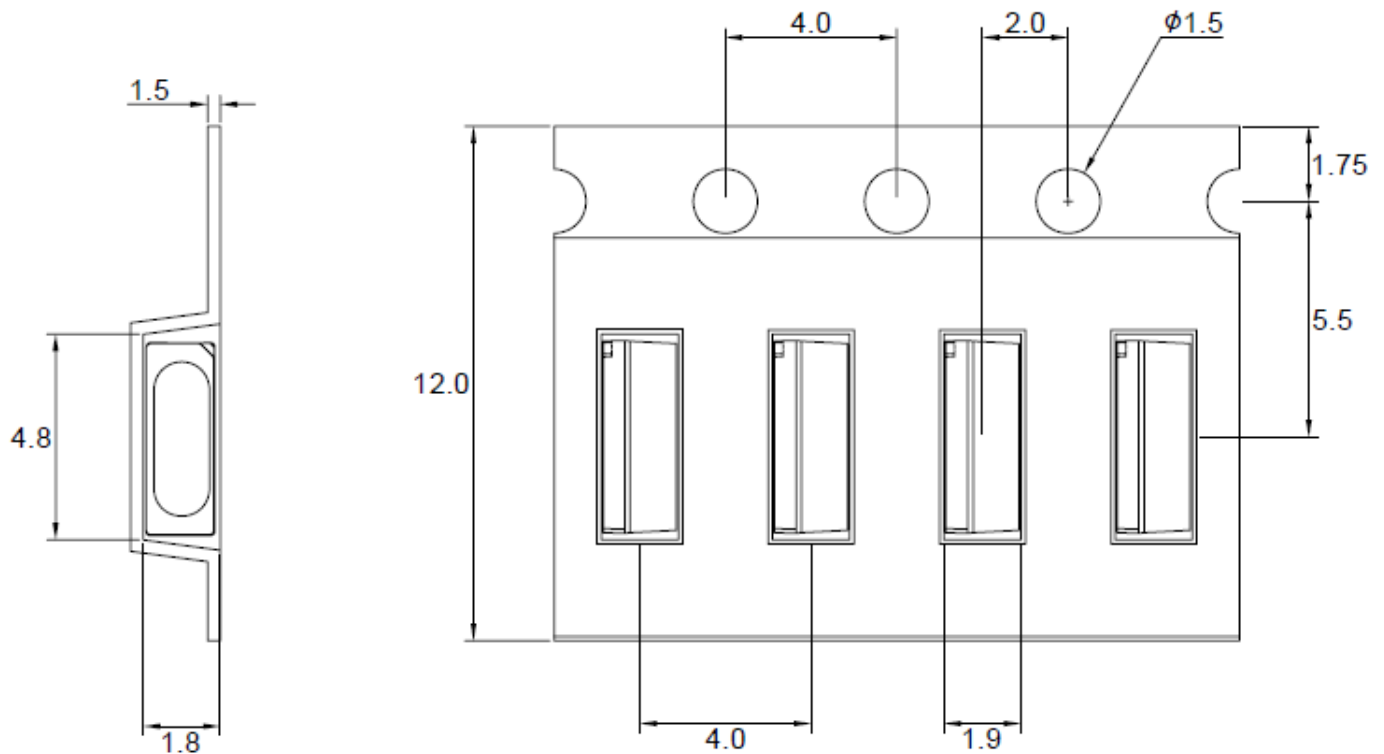
BIN CODE	Iv(mcd)	
	Min.	Max.
K1	1680	2100
K2	2100	2600
K3	2600	3250

Chromaticity Coordinates Specifications For Bin Grading



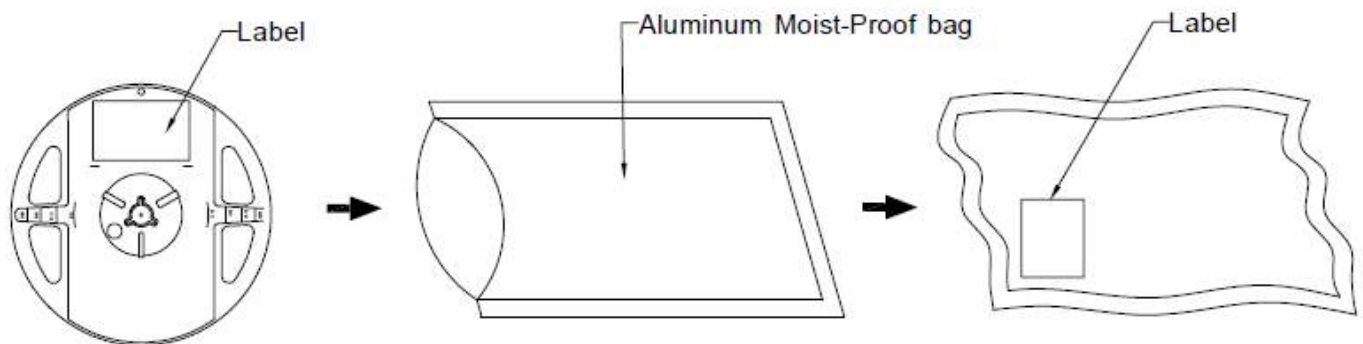
Color Coordiantes								
BIN CODE	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
AA1	0.275	0.255	0.275	0.285	0.305	0.285	0.305	0.255
AA2	0.275	0.225	0.275	0.255	0.305	0.255	0.305	0.225
AA3	0.305	0.255	0.305	0.285	0.335	0.285	0.335	0.255
AA4	0.305	0.225	0.305	0.255	0.335	0.255	0.335	0.225

Carrier Tape Dimensions



Note : The tolerances unless mentioned is ± 0.1 mm, Angle ± 0.5 . Unit=mm.

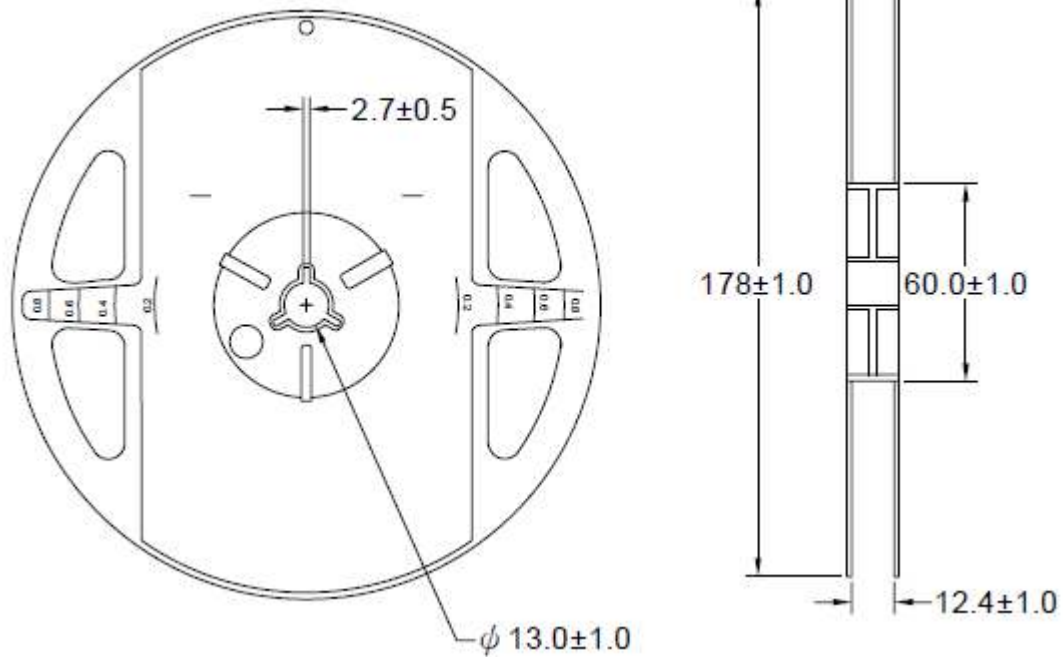
Packing Specifications



Part No.	Description	Quantity/Reel
BB4516A-C3A	12.0mm tape,7"reel	2000 devices

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Reel Dimensions

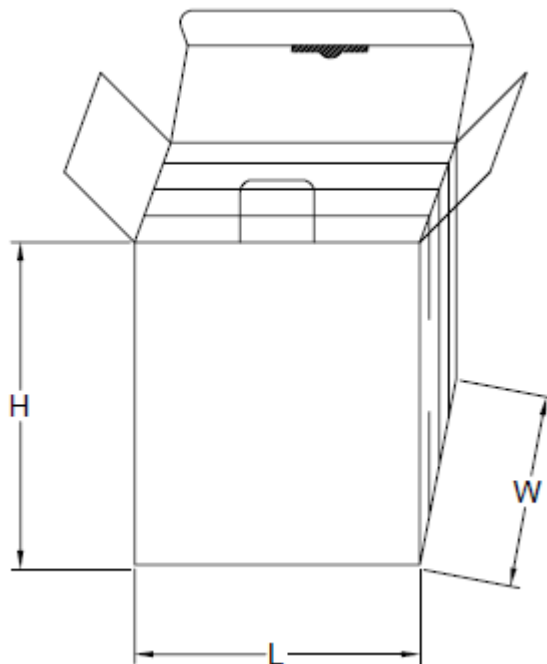


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Box Explanation

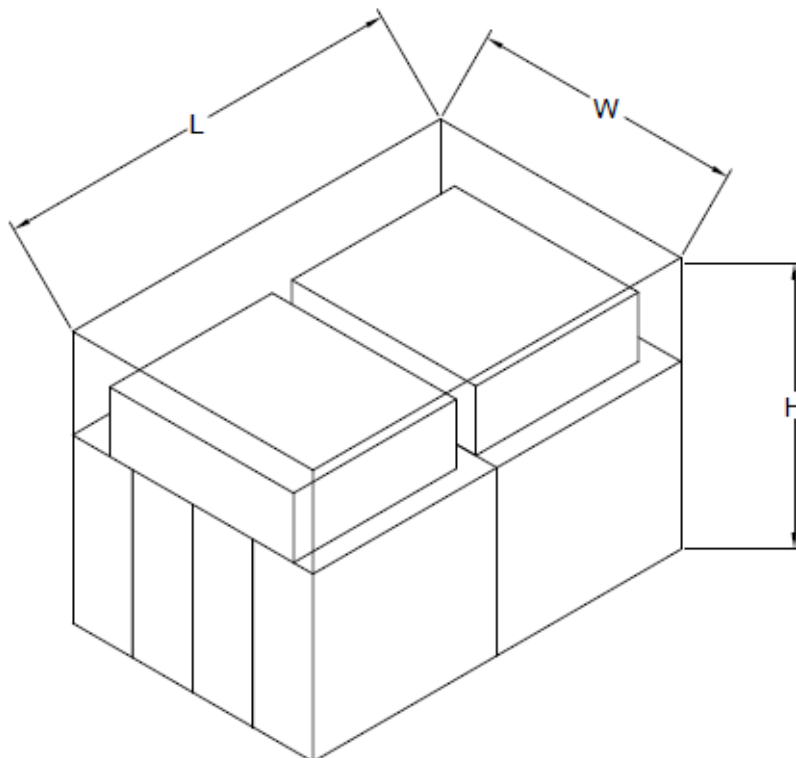
1. 5 BAG / INNER BOX

2. INNER BOX SIZE : L X W X H 23cm X 8.5cm x 26cm



3. 10 INNER BOXES / CARTON

4. CARTON SIZE : L X W X H 58cm X 34cm x 35cm

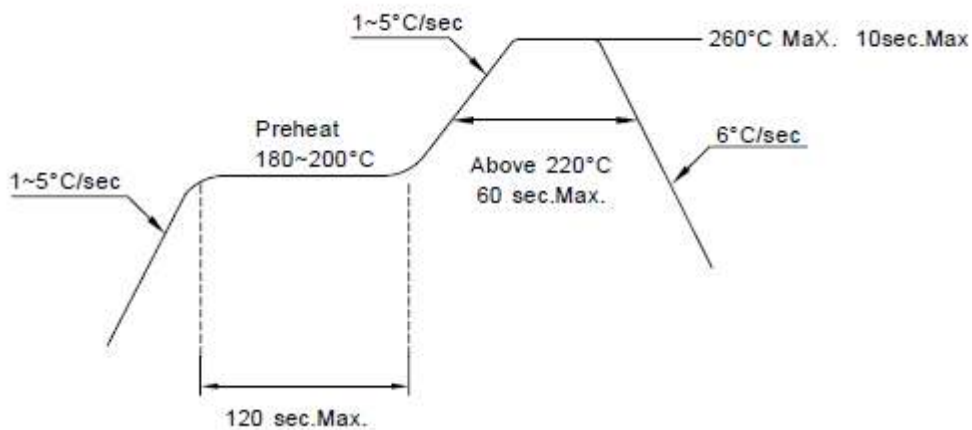


Recommended Soldering Conditions

1. Hand Solder

Basic spec is $\leq 280^{\circ}\text{C}$ 3 sec one time only.

2. PB-Free Reflow Solder



Note:

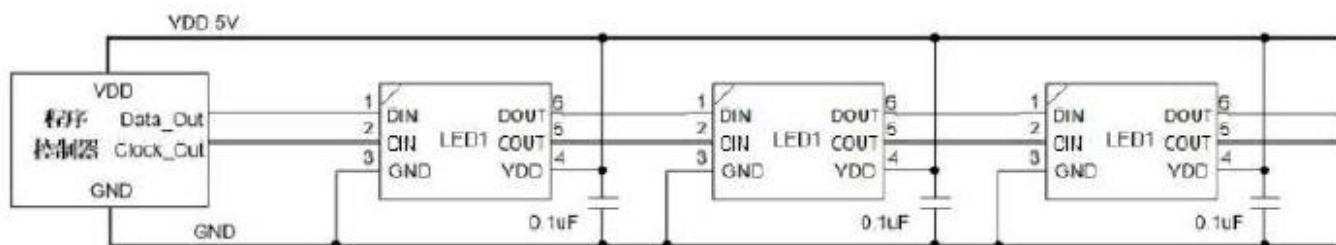
1. Reflow soldering should not be done more than two times.
2. When soldering, do not put stress on the LEDs during heating.
3. After soldering, do not warp the circuit board.

Precautions For Use:

Storage time:

1. Calculated shelf life before opening is 12 months at $< 30^{\circ}\text{C}$ and $< 90\%$ relative humidity (RH)
2. After bag is opened, devices which will be subjected to reflow soldering or other high temperature processes must be
 - a) Assembled within 168 hours in an environment of $\leq 30^{\circ}\text{C} / 60\%$ RH, or
 - b) Stored at ambient of 10% RH or less
3. Devices are required baking before assembly if:
 - a) Humidity Indicator Card reads $>10\%$ (for level 2a -5a) or $>60\%$ (for level 2) at ambient temperature $23\pm 5^{\circ}\text{C}$
 - b) 2.a) or 2.b) doesn't meet
4. If baking is required, devices should be baked for >72 hours at $60\pm 5^{\circ}\text{C} / 5\%$ RH. Performing baking only once, and using the baked devices within 72 hours.
MSL LEVEL 3

Recommended route



Cleaning:

Use alcohol-based cleaning solvents such as isopropyl alcohol to clean the LED.

ESD (Electrostatic Discharge):

Static Electricity or power surge will damage the LED. Use of a conductive wrist band or anti-electrostatic glove is recommended when handling these LED. All devices, equipment and machinery must be properly grounded.