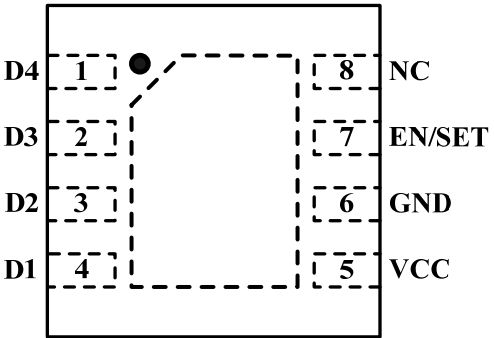
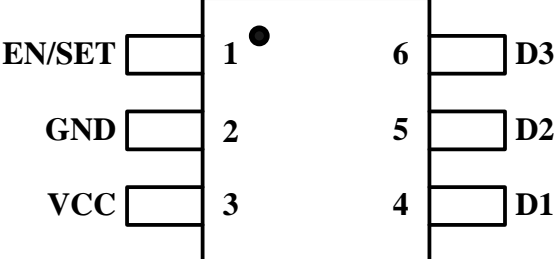


# IS31BL3212

## PIN CONFIGURATION

Package	Pin Configuration (Top View)
DFN-8	
SOT23-6	

## PIN DESCRIPTION

No.		Pin	Description
DFN-8	SOT23-6		
1	-	D4	White LED channel.
2~4	6~4	D3~D1	White LED channel.
5	3	VCC	Power supply input.
6	2	GND	Ground.
7	1	EN/SET	Serial digital input, control the output current. Internal 500kΩ pull down resistor.
8	-	NC	No connection.
	-	Thermal Pad	Connect to GND.

# IS31BL3212

## ORDERING INFORMATION

Industrial Range: -40°C to +85°C

Order Part No.	Package	QTY/Reel
IS31BL3212-DLS2-TR	DFN-8, Lead-free	3000
IS31BL3212-STLS2-TR	SOT23-6, Lead-free	

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Rev. C, 06/24/2014

# IS31BL3212

## ABSOLUTE MAXIMUM RATINGS

Supply voltage, $V_{CC}$	-0.3V ~ +6.0V
EN/SET voltage to GND, $V_{EN/SET}$	-0.3V ~ $V_{CC}+0.3V$
Maximum junction temperature, $T_{JMAX}$	+150°C
Storage temperature range, $T_{STG}$	-65°C ~ +150°C
Operating temperature range, $T_A$	-40°C ~ +85°C
ESD (HBM)	±3kV
ESD (CDM)	±1kV

**Note:** Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## ELECTRICAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$ , unless otherwise noted. Typical values are  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 3.6V$ . (Note 1)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
<b>Input Power Supply</b>						
$V_{CC}$	Operation range		2.7		5.5	V
$I_{IN}$	Operating current	$3.0 \leq V_{CC} \leq 5.5$ , active no load, current data = 1 (Note 2)		1.0		mA
$I_{SHDN}$	Shutdown current	$V_{EN/SET} = 0V$		1.0	2.6	μA
$V_{HR}$	Minimum headroom voltage (DX)	$I_{DX} = 15mA$ , $V_{CC} = 3.3V$		49		mV
$V_{HR}$	Minimum headroom voltage (DX)	$I_{DX} = 20mA$ , $V_{CC} = 3.3V$		60		mV
$I_{DX}$	Output current regulation	Data = 1 (Note 2)		23		mA
<b>EN/SET</b>						
$V_{EN/SET(L)}$	Enable threshold low	$V_{CC} = 2.7V$			0.4	V
$V_{EN/SET(H)}$	Enable threshold high	$V_{CC} = 5.5V$	1.4			V
$t_{EN/SET LO}$	EN/SET low time		0.3		75	μs
$t_{EN/SET HI\_MIN}$	Minimum EN/SET high time	(Note 3)	1.0			μs
$t_{EN/SET HI\_MAX}$	Maximum EN/SET high time	(Note 3)			92	μs
$t_{OFF}$	EN/SET off timeout		500			μs
$t_{LAT}$	EN/SET latch timeout		500			μs
$R_{EN/SET DOWN}$	EN/SET pull down resistor	(Note 3)		500		kΩ

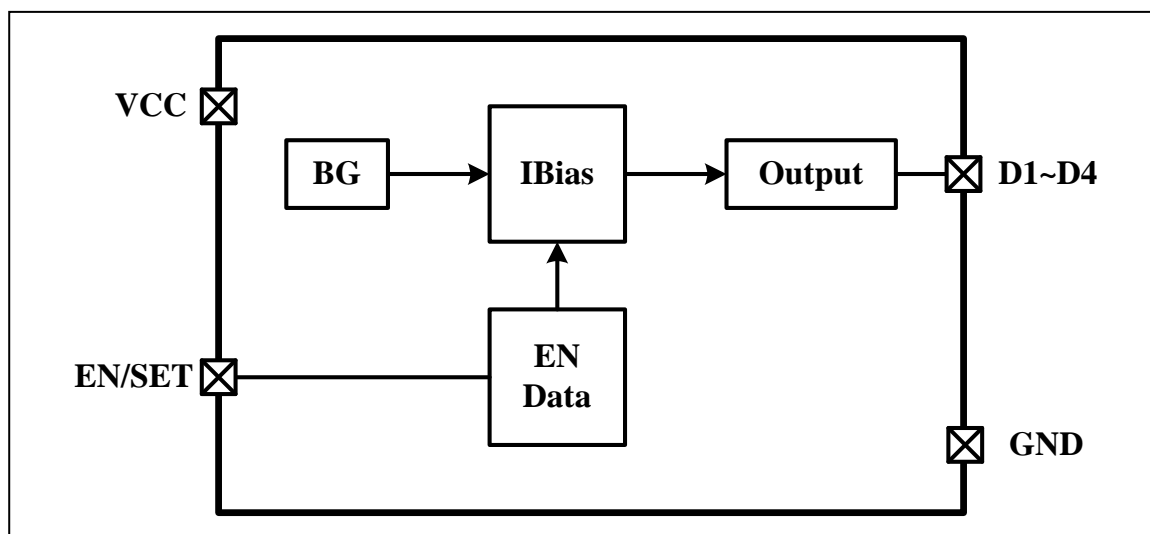
**Note 1:** The IS31BL3212 is production tested at room temperature but guaranteed to meet performance specifications over other temperature range by design, characterization, and correlation with statistical process controls.

**Note 2:** See PCC wire Serial Interface section in application information for more.

**Note 3:** Guaranteed by design.

# IS31BL3212

## FUNCTIONAL BLOCK DIAGRAM



# IS31BL3212

## APPLICATION INFORMATION

### OUTPUT CURRENT CAPABILITY

In order for the output currents to be regulated properly, sufficient headroom voltage ( $V_{HR}$ ) is required. The headroom voltage refers to the minimum amount of voltage that must be present across the current source in order to ensure the desired current is realizable. To ensure the desired current is obtained, apply the following equations to find the minimum input voltage required:

$$V_{CC} - V_{LEDX} \geq V_{HR}$$

Notice that if less than four LEDs connected, the left pin can be floating or connected to GND.

### FUNCTIONAL DESCRIPTION

The four constant current source outputs (D1 to D4) can drive four individual LEDs with a maximum current of 23mA each. The PCC wire serial interface enables the IS31BL3212 and sets the current source magnitudes.

### CONSTANT CURRENT OUTPUT LEVEL SETTINGS

The constant current source levels for D1 to D4 are set via the serial interface according to a logarithmic scale. For the whole 16 codes, each code is approximately 1.5dB lower than the previous code. In this manner, LED brightness appears linear with each increasing code count. Because the outputs D1 to D4 are true independent constant current sources, the voltage observed on any single given output will be determined by the actual forward voltage ( $V_F$ ) for the LED being driven.

Since the output current sources of the IS31BL3212 are programmable, no PWM (pulse width modulation) or additional control circuitry is needed to control LED brightness. This feature greatly reduces the burden on a microcontroller or system IC to manage LED or display brightness, allowing the user to "set it and forget it." With its high-speed serial interface (1MHz data rate), the output current of the IS31BL3212 can be changed successively to brighten or dim LEDs, in

smooth transitions (e.g., to fade-out) or in abrupt steps, giving the user complete programmability and real-time control of LED brightness.

### PCC WIRE SERIAL INTERFACE

The current level magnitude is controlled by Pulse Count Control (PCC wire) serial interface. The interface records rising edges of the EN/SET pin and decodes them into 16 different states. The 16 current level settings available are indicated in Table 1.

**Table 1: Current Level Setting**

Data	Output(mA/Ch)	Data	Output(mA/Ch)
1	23.0	9	5.8
2	19.6	10	4.8
3	16.1	11	4.1
4	13.8	12	3.5
5	11.8	13	2.8
6	9.9	14	2.1
7	8.1	15	1.4
8	6.9	16	0.7

The PCC wire serial interface has flexible timing. After data is submitted, EN/SET is held high to latch the data. Once EN/SET has been held in the logic high state for time  $T_{LAT}$ , the programmed current becomes active and the internal data register is reset to zero.

For subsequent current level programming, the number of rising edges corresponding to the desired code must be entered on the EN/SET pin.

### PCC WIRE SERIAL INTERFACE TIMING

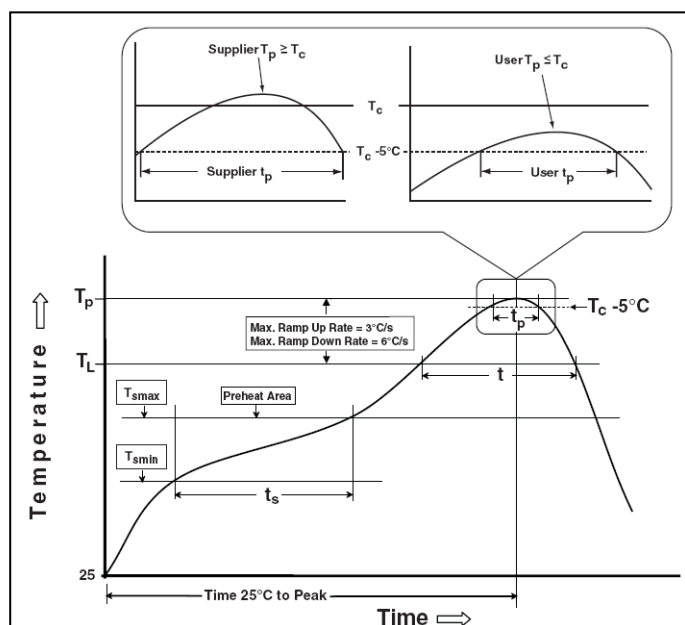
When EN/SET is held low for an amount of time greater than  $T_{OFF}$ , the IS31BL3212 enters into shutdown mode and draws 1.0 $\mu$ A typically from  $V_{CC}$ . The internal data register is reset to zero during shutdown.



# IS31BL3212

## CLASSIFICATION REFLOW PROFILES

Profile Feature	Pb-Free Assembly
<b>Preheat &amp; Soak</b> Temperature min (T <sub>smin</sub> ) Temperature max (T <sub>smax</sub> ) Time (T <sub>smin</sub> to T <sub>smax</sub> ) (t <sub>s</sub> )	150°C 200°C 60-120 seconds
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3°C/second max.
Liquidous temperature (T <sub>L</sub> ) Time at liquidous (t <sub>L</sub> )	217°C 60-150 seconds
Peak package body temperature (T <sub>p</sub> )*	Max 260°C
Time (t <sub>p</sub> )** within 5°C of the specified classification temperature (T <sub>c</sub> )	Max 30 seconds
Average ramp-down rate (T <sub>p</sub> to T <sub>smax</sub> )	6°C/second max.
Time 25°C to peak temperature	8 minutes max.

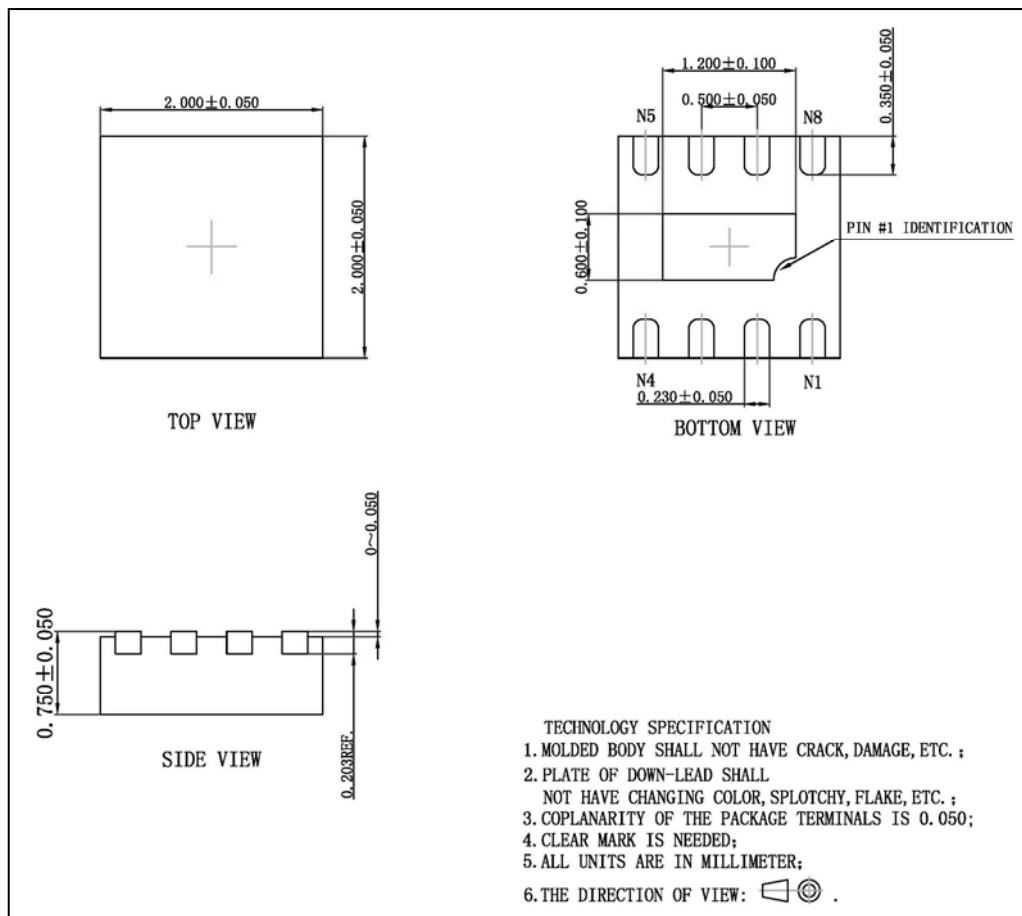


**Figure 3** Classification Profile

# IS31BL3212

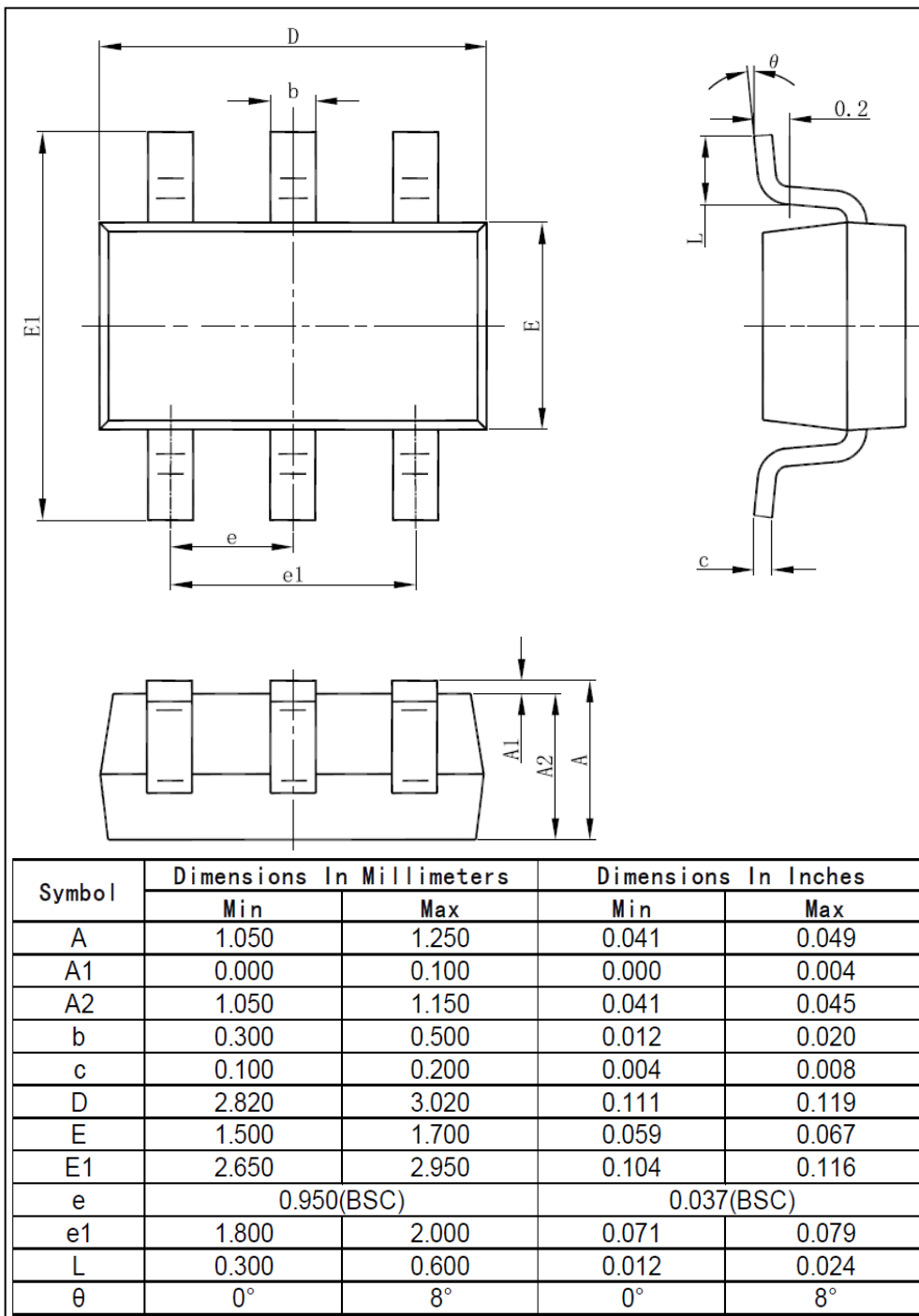
## PACKAGE INFORMATION

### DFN-8





## SOT23-6



**Note:** All dimensions in millimeters unless otherwise stated.