

# 400mA Low Dropout Voltage Regulators

The series of fixed-voltage monolithic micropower voltage regulators is designed for a wide range of applications. This device is an excellent choice for use in battery-power applications. Furthermore, the quiescent current increases only slightly at dropout, which prolongs battery life.

This series of fixed-voltage regulators features very low quiescent current (100mA Typ.) and very low drop output

voltage (Typ. 60mV at light load and 600mV at 400mA). This includes a tight initial tolerance of 0.5% typ., extremely good load and line regulation of 0.05% typ., and very low output temperature coefficient.

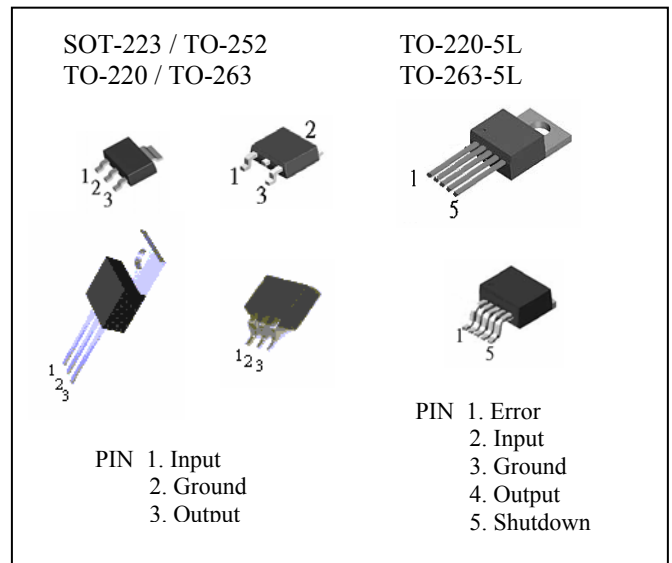
This series is offered in 3-pin TO-263, TO-220, TO-252 & SOT-223 package, and in 5-pin TO-220 & TO-263 package with shutdown input.

## FEATURES

- Output accuracy within 2% at over temperature
- Very low quiescent current
- Low dropout voltage (400mV Typ)
- Extremely tight load and line regulation
- Very low temperature coefficient
- Unregulated DC input can withstand -20V reverse battery and +60V positive transients
- Available Output Voltage 5V, 3.3V, 2.5V, 1.8V

## APPLICATIONS

- High-efficiency linear regulator
- Battery powered systems
- Portable instrumentation
- Portable consumer equipment
- Portable / Palm top / Notebook computers
- Automotive electronics
- SMPS Post-Regulator



## ORDERING INFORMATION

Device	Operating Temperature	Package
PJ48xxCZ-5L	-20°C to +85°C	TO-220-5L
PJ48xxCM-5L		TO-263-5L
PJ48xxCZ		TO-220
PJ48xxCM		TO-263
PJ48xxCP		TO-252
PJ48xxCW		SOT-223

xx- output voltage

## ABSOLUTE MAXIMUM RATINGS

Power Dissipation		Internally Limited
Lead Temperature (Soldering, 5 seconds)		260°C
Storage Temperature Range		-65 to +150°C
Operating Junction Temperature Range		-55 to +150°C
Input Supply Voltage		-20 to +35V
Continuous total dissipation at 25°C free-air temperature	TO-220/TO-263	2W
	TO-252	1W
	SOT-223	0.8W

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**ELECTRICAL CHARACTERISTICS** at  $V_{in} = 14.4V$ ,  $T_a = 25^{\circ}C$ ,  $I_L = 5mA$ ,  $C_o = 100 \mu F$ , unless otherwise noted.

Parameter	Conditions	Min	Typ	Max	UNITS
Output Voltage	$T_J = 25^{\circ}C$ Full Operating Temperature	$0.990 V_o $ $0.980 V_o $	5.0 / 3.3 2.5 / 1.8	$1.010 V_o $ $1.020 V_o $	V
Output Voltage	$1mA \leq I_L \leq 700mA$ , $T_J \leq T_{JMAX}$	$0.975 V_o $		$1.025 V_o $	V
Input Supply Voltage				26	V
Output Voltage Temperature Coefficient	(Note 1)		50	150	ppm/ $^{\circ}C$
Line Regulation (Note 2)	$13V \leq V_{in} \leq 26V$ (Note 3)		0.1	0.4	%
Load Regulation (Note 2)	$1mA \leq I_L \leq 700mA$		0.1	0.3	%
Dropout Voltage (Note 4)	$I_L = 100mA$ $I_L = 400mA$		200 400	300 600	mV mV
Ground Current (Note 5)	$I_L = 100 \mu A$ $I_L = 400mA$		100 30	200 40	$\mu A$ mA
Dropout Ground Current (Note 5)	$V_{in} = V_{out} - 0.5V$ , $I_L = 100 \mu A$		200	300	$\mu A$
Current Limit	$V_{out} = 0$		700	900	mA
Thermal Regulation (Note 6)			0.05	0.2	%W
Output Noise, 10Hz to 100KHz, $I_L = 400mA$	$C_L = 2.2 \mu F$ $C_L = 3.3 \mu F$ $C_L = 33 \mu F$		500 350 120		$\mu V_{rms}$
<b>Adjust Model</b>					
Reference Voltage		1.21	1.235	1.26	V
Reference Voltage	Over Temperature (Note 7)	1.185		1.285	V
Feedback Pin Bias Current			20	40	nA
Reference Voltage Temperature Coefficient	(Note 1)		50		ppm/ $^{\circ}C$
Feedback Pin Bias Current Temperature Coefficient			0.1		nA/ $^{\circ}C$
<b>Shutdown Input</b>					
Input Logic Voltage	Low (Regulator ON) High (Regulator OFF)		0.7 2		V
Shutdown Pin Input Current	$V_s = 2.4V$ $V_s = 26V$		30 450	50 600	$\mu A$
Regulator Output Current in Shutdown	(Note 8)			200	$\mu A$

Note 1: Output or reference voltage temperature coefficients defined as the worst case voltage change divided by the total temperature range.

Note 2: Regulation is measured at constant junction temperature, using pulse testing with a low duty cycle. Changes in output voltage due to heating effects are covered under the specification for thermal regulation.

Note 3: Line regulation is tested at  $125^{\circ}C$  for  $I_L = 5mA$ . For  $I_L = 100 \mu A$  and  $T_J = 125^{\circ}C$ , line regulation is guaranteed by design to 0.2% for  $13V \leq V_{in} \leq 26V$ .

Note 4: Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

Note 5: Ground pin current is the regulator quiescent current. The total current drawn from the source is the sum of the ground pin current and output load current.

Note 6: Thermal regulation is the change in output voltage at a time T after a change in power dissipation, excluding load or line regulation effects. Specifications are for a 200mA load pulse (3W pulse) for T = 10ms.

Note 7:  $V_{ref} \leq V_{out} \leq (V_{in} - 1V)$ ,  $2.3V \leq V_{in} \leq 26V$ ,  $100 \mu A \leq I_L \leq 400mA$ ,  $T_J \leq T_{JMAX}$ .

Note 8:  $2V \leq V_{shutdown}$ ,  $V_{in} \leq 26V$ ,  $V_{out} = 0V$

**BLOCK DIAGRAM AND TYPICAL APPLICATIONS**

Fixed Regulator for 3 Pin

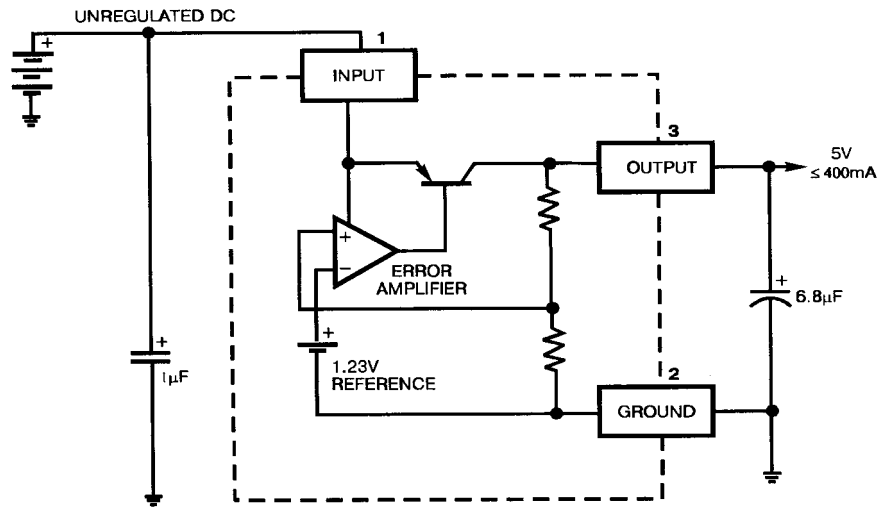
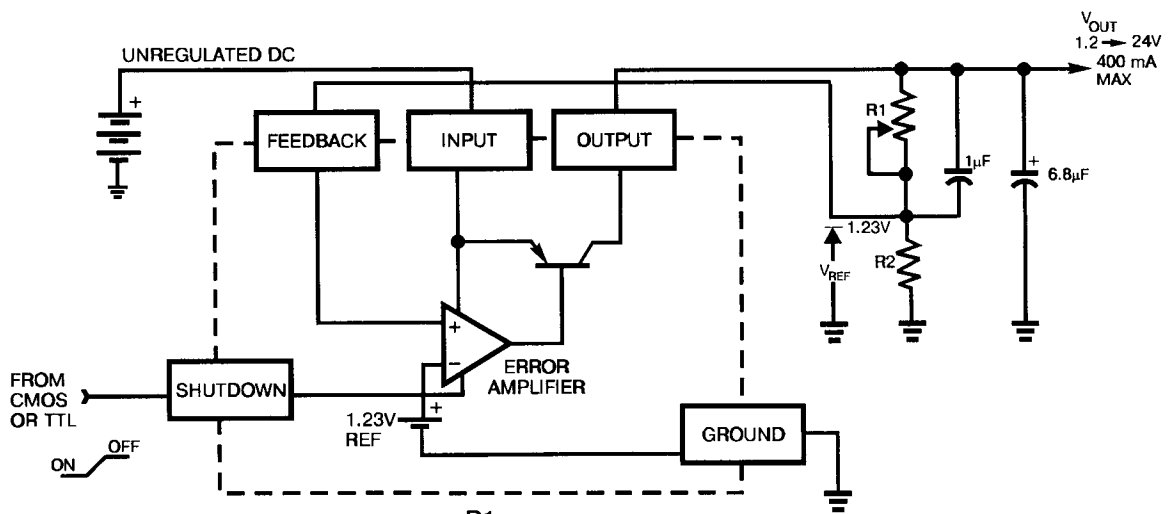


Figure 1. Fixed Regulator

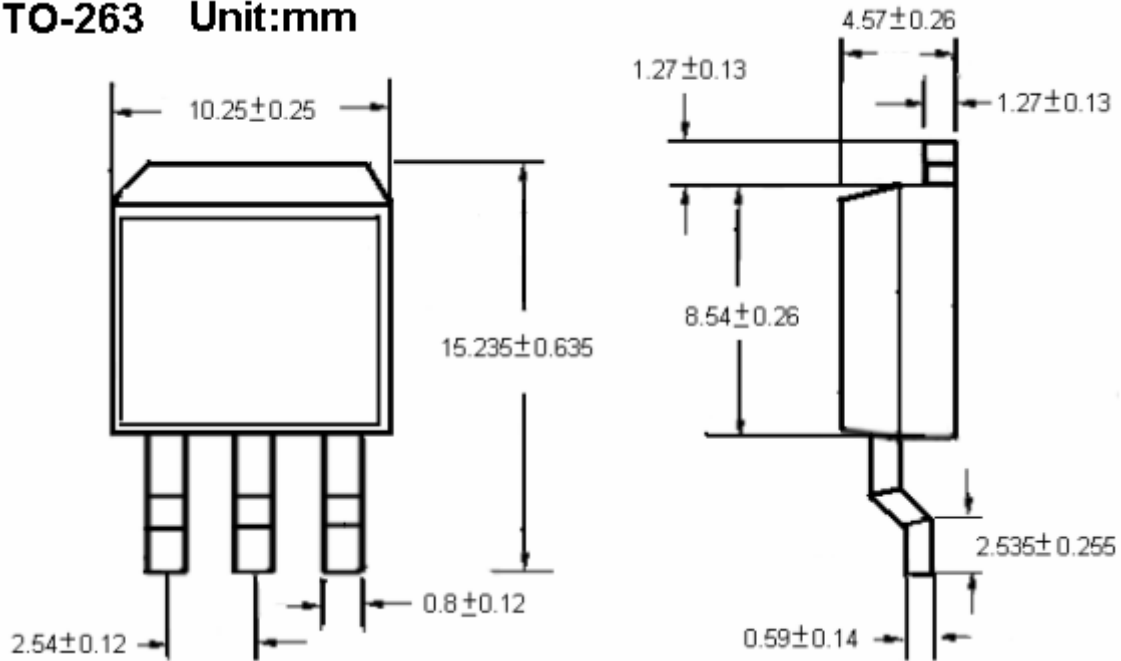
Adj / Fixed Regulator for 5 Pin



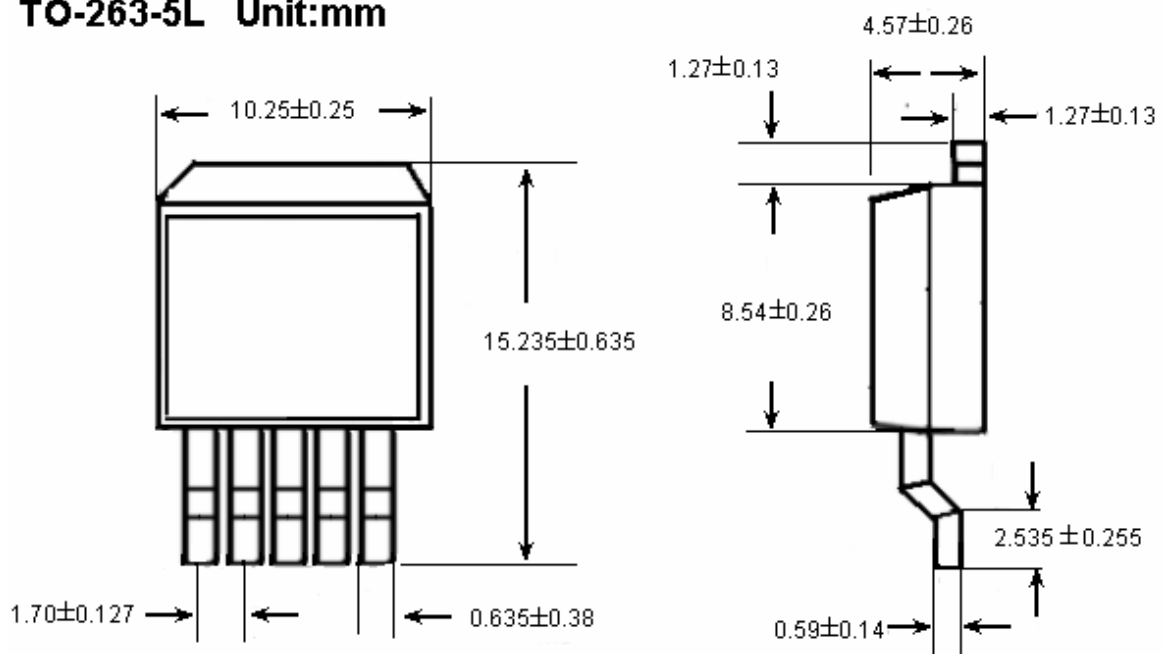
$$V_{out} = V_{REF} \left( 1 + \frac{R1}{R2} \right)$$

Figure 2. Adjustable Regulator

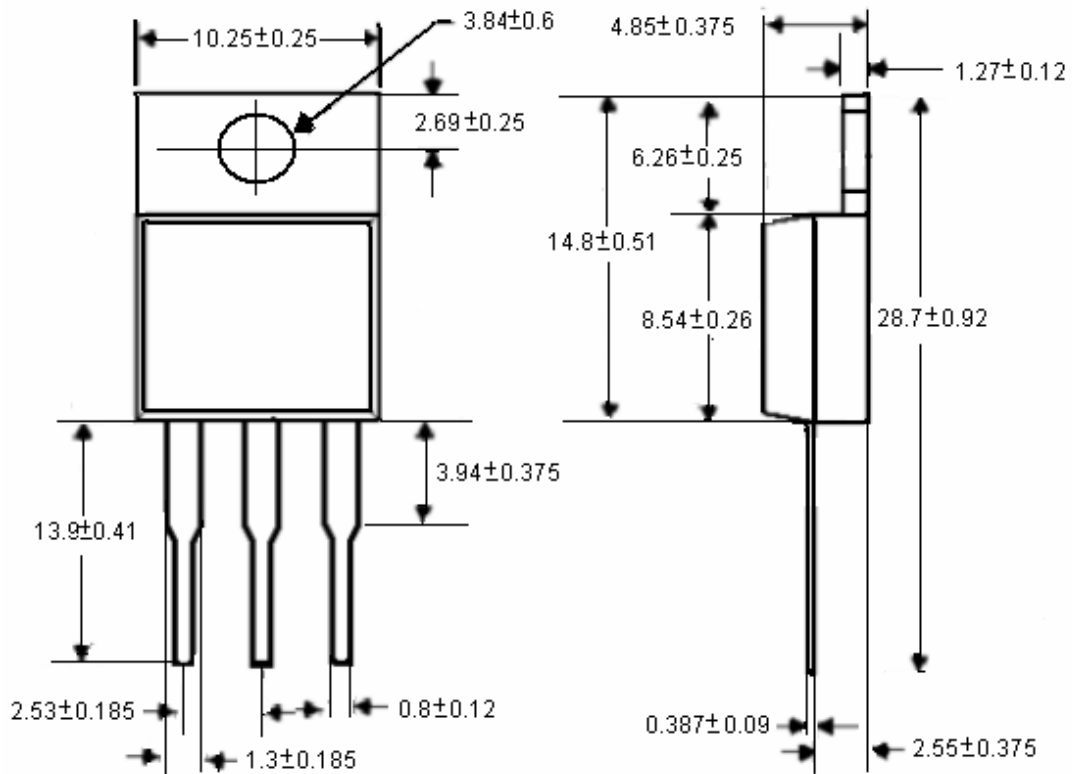
TO-263 Unit:mm



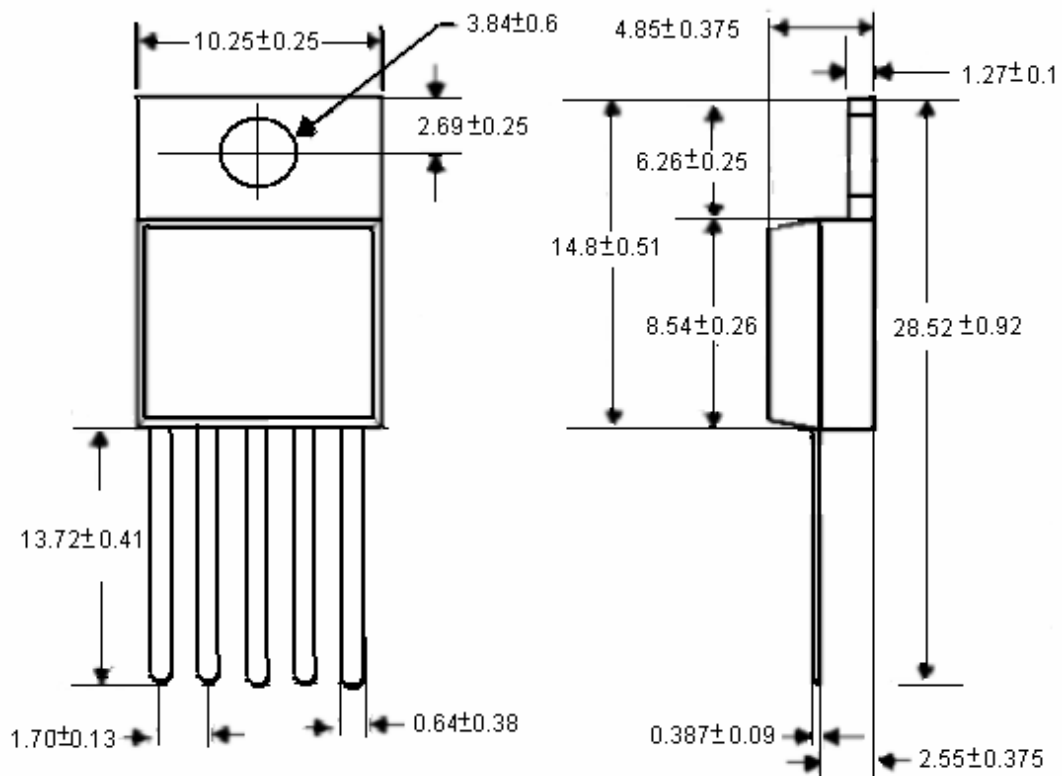
TO-263-5L Unit:mm



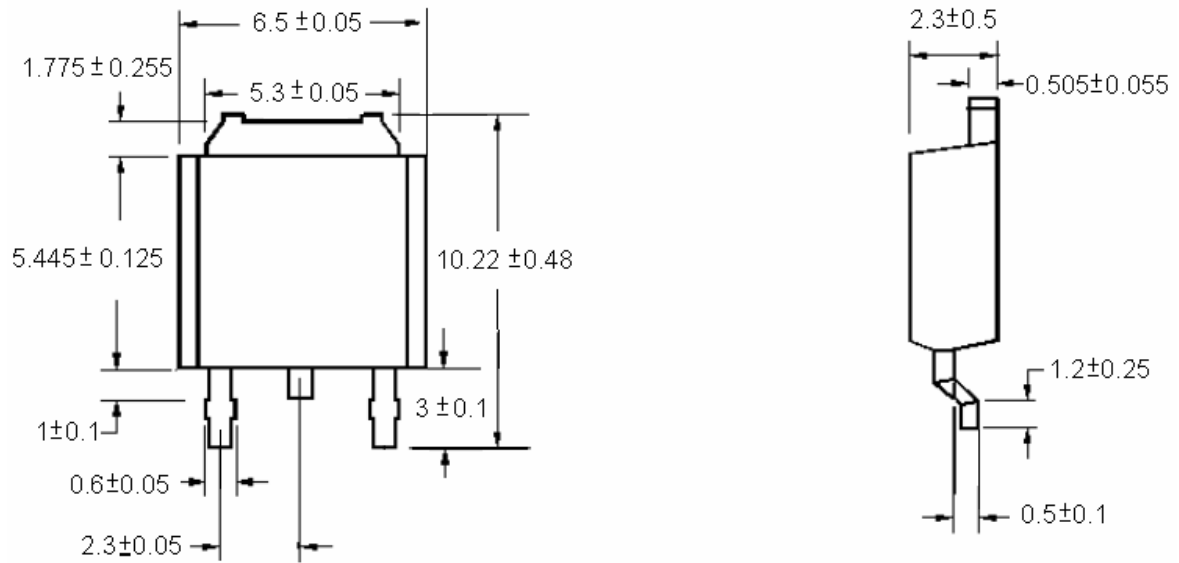
**TO-220 Unit:mm**



**TO-220-5L Unit:mm**



**TO-252 Unit:mm**



**SOT-223 Unit:mm**

