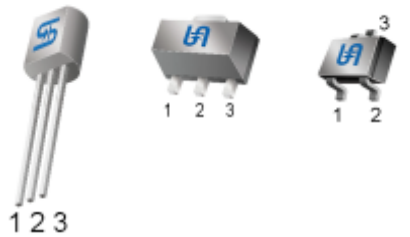
# TS9011

## 250mA CMOS Low Dropout Voltage Regulator

TO-92 SOT-89 SOT-23




Pin assignment

**TO-92 & SOT-89**
1. Gnd
2. Input
3. Output

**SOT-23**
1. Gnd
2. Out
3. Input

**Low Power Consumption 2uA**
**Low Drop Out Voltage 0.4V**

## General Description

The TS9011 series is a positive voltage regulator developed utilizing CMOS technology featured very low power consumption, low dropout voltage and high output voltage accuracy. Built in low on-resistor provides low dropout voltage and large output current. A 1uF or greater can be used as an output capacitor.

The TS9011 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 0.38V @Io=200mA (Vo=5V)
- ✧ Output current up to 250mA
- ✧ Low power consumption, 2uA(typ) @Vo=5V
- ✧ Output voltage +/-2%
- ✧ Internal current limit
- ✧ Thermal shutdown protection

## Applications

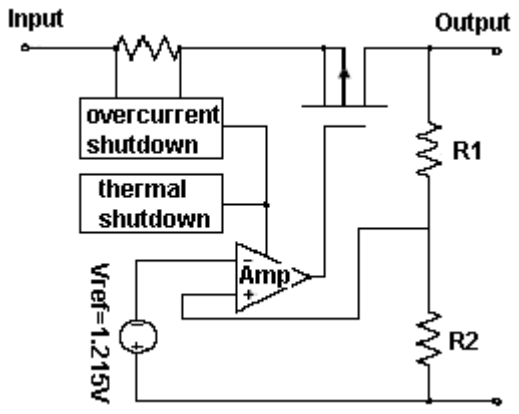
- ✧ Palmtops
- ✧ Video recorders
- ✧ Battery powered equipment
- ✧ PC peripherals
- ✧ CD-ROM
- ✧ Digital signal camera

## Ordering Information

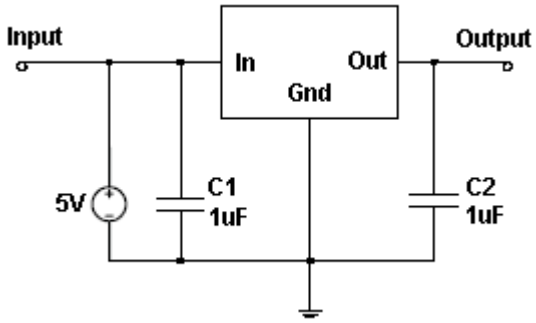
| Part No. | Operating Temp. (Ambient) | Package |
|---|---|---|
| TS9011**x**CT | -20 ~ +85 °C | TO-92 |
| TS9011**x**CX | | SOT-23 |
| TS9011**x**CY | | SOT-89 |

Note: Where **x** denotes voltage option, available are A = 1.5V, D=1.8V, K=2.5V, P=3.0V, S=3.3V, 5=5.0V. Contact factory for additional voltage options.

## Block Diagram




## Typical Application Circuit



## Absolute Maximum Rating

| | | | |
|---|---|---|---|
| Input Supply Voltage | Vin(max.) | +12 | V |
| Input Operating Voltage | Vin(opr.) | +10 | |
| Output Current | Io | $P_D$ / (Vin – Vo) | V |
| Power Dissipation SOT-23 | $P_D$ | 0.15 | W |
| SOT-89 | | 0.50 | |
| TO-92 | | 0.65 | |
| Operating Junction Temperature Range | Tj | -40 ~ +125 | °C |
| Storage Temperature Range | $T_{STG}$ | -65 ~ +150 | °C |
| Lead Soldering Temperature (260 °C) | | 10 | S |

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

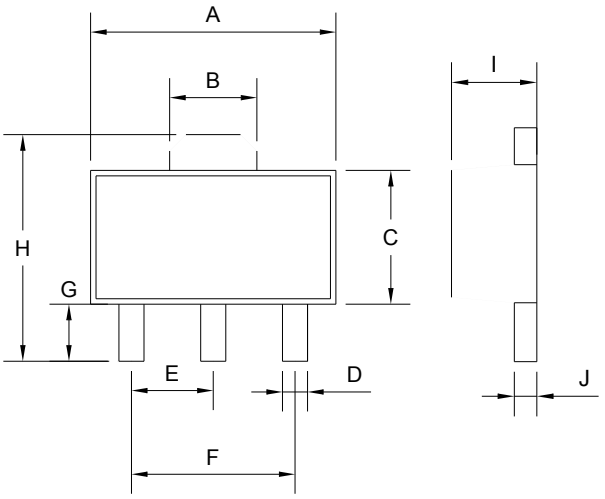
## Electrical Characteristics

Ta = 25 °C unless otherwise specified.

| Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | Vin=Vo + 1V, Io =40mA, | TS90115 | 4.900 | 5.0 | 5.100 | V |
| | | TS9011S | 3.234 | 3.3 | 3.366 | |
| | | TS9011P | 2.94 | 3.0 | 3.06 | |
| | | TS9011K | 2.450 | 2.5 | 2.550 | |
| | | TS9011D | 1.764 | 1.8 | 1.836 | |
| | | TS9011A | 1.47 | 1.5 | 1.53 | |
| Maximum Output Current | Vin=Vo+1V, | | 250 | -- | -- | mA |
| Input Stability | Vo+1V ≤ Vin ≤ Vo+2V, Io=1mA | | -- | 0.2 | 0.3 | % |
| Load Regulation (Note1) | Vin=Vo+1V, 1mA≤$I_L$≤100mA | TS90115 | -- | 40 | 80 | mV |
| | | TS9011S | | | | |
| | Vin=Vo+1V, 1mA≤$I_L$≤80mA | TS9011P | -- | 40 | 90 | |
| | | TS9011K | | | | |
| | | TS9011D | | | | |
| | | TS9011A | | | | |
| Dropout Voltage (Note 2) | Io=250mA | TS90115 | -- | 400 | 600 | mV |
| | Io=200mA | TS9011S | -- | 400 | 650 | |
| | Io=160mA | TS9011K | -- | 400 | 700 | |
| | Io=160mA | TS9011K | -- | 400 | 700 | |
| | Io=120mA | TS9011D | -- | 400 | 750 | |
| | Io=100mA | TS9011A | -- | 850 | 1000 | |
| Quiescent Current | Vin=Vo+1V, Io=0A | | -- | 2 | 5 | uA |
| Output Current Limit | Vout < 0.4V | | -- | 400 | -- | mA |
| Power Supply Rejection Ratio | At f=100KHz, Io=10mA, | | -- | 30 | -- | dB |
| Output Voltage Temperature Coefficient (Note 3) | | | -- | 100 | -- | ppm/°C |

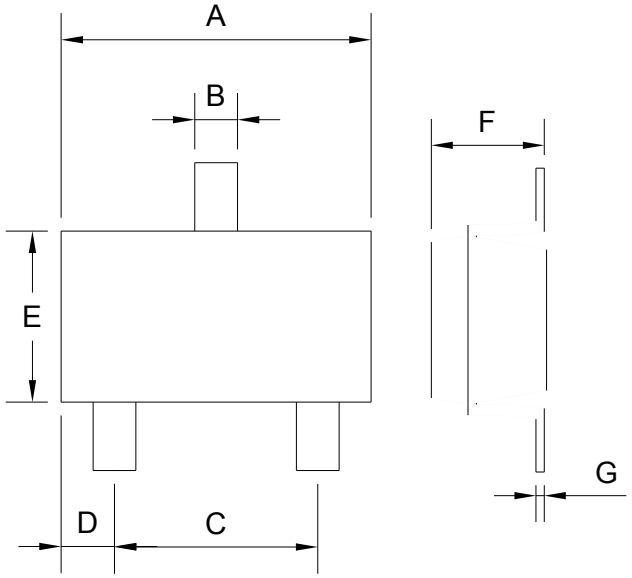
Note: 1. Regulation is measured at constant junction temperature, using pulsed ON time.
2. Dropout is measured at constant junction temperature, using pulsed ON time, and the criterion is Vout inside target value +/-2%.
3. Guaranteed by design.

# SOT-89 Mechanical Drawing



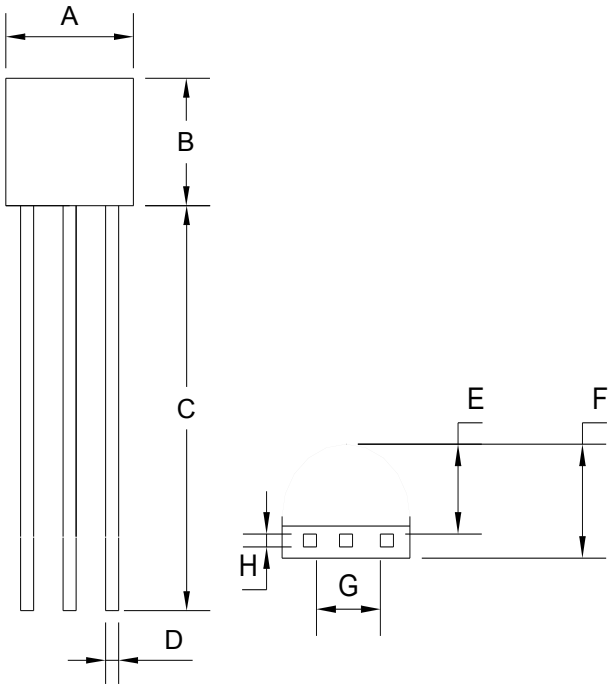

| SOT-89 DIMENSION | | | | |
|---|---|---|---|---|
| DIM | MILLIMETERS | | INCHES | |
| | MIN | MAX | MIN | MAX |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| B | 1.50 | 1.7 | 0.059 | 0.070 |
| C | 2.30 | 2.60 | 0.090 | 0.102 |
| D | 0.40 | 0.52 | 0.016 | 0.020 |
| E | 1.50 | 1.50 | 0.059 | 0.059 |
| F | 3.00 | 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 |
| | | | | |

# SOT-23 Mechanical Drawing




| SOT-23 DIMENSION | | | | |
|---|---|---|---|---|
| DIM | 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 | 1.59 | 1.66 | 0.063 | 0.065 |
| 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 |
| | | | | |