

APA102-2020

APA-102-2020 Series

Preliminary Top Mount IC+RGB Chip LED



Features 產品特色

- RGB Single point of control (RGB單點控制)
- 8Bit(256 level)color set (8bit,256灰度等級)
- 5Bit(32 level)brightness adjustment (5Bit,32等級亮度調節)
- IC input voltage 4.5v~7.5v (IC輸入電壓為4.5v~7.5v)
- 20mA,Contant current output (20mA恆流輸出)
- Anti-Reflection resin (抗反射膠體)
- View angle : $\geq 120^\circ$ (min 50% brightness) (可視角 $\geq 120^\circ$ (50%光強度時))
- High contrast (高對比度)

Main Applications 主要應用

- Indoor display (室內顯示屏)
- Full color display (全彩顯示器)
- Advertising light boxes (廣告燈箱)
- Soft light bar (軟燈條)



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Product Specifications (產品規格)

	Specification (規格)	Material (材質)	Quantity (數量)
Luminous Intensity(Iv) (發光強度)	Red:270~300mcd Green:500~550 mcd Blue:200~220mcd R/G/B@20mA, Ts= 25 ^o C; Tolerance ±10%		
Wavelength (波長)	Red: 620~625nm Green:522.5~525nm Blue:462.5~472.5nm R/G/B@20mA, Ts= 25 ^o C; Tolerance ±10%		
Applied voltage (應用電壓)	5V_DC		
Power consumption (消耗功率)	0.2W		
View angle (可視角)	140 度		
Refresh rate (刷新率)	400 Cycle		
Resin (樹脂)	Clear (透明)	Epoxy (環氧樹脂)	
Carrier tape (載帶)	EIA 481-1A specs (EIA 481-1A 規格)	Conductive black tape (黑色導電捲帶)	3000pcs/reel (3000 顆/捲)
Reel (捲帶)	EIA 481-1A specs (EIA 481-1A 規格)	Conductive black (黑色導電帶)	
Label (標籤)		Paper (紙)	
Packing bag (包裝袋)	250x230mm	Aluminum laminated bag/Zipper (鋁箔帶/有拉鍊)	One reel per bag (每一包裝袋一捲)
Carton (紙箱)		Paper (紙)	Non-specified 無指定

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Others:

Each immediate box consists of 28 reels. The 28 reels may not necessarily have the same lot number or the same bin combinations of I_v , λ_D and V_f . Each reel has a label identifying its specification; the immediate box consists of a product label.

(每一中箱有 28 捲捲帶，28 捲的捲帶不一定有一致的亮度、波長、順向偏壓或是批號。每一份捲帶都有其標籤定義出規格)

Note :This is shipped test conditions

(註：此為出廠檢驗條件)

※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.

(※備註：產品應於順向偏壓下操作，假如長期使用於逆向偏壓下可能形成電致遷移導致 LED 損壞。)

ATTENTION: Electrostatic Discharge (ESD) protection

(注意！！靜電放電保護)



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 AlInGaP, GaN, or/and InGaN based chips are STATIC SENSITIVE device. 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.

(左圖為須做靜電保護標誌。晶片中磷化鎵和砷化鋁鎵即便是在有相當安全的靜電放電的措施下，對於 ESD 的保護還是必要的。建構於磷化鋁鎵、氮化鎵或氮化鎵的晶片都是靜電敏感元件。在設計與組件中作的靜電保護都是必須的。

假設人工作業程序是必須的，須確保設備製程是擁有靜電保護的程序)

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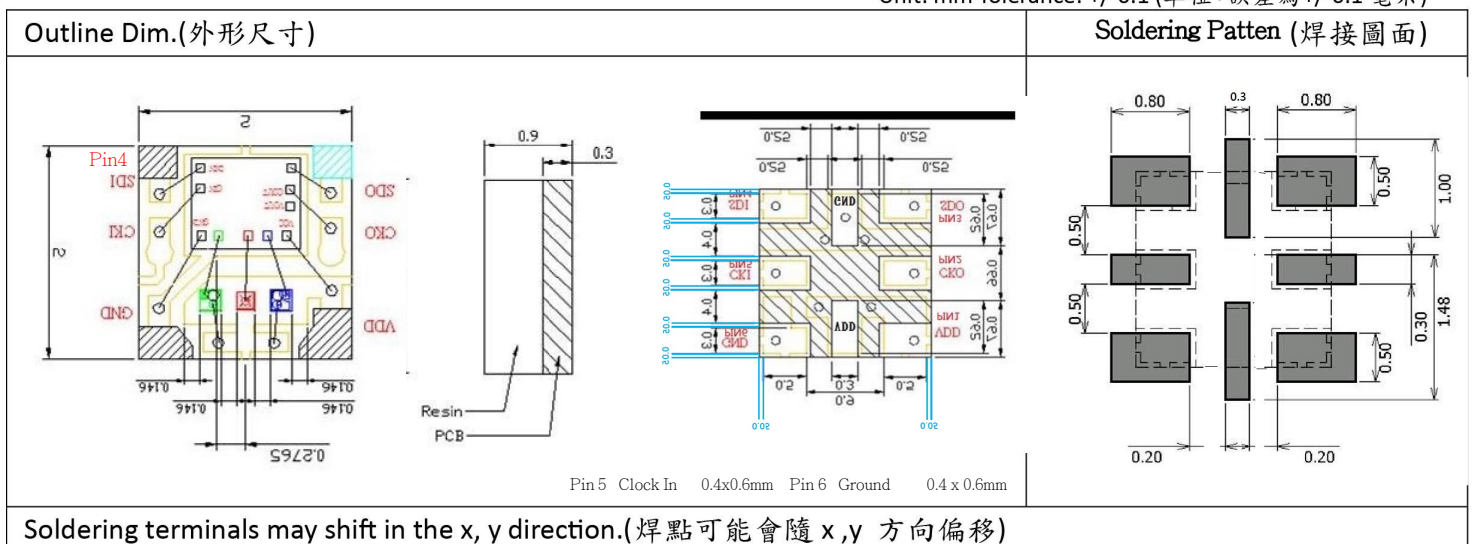
Lot No. (批次)

1	2	3	4	5	6	7	8	9	10
1	7	N	E	4	1	L	N	1	1
Code 1 2		Code 3	Code 4	Code 5	Code 6	Code 7	Code 8	Code 9	Code 10
Internal Tracing Code		Mixing Lot No.	Mfg.Year	Mfg.Month	Consecutive number		Special code		
			2010-A 2011-B 2012-C 2013-D 2014-E . . .	1:Jan 2:Feb A:Oct B:Nov C:Dec	01~ZZ		000~ZZZ		

Package Outline Dimension and Recommended Soldering Pattern for Reflow Soldering

封裝外形尺寸與建議的焊盤尺寸

Unit: mm Tolerance: +/-0.1 (單位: 誤差為 +/-0.1 毫米)



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■ Absolute maximum ratings 最大額定範圍

Supply voltage -0.3 to 6.0V

Input voltage VSS -0.3 to VDD +0.3V

Operation temperature -40 to 85°C

Storage temperature -40 to 85°C

Note: Stress above those listed may cause permanent damage to the devices.

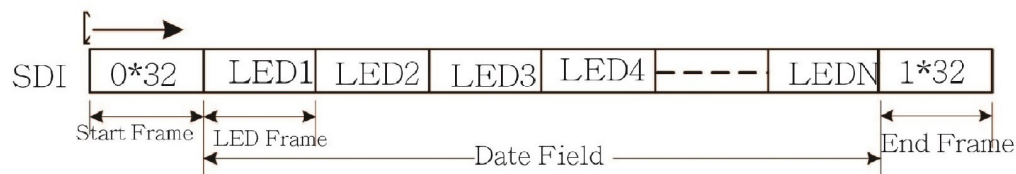
■ Electrical characteristics 電氣特性

Symbol	Parameter	Condition	Min	Typ.	Max	Units
VDD	Supply voltage			5.0	5.5	V
VIH	Input high voltage		0.7VDD		VDD+0.3	V
VH	Input low voltage		VSS-0.3		0.3VDD	V
IOL	Sink current (RGB)	@VDD=5V,VOL>1V	22.5	24.5	26.5	mA
RIN	Pull high	@VDD=5V		570		KΩ
VREG	Regulator voltage(VREG)	@VDD>5V	4.4	4.5	4.7	V
FOSC	Oscillator frequency		800		1200	KHz

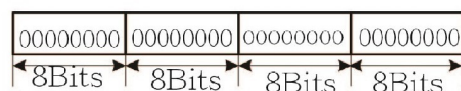
● 功能說明 (function description)

(1) .cascading data structure

Tabdem N-LED



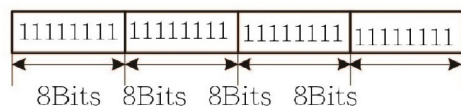
Start Frame 32 Bits



LED Frame 32 Bits



LED Frame 32 Bits

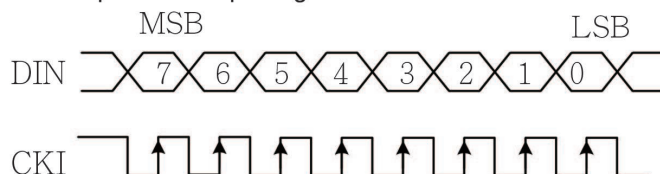


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Global bit : 5-bit (32 level) brightness setting, while controlling R, G, B three-color constant current output value, if set the Global bit for the 10000 (16/31) is the output current is half again the original PWM settings.

DATA MSB↔LSB	Driving Current
00000	0/31
00001	1/31
00010	2/31
...	
11110	30/31
11111	31/31(max)

PWM input and output signals Relations



Data MSB—	Duty Cycle
00000000	0/256(min)
00000001	1/256
00000010	2/256
...	
11111101	253/256
11111110	254/256
11111111	255/256(max)

2).The number of pixels per second sent to CKI frequency (FCKI) minus the Start Frame bit divided by the number 40 the number of LED Frame bit 32, if CKI frequency (FCKI) to 512KHz, the pixel number (512000-40) /32=15998, if the 50 second update Views can be connected in series LED number 15998/50=319.To increase the number of cascaded IC CKI frequency to be increased.

(3).POLAR to empty , R, G, B for the negative output; POLAR access VSS, R, G, B is positive output.

(4).VEN: Self-detection

Data Field to the middle of 3bit were B, G, R in the MSB of the opposite phase, otherwise regarded as invalid data. VEN close to empty when the self-detection: when VEN VSS then activated self-detection.

(5).CSEL to empty when the CKO and CKI RP :CSEL connected with VSS when the CKO compared with CKI.

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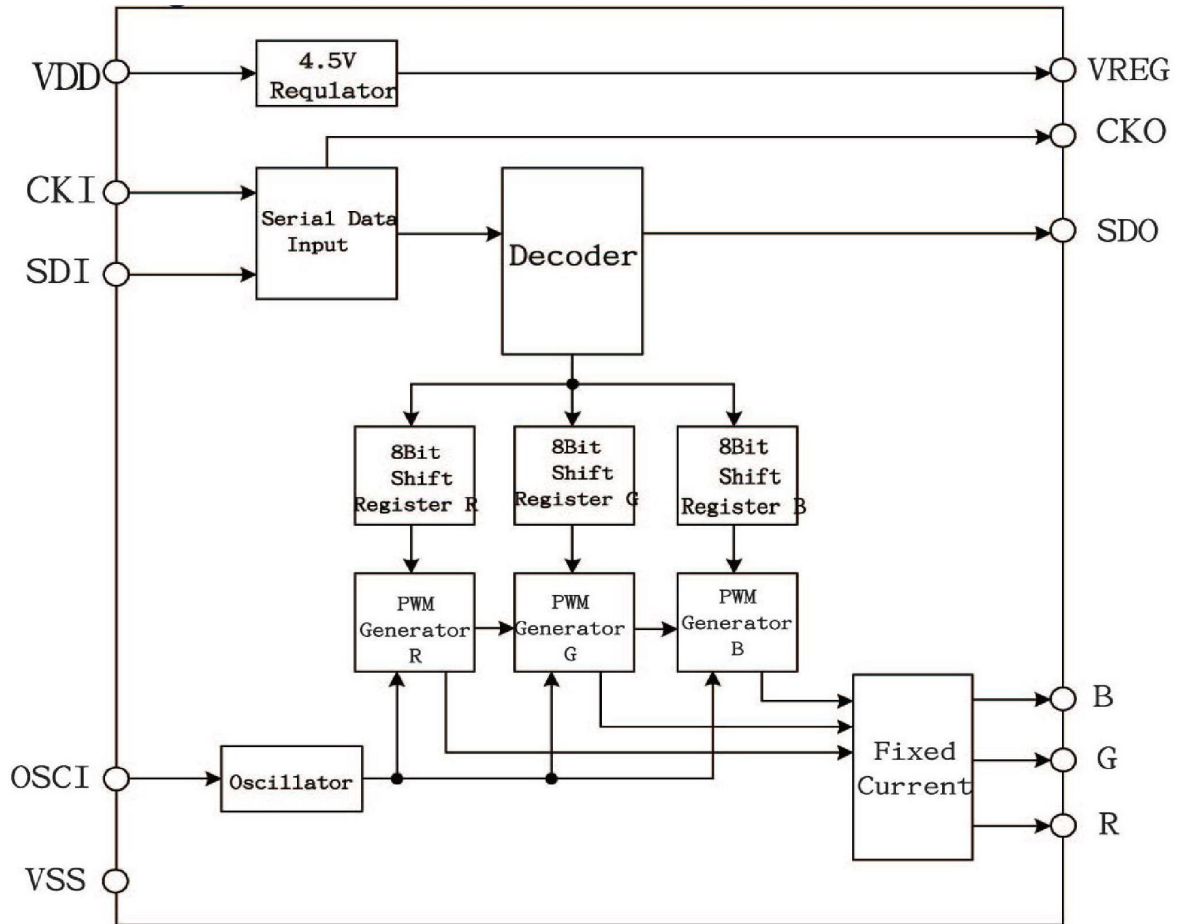
Maximum serial input data clock frequency 15MHZ (lighting applications, please control the clock frequency below 2MHz);

▲ Timing parameters: (T=25°C, VCC=5V)

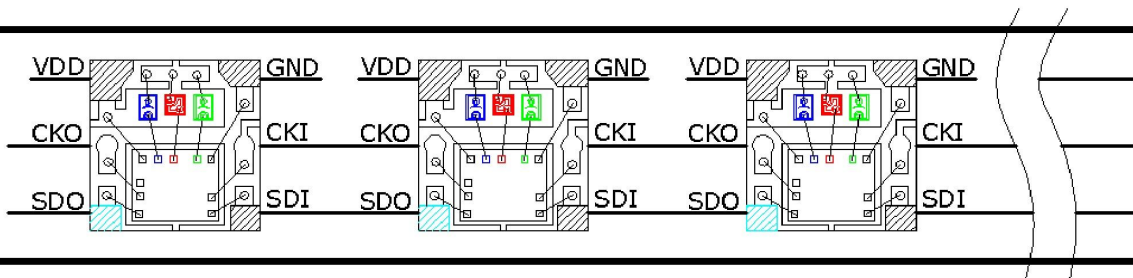
Input signal maximum rise and fall time	TR	VCC=5V	<500	ns
	TF		<400	
Cascade output signal maximum rise time and fall time	TTHH	CL=30pF,RL=1K	<15	ns
	TTHL		<15	
Cascade output signal maximum delay time	TPD	CL=30pF,RL=1K	<12	ns
	TCO		<12	
Drive output minimum PWM on-width	TONMIN	IOUT=20mA	200	ns
Drive output signal maximum on and off time	TON	IOUT=20mA	<80	ns
	TOFF		<80	

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■ Block diagram 功能方塊圖



■ Application circuit 應用線路圖



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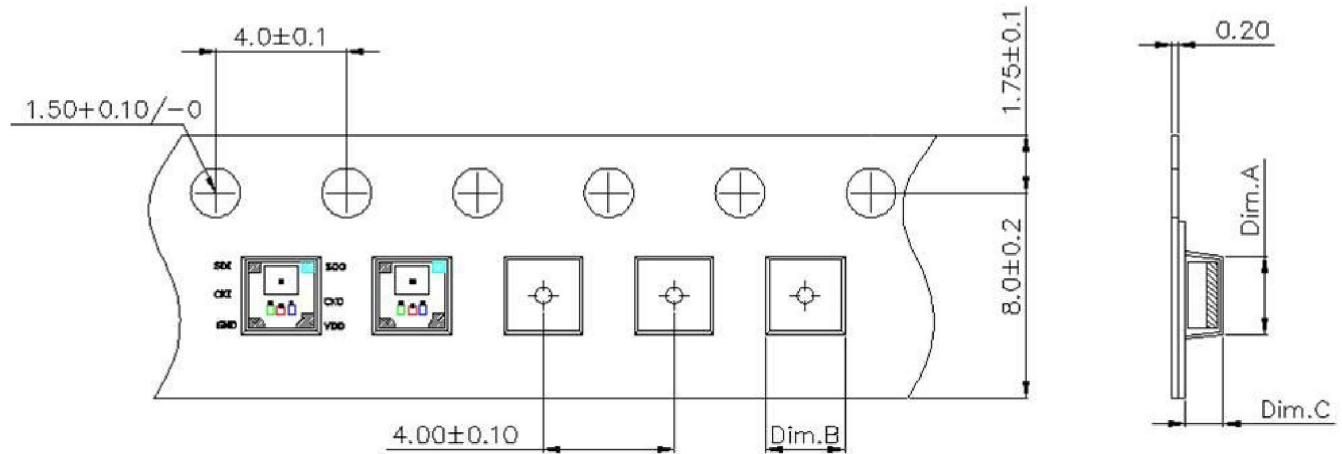
Precaution for Use (備用注意事項)

1. The chips should not be used directly in any type of fluid such as water, oil, organic solvent, etc. (晶片不可被直接用於任何液體，例如水、油、有機溶劑等等)
2. When the LEDs are illuminating, the maximum ambient temperature should be first considered before operation. (使用此 LED 前，應在操作前先確認環境的最高溫度)
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.
(LEDs 應存於一個乾淨的環境。如使用後要保存超過三個月的時間，需在有氮氣中的密閉空間下)
4. The LEDs must be used within seven days 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.
(LED 必須在開封後七天內使用。未使用的產品必須被重新包裝在防靜電包裝內，折疊封閉任何開口，並存放在乾燥、陰涼的空間)
5. The appearance and specifications of the products may be modified for improvement without further notice.
(產品的外觀和規格可能被修改或改善，恕不另行通知。)
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.
(LED 對靜電敏感。強烈建議在處理 LED 時要使用接地手環，防靜電手套。當電壓超過絕對最大額定值，會損壞 LED。損壞的 LED 會顯示一些異常特徵，如漏電流顯著增加，較低的導通電壓，並在低電流下不亮。)

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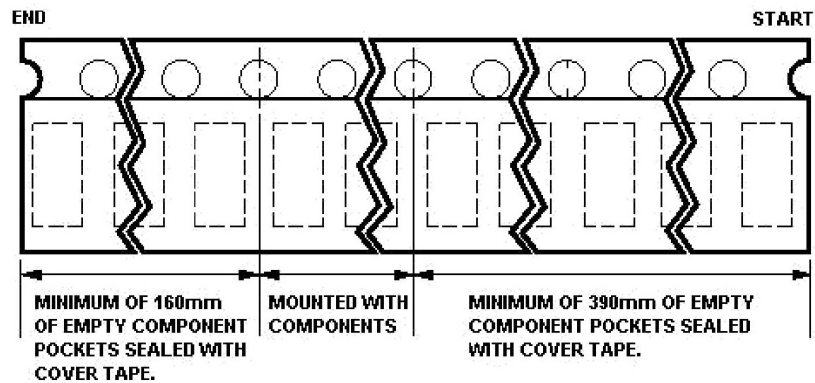
Packaging (包裝)

Tape Dimension (捲帶尺寸)



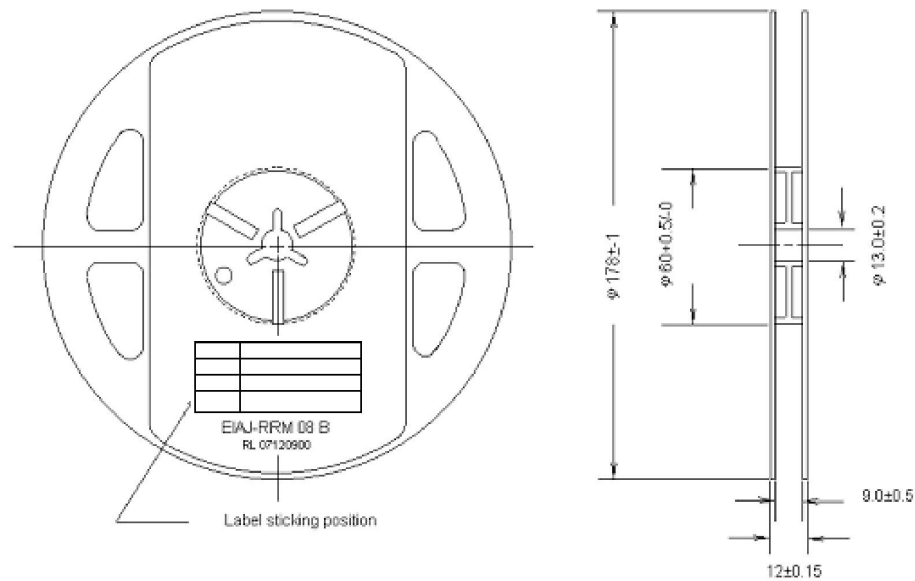
Dim. A (尺寸 A)	Dim. B (尺寸 B)	Dim. C (尺寸 C)	Q' tyReel (數量/1 捲)
2.15±0.10	2.15±0.10	1.05±0.10	3K

Unit: mm(單位：毫米)

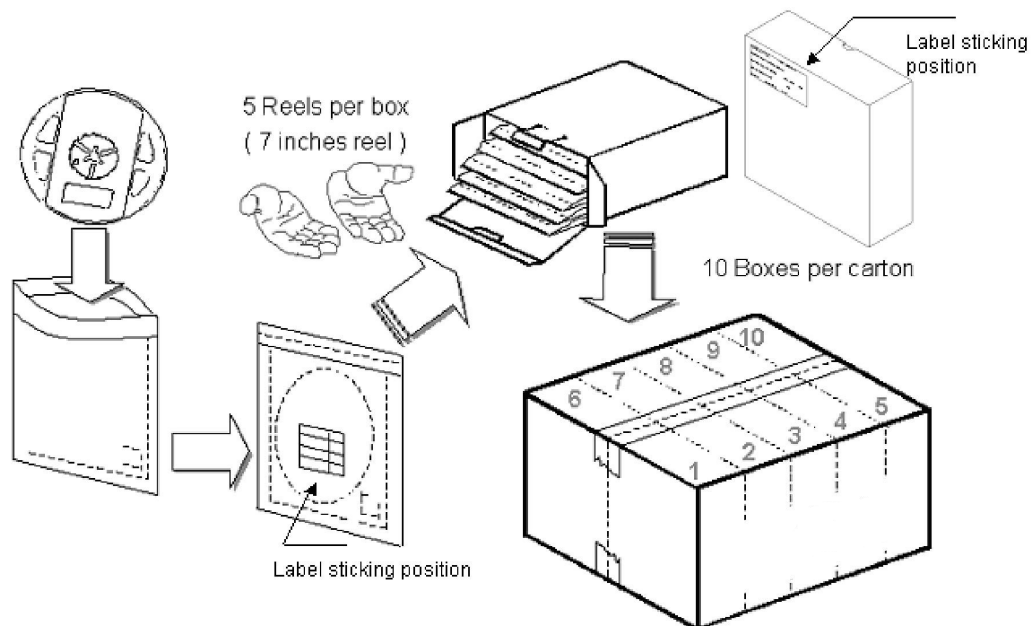


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Reel Dimension (捲盤尺寸)



Packing (包裝方式)



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5 boxes per carton is available depending on shipment quantity.

(裝貨量每一紙箱可裝載 5 袋)

Dry Pack (乾燥包裝方法)

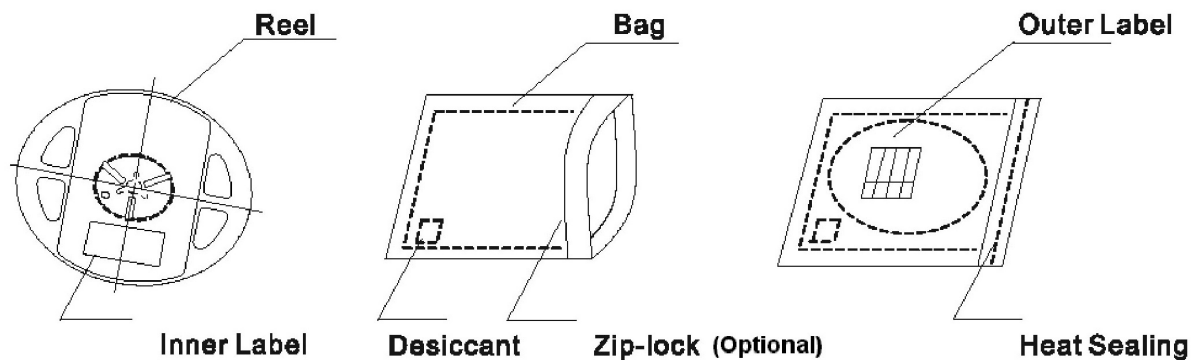
All SMD optical devices are **MOISTURE SENSITIVE**. Avoid exposure to moisture at all times during transportation or storage. Every reel is packaged in a moisture protected anti-static bag. Each bag is properly sealed prior to shipment.

(表面黏著光學元件是對**濕氣敏感**的。每個捲軸被包裝在防潮保護的防靜電袋裡，每袋發貨前需密封，避免在任何時候運輸或儲存過程中接觸濕氣。)

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

(根據要求，會在出貨前將濕度指示卡裝入被受保護的防靜電袋裡)

The packaging sequence is as follows: (包裝順序如下)



Baking (烘烤)

Baking before soldering is recommended when the package has been unsealed for 72hours.

(當包裝已開封 72 小時,在焊接時建議先烘烤)

The conditions are as followings: (條件如下述)

$60\pm3^{\circ}\text{C}\times(12\sim24\text{hrs})$ and $<5\%\text{RH}$, taped reel type. (捲帶內)

$100\pm3^{\circ}\text{C}\times(45\text{min}\sim1\text{hr})$, bulk type.(散裝)

$130\pm3^{\circ}\text{C}\times(15\text{min}\sim30\text{min})$, bulk type.(散裝)

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PRECAUTIONS (注意事項)

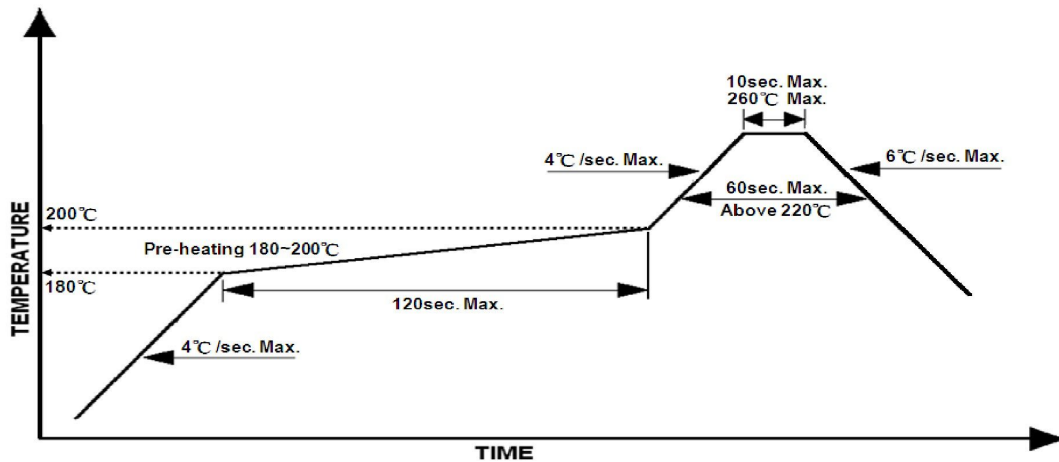
1. Avoid exposure to moisture at all times during transportation or storage.
(避免在任何運輸或儲存的過程中接觸濕氣)
2. Anti-Static precaution must be taken when handling GaN, InGaN, and AlInGaP products.
(處理氮化鎵，氮化銦鎵及磷化鋁銦鎵產品時，必須採取防靜電措施)
3. It is suggested to connect the unit with a current limiting resistor of the proper size. Avoid applying a reverse voltage beyond the specified limit.
(建議該元件應具有適當大小的限流電阻連接。避免施加反向電壓超出規定限定值。)
4. Avoid operation beyond the limits as specified by the absolute maximum ratings.
(避免操作超出所指定的絕對最大額定值)
5. Avoid direct contact with the surface through which the LED emits light.
(LED 發光時，避免與表面直接接觸)
6. If possible, assemble the unit in a clean room or dust-free environment.
(如果可能的話，組裝程序應在潔淨室或無塵環境)

Reflow Soldering (迴流焊)

Recommend soldering paste specifications: (推薦焊錫規格)

1. Operating temp.: Above 220 °C, 60sec (操作溫度： 220 度以上 60 秒)
2. Peak temp.: 260 °C Max., 10sec Max. (峰值溫度：最高 260 度、最多 10 秒)
3. Never take next process until the component is cooled down to room temperature after reflow. (不做任何步驟, 直到元件恢復常溫後再溶焊)
4. The recommended reflow soldering profile (measuring on the surface of the LED terminal) is following: (推薦的迴流焊溫度曲線 (測量 LED 的終端表面上) 如下述：)
Lead-free Solder Profile 無鉛焊料簡介
5. Reflow soldering should not be done more than two times 迴流焊不可執行超過兩次

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Temperature vs. Time

(溫度與時間對應圖)

Reworking (重工)

- Rework should be completed within 5 seconds under 260°C. (重工需在 260 溫度下 5 秒內)
- The iron tip must not come in contact with the copper foil. (烙鐵頭必須不與銅箔接觸)
- Twin-head type is preferred. (雙頭型為首選)。

Cleaning (清潔)

Following are cleaning procedures after soldering: (下述為是焊接後清洗程序)

- An alcohol-based solvent such as isopropyl alcohol (IPA) is recommended.
(建議醇系溶劑，如異丙醇)
- Temperature x Time should be 50°C x 30sec. or <30°C x 3min
(溫度 x 時間需 50°C x 30 秒或 <30°C x 3 分)
- Ultra sonic cleaning: < 15W/ bath; bath volume ≤ 1liter
(超音波清潔：小於 15W / 洗滌; 洗滌值 ≤ 1 升)
- Curing: 100°C max, <3min
(固化：最大 100 度, 小於三分鐘)

Cautions of Pick and Place (拾起與放置注意事項)

- Avoid stress on the resin at elevated temperature. (避免樹脂在高溫下受壓)
- Avoid rubbing or scraping the resin by any object. (避免任何物體刮或摩擦樹脂)
- Electric-static may cause damage to the component. Please ensure that the equipment is properly grounded. Use of an ionizer fan is recommended.
(靜電可能會損壞組件。請確保設備已正確接地。建議使用離子風扇。)