General Description
The AL3050 is a current mode Boost-type LED driver with programmable brightness dimming control for portable devices. With a 30V rated integrated MOSFET and power diode, the AL3050 can support up to 8 LEDs in series. The small solution size, advanced dimming features and high efficiency are suitable for LED backlight solutions for single cell Li-ion based equipment. The boost converter runs at 750kHz fixed switching frequency to reduce output ripple, improve conversion efficiency, and allows for the use of small external components.

The default LED current is adjustable by an external resistor at FB pin and the feedback voltage is regulated to 200mV typically. The AL3050 provides PWM dimming mode and 1-wire digital dimming mode for accurate LED current control from CTRL pin. In PWM dimming mode, the feedback reference voltage is changed with the PWM duty cycle proportionally and the available PWM frequency range is from 20kHz to 100kHz. In 1-wire digital dimming mode, it provides a programmable 32-step brightness dimming function with the CTRL pin setting.

The AL3050 provides protection functions including Under Voltage Lockout, Over Voltage Protection, Over Current Protection and Over Temperature Protection to protect the circuit.

The AL3050 is available in U-DFN2020-6 package.

Applications
- Feature Phones
- Smart Phones
- Portable Media Players
- Ultra Mobile Devices
- GPS Receivers
- Backlight for Small and Media Form Factor LCD Display

Key Features
- 2.7V to 5.5V Input Voltage Range
- 28V Open LED Protection (up to 8 LEDs)
- Integrated 0.7A/30V Internal MOSFET and Power Diode
- 200mV Reference with ±3% Accuracy
- 750kHz Switching Frequency
- Flexible Digital and PWM Brightness Control
- − 1-Wire Control Interface
- − PWM Dimming Control Interface
- Up to 100:1 PWM Dimming Ratio
- Integrated Loop Compensation
- Built-in Soft-Start
- Built-in OTP
- Built-in OCP
- Tiny Package with U-DFN2020-6 Package

AL3050EV1 Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Input Voltage</td>
<td>3VDC to 5VDC</td>
</tr>
<tr>
<td>LED Current</td>
<td>40mA</td>
</tr>
<tr>
<td>Number of LEDs</td>
<td>652P or 752P: 6 LEDs or 7LEDs in series per string, 2 strings in parallel</td>
</tr>
<tr>
<td>XYZ Dimension</td>
<td>87mm x 41mm x 10mm</td>
</tr>
</tbody>
</table>
**Connection Instructions**

- **Power Supply Input:** 3.6V\text{dc} (VIN, GND)
- **Enable Signal Input:** Connect Jumper to J4 by default
- **PWM Signal Input:** Remove Jumper on J4, apply PWM signal to CTRL (CTRL, GND)
- **One-Wire Digital signal Input:** Remove Jumper on J4, connect USB-TO-GPIO box to J3
- **LED Outputs:** Connect Jumper to J5 by default, Connect jumper to J6 and J6'(6S2P), J7and J7'(7S2P), J8and J8'(8S2P)
Evaluation Board Schematic

![Evaluation Board Schematic]

**Figure 3: Evaluation Board Schematic**
Quick Start Guide

1. By default, the evaluation board is preset at 40mA LED Current by R4 and R2.
2. Non-dimming operation: Connect the jumper to J4 by default.
3. Power Supply: Connect the 3.6Vdc to Vin & GND pin to supply the system and AL3050.
4. PWM Dimming: Remove the jumper on J4 of the default configuration; apply a PWM signal to CTRL pin to dim the LEDs. The recommended PWM signal frequency is from 20 kHz to 100 kHz, and the PWM duty is from 1% to 100%.
5. One-wire Dimming: Remove the jumper on J4 of the default configuration; connect one end of the USB-TO-GPIO box to the PC using the USB cable and the other end to J3, and run the software.
## Bill of Material

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Quantity</th>
<th>Package</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>U1</td>
<td>1</td>
<td>U-DFN2020-6</td>
<td>AL3050</td>
</tr>
<tr>
<td>2</td>
<td>L1</td>
<td>1</td>
<td>SMD</td>
<td>22uH, 1A, 0.24Ω</td>
</tr>
<tr>
<td>3</td>
<td>R1</td>
<td>1</td>
<td>0805</td>
<td>10Ω, 5% Precision</td>
</tr>
<tr>
<td>4</td>
<td>R2,R4</td>
<td>2</td>
<td>0805</td>
<td>10Ω, 1% Precision</td>
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<tr>
<td>5</td>
<td>R3</td>
<td>1</td>
<td>0805</td>
<td>4.7kΩ, 5% Precision</td>
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<tr>
<td>6</td>
<td>R5</td>
<td>1</td>
<td>0805</td>
<td>NC</td>
</tr>
<tr>
<td>7</td>
<td>C1,C4</td>
<td>2</td>
<td>0805</td>
<td>NC</td>
</tr>
<tr>
<td>8</td>
<td>C2,C3,C5</td>
<td>3</td>
<td>0805</td>
<td>1uF/16V, Ceramic X7R</td>
</tr>
</tbody>
</table>
Functional Waveforms

Waveforms:

- **Switching Waveform (Dimming Duty=100%)**
- **Switching Waveform (Dimming Duty=25%)**
- **Start-up Waveform (Dimming Duty=100%)**
- **Start-up Waveform (Dimming Duty=25%)**
Functional Waveforms

Waveforms:

![Waveform Diagrams]

- **Start-up Waveform (One-Wire mode)**
- **LED Open Protection**
Functional Data Curves

**Efficiency VS Vin (6S2P)**

**Efficiency VS Duty cycle (6S2P)**

**Efficiency VS Vin (7S2P)**

**Efficiency VS Duty cycle (7S2P)**
Functional Data Curves

**PWM Dimming**

- $I_{PWM}=40kHz$, $V_{in}=3.6V$
- $L=22\mu H$, $I_{sat}=1A$, $DCR=0.24\text{ohm}$
- $6S2P(V_{out}=19.7V, I=40\text{mA})$
- $R_{FB}=10R/10R=5R$

**One-wire Dimming**

- $V_{in}=3.6V$
- $L=22\mu H$, $I_{sat}=1A$, $DCR=0.24\text{ohm}$
- $6S2P(V_{out}=19.7V, I=40\text{mA})$
- $R_{FB}=10R/10R=5R$
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