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587 SERIES

3228 PLCC Addressable RGB LED

SMD LED + IC

MECHANICAL / SPECIFICATIONS

PART NUMBER:
587-2086-247F

DIMENSIONS:
3.20 x 2.80 x 1.00mm

LENS COLOR: Clear

LENS MATERIAL: Silicone

CONTROL WIRES:
Dual Wire

STANDARD PACKAGING:
2000 pcs on 7 inch Reel

MOISTURE SENSITIVITY LEVEL: 5a

CERTIFICATIONS & RATINGS

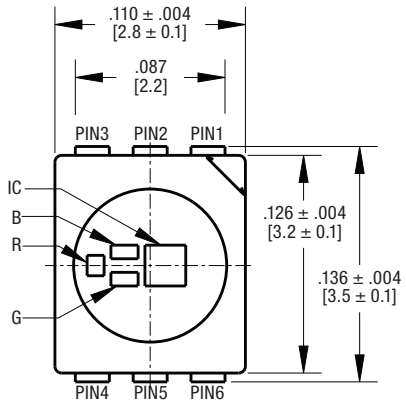
ROHS Compliant

FEATURES & BENEFITS

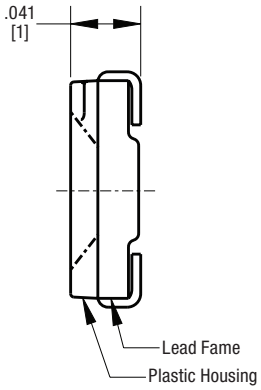
- Support signal reshaping to pass control waveforms to next adjacent driver
- Cascasing port transmission by dual-wire (clock and data) lines
- Built-in current regulator, three-way drive
- Maximal drive current: 5mA
- 256-step gray-scale output to allow 16,777, 216 color display
- 32-step dimming control
- Built-in oscillator 20MHz
- Maximum serial input data/clock frequency 15MHz
- Built-in power-on-reset (2.6V) (@VDD=5V)
- Built-in brown-out reset
- Operating voltage 3.3~5.5V
- Support sleep and wake up mode for power-saving

DIMENSIONS inches [mm]

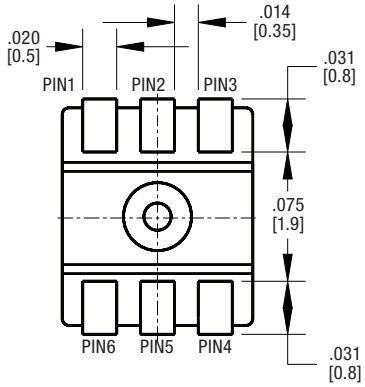
TOP VIEW



SIDE VIEW

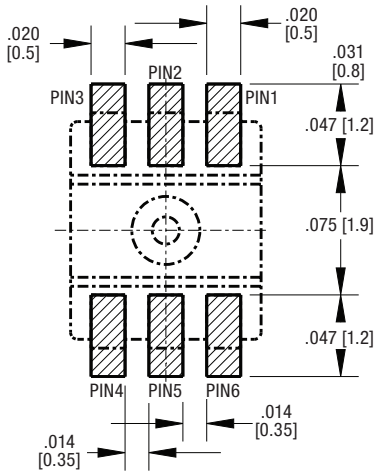


BOTTOM VIEW

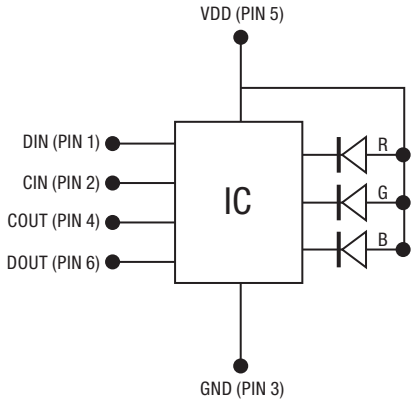


DIMENSIONS inches [mm]

RECOMMENDED PAD LAYOUT



LED SCHEMATIC



ELECTRICAL - OPTICAL CHARACTERISTICS **(25°C Ambient) IC@5V, RGB@5mA, Ts= 25°C**

Emitting Color	Material	Dominant Wavelength (nm)		Luminous Intensity (mcd)			Viewing Angle
		Min.	Max.	Min.	Typ.	Max.	
R	AlInGaP	620	626	90	155	226	120
G	InGaN	520	530	360	524	630	120
B	InGaN	460	472	56	73	90	120

ABSOLUTE MAXIMUM RATINGS **(TA=25°C)**

Symbol	Parameter	Rating	Units
V_{DD}	Supply Voltage	5.5	V
P_D	Total DC Current	15.75	mA
T_{OPR}	Operating Temperature Range	-40~+85	°C
T_{STO}	Storage Temperature Range	-65~+125	°C
V_{ESD}	ESD Voltage	4	kV

ELECTRICAL PARAMETERS **(TA=-20~+70°C , VDD=4.5~5.5V , VSS=0V)**

Symbol	Parameter	Min.	Typ.	Max.	Units	Test conditions
V_{DD}	Supply Voltage	3.3	5.0	5.5	V	-
I_{dyn}	Operation Current			1.5	mA	R,G,B no load (off)
I_{sleep}	Standby Current		1		μA	-

LOGIC INPUT CONTROL DIN/CIN

V_{IH}	Input High “H”	2.7		V_{DD}+0.4	V	-
V_{IL}	Input Low “L”	-0.4		1.0	V	-
R_{IN}	DIN Pull-up resistance @normal mode		80k		Ω	-
C_{FREQ}	CIN Frequency			15	MHz	-
T_{CKH}	CIN High pulse width	30			ns	-
T_{CKL}	CIN Low pulse width	30			ns	-
T_{SETUP}	DIN to CIN setup	10			ns	-
T_{HOLD}	DIN to CIN hold time	5			ns	-

LOGIC OUTPUT DOUT/COUT

V_{OH}	Output High “H”	4.5			V	I_{OH}=4mA
V_{OL}	Output High “L”			0.4	V	I_{OH}=4mA

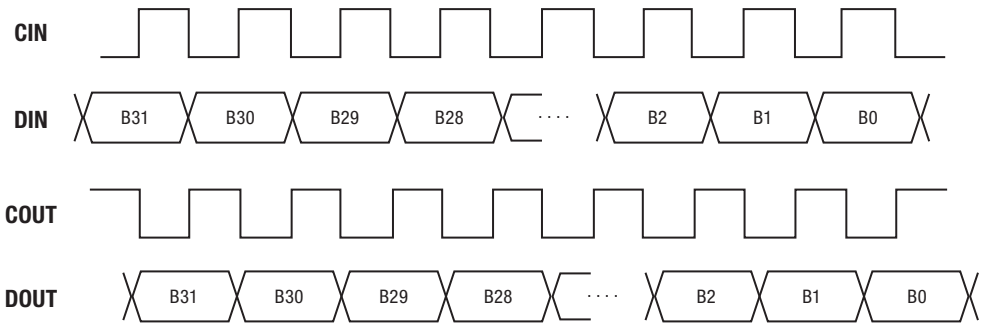
SINK CURRENT R/G/B

I_{SINK}	Sink Current	4.75	5	5.25	mA	@V_{DD}-Vf_{LED}≥1.0V
I_{Off}	R、G、B off leakage Current			1	uA	PWM off(0x00)

CASCADING DATA STRUCTURE

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]	32-bit 1
Start	LED 1					LED 2		N-1	LED N				End of Frame

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), the following 32 consecutive 1's denote the end of the current command for an RGB LED(End of Frame) and wait for next 32 consecutive 0's to start a new command set. (Note: LED is workable either with or without "End of Frame" command, but 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)

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

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

3228 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 quiescent current of 3228 LED 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), 3228 LED will enter sleep mode.

3228 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 3228 LED return to normal working mode within 1ms. Since it takes 1ms for a sleeping 3228 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:

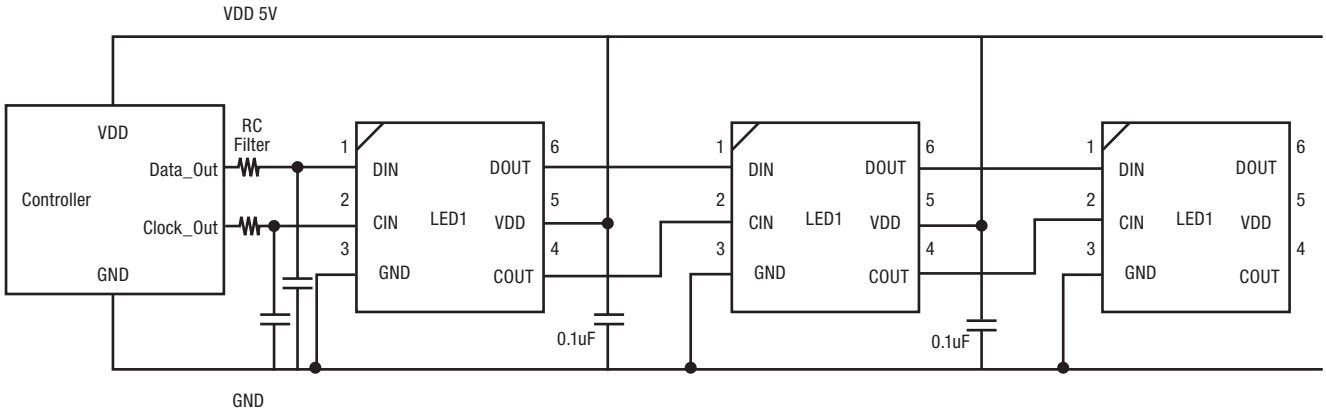
Lamp 1	Lamp 2	Lamp 3
1xx111118hFF8hFF8hFF	101000008h008h008h00	101000008h008h008h00
Normal mode	Sleep mode	Sleep mode

Case 2:

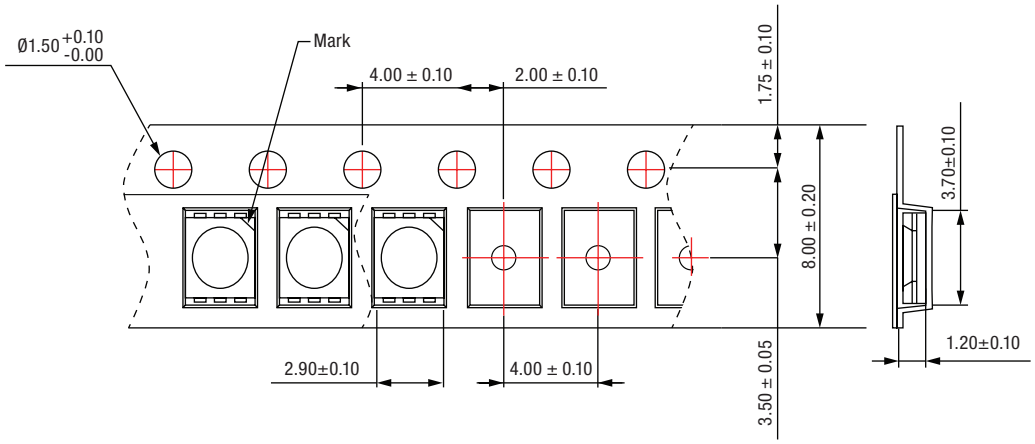
Lamp 1	Lamp 2	Lamp 3
1xx111118hFF8hFF8hFF	101000008h008h008h00	1xx111118h1F8h1F8h1F
Normal mode	Sleep mode	Sleep mode

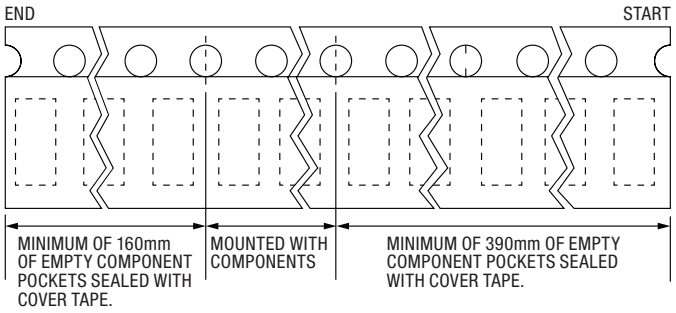
In case 2, while lamp2 is under sleep mode, in the following data transfer process, the state of lamp 2 will be not changed as long as the 32 bits data for lamp 2 is received with data of Flag [2:0]·DIMMING [4:0] being 8h"A0" . It means lamp2 will keep in sleep mode as well. In the situation, lamp2 can 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.

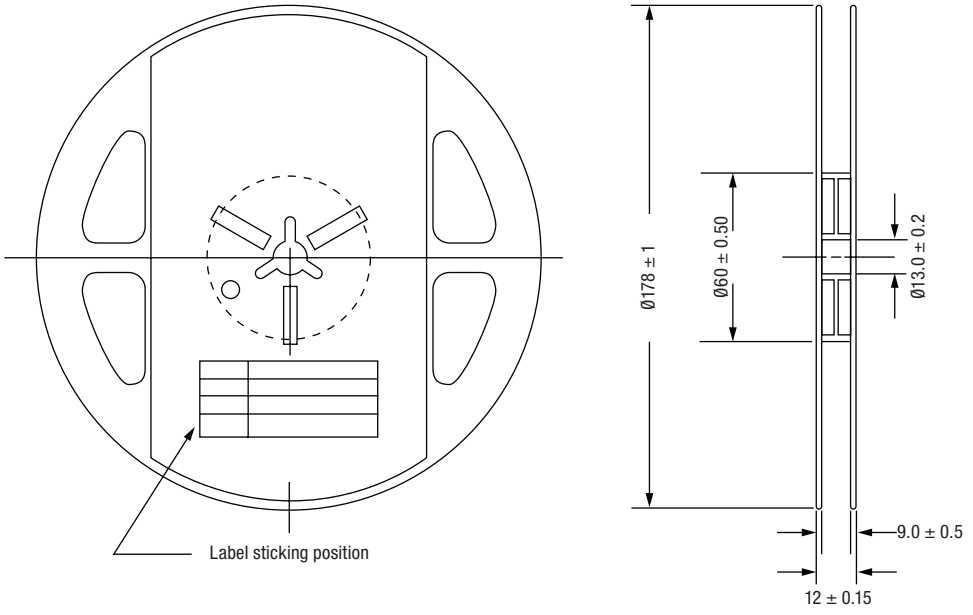
Typical Circuit of an RGB LED strip application



TAPE AND REEL SPECIFICATION







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