

SSD1030

Product Preview

Boost Regulating White LED drivers

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1 GENERAL DESCRIPTION

SSD1030 is a boost regulating white LED driver designed to drive up to 4 white LEDs in series with constant current.

LED brightness can be adjusted by PWM (Pulse Width Modulation) control or resistor value.

2 FEATURES

- V_{IN} operation range 2.4 to 5.0V
- Drive up to 4 LEDs at 3.0V supply
- High efficiency operations: over 80%
- 500KHz Switching Frequency
- Low shutdown current: 1uA max
- Digital brightness control by PWM method
- Analog brightness control by feedback resistor adjustment
- Low feedback voltage minimizes power loss
- TSOT23-5 pin package

3 ORDERING INFORMATION

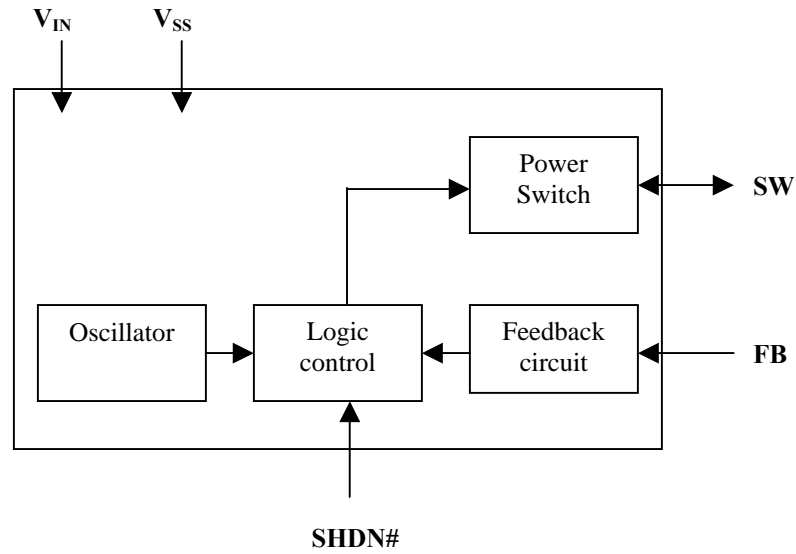
Table 3-1: Ordering Information

| Ordering Part Number | Package Form |
|----------------------|--------------|
| SSD1030JA02R3 | TSOT23-5 |

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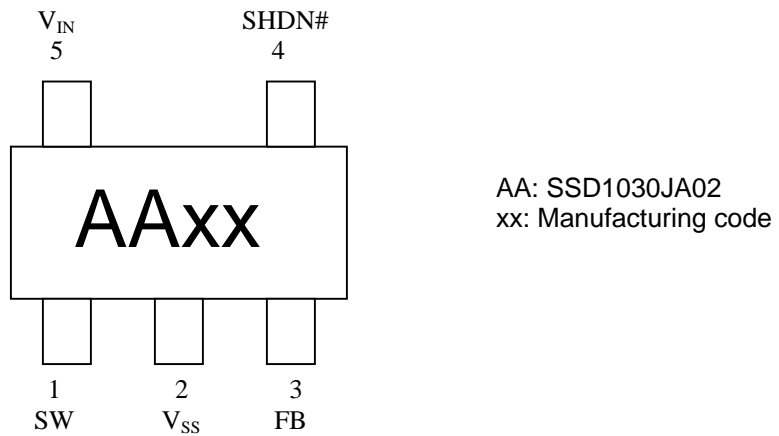
4 BLOCK DIAGRAM

Figure 4-1: Block diagram of SSD1030



5 SSD1030 PIN ASSIGNMENT AND MARKING

Figure 5-1: Pin assignment diagram (Topview)



6 PIN DESCRIPTIONS

Table 6-1: Pin Descriptions

| Pin Name | Type | Pin no. | Description |
|-----------------|------|---------|--|
| SW | IO | 1 | Power switch switching terminal connecting to external inductor and diode. The signal at SW has high frequency switching properties. Connecting trace should have minimized length to reduce EMI. |
| V _{SS} | P | 2 | Ground pin. |
| FB | IO | 3 | Feedback pin. A R _{FB} resistor connected between this pin and ground controlled the LED current (I _{LED}). Relationship between R _{FB} and I _{LED} is: $I_{LED} = \text{Reference voltage} / R_{FB}$ where Reference voltage is the voltage at FB, which is 95mV typical. |
| SHDN# | IO | 4 | Shutdown pin. H – Normal operation L – Shutdown mode |
| V _{IN} | P | 5 | Input Power supply. |

Note

⁽¹⁾ Normal operation is to connect the SHDN# pin with V_{IN}; Shutdown mode is to connect the SHDN# pin with V_{SS}.

7 FUNCTIONAL BLOCK DESCRIPTIONS

7.1 Feedback circuit

The feedback block senses the voltage at FB pin and maintains constant current output I_{LED} .

7.2 Logic Control

This is the main control logic block for the operation of the power switch.

When SHDN# connects to V_{IN} , it generates clocks to the power switch according to the feedback circuit sensing inputs.

When SHDN# connects to V_{SS} , IC operation turns off.

7.3 Oscillator

The internal oscillator generates clock signal for DC/DC switching operations.

7.4 Power Switch

The power switch is the basic element of a boost converter. The control logic block controls the on-off operation of the power switch to achieve boost up function.

8 INPUT VOLTAGE SETTING

For LED voltage required is larger than 14V, V_{IN} voltage should be larger than or equal to 3.0V.

9 LED CURRENT SETTING

The current passing through the LED can be set by external resistor R_{FB} (Refer to application circuit Figure 13-1)

The relationship between R_{FB} and I_{LED} is:

$$I_{LED} = \text{Reference voltage} / R_{FB}$$

where Reference voltage = 95mV typical

Table 9-1: I_{LED} Configuration Reference Table

| I_{LED} current (mA) | R_{FB} resistance (Ω) |
|--|---|
| 2 | 47.50 |
| 4 | 23.75 |
| 6 | 15.83 |
| 8 | 11.88 |
| 10 | 9.50 |
| 12 | 7.92 |
| 14 | 6.79 |
| 16 | 5.94 |
| 18 | 5.28 |
| 20 | 4.75 |

10 MAXIMUM RATINGS

Table 10-1: Maximum Ratings (Voltage Referenced to V_{SS})

| Symbol | Parameter | Value | Unit |
|----------------------|-----------------------|-------------|------|
| V _{IN} | Supply voltage | -0.3 to 6.0 | V |
| V _{SW} | Switch voltage | 18 | V |
| I _{OUT-MAX} | Output current drive | 25 | mA |
| T _A | Operating temperature | -40 to +85 | °C |
| T _{STG} | Storage temperature | -65 to +150 | °C |
| T _J | Junction temperature | 125 | °C |

Note

The device contains ESD protection with the following voltage level:

Human Body Model (HBM) ±2.0kV per JEDEC JESD22 standard for all pins.

Machine Model (MM) ±200V per JEDEC JESD22 standard for all pins except SW pin.

Machine Model (MM) ±150V for SW pin.

Latch-up Rating: ±200mA per JEDEC JESD78standard

Maximum ratings are those values beyond which damages to the device may occur. Functional operation should be restricted to the limits in the Electrical Characteristics tables or Pin Description section.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. Reliability of operation is enhanced if unused input is connected to an appropriate logic voltage level (e.g., either V_{SS} or V_{IN}). Unused outputs must be left open. This device is not radiation protected.

11 DC CHARACTERISTICS

Conditions:

Unless otherwise specified,
Voltage referenced to V_{SS}
 $V_{IN} = 3.0V$

Table 11-1: DC Characteristics

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|-----------------|--------------------------|-----------------------------------|---------------------|-----|---------------------|---------|
| V_{IN} | Operating voltage | | 2.4 | - | 5 | V |
| ISTD | Shut down supply current | | | | 1 | μA |
| IOP | Operating current | Quiescent current, No loading (1) | | | 250 | μA |
| V_{FB} | Feedback voltage | | 86 | 95 | 104 | mV |
| I_{SWLIM} | Switch current limit | | | 250 | | mA |
| $I_{SWLEAKAGE}$ | Switch leakage current | | | | 1 | μA |
| V_{IH} | Input Logic High Voltage | | $0.8 \times V_{IN}$ | | | V |
| V_{IL} | Input Logic Low Voltage | | | | $0.2 \times V_{IN}$ | V |

Note

⁽¹⁾ No loading condition applies only for the application circuit in Figure 13-1: Typical Application with Open Circuit Current Protection.

12 AC CHARACTERISTICS

Conditions:

Unless otherwise specified,
Voltage referenced to V_{SS}
 $V_{IN} = 3.0V$

Table 12-1: AC Characteristics

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|-----------------|---------------------|----------------|-----|-----|-----|------|
| F _{SW} | Switching frequency | $V_{FB}=0V$ | | | 600 | KHz |
| DCYC | Maximum duty cycle | | | 85 | | % |

13 APPLICATION EXAMPLES

Figure 13-1: Typical Application with Open Circuit Current Protection

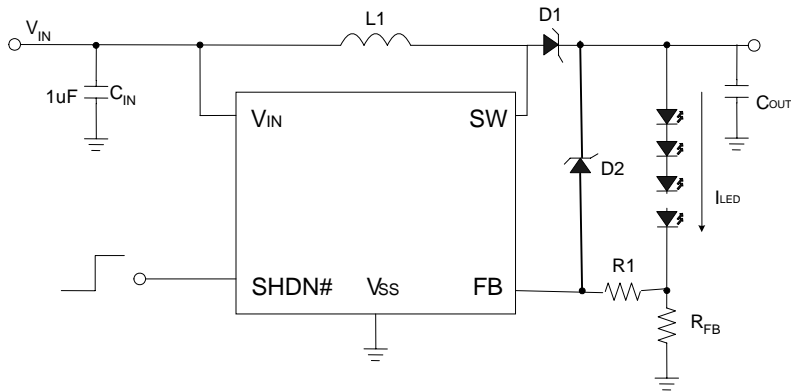


Table 13-1: Typical Component Values of Open circuit current protection application

| Components | Typical Value | Remark |
|------------|---------------------------|--|
| C_{IN} | 1uF, 16V | |
| C_{OUT} | 0.22uF, 25V | |
| D1 | 30V, 200mA | Schottky diode, e.g. On Semiconductors BAT54ALT1 |
| D2 | 18V, 0.1mA rating | Zener diode, DO-35 package, e.g. 1N4112 |
| L1 | 22uH, 300mA | |
| R_{FB} | 4.75 Ω , $\pm 1\%$ | Feedback resistor |
| R1 | 1k Ω , $\pm 5\%$ | |

Figure 13-2: Typical Application of Li-ion Powered Driver for 3 White LEDs

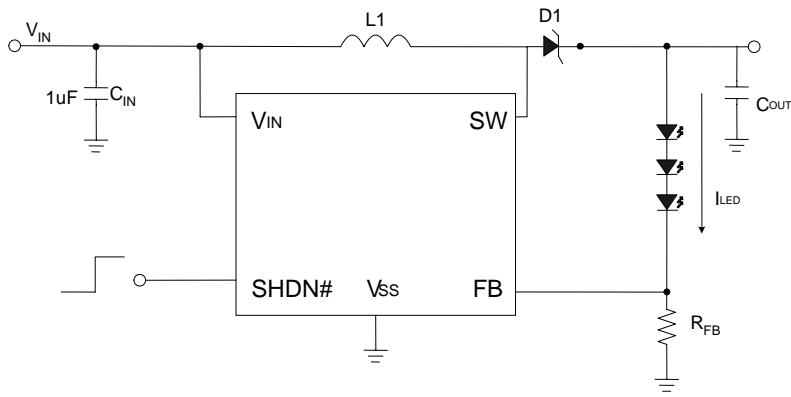
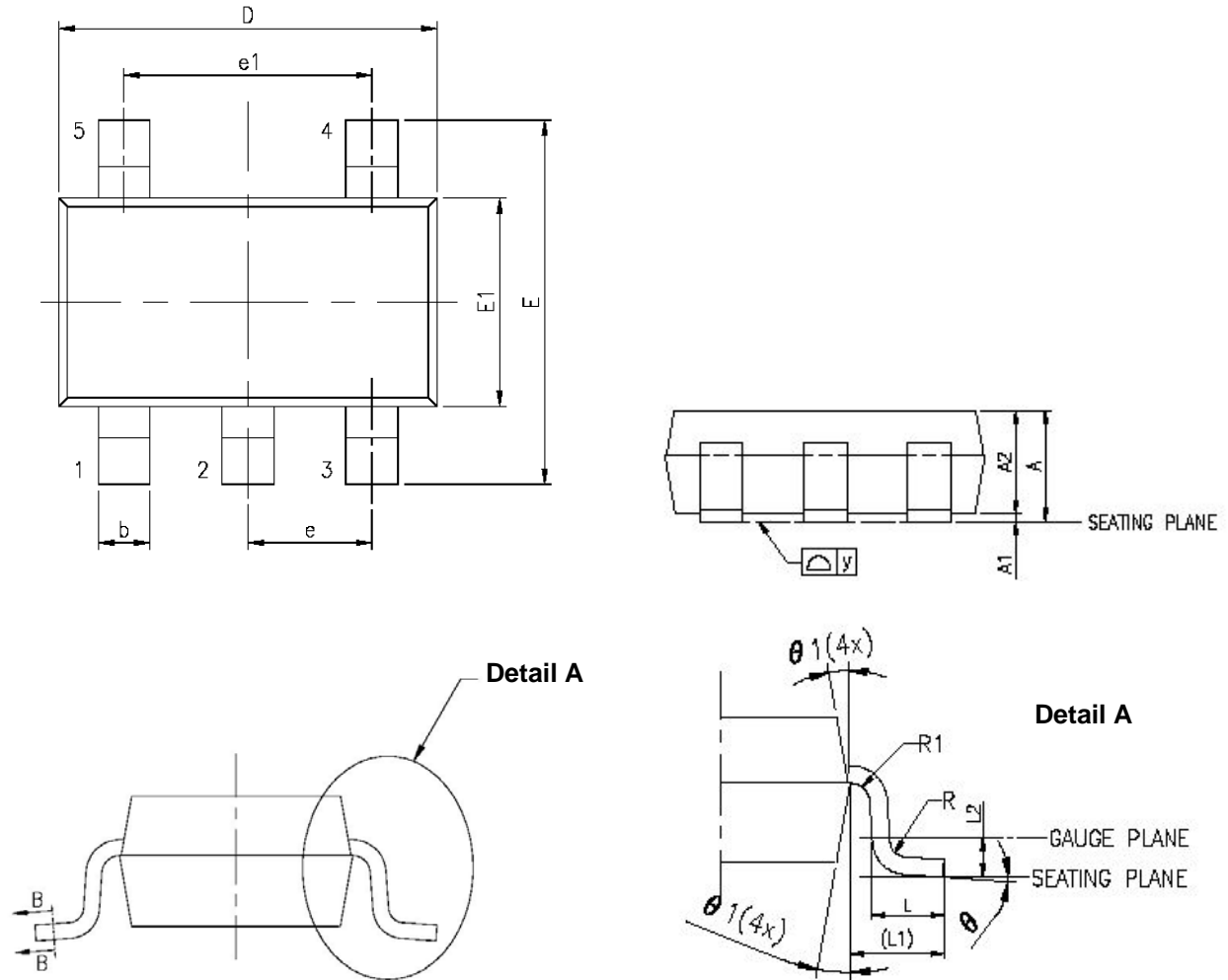


Table 13-2: Typical Component Values of typical application.

| Components | Typical Value | Remark |
|------------|--------------------|--|
| C_{IN} | 1uF, 16V | |
| C_{OUT} | 0.22uF, 25V | |
| D1 | 30V, 200mA | Schottky diode, e.g. On Semiconductors BAT54ALT1 |
| L1 | 22uH, 300mA | |
| R_{FB} | 5.6 ohm, $\pm 1\%$ | Feedback resistor |

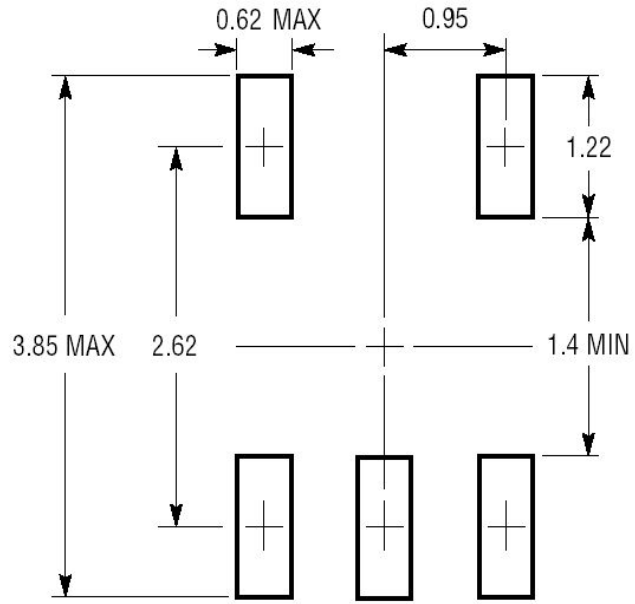
14 PACKAGE DIMENSIONS

Figure 14-1: Package Dimension



| SYMBOLS | DIMENSIONS IN MILLIMETERS | | |
|------------|---------------------------|---------|------|
| | MIN | TYPICAL | MAX |
| A | - | - | 1.1 |
| A1 | 0 | - | 0.1 |
| A2 | 0.7 | 0.9 | 1 |
| b | 0.3 | - | 0.5 |
| b1 | 0.3 | 0.4 | 0.45 |
| c | 0.08 | - | 0.2 |
| c1 | 0.08 | 0.13 | 0.16 |
| D | - | 2.9 | - |
| E | - | 2.8 | - |
| E1 | - | 1.6 | - |
| L | 0.3 | 0.45 | 0.6 |
| L1 | - | 0.6 | - |
| L2 | - | 0.25 | - |
| R | 0.1 | - | - |
| R1 | 0.1 | - | 0.25 |
| e | - | 0.095 | - |
| e1 | - | 1.9 | - |
| θ | 0° | 4° | 8° |
| θ_1 | 4° | 10° | 12° |

Figure 14-2: Recommended PCB Landing Pattern



Unit: mm

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