

## 250mA Low Quiescent Current CMOS LDO

### DESCRIPTION

TS9011 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 1 $\mu$ F or greater can be used as an output capacitor. TS9011 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.

### FEATURES

- Dropout Voltage 0.4V (typ.) @ I<sub>o</sub>=250mA
- Output Current up to 250mA
- Low Power Consumption, 2 $\mu$ A (typ.)
- Output Voltage  $\pm$  2%
- Internal Current Limit
- Thermal Shutdown Protection

### APPLICATION

- Battery-operated systems
- Microprocessor reset circuitry
- Memory battery back-up circuits
- Power-on reset circuits
- Power failure detection
- System battery life and charge voltage monitors



#### Pin Definition:

1. Ground
2. Output
3. Input

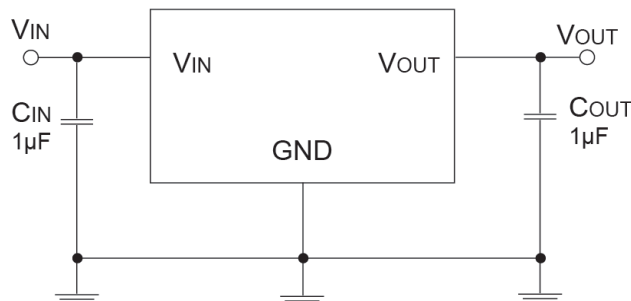


#### Pin Definition:

1. Ground
2. Input
3. Output

**Notes:** Moisture sensitivity level: level 3. Per J-STD-020

### TYPICAL APPLICATION CIRCUIT



\*Tantalum capacitor for Input & Output capacitor are recommended.

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise specified) <sup>(Note 1)</sup>				
PARAMETER		SYMBOL	LIMIT	UNIT
Input Supply Voltage		$V_{IN}$	12	V
Output Current		$I_{OUT}$	250	mA
Power Dissipation	SOT-23	$P_D$	0.30	W
	SOT-89		0.50	
Operating Ambient Temperature		$T_{OPR}$	-40 ~ +85	$^\circ\text{C}$
Junction Temperature Range		$T_J$	-40 ~ +150	$^\circ\text{C}$
Storage Temperature Range		$T_{STG}$	-65 ~ +150	$^\circ\text{C}$

<b>THERMAL PERFORMANCE</b>				
PARAMETER		SYMBOL	LIMIT	UNIT
Thermal Resistance - Junction to Ambient	SOT-23	$R_{\theta JA}$	333	$^\circ\text{C/W}$
	SOT-89		200	

**Note:** Measured with FR4 4-layer board having thermal via holes

<b>ELECTRICAL SPECIFICATIONS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise specified)						
PARAMETER	CONDITION		MIN	TYP	MAX	UNIT
Output Voltage	$V_{IN}=V_o + 1V,$ $I_o=40mA,$	TS90115	4.90	5.0	5.10	V
		TS9011S	3.23	3.3	3.36	
		TS9011P	2.94	3.0	3.06	
		TS9011K	2.45	2.5	2.55	
		TS9011D	1.76	1.8	1.83	
		TS9011A	1.47	1.5	1.53	
Maximum Output Current	$V_{IN}=V_o+1V,$		250	--	--	mA
Input Stability	$V_o+1V \leq V_{in} \leq V_o+2V, I_o=1mA$		--	0.2	0.3	%
Load Regulation <sup>(Note1)</sup>	$V_{IN}=V_o+1V,$ $1mA \leq I_L \leq 100mA$	TS90115	--	40	80	mV
		TS9011S				
	$V_{IN}=V_o+1V,$ $1mA \leq I_L \leq 80mA$	TS9011P	--	40	90	
		TS9011K				
		TS9011D				
TS9011A						
Dropout Voltage <sup>(Note 2)</sup>	$I_o=250mA$	TS90115	--	400	600	mV
	$I_o=200mA$	TS9011S	--	400	650	
	$I_o=160mA$	TS9011P	--	400	700	
	$I_o=160mA$	TS9011K	--	400	700	
	$I_o=120mA$	TS9011D	--	400	750	
	$I_o=100mA$	TS9011A	--	850	1000	
Quiescent Current	$V_{IN}=V_o+1V, I_o=0A$		--	2	5	$\mu\text{A}$
Output Current Limit	$V_{OUT} < 0.4V$		--	400	--	mA
Power Supply Rejection Ratio	At $f=100\text{KHz}, I_o=10mA,$		--	30	--	dB
Output Voltage Temperature Coefficient <sup>(Note 3)</sup>			--	100	--	ppm/ $^\circ\text{C}$

**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  $V_{OUT}$  inside target value +/-2%.
3. Guaranteed by design.

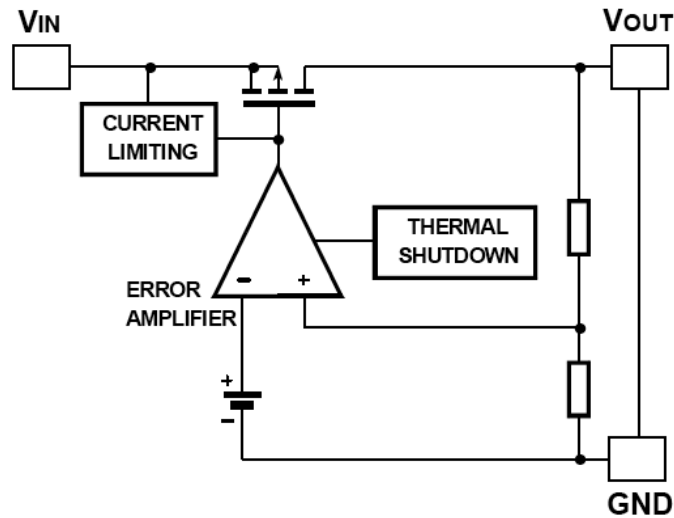
**ORDERING INFORMATION**

OUTPUT VOLTAGE	PART NO.	PACKAGE	PACKING
1.5V	TS9011ACX RFG	SOT-23	3,000pcs / 7" Reel
1.8V	TS9011DCX RFG	SOT-23	3,000pcs / 7" Reel
	TS9011DCY RMG	SOT-89	1,000pcs / 7" Reel
2.5V	TS9011KCX RFG	SOT-23	3,000pcs / 7" Reel
	TS9011KCY RMG	SOT-89	1,000pcs / 7" Reel
3.0V	TS9011PCX RFG	SOT-23	3,000pcs / 7" Reel
	TS9011PCY RMG	SOT-89	1,000pcs / 7" Reel
3.3V	TS9011SCX RFG	SOT-23	3,000pcs / 7" Reel
	TS9011SCY RMG	SOT-89	1,000pcs / 7" Reel
5V	TS90115CX RFG	SOT-23	3,000pcs / 7" Reel
	TS90115CY RMG	SOT-89	1,000pcs / 7" Reel

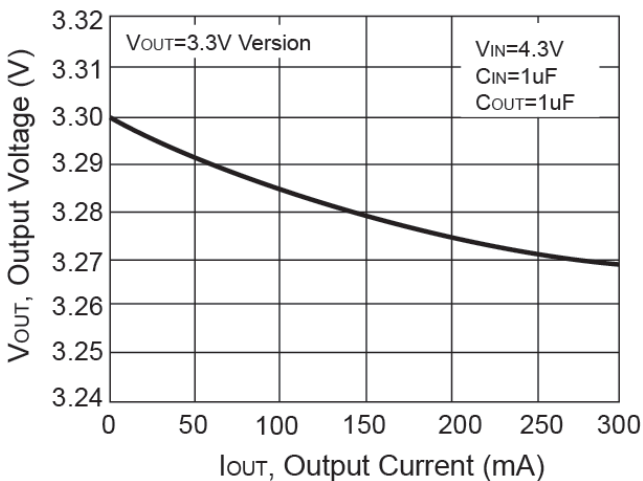
**Note:**

1. Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC.
2. Halogen-free according to IEC 61249-2-21 definition.

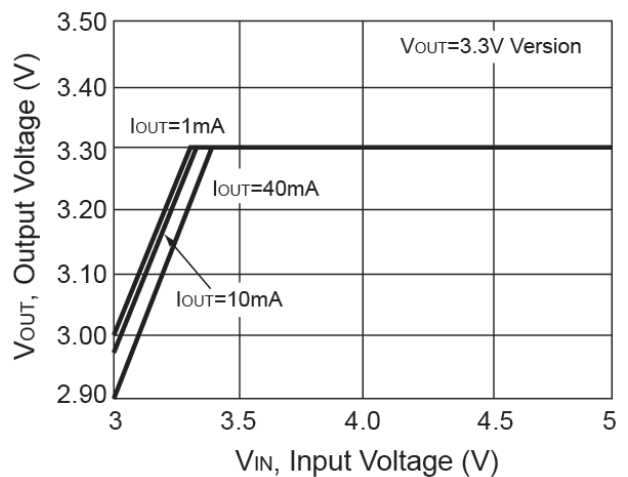
**FUNCTION BLOCK DIAGRAM**



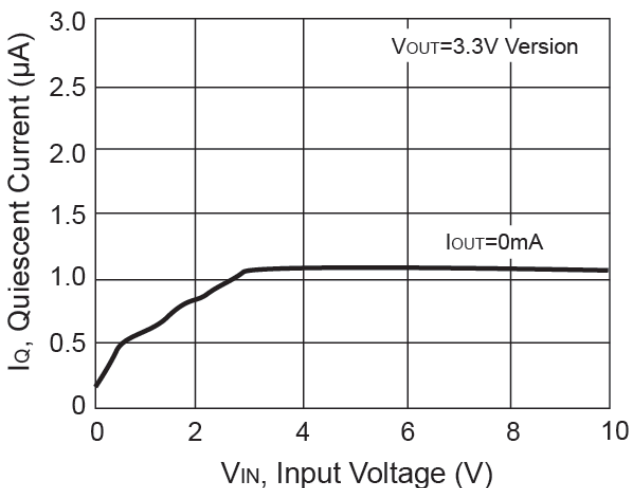
**ELECTRICAL CHARACTERISTICS CURVES** ( $T_A=25^{\circ}\text{C}$ , unless otherwise noted)



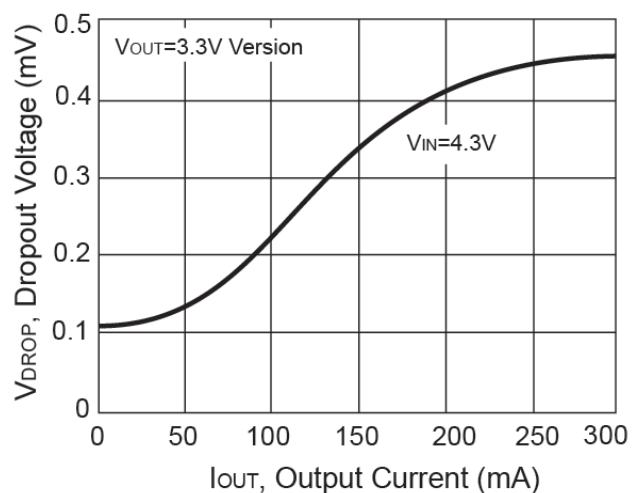
**Figure 1. Output Voltage vs. Output Current**



**Figure 2. Output Voltage vs. Input Voltage**



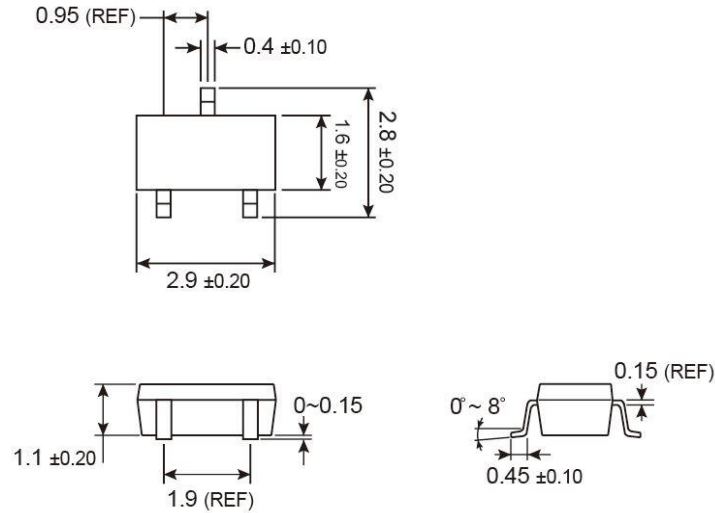
**Figure 3. Quiescent Current vs. Input Voltage**



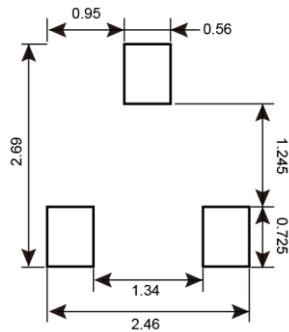
**Figure 4. Short Circuit Current vs. Input Voltage**

**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

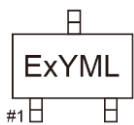
**SOT-23**



**SUGGESTED PAD LAYOUT** (Unit: Millimeters)



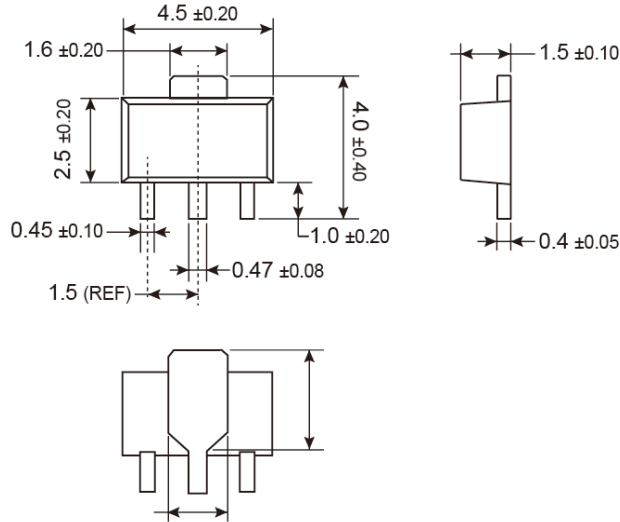
**MARKING DIAGRAM**



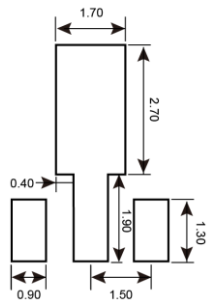
- E** = Product Code
- Y** = Year Code
- M** = Month Code for Halogen Free Product
  - O** =Jan    **P** =Feb    **Q** =Mar    **R** =Apr
  - S** =May    **T** =Jun    **U** =Jul    **V** =Aug
  - W** =Sep    **X** =Oct    **Y** =Nov    **Z** =Dec
- L** = Lot Code (1~9, A~Z)
- X** = Fixed Output Voltage Code
  - A**=1.5V, **D**=1.8V, **K**=2.5V, **P**=3.0V, **S**=3.3V, **5**=5.0V.

**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

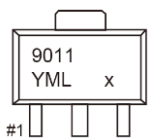
**SOT-89**



**SUGGESTED PAD LAYOUT** (Unit: Millimeters)



**MARKING DIAGRAM**



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