TSC

TS9001
300mA CMOS Low Dropout Voltage Regulator with Enable

SOT-25

Pin assignment
1. Input
2. Ground
3. Enable
4. Bypass
5. Output

Low Drop Out Voltage 0.4V
Enable Shutdown

General Description

The TS9011 series is a positive voltage linear regulator developed utilizing CMOS technology featured low quiescent current (30uA typ.), low dropout voltage, and high output voltage accuracy, making them ideal for battery applications. The Chip Enable (CE) includes a CMOS or TTL compatible input allows the output to be turned off to prolong battery life. The TS9001 series is included a precision voltage reference, error correction circuit, a current limited output driver, over temperature shutdown, and a reference bypass pin to improve its already excellent low-noise performance.
This series are offered in 5-pin SOT-25 package.

Features

✧ Dropout voltage typically 0.4V@Io=300mA (Vo>2.5V)
✧ Output current up to 300mA
✧ Low power consumption
✧ Output voltage +/-2%
✧ Internal current limit and thermal shutdown
✧ Thermal shutdown protection

Applications

✧ Palmtops
✧ Video recorders
✧ Battery powered equipment
✧ PC peripherals
✧ High-efficiency linear power supplies
✧ Digital signal camera
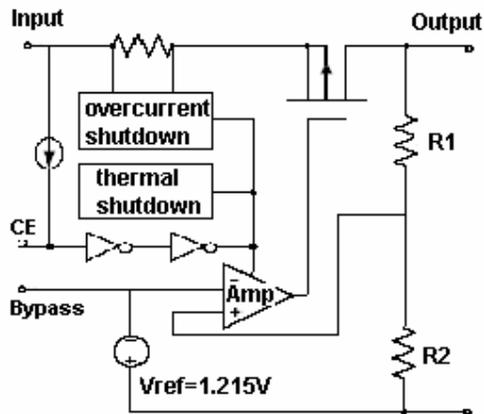
Ordering Information

Part No.	Operating Temp. (Ambient)	Package
TS9001**x**CX5	-40 ~ +85 $^{\circ}$C	SOT-25

Note: Where **x** denotes voltage option, available are
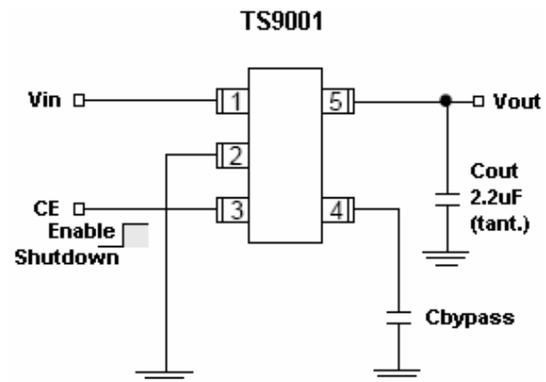   **A**=1.5V
   D=1.8V,
   K=2.5V,
   P=3.0V,
   S=3.3V,
   Contact factory for additional voltage options.

Typical Application Circuit

CE (pin 3) may be connected directly to Vin (pin 1)
Low noise operation: Cbypass=470pF, Cout>2.2uF
Basic operation: Cbypass=not used, Cout>1uF

Block Diagram

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Absolute Maximum Rating

Input Supply Voltage	Vin	+7	V
Enable Input Voltage	Vce	Gnd-0.3 ~ Vin+0.3	V
Output Current	Io	Pd / (Vin – Vout)	
Power Dissipation	P_D	380	mW
Thermal Resistance	Θja	260	^{o}C/W
Operating Junction Temperature Range	Tj	-40 ~ +125	^{o}C
Storage Temperature Range	T_{STG}	-65 ~ +150	^{o}C
Lead Soldering Temperature (260 ^{o}C)		5	S

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

Electrical Characteristics

Ta = 25 ^{o}C, Io=1mA, Cout=2.2uF, Vce≥2V, unless otherwise specified.

Parameter	Conditions		Min	Typ	Max	Unit
Output Voltage	Vin=Vo + 1V		0.985|Vo|		1.015|Vo|	V
Output Voltage Temperature Coefficient			--	50	--	ppm/ ^{o}C
Maximum Output Current	Vin=Vo+1V,		300	--	--	mA
Line Regulation	Vo+1V ≤ Vin ≤ 7V		--	--	0.3	%/V
Load Regulation	Vin=Vo+1V, 1mA≤I$_L$≤300mA	Vout≥2.5V	--	0.2	1.0	%/V
	Vin=Vo+1V, 1mA≤I$_L$≤200mA	Vout<2.5V	--	0.2	1.0	
Dropout Voltage	Io=300mA, Vout=Vo - 2%	Vout≥2.5V	--	300	--	mV
	Io=200mA, Vout=Vo - 2%	Vout<2.5V	--	800	1000	
Quiescent Current	Vin≤0.4V (shutdown)		--	2	3	uA
Ground Pin Current	Io=1mA to 300mA		--	30	50	uA
Output Current Limit	Vout=0V		--	450	--	mA
Power Supply Rejection Ratio	At f=1kHz, Io=100mA,		--	60	--	dB
Power Supply Rejection Ratio	At f=1kHz, Io=100mA, Cbypass=0.01uF		--	75	--	dB
Output Noise	Io=10mA, f=10Hz to 100kHz, 10pF from bypass to Ground		--	30	--	uVrms
Enable Input						
Enable Input Logic-Low Voltage	Regulation shutdown		--	--	0.4	V
Enable Input Logic-High Voltage	Regulation enable		2.0	--	--	V
Enable Input Current	V$_{IL}$≤0.4V		--	0.01	1	uA
	V$_{IL}$≥2.0V		--	1	5	

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Detail Description

Description

The TS9001 series of CMOS regulators contain a P-MOS pass transistor, voltage reference, error amplifier, over current protection, thermal shutdown and short circuit protection.

The TS9001 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 1.05V, and reduces the current flow by 65%. Full current is restored when the voltage exceeds 0.95V.

The internal P-channel pass transistor receives data from the error amplifier, over current shutdown, short output protection 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 ^{o}C, or the current exceeds 300mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120 ^{o}C.

Enable

The Chip Enable pin normally floats high. When actively, pulled low, the PMOS pass transistor shut off, and all internal circuits are powered down. In this state, the quiescent current is less than 5uA. This pin behaves much like an electronic switch.

External Capacitor

The TS9001 series is stable with an output capacitor to ground of 2.2uF or greater. It can keep stable even with higher or poor ESR capacitors.

A second capacitor is recommended between the input and ground to stabilize Vin. The input capacitor should be larger than 0.1uF to have a beneficial effect.

A third capacitor can be connected between the Bypass pin and Ground. This capacitor can be a low cost polyester film variety between the value of 1~10nF. A larger capacitor improves the AC ripple rejection, but also makes the output come up slowly. This "soft" turn-on is desirable in some applications to limit turn-on surges.

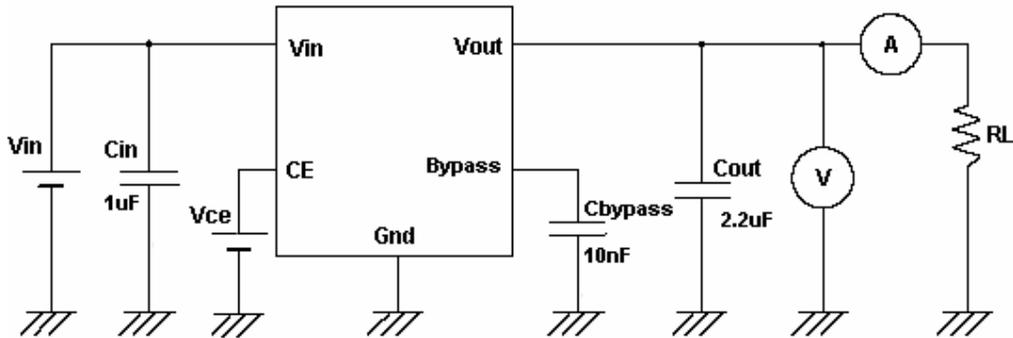All capacitors should be placed in close proximity to the pins. A "quiet" ground termination is desirable.
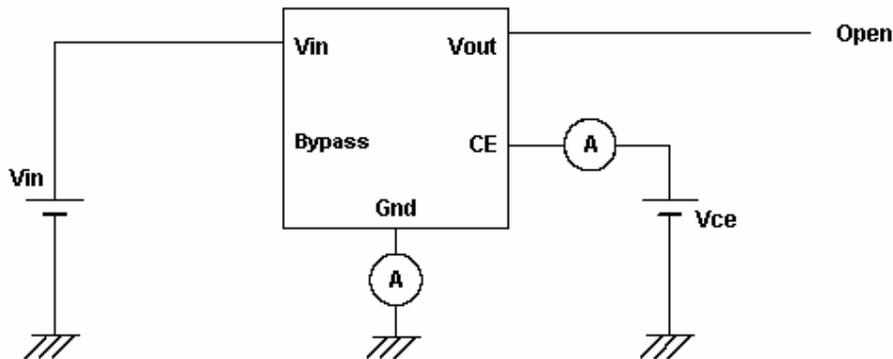
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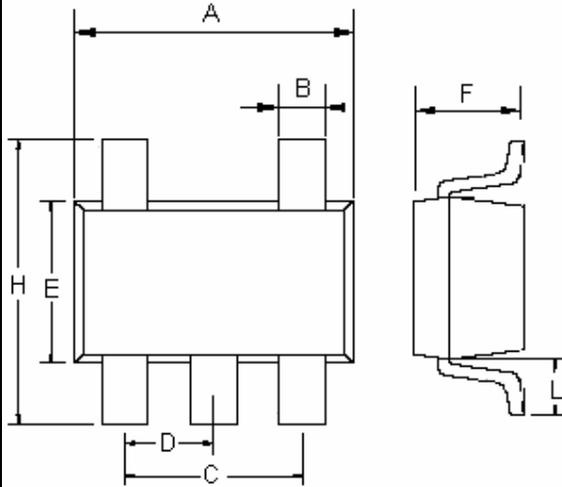**Application Examples**

Standard Circuit
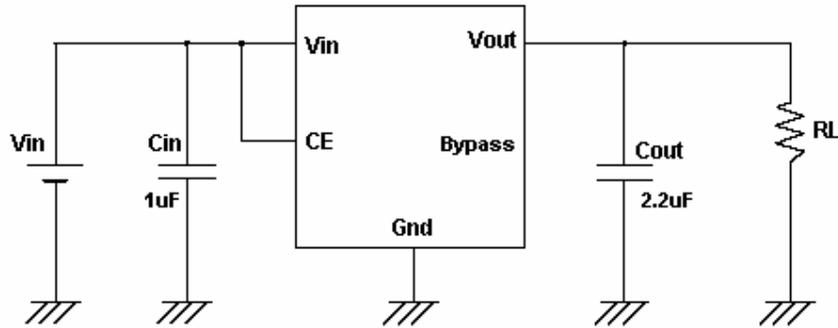
Typical Application Circuit 1

Typical Application Circuit 2

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SOT-25 Mechanical Drawing

DIM	SOT-23 DIMENSION			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.70	3.00	0.106	0.118
B	0.25	0.50	0.010	0.020
C	1.90(typ)		0.075(typ)	
D	0.95(typ)		0.037(typ)	
E	1.50	1.70	0.059	0.067
F	1.05	1.35	0.041	0.053
H	2.60	3.00	0.102	0.118
L	0.60(typ)		0.024(typ)	