3A 180KHz 36V Buck DC to DC Converter With CV/CC Loop XL2009

Features

- Wide 8V to 36V Input Voltage Range
- Output Adjustable from 1.25V to 32V
- Maximum Duty Cycle 100%
- Minimum Drop Out 0.3V
- Fixed 180KHz Switching Frequency
- Maximum 3A Switching Current
- Internal Optimize Power MOSFET
- High efficiency
- Excellent line and load regulation
- With output constant current loop
- Built in thermal shutdown function
- Built in current limit function
- Built in output short protection function
- Available in SOP8 package

Applications

- Car Charger
- Battery Charger
- LCD Monitor and LCD TV
- Portable instrument power supply
- Telecom / Networking Equipment

General Description

The XL2009 is a 180 KHz fixed frequency PWM buck (step-down) DC/DC converter, capable of driving a 2.5A load with high efficiency, low ripple and excellent line and load regulation. Requiring a minimum number of external components, the regulator is simple to use and include internal frequency compensation and a fixed-frequency oscillator.

The PWM control circuit is able to adjust the duty ratio linearly from 0 to 100%. An over current protection function is built inside. When short protection function happens, the operation frequency will be reduced from 180KHz to 48KHz. An internal compensation block is built in to minimize external component count.

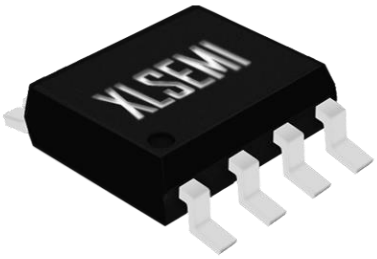


Figure1. Package Type of XL2009

Pin Configurations

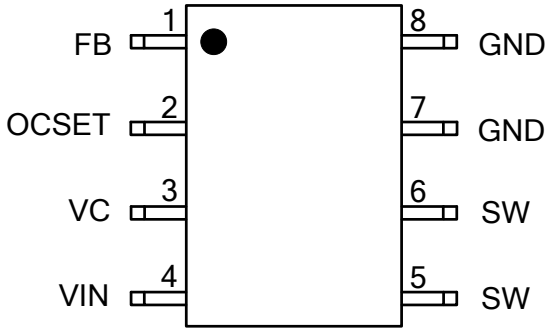


Figure2. Pin Configuration of XL2009 (Top View)

Table 1 Pin Description

Pin Number	Pin Name	Description
1	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.
2	OCSET	Output Constant Current Set Pin.
3	VC	Internal Voltage Regulator Bypass Capacitor Pin (VC). The VC pin connect a 1uf capacitor to VIN.
4	VIN	Supply Voltage Input Pin. XL2009 operates from a 8V to 36V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.
5,6	SW	Power Switch Output Pin (SW). SW is the switch node that supplies power to the output.
7,8	GND	Ground Pin. Care must be taken in layout. This pin should be placed outside of the Schottky Diode to output capacitor ground path to prevent switching current spikes from inducing voltage noise into XL2009.

Function Block

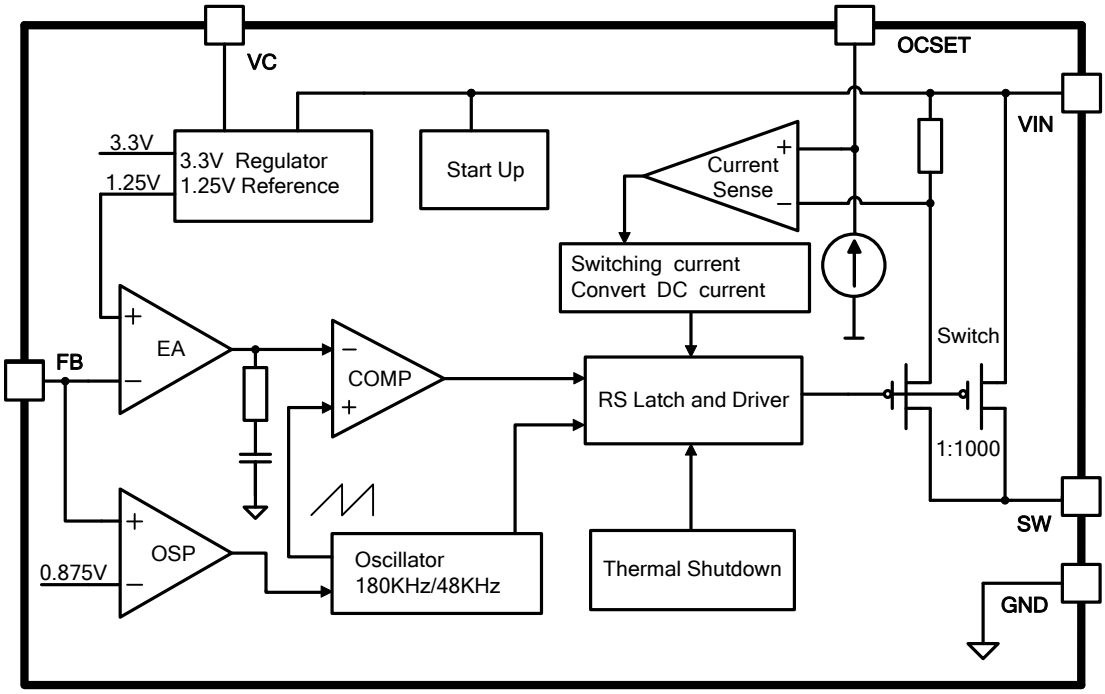


Figure3. Function Block Diagram of XL2009

Typical Application Circuit

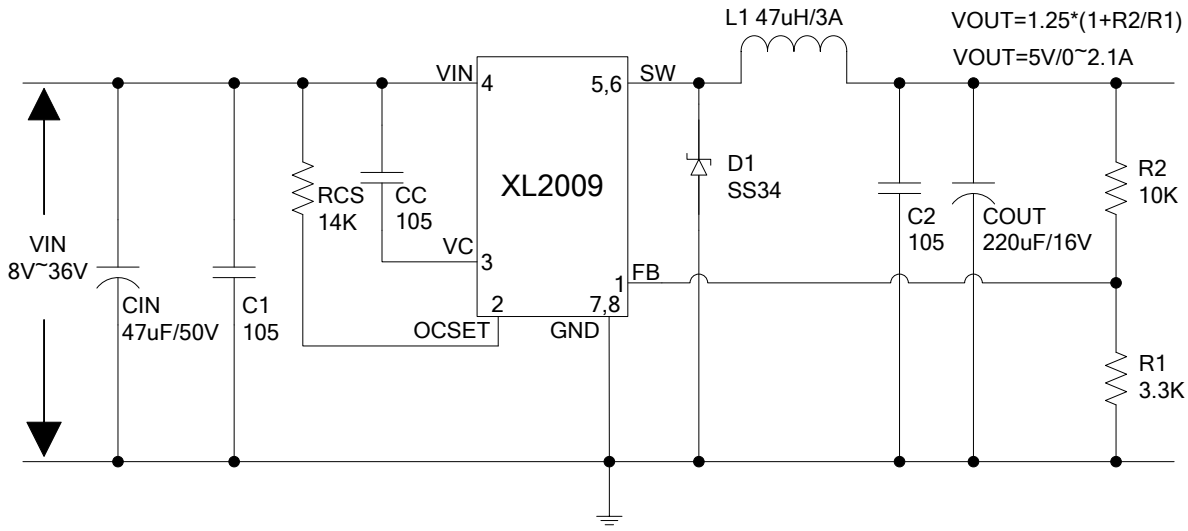


Figure4. XL2009 Typical Application Circuit (VIN=8V~36V, VOUT=5V/2.1A)

Ordering Information

Order Information	Marking ID	Package Type	Packing Type Supplied As
XL2009E1	XL2009E1	SOP8	2500/4000 Units on 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	Vin	-0.3 to 40	V
Feedback Pin Voltage	V_{FB}	-0.3 to Vin	V
Output Switch Pin Voltage	V_{SW}	-0.3 to Vin	V
Power Dissipation	P_D	Internally limited	mW
Thermal Resistance (SOP8) (Junction to Ambient, No Heatsink, Free Air)	R_{JA}	100	℃/W
Operating Junction Temperature	T_J	-40 to 125	℃
Storage Temperature	T_{STG}	-65 to 150	℃
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	℃
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.

XL2009 Electrical Characteristics

T_a = 25℃;unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
System parameters test circuit figure4						
VFB	Feedback Voltage	Vin = 8V to 36V, Vout=5V Iload=0.5A to 2.5A	1.225	1.25	1.275	V
η	Efficiency	Vin=12V,Vout=5V Iout=2.1A	–	89	–	%

Electrical Characteristics (DC Parameters)

Vin = 12V, GND=0V, Vin & GND parallel connect a 100uf/50V capacitor; Iout=500mA, T_a = 25℃; the others floating unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	Vin		8		36	V
Quiescent Supply Current	I_q	V_{FB} =Vin		2.1	5	mA
Oscillator Frequency	Fosc		153	180	207	KHz
Output Short Frequency	Fosp			48		KHz
Switch Current Limit	I_L	V_{FB} =0V		4		A
Max. Duty Cycle	D_{MAX}	V_{FB}=0V		100		%
Output Power PMOS	Rdson	V_{FB}=0V, Vin=12V, I_{SW}=3A		60	80	mohm

Typical System Application (VOUT=5V/2.1A)

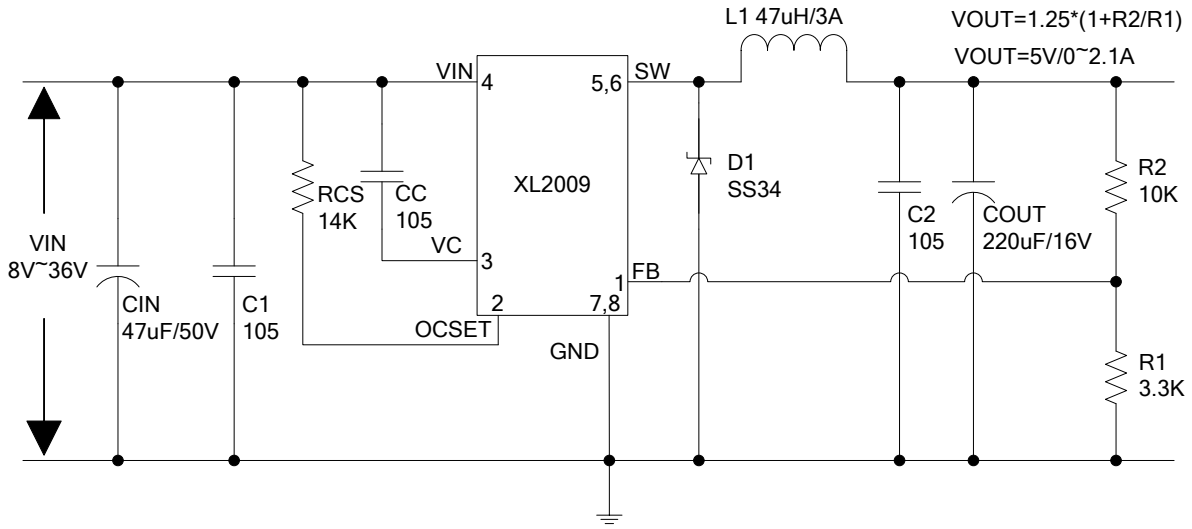


Figure5. XL2009 System Parameters Test Circuit (VIN=8V~36V, VOUT=5V/2.1A)

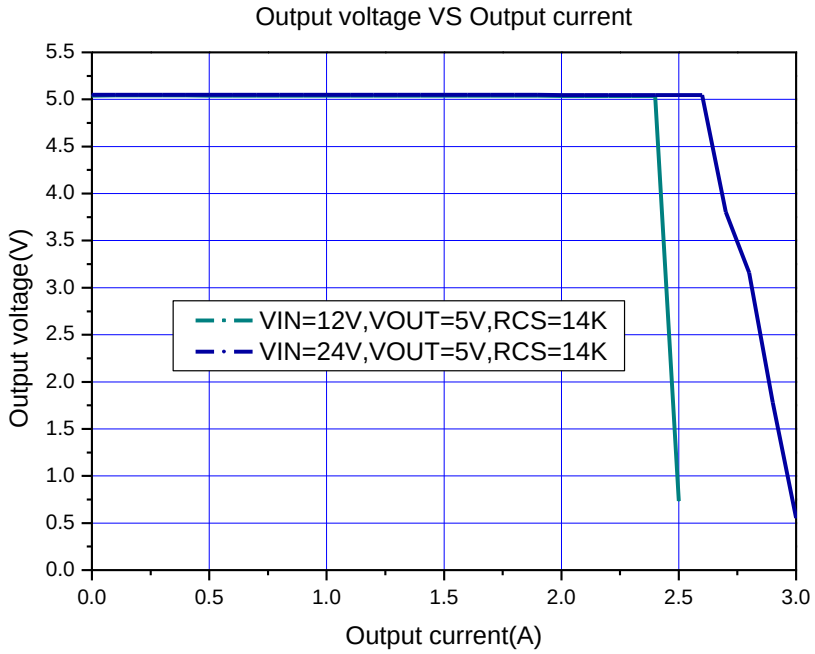


Figure6. XL2009 System Output Constant Current Curve

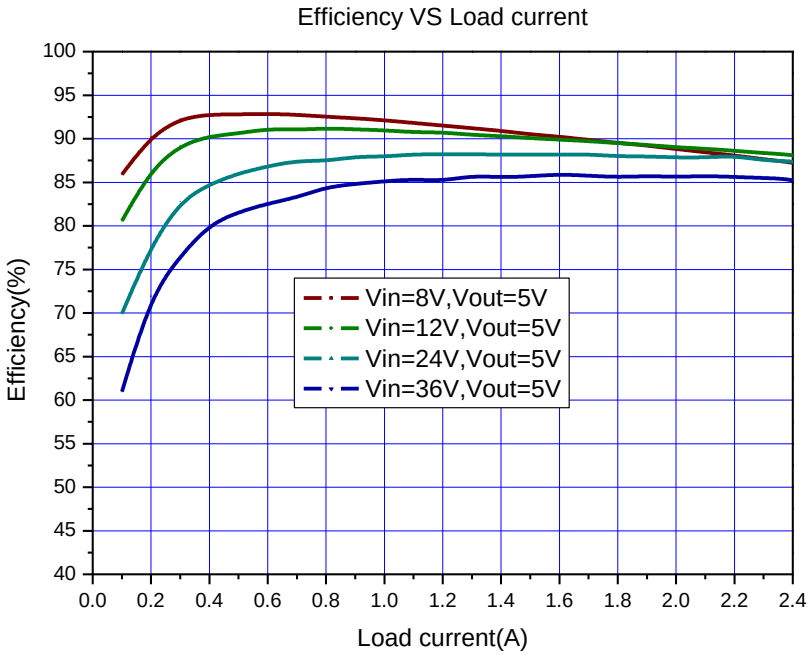


Figure7. XL2009 System Efficiency Curve

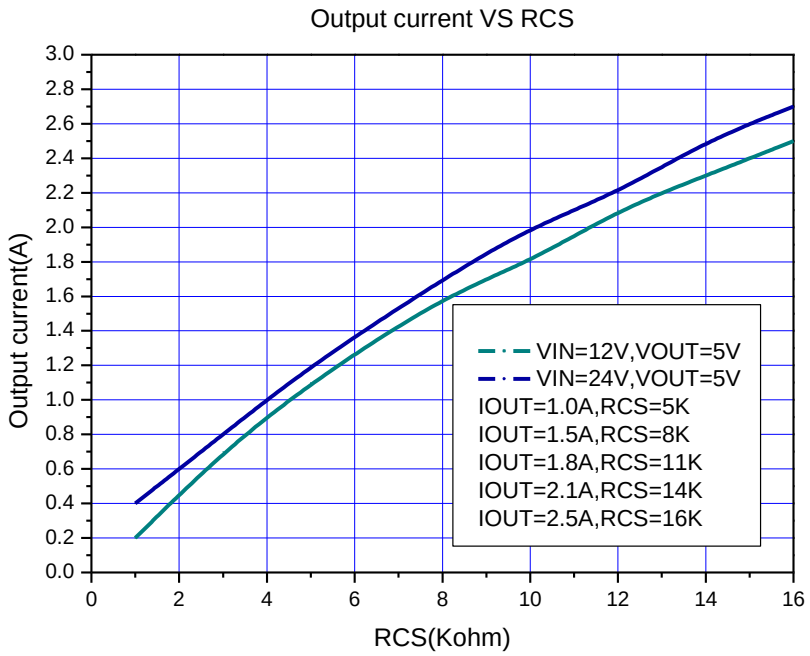


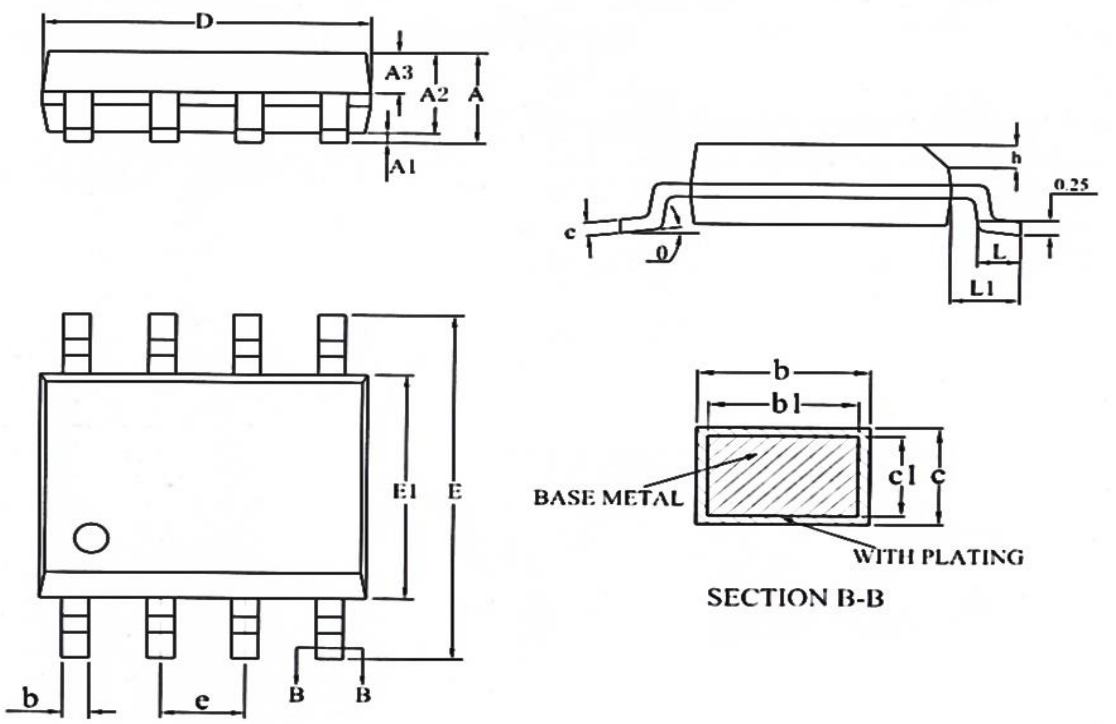
Figure8. RCS VS Output Current Select Curve

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		
3A		✓	1N5820	1N5821	1N5822		
		✓	MBR320	MBR330	MBR340	MBR350	MBR360
	✓		SK32	SK33	SK34	SK35	SK36
	✓			30WQ03	30WQ04	30WQ05	
		✓		31DQ03	31DQ04	31DQ05	
		✓	SR302	SR303	SR304	SR305	SR306

Package Information

SOP8



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.35	1.55	1.75	0.053	0.061	0.069
A1	0.05	–	0.25	0.002	–	0.010
A2	1.25	1.40	1.65	0.049	0.055	0.065
A3	0.50	0.60	0.70	0.019	0.024	0.028
b	0.30	–	0.51	0.012	–	0.020
b1	0.29	0.41	0.48	0.011	0.016	0.018
c	0.17	–	0.25	0.007	–	0.010
c1	0.17	0.20	0.23	0.007	0.008	0.009
D	4.70	4.90	5.10	0.185	0.193	0.200
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e	1.14	1.27	1.40	0.045	0.050	0.055
h	0.25	–	0.50	0.010	–	0.020
L	0.45	–	0.80	0.017	–	0.031
L1	0.82	1.03	1.23	0.032	0.040	0.048
θ	0	–	8°	0	–	8°

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