LM5175 LED Dimming Reference Design Test Report

TI number: PMP10592 Rev A

$V_{\text{IN}}$: 6V-42V
$V_{\text{OUT}}$: 35V (max)
$I_{\text{OUT}}$: 1.1 A constant current

Test Results
1 Circuit Description

The reference design contains a complete LM5175 based buck-boost converter and a driver and FET for PWM dimming. This design has been optimized for the 12-V automotive supply rail with support for cold-crank profile based on ISO 7637-2 pulse 4. The design provides 1.1-A constant current output to a string of 8 LEDs.

The reference design uses the average current loop available in LM5175. The average current sense pins (ISNS+/−) have a wide dynamic range extending from ground to the higher of VIN or VOUT. This allows the current loop to be configured for either low or high side current sensing. High side current sensing provides more robust current limiting in faults and is used in this reference design.
2 Photos

(top view: power stage)

(bottom view: LM5175 controller)
## 3 Steady State Switch Node Waveforms

<table>
<thead>
<tr>
<th>CH1: SW1</th>
<th>CH2: SW2</th>
<th>VIN</th>
<th>PWM</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN=8V</td>
<td>PWM: 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIN=14V</td>
<td>PWM: 100%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CH1: SW1
CH2: SW2
VIN=18V
PWM: 100%

CH1: SW1
CH2: SW2
VIN=42V
PWM: 100%
4 Steady state LED current waveforms (VIN=14V)

CH2: IOUT (PWM=10%)

CH2: IOUT (PWM=40%)

CH2: IOUT (PWM=60%)
CH2: IOUT (PWM=100%)
5 Steady State (VIN=8V)

CH2: IOUT (PWM=10%)

CH2: IOUT (PWM=40%)

CH2: IOUT (PWM=60%)
CH2: IOUT (PWM=100%)
6 Steady State (VIN=18V)

CH2: IOUT (PWM=10%)

CH2: IOUT (PWM=40%)

CH2: IOUT (PWM=60%)
CH2: IOUT (PWM=100%)
7 Cold-Crank Performance

Cold-Crank Test Setup (Using TI Cold Crank Simulator)
Cold Crank Performance: TI’s cold crank simulator was used to create the input profile. The input dips from 12V nominal to approximately 6V following ISO 7637-2 pulse 4 profile.

(Blue CH2: VIN, Green CH4: IOUT (1.1A PWM current to LED string))

Previous waveform zoomed in to show that there is no change in LED output current before and after the VIN drop

(Blue CH2: VIN, Green CH4: IOUT (1.1A PWM current to LED string))
8 Short Circuit Protection

Overload protection with a 2Ω load resistor. (CH1: VOUT, CH4: IOUT)
Efficiency vs Input Voltage (IOUT=1.1A, output in constant current mode)
9 Thermal Images

VIN=14V, PWM=100% (ILED=1.1A)
VIN=8V, PWM=100% (ILED=1.1A)
VIN=8V, PWM=100% (ILED=1.1A)
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