TAIWAN SEMICONDUCTOR

RoHS COMPLIANCE

TS9005

600mA Adjustable CMOS LDO with Enable Function

SOT-223



Pin Definition:
1. Ground
2. Input
3. Output

SOT-89



Pin Definition:
1. Ground
2. Input
3. Output

SOT-25



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

General Description

The TS9005 is a low dropout, positive linear regulator with very low quiescent. It can supply 600mA output current with low dropout about 500mV.The BP pin with a 10nF bypass capacitor can help reduce the output noise level. The characteristics of low dropout voltage and less quiescent current make it good for some critical current application, for example, some battery powered devices. The typical quiescent current is approximately 45μA. In the shutdown mode, the maximum supply current is less than 1uA. The TS9005 regulator is able to operate with output capacitors as small as 1uF for stability.

Features

- Input voltage range: 2.5V~6V
- V_{DROP} typically 400mV@Io=600mA (Vout≥2.8V)
- V_{OUT} adjust range from 0.8V~5V
- Output current up to 600mA guaranteed
- Current limit and thermal shutdown protection
- Low quiescent current at 45uA (typ.)
- Needs only 1uF capacitor for stability
- Maximum supply current in shutdown mode <1uA

Applications

- Instrumentation
- Wireless device
- Battery powered equipment
- Portable Devices

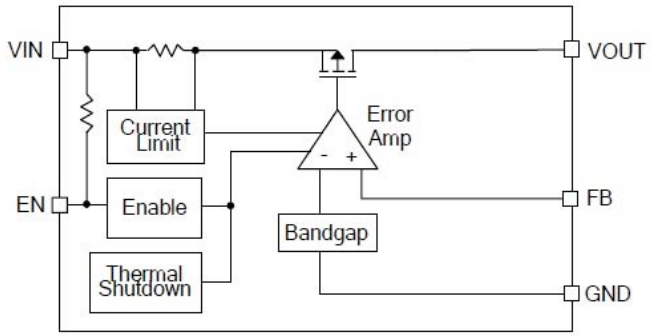
Ordering Information

Part No.	Package	Packing
TS9005**x**CW RP	SOT-223	2.5Kpcs / 13” Reel
TS9005**x**CY RM	SOT-89	1Kpcs / 7” Reel
TS9005**x**CX5 RF	SOT-25	3Kpcs / 7” Reel

Note: Where **x** denotes voltage option, available are
D=1.8V
K=2.5V
S=3.3V
Leave blank for adjustable voltage
Contact factory for additional voltage options.

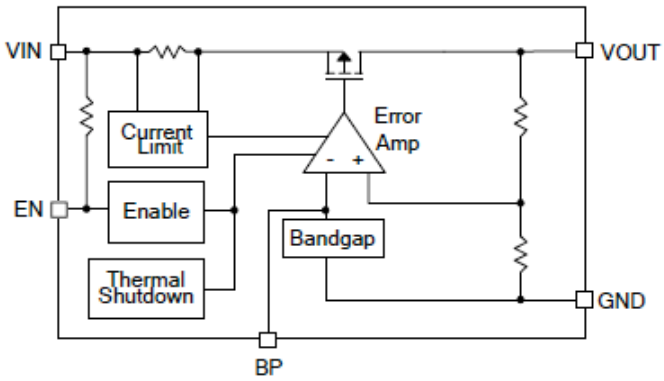
Block Diagram

(Adjustable Version)



Block Diagram

(Fixed Version)



TS9005

600mA Adjustable CMOS LDO with Enable Function

Absolute Maximum Rating

Parameter		Symbol	Limit	Unit
Input Supply Voltage		V_{IN}	GND -0.3 ~ +6.5	V
Output Voltage		V_{OUT}	GND -0.3 ~ V_{IN} +0.3	V
Enable Input Voltage		V_{EN}	GND -0.3 ~ GND +6	V
Feedback Voltage		V_{FB}	GND -0.3 ~ GND +6	V
Power Dissipation	SOT-223	P_D	800	mW
	SOT-89		500	
	SOT-25		300	
Thermal Resistance – Junction to Case		Θ_{JC}	25	°C/W
Thermal Resistance – Junction to Ambient		Θ_{JA}	120	°C/W
Operating Temperature Range		T_{OPR}	-40 ~ +85	°C
Junction Temperature Range		T_J	-40 ~ +125	°C
Storage Temperature Range		T_{STG}	-65 ~ +150	°C

Notes: Θ_{JA} is measured with the PCB copper area of approximately 1 in^2(multi-layer). That need connect to GND pin.

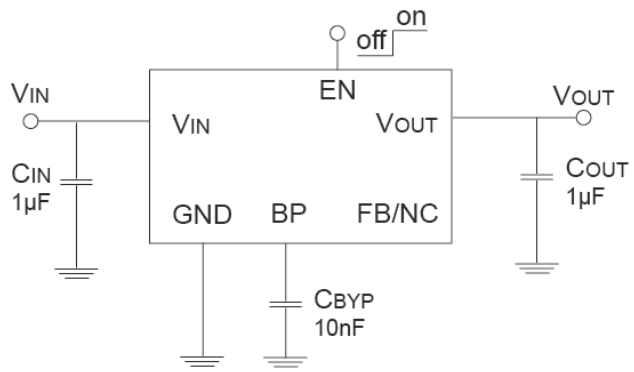
Electrical Characteristics (Ta = 25°C, unless otherwise noted)

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Input Voltage	V_{IN}	(Note 1)		2.5	--	5.5	V
Output Voltage Accuracy	ΔV_{OUT}	I_{OUT} =1mA		-2	--	+2	%
Feedback Voltage	V_{FB}	V_{IN} =2.8V ~ 5.5V, I_{OUT} =1mA		0.784	0.8	0.816	V
FB Input leakage Current	I_{FB}	V_{FB} =0.8V		-100	--	100	mA
Dropout Voltage	V_{DROP}	I_O =600mA V_O =$V_{O(NOM)}$ -2%	1.5V ≤ V_{OUT} ≤ 2V	--	1000	1200	mV
			2.0V ≤ V_{OUT} ≤ 2.8V	--	500	800	
			2.8V ≤ V_{OUT} ≤ 5V	--	350	500	
Quiescent Current	I_Q	I_{OUT} 0mA		--	45	70	uA
Current Limit	I_{LIMIT}	R_{LOAD}=1Ω		600	--	--	mA
Line Regulation	REG_{LINE}	I_{OUT} =1mA , V_{IN}= V_{OUT} +1V ~ 5V		--	1	5	mV
Load Regulation	REG_{LOAD}	I_{OUT} =0~600mA		--	13	50	mV
Power Supply Rejection	PSRR	f=120Hz.		--	60	--	dB
Shutdown Current	I_{SD}	V_{IN}= 2.8V~5V, V_{EN} =0V		--	--	1	uA
Enable Pin Current	I_{EH}	V_{EH} =V_{IN}		--	--	0.1	uA
EN Input Threshold	V_{EH}			2	--	--	V
	V_{EL}			--	--	0.6	V
Over Temp. Shutdown	OTS			--	160	--	°C
Over Temp. Hysterisis	OTH			--	25	--	°C

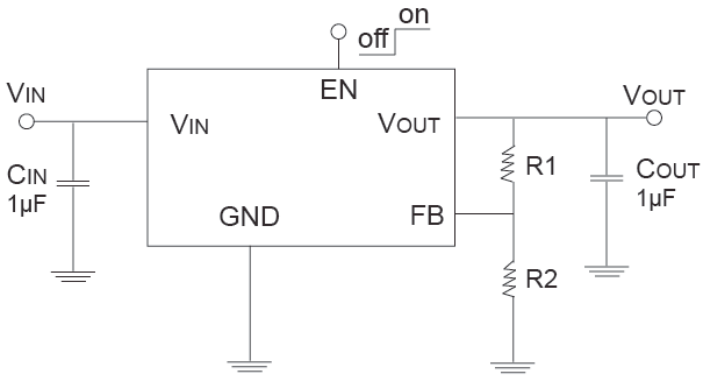
Note1: $V_{IN(MIN)}$=V_{OUT}+$V_{DROPOUT}$
Note2: The is $V_{DROPOUT}$ defined as V_{IN}-V_{OUT}, which is measured when V_{OUT} drop about 100mV
Note3: Regulation is measured at constant junction temperature by using pulsed testing with a low ON time.

Typical Application Circuit

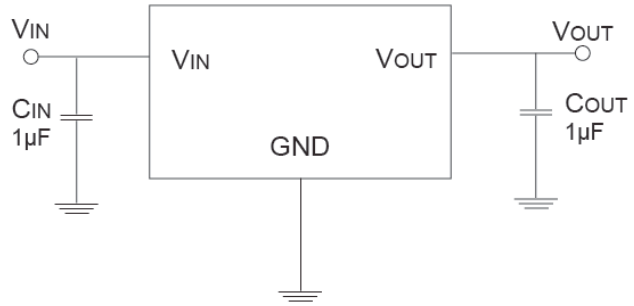
Fixed Version



Adjustable Version



Fixed Version



Application Information

TS9005 is specifically designed for portable applications requiring minimum board space and smallest components. It can provide 600mA output current at dropout voltage about 600mV. Beside, current limit and thermal shutdown features provide protection against any combination of overload or ambient temperature that could exceed junction temperature.

Capacitor Selection

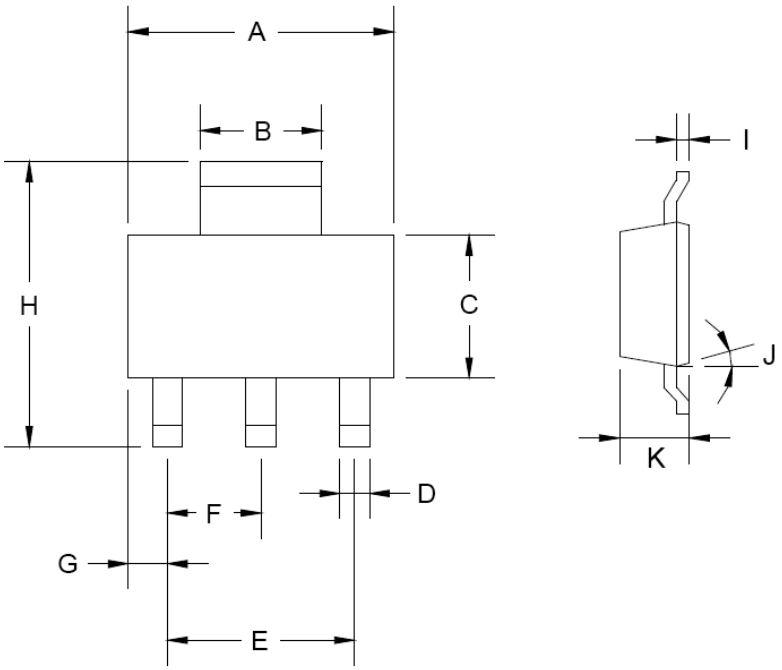
TS9005 is designed to be stable with a wide range of output capacitors. The ESR of the output capacitor affects stability. Larger output capacitor value can decrease peak deviations and to improve transition response for larger current changes. So the ESR of output capacitor is very important because it generates a zero to provide phase lead for loop stability. There is no requirement for the ESR on the input capacitor, but voltage and temperature coefficient have to be considered for device application environments.

The capacitor types (aluminum, ceramic and tantalum) have difference characterizations such as temperature and voltage coefficients. All ceramic capacitors are produces with a variety of dielectrics, each with different behavior across temperature and applications. Common dielectric use are X5R, X7R and Y5V. It is recommended to use 1uF X5R or X7R dielectric ceramic capacitor with 30mΩ~50mΩ ESR range between device outputs to ground for transient stability.

Current Limit and Thermal Shutdown Protection

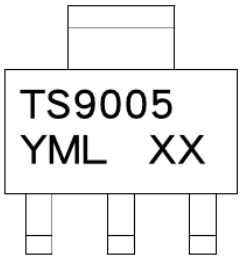
In order to prevent overloading or thermal condition from damaging the device, TS9005 regulator has internal thermal and current limiting functions designed to protect the device. It will rapidly shut off PMOS pass element during overloading or over temperature condition.

SOT-223 Mechanical Drawing



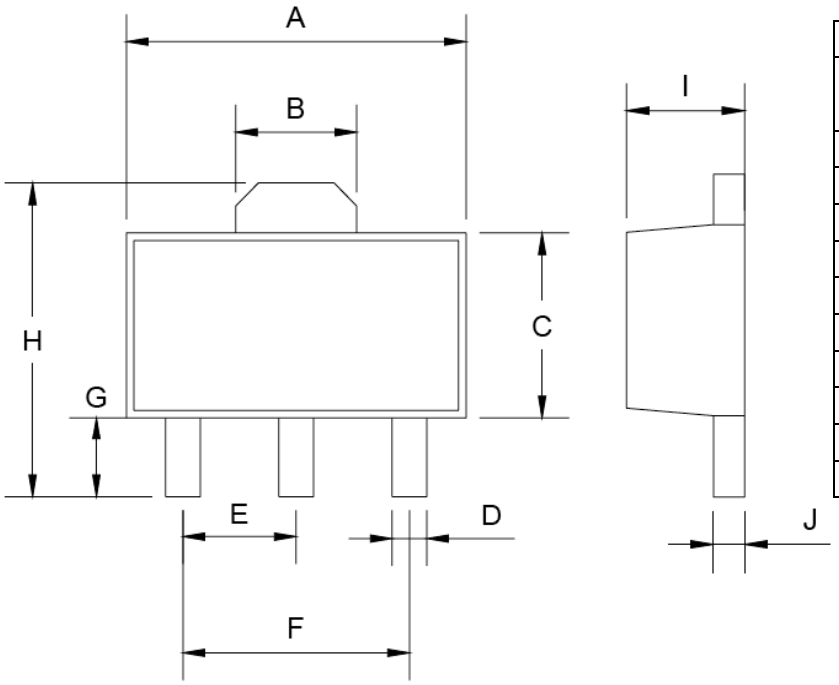
SOT-223 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.350	6.850	0.250	0.270
B	2.900	3.100	0.114	0.122
C	3.450	3.750	0.136	0.148
D	0.595	0.635	0.023	0.025
E	4.550	4.650	0.179	0.183
F	2.250	2.350	0.088	0.093
G	0.835	1.035	0.032	0.041
H	6.700	7.300	0.263	0.287
I	0.250	0.355	0.010	0.014
J	10˚	16˚	10˚	16˚
K	1.550	1.800	0.061	0.071

Marking Diagram



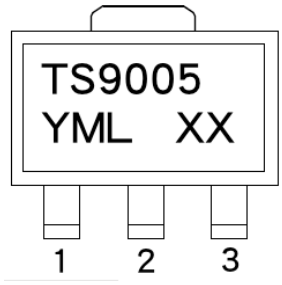
A = Device Code
Y = Year Code
M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
L = Lot Code
XX = Fixed Output Voltage Code
D=1.8V, **K**=2.5V, **S**=3.3V

SOT-89 Mechanical Drawing



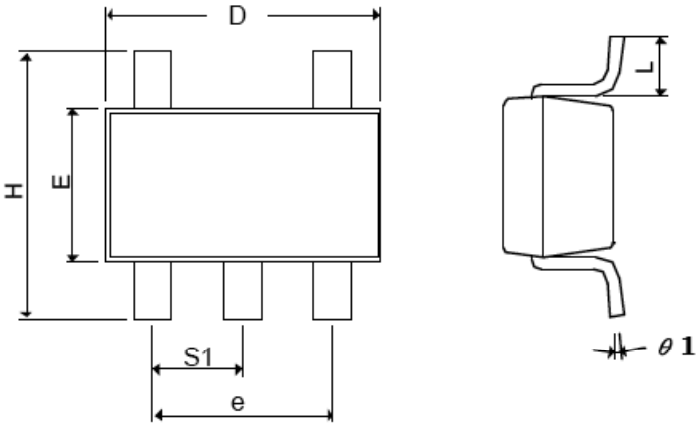
SOT-89 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.40	4.60	0.173	0.181
B	1.50	1.7	0.059	0.070
C	2.30	2.60	0.090	0.102
D	0.40	0.52	0.016	0.020
E	1.50	1.50	0.059	0.059
F	3.00	3.00	0.118	0.118
G	0.89	1.20	0.035	0.047
H	4.05	4.25	0.159	0.167
I	1.4	1.6	0.055	0.068
J	0.35	0.44	0.014	0.017

Marking Diagram

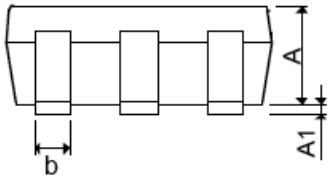


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L = Lot Code
XX = Fixed Output Voltage Code
D=1.8V, **K**=2.5V, **S**=3.3V

SOT-25 Mechanical Drawing



Front View



SOT-25 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX.
A+A1	0.09	1.25	0.0354	0.0492
B	0.30	0.50	0.0118	0.0197
C	0.09	0.25	0.0035	0.0098
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
E	1.90 BSC		0.0748 BSC	
H	2.40	3.00	0.09449	0.1181
L	0.35 BSC		0.0138 BSC	
Θ1	0º	10º	0º	10º
S1	0.95 BSC		0.0374 BSC	

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