AMERICAN BRIGHT OPTOELECTRONICS CORP.
Toll Free: 888-533-0800 | Fax: 909-628-5006
13815-C Magnolia Ave. Chino, CA 91710
www.americanbrightled.com

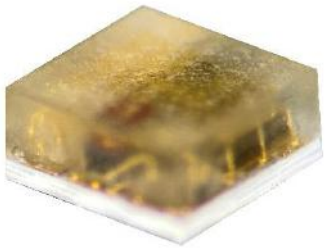
AB-PL1515C0I6-5VX0

Features

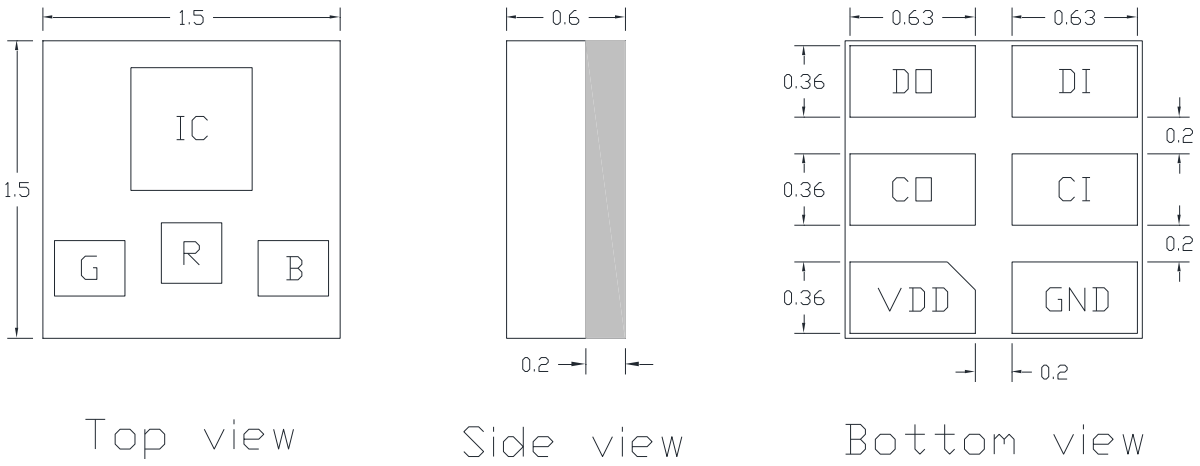
1. RoHS compliant
2. Support RGB color display and in a single addressable LED
3. Cascading port transmission by dual-wire (clock & data)
4. Built-in current regulator, three-way drive.
5. 256-step gray scale output to allow 16M color display.
6. 32 step dimming control.
7. Built-in oscillator 20MHZ
8. Maximum serial input data / clock frequency 15MHZ
9. Built-in power on reset (2.6V @ VDD=5V)
10. Support sleep and wake up mode for power saving.

Main Applications

- Decorative LED Lighting
- Automotive Interior Ambient lighting



Mechanical Dimensions



Pin Name	Function Description
VDD	Power supply
GND	Ground
DI	Serial data input
DO	Serial data output
CI	Clock signal input
CO	Clock signal output

Notes□
1. Drawing not to scale.
2. All dimensions are in millimeters.
3. Unless otherwise indicated, tolerances are □0.05mm.
4. Please do not use a force of over 0.3kgf impact or pressure on the lens of the LED, otherwise

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Absolute Maximum Ratings, T_a = 25˚C

(unless otherwise specified, Temperature=25˚C)

Parameter	Symbol	Rating	Unit
Supply Voltage	V_{DD}	6.5	V
Power Dissipation	P_D	<400	mW
Maximum Output Current	I_{LEDOUT}	25	mA
Operating Temperature Range	T_{OPR}	-40~105	˚C
Storage Temperature Range	T_{STO}	-40~125	˚C

Electrical / Optical Characteristics, T_a = 25˚C

Parameter	Symbol	Color	Min.	Typ.	Max.	Unit
Luminous Intensity	IV	Red	400	-	1000	mcd
		Green	800	-	2000	
		Blue	150	-	300	
Dominant Wavelength	λd	Red	620	-	630	nm
		Green	520	-	535	
		Blue	460	-	475	
View Angle	$2\theta_{1/2}$	-	120			deg

- Luminous intensity is measured with a light sensor and filter combination that approximates the CIE eye-response curve.
- θ1/2 is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
- The dominant wavelength, λd is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device. Peak Emission Wavelength Tolerance is +/- 1nm.

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Electrical Characteristics

(unless otherwise specified, Temperature=25˚C & VDD=5.0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V_{DD}	3.3	5.0	5.5	V	
Operation current	I_{dyn}	-	-	1.5	mA	RGB No load(off)
Standby Current	I_{sleep}	-	1	10	uA	
Logic input control DIN/CIN						
Input High “H”	V_{IH}	2.7	-	V_{DD}+0.4	V	
Input High “L”	V_{IL}	-0.4	-	1.0	V	
DIN Pull-up resistance @normal mode	R_{IN}	-	80K	-	Ω	
CIN Frequency	C_{FREQ}	-	-	15	MHz	
CIN High pulse width	T_{CKH}	30	-	-	ns	
CIN Low pulse 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/COUT						
Output High “H”	V_{OH}	4.5	-	-	V	I_{OH}=4mA
Output High “L”	V_{OL}	-	-	0.4	V	I_{OL}=4mA
Sink Current R/G/B						
AP6102Q-20	I_{SINK}	19	20	21	mA	@V_{DD}-Vf_{LED} ≥ 1.5V
R、G、B off leakage current	I_{off}	-	-	1	uA	PWM off(0x00)

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Luminous Intensity Bin Structure at 20mA

Color	Bin Code	Min.	Max.	Unit
Red	A	400	1000	mcd
Green	A	800	2000	
Blue	A	150	300	

- AB maintains a tolerance of ±10% on flux and power measurements.
- The flux bin of the product may be modified for improvement without notice.

Dominant Wavelength Bin Structure at 20mA

Color	Bin Code	Min.	Max.	Unit
Red	4	620	630	nm
Green	1	520	535	
Blue	A	460	475	

- AB maintains a tolerance of ±1nm for dominant wavelength measurements.

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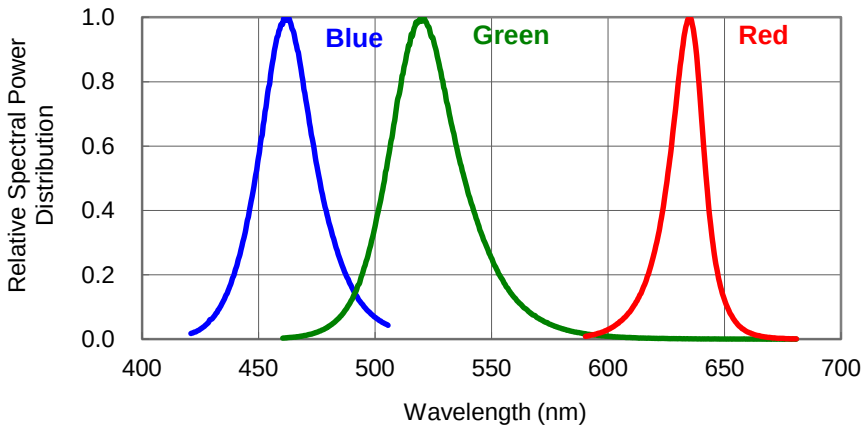
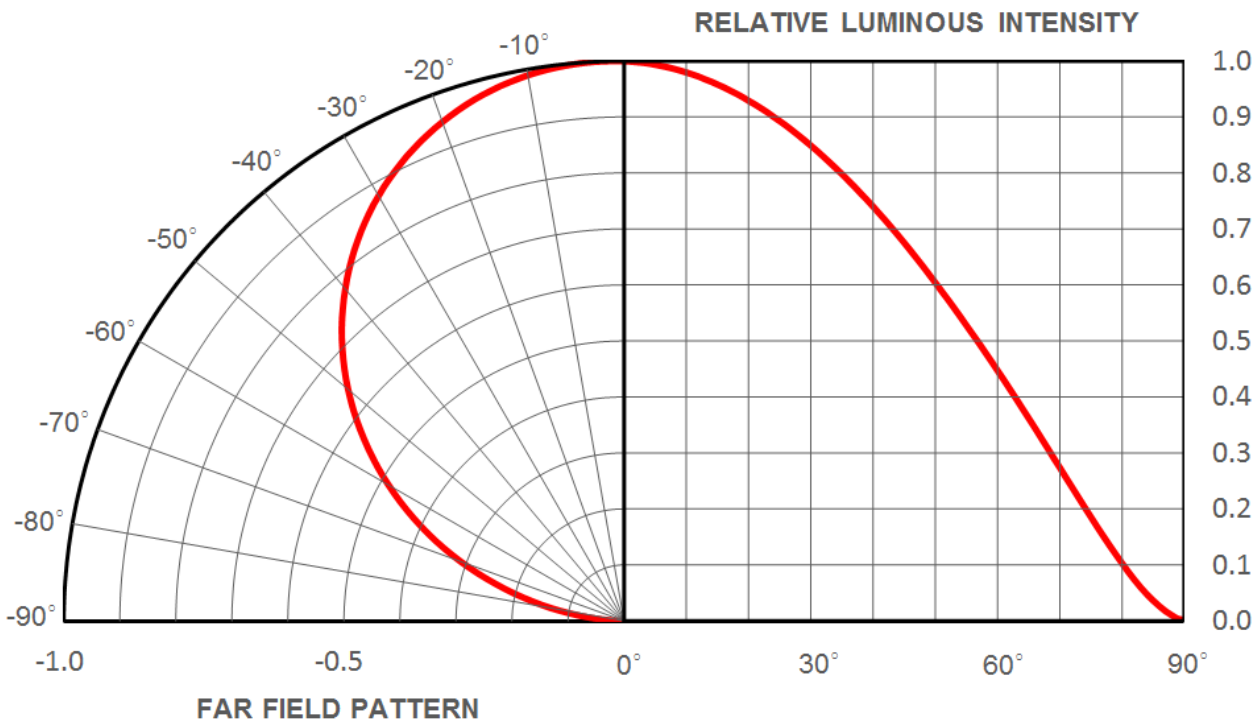
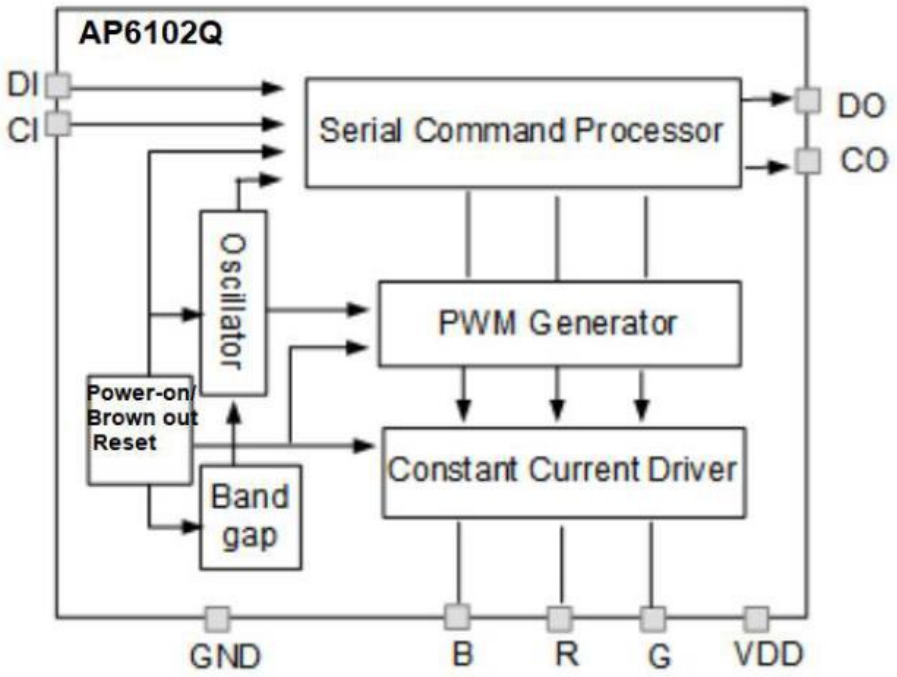
Color Spectrum, T_a = 25˚C



Typical Representative Spatial Radiation Pattern



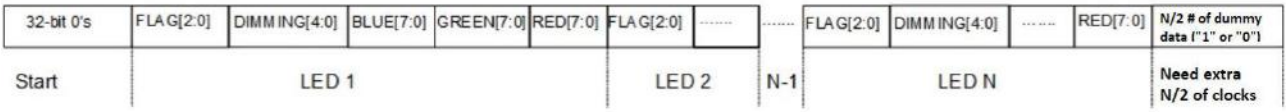
Block Diagram



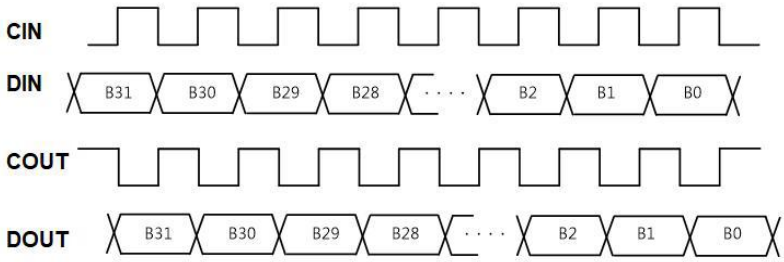
Pin Function Description

Pin Name	IO	Description
VDD	P	Power Supply
GND	G	Ground
DIN	I	Serial data input
CIN	I	Clock input
DOUT	O	Serial data output
COUT	O	Clock output
R	O	Red LED output driver
G	O	Green LED output driver
B	O	Blue LED output driver

Command Set

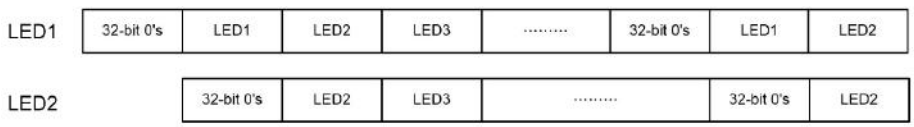


- 32 consecutive 0's denote the start of a command for an RGB LED. After receiving 320's, ST6N-26FFE-HD7C gets the following 32 bits as the received command, including FLAG,DIMMING, BLUE, GREEN and RED fields.



- 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, ST6N-26FFE-HD7C 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

- 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 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), it will enter sleep mode.
- it 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 return to normal working mode within 1ms. Since it take 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

Case 1:

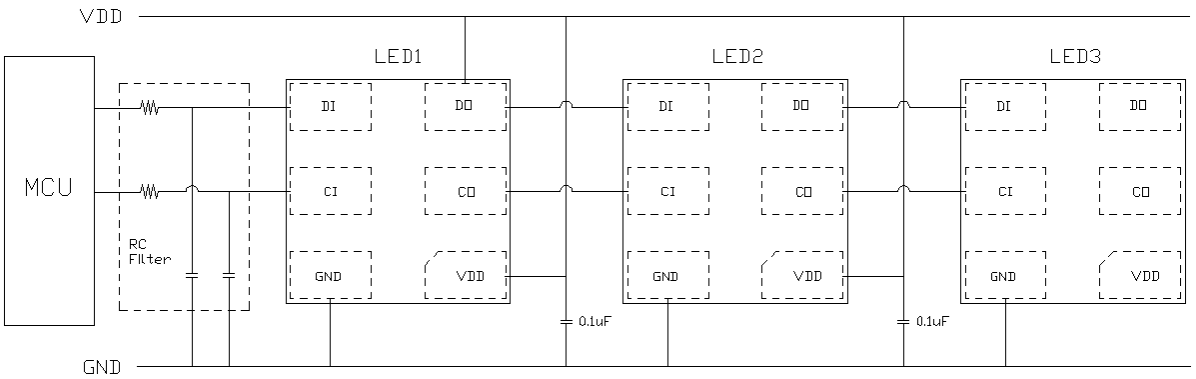
Lamp 1	Lamp 2	Lamp 3
1xx111118hFF8hFF8hFF	101000008h008h008h00	101000008h008h008h00
Normal mode	Sleep mode	Sleep mode

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



- RC Filter should be added or reserved on the board for better waveform of signals in different applications. The value is subject to the practical system environment.
- The by-pass capacitor of VDD pin is necessary to be added on the board for the stability of chip operation. The suggested value of capacitor is 0.1uF.

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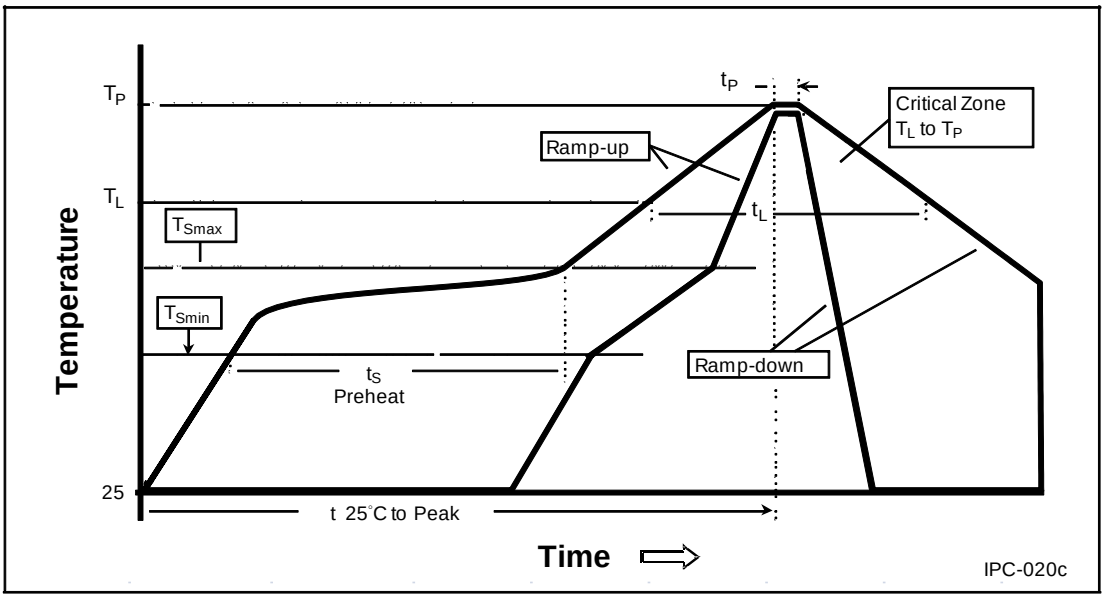
Reflow Soldering Condition

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate (T_{Smax} to T_P)	3°C / second max.	3°C / second max.
Preheat – Temperature Min (T_{Smin}) – Temperature Max (T_{Smax}) – Time (t_{Smin} to t_{Smax})	 100°C 150°C 60-120 seconds	 150°C 200°C 60-180 seconds
Time maintained above: – Temperature (T_L) – Time (t_L)	 183°C 60-150 seconds	 217°C 60-150 seconds
Peak/Classification Temperature (T_P)	240°C	260°C
Time Within 5°C of Actual Peak Temperature (t_p)	10-30 seconds	20-40 seconds
Ramp-Down Rate	6°C/second max.	6°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.



- We recommend using the M705-RGS800HF Type5 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.
  Do not use solder pastes with post reflow flux residue>47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.
- All temperatures refer to topside of the package, measured on the package body surface.
- Repairing should not be done after the LEDs have been soldered. When repairing is unavoidable, a double-head soldering iron should be used. It should be confirmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairing.
- Reflow soldering should not be done more than three times.
- When soldering, do not put stress on the LEDs during heating.
- After soldering, do not warp the circuit board.

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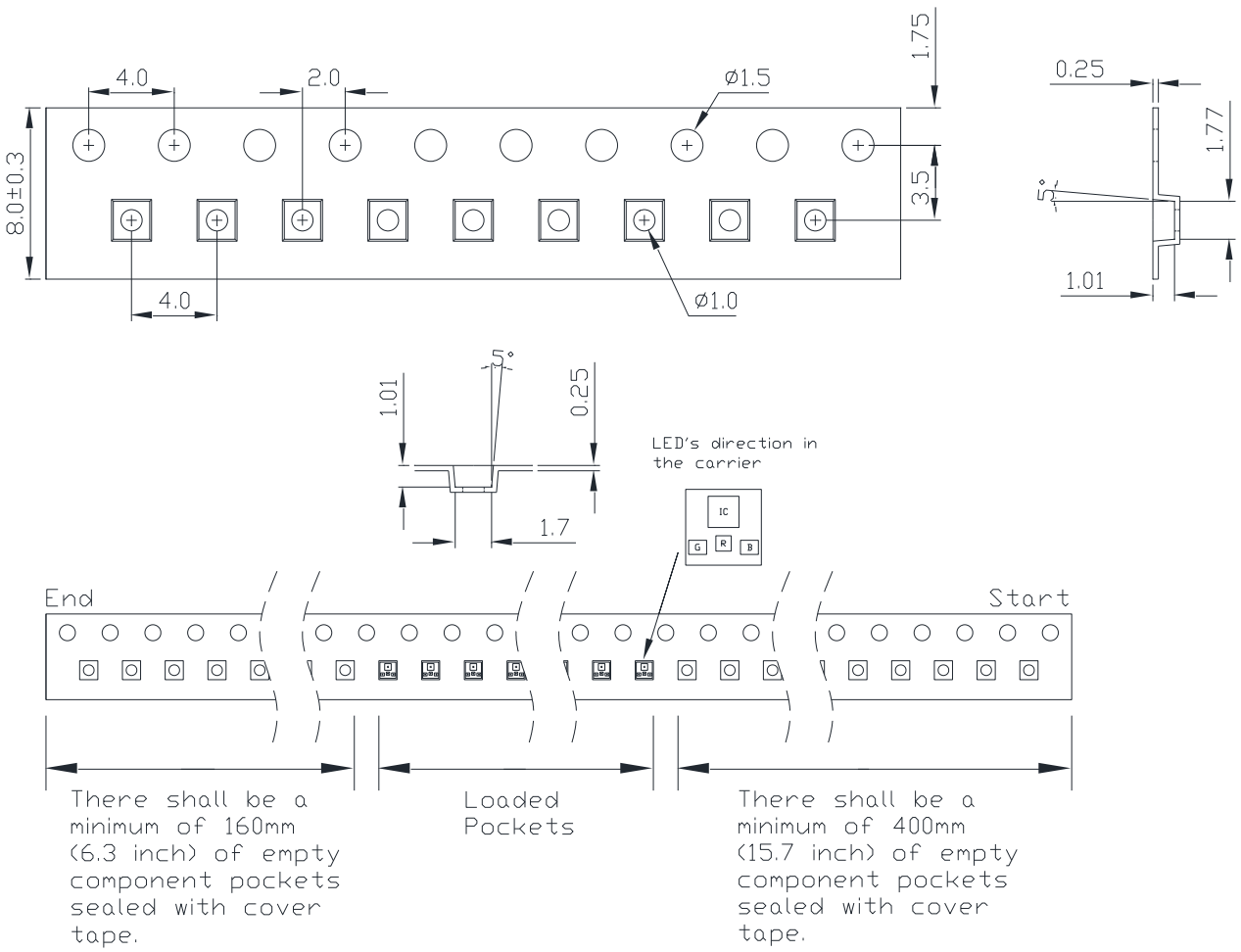
Emitter Reel Packaging



Notes:
1. Drawing not to scale.
2. All dimensions are in millimeters.
3. Unless otherwise indicated, tolerances are ± 0.1mm.

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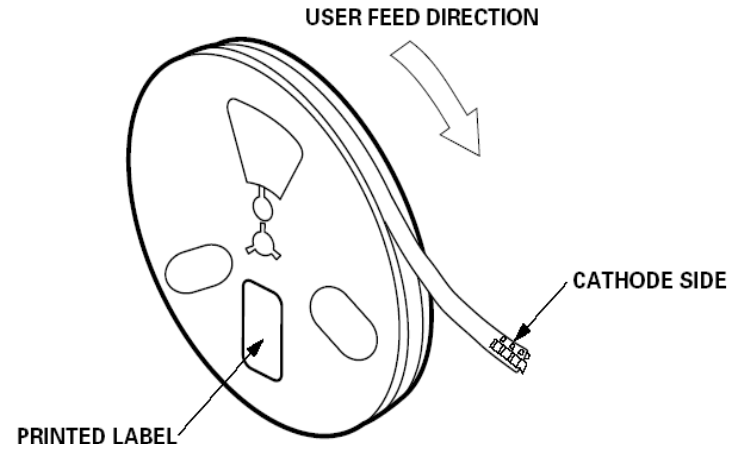

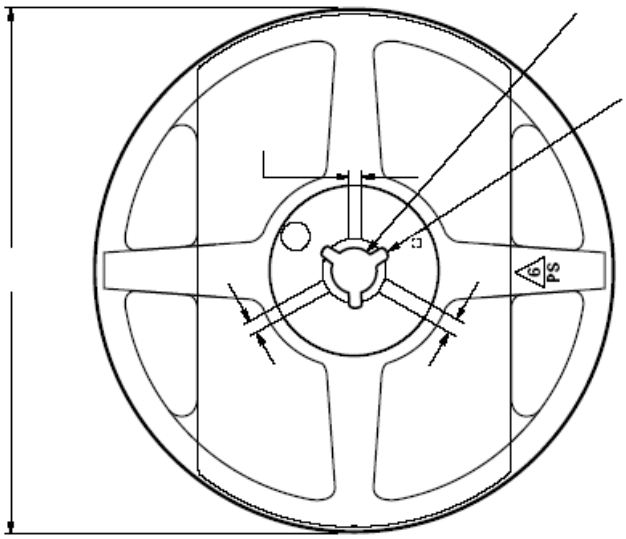

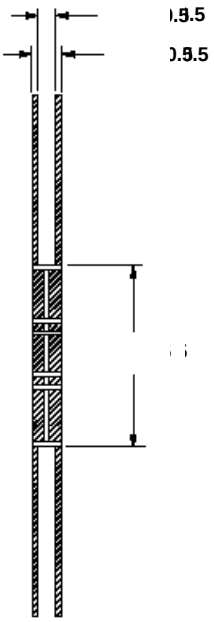

Notes:
1. Empty component pockets sealed with top cover tape.
2. 5,000 pieces per reel.
3. Drawing not to scale.
4. All dimensions are in millimeters.

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Precaution for Use

- Storage
  Please do not open the moisture barrier bag (MBB) more than one week. This may cause the leads of LED discoloration. We recommend storing the LEDs in a dry box after opening the MBB. The recommended storage conditions are temperature 5 to 30°C and humidity less than 40% RH. It is also recommended to return the LEDs to the MBB and to reseal the MBB.
- We recommend using the M705-RGS800HF Type5 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.
- Do not use solder pastes with post reflow flux residue>47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.
- Any mechanical force or any excess vibration shall not be accepted to apply during cooling process to normal temperature after soldering.
- Please avoid rapid cooling after soldering.
- Components should not be mounted on warped direction of PCB.
- Repairing should not be done after the LEDs have been soldered. When repairing is unavoidable, a heat plate should be used. It should be confirmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairing.
- This device should not be used in any type of fluid such as water, oil, organic solvent and etc. When cleaning is required, isopropyl alcohol should be used.
- When the LEDs are illuminating, operating current should be decide after considering the package maximum temperature.

Handling of Lens LEDs

Notes for handling of lens LEDs

- Please do not use a force of over 0.3kgf impact or pressure on the lens, otherwise it will cause a catastrophic failure.
- The LEDs should only be picked up by making contact with the sides of the LED body.
- Avoid touching the lens especially by sharp tools such as Tweezers.
- Avoid leaving fingerprints on the lens.
- Please store the LEDs away from dusty areas or seal the product against dust.
- 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 lens must be prevented.
- Please do not mold over the lens with another resin. (epoxy, urethane, etc)

Mouser Electronics

Authorized Distributor

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