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Opto Plus LED Corp.
0.40” SMD Type LED Display
OPS-S40AAF6

EDIT HISTORY

Version A: FEB. 17, 2025

Preliminary Spec.

Confidential Document

Opto Plus LED Corp. 7F-3, No.496 , Bannan Road, Jhonghe Dist., New Taipei City 235, Taiwan (R.O.C)
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0.40” SMD Type LED Display
OPS-S40AAF6

FEATURES

- 0.40 inch (10.16 mm) digit height.
- SMD type.
- Low current operation.
- RoHS Compliant, Pb Free.

DESCRIPTION

The device are 0.40 inch (10.16 mm) height single digit 7-segment displays,

Built-in programmable LEDs.

This device are 256-step gray-scale output to allow 16,777,216 color display,

Built-in oscillator 20M.

The device is Opto Plus LED Corp standard LED Display.

The device has face and segment option, please refer to **PRODUCT APPEARANCE**.

DEVICE

	PART NO.	DESCRIPTION
	OPS-S40AAF6-GW	Single data line｜Gray face｜White segment
	OPS-S40AAF6-BW	Single data line｜Black face｜White segment

RoHS Compliance

Pb Free.

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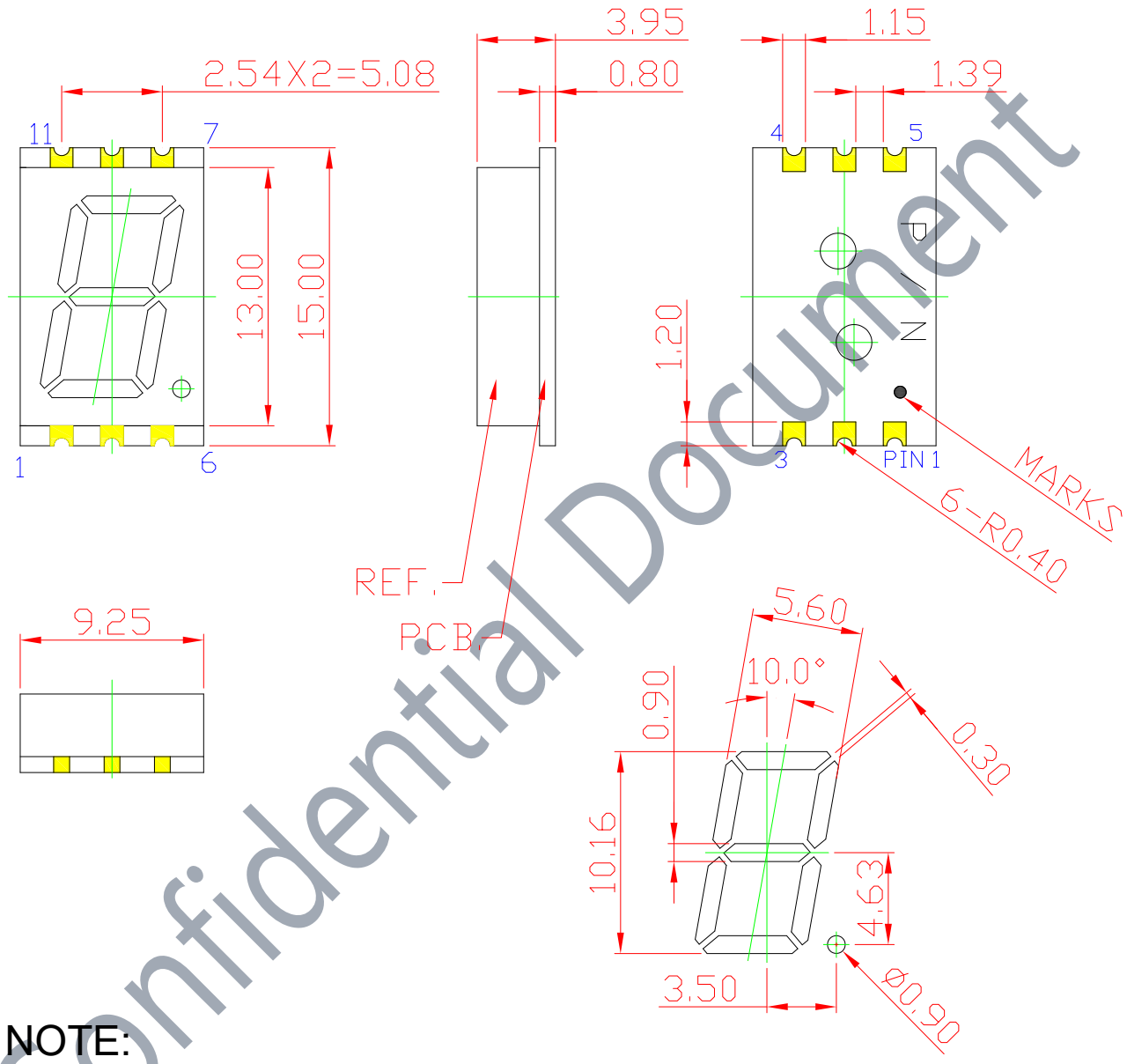
MECHANICAL DIMENSIONS



NOTE:
Dimension in millimeters (inches),
And tolerances are ± 0.25mm (.01") specified.

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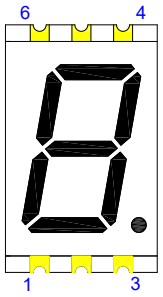
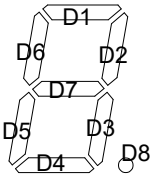
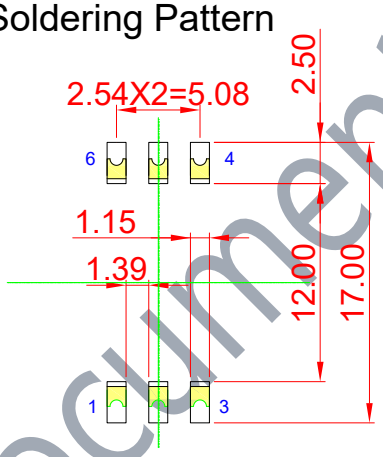
TYPICAL INTERNAL EQUIVALENT CIRCUIT

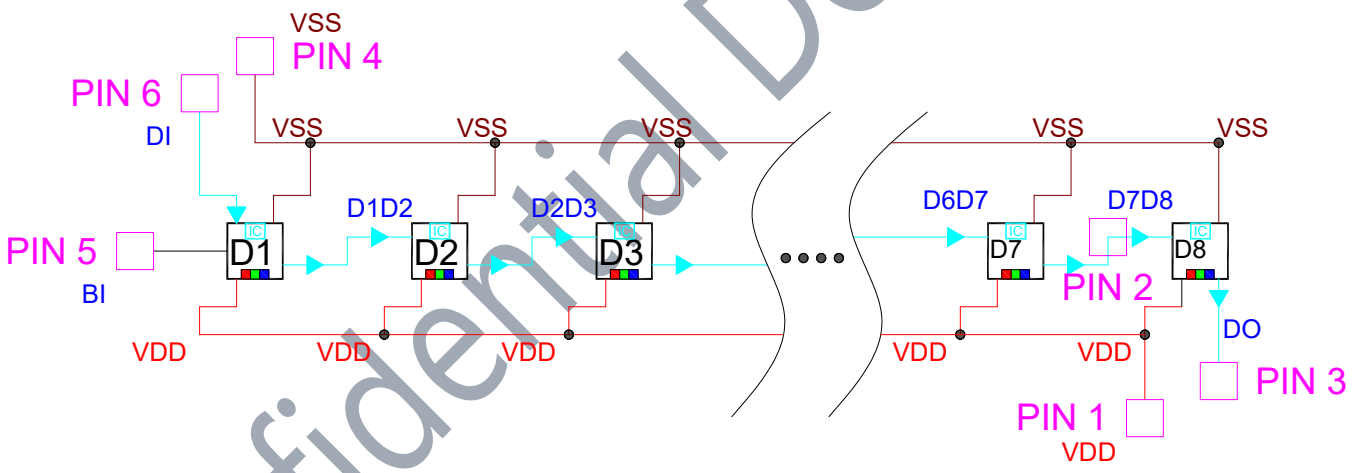
Turn On Color





Recommended Soldering Pattern





PIN 1 : Power Supply.

PIN 2 : Backup Data Signal Input From D8.

PIN 3 : Control Data Signal Output.

PIN 4 : Ground.

PIN 5 : Backup Data Signal Input. (Single Signal Wiring Diagram：BI is connected to GND.)

PIN 6 : Control Data Signal Input

※ SUPPORT BI BACKUP [PIN 2] INPUT DATA LINE

TO PREVENT DATA INPUT FAILURE FROM MALFUNCTION DI.

※EMITTED COLOR：RED & GREEN & BLUE

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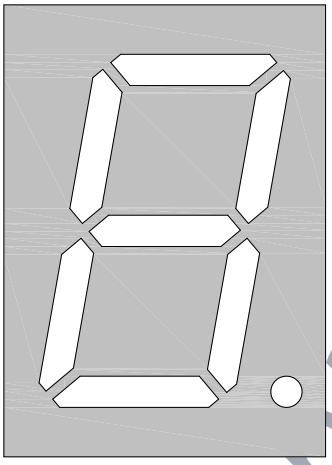
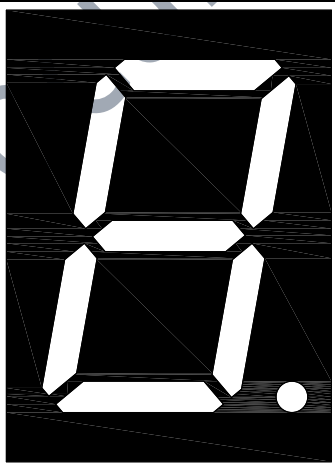
IN THE PRACTICAL APPLICATION CIRCUIT, THE SIGNAL INPUT AND OUTPUT PINS OF THE IC SIGNAL INPUT AND OUTPUT PINS SHOULD BE CONNECTED TO THE SIGNAL INPUT AND OUTPUT TERMINALS. IN ADDITION, IN ORDER TO MAKE THE IC CHIP IS MORE STABLE, EVEN THE CAPACITANCE BETWEEN DISPLAY IS ESSENTIAL BACK; APPLICATION: DISPLAY TRANSMISSION DISTANCE IS SHORT, SUGGESTED IN SIGNAL IN TIME THE CLOCK LINE INPUT AND OUTPUT END OF EACH CONNECTED IN SERIES PROTECTION RESISTOR (ABOUT 470 OHMS). APPLICATION: FOR MODULE OR GENERAL SPECIAL-SHAPED PRODUCTS, DISPLAY TRANSMISSION DISTANCE IS LONG, BECAUSE OF DIFFERENT WIRE AND TRANSMISSION DISTANCE, IN THE SIGNAL IN TIME CLOCK AT BOTH ENDS OF THE LINE ON GROUNDING PROTECTION RESISTANCE WILL BE SLIGHTLY DIFFERENT;
TO THE ACTUAL USE OF FIXED;

● PRODUCT APPEARANCE

The most common reflector color and segment color are show in below diagram.

-GW	-BW
	
※ REFLECTOR COLOR: Gray ※ SEGMENT COLOR: White	※ REFLECTOR COLOR: Black ※ SEGMENT COLOR: White

Opto Plus can customize reflector and segment colors by customer’s request. If you have these request please visit www.opledtw.com or contact sales@opledtw.com for more **Standard Product Customization** information.

Part NO. related to reflector and segment colors show as table below.

PART NO.	DESCRIPTION
OPS-S40AAF6-GW	Single data line ｜ Gray face ｜ White segment
OPS-S40AAF6-BW	Single data line ｜ Black face ｜ White segment

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● F6: FULL COLOR (AlInGaP/InGaP)

ABSOLUTE MAXIMUM RATING AT Ta=25°

Parameter	Symbol	Maximum Rating	Unit
Supply Voltage	VDD	6.5	V
Power Dissipation	PD	<400	mW
Maximum Output Current	I_{LEDOUT}	5	mA
Operating temperature	T_{OP}	-25 to + 85	°C
Storage temperature	T_{ST}	-40 to + 100	°C
Welding temperature	T_M	300(<8sec.)	°C

ELECTRICAL - OPTICAL CHARACTERISTICS AT Ta=25°C (Each. Segment)

Characteristic	Symbol	Condition	Min.	Type.	Max.	Unit
Dominant Wavelength (Red) (Each. Segment)	λ_D	I_{SINK} =5mA	-	622	-	nm
Dominant Wavelength (Green) (Each. Segment)	λ_D	I_{SINK} =5mA	-	525	-	nm
Dominant Wavelength (Blue) (Each. Segment)	λ_D	I_{SINK} =5mA	-	466	-	nm
Luminous Intensity (Red) (Each. Segment)	I_V	I_{SINK} =5mA	-	22	-	mcd
Luminous Intensity (Green) (Each. Segment)	I_V	I_{SINK} =5mA	-	55	-	mcd
Luminous Intensity (Blue) (Each. Segment)	I_V	I_{SINK} =5mA	-	13	-	mcd
Spectrum Radiation Bandwidth (Red) (Each. Segment)	$\Delta\lambda$	I_{SINK} =5mA	-	16	-	nm
Spectrum Radiation Bandwidth (Green) (Each. Segment)	$\Delta\lambda$	I_{SINK} =5mA	-	28	-	nm
Spectrum Radiation Bandwidth (Blue) (Each. Segment)	$\Delta\lambda$	I_{SINK} =5mA	-	18	-	nm

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ELECTRICAL - OPTICAL CHARACTERISTICS AT TA=25℃ (DRIVER IC.)

Characteristic	Symbol	Min.	Typ.	Max.	Unit	Note.
Supply Voltage	VDD	3.3	5.0	5.5	V	
Operation Current (With IC)	I_{DD-1}		1		mA	R/G/B Without load @VDD=5V
Operation Current (With IC)	I_{DD-2}		0.6		mA	R/G/B Without load @VDD=3.3V
Sleep Mode Current	Isleep		5		uA	
Input High “H” of DI、BI	VIH	0.7*VDD		VDD+0.4	V	
Input Low “L” of DI、BI	VIL	-0.4		0.2*VDD	V	
Output High “H” of DO	VOH	4.5			V	IOH=3mA
Output Low “L” of DO	VOL			0.4	V	IOL=3mA
R/G/B Sink Current	I_{Sink-1}	2.9	3.0	3.1	mA	Max. 3mA option
R/G/B Sink Current	I_{Sink-2}	4.8	5.0	5.2	mA	Max. 5mA option
R/G/B Current Gain	$G_{level-1}$		3/17		mA/level	Max. 3mA option
R/G/B Current Gain	$G_{level-2}$		5/17		mA/level	Max. 5mA option
DI / BI Input Leakage	I_{leak}			1	uA	$V_{DI}=V_{BI}=VDD$ =5V
R/G/B off Leakage Current	I_{off}			1	uA	VR/G/B=5V, PWM off
Propagation delay time	tPLZ			80	ns	DI → DO, load=30pF
	tPZL			80	ns	
Rising time	tTHL		15		ns	
Falling time	tTLH		15		ns	
Rising time	tR		50		ns	ISK(R/G/B) =3/5mA, load=30pF
Falling time	tF		50		ns	
Data rate	Fdata		800		KHz	

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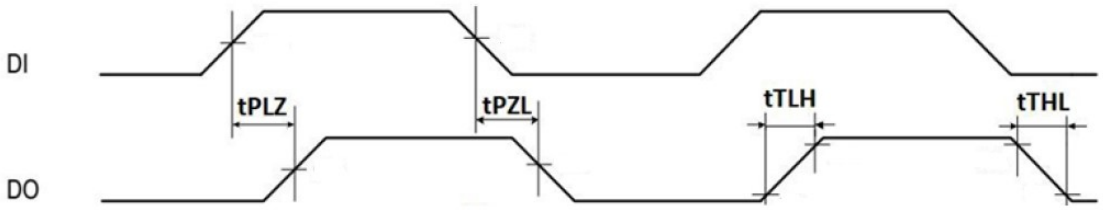
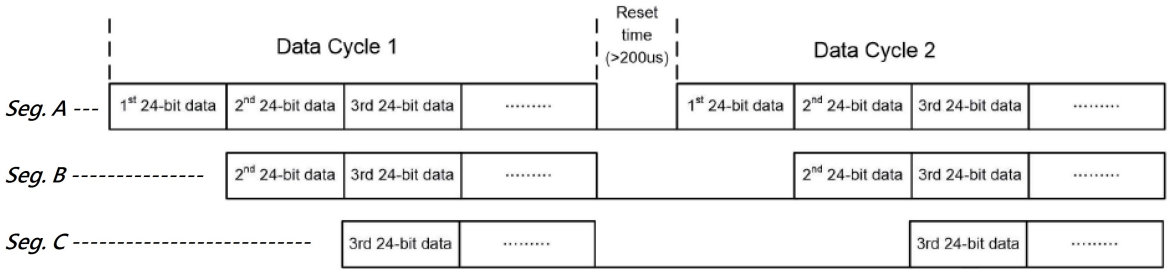


Data Transfer Protocol

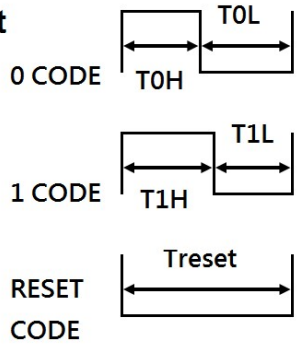


The single wire data transfer protocol supports 24-bit data for each LED RGB display data refresh. The IC receives 24-bit data and passes the remaining data to next LED. The 24-bit data consist of green, red and blue data, each with 8-bit width, and are transferred with MSB first.

R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0

The transferred data are recognized based on the pulse widths received by the IC. A low bit 0 is represented by a 0.3us high pulse followed by a 0.9us low pulse. A high bit 1 is represented by a 0.9us high pulse followed by a 0.3us low pulse. A low pulse ≧ 200us is used to issue a reset command to the IC to start a new cycle of serial commands.

Sequence Chart



(T0H:0.3us+0.15us,T0L:0.9us+0.15us)

(T1H:0.9us+0.15us,T1L:0.3us+0.15us)

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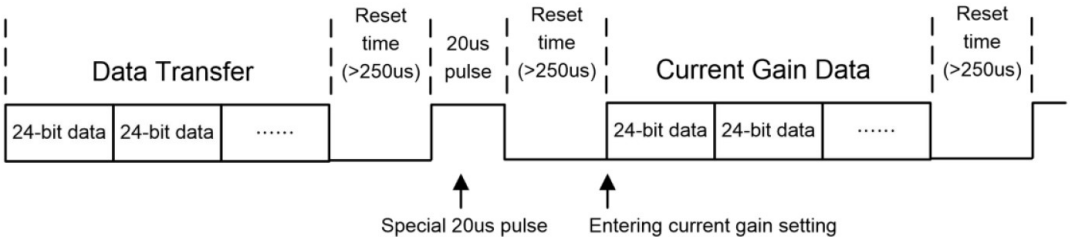
Dimming Control

Supports a 16-level current gain control to adjust the sink current of the R/G/B channels. This feature enables dimming control of LED lighting. Each of the red, green, and blue channels can be controlled individually, which not only saves power consumption but also fine-tunes the color temperature of the R/G/B LEDs. To set the current gain of the R/G/B channels, a special pulse must be issued by the MCU before setting the current gain levels, as shown.



After a reset pulse following normal data transfer, if a 20us positive pulse is issued with another reset pulse, OPS-L0404F6 is forced into a special mode to interpret following 24-bit data as current gain setting data. Each of the 24-bit data comprises 4-bit gain values of R/G/B channels, as shown below.

S23	S22	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
0	0	0	0	R[3]	R[2]	R[1]	R[0]	0	0	0	0	G[3]	G[2]	G[1]	G[0]	0	0	0	0	B[3]	B[2]	B[1]	B[0]

The maximum output current of each R/G/B channels is then determined as below (ISK=3mA or 5mA).

Rsink = ISK * (R[3]*10/17 + R[2]*4/17 + R[1]*2/17 + R[0]*1/17)
Gsink =ISK * (G[3]*10/17 + G[2]*4/17 + G[1]*2/17 + G[0]*1/17)
Bsink = ISK * (B[3]*10/17 + B[2]*4/17 + B[1]*2/17 + B[0]*1/17)
By default, R[3:0] = G[3:0] = B[3:0] = 0x0F.
Recommended programming flow:
After system power-on, MCU should send data 0 first (dark mode) for all LEDs in the strip, then MCU can deliver normal display data or execute current gain (dimming) command to LEDs.

Sample CODE

```
// Please write using Arduino IDE.

// Make sure that the Adafruit_NeoPixel library has been installed.

#include <Adafruit_NeoPixel.h>
#define LED_PIN     4   // Signal pin for the LED Display.
#define LED_COUNT   8   // Number of LEDs in the LED Display.
Adafruit_NeoPixel strip(LED_COUNT, LED_PIN, NEO_GRB + NEO_KHZ800);
//  Function used to create colorful effects
void setup() {
  strip.begin();
  strip.show();
  strip.setBrightness(127); //Set brightness to approximately 1/2 (maximum value = 255)
}
void loop() {
    strip.setPixelColor(0, 255, 0, 0); // Turn on D1-Red
    strip.setPixelColor(1, 255, 0, 0); // Turn on D3-Red
    strip.setPixelColor(8,   0, 0, 0); // Turn off
    strip.setPixelColor(9,   0, 0, 0); // Turn off
    strip.show();  // Update to display
    delay(500); // delay 0.5 seconds.
    strip.setPixelColor(0, 0, 0, 0); // Turn off
    strip.setPixelColor(1, 0, 0, 0); // Turn off
    strip.setPixelColor(8, 0, 255, 0); // Turn on D9-Green
    strip.setPixelColor(9, 0, 255, 0); // Turn on D10-Green
    strip.show();  // Update to display
    delay(500); // delay 0.5 seconds.
}
```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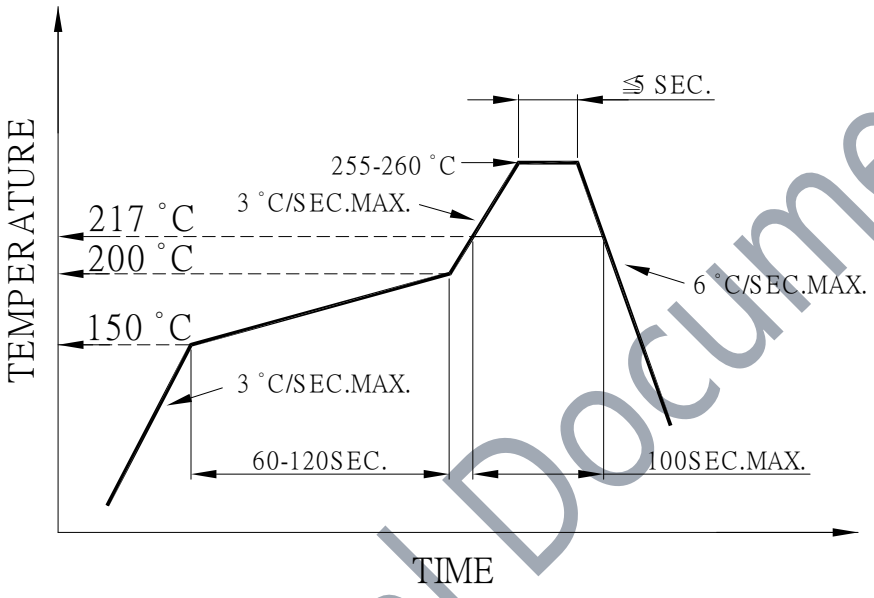
SMT REFLOW SOLDERING INSTRUCTIONS

SMT Soldering Profile

Pb free reflow soldering Profile



- We recommend the reflow temperature 245°C (+/- 5°C).
  The maximum soldering temperature should be limited to 260°C.
- Number of reflow process shall be 2 times or less.

SOLDERING IRON

Basic spec is ≦4 sec when 260°C. If temperature is higher, time should Be shorter (+10°C→1 sec). Power dissipation of Iron should be smaller Than 15W, and temperature should be controllable. Surface temperature Of the device should be under 230°C.

REWORK

- Customer must finish rework within 3 sec. under 350℃.
- The head of soldering iron cannot touch copper foil.

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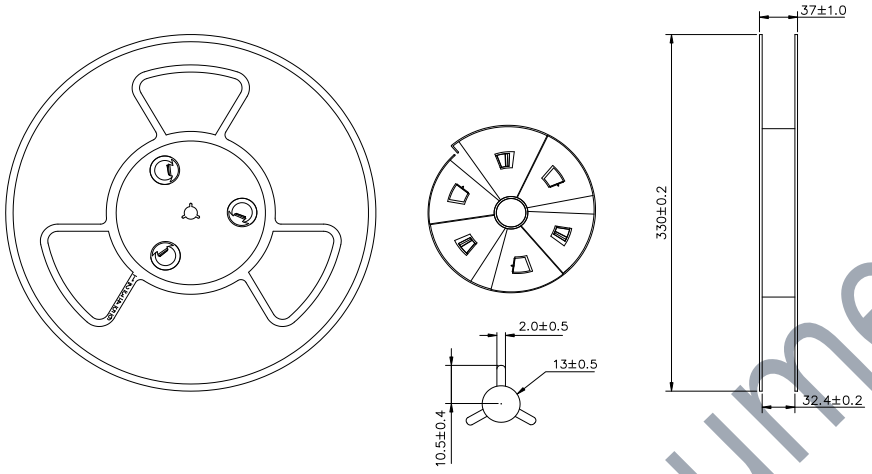
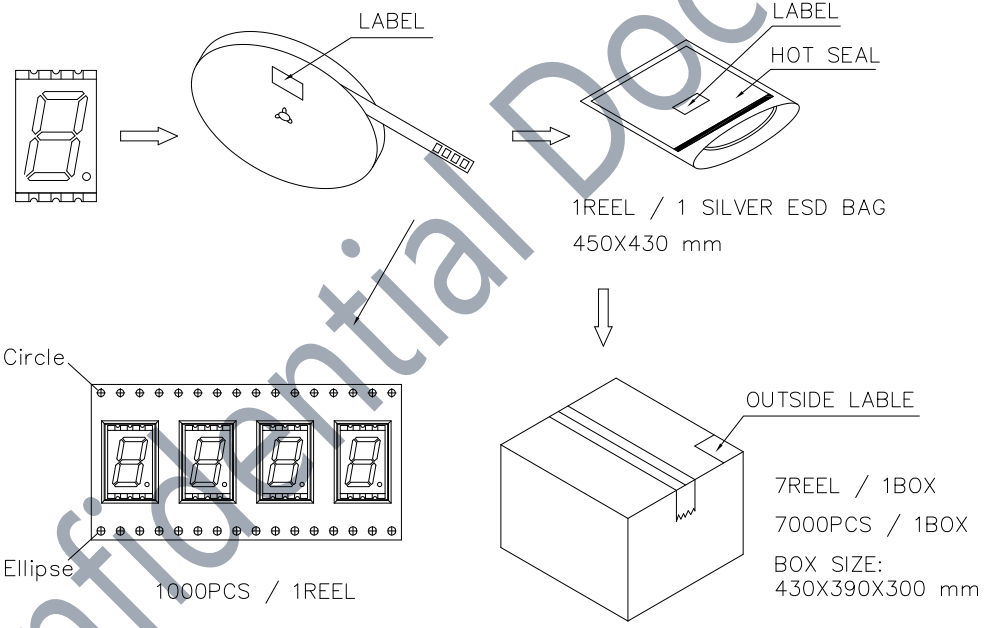
REEL DIMENSIONS



PACKING & LABEL SPECIFICATIONS



STORAGED CONDITION

In factory original sealed bag package

TEMPERATURE CONDITION	HUMIDITY CONDITION
5℃ ~ 30℃	Below 60%RH

After opened and not in factory original sealed bag package

TEMPERATURE CONDITION	HUMDITY CONDITION	STORAGE TIME
5℃ ~ 30℃	Below 60%RH	Within 4 weeks (MSL as level 2a)

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