

**2A 150KHz 40V Buck DC to DC Converter****XL1509****Features**

- Wide 4.75 to 40V Input Voltage Range
- 3.3V, 5V, 12V, and adjustable versions
- Output Adjustable from 1.23V to 38V
- Maximum Duty Cycle 100%
- Minimum Drop Out 1.5V
- Fixed 150KHz Switching Frequency
- 2A Constant Output Current Capability
- Internal Optimize Power Transistor
- Up to 88% Efficiency
- Excellent line and load regulation
- TTL shutdown capability
- Built in Frequency Compensation
- Built in Thermal Shutdown Function
- Built in Current Limit Function
- Built in Short Protection Function
- SOIC-8 Package is Available

**Applications**

- LCD Monitor and LCD TV
- Digital Photo Frame
- Set-up Box
- ADSL Modem
- Telecom / Networking Equipment

**General Description**

The XL1509 is a 150 KHz fixed frequency PWM buck (step-down) DC/DC converter, capable of driving a 2A 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 enable function, an over current protection function and a short circuit protection function are built inside. When OCP or SCP happens, the operation frequency will be reduced from 150KHz to 50KHz. An internal compensation block is built in to minimize external component count.

**SOIC-8****Figure1. Package Type of XL1509**

## 2A 150KHz 40V Buck DC to DC Converter

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### Pin Configurations

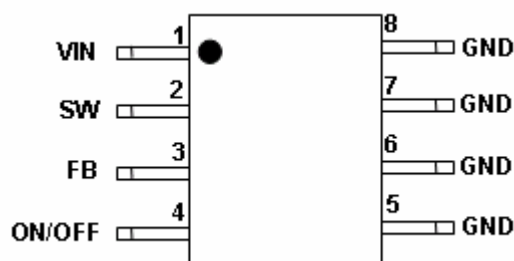


Figure2. Pin Configuration of XL1509 (Top View)

Table 1 Pin Description

Pin Number	Pin Name	Description
1	Vin	Supply Voltage Input Pin. XL1509 operates from a 4.75V to 40V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.
2	Output	Power Switch Output Pin (SW). Output is the switch node that supplies power to the output.
3	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 XL1509.
4	Feedback	Feedback Pin (FB). Through an external resistor divider network, Feedback senses the output voltage and regulates it. The feedback threshold voltage is 1.23V.
5	ON/OFF	Enable Pin. Drive ON/OFF pin low to turn on the device, drive it high to turn it off. Floating is default low.

## Function Block

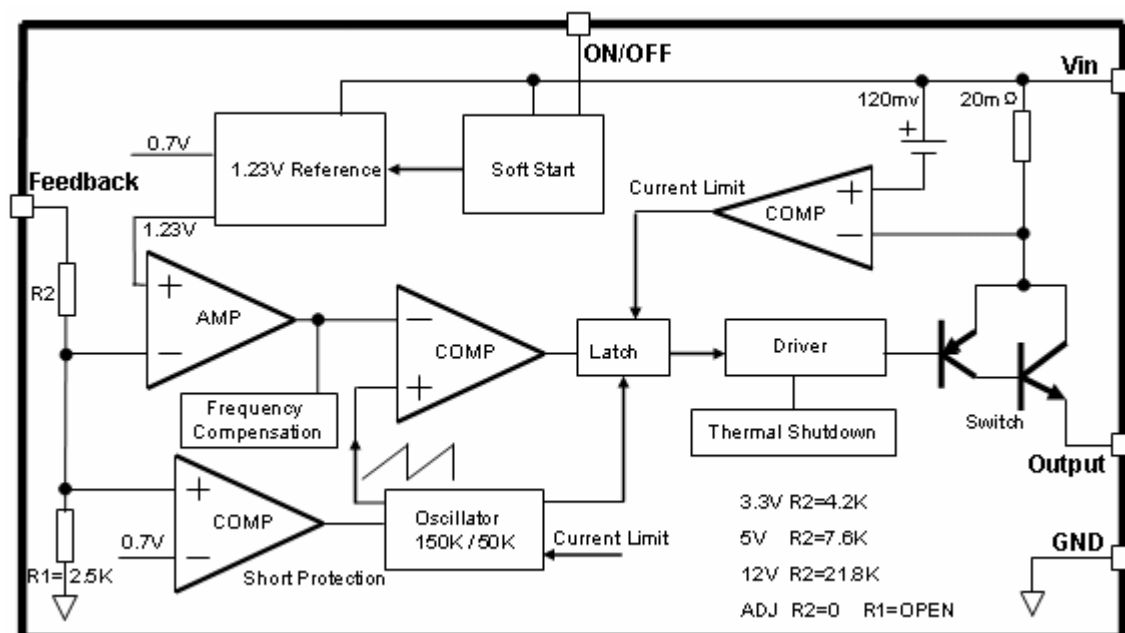


Figure3. Function Block Diagram of XL1509

## Typical Application Circuit

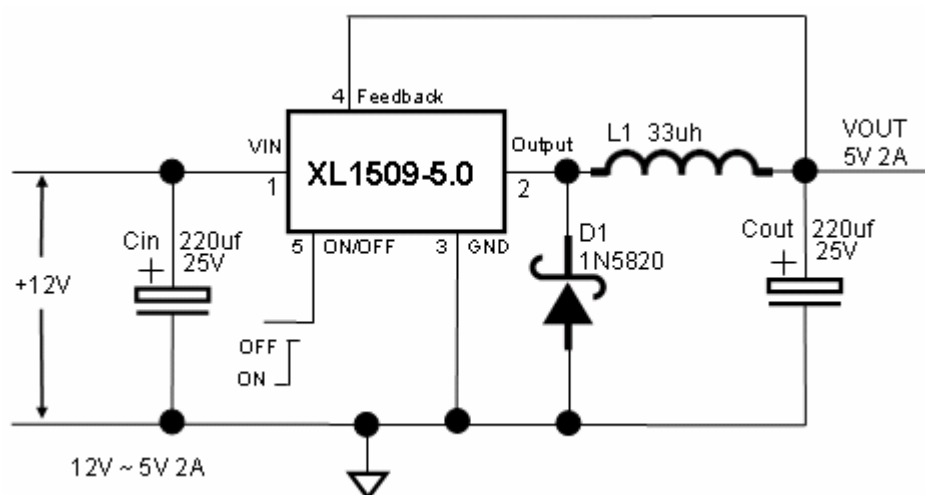
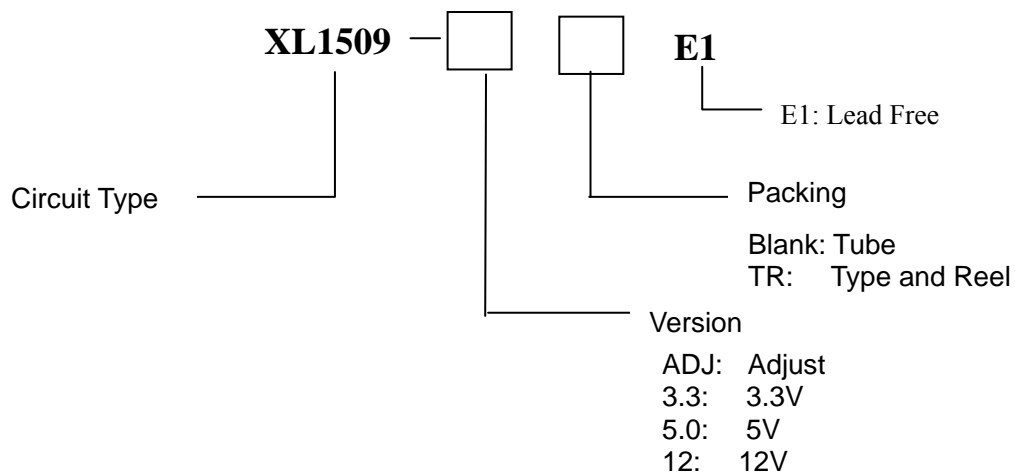


Fig4. XL1509 Typical Application Circuit 12V-5V/2A

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## Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
		Lead Free	Lead Free	
SOIC8	-40°C ~ 85°C	XL1509-ADJE1	XL1509-ADJE1	Tube
		XL1509-3.3E1	XL1509-3.3E1	Tube
		XL1509-5.0E1	XL1509-5.0E1	Tube
		XL1509-12E1	XL1509-12E1	Tube
		XL1509-ADJTRE1	XL1509-ADJTRE1	Tape & Reel
		XL1509-3.3TRE1	XL1509-3.3TRE1	Tape & Reel
		XL1509-5.0TRE1	XL1509-5.0TRE1	Tape & Reel
		XL1509-12TRE1	XL1509-12TRE1	Tape & Reel

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

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**Absolute Maximum Ratings ( Note1 )**

Parameter	Symbol	Value	Unit
Input Voltage	V <sub>in</sub>	-0.3 to 45	V
Feedback Pin Voltage	V <sub>FB</sub>	-0.3 to V <sub>in</sub>	V
ON/OFF Pin Voltage	V <sub>ON/OFF</sub>	-0.3 to V <sub>in</sub>	V
Output Switch Pin Voltage	V <sub>Output</sub>	-0.3 to V <sub>in</sub>	V
Power Dissipation	P <sub>D</sub>	Internally limited	mW
Thermal Resistance (SOIC8) (Junction to Ambient, No Heatsink, Free Air)	R <sub>JA</sub>	100	°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)		4000	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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**XL1509**
**Electrical Characteristics (DC Parameters)**

$V_{in} = 12V$  for the 3.3V, 5V, and Adjustable versions and  $V_{in} = 24V$  for the 12V version,  $GND = 0V$ ,  $V_{in}$  &  $GND$  parallel connect a 220uF/50V capacitor;  $I_{out} = 500mA$ ,  $T_a = 25^\circ C$ ; the others floating unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	$V_{in}$		4.75		40	V
Shutdown Supply Current	$I_{STBY}$	$V_{ON/OFF} = 5V$		100	200	uA
Quiescent Supply Current	$I_q$	$V_{ON/OFF} = Gnd$ , $V_{FB} = V_{in}$		2	5	mA
Switch Current Limit	$I_L$	$V_{FB} = 0$		3.5		A
ON/OFF Pin Threshold	$V_{ON/OFF}$	$V_{FB} = 0V$ , $V_{ON/OFF}$ from 0.5V~2V		1.3		V
ON/OFF Pin Input Leakage Current	$I_H$	$V_{ON/OFF} = 2.5V$ (OFF)		5	15	uA
	$I_L$	$V_{ON/OFF} = 0.5V$ (ON)		0.2	5	uA
Output Saturation Voltage	$V_{CE}$	$V_{FB} = 0V$ $I_{out} = 2A$		1.2	1.5	V
Max. Duty Cycle	$D_{MAX}$	$V_{FB} = 0V$		100		%
Thermal Shutdown	$T_{OTSD}$	$V_{FB} = 0V$		165		$^\circ C$
Thermal Shutdown Hysteresis	$T_{HYS}$	$V_{FB} = 0V$		15		$^\circ C$

## Electrical Characteristics (System Parameters 3.3V Version)

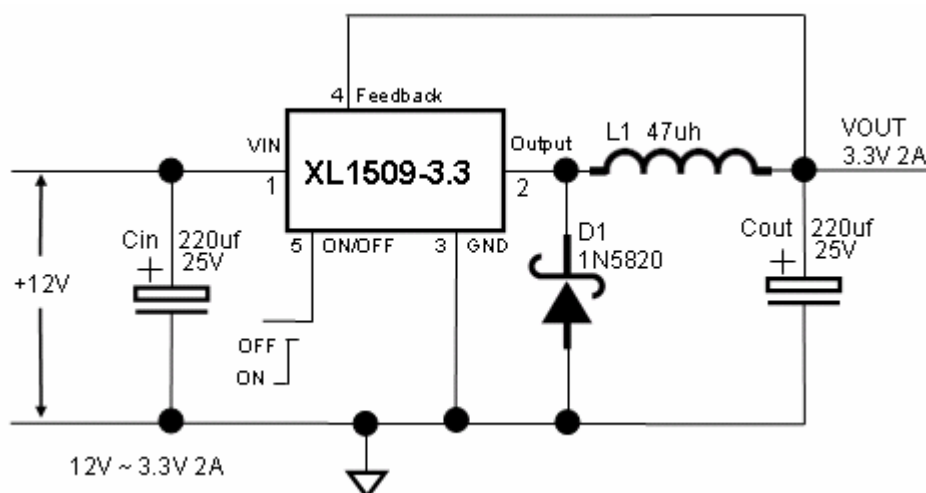


Fig5. XL1509 System Parameters Test Circuit

$T_a = 25^\circ\text{C}$  ; unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Feedback Voltage	$V_{FB}$	$V_{in} = 6V \text{ to } 36V$ $V_{out}=3.3V, I_{out}=0.5A$	3.168	3.3	3.432	V
VOUT Line Regulation	$R_{LINE}$	$V_{in} = 6V \text{ to } 36V$ $V_{out}=3.3V, I_{out}=0.5A$		0.5	2	%
VOUT Load Regulation	$R_{LOAD}$	$V_{in}=12V, V_{out}=3.3V$ $I_{out}=0.5 \text{ to } 2A$		0.6	2	%
Switching Frequency	$F_{output}$	$V_{in}=12V, V_{out}=3.3V$ $I_{out}=0.5A$	127	150	173	KHz
Frequency of Short Circuit Protection	$F_{output1}$	$V_{in}=12V, V_{out}=\text{Short}$ $V_{FB}<1.9V$		50		KHz
Efficiency(12V~3.3V)	$\eta$	$V_{in}=12V, V_{out}=3.3V$ $I_{out}=2A$	-	76	-	%

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### Electrical Characteristics (System Parameters 5V Version)

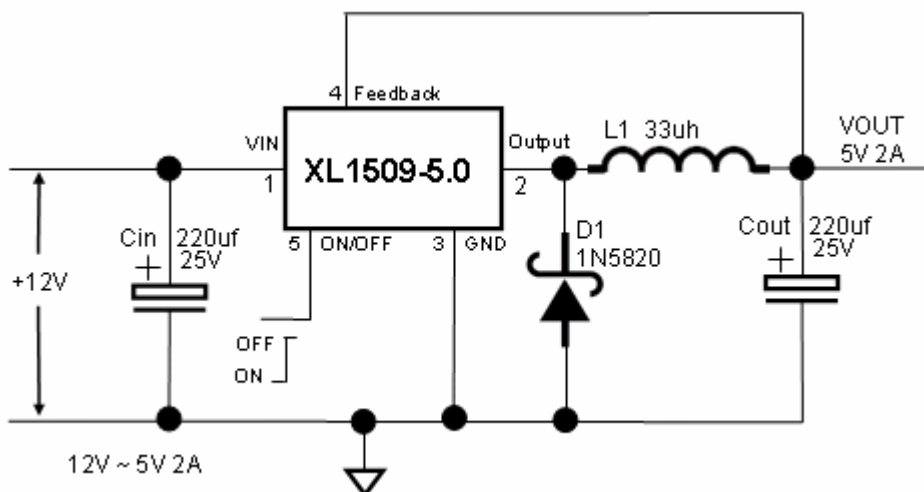


Fig6. XL1509 System Parameters Test Circuit

$T_a = 25^\circ\text{C}$  ; unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Feedback Voltage	$V_{FB}$	$V_{in} = 8V \text{ to } 36V$ $V_{out}=5V, I_{out}=0.5A$	4.8	5	5.2	V
VOUT Line Regulation	$R_{LINE}$	$V_{in} = 8V \text{ to } 36V$ $V_{out}=5V, I_{out}=0.5A$		0.5	2	%
VOUT Load Regulation	$R_{LOAD}$	$V_{in}=12V, V_{out}=5V$ $I_{out}=0.5 \text{ to } 2A$		0.6	2	%
Switching Frequency	$F_{output}$	$V_{in}=12V, V_{out}=5V$ $I_{out}=0.5A$	127	150	173	KHz
Frequency of Short Circuit Protection	$F_{output1}$	$V_{in}=12V, V_{out}=\text{Short}$ $V_{FB}<2.8V$		50		KHz
Efficiency(12V~5V)	$\eta$	$V_{in}=12V, V_{out}=5V$ $I_{out}=2A$	-	82	-	%



## Electrical Characteristics (System Parameters 12V Version)

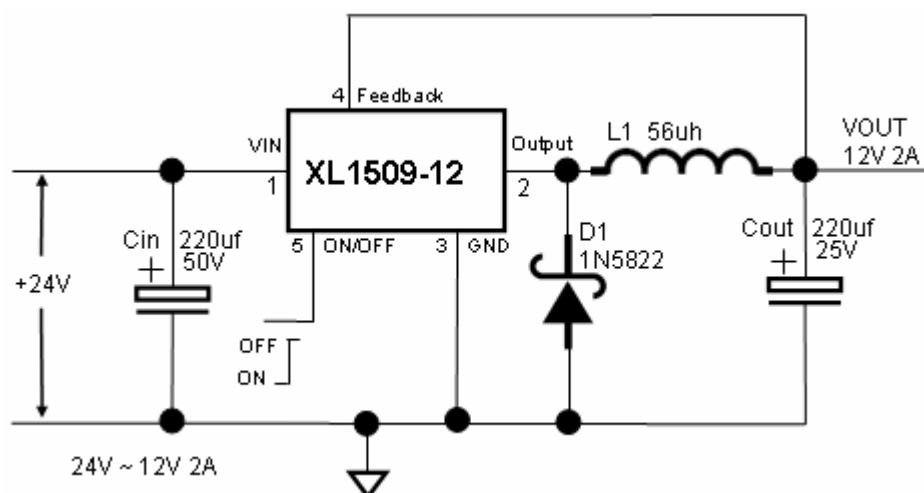


Fig7. XL1509 System Parameters Test Circuit

$T_a = 25^\circ\text{C}$  ; unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Feedback Voltage	$V_{FB}$	$V_{in} = 15\text{V to } 36\text{V}$ $V_{out}=12\text{V}, I_{out}=0.5\text{A}$	11.52	12	12.48	V
VOUT Line Regulation	$R_{LINE}$	$V_{in} = 15\text{V to } 36\text{V}$ $V_{out}=12\text{V}, I_{out}=0.5\text{A}$		0.6	2	%
VOUT Load Regulation	$R_{LOAD}$	$V_{in}=24\text{V}, V_{out}=12\text{V}$ $I_{out}=0.5 \text{ to } 2\text{A}$		0.6	2	%
Switching Frequency	$F_{output}$	$V_{in}=24\text{V}, V_{out}=12\text{V}$ $I_{out}=0.5\text{A}$	127	150	173	KHz
Frequency of Short Circuit Protection	$F_{output1}$	$V_{in}=24\text{V}, V_{out}=\text{Short}$ $V_{FB}<6.8\text{V}$		50		KHz
Efficiency(24V~12V)	$\eta$	$V_{in}=24\text{V}, V_{out}=12\text{V}$ $I_{out}=2\text{A}$	-	88	-	%

## Electrical Characteristics (System Parameters ADJ Version)

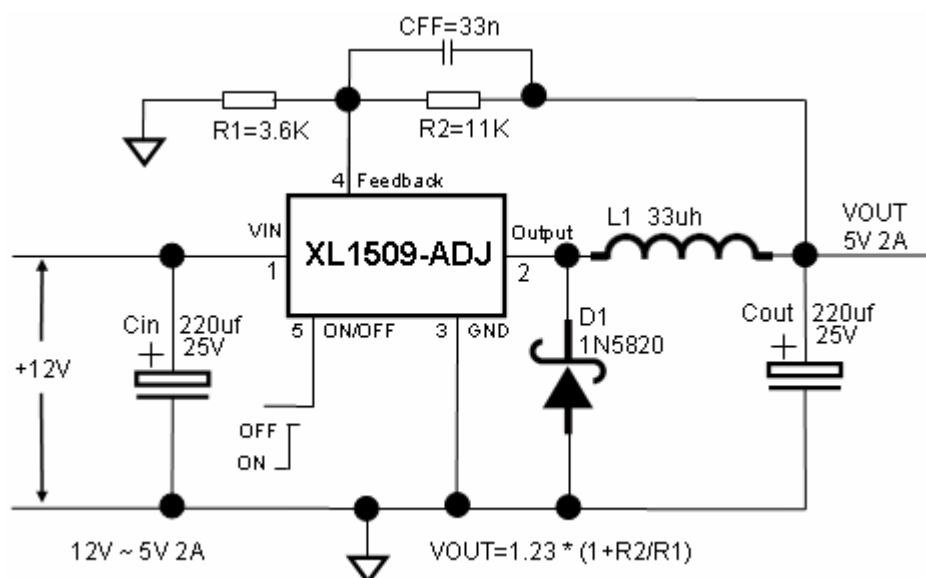


Fig8. XL1509 System Parameters Test Circuit

(The CFF is optional. It provides additional stability for high output voltages, low input-output voltages, and/or very low ESR output capacitors, such as solid tantalum capacitors)

$T_a = 25^\circ\text{C}$ ; unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Feedback Voltage	$V_{FB}$	$V_{in} = 8V \text{ to } 36V$ $V_{out}=5V, I_{out}=0.5A$	1.193	1.23	1.267	V
VOUT Line Regulation	$R_{LINE}$	$V_{in} = 8V \text{ to } 36V$ $V_{out}=5V, I_{out}=0.5A$		0.5	2	%
VOUT Load Regulation	$R_{LOAD}$	$V_{in}=12V, V_{out}=5V$ $I_{out}=0.5 \text{ to } 2A$		0.6	2	%
Switching Frequency	$F_{output}$	$V_{in}=12V, V_{out}=5V$ $I_{out}=0.5A$	127	150	173	KHz
Frequency of Short Circuit Protection	$F_{output1}$	$V_{in}=12V, V_{out}=\text{Short}$ $V_{FB}<0.7V$		50		KHz
Efficiency(12V~5V)	$\eta$	$V_{in}=12V, V_{out}=5V$ $I_{out}=2A$	-	82	-	%

## SOP8 Package Mechanical Dimensions

Unit: mm(inch)

