

**◆ DESCRIPTION**

The MT509 is a low noise, fast enable response time and low dropout. An external capacitor can be connected to the bypass pin to lower the output noise. Each device contains a voltage reference unit, an error amplifier, a PMOS power transistor, and resistors for setting output voltage, and current limit and temperature limit protection circuits.

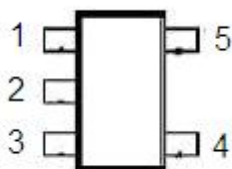
The MT509 has been designed to be used with low cost ceramic and requires a minimum output capacitor of 1.0 $\mu$ F. Standard voltage versions are 1.5, 1.8, 2.5, 2.8, 3.0 and 3.3V. Beside, MT509 comes in a miniature 3-pin / 5-pin SOT-23 and SC-70 5pin package. The MT509 is characterized for operation from -40 $^{\circ}$ C to 125 $^{\circ}$ C ,junction temperature.

**◆ FEATURES**

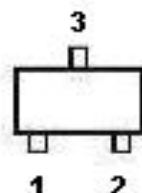
- Fast Enable Turn-On Time of 20 $\mu$ s (Typ.)
- Typical Low Dropout Voltage of 110mV at 150mA.
- Thermal shutdown protection
- Excellent Line and Load Regulation.
- High Accuracy Output Voltage of 2%.
- Ultra- Low Ground Current at 35 $\mu$ A (Typ.)
- No Reverse Current.

**◆ APPLICATIONS**

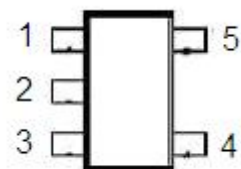
- Wireless LAN's
- Cellular Telephones
- PCMCIA Cards
- USB removable devices
- MPEG4 devices

**◆ PIN CONFIGURATIONS**
**SOT-23-5L (Top View)**

**MT509-X.XN**

1.VIN 2.GND 3. ENABLE 4.BP 5.VOUT

**SOT-23-3L (Top View)**

**MT509-X.XS**

1.GND 2.VOUT 3.VIN

**SC-70-5L (Top View)**

**MT509-X.XE**

1.VIN 2.GND 3.ENABLE 4.BP 5.VOUT

**300mA CMOS Low Noise LDO Voltage Regulator**
**◆ ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Maximum	Unit
Input supply voltage	$V_{IN}$	8	V
Enable voltage	$V_{EN}$	-0.3 to $V_{IN}$	V
Output voltage	$V_{OUT}$	-0.3 to 4.6	V
Thermal resistance junction to ambient SOT-23-5L SC-70-5L	$\theta_{JA}$	230 300	$^{\circ}\text{C}/\text{W}$
Junction temperature	$T_J$	150	$^{\circ}\text{C}$
Storage temperature range	$T_{STG}$	- 40 to 150	$^{\circ}\text{C}$
Lead temperature (soldering) 10sec	$T_{LEAD}$	260	$^{\circ}\text{C}$

Note:

Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.

**◆ ORDERING INFORMATION**

Device	Package		Vout Volts
MT509-X.XN	N	SOT-23-5L	X.X_1.2/1.5/1.8/2.5/2.8/3.0/3.3
MT509-X.XS	S	SOT-23-3L	X.X_1.2/1.5/1.8/2.5/2.8/3.0/3.3
MT509-X.XE	E	SC-70-5L	X.X_1.2/1.5/1.8/2.5/2.8/3.0/3.3

**◆ POWER DISSIPATION TABLE:**

Package	$\theta_{JA}$ ( $^{\circ}\text{C}/\text{W}$ )	$T_A \leq 25^{\circ}\text{C}$ Power rating(mW)	$T_A = 70^{\circ}\text{C}$ Power rating(mW)	$T_A = 85^{\circ}\text{C}$ Power rating (mW)
N/S	230	543	348	283
E	300	417	267	217

Note :

- Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into Thermal shutdown
- $T_J$  Junction Temperature Calculation:  $T_J = T_A + (P_D \times \theta_{JA})$ ,  
The  $\theta_{JA}$  numbers are guidelines for the thermal performance of the device/PC-board system  
All of the above assume no ambient airflow
- $\theta_{JA}$ : Thermal Resistance-Junction to Ambient,  $D_F$ : Derating factor,  $P_O$ : Power consumption.

**◆ RECOMMENDED OPERATING CONDITIONS**

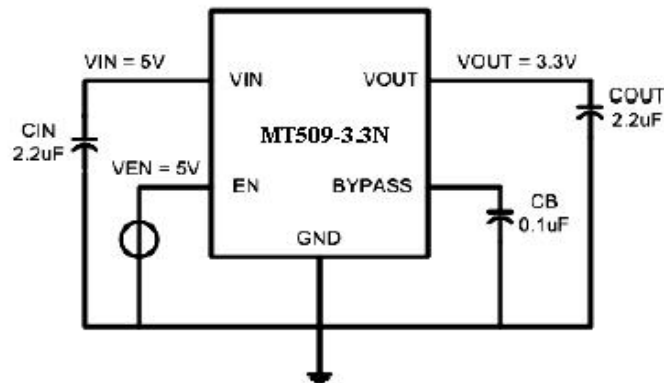
Parameter	Symbol	Operating Conditions			Units
		Min.	Typ.	Max.	
Input Voltage	$V_{IN}$	-	-	7	V
Input Capacitor ( $V_{IN}$ to GND)	$C_{IN}$	-	2.2	-	$\mu\text{F}$
Output Capacitor with ESR of $10\Omega$ max. ( $V_{OUT}$ to GND)	$C_{OUT}$	-	2.2	-	$\mu\text{F}$
Junction temperature range	$T_J$	0~150			$^{\circ}\text{C}$

**300mA CMOS Low Noise LDO Voltage Regulator**
**◆ ELECTRICAL CHARACTERISTICS**
 $V_{IN} = 5V$ ;  $C_{IN} = 2.2\mu F$ ;  $C_{OUT} = 2.2\mu F$ ;  $I_{OUT} = 10mA$ ;  $T_A = 25^\circ C$ ; unless otherwise noted

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_{OUT}$	MT509-1.2	1.176	1.2	1.224	V
		MT509-1.5	1.470	1.5	1.530	
		MT509-1.8	1.764	1.8	1.836	
		MT509-2.5	2.450	2.5	2.550	
		MT509-2.8	2.744	2.8	2.856	
		MT509-3.0	2.940	3.0	3.060	
		MT509-3.3	3.234	3.3	3.366	
Line Regulation	$V_{SR}$	$V_{IN} = (V_{OUT} + 0.8V)$ to 5.5V,	-	0.2	-	%/V
Load Regulation (1)	$V_{LR}$	$V_{IN} = (V_{OUT} + 0.8V)$ or 2.5V, $I_{OUT} = 10mA$ to 300mA	-	2.0	-	%/V
Dropout Voltage (2)	$V_D$	$I_{OUT} = 10mA$	-	8	-	mV
		$I_{OUT} = 150mA$	-	110	-	
		$I_{OUT} = 300mA$	-	250	-	
Current Limit	$I_{CL}$		-	600	-	mA
$V_{OUT}$ Temperature Coefficient (3)	$T_c$		-	0.1	-	mV/ $^\circ C$
Quiescent Current	$I_Q$	$V_{EN} = 0.4V$	-	0.01	-	$\mu A$
		$V_{EN} = V_{IN}$	-	35	-	
Thermal Protection	$T_{PRO}$	Thermal protection temperature	-	150	-	$^\circ C$
		Protection Hysterisys	-	20	-	
Enable Input Threshold Voltage	$V_{TH(EN)}$	Voltage Increasing, Output Turns On, Logic High	1.6	-	-	V
		Voltage Decreasing, Output Turns Off, Logic Low	-	-	0.4	
Ripple Rejection Ratio	PSRR	$f = 10kHz$ , $I_{OUT} = 50mA$ , $C_{bypass} = 0.1\mu F$	-	70	-	dB

**NOTES:**

- (1) 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 duo to heating effects are covered by the thermal regulation specification.
- (2) The  $V_D$  is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

**◆ TYPICAL APPLICATIONS**

**APPLICATION HINTS**

Like any low dropout regulator, MT509 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. The inexpensive Electrolytic capacitor is preferred. The value can be increased without upper limit.

**Output Capacitor**

An output capacitor is required for stability. It must be placed no more than 1 cm away from the VOUT pin, and connected directly between VOUT and GND pins. The inexpensive Electrolytic capacitor is recommended. The minimum value is 1µF but may be increased without limit.

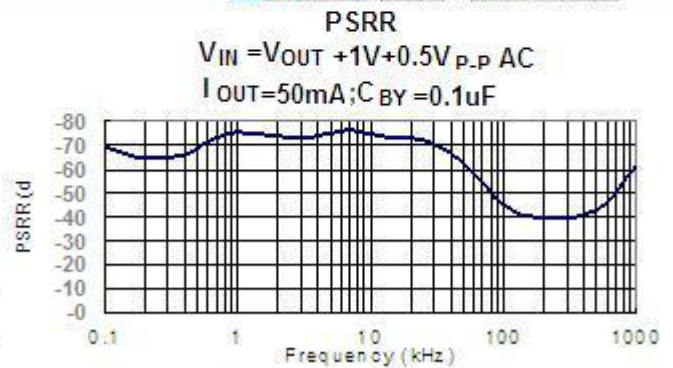
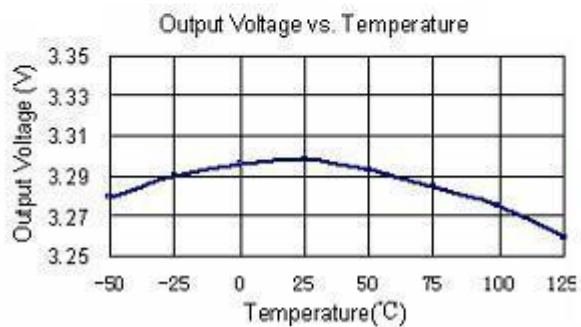
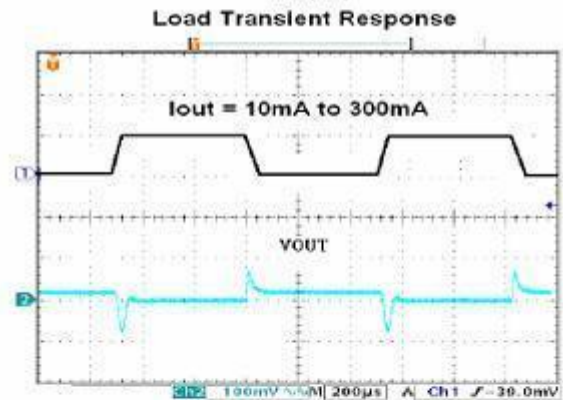
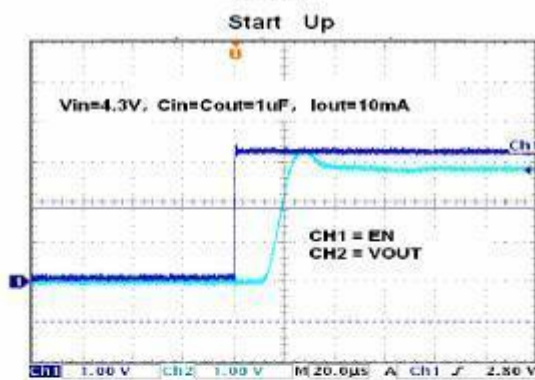
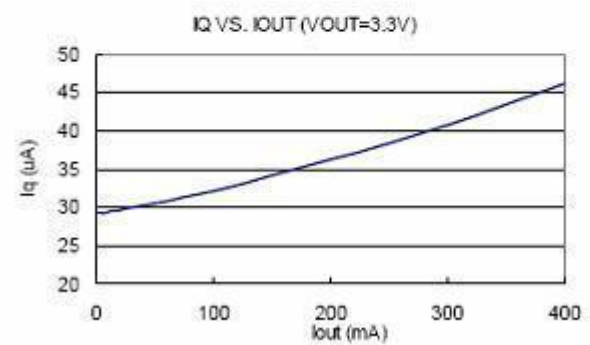
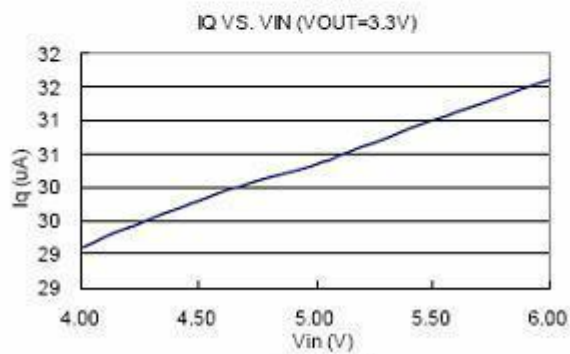
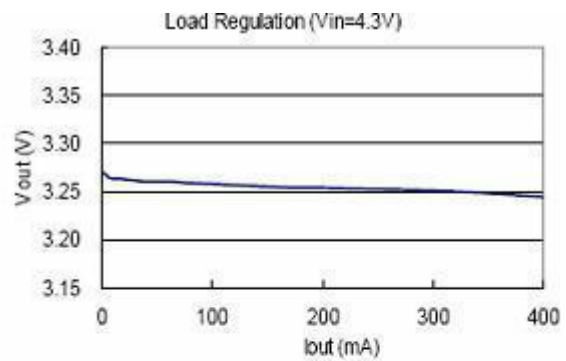
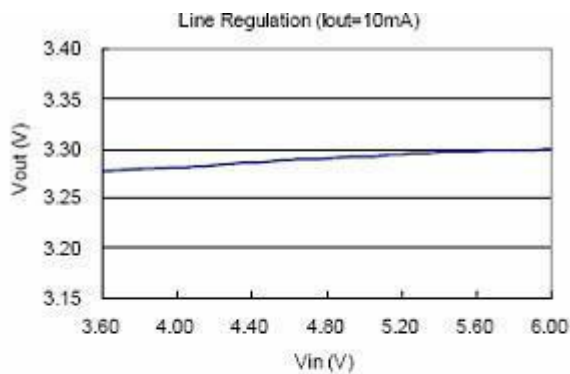
**Thermal Considerations**

It is important that the thermal limit of the package is not exceeded. The MT509 has built-in thermal protection. When the thermal limit is exceeded, the IC will enter protection, and V<sub>OUT</sub> will be pulled to ground. The power dissipation for a given application can be calculated as following:

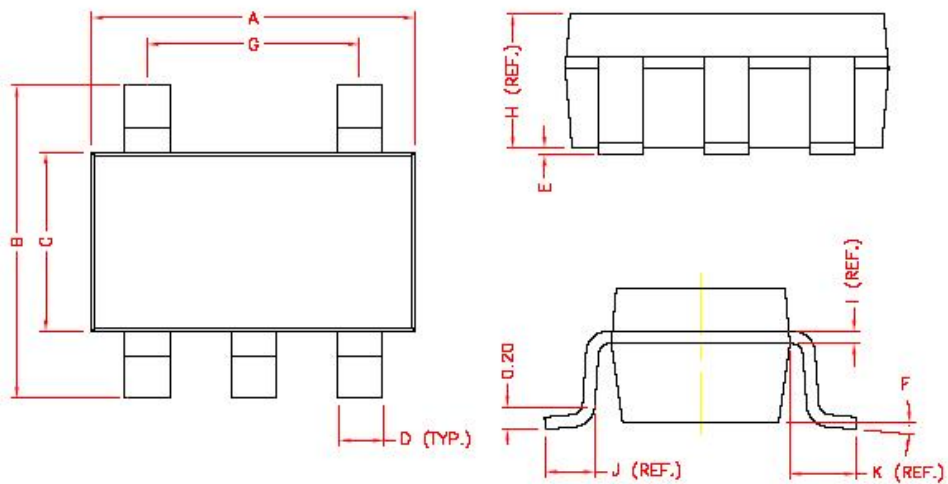
The power dissipation (P<sub>D</sub>) is

$$P_D = I_{OUT} * [V_{IN} - V_{OUT}]$$

The thermal limit of the package is then limited to  $P_{D(MAX)} = [T_J - T_A] / \Theta_{JA}$  where T<sub>J</sub> is the junction temperature, T<sub>A</sub> is the ambient temperature, and Θ<sub>JA</sub> is around 230°C/W for MT509. MT509 is designed to enter thermal protection at 150°C. For example, if T<sub>A</sub> is 25°C then the maximum P<sub>D</sub> is limited to about 0.6W. In other words, if I<sub>OUT(MAX)</sub> = 300mA, then [V<sub>IN</sub> - V<sub>OUT</sub>] cannot exceed 2V.

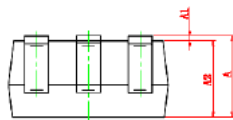
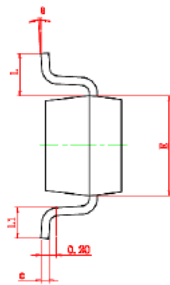
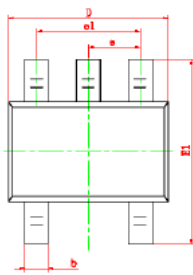
**◆ TYPICAL PERFORMANCE CHARACTERISTICS**


◆ **PHYSICAL DIMENSIONS**  
**5-Pin surface Mount SOT-23(N)**



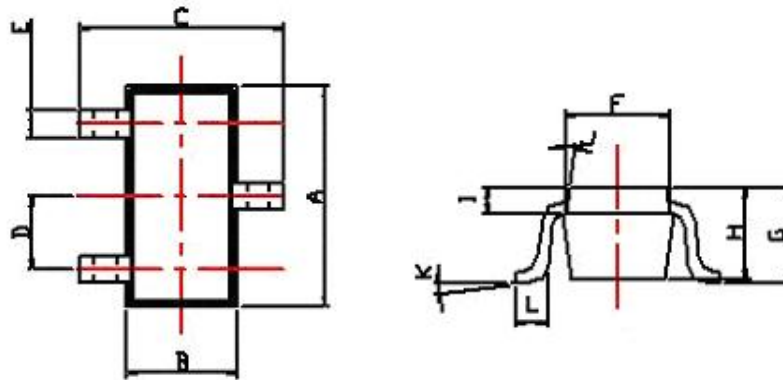
REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	2.70	3.10	G	1.90 REF.	
B	2.60	3.00	H	1.20 REF.	
C	1.40	1.80	I	0.12 REF.	
D	0.30	0.55	J	0.37 REF.	
E	0	0.10	K	0.60 REF.	
F	0°	10°			

◆ **PHYSICAL DIMENSIONS**  
5-Pin surface Mount SC-70 (E)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.160	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

◆ **PHYSICAL DIMENSIONS**  
**3-Pin surface Mount SOT-23(S)**



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	2.70	3.10	G	0.9	1.4
B	1.20	1.66	H	0.8	1.30
C	2.37	2.90	I	0.25	0.7
D	0.85	1.15	J	7 ± 2°	
E	0.350 + 0.15/-0.05		K	0 ~ 10°	
F	1.07	1.53	L	0.2 (MIN)	