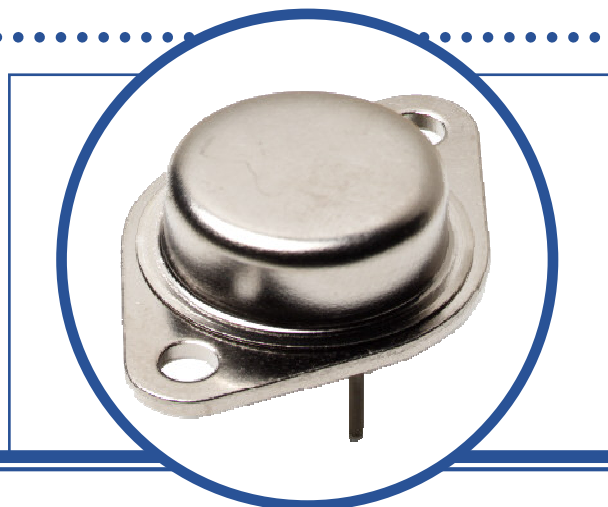


# POSITIVE ADJUSTABLE VOLTAGE REGULATOR

**IP117K / LM117K**  
**IP117AK / LM117AK**  
**IP117HVK / LM117HVK**  
**IP117AHVK / LM117AHVK**  
**IP317K / LM317K**  
**IP317AK / LM317AK**  
**IP317HVK / LM317HVK**  
**IP317AHVK / LM317AHVK**



## FEATURES

- 1.5A Output Current Guaranteed
- Internal Thermal Overload Protection
- Output Short Circuit Protected
- Hermetic Metal TO3 Package
- Screening Options Available

## APPLICATIONS

- Adjustable Power Supplies
- System Power Supplies
- Precision Voltage / Current Regulators

## DESCRIPTION

The 117/317 Series regulators are adjustable 3 terminal voltage regulators capable of supplying in excess of 1.5A over an output voltage range of 1.25V to 40V (HV Series, 60V). The regulators are exceptionally easy to apply requiring only 2 external resistors to set the output voltage.

Every effort has been made to make these devices easy to use and difficult to damage. Internal current limiting and power limiting coupled with true thermal limiting prevents damage due to overloads or shorts, even if the regulators are not fastened to a heat sink.

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise stated)

V <sub>I</sub> - V <sub>O</sub>	Input – Output Voltage Differential	Standard	40V
		HV Series	60V
I <sub>O</sub>	Output Current	Internally Limited	
P <sub>D</sub>	Power Dissipation	Internally Limited	
T <sub>J</sub>	Operating Junction Temperature Range	117 Series	-55 to +150°C
		317 Series	0 to +125°C
T <sub>stg</sub>	Storage Temperature Range	-65 to +150°C	

## THERMAL PROPERTIES

Symbols	Parameters	Min.	Typ.	Max.	Units
R <sub>θJC</sub>	Thermal Resistance, Junction To Case			3	°C/W

\*\* This datasheet supersedes document 2829

Semelab Limited reserves the right to change test conditions, parameter limits and package dimensions without notice. Information furnished by Semelab is believed to be both accurate and reliable at the time of going to press. However Semelab assumes no responsibility for any errors or omissions discovered in its use. Semelab encourages customers to verify that datasheets are current before placing orders.



# POSITIVE ADJUSTABLE VOLTAGE REGULATOR

## ELECTRICAL CHARACTERISTICS(1)(3) ( $T_C = 25^\circ\text{C}$ unless otherwise stated)

LM117, IP117, LM117HV, IP117HV							
Symbols	Parameters	Test Conditions	Min.	Typ	Max.	Units	
$V_{REF}$	Reference Voltage	$I_{OUT} = 10\text{mA}$	1.200	1.250	1.300	V	
		$10\text{mA} \leq I_{OUT} \leq I_{MAX}$ , $P \leq P_{MAX}$ , $3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$	• 1.200	1.250	1.300		
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation (2)	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$ , $I_{OUT} = 10\text{mA}$		0.010	0.020	%V	
			•	0.020	0.050		
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation (2)(3)	$10\text{mA} \leq I_{OUT} \leq I_{MAX}$	$V_{OUT} \leq 5\text{V}$		5	15	mV
			$V_{OUT} \geq 5\text{V}$		0.1	0.3	%
			$V_{OUT} \leq 5\text{V}$	•	20	50	mV
			$V_{OUT} \geq 5\text{V}$	•	0.3	1.0	%
	Thermal Regulation	$V_{IN} = 14.58\text{V}$ , $I_{OUT} = 1.5\text{A}$ , $P_D = 20\text{W}$ , $T_A = 25^\circ\text{C}$ , 20ms Pulse		0.030	0.070	%/W	
	Ripple Rejection	$V_{OUT} = 10\text{V}$ $f = 120\text{Hz}$	$C_{ADJ} = 0$		65		dB
			$C_{ADJ} = 10\mu\text{F}$	•	66	80	
$I_{ADJ}$	Adjust Pin Current		•	50	100	$\mu\text{A}$	
$\Delta I_{ADJ}$	Adjust Pin Current Change	$10\text{mA} \leq I_{OUT} \leq I_{MAX}$ , $2.5\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$	•	0.2	5		
$I_{MIN}$	Minimum Load Current	$(V_{IN} - V_{OUT}) = 40\text{V}$	•	3.5	5	mA	
		$(V_{IN} - V_{OUT}) = 60\text{V}$ (HV Series)	•	3.5	7		
$I_{CL}$	Current Limit	$(V_{IN} - V_{OUT}) \leq 15\text{V}$	•	1.5	2.2	A	
		$(V_{IN} - V_{OUT}) = 40\text{V}$	•	0.3	0.5		
		$(V_{IN} - V_{OUT}) = 60\text{V}$ (HV Series)	•	0.1			
$\frac{\Delta V_{OUT}}{\Delta \text{TEMP}}$	Temperature Stability		•	1.0		%	
$\frac{\Delta V_{OUT}}{\Delta \text{TIME}}$	Long Term Stability	$T_A = 125^\circ\text{C}$ , 1000Hrs		0.3	1.0		
$e_n$	RMS Output Noise (% of $V_{OUT}$ )	$T_A = 25^\circ\text{C}$ , $10\text{Hz} \leq f \leq 10\text{KHz}$		0.001			

### Notes

The • denotes the specifications which apply over the full operating temperature range.

- Test conditions unless otherwise stated:  $V_{IN} - V_{OUT} = 5\text{V}$ ,  $I_{OUT} = 0.5\text{A}$ ,  $P_{MAX} = 20\text{W}$ ,  $I_{MAX} = 1.5\text{A}$
- Regulation is measured at constant junction temperature, using pulse testing at a low duty cycle. Changes in output voltage due to heating effects are covered under thermal regulation specifications. Load regulation is measured at  $\frac{1}{8}$ " below the bottom of the package.
- $V_{MAX} = 40\text{V}$  for LM117, IP117, LM117A, IP117A, LM317, IP317, LM317A, IP317A  
 $V_{MAX} = 60\text{V}$  for LM117HV, IP117HV, LM117AHV, IP117AHV, LM317HV, IP317HV, LM317AHV, IP317AHV

# POSITIVE ADJUSTABLE VOLTAGE REGULATOR

## ELECTRICAL CHARACTERISTICS(1)(3) ( $T_C = 25^\circ\text{C}$ unless otherwise stated)

LM117A, IP117A, LM117AHV, IP117AHV							
Symbols	Parameters	Test Conditions	Min.	Typ	Max.	Units	
$V_{REF}$	Reference Voltage	$I_{OUT} = 10\text{mA}$	1.238	1.250	1.262	V	
		$10\text{mA} \leq I_{OUT} \leq I_{MAX}$ , $P \leq P_{MAX}$ , $3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$	• 1.225	1.250	1.270		
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation (2)	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$ , $I_{OUT} = 10\text{mA}$		0.005	0.010	%/ $V$	
			•	0.010	0.020		
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation (2)(3)	$10\text{mA} \leq I_{OUT} \leq I_{MAX}$	$V_{OUT} \leq 5\text{V}$		5	15	mV
			$V_{OUT} \geq 5\text{V}$		0.1	0.3	%
			$V_{OUT} \leq 5\text{V}$	•	15	50	mV
			$V_{OUT} \geq 5\text{V}$	•	0.3	1.0	%
	Thermal Regulation	$V_{IN} = 14.58\text{V}$ , $I_{OUT} = 1.5\text{A}$ , $P_D = 20\text{W}$ , $T_A = 25^\circ\text{C}$ , 20ms Pulse		0.002	0.020	%/ $W$	
	Ripple Rejection	$V_{OUT} = 10\text{V}$ $f = 120\text{Hz}$	$C_{ADJ} = 0$		65		dB
•			$C_{ADJ} = 10\mu\text{F}$	66	80		
$I_{ADJ}$	Adjust Pin Current		•	50	100	$\mu\text{A}$	
$\Delta I_{ADJ}$	Adjust Pin Current Change	$10\text{mA} \leq I_{OUT} \leq I_{MAX}$ , $2.5\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$	•	0.2	5		
$I_{MIN}$	Minimum Load Current	$(V_{IN} - V_{OUT}) = 40\text{V}$	•	3.5	5	mA	
		$(V_{IN} - V_{OUT}) = 60\text{V}$ (HV Series)	•	3.5	7		
$I_{CL}$	Current Limit	$(V_{IN} - V_{OUT}) \leq 15\text{V}$	•	1.5	2.2	A	
		$(V_{IN} - V_{OUT}) = 40\text{V}$	•	0.3	0.5		
		$(V_{IN} - V_{OUT}) = 60\text{V}$ (HV Series)	•	0.1			
$\frac{\Delta V_{OUT}}{\Delta \text{TEMP}}$	Temperature Stability		•	1.0	2	%	
$\frac{\Delta V_{OUT}}{\Delta \text{TIME}}$	Long Term Stability	$T_A = 125^\circ\text{C}$ , 1000Hrs		0.3	1.0		
$e_n$	RMS Output Noise (% of $V_{OUT}$ )	$T_A = 25^\circ\text{C}$ , $10\text{Hz} \leq f \leq 10\text{KHz}$		0.001			

### Notes

The • denotes the specifications which apply over the full operating temperature range.

- (1) Test conditions unless otherwise stated:  $V_{IN} - V_{OUT} = 5\text{V}$ ,  $I_{OUT} = 0.5\text{A}$ ,  $P_{MAX} = 20\text{W}$ ,  $I_{MAX} = 1.5\text{A}$
- (2) Regulation is measured at constant junction temperature, using pulse testing at a low duty cycle. Changes in output voltage due to heating effects are covered under thermal regulation specifications. Load regulation is measured at  $\frac{1}{8}$ " below the bottom of the package.
- (3)  $V_{MAX} = 40\text{V}$  for LM117, IP117, LM117A, IP117A, LM317, IP317, LM317A, IP317A  
 $V_{MAX} = 60\text{V}$  for LM117HV, IP117HV, LM117AHV, IP117AHV, LM317HV, IP317HV, LM317AHV, IP317AHV

# POSITIVE ADJUSTABLE VOLTAGE REGULATOR

## ELECTRICAL CHARACTERISTICS(1)(3) ( $T_C = 25^\circ\text{C}$ unless otherwise stated)

LM317, IP317, LM317HV, IP317HV							
Symbols	Parameters	Test Conditions	Min.	Typ	Max.	Units	
$V_{REF}$	Reference Voltage	$I_{OUT} = 10\text{mA}$	1.200	1.250	1.300	V	
		$10\text{mA} \leq I_{OUT} \leq I_{MAX}$ , $P \leq P_{MAX}$ , $3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$	• 1.200	1.250	1.300		
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation (2)	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$ , $I_{OUT} = 10\text{mA}$		0.010	0.040	%V	
			•	0.020	0.070		
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation (2)(3)	$10\text{mA} \leq I_{OUT} \leq I_{MAX}$	$V_{OUT} \leq 5\text{V}$		5	25	mV
			$V_{OUT} \geq 5\text{V}$		0.1	0.5	%
			$V_{OUT} \leq 5\text{V}$	•	20	70	mV
			$V_{OUT} \geq 5\text{V}$	•	0.3	1.5	%
	Thermal Regulation	$V_{IN} = 14.58\text{V}$ , $I_{OUT} = 1.5\text{A}$ , $P_D = 20\text{W}$ , $T_A = 25^\circ\text{C}$ , 20ms Pulse		0.030	0.070	%/W	
	Ripple Rejection	$V_{OUT} = 10\text{V}$ $f = 120\text{Hz}$	$C_{ADJ} = 0$		65	dB	
• $C_{ADJ} = 10\mu\text{F}$			66	80			
$I_{ADJ}$	Adjust Pin Current		•	50	100	$\mu\text{A}$	
$\Delta I_{ADJ}$	Adjust Pin Current Change	$10\text{mA} \leq I_{OUT} \leq I_{MAX}$ , $2.5\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$	•	0.2	5		
$I_{MIN}$	Minimum Load Current	$(V_{IN} - V_{OUT}) = 40\text{V}$	•	3.5	10	mA	
		$(V_{IN} - V_{OUT}) = 60\text{V}$ (HV Series)	•	3.5	12		
$I_{CL}$	Current Limit	$(V_{IN} - V_{OUT}) \leq 15\text{V}$	•	1.5	2.2	A	
		$(V_{IN} - V_{OUT}) = 40\text{V}$	•	0.15	0.4		
		$(V_{IN} - V_{OUT}) = 60\text{V}$ (HV Series)	•		0.1		
$\frac{\Delta V_{OUT}}{\Delta \text{TEMP}}$	Temperature Stability		•	1.0		%	
$\frac{\Delta V_{OUT}}{\Delta \text{TIME}}$	Long Term Stability	$T_A = 125^\circ\text{C}$ , 1000Hrs		0.3	1.0		
$e_n$	RMS Output Noise (% of $V_{OUT}$ )	$T_A = 25^\circ\text{C}$ , $10\text{Hz} \leq f \leq 10\text{KHz}$		0.003			

### Notes

The • denotes the specifications which apply over the full operating temperature range.

- Test conditions unless otherwise stated:  $V_{IN} - V_{OUT} = 5\text{V}$ ,  $I_{OUT} = 0.5\text{A}$ ,  $P_{MAX} = 20\text{W}$ ,  $I_{MAX} = 1.5\text{A}$
- Regulation is measured at constant junction temperature, using pulse testing at a low duty cycle. Changes in output voltage due to heating effects are covered under thermal regulation specifications. Load regulation is measured at  $\frac{1}{8}$ " below the bottom of the package.
- $V_{MAX} = 40\text{V}$  for LM117, IP117, LM117A, IP117A, LM317, IP317, LM317A, IP317A  
 $V_{MAX} = 60\text{V}$  for LM117HV, IP117HV, LM117AHV, IP117AHV, LM317HV, IP317HV, LM317AHV, IP317AHV

# POSITIVE ADJUSTABLE VOLTAGE REGULATOR

## ELECTRICAL CHARACTERISTICS(1)(3) ( $T_C = 25^\circ\text{C}$ unless otherwise stated)

LM317A, IP317A, LM317AHV, IP317AHV							
Symbols	Parameters	Test Conditions	Min.	Typ	Max.	Units	
$V_{REF}$	Reference Voltage	$I_{OUT} = 10\text{mA}$	1.238	1.250	1.262	V	
		$10\text{mA} \leq I_{OUT} \leq I_{MAX}$ , $P \leq P_{MAX}$ , $3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$	● 1.225	1.250	1.270		
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation (2)	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$ , $I_{OUT} = 10\text{mA}$		0.005	0.010	%/ $V$	
			●	0.010	0.020		
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation (2)(3)	$10\text{mA} \leq I_{OUT} \leq I_{MAX}$	$V_{OUT} \leq 5\text{V}$		5	25	mV
			$V_{OUT} \geq 5\text{V}$		0.1	0.5	%
			$V_{OUT} \leq 5\text{V}$	●	15	50	mV
			$V_{OUT} \geq 5\text{V}$	●	0.3	1.0	%
	Thermal Regulation	$V_{IN} = 14.58\text{V}$ , $I_{OUT} = 1.5\text{A}$ , $P_D = 20\text{W}$ , $T_A = 25^\circ\text{C}$ , 20ms Pulse		0.002	0.020	%/ $W$	
	Ripple Rejection	$V_{OUT} = 10\text{V}$ $f = 120\text{Hz}$	$C_{ADJ} = 0$		65		dB
●			$C_{ADJ} = 10\mu\text{F}$	66	80		
$I_{ADJ}$	Adjust Pin Current		●	50	100	$\mu\text{A}$	
$\Delta I_{ADJ}$	Adjust Pin Current Change	$10\text{mA} \leq I_{OUT} \leq I_{MAX}$ , $2.5\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$	●	0.2	5		
$I_{MIN}$	Minimum Load Current	$(V_{IN} - V_{OUT}) = 40\text{V}$	●	3.5	10	mA	
		$(V_{IN} - V_{OUT}) = 60\text{V}$ (HV Series)	●	3.5	12		
$I_{CL}$	Current Limit	$(V_{IN} - V_{OUT}) \leq 15\text{V}$	●	1.5	2.2	A	
		$(V_{IN} - V_{OUT}) = 40\text{V}$	●	0.15	0.4		
		$(V_{IN} - V_{OUT}) = 60\text{V}$ (HV Series)	●	0.1			
$\frac{\Delta V_{OUT}}{\Delta \text{TEMP}}$	Temperature Stability		●	1.0	2	%	
$\frac{\Delta V_{OUT}}{\Delta \text{TIME}}$	Long Term Stability	$T_A = 125^\circ\text{C}$ , 1000Hrs		0.3	1.0		
$e_n$	RMS Output Noise (% of $V_{OUT}$ )	$T_A = 25^\circ\text{C}$ , $10\text{Hz} \leq f \leq 10\text{KHz}$		0.003			

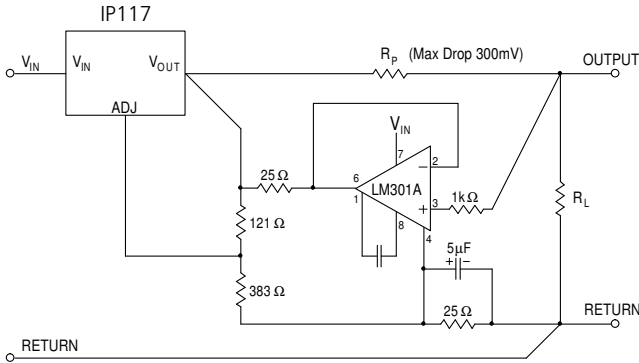
### Notes

The ● denotes the specifications which apply over the full operating temperature range.

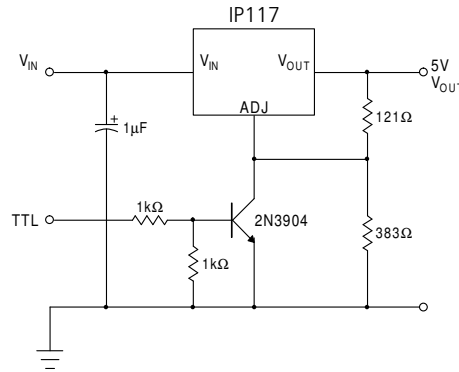
- (1) Test conditions unless otherwise stated:  $V_{IN} - V_{OUT} = 5\text{V}$ ,  $I_{OUT} = 0.5\text{A}$ ,  $P_{MAX} = 20\text{W}$ ,  $I_{MAX} = 1.5\text{A}$
- (2) Regulation is measured at constant junction temperature, using pulse testing at a low duty cycle. Changes in output voltage due to heating effects are covered under thermal regulation specifications. Load regulation is measured at  $\frac{1}{8}$ " below the bottom of the package.
- (3)  $V_{MAX} = 40\text{V}$  for LM117, IP117, LM117A, IP117A, LM317, IP317, LM317A, IP317A  
 $V_{MAX} = 60\text{V}$  for LM117HV, IP117HV, LM117AHV, IP117AHV, LM317HV, IP317HV, LM317AHV, IP317AHV

# POSITIVE ADJUSTABLE VOLTAGE REGULATOR

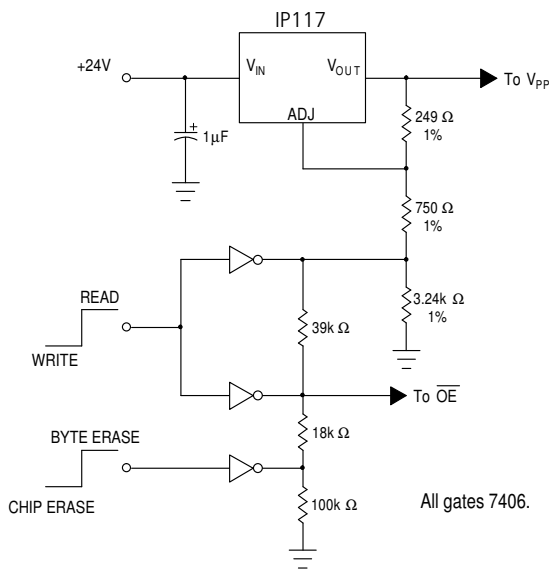
## APPLICATIONS INFORMATION



**Remote Sensing**

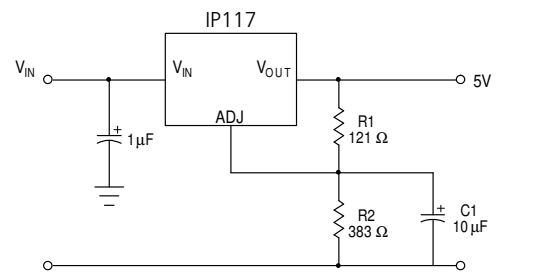


**5V Regulator with Shut Down**



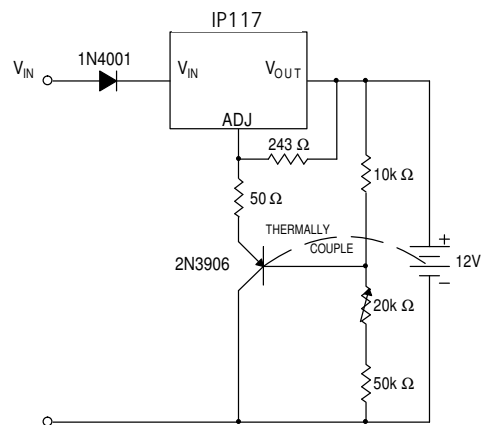
	OE	Vpp
READ	0V	5V
WRITE		
BYTE ERASE	5V	21V
CHIP ERASE	12V	21V

**2816 EEPROM Supply Programmer for Read / Write Control**



C1 improves ripple rejection  
Xc should be small compared to R2

**Improving Ripple Rejection**

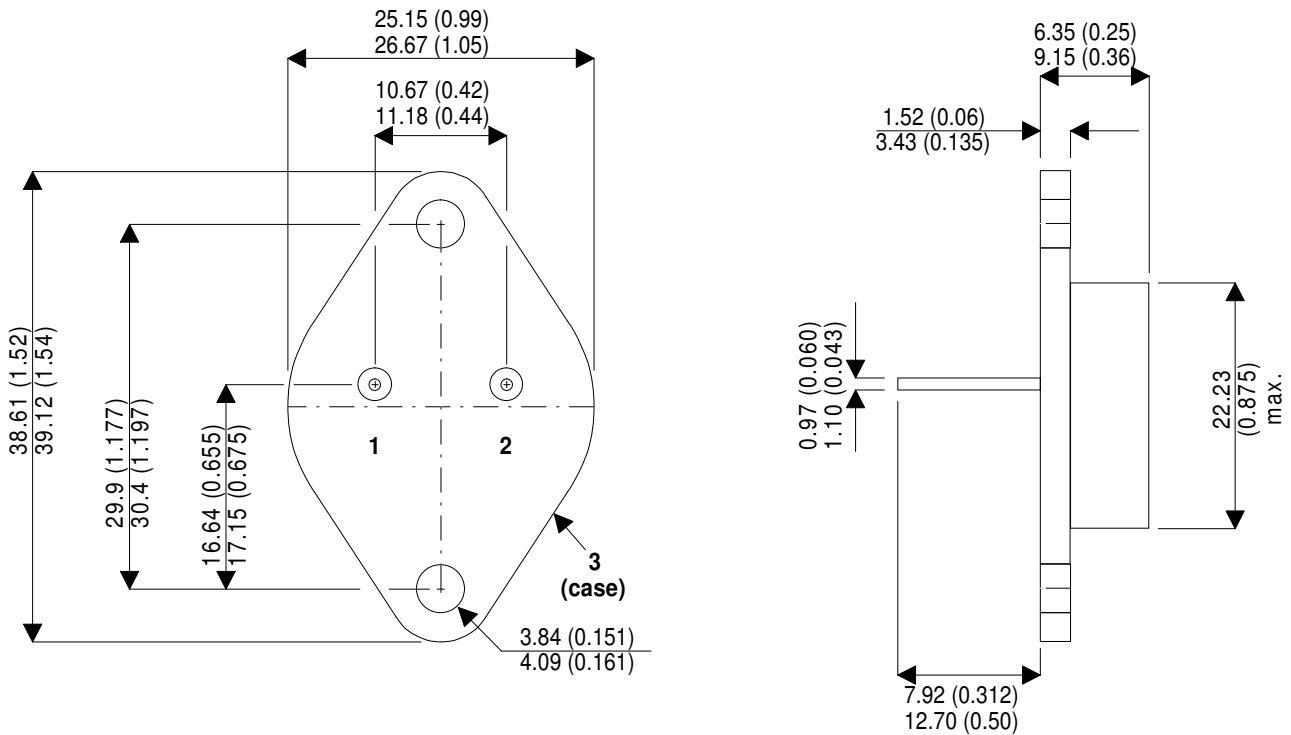


**Temperature Compensated Lead-Acid Battery Charger**

# POSITIVE ADJUSTABLE VOLTAGE REGULATOR

## MECHANICAL DATA

Dimensions in mm (inches)



## TO3 (TO-204AA)

Pin 1 = ADJ. Pin 2 =  $V_{IN}$  Case =  $V_{OUT}$