

FSP3604
FEATURES

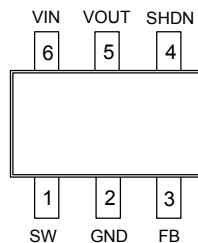
- LED Power Efficiency: up to 90%
- 1MHz Switching Frequency
- Uses small, Low Profile External Components
- Low Start-Up Voltage: 0.9V($I_{LED} = 270mA$)
- Low $R_{DS(ON)}$: 100m Ω (TYP.)
- Open LED Protection
- Over Temperature Protection
- Low Profile SOT23-6L Package

APPLICATIONS

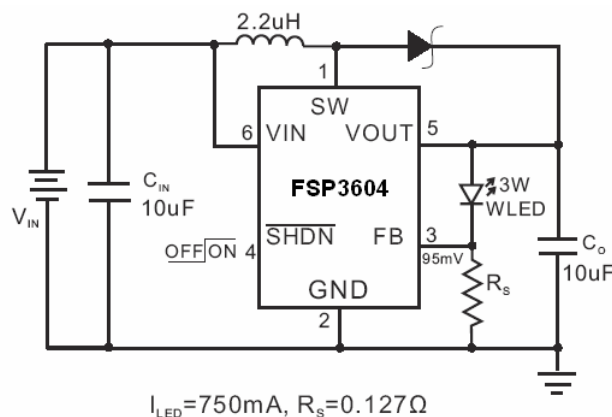
- White LED Torch (Flashlight)
- White LED Camera Flash
- DSC (Digital Still Camera)Flash
- Cellular Camera Phone Flash
- PDA Camera Flash
- Camcorder Torch (Flashlight) Lamp

PIN CONFIGURATION

(Top View)



Pin Number	Pin Name	Pin Function
1	SW	Power Switch Pin.
2	GND	Ground Pin
3	FB	Feedback Pin
4	SHDN	Chip Shutdown Signal Input
5	VOUT	Power Output Pin.
6	VIN	Power Supply Input.

TYPICAL APPLICATION CIRCUIT


■ ABSOLUTE MAXIMUM RATINGS(NOTE 1)

Parameter	Rating	Unit
V_{IN}	- 0.3 ~ +6	V
V_{SW}	- 0.3 ~ +6	A
FB SHDN Voltages	- 0.3 ~ +6	°C
Operating Temperature Range	- 40 ~ +85	°C
Operating Junction Temperature	-40~+125	°C
Lead Temperature (Soldering 5 sec.)	+ 300	°C
Internal Power Dissipation	400	mW
Thermal Resistance	250(θ_{JA})	°C/W
	130(θ_{JC})	
Storage Temperature Range	- 65 ~ +125	°C

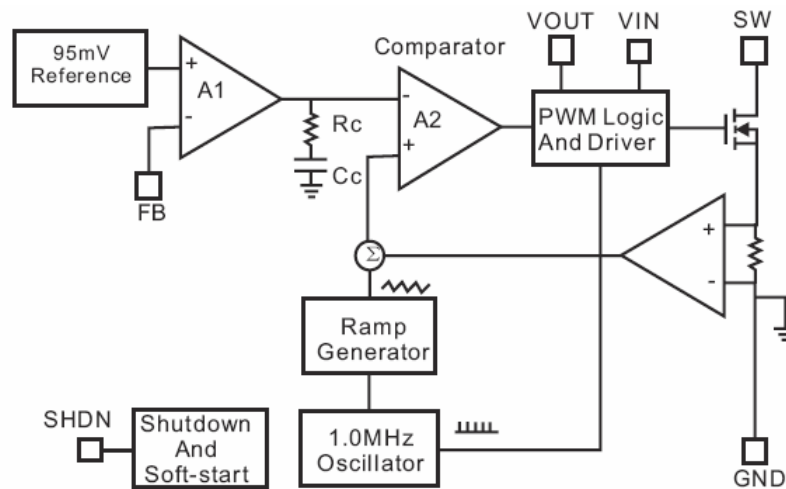
Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

■ ELECTRICAL CHARACTERISTICS

($V_{IN}= 2.4V$, $I_{LED}=750mA$, $V_{SHDN}=V_{IN}$, $L=2.2\mu H$, $C_{IN}=10\mu F$, $C_O=10\mu F$, $T_A=25^\circ C$, Unless otherwise noted)

Parameter	Condition	Min.	Typ.	Max.	Unit
Input Voltage Range		0.9		$V_F-0.2$ (Note 2)	V
Start-Up Voltage	$V_{IN}: 0V \rightarrow 2.4V$, $I_{LED} = 100mA$		0.7	0.9	V
Hold Voltage	$V_{IN}: 2.4V \rightarrow 0V$, $I_{LED}: 750mA \rightarrow 200mA$		0.75		V
Switching Frequency		0.85	1.0	1.15	MHz
SHDN Input High	$V_{IN} = 1.8V$	1.0			V
SHDN Input Low	$V_{IN} = 1.8V$			0.4	
Feedback Voltage		90	95	100	mV
Over Temperature Shutdown			150		°C
Over Temperature Hysteresis			15		°C
Maximum Output Current Range		750			mA
Quiescent Current	$I_{LED} = 0mA$, $V_O = 3.4V$ Device Switching at 1MHz		1	3	mA
Shutdown current	Shutdown mode			1	uA
Switch on Resistance	$V_O = 3.4V$		0.1		Ω
Current Limit	$V_O = 3.4V$	2			A
Efficiency	$I_{LED} = 750mA$		90		%

Note 2: V_F : LED Forward Voltage

FUNCTIONAL BLOCK DIAGRAM

APPLICATION INFORMATION
Inductor Selection

The FSP3604 can use small value inductors due to its switching frequency of 1 MHz. The value of inductor will focus in the range of 2.2uH to 4.7uH for most FSP3604 applications. In typical high current white LED applications, it is recommended to use a 4.7uH inductor. The inductor should have low DCR (DC resistance) to minimize the $I^2 R$ power loss, and it requires a current rating of 2A to handle the peak inductor current without saturating.

Capacitor Selection

An input capacitor is required to reduce the input ripple and noise for proper operation of the FSP3604. For good input decoupling, Low ESR (equivalent series resistance) capacitors should be used at the input. At least 2.2uF input capacitor is recommended for most applications.

A minimum output capacitor value of 6.8uF is recommended under normal operating conditions, while a 10uF-22uF capacitor may be required for higher power LED current. A reasonable value of the output capacitor depends on the LED current. The ESR of the output capacitor is the important parameter to determine the output voltage ripple of the converter, so low ESR capacitors should be used at the output to reduce the output voltage ripple. The small size of ceramic capacitors is an excellent choice for FSP3604 applications. The X5R and X7R types are preferred because they maintain capacitance over wide voltage and temperature ranges.

Diode Selection

It's indispensable to use a Schottky diode rated at 2A with the FSP3604. Using a Schottky diode with a lower forward voltage drop is better to improve the power LED efficiency, and its voltage rating should be greater than the output voltage.

In application, the ON semiconductor MBRA210LT3G is recommended.

LED Current Setting

The LED current is set by the single external R_s resistor connected to the FB pin as shown in the typical application circuit on page 1. The typical FB reference is internally regulated to 95mV. The LED current is $95mV/R_s$. It's recommended to use a 1% or better precision resistor for the better LED current accuracy. The formula and table 1 for R_s selection are shown as follows:

$$R_s = 95mV / I$$

Table 1. R_s Resistor Value Selection

$I_{LED}(mA)$	$R_s(\Omega)$
500	0.19
600	0.158
750	0.127
800	0.119
900	0.106

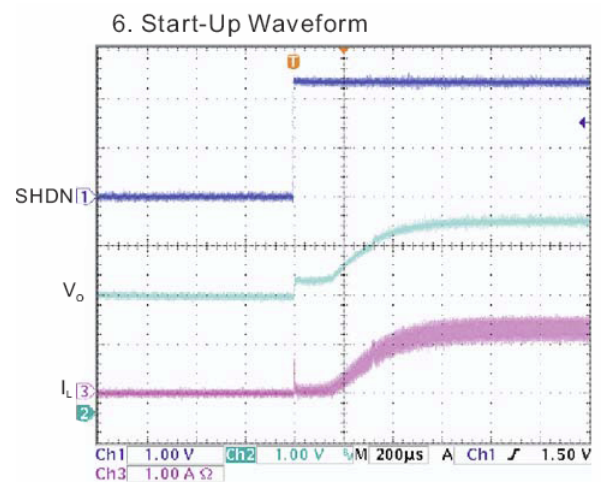
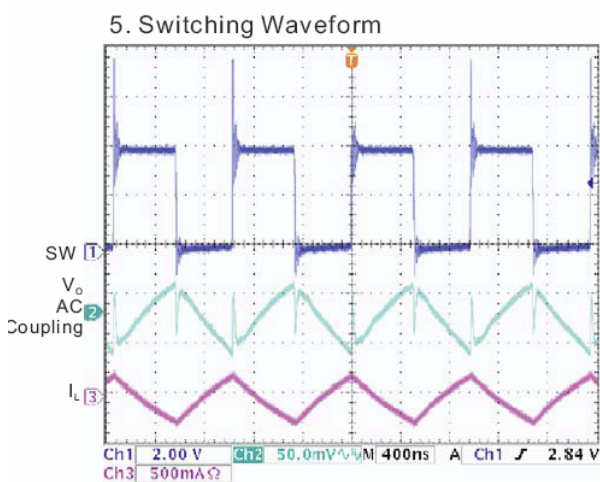
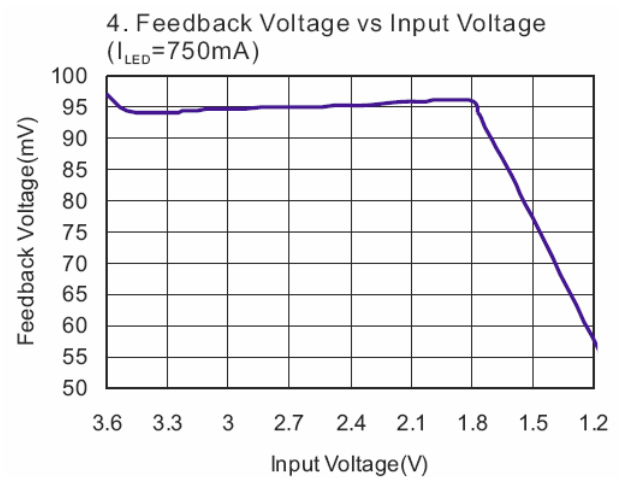
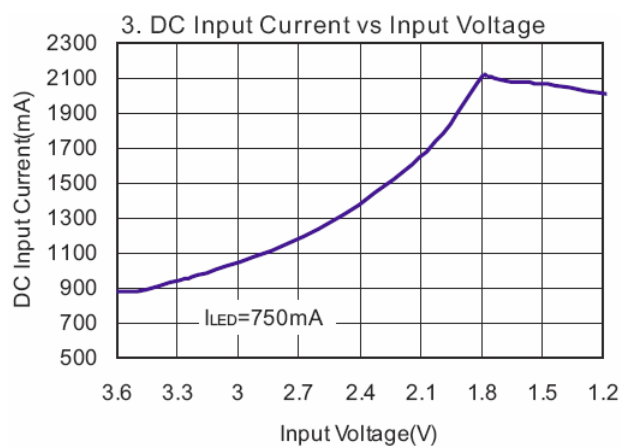
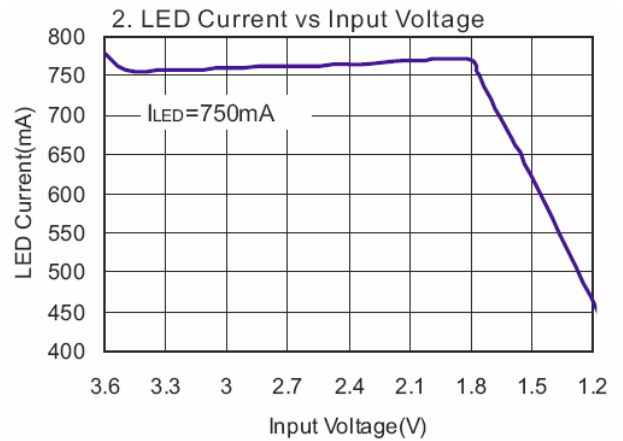
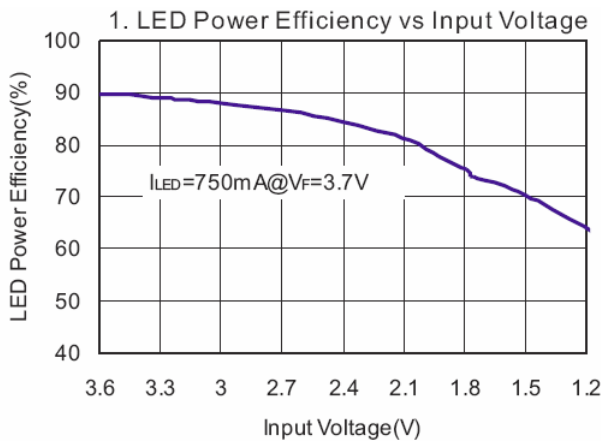
PCB Layout Guidelines

As for all switching power supplies, the layout and components placement of the FSP3604 is an important step in the design; especially at high peak currents and high switching frequencies.

The input capacitor and output capacitor should be placed respectively as close as possible to the input pin and output pin of the IC; the inductor and schottky diode should be placed as close as possible to the switch pin by using wide and short traces for the main current path; the current sense resistor should be placed as close as possible between the ground pin and feedback pin.

TYPICAL CHARACTERISTICS

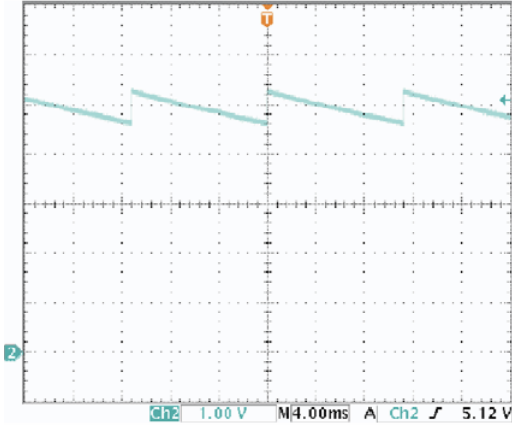
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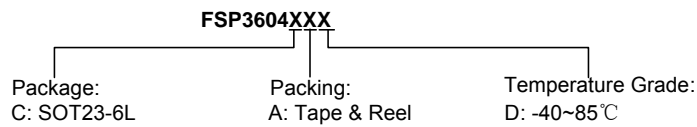
■ **TYPICAL CHARACTERISTICS (CONTINUED)**

($L=2.2\mu\text{H}$, $C_{\text{IN}}=10\mu\text{F}$, $C_{\text{O}}=10\mu\text{F}$, $T_{\text{A}}=25^{\circ}\text{C}$, Unless otherwise noted)

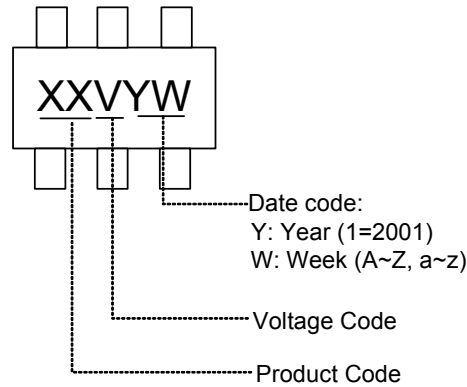
7. Overvoltage Protection

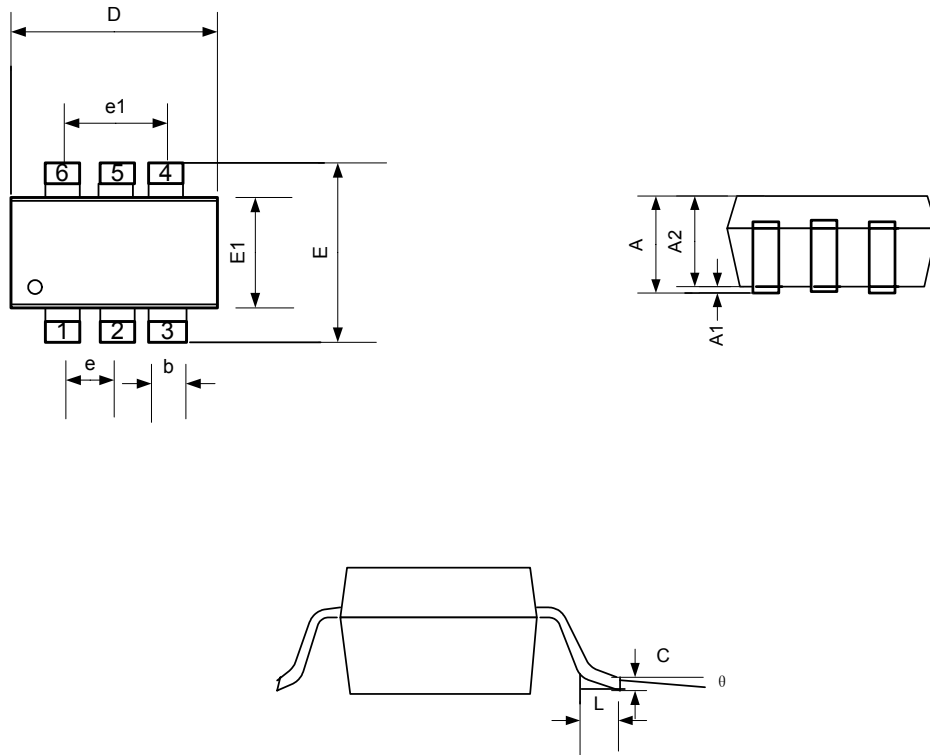


■ **ORDERING INFORMATION**



■ **MARKING INFORMATION**



■ PACKAGE INFORMATION


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.450	0.036	0.058
A1	0.000	0.150	0.000	0.006
A2	0.900	1.300	0.036	0.052
b	0.300	0.500	0.012	0.020
C	0.100	0.200	0.004	0.008
D	2.800	3.100	0.112	0.124
E	2.50	3.100	0.100	0.124
E1	1.500	1.700	0.060	0.068
L	0.200	0.550	0.002	0.022
e	0.95 Bsc.		0.038 Bsc.	
e1	1.90 Bsc.		0.076 Bsc.	
θ	0°	8°	0°	8°