1 General Description

The LM3519 evaluation board is a working demonstration of a step up DC-DC converter. The LM3519 drives up to four white LEDs with a constant current to provide LCD backlighting in handheld devices. The LED current is internally set to 20 mA eliminating the use of external resistor. The series connection allows the LED current to be identical for uniform brightness and minimizes the number of traces to the LEDs. Brightness control is achieved by applying a PWM signal on the En pin with frequencies up to 30 kHz. A proprietary PFM architecture implementation results in non pulse skipping variable frequency operation over input voltage range permitting the use of low-cost, small external components. For further information and electrical characteristics, see the LM3519 High Frequency Boost White LED Driver with High-Speed PWM Brightness Control Data Sheet (SNVS394).

2 Operating Conditions

- Junction temperature (T_J) range: -40°C to +125°C
- Ambient temperature (T_A) range: -40°C to +85°C
- Input Voltage Range: 2.7 V to 5.5 V
- I_OUT = 20 mA

Package
- SOT 23 - 6 pin

3 Typical Application

Figure 1. Typical Application Circuit
4  Connection Diagram and Package Information

![Figure 2. SOT23-6, Top View](image)

Table 1. Pin Descriptions (SOT23-6)

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>En</td>
<td>Device Enable Connection</td>
</tr>
<tr>
<td>2</td>
<td>Gnd</td>
<td>Ground Connection</td>
</tr>
<tr>
<td>3</td>
<td>V\textsubscript{OUT}</td>
<td>Output Voltage Connection</td>
</tr>
<tr>
<td>4</td>
<td>LED_rtn</td>
<td>White LED Current Sensing Input Connection</td>
</tr>
<tr>
<td>5</td>
<td>Sw</td>
<td>Drain Connection of the Internal Power Field Effect Transistor (FET) Switch</td>
</tr>
<tr>
<td>6</td>
<td>\textbf{V\textsubscript{IN}}</td>
<td>Input or Supply Voltage Connection</td>
</tr>
</tbody>
</table>

5  PWM Dimming

If a pulse width modulation (PWM) signal is used to adjust the brightness, a control signal frequency between 17 kHz to 30 kHz is recommended. Although the LM3519 is capable of operating outside this frequency range, it is not recommended to operate below 17 kHz for the following reasons:

- Frequency below 100Hz is likely to cause visible flicker in the light emitted by the LED string
- Frequency below 17 kHz may induce audible noise due to combinations of some capacitance and PCB

A PWM frequency above 30 kHz is possible but the current linearity vs duty cycle will be affected. If it is not possible to operate the dimming control above 17 kHz, audible noise emission can be minimized by using capacitors with low susceptibility to piezoelectric induced stresses, such as poly film designs. Minimum audible noise is most likely to occur when the PWM frequency is less than 2 kHz. It is recommended that any application using a PWM control signal below 17 kHz be thoroughly evaluated for undesirable audible noise.

6  Layout Guidelines

The input capacitor, \(C\text{\textsubscript{in}}\), must be placed close to the LM3519. Placing \(C\text{\textsubscript{in}}\) close to the device will reduce the metal trace resistance effect on input voltage ripple. Metal trace connections for the \(C\text{\textsubscript{out}}\) capacitor can increase the effective series resistance, which affects output voltage ripple and efficiency. Trace connections to the inductor should be short and wide to reduce power dissipation, increase overall efficiency and reduce EMI radiation. The diode, like the inductor, should have trace connections that are short and wide to reduce power dissipation and increase overall efficiency. For more details regarding layout guidelines for switching regulators, see *AN-1149 Layout Guidelines for Switching Power Supplies* (SNVA021).
Evaluation Board Layout

Figure 3. Top Layer

Figure 4. Bottom Layer
### Table 2. Bill of Materials (BOM) For Common Configurations

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Value</th>
<th>Specification</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>LM3519</td>
<td>SOT23-6</td>
<td>Texas Instruments</td>
</tr>
<tr>
<td>Cin</td>
<td>4.7 uF, 6.3 V, 0603</td>
<td>AVX06033D475MAT</td>
<td>AVX</td>
</tr>
<tr>
<td>Cout</td>
<td>1 µF, 25 V, 0603</td>
<td>AVX06033D105MAT</td>
<td>AVX</td>
</tr>
<tr>
<td>D1</td>
<td>Schottky Diode</td>
<td>CMMSH1-40</td>
<td>Central Semiconductor</td>
</tr>
<tr>
<td>L1</td>
<td>2.2 µH</td>
<td>LPO3310-222ML</td>
<td>CoilCraft</td>
</tr>
<tr>
<td>LED1-4</td>
<td>LWT67C</td>
<td>Hyper Topled</td>
<td>Osram Opto Semiconductors</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Pin</th>
<th>Description</th>
<th>Size</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>V&lt;sub&gt;In&lt;/sub&gt;</td>
<td>Turret</td>
<td>0.09in</td>
<td>1</td>
</tr>
<tr>
<td>GND</td>
<td>Turret</td>
<td>0.09in</td>
<td>1</td>
</tr>
<tr>
<td>EN</td>
<td>Turret</td>
<td>0.09in</td>
<td>1</td>
</tr>
<tr>
<td>SW</td>
<td>Turret</td>
<td>0.09in</td>
<td>1</td>
</tr>
<tr>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>Turret</td>
<td>0.09in</td>
<td>1</td>
</tr>
</tbody>
</table>
IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have not been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products
- **Audio**: www.ti.com/audio
- **Amplifiers**: www.ti.com/amplifier
- **Data Converters**: dataconverter.ti.com
- **DLP® Products**: www.dlp.com
- **DSP**: dsp.ti.com
- **Clocks and Timers**: www.ti.com/clocks
- **Interface**: interface.ti.com
- **Logic**: logic.ti.com
- **Power Mgmt**: power.ti.com
- **Microcontrollers**: microcontroller.ti.com
- **RFID**: www.ti-rfid.com
- **OMAP Applications Processors**: www.ti.com/omap
- **Wireless Connectivity**: www.ti.com/wirelessconnectivity

### Applications
- **Automotive and Transportation**: www.ti.com/automotive
- **Communications and Telecom**: www.ti.com/communications
- **Computers and Peripherals**: www.ti.com/computers
- **Consumer Electronics**: www.ti.com/consumer-electronics
- **Energy and Lighting**: www.ti.com/energy
- **Industrial**: www.ti.com/industrial
- **Medical**: www.ti.com/medical
- **Security**: www.ti.com/security
- **Space, Avionics and Defense**: www.ti.com/space-avionics-defense
- **Video and Imaging**: www.ti.com/video

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2013, Texas Instruments Incorporated