

400KHz 60V 4A Switching Current Boost / Buck-Boost / Inverting DC/DC Converter

**Features**

- n Wide 5V to 32V Input Voltage Range
- n Positive or Negative Output Voltage Programming with a Single Feedback Pin
- n Current Mode Control Provides Excellent Transient Response
- n 1.25V reference adjustable version
- n Fixed 400KHz Switching Frequency
- n Maximum 4A Switching Current
- n SW PIN Built in Over Voltage Protection
- n Excellent line and load regulation
- n EN PIN TTL shutdown capability
- n Internal Optimize Power MOSFET
- n High efficiency up to 94%
- n Built in Frequency Compensation
- n Built in Soft-Start Function
- n Built in Thermal Shutdown Function
- n Built in Current Limit Function
- n Available in TO263-5L package

**General Description**

The XL6009 regulator is a wide input range, current mode, DC/DC converter which is capable of generating either positive or negative output voltages. It can be configured as either a boost, flyback, SEPIC or inverting converter. The XL6009 built in N-channel power MOSFET and fixed frequency oscillator, current-mode architecture results in stable operation over a wide range of supply and output voltages.

The XL6009 regulator is special design for portable electronic equipment applications.

**Applications**

- n EPC / Notebook Car Adapter
- n Automotive and Industrial Boost / Buck-Boost / Inverting Converters
- n Portable Electronic Equipment



**TO263-5L**

Figure1. Package Type of XL6009

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**Pin Configurations**

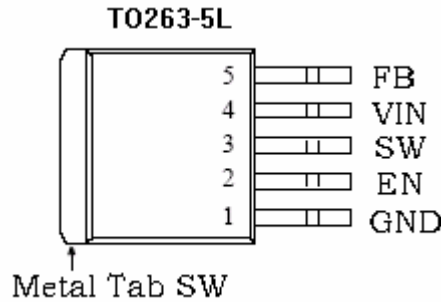


Figure2. Pin Configuration of XL6009 (Top View)

Table 1 Pin Description

Pin Number	Pin Name	Description
1	GND	Ground Pin.
2	EN	Enable Pin. Drive EN pin low to turn off the device, drive it high to turn it on. Floating is default high.
3	SW	Power Switch Output Pin (SW).
4	VIN	Supply Voltage Input Pin. XL6009 operates from a 5V to 32V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.
5	FB	Feedback Pin (FB). Through an external resistor divider network, FB senses the output voltage and regulates it. The feedback threshold voltage is 1.25V.

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**Function Block**

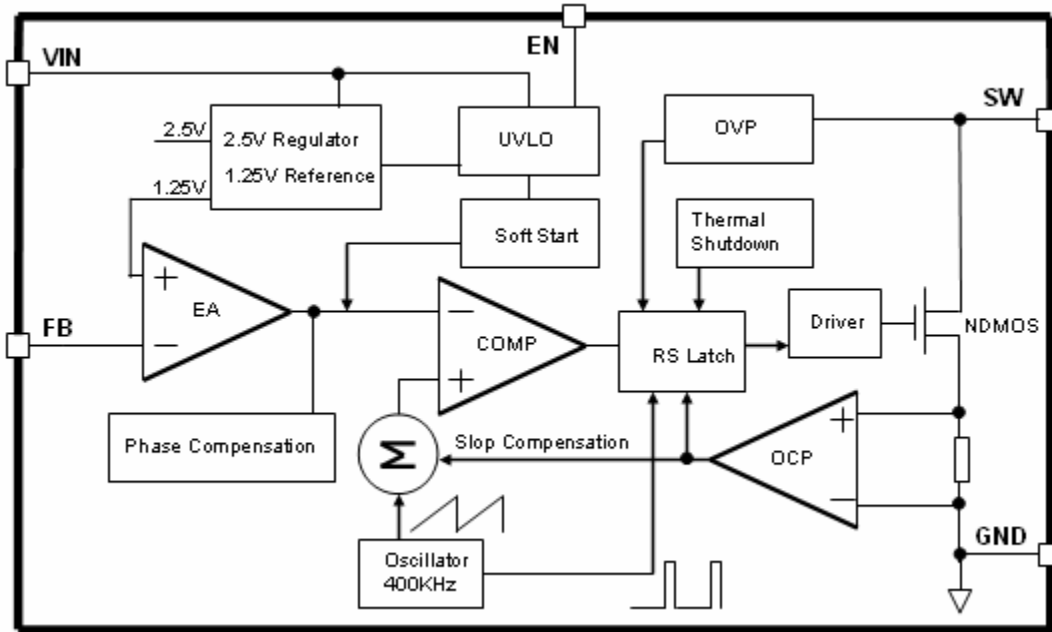


Figure3. Function Block Diagram of XL6009

**Typical Application Circuit**

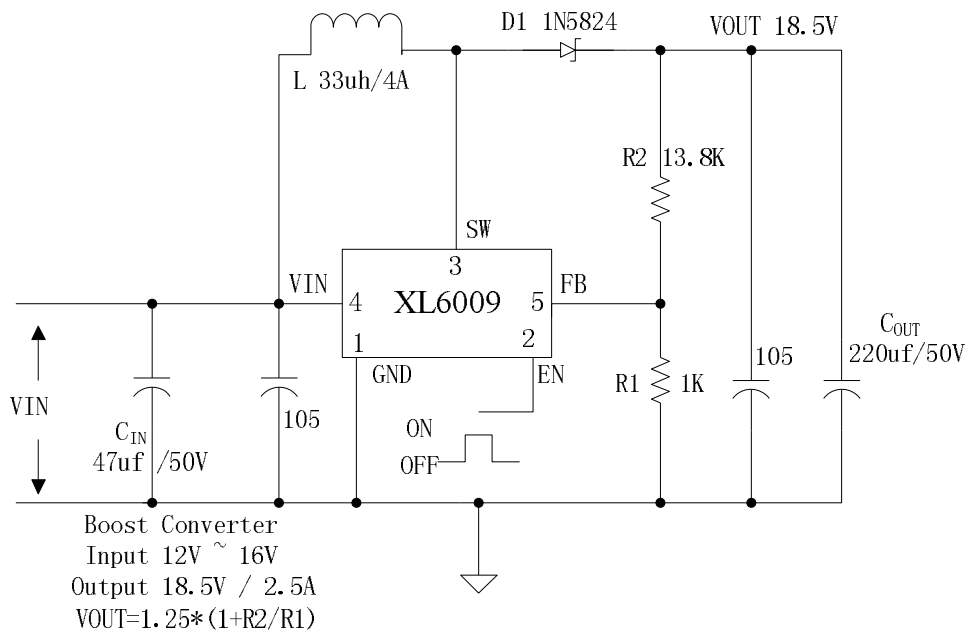


Figure4. XL6009 Typical Application Circuit (Boost Converter)

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### Ordering Information

Package	Temperature Range	Part Number	Marking ID	Packing Type
		Lead Free	Lead Free	
		XL6009E1	XL6009E1	Tube
		XL6009TRE1	XL6009E1	Tape & Reel

XLSEMI Pb-free products, as designated with “E1” suffix in the par number, are RoHS compliant.

### Absolute Maximum Ratings (Note1)

Parameter	Symbol	Value	Unit
Input Voltage	V <sub>in</sub>	-0.3 to 36	V
Feedback Pin Voltage	V <sub>FB</sub>	-0.3 to V <sub>in</sub>	V
EN Pin Voltage	V <sub>EN</sub>	-0.3 to V <sub>in</sub>	V
Output Switch Pin Voltage	V <sub>Output</sub>	-0.3 to 60	V
Power Dissipation	P <sub>D</sub>	Internally limited	mW
Thermal Resistance (TO263-5L) (Junction to Ambient, No Heatsink, Free Air)	R <sub>JA</sub>	30	°C/W
Operating Junction Temperature	T <sub>J</sub>	-40 to 125	°C
Storage Temperature	T <sub>STG</sub>	-65 to 150	°C
Lead Temperature (Soldering, 10 sec)	T <sub>LEAD</sub>	260	°C
ESD (HBM)		>2000	V

**Note1:** Stresses greater than those listed under Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

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**XL6009 Electrical Characteristics**

T<sub>a</sub> = 25 °C ;unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<i>System parameters test circuit figure4</i>						
VFB	Feedback Voltage	V <sub>in</sub> = 12V to 16V, V <sub>out</sub> =18V I <sub>load</sub> =0.1A to 2A	1.213	1.25	1.287	V
Efficiency	η	V <sub>in</sub> =12V ,V <sub>out</sub> =18.5V I <sub>out</sub> =2A	-	92	-	%

**Electrical Characteristics (DC Parameters)**

V<sub>in</sub> = 12V, GND=0V, V<sub>in</sub> & GND parallel connect a 220uf/50V capacitor; I<sub>out</sub>=0.5A, T<sub>a</sub> = 25 °C ; the others floating unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	V <sub>in</sub>		5		32	V
Shutdown Supply Current	I <sub>STBY</sub>	V <sub>EN</sub> =0V		70	100	uA
Quiescent Supply Current	I <sub>q</sub>	V <sub>EN</sub> =2V, V <sub>FB</sub> =V <sub>in</sub>		2.5	5	mA
Oscillator Frequency	F <sub>osc</sub>		320	400	480	Khz
Switch Current Limit	I <sub>L</sub>	V <sub>FB</sub> =0		4		A
Output Power NMOS	R <sub>dson</sub>	V <sub>in</sub> =12V, I <sub>sw</sub> =4A		110	120	mohm
EN Pin Threshold	V <sub>EN</sub>	High (Regulator ON) Low (Regulator OFF)		1.4 0.8		V
EN Pin Input Leakage Current	I <sub>H</sub>	V <sub>EN</sub> =2V (ON)		3	10	uA
	I <sub>L</sub>	V <sub>EN</sub> =0V (OFF)		3	10	uA
Max. Duty Cycle	D <sub>MAX</sub>	V <sub>FB</sub> =0V		90		%

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**Schottky Diode Selection Table**

Current	Surface Mount	Through Hole	VR (The same as system maximum input voltage)				
			20V	30V	40V	50V	60V
1A		✓	1N5817	1N5818	1N5819		
		✓	1N5820	1N5821	1N5822		
3A		✓	MBR320	MBR330	MBR340	MBR350	MBR360
	✓		SK32	SK33	SK34	SK35	SK36
	✓			30WQ03	30WQ04	30WQ05	
		✓		31DQ03	31DQ04	31DQ05	
		✓	SR302	SR303	SR304	SR305	SR306
5A		✓	1N5823	1N5824	1N5825		
		✓	SR502	SR503	SR504	SR505	SR506
		✓	SB520	SB530	SB540	SB550	SB560
	✓			50WQ03	50WQ04	50WQ05	

**Typical System Application for EPC/Notebook Car Adapter – Boost (Output 18.5V/2.5A)**

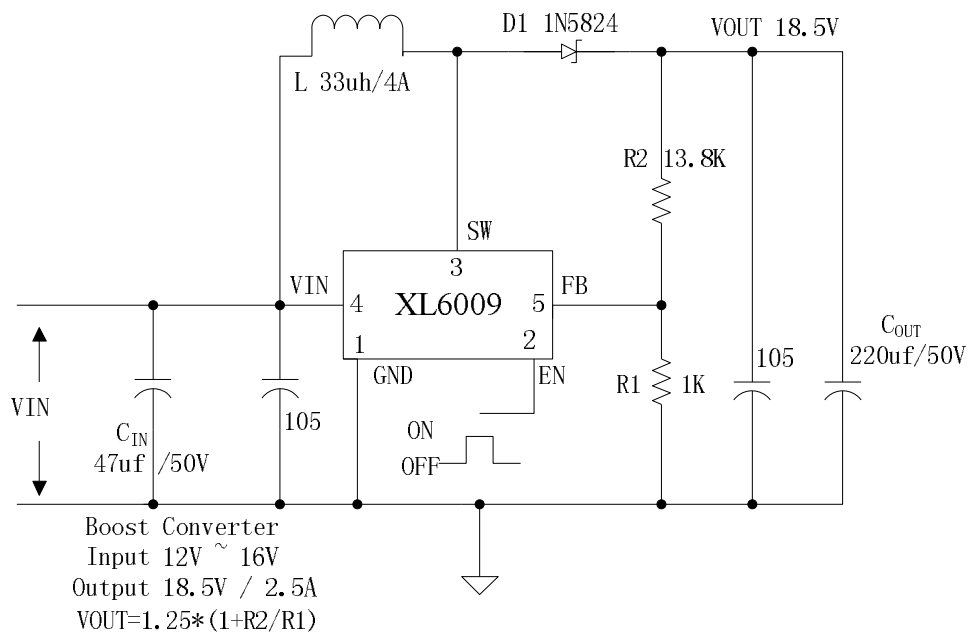


Figure5. XL6009 Typical System Application (Boost Converter)

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**Typical System Application for Portable Notebook Car Adapter**  
**- SEPIC Buck-Boost Topology (Input 10V~30V, Output 12V/2A)**

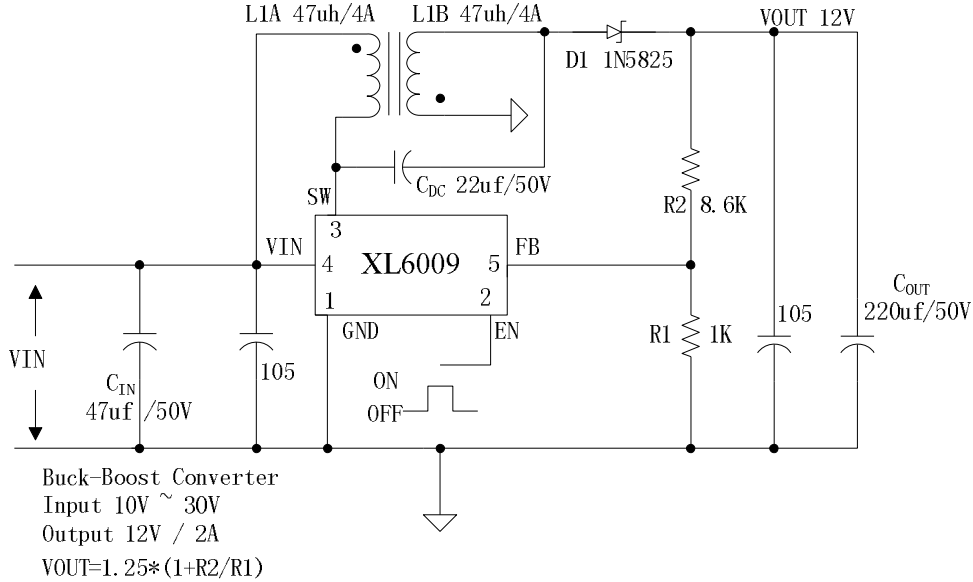


Figure6. XL6009 Typical System Application (SEPIC Buck-Boost Converter)

**Typical System Application for Inverting Converter**  
**- SEPIC Inverting Topology (Input 10V~30V, Output + -12V/1A)**

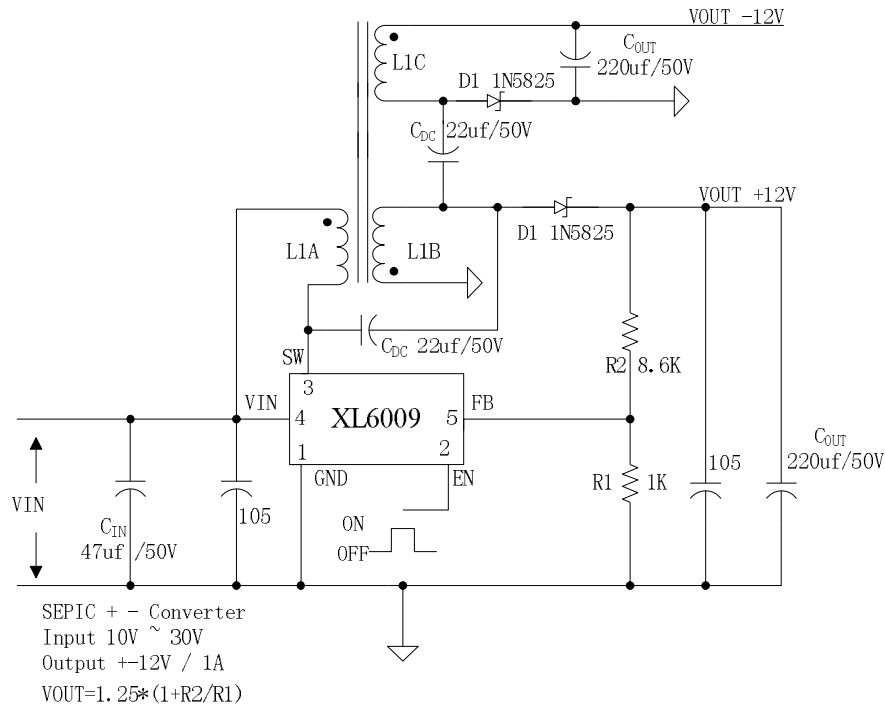
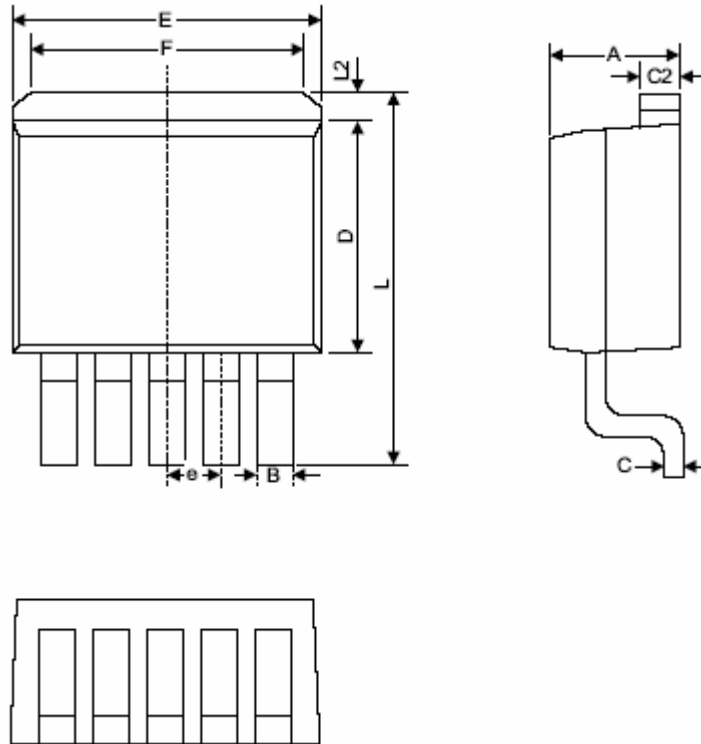


Figure7. XL6009 Typical System Application (SEPIC Inverting Converter)

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**Package Information**

**TO263-5L**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	0.160	0.190
B	0.76	1.02	0.030	0.040
C	0.36	0.64	0.014	0.025
C2	1.14	1.40	0.045	0.055
D	8.64	9.65	0.340	0.380
E	9.78	10.54	0.385	0.415
e	1.57	1.85	0.062	0.073
F	6.60	7.11	0.260	0.280
L	15.11	15.37	0.595	0.605
L2	-	1.40	-	0.055