

# 1MHz Boost Regulator with 18V Integrated FET Switch in Tiny SOT-23

## DESCRIPTION

The EUP2570 switching regulator is a current-mode boost converter operating at fixed frequency of 1MHz. It is designed for small LCD bias supply and others micropower step-up applications. The 18V switch allows for output voltage as high as 17V. The integrated 0.19Ω power switch and 2A current limit will provide high efficiency over a wide range of load conditions with high power density.

The EUP2570 integrated multiple protections, such as OC, UVLO, OT, OVP, which will prevent damage in the event of an output overload.

The EUP2570 is available in the tiny SOT23-5 package to provide the best solution for PCB space saving and total BOM cost.

## FEATURES

- 2.6V to 5.5V Input Range
- 18V Output Over Voltage Protection
- Internal Soft-Start
- Adjustable Output Voltage
- Internal 0.19Ω 18V MOSFET Switch
- 1MHz Switching Frequency
- 2A Current Limit
- Low-Profile Inductors and Capacitors
- Peak Efficiency Up to 88%
- Available in TSOT23-5 Package
- RoHS Compliant and 100% Lead (Pb)-Free Halogen-Free

## APPLICATIONS

- LCD Panel Bias Supplies
- Local Boost Regulator
- Digital Camera
- Portable Applications

## Typical Application Circuit

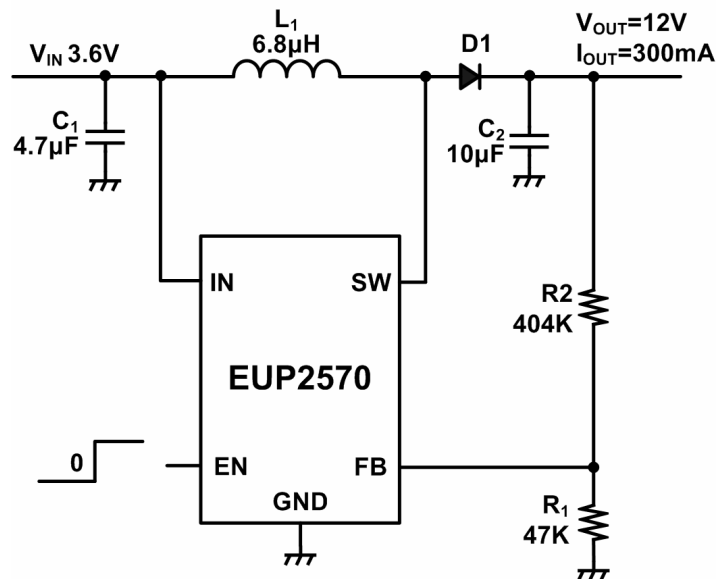


Figure 1. EUP2570 Typical 12V Application

## Block Diagram

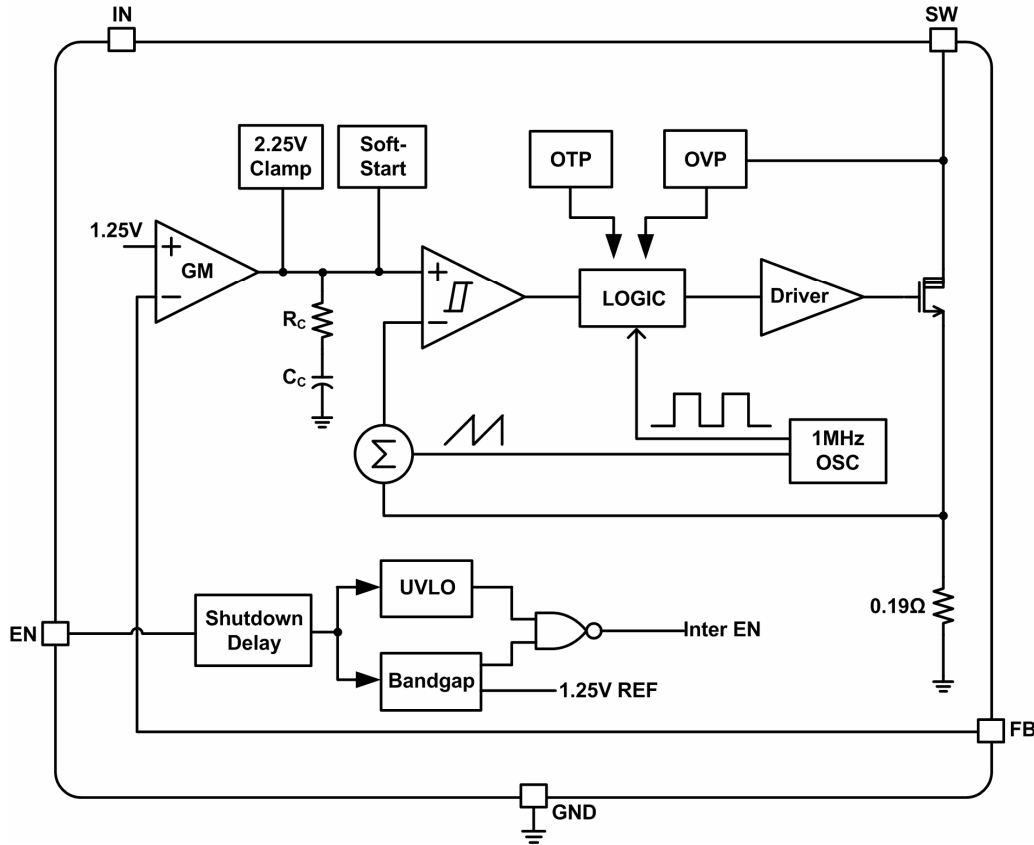


Figure 2. Block Diagram

## Pin Configurations

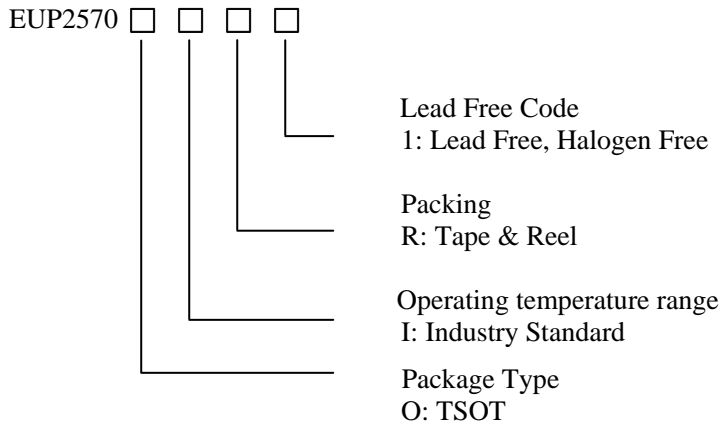
Package Type	Pin Configurations
TSOT23-5	

## 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 1.25V, Connects to the external resistive divider.
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
EUP2570OIR1	TSOT23-5	xxxxx At00	-40 °C to +85°C



## Absolute Maximum Ratings (1)

■ IN, EN, FB to GND -----	-0.3V to 6V
■ SW to GND -----	-0.3V to 18V
■ Power dissipation, P <sub>D</sub> @ T <sub>A</sub> =25°C TSOT23-5 -----	0.5W
■ Package Thermal Resistance TSOT23-5,θ <sub>JA</sub> -----	200°C/W
■ Maximum Junction Temperature -----	125°C
■ Lead Temperature (Soldering, 10sec.) -----	260°C
■ Storage Temperature Range -----	-65°C to +150°C

## Operating Conditions (2)

■ Operating Temperature Range -----	-40°C to +85°C
■ Supply Voltage , V <sub>IN</sub> -----	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.

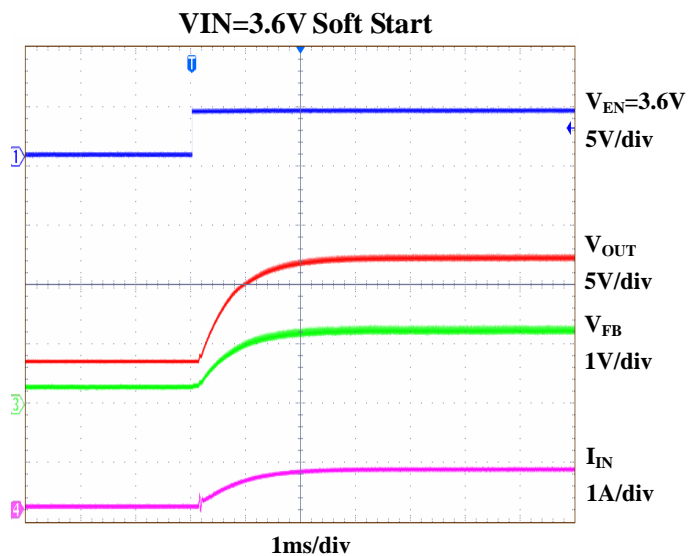
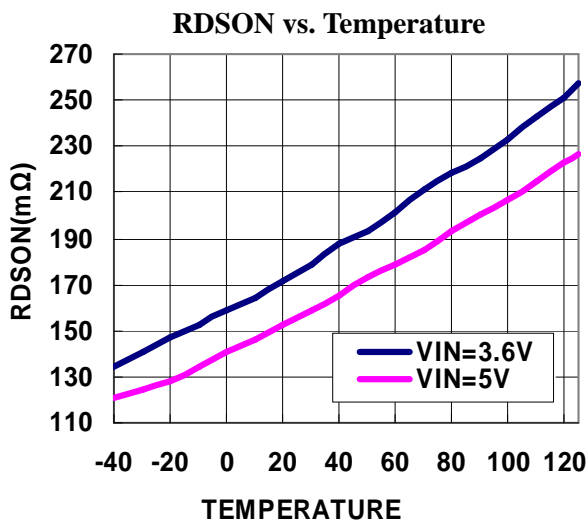
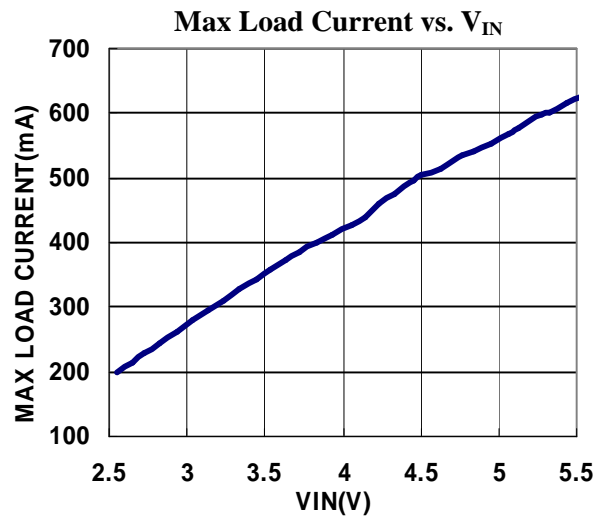
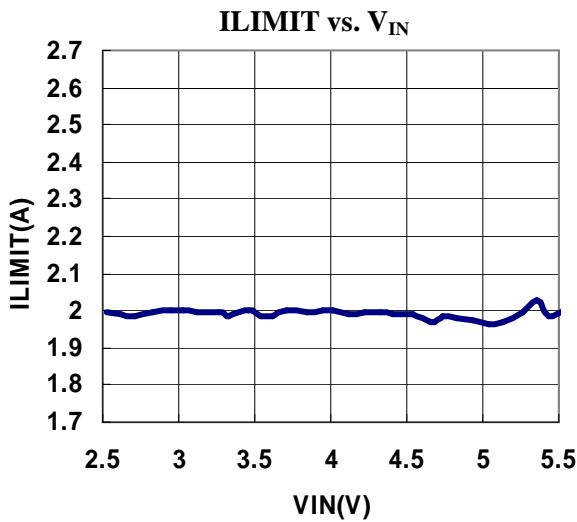
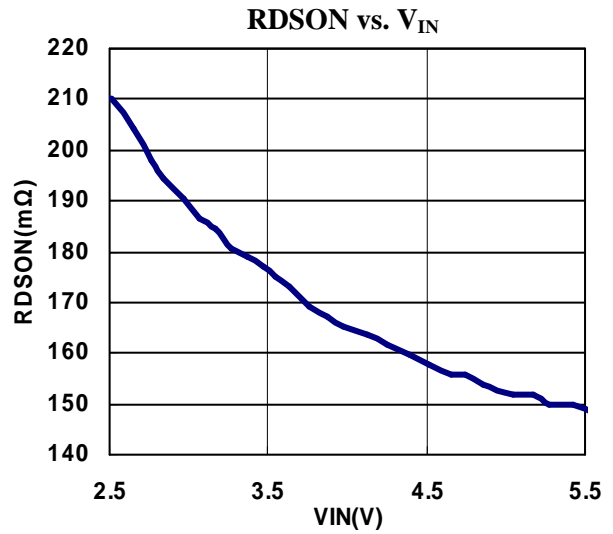
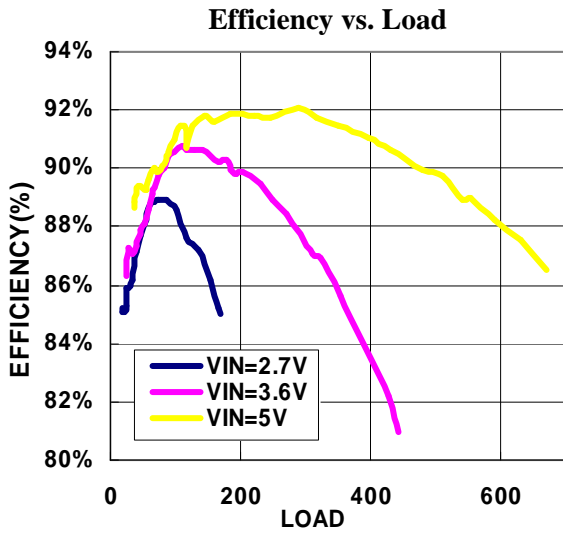
## Electrical Characteristics

(V<sub>IN</sub>=3.6V, V<sub>OUT</sub> =12V, C<sub>OUT</sub>=10μF, C<sub>IN</sub>=4.7μF, L1=6.8μH, T<sub>A</sub> = -40°C to+85°C. Unless otherwise noted.  
Typical values are at T<sub>A</sub> = +25°C)

Symbol	Parameter	Conditions	EUP2570			Unit
			Min.	Typ.	Max.	
UVLO	Under Voltage Lockout	Rising		2.4	2.6	V
	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	μA
Icc3	Shutdown Current	Vcc=5.5V,V <sub>EN</sub> <0.4V		0.1	1	μA
<b>Oscillator</b>						
Fosc	Operation Frequency		0.8	1	1.3	MHz
Dmax	Maximum Duty Cycle			90		%
<b>Reference Voltage</b>						
V <sub>FB</sub>	Feedback Voltage		1.22	1.25	1.28	V
<b>MOSFET</b>						
Rds(on)	On Resistance of MOSFET			0.19	0.5	Ω
ILX	Current Limit		1.7	2.0	2.4	A
<b>Control and Protection</b>						
V <sub>EN1</sub>	Shutdown Voltage		0.4	0.7		V
V <sub>EN2</sub>	Enable Voltage			0.7	1.4	V
R <sub>EN</sub>	EN Pin Pull Low Resistance			1		MΩ
OVP	OVP Threshold			18		V

## Typical Operating Characteristics

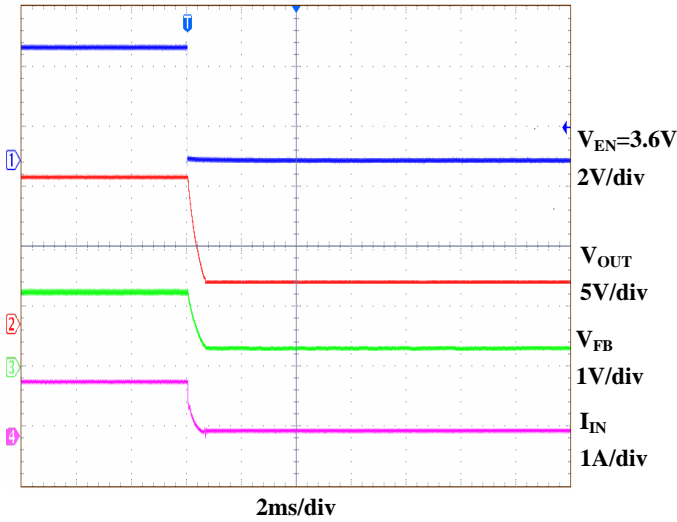
( $V_{IN}=3.6V$ ,  $L=6.8\mu H$ ,  $C_{IN}=4.7\mu F$ ,  $C_{OUT}=10\mu F$ ,  $V_{OUT}=12V$ )



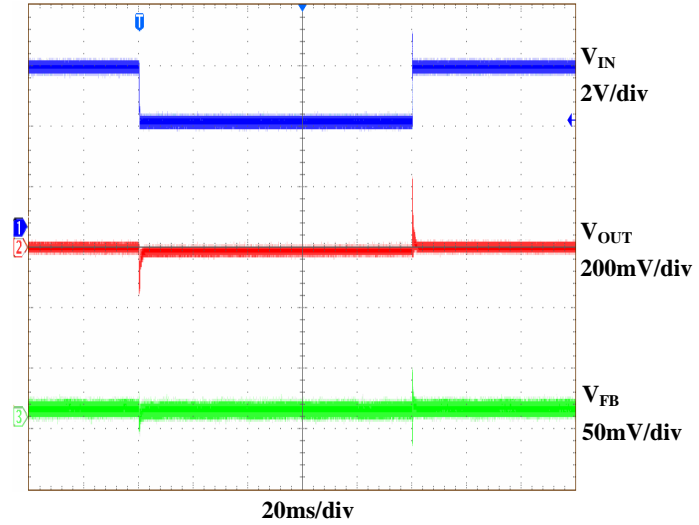
## Typical Operating Characteristics (continued)

( $V_{IN}=3.6V$ ,  $L=6.8\mu H$ ,  $C_{IN}=4.7\mu F$ ,  $C_{OUT}=10\mu F$ ,  $V_{OUT}=12V$ )

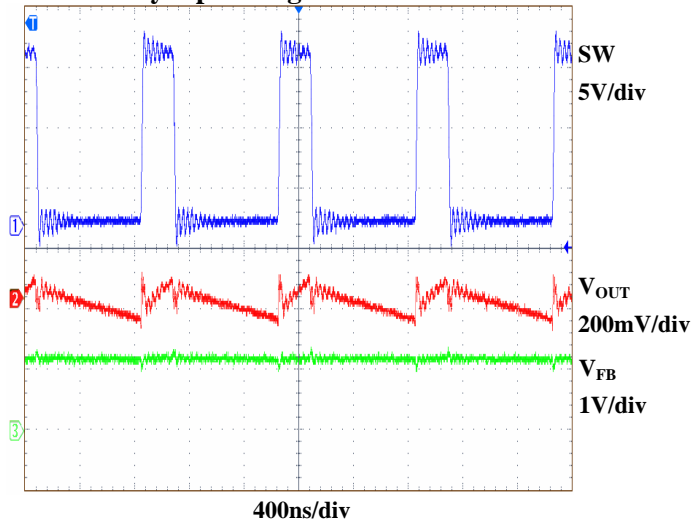
### VIN=3.6V EN Turn Off



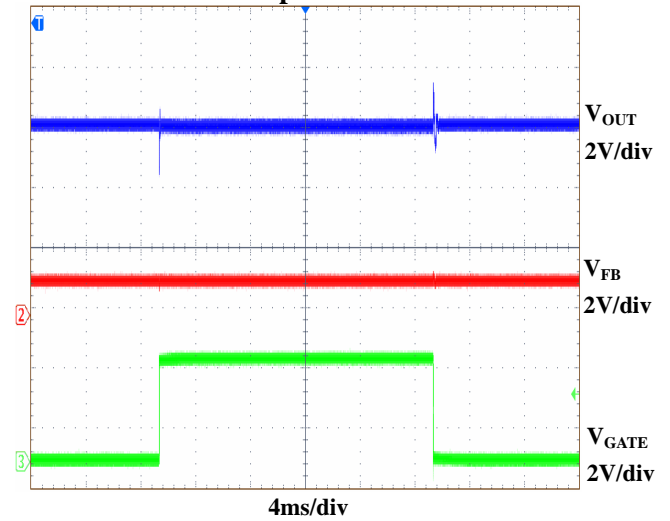
### VIN Line Regulation 3.6V<-->5V



### Steady Operating Characteristic



### Load Transient Response 10mA<-->300mA



## Application Information

The EUP2570 is a highly efficient power supply that employs a current-mode, fixed-frequency PWM architecture for fast-transient response and low-noise operation, this architecture will provide a cycle-to-cycle current limit also. The device regulates the output voltage through a combination of an error amplifier, two comparators, and several signal generators. The error amplifier compares the signal at FB to 1.25V and varies the COMP output. The voltage at COMP determines the current trip point each time the internal MOSFET turns on. As the load varies, the error amplifier sources or sinks current to the COMP output accordingly to produce the inductor peak current necessary to service the load. To maintain stability at high duty cycle, a slope-compensation signal is summed with the current-sense signal. At light loads, this architecture allows the ICs to “skip”cycles to prevent overcharging the output voltage. In this region of operation, the inductor ramps up to a fixed peak value, discharges to the output, and waits until another pulse is needed again.

### Over-Voltage Shutdown

In the event of an external resistive divider fault condition, the EUP2570 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 toggled off and on or power reset.

### 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 $\mu$ F to 10 $\mu$ F ceramic input capacitor (C<sub>in</sub>) and a 4.7 $\mu$ F to 47 $\mu$ F ceramic output capacitor (C<sub>out</sub>) are sufficient for most applications. For applications with higher output power, a larger input capacitor of 10 $\mu$ F may be appropriate. X5R and X7R capacitor types are ideal due to their stability across temperature range.

### Inductor Selection

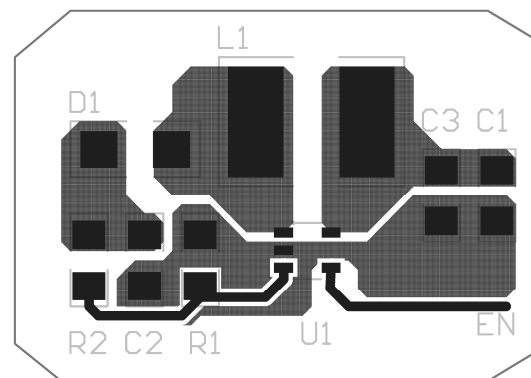
The recommended value of inductor for most applications is 4.7 $\mu$ H to 10 $\mu$ H. Small size and better efficiency are the major concerns for portable device, such as EUP2570 used for LCD panel bias suppliers. The inductor should have low core loss at 1MHz and low DCR for better efficiency. To avoid 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

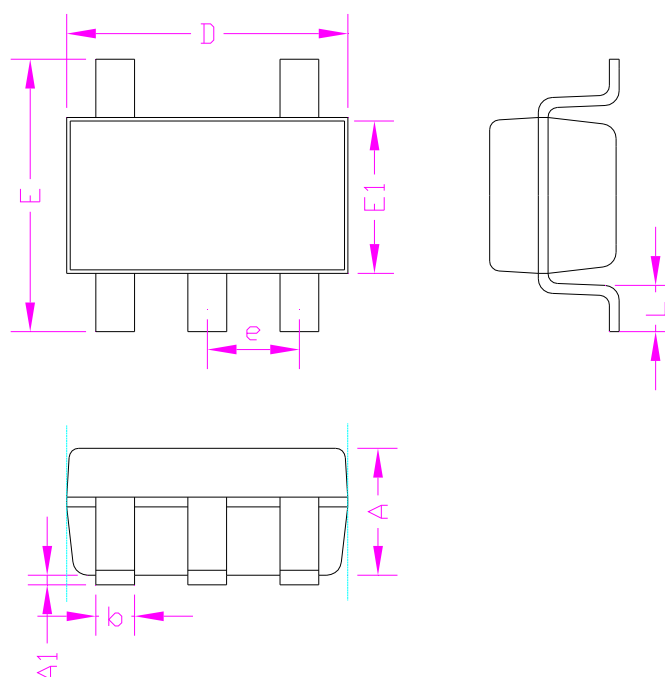
Careful PC board layout is required due to fast switching. All components must be placed as close to the device as possible. Keep the path between the inductor L1, diode D1, and output capacitor C2 extremely short for minimal noise and ringing. The feedback components such as the sense resistor R1/R2 must be kept close to the FB pin to prevent noise injection on the FB pin trace. The ground return of C1 and C2 should be tied close to the GND pin. See the EUP2570 demo board layout for reference.



**Figure 3. EUP2570 Demo Board**

**Packaging Information**

**TSOT23-5**



SYMBOLS	MILLIMETERS			INCHES		
	MIN.	Normal	MAX.	MIN.	Normal	MAX.
A	-	-	1.00	-	-	0.039
A1	0.00	-	0.15	0.000	-	0.006
D	2.65	2.90	3.15	0.104	0.114	0.124
E1	1.40	1.60	1.80	0.055	0.063	0.071
E	2.60	2.80	3.00	0.102	0.110	0.118
L	0.30	0.45	0.60	0.012	0.018	0.024
b	0.30	-	0.55	0.012	-	0.020
e	0.95			0.037		