Introduction

This application note is dedicated to the STLD40D, it’s a boost converter that operates from 3.0 V to 5.5 V dc and can provide an output voltage as high as 37 V DC and can drive up to 10 white LEDs in series.

Figure 1. Package

![Package Diagram]

Figure 2. Pin configuration

![Pin Configuration Diagram]

V<sub>i</sub>  SW  SW
R<sub>SET</sub>  EN  EN
GND  V<sub>0</sub>  V<sub>0</sub>
FB  N.C.  N.C.
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1 Schematic description

The converter is a PFM (pulse frequency modulation) inductor switcher and can work in discontinuous (DCM) as well as continuous (CCM) Mode operation. The output current capability is 20 mA with an output voltage of 37Vdc. The regulation is done by sensing the LED current through resistor $R_{LED}$. The device can be turned ON/OFF through the logic enable signal pin EN. By applying a low frequency PWM signal the WLEDs can be dimmed.

The maximum peak inductor current can be programmed by connecting a resistor $R_{SET}$ to pin $R_{SET}$.

1.1 Application schematic

Figure 3. Typical application schematic

![Typical application schematic](image)
2 Selection of external components

2.1 Input and output capacitor selection

For input and output capacitor it is recommended to use a ceramic capacitor with low ESR. For good stability of the device supplied by a low input voltage of 3.0 V at maximum ratings of output power, it is recommended to use 2.2 µF / 6.3 V as a minimum value of input capacitor and 4.7 µF / 40 V as a minimum value of output capacitor.

2.2 Inductor selection

Shielded thick inductor with low DC series resistance of wiring is recommended for this application. For good efficiency it is recommended to use inductor with series DC resistance $R_{DCL} = R_D/10$, $[\Omega; 1, \Omega]$ where $R_D$ is the dynamic resistance of the LED $[\Omega; 1, \Omega]$. For nominal operation, the peak inductor current can be calculated by this formula:

Equation 1

$$I_{\text{OUT}} + \frac{(V_{\text{OUT}} - V_{\text{IN}}^2)}{(2 \cdot L \cdot F \cdot V_{\text{OUT}}^2)}$$

Where:

- $I_{\text{PEAK}}$ Peak inductor current
- $I_{\text{OUT}}$ Current sourced at the VOUT pin
- $n$ Efficiency of the STLD40D
- $V_{\text{OUT}}$ Output voltage at pin VOUT
- $V_{\text{IN}}$ Input voltage at pin VIN
- $L$ Inductance value of the inductor
- $F$ Switching frequency

2.3 LED selection

All LEDs with forward voltage from 2.7 V to 5 V are feasible for use with device STLD40D. The LED forward voltage must include the voltage spread of this value. The current in the LED can be set through the sensing resistor value.
### Table 1. Recommended components

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
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<td></td>
<td></td>
<td>VRRM</td>
<td>40</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_T at I_T = 300 mA, T_J = 25 °C</td>
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<td>V</td>
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<td>µA</td>
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<td>D</td>
<td>Boost schottky diode</td>
<td>STPS1L40M</td>
<td>VRRM</td>
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<td>Ceramic type</td>
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<td>C_out</td>
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<td></td>
<td></td>
<td></td>
<td>Voltage</td>
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<td>ESR</td>
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<td>L</td>
<td>Boost inductor (height&lt;2mm)</td>
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<td>I_satRSET=GND</td>
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Selection of external components

Figure 4. $I_{\text{LED}}$ vs. $R_{\text{LED}}$

- $V_i = 4V$
- $V_{\text{th}} = 3V$
- $R_{\text{set}} = V_i$
- 10W LED load ($V_{\text{D}} = 32V$)

Figure 5. $I_{\text{LIMIT}}$ vs. $R_{\text{SET}}$

- $V_{\text{EN}} = 3V$
- $R_{\text{LED}} = 8\Omega$
- $V_i = 3V$
- $V_\Phi = 8.5V$

Figure 6. $\gamma$ vs. $V_i$

$V_{\text{EN}} = 3V$, $R_{\text{SET}} = V_i$, $R_{\text{LED}} = 8\Omega$, $V_{\text{D}} = 32V$

Figure 7. $I_{\text{LED}}$ vs. duty cycle EN pin (dimming)

$V_i = 3V$, $R_{\text{SET}} = V_i$, $R_{\text{LED}} = 8\Omega$, $V_{\text{EN}} = 0V$ to $3V$ (Ω), Freq = 1kHz, 5kHz, 10kHz
3 PCB design

3.1 PCB design rules

STLD40D is a powerful switched device. The PCB must be designed in line with the rules for designing switched supplies. The power windings must be as short as possible and wide, because of large current. It is recommended to use a dual layer PCB minimal. Place all external components close to the STLD40D. Also switched high-energy loops should be as small as possible to reduce EMI.

Figure 8. PCB layout - Top overlay view
4 Revision history

Table 2. Document revision history

<table>
<thead>
<tr>
<th>Date</th>
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<th>Changes</th>
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<tr>
<td>20-Mar-2006</td>
<td>1</td>
<td>Initial release</td>
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<tr>
<td>19-May-2006</td>
<td>2</td>
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<tr>
<td>01-Jun-2011</td>
<td>3</td>
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