300mA Low Power Low Noise LDO CMOS Voltage Regulator

Description

The EC49509 series of fixed output low dropout linear regulators are designed for portable battery powered applications, which require low power consumption, low noise environment, and low dropout voltage. Each device contains a bandgap voltage reference, an error amplifier, a PMOS power transistor, and resistors for setting output voltage, and current limit and temperature limit protection circuits.

The EC49509 has been designed to be used with low cost capacitors and requires a minimum output capacitor of 1.0μF. The output voltages range from 1.3V to 4.4V in 100mV increments. Standard voltage versions are 1.5, 1.8, 2.5, 2.8, 3.0, and 3.3V.

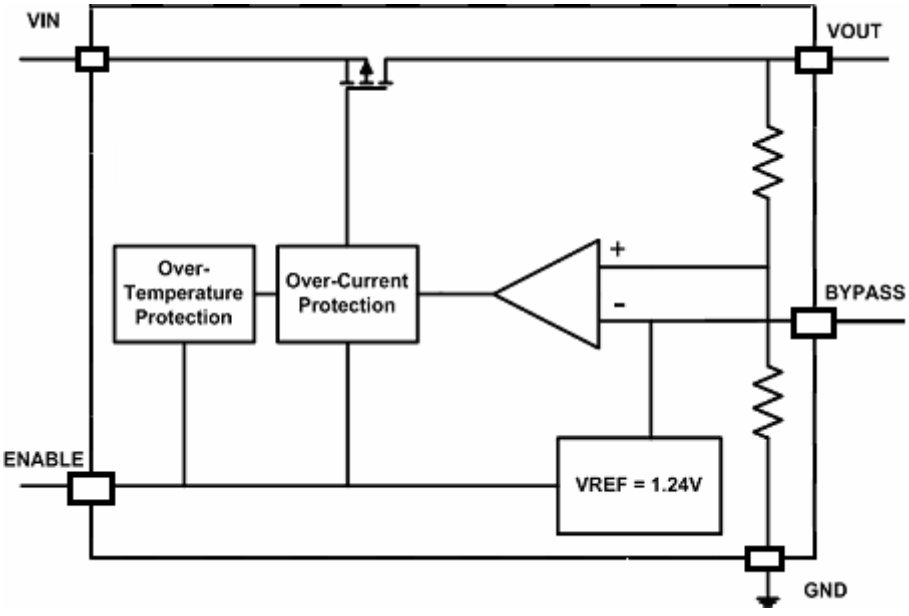
Features

- Typical 200mV Dropout Voltage at 150mA
- Fast Enable Turn-On Time of 20μs (Typ.)
- Excellent Line and Load Regulation
- High Accuracy Output Voltage of 2%
- Ultra-Low Ground Current at 20μA (Typ.)
- Disable Current Less than 0.1μA (Typ.)
- Over Current and thermal Protection
- No Reverse Current
- Standard SOT-23-5L Package

Applications

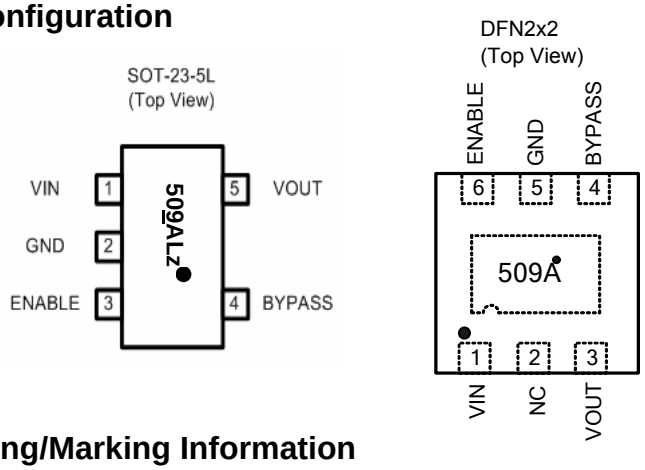
- USB removable devices
- MPEG4 devices
- Wireless LAN's
- Hand-Held Instrumentation
- Portable DVD players
- Digital camera

Block Diagram



300mA Low Power Low Noise LDO CMOS Voltage Regulator

Pin Configuration



Ordering/Marking Information

EC49509 X X X - F

F: Lead-Free

Pin (1-5) : G = V_{IN}/GND/EN/BYPASS/V_{OUT}

Package: L = SOT-23-5L
F = DFN 2X2

Output Voltage: A = V_{OUT}= 3.3V
B = V_{OUT}= 2.8V
C = V_{OUT}= 2.5V
D = V_{OUT}= 1.8V
E = V_{OUT}= 1.5V
F = V_{OUT}= 3.0V

Package	Vout Voltage	Part Number	Marking	Marking Information
SOT-23-5L	3.3V	EC49509ALG-F	509ALz	Starting with 9, a bar on top of 9 is for production year 2005, and underlined 9 is for year 2006. The naming pattern continues with consecutive characters for later years. The middle character (A-F) is the output voltage of production. L means the package is SOT-23-5L. The last character is the week code. (A-Z: 1-26, a-z: 27-52). A dot on top right corner is for lead-free process.
	2.8V	EC49509BLG-F	509BLz	
	2.5V	EC49509CLG-F	509CLz	
	1.8V	EC49509DLG-F	509DLz	
	1.5V	EC49509ELG-F	509ELz	
	3.0V	EC49509FLG-F	509FLz	
DFN2X2	3.3V	EC49509AF-F	509A	

Absolute Maximum Rating (Note1)

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	6	V
Enable Voltage	V_{EN}	-0.3 to V_{IN}	V
Output Voltage	V_{OUT}	-0.3 to 4.6	V
Power Dissipation	P_D	Internally Limited (Note3)	W
Output Short Circuit Duration	—	Infinite	—
Thermal Resistance, Junction-to-Ambient	Θ_{JA}	230	°C/W
Lead Temperature (Soldering, 5 sec.)	—	260	°C
Junction Temperature	T_J	0 to +150	°C
Storage Temperature	T_S	-40 to +150	°C

Recommended Operating Conditions (Note 2)

Parameter	Symbol	Value	Units
Supply Input Voltage Range	V_{IN}	5.5	V
Junction Temperature Range	T_J	0 to +125	°C

Electrical Characteristics

V_{IN} = 5V; V_{EN}=V_{IN}; C_{IN} = 2.2μF; C_{OUT} = 2.2μF; I_{OUT} = 10mA; T_J = 25°C; unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT}	Output Voltage Accuracy	EC49509 – 1.5 (V_{IN}=1.8V) EC49509 – 1.8 (V_{IN}=3.3V) EC49509 – 2.5 EC49509 – 2.8 EC49509 – 3.0 EC49509 – 3.3	1.470 1.764 2.450 2.744 2.940 3.234	1.5 1.8 2.5 2.8 3.0 3.3	1.530 1.836 2.550 2.856 3.060 3.366	V
ΔV_{OUT}	Line Regulation	V_{IN} = (V_{OUT} + 0.8) V to 5.5V	—	0.2	—	%/V
ΔV_{OUT}	Load Regulation (Note 5)	V_{IN} = (V_{OUT} + 0.8) V or 2.5V I_{OUT} = 10mA to 300mA	—	2.0	—	%
$\Delta V_{OUT}/\Delta T$	Output Voltage Temperature Coefficient	Note 4	—	0.1	—	mV/°C
$V_{IN} - V_{OUT}$	Dropout Voltage (Note 6) (V_{OUT}>3.0V)	I_{OUT} = 10mA	—	8	—	mV
		I_{OUT} = 150mA	—	200	—	
		I_{OUT} = 300mA	—	350	—	
$T_{PROTECTION}$	Thermal Protection	Thermal Protection Temperature	—	150	—	°C
		Protection Hysterisys	—	20	—	
PSRR	Ripple Rejection	f =10kHz,I_{OUT}=50mA,C_{bypass}=0.1uF	—	70	—	dB
I_Q	Quiescent Current	V_{EN} = 0.4V	—	0.1	—	μA
		V_{EN} = V_{IN}	—	20	—	
$V_{TH\ (EN)}$	Enable Input Threshold Voltage	Voltage Raising, Output Turns On, Logic High	1.6	—	—	V
		Voltage Falling, Output Turns Off, Logic Low	—	—	0.4	
I_{LIMIT}	Current Limit		—	600	—	mA

Note 1: Exceeding the absolute maximum rating may damage the device.

Note 2: The device is not guaranteed to function outside its operating rating.

Note 3: The maximum allowable power dissipation at any T_A (ambient temperature) is calculated using: $P_{D\ (MAX)}$ = ($T_{J\ (MAX)} - T_A$)/Θ_{JA}. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown. See "Thermal Consideration" section for details

Note 4: Output voltage temperature coefficient is the worst case voltage change divided by the total temperature range.

Note 5: Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 300mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.

Note 6: Dropout voltage is defined as the input to output differential at which the output voltage drops 100mV below its nominal value measured at 0.8V differential.

Typical Performance Characteristics

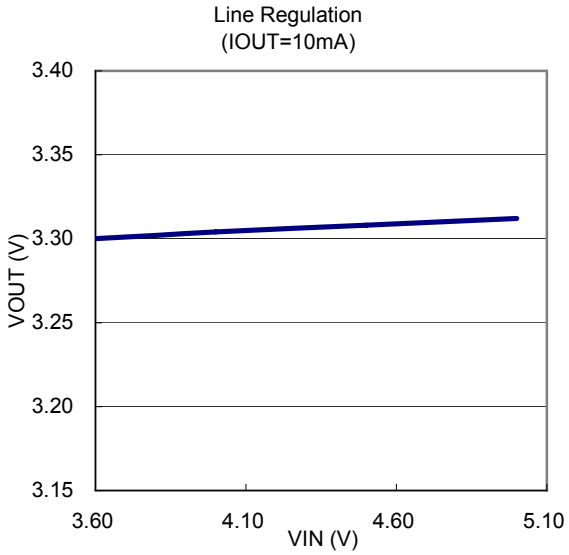


Figure 1.

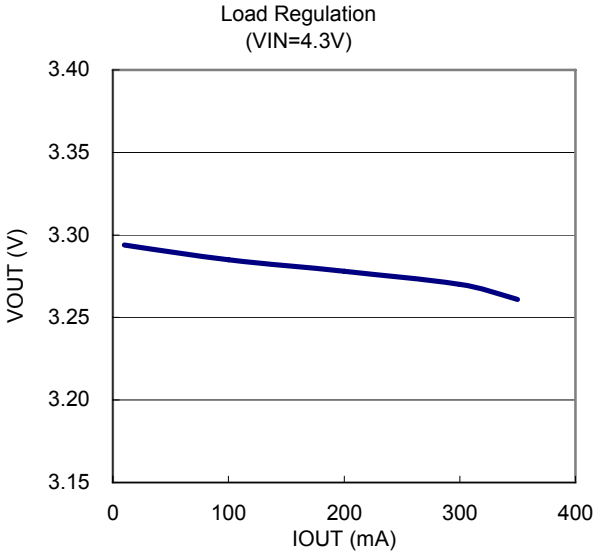


Figure 2.

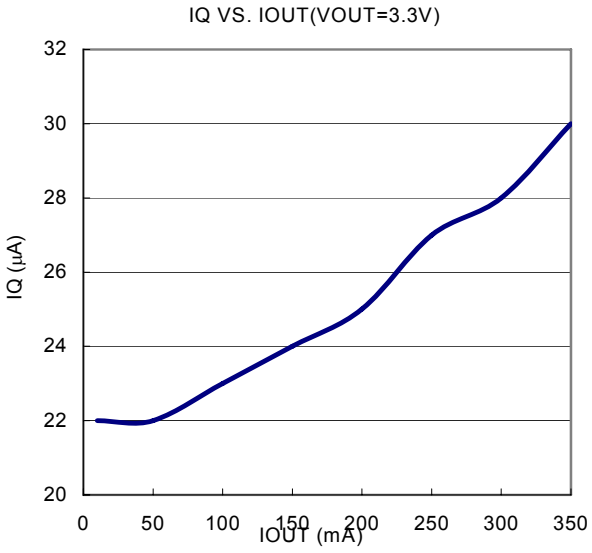


Figure 3.

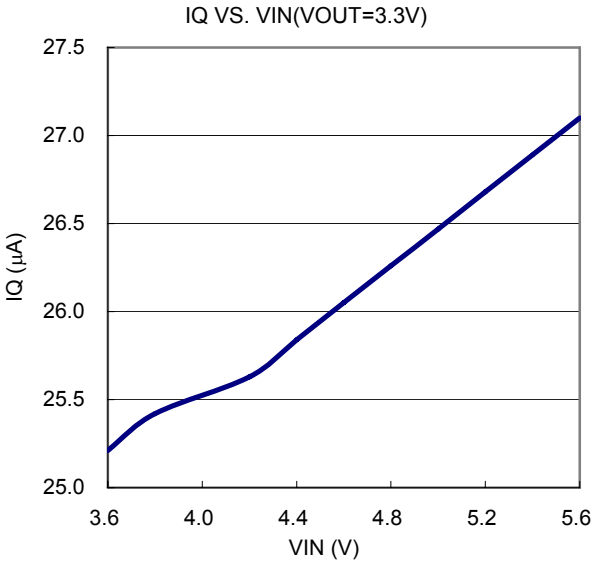


Figure 4.

Typical Performance Characteristics (Continued)

Load Transient Response (VOUT = 3.3V)

(IOUT=10mA to 300mA)

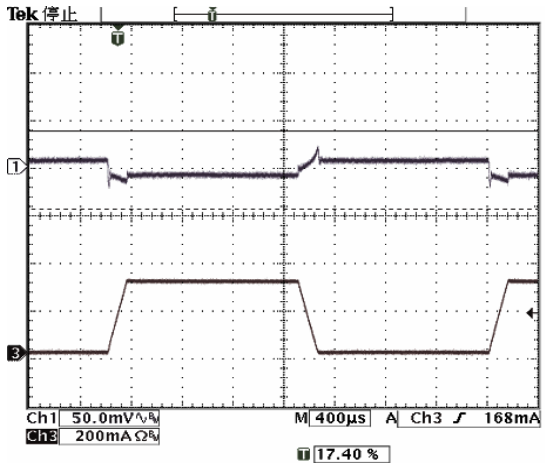


Figure 5.

Input Transient Response (VOUT = 3.3V)

(VIN=3.6V to 5.0V)

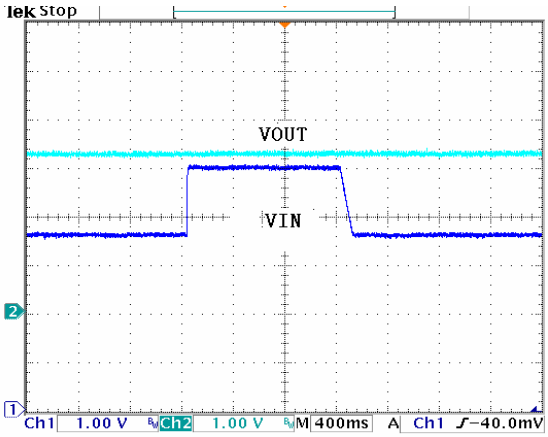


Figure 6.

PSRR

(VIN=VOUT+1V+0.5Vp-pAC，IOUT=50mA，Cbypass=0.1µF)

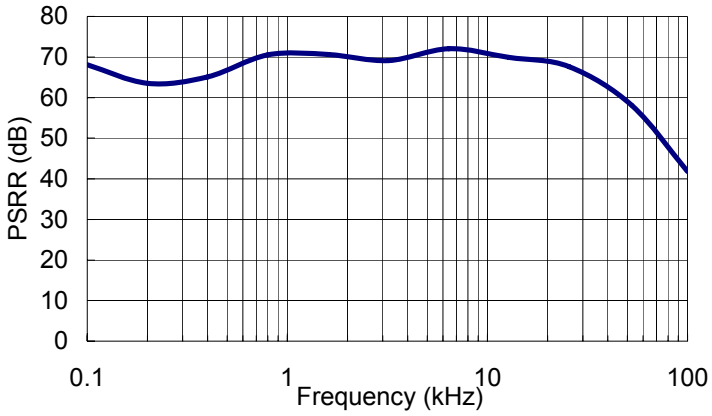


Figure 7.

Application Hints

Like any low dropout regulator, EC49509 requires external capacitors to ensure stability. The external capacitors must be carefully selected to ensure performance.

Input Capacitor

An input capacitor of at least 1μF is required. Ceramic or Tantalum can be used. The value can be increase without upper limit.

Output Capacitor

An output capacitor is required for stability. It must be placed no more than 1 cm away from the V_{OUT} pin, and connected directly between V_{OUT} and GND pins. The minimum value is 1μF but may be increase without limit.

Thermal Considerations

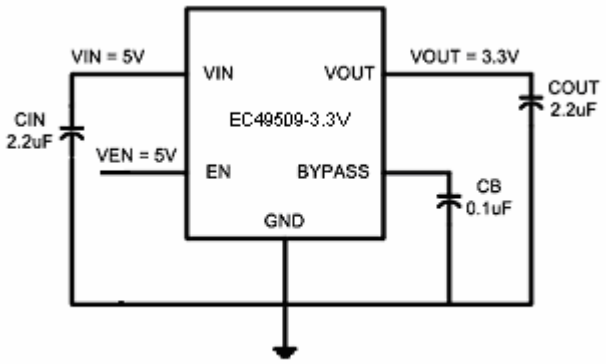
It is important that the thermal limit of the package is not exceeded. The EC49509 has built-in thermal protection. When the thermal limit is exceeded, the IC will enter protection, and V_{OUT} will be pulled to ground. The power dissipation for a given application can be calculated as following:

The power dissipation (P_D) is

$P_D = I_{OUT} * [V_{IN} – V_{OUT}]$

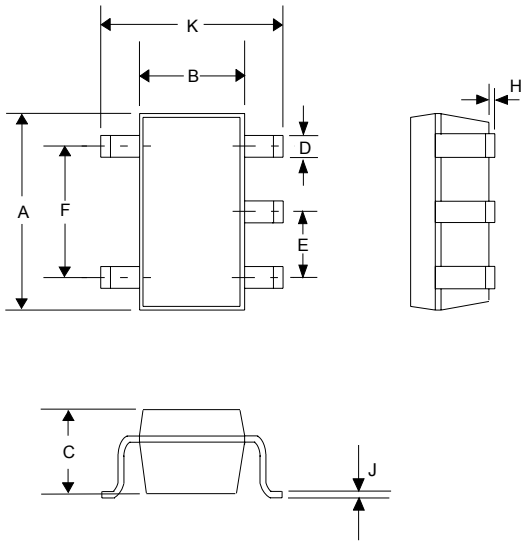
The thermal limit of the package is then limited to $P_{D\,(MAX)} = [T_J – T_A]/\Theta_{JA}$ where T_J is the junction temperature, TA is the ambient temperature, and Θ_{JA} is around 230°C/W for EC49509. EC49509 is designed to enter thermal protection at 150°C. For example, if T_A is 25°C then the maximum P_D is limited to about 0.6W. In other words, if $I_{OUT\,(MAX)}$ = 300mA, then $[V_{IN} – V_{OUT}]$ cannot exceed 2V.

Application Diagram



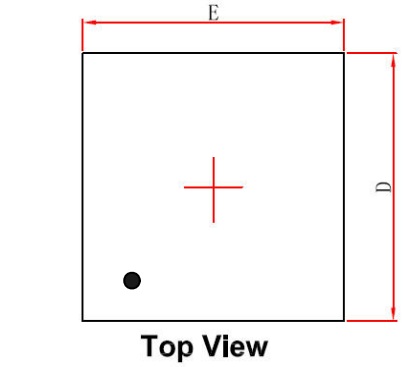
300mA Low Power Low Noise LDO CMOS Voltage Regulator

OUTLINE DRAWING SOT-23-5L

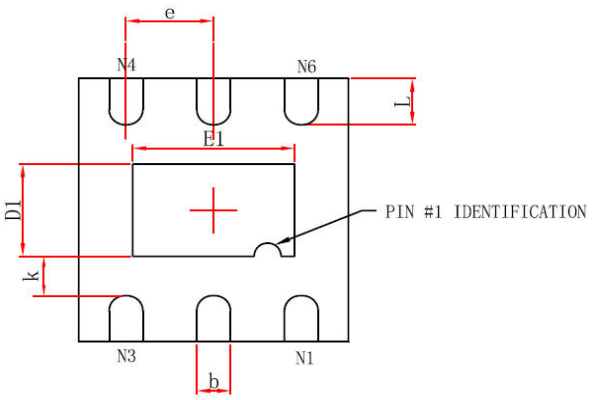


DIMENSIONS				
DIMN	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.106	0.122	2.70	3.10
B	0.055	0.071	1.40	1.80
C	0.030	0.045	0.75	1.15
D	0.011	0.022	0.30	0.55
E	–	0.037	–	0.95
F	–	0.075	–	1.90
H	–	0.006	–	0.15
J	0.0035	0.008	0.090	0.20
K	0.102	0.118	2.60	3.00

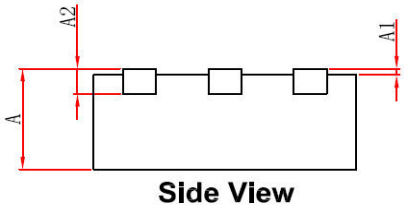
OUTLINE DRAWING DFN2X2



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A2	0.153	0.253	0.006	0.010
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	0.600	0.800	0.024	0.031
E1	1.100	1.300	0.043	0.051
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.650TYP.		0.026TYP.	
L	0.250	0.450	0.010	0.018