

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 1µA. The TS9005 regulator is able to operate with output capacitors as small as 1µF for stability.

Features

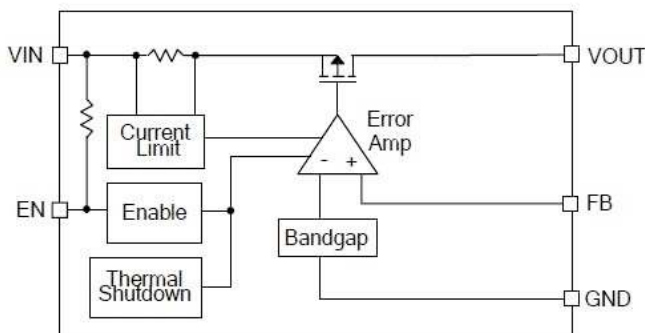
- Input voltage range: 2.5V~6V
- V_{DROP} typically 400mV@ $I_o=600mA$ ($V_{out} \geq 2.8V$)
- V_{OUT} adjust range from 0.8V~5V
- Output current up to 600mA guaranteed
- Current limit and thermal shutdown protection
- Low quiescent current at 45µA (typ.)
- Needs only 1µF capacitor for stability
- Maximum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

Applications

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

Block Diagram

(Adjustable Version)



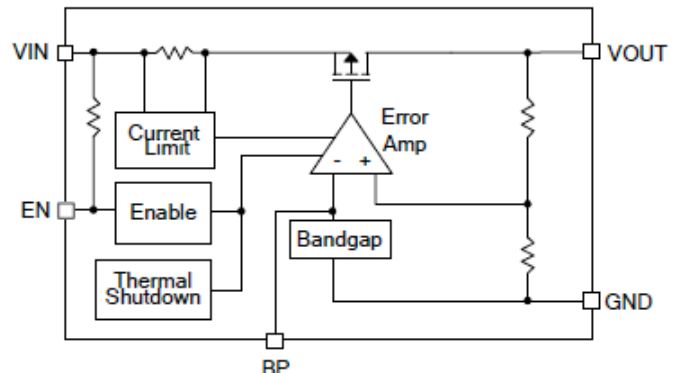
Ordering Information

| Part No. | Package | Packing |
|-------------------------------|---------|--------------------|
| TS9005 \underline{x} CW RP | SOT-223 | 2.5Kpcs / 13" Reel |
| TS9005 \underline{x} CY RM | SOT-89 | 1Kpcs / 7" Reel |
| TS9005 \underline{x} CX5 RF | SOT-25 | 3Kpcs / 7" Reel |

Note: Where \underline{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

(Fixed Version)



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 | 800 | mW |
| | SOT-89 | 500 | |
| | SOT-25 | 300 | |
| Thermal Resistance – Junction to Case | θ_{JC} | 25 | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance – Junction to Ambient | θ_{JA} | 120 | $^{\circ}\text{C}/\text{W}$ |
| Operating Temperature Range | T_{OPR} | -40 ~ +85 | $^{\circ}\text{C}$ |
| Junction Temperature Range | T_J | -40 ~ +125 | $^{\circ}\text{C}$ |
| Storage Temperature Range | T_{STG} | -65 ~ +150 | $^{\circ}\text{C}$ |

Notes: θ_{JA} is measured with the PCB copper area of approximately 1 in²(multi-layer). That need connect to GND pin.

Electrical Characteristics (Ta = 25 $^{\circ}\text{C}$, 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} | $I_{OUT} = 1\text{mA}$ | -2 | -- | +2 | % | |
| Feedback Voltage | V_{FB} | $V_{IN} = 2.8\text{V} \sim 5.5\text{V}$, $I_{OUT} = 1\text{mA}$ | 0.784 | 0.8 | 0.816 | V | |
| FB Input leakage Current | I_{FB} | $V_{FB} = 0.8\text{V}$ | -100 | -- | 100 | mA | |
| Dropout Voltage | $V_{DROPOUT}$ | $I_O = 600\text{mA}$ $V_O = V_{O(NOM)} - 2\%$ | $1.5\text{V} \leq V_{OUT} \leq 2\text{V}$ | -- | 1000 | 1200 | mV |
| | | | $2.0\text{V} \leq V_{OUT} \leq 2.8\text{V}$ | -- | 500 | 800 | |
| | | | $2.8\text{V} \leq V_{OUT} \leq 5\text{V}$ | -- | 350 | 500 | |
| Quiescent Current | I_Q | $I_{OUT} = 0\text{mA}$ | -- | 45 | 70 | μA | |
| Current Limit | I_{LIMIT} | $R_{LOAD} = 1\Omega$ | 600 | -- | -- | mA | |
| Line Regulation | REG_{LINE} | $I_{OUT} = 1\text{mA}$, $V_{IN} = V_{OUT} + 1\text{V} \sim 5\text{V}$ | -- | 1 | 5 | mV | |
| Load Regulation | REG_{LOAD} | $I_{OUT} = 0 \sim 600\text{mA}$ | -- | 13 | 50 | mV | |
| Power Supply Rejection | PSRR | $f = 120\text{Hz}$. | -- | 60 | -- | dB | |
| Shutdown Current | I_{SD} | $V_{IN} = 2.8\text{V} \sim 5\text{V}$, $V_{EN} = 0\text{V}$ | -- | -- | 1 | μA | |
| Enable Pin Current | I_{EH} | $V_{EH} = V_{IN}$ | -- | -- | 0.1 | μA | |
| EN Input Threshold | V_{EH} | | 2 | -- | -- | V | |
| | V_{EL} | | -- | -- | 0.6 | V | |
| Over Temp. Shutdown | OTS | | -- | 160 | -- | $^{\circ}\text{C}$ | |
| Over Temp. Hysteresis | OTH | | -- | 25 | -- | $^{\circ}\text{C}$ | |

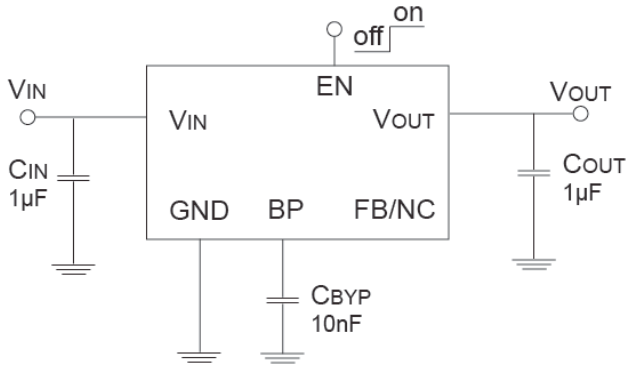
Note1: $V_{IN(MIN)} = V_{OUT} + V_{DROPOUT}$

Note2: The is $V_{DROPOUT}$ defined as $V_{IN} - V_{OUT}$, which is measured when V_{OUT} drop about 100mV

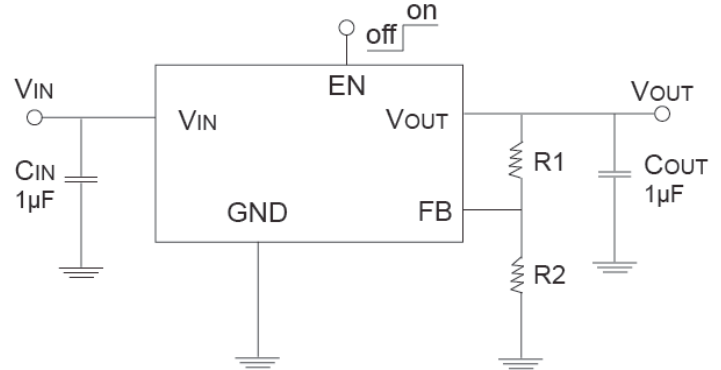
Note3: Regulation is measured at constant junction temperature by using pulsed testing with a low ON time.

Typical Application Circuit

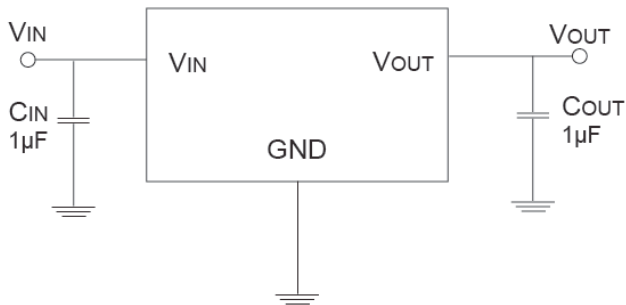
Fixed Version



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

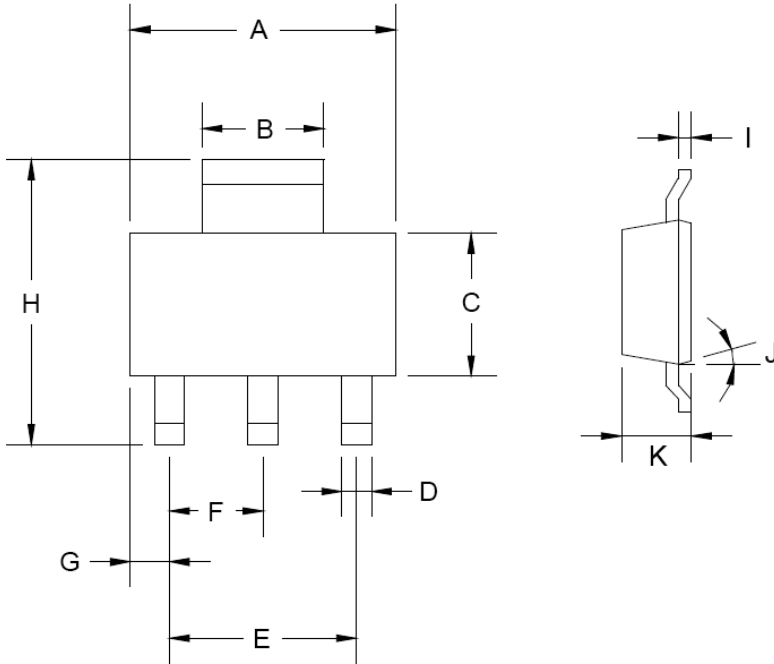
TS9005 is designed to be stable with a wide range of output capacitors. The ESR of the output capacitor affects stability. Larger output capacitor value can decrease peak deviations and to improve transition response for larger current changes. So the ESR of output capacitor is very important because 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 produced 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

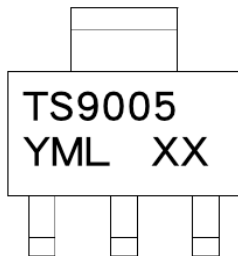
In order to prevent overloading or thermal condition from damaging the device, TS9005 regulator has internal thermal and current limiting functions designed to protect the device. It will rapidly shut off PMOS pass element during overloading or over temperature condition.

SOT-223 Mechanical Drawing



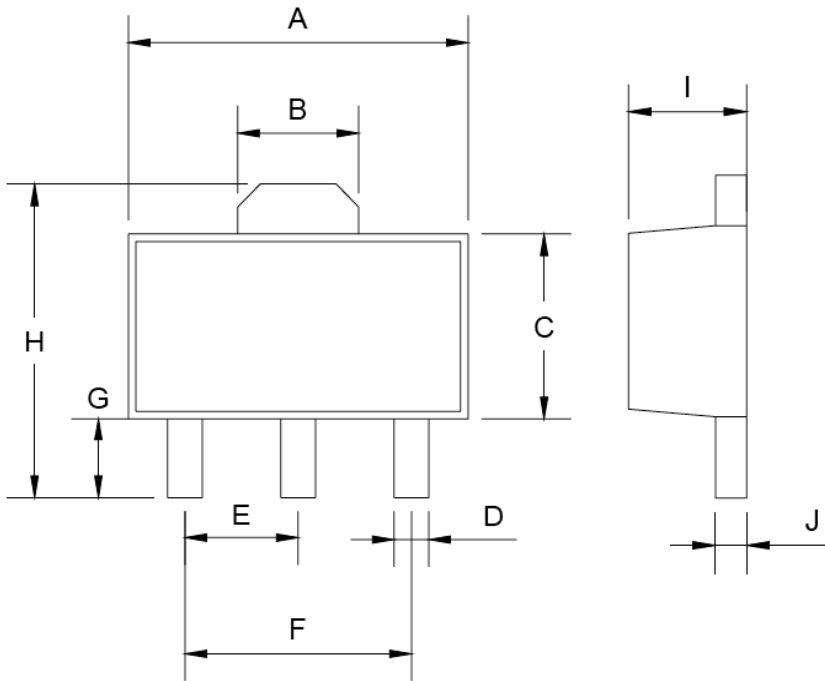
| SOT-223 DIMENSION | | | | |
|-------------------|-------------|-------|--------|-------|
| DIM | MILLIMETERS | | INCHES | |
| | MIN | MAX | MIN | MAX |
| A | 6.350 | 6.850 | 0.250 | 0.270 |
| B | 2.900 | 3.100 | 0.114 | 0.122 |
| C | 3.450 | 3.750 | 0.136 | 0.148 |
| D | 0.595 | 0.635 | 0.023 | 0.025 |
| 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



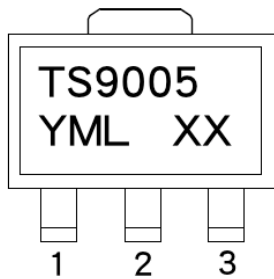
- A** = Device Code
- Y** = Year Code
- M** = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apr, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
- L** = Lot Code
- XX** = Fixed Output Voltage Code
D=1.8V, **K**=2.5V, **S**=3.3V

SOT-89 Mechanical Drawing



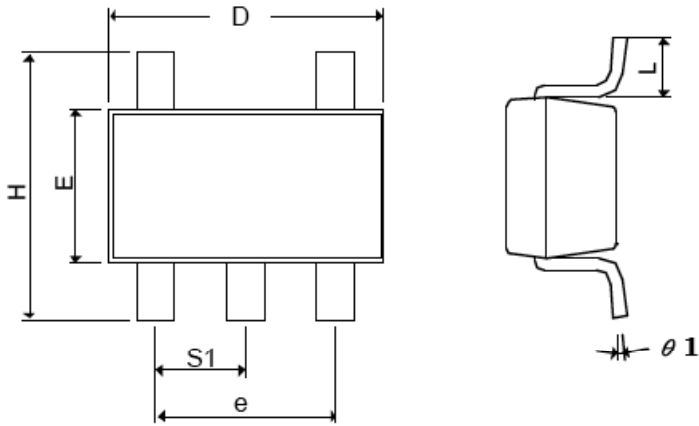
| SOT-89 DIMENSION | | | | |
|------------------|-------------|------|--------|-------|
| DIM | MILLIMETERS | | INCHES | |
| | MIN | MAX | MIN | MAX |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| B | 1.50 | 1.7 | 0.059 | 0.070 |
| C | 2.30 | 2.60 | 0.090 | 0.102 |
| D | 0.40 | 0.52 | 0.016 | 0.020 |
| E | 1.50 | 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

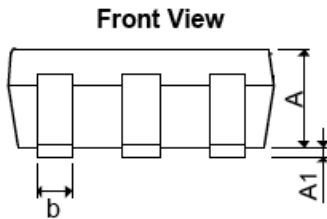


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- L** = Lot Code
- XX** = Fixed Output Voltage Code
D=1.8V, **K**=2.5V, **S**=3.3V

SOT-25 Mechanical Drawing



| 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 | 0° | 10° | 0° | 10° |
| S1 | 0.95 BSC | | 0.0374 BSC | |



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