FP6755

High-Efficiency, 29V White LED Driver with Dimming Control Converter in Tiny Package

Features

Description

The FP6755 is a step-up DC/DC converter specifically designed for driving WLEDs with a constant current. The FP6755 can drive up 8 white LEDs in series from a Lithium Lon battery. Series connection of LEDs provides identical LED current for uniform brightness and minimizes the number of traces to the LEDs. The FP6755 uses current mode, fixed frequency of approximately 1.3MHz architecture to regulate the LED current through an external current sense resistor. The low feedback voltage of 195mV can minimize power dissipation. Other features include current limit protection, thermal shutdown protection, under-voltage lockout (UVLO), and over-voltage function, which can shut off the device if output voltage reaches above 29V. The FP6755 is available in space saving SOT-23-6, TSOT-23-6 and TDFN-6 (2mm×2mm) packages.

Wide Range for PWM Dimming, Ranging from 100Hz to 50kHz

High Efficiency: 87% Drives up to 8 WLEDs

Fast 1.3MHz Switching Frequency Low 195mV Feedback Voltage Over Voltage Protection

Low Profile SOT-23-6 , TSOT-23-6 and TDFN-6 (2mm×2mm) Packages RoHS Compliant

Applications

Cellular Phone Digital Camera

LCD Panel Backlight GPS Receiver

PDA, Handheld Computer

Part Number	Product Code
FP6755S6CTR	**FG4**

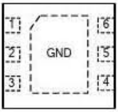
Part Number	Product Code
FP6755S9CTR	**FG5**

Part Number	Product Code
FP6755WDCTR	**FG6**

TR: Tape/Reel C: Green

Package Type S6: SOT-23-6 S9: TSOT-23-6

WD: TDFN-6 (2mm×2mm)



WD Package (TDFN-6 (2mm×2mm))

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Typical Application Circuit

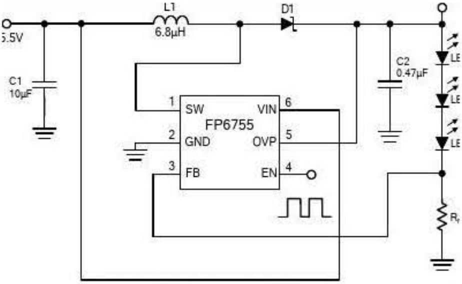

Figure 2. Typical Application Circuit of FP6755 (SOT-23-5 and TSOT-23-6 Package)

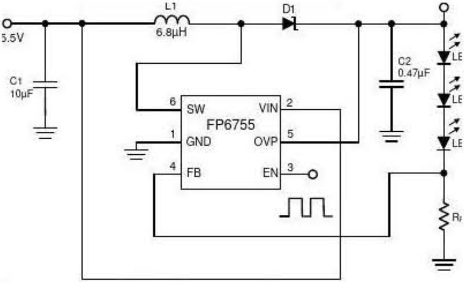

Figure 3. Typical Application Circuit of FP6755 (TDFN-6 Package)

Functional Pin Description

Pin Name	Pin No. (SOT-23-6) (TSOT-23-6)	Pin No. (TDFN-6)	Pin Function
SW	1	6	Switch Node Pin. Connect inductor/diode here. Minimize trace area at this node to reduce EMI.
GND	2	1	Ground Pin. Connect directly to local ground plane.
FB	3	4	Feedback Pin. Reference voltage is 195mV. Connect cathode of the lowest LED and resistor here. Calculate resistor value according to the formula: $R_{FB}=V_{FB}/I_{LED}$
EN	4	3	Enable and dimming control 1. Enable: Logic high enables the device; logic low forces the device into shutdown mode. 2. Digital dimming control: apply external 100Hz to 50kHz PWM pulse signal with amplitude greater than 1.5V.
OVP	5	5	Over Voltage Input. OVP measures the output voltage for open circuit protection. Connect OVP to the output at the top of the LED string.
VIN	6	2	Input Supply Pin. Must be locally bypassed.

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Block Diagram

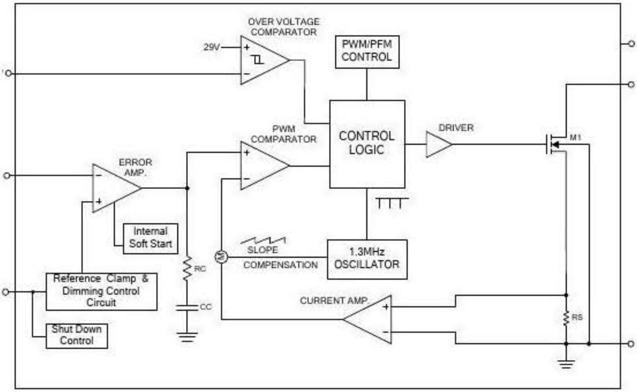

Figure 4. Block Diagram of FP6755

Absolute Maximum Ratings

- VIN -- +6V
- SW Voltage -- +34V

- FB Voltage -- +6V
- EN Voltage -- +6V
- Maximum Junction Temperature (TJ) -- +150ºC

@TA=25℃, (PD)

- Power Dissipation SOT-23-6/TSOT-23-6 -- + 0.40W

TDFN-6 (2mm×2mm) -- +1.25W

- Package Thermal Resistance, (θJA)

SOT-23-6/TSOT-23-6 -- +250ºC/W

TDFN-6 (2mm×2mm) -- +80°C/W

- Storage Temperature Range (TS) --- -65ºC to +150ºC
- Lead Temperature (Soldering, 10 sec.) (TLEAD) ---------------------------------- +260ºC

Note 1：Stresses beyond those listed under “Absolute Maximum Ratings" may cause permanent damage to the device.

Recommended Operating Conditions

- Input Voltage (VIN) -- +2.5 to +5.5V
- Operating Temperature Range -- -40ºC to +85ºC

Electrical Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Input Voltage	V_{IN}		2.5		5.5	V
Operation Current	I_{SD}	V_{EN}=0V		4	8	μA
	I_Q	V_{FB}=0.2V		430	550	μA
Switching Frequency	f_{SW}		1.0	1.3	1.5	MHz
Maximum Duty Cycle	Duty	V_{FB}=0V	90			%
Under Voltage Lockout						
VIN Under Voltage Lockout	UVLO	V_{IN} Rising		2.25	2.45	V
Under Voltage Lockout Hysteresis				300		mV
Open Lamp Shutdown Threshold	V_{OV}	V_{OUT} Rising	28	29		V
Enable						
EN OFF Threshold		V_{EN} Falling			0.3	V
EN ON Threshold		V_{EN} Risingd	1.4			V
Dimming On Time	T_{ON}	PWM=20kHz at V_{IN}=5V.	6			μs
Feedback						
FB Voltage	V_{FB}	V_{EN}=1.5V	185	195	205	mV
FB Input Bias Current	I_{FB}	V_{FB}=0.1V		-300		nA
Output Switch						
SW ON-Resistance (Note 2)	R_{ON}			0.25		Ω
SW Current Limit (Note 2)	I_{LM}			2		A
Thermal Shutdown (Note 2)	T_{SD}			150		℃

=V=5V, T=+25ºC, unless otherwise noted)

Note 2：The specification is guaranteed by design, not production test.

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Typical Performance Curves

VIN=5V, C1=10μF, C2=1μF, L1=6.8μH, 5S5P WLEDs. TA=+25°C, unless otherwise noted.

VOUT 100mV/div.

VEN 5V/div. VFB 10V/div.

VSW 10V/div.

VSW 10V/div.

IL 500mA/div.

ILED 100mA/div.

1µs/div.

Figure 5. Steady State Waveform

200µs/div.

Figure 6. Enable Startup Response Waveform

VEN 5V/div. VEN 5V/div.

VOUT 10V/div. VSW 10V/div.

VOUT 10V/div. VSW 10V/div.

ILED 100mA/div.

400µs /div.

Figure 7. Enable Shutdown Response Waveform

ILED 100mA/div.

40µs/div.

Figure 8. PWM Dimming Response Waveforms at a

Frequency of 10kHz

VEN 5V/div. VEN 5V/div.

VOUT 10V/div. VSW 10V/div.

VOUT 10V/div.

VSW 10V/div.

ILED 500mA/div.

ILED 100mA/div.

4ms/div.

80µs/div.

Figure 10. Open Load Protection Waveform

Figure 9. PWM Dimming Response Waveform at a

Frequency of 100Hz

Typical Performance Curves (Continued)

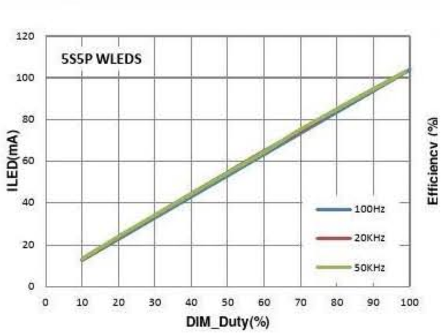


Figure 11. LED Current vs. Duty Cycle

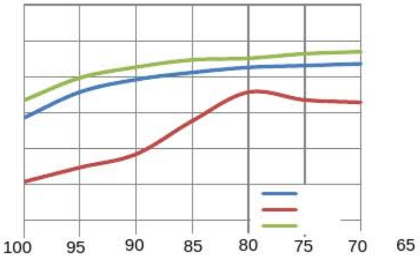
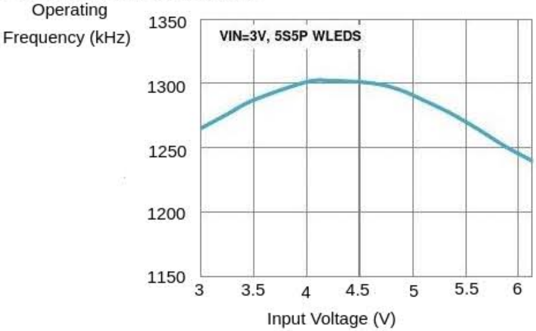
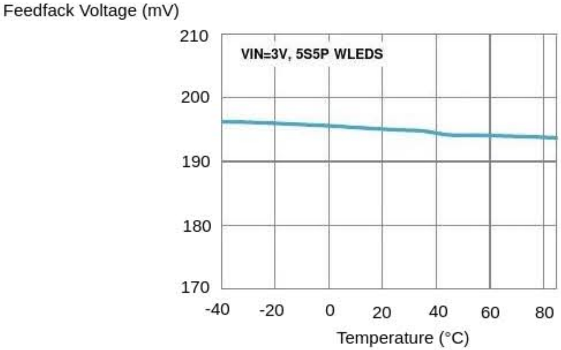


Figure 12. Efficiency vs. Input Voltage.





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Applications Information

Operation

The FP6755 is designed in a current mode, fixed-frequency pulse-width modulation (PWM) step-up converter to drive up to 8 series-connected WLEDs. The FP6755 operates well with a variety of external components. See the following sections to optimize external components for a particular application. The

PWM controller that goes automatically into PSM mode at light load. Inductor Selection

For most applications, a 4.7µH to 15µH is recommended for general used. The inductor parameters, current rating, DCR and physical size, should be considered. The DCR of inductor affects the efficiency of the converter. The inductor with lowest DCR is chosen for highest efficiency. The saturation current rating of inductor must be greater than the switch peak current, typically 2A. These factors affect the efficiency, output load capability, output voltage ripple, and cost.

The inductor selection depends on the switching frequency and current ripple by the following formula:

Where fSW is the 1.3MHz switching frequency. IL is

the inductor ripple current. Capacitor Selection

The ceramic capacitor is ideal for FP6755 application. X5R or X7R types are recommended because they hold their capacitance over wide voltage and temperature ranges than other Y5V or Z5U types. The input capacitor can reduced peak current and noise at power source. The output capacitor is typically selected based on the output voltage ripple requirements. For most applications, a 10µF input capacitors with a 0.47µF output capacitor are sufficient for general used. A higher or lower capacitance may be used depending on the acceptable noise level. LED Current Setting

The LED current is specified by resistor from the FB pin to ground. In order to have accurate LED current, precision resistors are preferred (1% is recommended). The LED current can be programmed by:

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Over Voltage Protection

The FP6755 has an internal open-lamp protection

circuit. In the cases of output open circuit, when the LEDs are disconnected from the circuit or the LEDs fail open circuit, the over-voltage function monitors the output voltage through SW pin to protect the converter against. The LED strings open will cause N-MOS to switch with a maximum duty cycle and come out output over-voltage. This may cause the SW voltage exceed its maximum rating then damage built-in N-MOS. In the state, the OVP protection circuitry will be triggered if output voltage exceeds 29V (typ.). The FP6755 can automatically recovery.

Dimming Control (PWM Signal)

The LED current can be set by modulating the EN pin with a PWM signal.

Changing the LED forward current not only changes the intensity of the LEDs, but also changes the color. Controlling the intensity of the LEDs with a direct PWM signal allows dimming of the LEDs without changing the color.

Dimming the LEDs via a PWM signal essentially involves turning the LED on and off. The LEDs operate at either zero or full current. The amplitude of the PWM signal should be higher than the minimum EN dimming voltage (typically 1.4V). The LED average current increases proportionally with the duty cycle of the PWM signal. The color of the LEDs remains unchanged since the LED current value is either zero or a constant value. The dimming frequency of the PWM signal can up to 50kHz and still retain well linearity. To avoid audio noise, dimming frequency greater than 20kHz is recommended.

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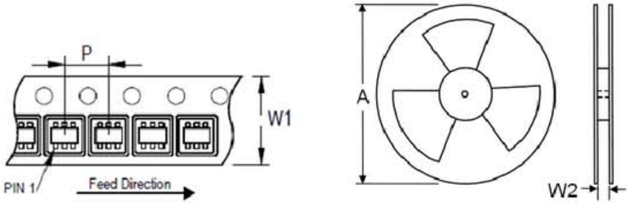
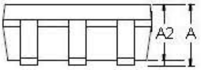
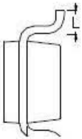
Outline Information (Continued)

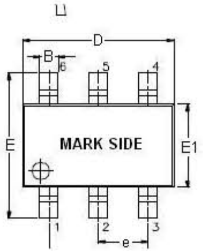
TSOT-23-6 Package (Unit: mm)



Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
8	4	7	180	8.4	300~1000	3.000







SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	0.70	0.90
A1	0.00	0.10
A2	0.70	1.00
B	0.30	0.50
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.90	1.00
e1	1.80	2.00
L	0.30	0.60

Carrier Dimensions

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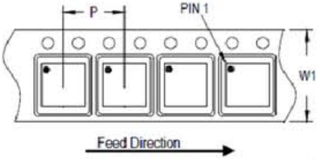
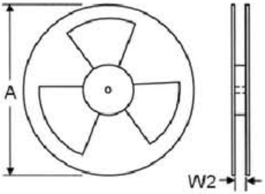
Outline Information (Continued)

TDFN-6 2mm×2mm (pitch 0.65 mm)Package (Unit: mm)

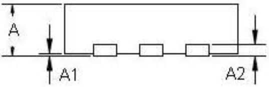
SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	0.70	0.80
A1	0.00	0.05
A2	0.19	0.22
D	1.95	2.05

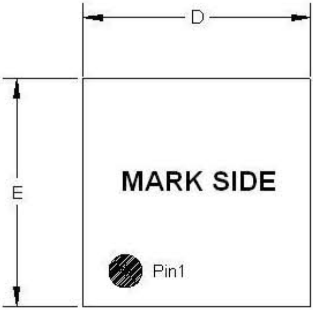
E	1.95	2.05
a	0.20	0.40
b	0.25	0.35
e	0.60	0.70
D1	1.15	1.65
E1	0.55	1.05

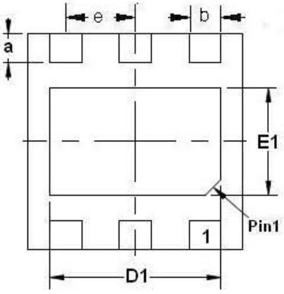




Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
8	4	7	180	8.4	400~1000	3,000







Carrier Dimensions

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Life Support Policy

Fitipower's products are not authorized for use as critical components in life support devices or other medical systems. FP6755-1.1-JAN-2015