APA
Electronic co. LTD.

SUPER LED

PRODUCT FEATURES

Our LED is integrated with driver IC and wide application

Increases safety by better device reliability and visibility

Save energy and maintenance cost

Create more than one billion colors

Entire cabinet comply with IP65

Replace LED and display LED
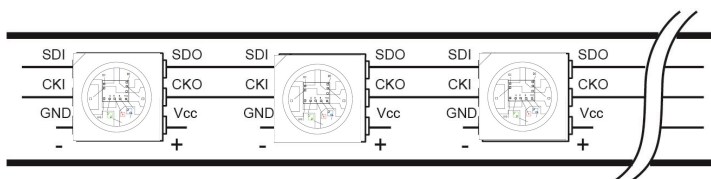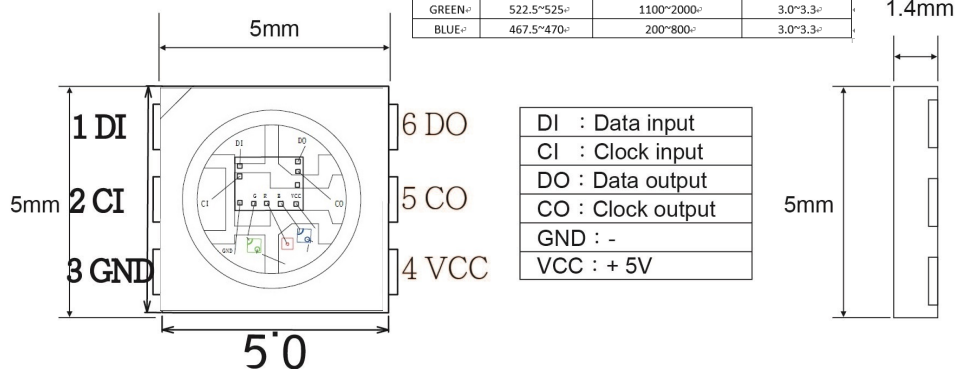
PATENT WORLDWIDE

APPLICATION

Architectural lighting

Landscape lighting

Signage

LED displayer

PRODUCT SPECIFICATIONS

Model number	Color	Millicandela	refresh rate	Applied voltage	Power consumption	View angle	weight (g)	Dimensions(mm) L x W x D	Operating temperature
APA-102C -NEW-260	Full Color 16777216	R 400-800 mcd G 1100-2000 mcd B 200-800 mcd	400 cycle	5VDC	0.2W (MAX:1W)	H:160	0.1	5x5x1.4	-40°C~+70°C

PHYSICAL DIMENSIONS

COLOR	Wavelength(nm)	Luminous intensity(mcd)	Voltage(v)
RED	620~625	400~800	2.0~2.2
GREEN	522.5~525	1100~2000	3.0~3.3
BLUE	467.5~470	200~800	3.0~3.3

5mm

5mm

1 DI
2 CI
3 GND

6 DO
5 CO
4 VCC

5.0

1.4mm

5mm

DI	: Data input
CI	: Clock input
DO	: Data output
CO	: Clock output
GND	: -
VCC	: + 5V

SDI SDO SDI SDO SDI SDO
CKI CKO CKI CKO CKI CKO
GND Vcc GND Vcc GND Vcc
- + - + - +

● 最大額定範圍（Absolute Maximum Ratings）

Supply Voltage—————–0.3V to 6.0V

Input Voltage————VSS–0.3 to VDD+0.3

Operating Temperature————–40℃ to 70 ℃

Storage Temperature—————–50℃ to 125 ℃

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

● 電氣特性（Electrical Characteristics）

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
LOL	Sink Current Voltage（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			5.1		MHz

● 功能說明（function description）

（1）.cascading data structure

Tabdem N–LED

SDI 0*32 LED1 LED2 LED3 LED4 —— LEDN 1*32

Start Frame — LED Frame — Date Field — End Frame

Start Frame 32 Bits

00000000	00000000	00000000	00000000
8Bits	8Bits	8Bits	8Bits

LED Frame 32 Bits

MSB LSB MSB LSB

111	Global	BLUE	GREEN	RED
3Bits	5Bits	8Bits	8Bits	8Bits

LED Frame 32 Bits
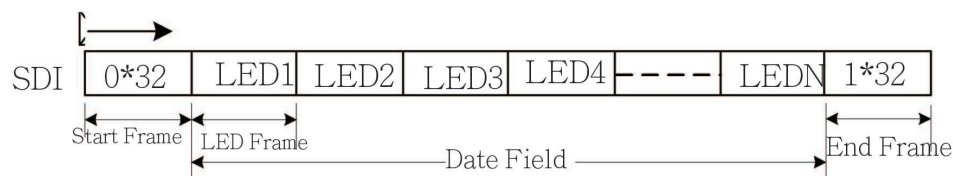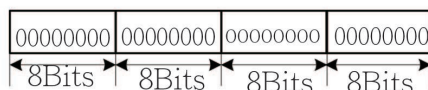
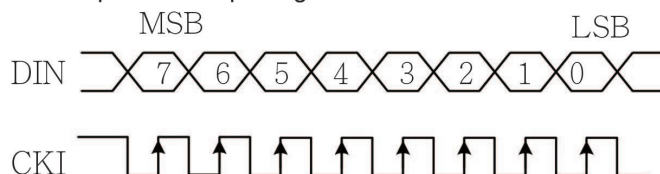| 11111111	11111111	11111111	11111111
8Bits	8Bits	8Bits	8Bits
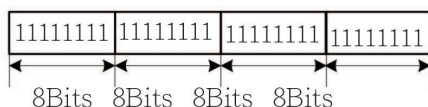
Global bit：5-bit（32 level）brightness setting，while controlling R, G, B three-color constant current output value，if set the Global bit for the 10000（16/31）is the output current is half again the original PWM settings.

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

Three-way constant current 256-level lantern driver chip

Characteristics: IC input voltage is 4.5V~5.5V & led light is off by default when led chip is powered initially;

Built-in fixed constant current and external feedback mode optional, three-way drive

Moving, each drive current is 18mA;

256 levels of grayscale adjustable;

Built-in ring vibration (5.1MHZ) supports supports uninterrupted FREE-RUN modulation output to maintain the picture still function;
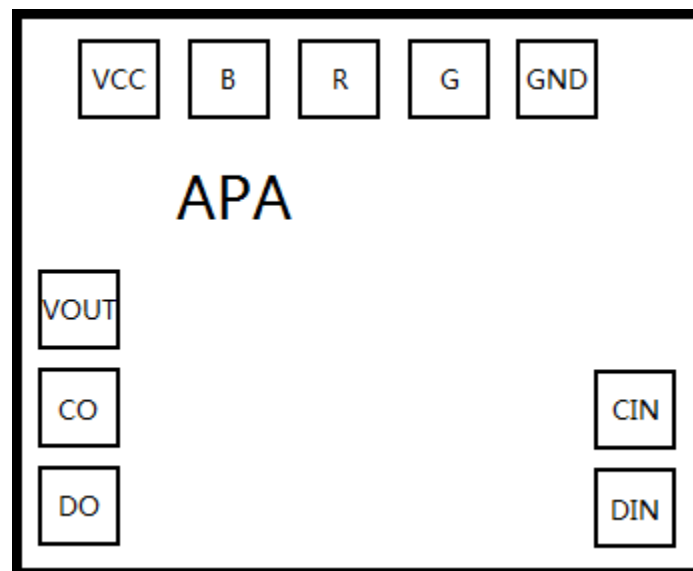
Maximum serial input data clock PWM :20KHz, frequency 30MHZ (lighting application When the clock frequency is controlled below 2MHz)

Data signal phase-locked regeneration, cascaded at 1MHZ data transmission speed Point source can reach 1000;

Adopt special global clock latching mode to make the picture more consistent;

Overview

AP A102 is a full color point source LED driver chip

It uses a CMOS process to provide three constant current drives. The three-wire transmission scheme (DATA, CLOCK and GND) is used for built-in regeneration to increase the transmission distance. It is used to drive display light conversion, various character transformations, and color animation patterns. Offline or online operation according to different controller and customer different form requirements.

This product has excellent performance, clear visual effect, simple cascading mode, and is most suitable for applying large-scale point source pixel screen; stable data transmission and strong anti-interference ability.

Provide DIE package.

Pin map

APA102(DIE)   R: RED   G: GREEN B: BLUE

NO	sign	Function Description
1	DOUT	Serial data output。
2	COUT	Serial clock output。
3	VOUT	Internal working voltageVCC>4.5V 时，4.5VRegulated output，VCC<4.5V，Vout=VCC，External 0.1uF capacitor to ground。
4	VCC	voltage，4.5-5.5V。
5、6、7	R、G、B	Constant current output port
8	GND	GRAND。
10	CIN	Serial clock input, built-in pull-up。
11	DIN	Serial data input, built-in pull-up。

Functional framework:
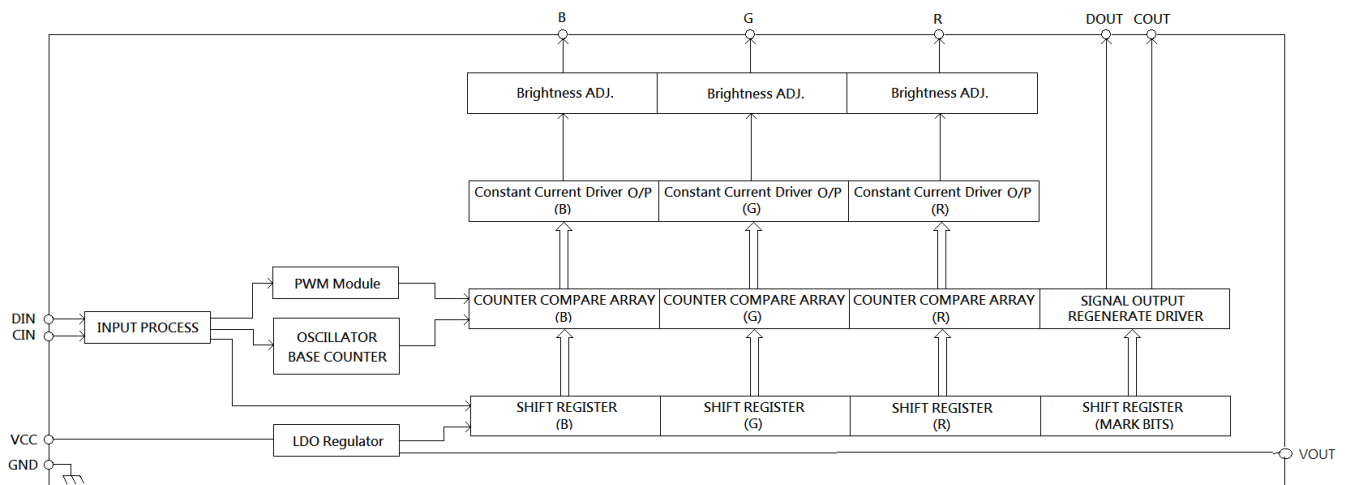
5.1 APA102 Functional block diagram

Communication protocol and timing：

1. The first 32 bits of "0" are the start frame, which is entered at the rising edge of Cin, and the timing DIN is preceded by CIN;
2. T　flag is three "1"
3. D　D3, D2, D1 and D0 are 32-level brightness adjustment, D4 is the highest position;
4. G　y level data should be high first, and it is blue green and red.

Electrical parameter（Ta = 25℃, Vss = 0 V）

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Limit parameter:

parameter	symbol	range	UNIT
voltage	VDD	2.5 ～7.5	V
LED voltage	VLED	3～7.5	V
Data clock frequency	FCLK	30	MHZ
Maximum LED output current	Iomax	18	mA
Channel current deviation	DIO	片内<3%，片间<5%	%
Power loss	PD	<400	mW
Welding temperature	TM	300(8S)	℃
Operating temperature	Topt	−30 ～ +85	℃
Storage temperature	Tstg	−65 ～ +120	℃

Recommended working parameters:

parameter	symbol	range	UNIT
voltage	VDD	4.5～5.5	V
LED voltage	VLED	3～7.5	V
Regulated output voltage	VOUT	4.5 ±0.3%	V
Input voltage	VIN	−0.4−VOUT+0.4	V
Data clock frequency	FCLK	0−5	MHZ
Clock high width	TCLKH	>30	ns
Clock low width	TCLKL	>30	ns
Time when data was created	TSETUP	>10	ns
Data retention time	THOLD	>5	ns
Power consumption	PD	<300	mW
Operating temperature	TOP	−25～+80	℃

Timing parameter：(T=25℃,VCC=5V)

parameter	symbol	range		unit
Input signal maximum rise and fall times	TR	VCC=5V	<500	ns
Input signal maximum rise and fall times	TF	VCC=5V	<400	ns
Cascaded output signal maximum rise time and fall time	TTHH	CL=30pF,RL=1K	<15	ns
Cascaded output signal maximum rise time and fall time	TTHL	CL=30pF,RL=1K	<15	ns
Cascaded output signal maximum delay time	TPD	CL=30pF,RL=1K	<15	ns
Cascaded output signal maximum delay time	TCO	CL=30pF,RL=1K	<15	ns
Drive output minimum PWM turn-on width	TONMIN	IOUT=0~20mA	200	ns
Drive output signal maximum on and off time	TON	IOUT=0~20mA	<80	ns

Logic level normal working range (Ta = −20 ～ +80℃, Vss = 0 V)

parameter	symbol	Min.	typical	Max.	unit	Test Conditions
Logic supply voltage	VDD	—	5	—	V	—
High level input voltage	VIH	0.7 VDD	—	VDD	V	—
Low level input voltage	VIL	—	—	0.3VDD	V	—

RELIABILITY PLAN:

* The reliability of products shall be satisfied with items listed below.

Confidence Level : 90 % , LTPD : 10 %

No	Test Item	Description & Condition		Sample size	Ac/Re
1	Solderability	Tsld =235±5℃, 10sec,	1 time	22	0/1
2	Low / High Temperature Storage	Ta = -40 °C / Ta = 100 °C	1000 hrs	22	0/1
3	ESD HMB Contact Discharge Air Discharge	V=2000V : tr=10ns V=+2K,-2KV: tr=1ns	45times 10times	3 3	0/1 0/1
4	Temperature Cycle	-40°C ~ 25°C ~ 100°C ~ 25 °C 30min 5min 30min 5 min	300 cycles	22	0/1

CAUTIONS:

Recommendation: Be sure to bake according to the requirements before use to ensure quality.

(1)Storage

· Before opening the package :

The LEDs should be kept at 30℃ or less and 30%RH~85%RH. The LEDs should be used within a year. When storing the LEDs, moisture proof packaging with desiccant (Silica gel)is recommended.

· After opening the package :

The LEDs should be kept at 30℃ or less and 30%RH~70%RH.The LEDs should be soldered within 168hours (7days) after opening the package. If unused LEDs remain, they should be stored in moisture proof packages, such as sealed containers with packages of moisture desiccant (Silica ge1), or reseal the moisture proof bag again.

If the moisture desiccant (Silica ge1)has faded away or the LEDs have exceeded the storage time, baking treatment should be performed using the fo1lowing conditions.

Baking treatment: 7 hours at 60℃ on tap and reel, 7 hours at 125℃ have no ree1&tap.

Please avoid conditions which may cause the LED to corrode, tarnish or disco1or. This corrosion or discoloration might lower solderability or might effect on optical characteristics.-Please avoid rapid transitions in ambient temperature, especially in high humidity environments where condensation can occur.

· Moisture Proof package

When moisture is absorbed into the SMT package it may vaporize and expand during soldering. There is a possibility that this can cause exfoliation of the contacts and damage to the optical characteristics of the LEDs. For this reason, the moisture proof package is used to keep moisture to a minimum in the package. A package of a moisture desiccant (silica gel)is inserted into the moisture proof bag-The silica gel changes its color from blue to pink as it absorbs moisture.

MSL:5a

(2)Static Electricity

- Static electricity or surge voltage damages the LEDs. It is recommended that a wrist band or an anti-electrostatic glove and shoe be used when handling the LEDs.
- All devices, equipment and machinery must be properly grounded. It is recommended that measures be taken against surge voltage to the equipment that mounts the LEDs.
- when inspecting the final products in which LEDs were assembled, it is recommended to check whether the assembled LEDs are damaged by static electricity or not. It is easy to End static-damaged LEDs by a light-on test or a V_F test at a lower current (below l mA).
- Damaged LEDs will show some unusual characteristics such as the leak current remarkably increases, the forward voltage becomes lower, or the LEDs do not light at the low current. (Criteria : V_F>2.0V at I_F=0.5mA.)

(3)Heat Generation

- Please consider the heat generation of the LED when making the system design that it's very importance. The coefficient of temperature increase per input electric power is effected by the thermal resistance of the circuit board and density of LED placement on the board, and other components. It is necessary to avoid intense heat generation and operate within the maximum ratings given in this specification.
- The operating current should be decided after considering the ambient maximum temperature of LEDs.

(4)Others

- Care must be taken to ensure that the reverse voltage will not exceed the absolute maximum rating when using the LEDs with matrix drive.
- The LED light output is strong enough to injure human eyes. Precautions must be taken to prevent looking directly for more than a few seconds. Flashing lights have been known to cause discomfort in people; you can prevent this by taking precautions during use. Also, people should be cautious when using equipment that has had LEDs incorporated into it.

SOLDERING CONDITIONS:
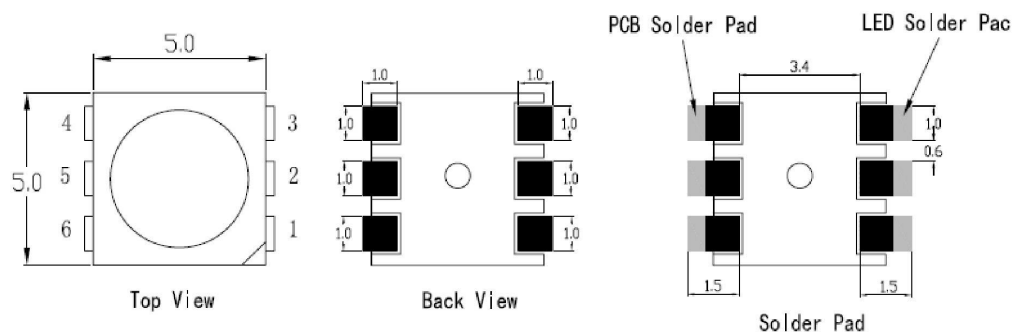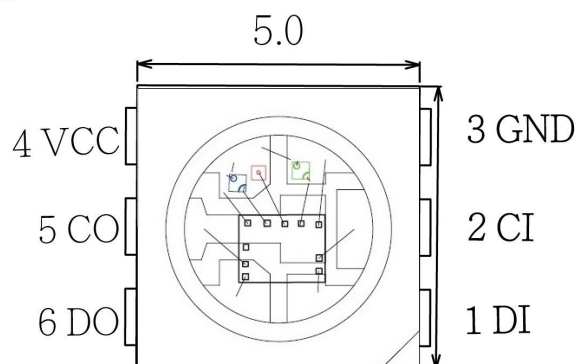
(1) Recommended Re-flow profile
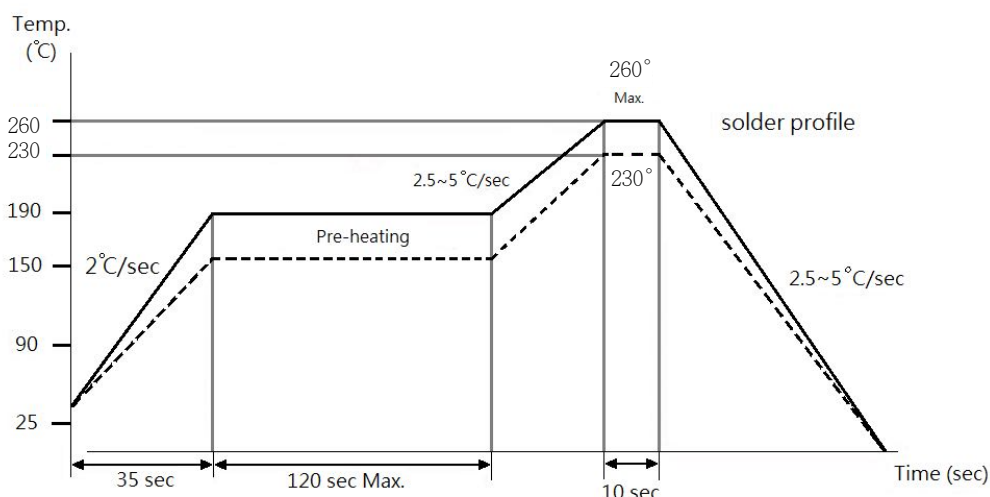
Super Led APA-102C

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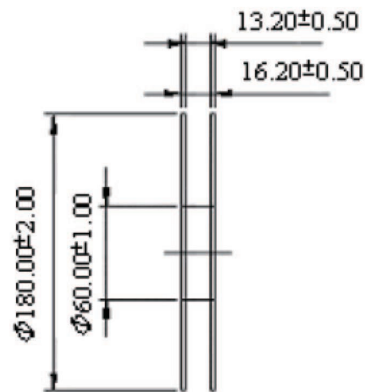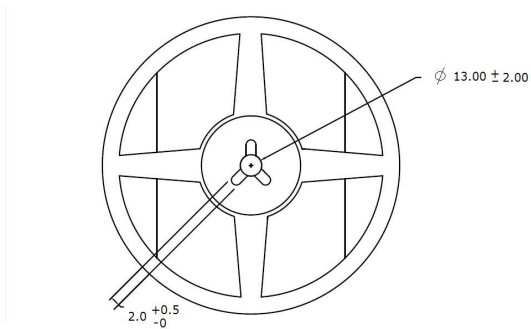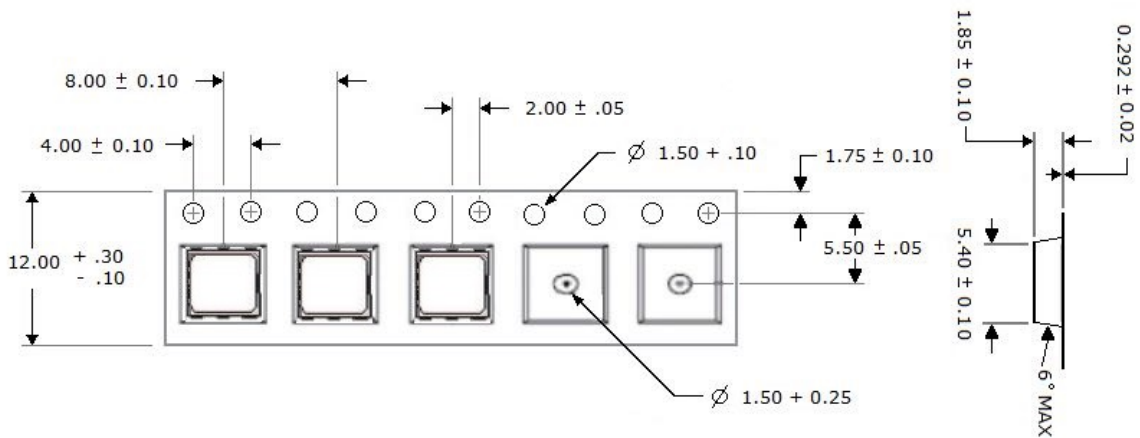
APA-102C SUPER LED

Mechanical Dimensions

Top View   Back View   Solder Pad

PIN configuration

4 VCC   3 GND

5 CO   2 CI

6 DO   1 DI

PIN function

NO.	Symbol	Function description
1	DI	Control data signal input
2	CI	Clock input
3	VSS	Ground
4	VCC	Power supply LED
5	CO	Clock output
6	DO	Control data signal output

REEL PACKAGE:

Pull Direction:

TRAILER	component	LEADER
40 pcs	1000 pcs	40 pcs
Empty components	Mounted with Components	Empty components

8.00 ± 0.10

4.00 ± 0.10

2.00 ± .05

Ø 1.50 + .10

1.75 ± 0.10

12.00 + .30 − .10

5.50 ± .05

Ø 1.50 + 0.25

1.85 ± 0.10

0.292 ± 0.02

5.40 ± 0.10

6° MAX

13.20 ± 0.50

16.20 ± 0.50

Ø 13.00 ± 2.00

Ø 180.00 ± 2.00

Ø 60.00 ± 1.00

2.0 +0.5 −0
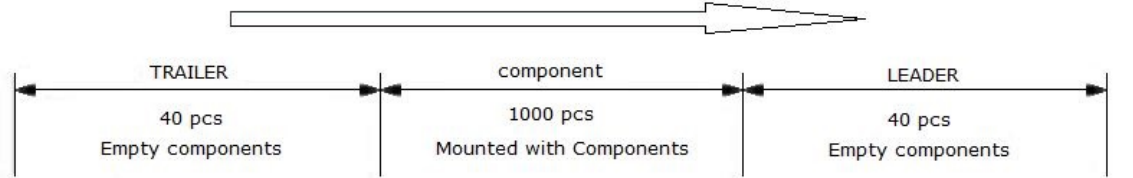
Note:
1. Unit: mm
2. 1,000 pcs / reel

Super Led APA-102C

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Electronic co. LTD.

SHIPPING PACKAGE:

Anti-Moisture foil bag

Moisture absorbent agent

```
APA                          DATE:05/31/2012        RoHS
CUSTOMER P/N: APA102
APA P/N: APA102                      QTY: 1000   PCS
LOT NO:0DC5U55Y14                         QC:
IV: A020C2   CR: AAGHBF    VF:G1J2J2
```

APA
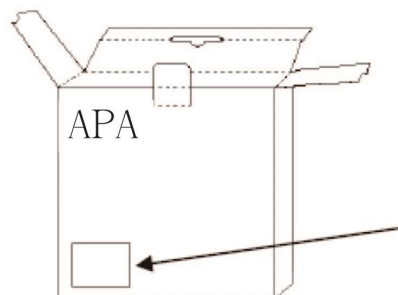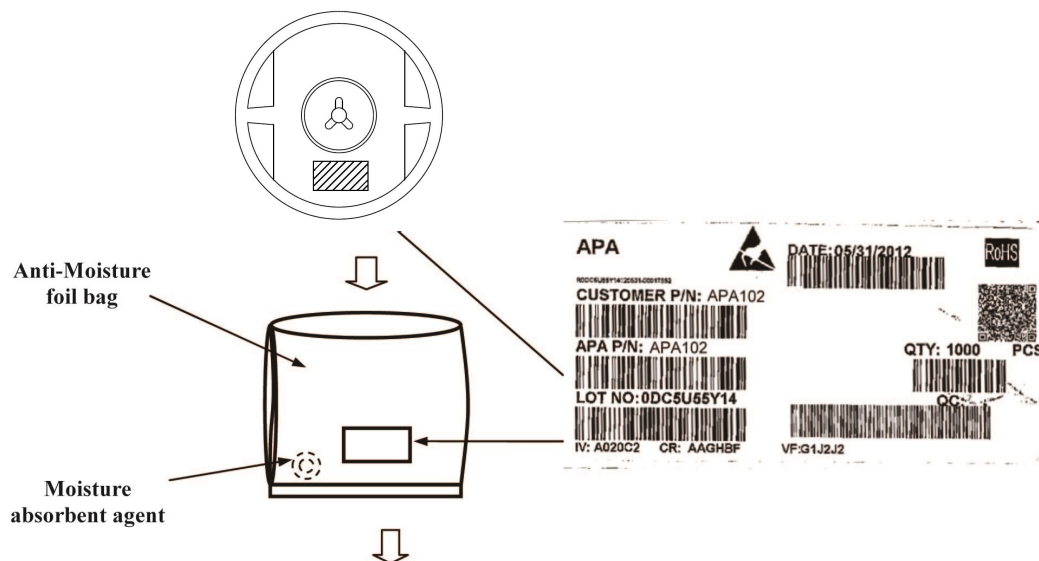
APA

QTY:5000PCS

DATE:2012/06/01

APA
QTY:50000PCS
DATE:2012/06/01

APA ELECTRONIC CO., LTD.
TEL:886-2-2240-9871
FAX:886-2-2240-9870

Note:
1.   1000 pcs (max.) / reel
2.   5 reels / box
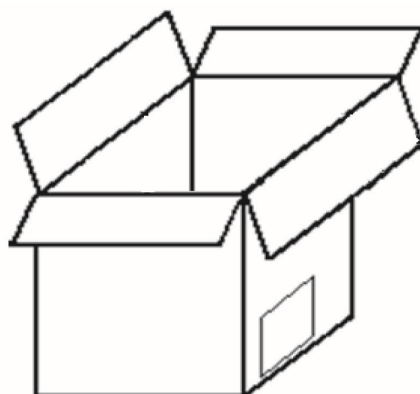3.   10 box / carton

APA ELECTRONIC CO., LTD.
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CAUTION:
1.   Recommended storage condition: At 5°C~3°C and relative humidity 60% RH max.
2.   After this bag is opened, devices that will be applied to infrared reflow, vapor-phase reflow, or equivalent
       soldering process must be:
a.   Completed within 24 hours.
b.   Stored at less than 30% RH.
3.   Devices require baking before mounting, devices must be baked under below conditions: 12hours
       at 60°C+-3°C.

金建電子有限公司
APA ELECTRONIC CO., LTD

Change History

FCN No.	Date	Rev. No.	Changes/Reason of changes
	11 OCT 18	REV.01	1st released copy mfg p/n : APA-102C-NEW-260