



Small Package, High Performance, Asynchronies Boost for WLED Driver

DESCRIPTION

The EUP2586 is a high frequency, asynchronous boost converter designed for driving white LED arrays. With integrated 0.19 Ω power switch and 2A current limit, the EUP2586 provides enough driving capability for 7"~10" LCD backlighting(13 strings of 3 or 4 LEDs each). The device uses current mode, fixed frequency architecture to regulate the LED current, which is measured through an external current sense resistor. Its low 200mV feedback voltage reduces power loss and improves efficiency.

With the built-in over-voltage protection function (OVP), the SW pin monitors the output voltage and turn off the device if an over-voltage condition is present due to an open circuit condition. Other features include soft start, over-current limiting, thermal protection and under-voltage lockout.

The EUP2586 is available in the tiny TSOT23-5 package to provide the best solution for PCB space saving and total BOM cost.

FEATURES

- 2.6V to 5.5V Input Range
- Internal 0.19 Ω , 18V MOSFET Switch
- High Efficiency Up to 93%
- Lower Surface Temperature at ILED=180mA
- 1MHz Switching Frequency
- 2A Current Limit
- Open LED Overvoltage Protection
- Internal Soft-Start
- PWM and DC Dimming Control
- Available in TSOT23-5 Package
- RoHS Compliant and 100% Lead (Pb)-Free Halogen-Free

APPLICATIONS

- 7'' to 10'' LCD Panels
- MID Backlighting
- Netbook Backlighting
- Portable Media Players
- GPS Navigation Systems

Typical Application Circuit

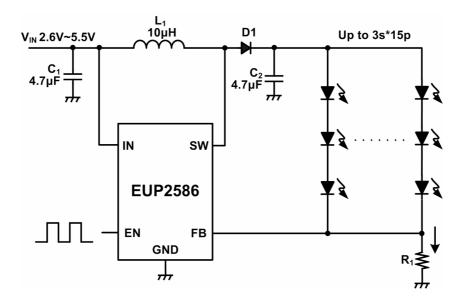


Figure 1. EUP2586 PWM Dimming Application for White LED Driver





Block Diagram

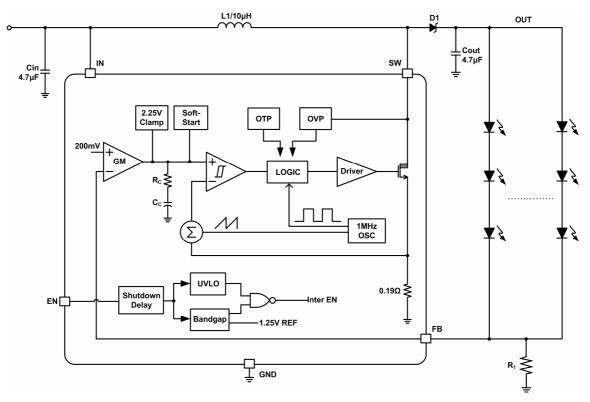


Figure 2. Block Diagram

Pin Configurations

Package Type	Pin Configurations		
TSOT23-5	$ \begin{array}{c cccc} FB & GND & SW \\ \hline & & & \\ 3 & 2 & 1 \\ & & & \\ 4 & 5 \\ \hline & & & \\ EN & IN \end{array} $		

Pin Description

PIN	TSOT23-5	DESCRIPTION
1	SW	Switch Pin. This is the drain of the internal power switch. Connect inductor/diode here. Minimize trace area at this pin to reduce EMI.
2	GND	Common Ground. Connect the pin to ground plane.
3	FB	Feedback Pin. Reference voltage is 200mV. Connect cathode of lowest LED and resistor here. Calculate resistor value according to the formula: RFB=200mV/ILED
4	EN	Chip Enable Pin. Connect it to 1.4V or higher voltage to enable device, 0.3V or less voltage to disable device.
5	IN	Input Supply Voltage.



Ordering Information

Order Number	Package Type	Marking	Operating Temperature Range
EUP2586OIR1	TSOT23-5	xxxxx Ad00	-40 °C to +85°C
EUP2586 [] [] []	Packing R: Tape &	e, Halogen Free Reel emperature range Standard	





Absolute Maximum Ratings (1)

Absolute Ma	Annum Kaungs (1)	
	IN, EN, FB to GND	-0.3V to 6V
	SW to GND	-0.3V to 18V
-	Power dissipation, $P_D @ T_A = 25^{\circ}C$	
	TSOT23-5	0.5W
-	Package Thermal Resistance	
	TSOT23-5,θ _{JA}	200°C/W
-	Maximum Junction Temperature	125°C
-	Lead Temperature (Soldering, 10sec.)	260°C
-	Storage Temperature Range	-65°C to +150°C
Operating C	onditions (2)	
•	Operating Temperature Range	-40°C to +85°C
•	Supply Voltage , V _{IN}	2.6V to 5.5V

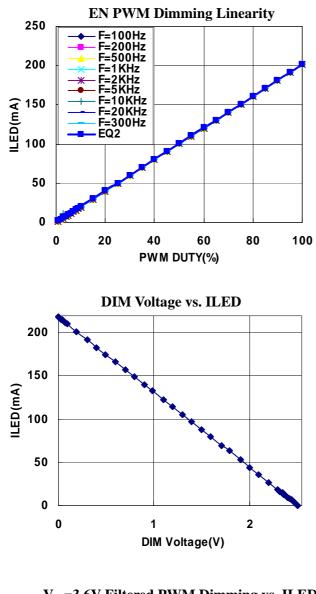
Note (1): Stress beyond those listed under "Absolute Maximum Ratings" may damage the device. Note (2): The device is not guaranteed to function outside the recommended operating conditions.

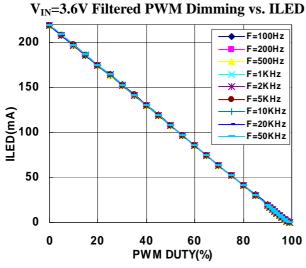
Electrical Characteristics

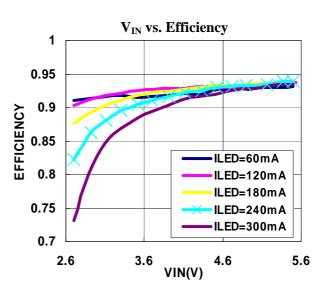
 $(V_{IN}=3.6V, V_{OUT}=12V, C_{OUT}=2.2\mu F, C_{IN}=4.7\mu F, L1=10\mu H, T_A = -40^{\circ}C \text{ to}+85^{\circ}C.$ Unless otherwise noted. Typical values are at $T_A = +25^{\circ}C$)

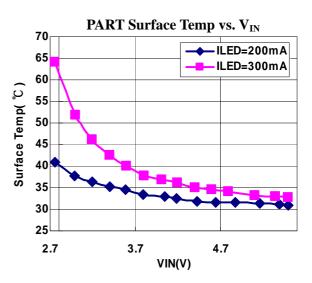
Growhal	Parameter	Conditions	EUP2586			TI.4
Symbol			Min.	Тур.	Max.	Unit
UVLO	Under Voltage Lockout	Rising		2.4	2.6	V
UVLU	Maximum Output Voltage	No Switching			18	V
Icc1	Supply Current	Vcc=5.5V,Continuous Switching		1.0	1.5	mA
Icc2	Quiescent Current	Vcc=5.5V,FB=1.3V,No Switching		400	600	μΑ
Icc3	Shutdown Current	Vcc=5.5V,VEN<0.4V		0.1	1	μΑ
Oscillator						·
Fosc	Operation Frequency		0.8	1	1.3	MHz
Dmax	Maximum Duty Cycle			90		%
Reference V	oltage		-			
V _{FB}	Feedback Voltage		190	200	210	mV
MOSFET						
Rds(on)	On resistance of MOSFET			0.19		Ω
ILX	Current Limit		1.7	2.0	2.4	Α
Control and	Protection					
V _{EN1}	Shutdown Voltage		0.4	0.7		V
V _{EN2}	Enable Voltage			0.7	1.4	V
R _{EN}	EN Pin Pull Low Resistance			1		MΩ
OVP	OVP Threshold			18		V

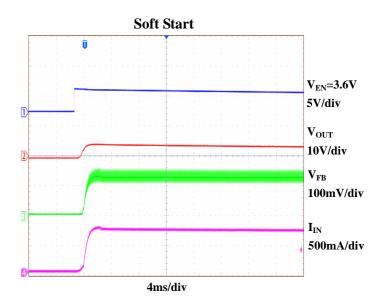
Typical Operating Characteristics (V_{IN}=3.6V, L=10μH, C_{IN}=4.7μF, C_{OUT}=2.2μF, R_{FB}=1.0Ω, I_{LED}=195mA)





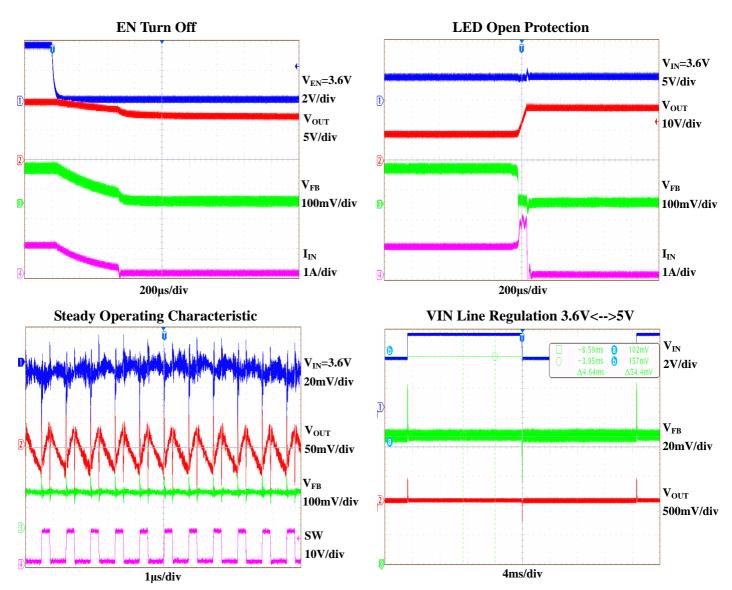








Typical Operating Characteristics (continued) (V_{IN} =3.6V, L=10µH, C_{IN}=4.7µF, C_{OUT}=2.2µF, R_{FB}=1.0Ω, I_{LED}=195mA)







Application Information

LED Current Control

The EUP2586 regulates the LED current by setting the Current sense resistor (R1) connecting to feedback and ground. The internal feedback reference voltage is 200mV. The LED current can be set from following equation easily.



In order to have an accurate LED current, precision resistors are preferred (1% is recommended).

Table1 shows a selection of resistors for a given current:

ILED(mA)	$R1(\Omega)$
60	3.3
120	1.67
180	1.11
240	0.833
300	0.667

Dimming Control

a. Using a PWM Signal to EN Pin

For controlling the LED brightness, the EUP2586 can perform the dimming control by applying a PWM signal to EN pin, and the PWM signal frequency range is from 100Hz to 100 KHz. The average LED current is proportional to the PWM signal duty cycle. The magnitude of the PWM signal should be higher than the maximum enable voltage of EN pin, in order to let the dimming control perform correctly.

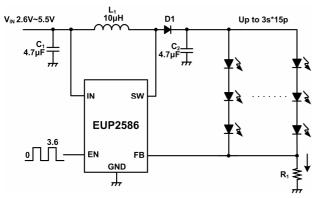


Figure 3. Direct PWM Dimming Control

b. Using a DC Voltage

Using a variable DC voltage to adjust the brightness is a popular method in some applications. The dimming control using a DC voltage circuit is shown in figure 3.According to the Superposition Theorem, as the DC voltage increase, the voltage contributed to VFB increases and the voltage drop on R1 decreases, i.e. the LED current decrease. For example, if the VDC range is from 0V to 2.5V, the selection of resistors in figure 4 sets dimming control of all of the LED current from 218mA to $0mA(R1=1\Omega, R2=4.7K\Omega, R4=54K\Omega)$.

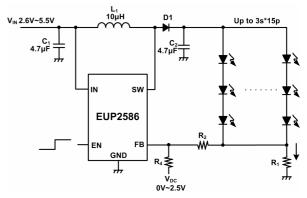


Figure 4. DC Voltage Dimming Control

In figure 4 application, $ILED_{MAX}$ and $ILED_{MIN}$ setting equation shown as follow:

ILED_{MAX} (mA) =
$$\frac{200 \times (R_2 + R_4)}{R_4 \times R_1} + \frac{200}{R_4}$$

ILED_{MIN} (A) $\approx \frac{0.2 - \frac{R_2}{R_2 + R_4} \times V_{DCMAX}}{R_1}$

c. Using a Filtered PWM Signal

Another common application is using a filtered PWM signal as an adjustable DC voltage for LED dimming control. A filtered PWM signal acts as the DC voltage to regulate the output current. The recommended application circuit is shown in the Figure 6. In this circuit, the output ripple depends on the frequency of PWM signal. For output voltage ripple (<100mV), smaller the recommended frequency of 2.5V PWM signal should be above 2 kHz. To fix the frequency of PWM signal and change the duty cycle of PWM signal can get different output current. According to the application circuit of figure 5, total output current is from 218mA to 0mA by adjusting the PWM duty cycle from 0% to 100% ($R1=1\Omega$, R2=4.7KΩ, R3=27KΩ, R4=27KΩ, C3=1µF).

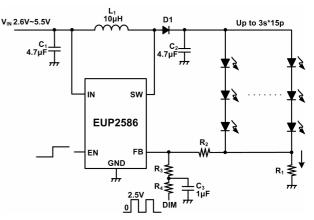


Figure 5. Filtered PWM Dimming Control





Open Load Shutdown

In the event of an "Open LED" fault condition, the EUP2586 will continue to boost the output voltage with maximum power until the output voltage reaches approximately 18V. Once the output exceeds this level, the device will cease operation until the EN pin is cycled off and on.

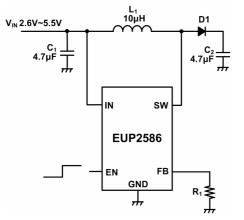


Figure 6. EUP2586 Open Protection Test Circuit

Thermal Shutdown

Thermal overload protection circuitry has been included to prevent the device from operation at unsafe junction temperatures above 150° C. In the event of a thermal overload condition the device will automatically shutdown and wait till the junction temperatures cools to 130° C before normal operation is resumed.

Capacitors Selection

A 4.7 μ F to 10 μ F ceramic input capacitor (Cin) and a 1.0 μ F to 10 μ F ceramic output capacitor (Cout) are sufficient for most applications. During Direct PWM Dimming control, a larger output capacitor will significantly reduce audio noise induced by output capacitor, and a smaller will enlarge the audio noise, a 4.7 μ F Cout is recommended. Under normal condition, a 4.7 μ F input capacitor is sufficient. For applications with higher output power, a larger input capacitor of 10 μ F may be appropriate. X5R and X7R capacitor types are ideal due to their stability across temperature range.

Inductor Selection

The recommended value of inductor for most applications is 4.7μ H to 47μ H. Small size and better efficiency are the major concerns for portable device, such as EUP2586 used for mobile phone. The inductor should have low core loss at 1MHz and low DCR for better efficiency. To avoid inductor saturation current rating should be considered.

Schottky Diode Selection

The current rating of the Schottky diode must exceed the peak current flowing through it. The Schottky diode performance is rated in terms of its forward voltage at a given current. In order to achieve the best efficiency, this forward voltage should be as low as possible. The response time is also critical since the driver is operating at 1MHz.

Board Layout

Careful PC board layout is required due to fast switching. All components must be placed as close to the device as possible. Keep the path between the inductor L1, diode D1, and output capacitor Cout extremely short for minimal noise and ringing. The feedback components such as the sense resistor RFB must be kept close to the FB pin to prevent noise injection on the FB pin trace. The ground return of Cin and Cout should be tied close to the GND pin. See the EUP2586 demo board layout for reference.

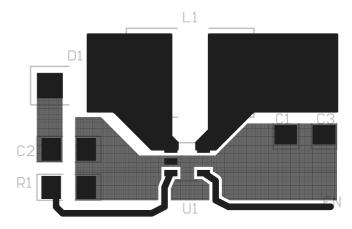
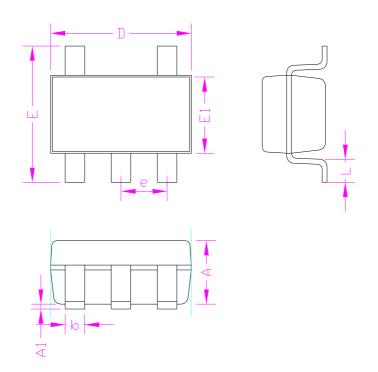


Figure 7. EUP2586 Demo Board



Packaging Information





SYMBOLS	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
А	-	1.00	-	0.039	
A1	0.00	0.15	0.000	0.006	
D	2.90		0.114		
E1	1.60		0.063		
Е	2.60	3.00	0.102	0.118	
L	0.30	0.60	0.012	0.024	
b	0.30	0.50	0.012	0.020	
е	0.95		0.037		

