587 SERIES
2020 6 Pin Addressable RGB LED
SMD LED + IC

MECHANICAL / SPECIFICATIONS

PART NUMBER:
587-1026-237F

DIMENSIONS:
2.0 x 2.0 x 0.75mm

LENS COLOR: Clear

LENS MATERIAL: Epoxy

 # CONTROL WIRES:
Dual Wire
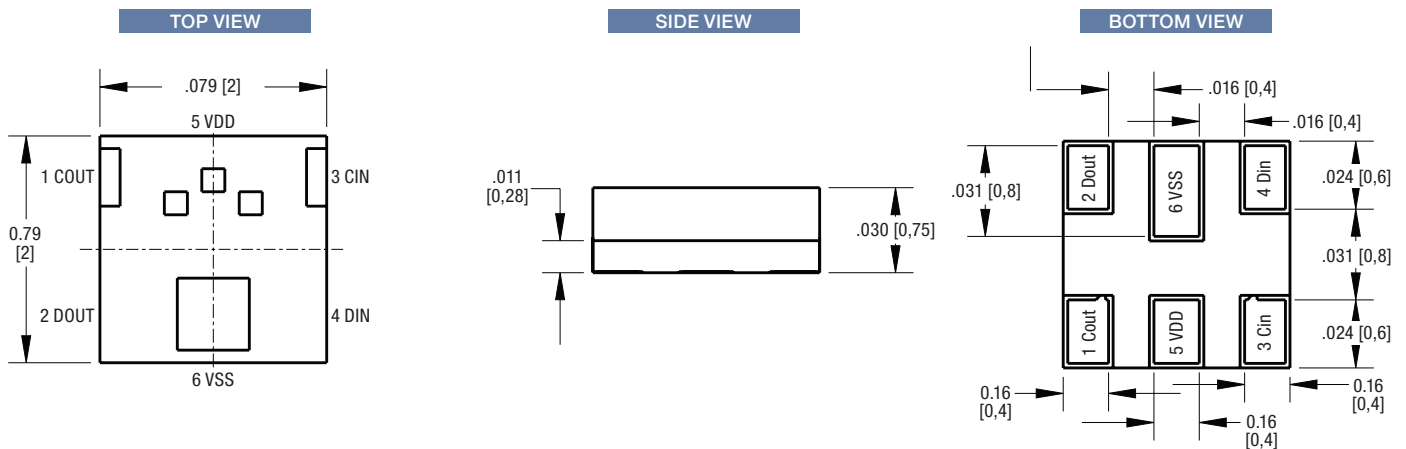
STANDARD PACKAGING:
3000 pcs on 7 inch Reel

MOISTURE SENSITIVITY LEVEL: 3

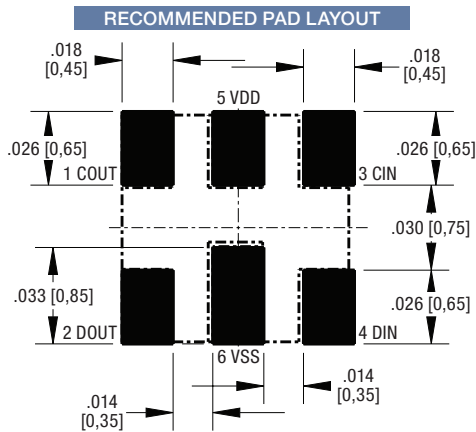## CERTIFICATIONS & RATINGS
ROHS Compliant

FEATURES & BENEFITS

- Dual Wire transmission LED with RGB intelligent driving control circuit and light emitting circuit.
- SMD 2020 package with control circuit and RGB LED chip creates a complete control of pixel, color mixing uniformity and consistency.
- The LED contains a signal decoding module, data buffer, a built-in constant current circuit, and RC oscillator.
- It uses CMOS process, low voltage and low power consumption.
- It has 256 level grayscale PWM adjustment and 32-step dimming control.
- The double data transmission, built-in support uninterrupted oscillation PWM output, can maintain a static image.

DIMENSIONS inches [mm]

TOP VIEW

.079 [2]

5 VDD

1 COUT   3 CIN

0.79 [2]

2 DOUT   4 DIN

6 VSS

SIDE VIEW

.011 [0,28]

.030 [0,75]

BOTTOM VIEW

.016 [0,4]
.016 [0,4]

2 Dout   6 VSS   4 Din

.031 [0,8]   .024 [0,6]

1 Cout   5 VDD   3 Cin

.031 [0,8]

.024 [0,6]

0.16 [0,4]   0.16 [0,4]

0.16 [0,4]

DIMENSIONS inches [mm]

RECOMMENDED PAD LAYOUT

.018 [0,45]
.018 [0,45]
5 VDD
.026 [0,65]
1 COUT
.026 [0,65]
3 CIN
.030 [0,75]
.033 [0,85]
2 DOUT
.026 [0,65]
4 DIN
6 VSS
.014 [0,35]
.014 [0,35]

PIN FUNCTION

Serial Number	Symbol	Function Description
1	COUT	Clock output
2	DOUT	Serial data output
3	CIN	Clock in
4	DIN	Serial data input
5	VDD	DC power input
6	VSS	Ground

ELECTRICAL - OPTICAL CHARACTERISTICS (Ta=25°C IF=20mA)

Items	Symbol		Material	Min	Typ	Max	Unit	Conditions
Luminous Intensity	Iv	R	AlInGaP	----	400	----	mcd	
		G	InGaN	----	800	----		
		B	InGaN	----	155	----		
Dominant Wavelength	λD	R		----	620	----	nm	VDD = 5V
		G		----	520	----		
		B		----	465	----		
Viewing Angle	2θ 1/2			----	120	----	deg	

ABSOLUTE MAXIMUM RATINGS (Ta=25°C, VDD=5V, VSS=0)

Parameter	Symbol	Ratings	Units
IC Power Supply Voltage	VDD	6.5	V
Rate of data signal	FCLK	15	MHZ
ESD voltage	VESD	2000	V
Soldering Temperature	TSD	260	°C
Operating Temperature Range	Topr	-40~ +85	°C
Storage Temperature Range	Tstg	-40 ~ +85	°C

TYPICAL ELECTRICAL & OPTICAL CHARACTERISTICS (Ta=25°C)

Items	Symbol	Min	Typ	Max	Unit	Test Conditions
Supply Voltage	VDD	3.3	5	5.5	V	
Rate of data signal	FCLK		5		MHZ	
Operation Current	Ioc			1.5	mA	VDD=5V RGB off
Standby Current	Isleep		1		uA	

Logic input control DIN/CIN

Items	Symbol	Min	Typ	Max	Unit	Test Conditions
Input high voltage	VIH	2.7		VDD+0.4	V	
Input low voltage	VIL	-0.4		1.0	V	
The clock high level widch	TckH	30			ns	
The clock low level widch	TckL	30			ns	
Data set up time	Tsetup	10			ns	
Data hold time	THold	5			ns	
The frequency of PWM	FPWM			20	KHz	

Logic output DOUT/COUT

Items	Symbol	Min	Typ	Max	Unit	Test Conditions
Output High "H"	VOH	4.5				4mA@VDD=5V
Output Low "L"	VOL			0.4 VDD	V	4mA@VDD=5V

COMMAND SET

32-bit 0's	FLAG[2:0]	DIMMING[4:0]	BLUE[7:0]	GREEN[7:0]	RED[7:0]	FLAG[2:0]	----	---	FLAG[2:0]	DIMMING[4:0]	----	RED[7:0]	N/2 # of dummy data ("1" or "0")
Start	LED 1					LED 2		N-1	LED N				Need extra N/2 of clocks

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.
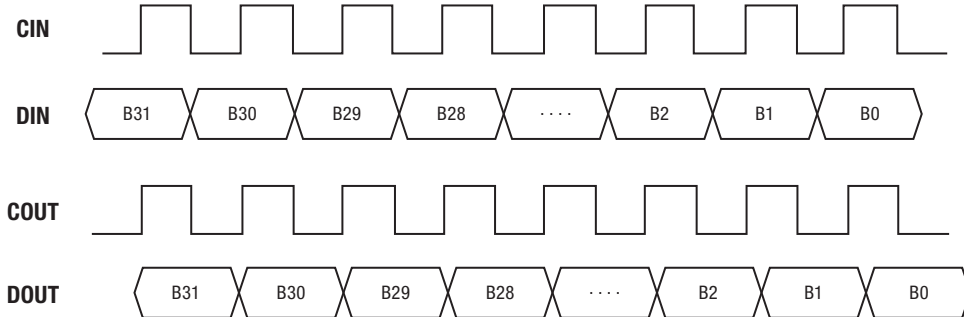
The serial command is transmitted with MSB first, DIN is latched at the rising edge of CIN clock. COUT and DOUT are re-generated for the next RGB LED. COUT is inverted from CIN. When 32 consecutive 0's are encountered, the next 1 is expected to start a 32-bit command, i.e., FLAG[2:0]=111. When FLAG[2:0]=111, 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")

LED1	32-bit 0's	LED1	LED2	LED3	---	32-bit 0's	LED1	LED2
LED2		32-bit 0's	LED2	LED3	---		32-bit 0's	LED2

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

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

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

BLUE [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 quiencent current of LED is approximately 1uA(typ.).

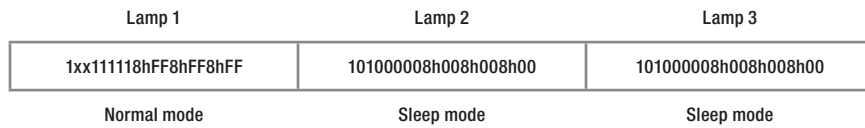**Command Setup to enable sleep or wake up mode**

When recieving 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.
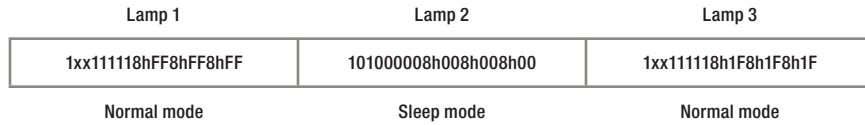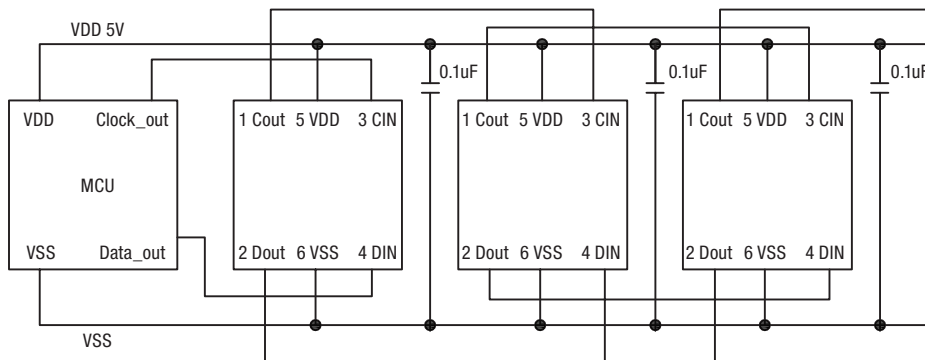
Sleep power-saving mode example:

32-bits 0	Flag[2:0]=3'b101	Dimming[4]=5'b00000	Blue[8'h00]	Green[8'h00]	Red[8'h00]	Sleep mode

Case 1:

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

Case 2:

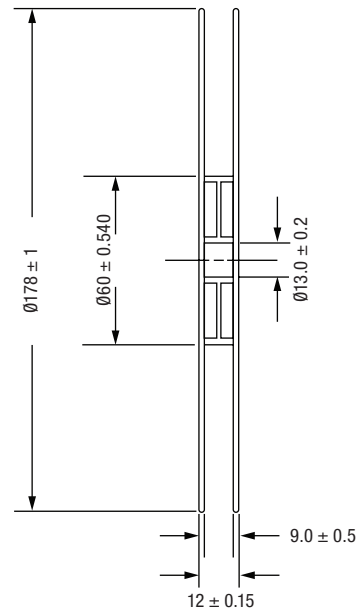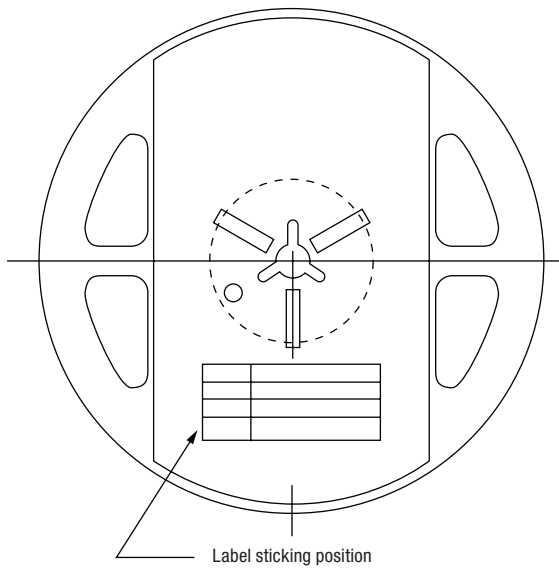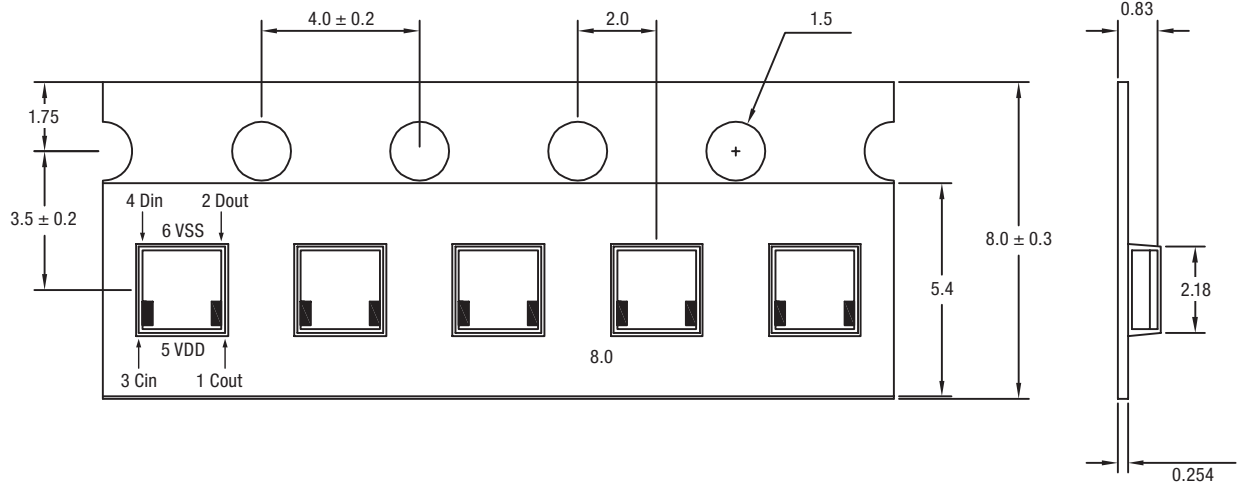| Lamp 1	Lamp 2	Lamp 3
1xx111118hFF8hFF8hFF	101000008h008h008h00	1xx111118h1F8h1F8h1F
Normal mode	Sleep mode	Normal mode

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.

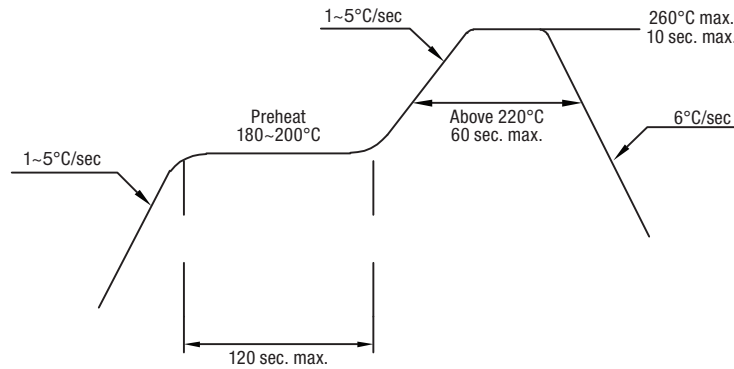RECOMMENDED ROUTE

TAPE AND REEL SPECIFICATION

4.0 ± 0.2   2.0   1.5

1.75

3.5 ± 0.2

4 Din   2 Dout
6 VSS

5 VDD
3 Cin   1 Cout

8.0

8.0 ± 0.3

5.4

0.83

2.18

0.254

Label sticking position

Ø178 ± 1

Ø60 ± 0.540

Ø13.0 ± 0.2

2.0 ± 0.2

9.0 ± 0.5

12 ± 0.15

Unit: mm

REFLOW SOLDERING

Recommended soldering paste specifications:

1. Operating temp.: Above 217 °C, 60~150 sec.

2. Peak temp.: 260 °C max, 10 sec max

3. Reflow soldering should not be done more than two times.

4. Never attempt next process until the component is cooled down to room temperature after reflow.

5. The recommended reflow soldering profile (measured on the surface of the LED terminal) is as following:

LEAD-FREE SOLDER PROFILE

1~5°C/sec
260°C max. 10 sec. max.
Preheat 180~200°C
Above 220°C 60 sec. max.
6°C/sec
1~5°C/sec
120 sec. max.