






# TS9000/TS9000A

## 300mA CMOS Low Dropout Voltage Regulator

TO-92	Pin assignment	SOT-89	Pin assignment	SOT-23	Pin assignment
	TS9000 1. Gnd 2. Input 3. Output		TS9000 1. Gnd 2. Input 3. Output		TS9000 1. Input 2. Output 3. Gnd
	TS9000A 1. Input 2. Gnd 3. Output		TS9000A 1. Output 2. Gnd 3. Input		TS9000A 1. Gnd 2. Output 3. Input

### General Description

The TS9000/TS9000A series is a positive voltage regulator developed utilizing CMOS technology featured low quiescent current, low dropout voltage and high output voltage accuracy. Built in low on-resistor provides low dropout voltage and large output current. A 2.2uF or greater can be used as an output capacitor.

The TS9000/TS9000A series are prevented device failure under the worst operation condition with both thermal shutdown and current fold-back. These series are recommended for configuring portable devices and large current application, respectively.

This series are offered in 3-pin TO-92, SOT-89 and SOT-23 package.

### Features

- ◇ Dropout voltage typically 0.4V @ $I_o=300mA$
- ◇ Output current up to 300mA
- ◇ Low quiescent current
- ◇ Output voltage trimmed before assembly
- ◇ Internal current limit
- ◇ Thermal shutdown protection

### Applications

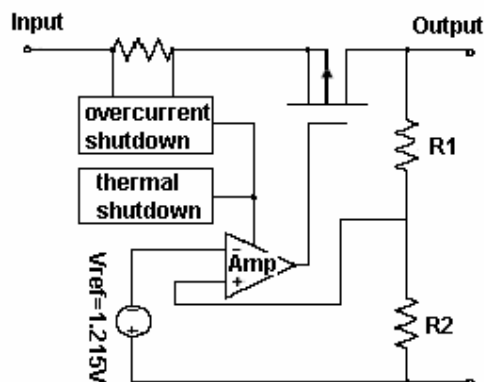
- ◇ Battery power equipment
- ◇ Personal communication devices
- ◇ Home electronic appliances
- ◇ PC peripherals
- ◇ CD-ROM
- ◇ Digital signal camera

### Ordering Information

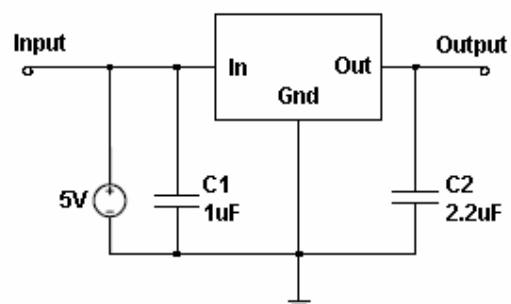
Part No.	Operating Temp. (Ambient)	Package
TS9000xCT	-40 ~ +85 °C	TO-92
TS9000xCX		SOT-23
TS9000xCY		SOT-89
TS9000AxCT		TO-92
TS9000AxCX		SOT-23
TS9000AxCY		SOT-89

Note: Where **x** denotes voltage option, available are  
**K**=2.5V, **M**=2.7V, **N**=2.8V, **P**=3.0V,  
**S**=3.3V, **U**=3.5V, **V**=3.6V, **X**=3.8V.  
 Contact factory for additional voltage options.

### Block Diagram



### Typical Application Circuit





## Absolute Maximum Rating

Input Supply Voltage	V <sub>in</sub>	+7	V
Output Current	I <sub>o</sub>	P <sub>D</sub> / (V <sub>in</sub> – V <sub>o</sub> )	V
Power Dissipation	SOT-23	0.3	W
	SOT-89	0.5	
	TO-92	0.65	
Thermal Resistance	SOT-23	325	°C/W
	SOT-89	180	
	TO-92	160	
Operating Junction Temperature Range	T <sub>j</sub>	-40 ~ +150	°C
Storage Temperature Range	T <sub>STG</sub>	-65 ~ +150	°C
Lead Soldering Temperature (260 °C)		10	S

**Caution:** Stress above the listed absolute rating may cause permanent damage to the device.

## Electrical Characteristics

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

Parameter	Conditions	Min	Typ	Max	Unit
Output Voltage	V <sub>in</sub> =V <sub>o</sub> + 0.3V, 1mA ≤ I <sub>o</sub> ≤ 300mA,	0.985 V <sub>o</sub>		1.015 V <sub>o</sub>	
Input Supply Voltage		V <sub>o</sub> +0.3V	--	7	V
Output Voltage Temperature Coefficient		--	40	--	ppm/°C
Line Regulation	V <sub>o</sub> +1V ≤ V <sub>in</sub> ≤ V <sub>o</sub> +2V, I <sub>o</sub> =5mA	--	0.02	0.1	%
Load Regulation	1mA ≤ I <sub>L</sub> ≤ 300mA	--	0.2	1.0	%
Dropout Voltage	I <sub>o</sub> =300mA, V <sub>o</sub> =V <sub>o</sub> -2%	--	--	400	mV
Quiescent Current	V <sub>in</sub> =5V, I <sub>o</sub> =0A	--	30	50	μA
Short Circuit Current	V <sub>out</sub> < 0.4V	--	300	400	mA
Output Noise		--	20	--	μV <sub>rms</sub>
Power Supply Rejection Ratio	At 1KHz	--	55	--	dB

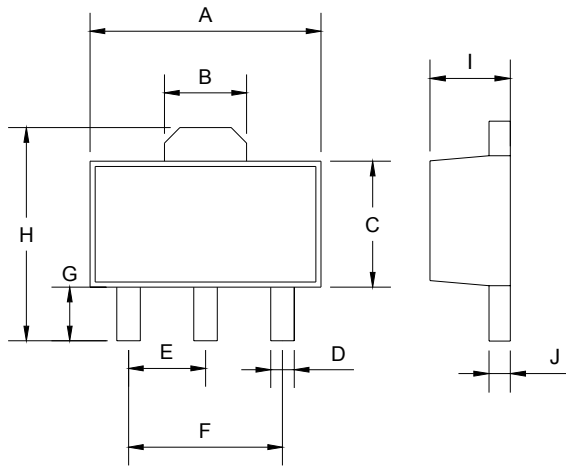
## Detail Description

The TS9000/TS9000A series of CMOS regulators contain a P-MOS pass transistor, voltage reference, error amplifier, over current protection and thermal shutdown.

The TS9000/TS9000A series switches from voltage mode to current mode when the load exceeds the rated output current. This prevents over stress. The TS9000 also incorporates current fold-back to reduce power dissipation when the output is short circuit. This feature becomes active when the output drops below 0.8V, and reduces the current flow by 65%. Full current is restored when the voltage exceeds 0.8V.

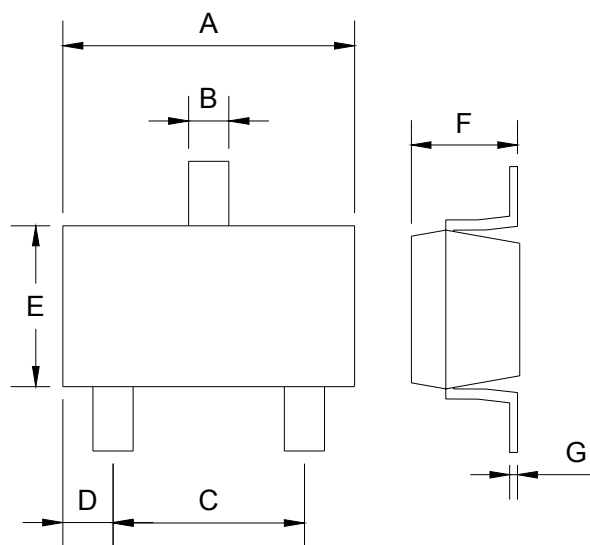
The internal P-channel pass transistor receives data from the error amplifier, over current shutdown and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. Over current and thermal shutdown circuits become active when the junction temperature exceeds 150 °C, or the current exceeds 300mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 110 °C.

### SOT-89 Mechanical Drawing



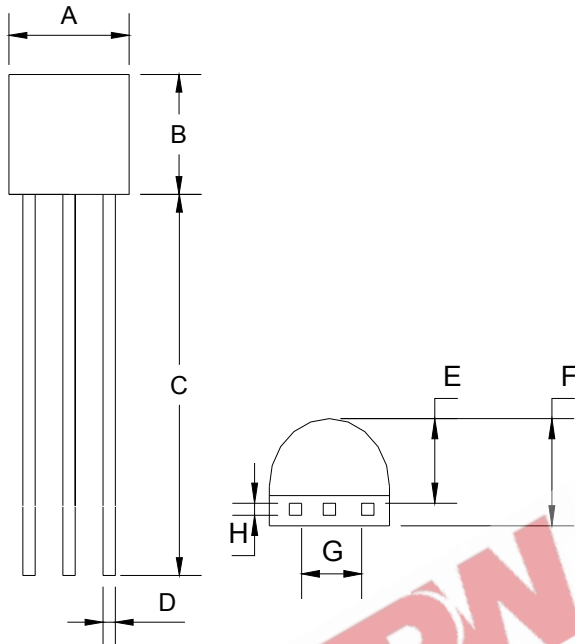
DIM	SOT-89 DIMENSION			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.40	4.60	0.173	0.181
B	1.50	1.7	0.059	0.070
C	2.30	2.60	0.090	0.102
D	0.40	0.52	0.016	0.020
E	1.50	1.50	0.059	0.059
F	3.00	3.00	0.118	0.118
G	0.89	1.20	0.035	0.047
H	4.05	4.25	0.159	0.167
I	1.4	1.6	0.055	0.068
J	0.35	0.44	0.014	0.017

### SOT-23 Mechanical Drawing



DIM	SOT-23 DIMENSION			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.88	2.91	0.113	0.115
B	0.39	0.42	0.015	0.017
C	1.78	2.03	0.070	0.080
D	0.51	0.61	0.020	0.024
E	1.50	1.70	0.059	0.067
F	1.04	1.08	0.041	0.043
G	0.07	0.09	0.003	0.004

## TO-92 Mechanical Drawing



TO-92 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.70	0.169	0.185
B	4.30	4.70	0.169	0.185
C	14.30(typ)		0.563(typ)	
D	0.43	0.49	0.017	0.019
E	2.19	2.81	0.086	0.111
F	3.30	3.70	0.130	0.146
G	2.42	2.66	0.095	0.105
H	0.37	0.43	0.015	0.017

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