

LM117HV/LM317HV

3-Terminal Adjustable Regulator

General Description

The LM117HV/LM317HV are adjustable 3-terminal positive voltage regulators capable of supplying in excess of 1.5A over a 1.2V to 57V output range. They are exceptionally easy to use and require only two external resistors to set the output voltage. Further, both line and load regulation are better than standard fixed regulators. Also, the LM117HV is packaged in standard transistor packages which are easily mounted and handled.

In addition to higher performance than fixed regulators, the LM117HV series offers full overload protection available only in IC's. Included on the chip are current limit, thermal overload protection and safe area protection. All overload protection circuitry remains fully functional even if the adjustment terminal is disconnected.

Normally, no capacitors are needed unless the device is situated more than 6 inches from the input filter capacitors in which case an input bypass is needed. An optional output capacitor can be added to improve transient response. The adjustment terminal can be bypassed to achieve very high ripple rejections ratios which are difficult to achieve with standard 3-terminal regulators.

Besides replacing fixed regulators, the LM117HV is useful in a wide variety of other applications. Since the regulator is "floating" and sees only the input-to-output differential voltage, supplies of several hundred volts can be regulated as long as the maximum input to output differential is not exceeded, i.e. do not short the output to ground.

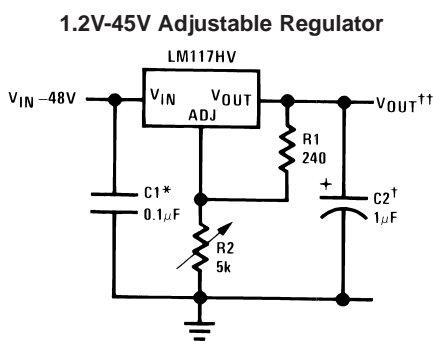
Also, it makes an especially simple adjustable switching regulator, a programmable output regulator, or by connecting a fixed resistor between the adjustment and output, the LM117HV can be used as a precision current regulator. Supplies with electronic shutdown can be achieved by clamping the adjustment terminal to ground which programs the output to 1.2V where most loads draw little current.

The LM117HVK STEEL and LM317HVK STEEL are packaged in standard TO-3 transistor packages, while the LM117HVH and LM317HVH are packaged in a solid Kovar base TO-39 transistor package. The LM317HVT uses a TO-220 plastic package. The LM117HV is rated for operation from -55°C to +150°C, and the LM317HV from 0°C to +125°C.

Features

- Adjustable output down to 1.2V
- Guaranteed 1.5A output current
- Line regulation typically 0.01%/V
- Load regulation typically 0.1%
- Current limit constant with temperature
- 100% electrical burn-in
- Eliminates the need to stock many voltages
- Standard 3-lead transistor package
- 80 dB ripple rejection
- Output is short-circuit protected
- P+ Product Enhancement tested

Typical Applications



Full output current not available at high input-output voltages

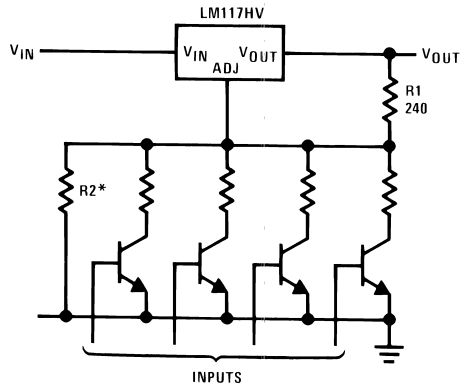
†Optional—improves transient response. Output capacitors in the range of 1 μF to 1000 μF of aluminum or tantalum electrolytic are commonly used to provide improved output impedance and rejection of transients.

*Needed if device is more than 6 inches from filter capacitors.

$$\dagger\dagger V_{OUT} = 1.25V \left(1 + \frac{R_2}{R_1} \right) + I_{ADJ} R_2$$

Typical Applications (Continued)

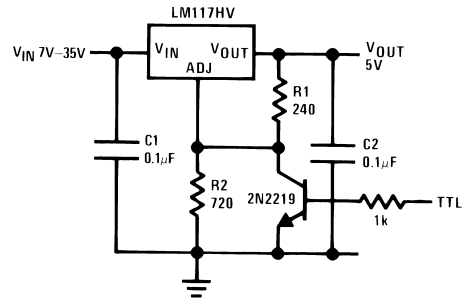
Digitally Selected Outputs



DS009062-2

*Sets maximum V_{OUT}

5V Logic Regulator with Electronic Shutdown*



DS009062-3

*Min. output $\approx 1.2V$

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

(Note 4)

Power Dissipation Internally limited
Input—Output Voltage Differential +60V, -0.3V

Operating Junction Temperature Range

LM117HV -55°C to +150°C
LM317HV 0°C to +125°C
Storage Temperature -65°C to +150°C
Lead Temperature (Soldering, 10 sec.) 300°C
ESD Tolerance (Note 5) 2000V

Electrical Characteristics (Note 2)

Parameter	Conditions	LM117HV			LM317HV			Units
		Min	Typ	Max	Min	Typ	Max	
Line Regulation	$T_J = 25^\circ\text{C}$, $3\text{V} \leq V_{\text{IN}} - V_{\text{OUT}} \leq 60\text{V}$ (Note 3) $I_L = 10\text{ mA}$		0.01	0.02		0.01	0.04	%/V
Load Regulation	$T_J = 25^\circ\text{C}$, $10\text{ mA} \leq I_{\text{OUT}} \leq I_{\text{MAX}}$		0.1	0.3		0.1	0.5	%
Thermal Regulation	$T_J = 25^\circ\text{C}$, 20 ms Pulse		0.03	0.07		0.04	0.07	%/W
Adjustment Pin Current			50	100		50	100	μA
Adjustment Pin Current Change	$10\text{ mA} \leq I_L \leq I_{\text{MAX}}$ $3.0\text{ V} \leq (V_{\text{IN}} - V_{\text{OUT}}) \leq 60\text{V}$		0.2	5		0.2	5	μA
Reference Voltage	$3.0\text{ V} \leq (V_{\text{IN}} - V_{\text{OUT}}) \leq 60\text{V}$, (Note 4) $10\text{ mA} \leq I_{\text{OUT}} \leq I_{\text{MAX}}$, $P \leq P_{\text{MAX}}$	1.20	1.25	1.30	1.20	1.25	1.30	V
Line Regulation	$3.0\text{V} \leq (V_{\text{IN}} - V_{\text{OUT}}) \leq 60\text{V}$, $I_L = 10\text{ mA}$, (Note 3)		0.02	0.05		0.02	0.07	%/V
Load Regulation	$10\text{ mA} \leq I_{\text{OUT}} \leq I_{\text{MAX}}$ (Note 3)		0.3	1		0.3	1.5	%
Temperature Stability	$T_{\text{MIN}} \leq T_J \leq T_{\text{MAX}}$		1			1		%
Minimum Load Current	$(V_{\text{IN}} - V_{\text{OUT}}) = 60\text{V}$		3.5	7		3.5	12	mA
Current Limit	$(V_{\text{IN}} - V_{\text{OUT}}) \leq 15\text{V}$ K, T Packages	1.5	2.2	3.5	1.5	2.2	3.7	A
		0.5	0.8	1.8	0.5	0.8	1.9	A
	$(V_{\text{IN}} - V_{\text{OUT}}) \leq 60\text{V}$ K, T Packages		0.3			0.3		A
			0.03			0.03		A
RMS Output Noise, % of V_{OUT}	$T_J = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 10\text{ kHz}$		0.003			0.003		%
Ripple Rejection Ratio	$V_{\text{OUT}} = 10\text{V}$, $f = 120\text{ Hz}$ $C_{\text{ADJ}} = 10\text{ }\mu\text{F}$		65			65		dB
		66	80		66	80		dB
Long-Term Stability	$T_J = 125^\circ\text{C}$		0.3	1		0.3	1	%
Thermal Resistance, Junction to Case	H Package		12	15		12	15	$^\circ\text{C/W}$
	T Package					4	5	$^\circ\text{C/W}$
	K Package		2.3	3		2.3	3	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient (no heat sink)	H Package		140			140		$^\circ\text{C/W}$
	T Package					50		$^\circ\text{C/W}$
	K Package		35			35		$^\circ\text{C/W}$

Note 1: "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits.

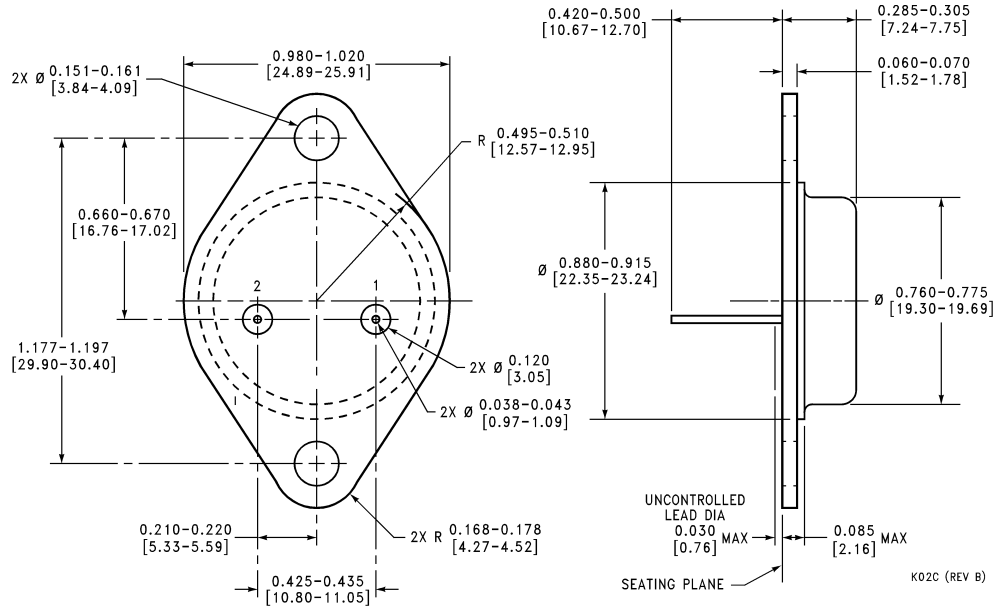
Note 2: Unless otherwise specified, these specifications apply: $-55^\circ\text{C} \leq T_J \leq +150^\circ\text{C}$ for the LM117HV, and $0^\circ\text{C} \leq T_J \leq +125^\circ\text{C}$ for the LM317HV; $V_{\text{IN}} - V_{\text{OUT}} = 5\text{V}$ and $I_{\text{OUT}} = 0.1\text{A}$ for the TO-39 package and $I_{\text{OUT}} = 0.5\text{A}$ for the TO-3 and TO-220 packages. Although power dissipation is internally limited, these specifications are applicable for power dissipations of 2W for the TO-39 and 20W for the TO-3 and TO-220. I_{MAX} is 1.5A for the TO-3 and TO-220 and 0.5A for the TO-39 package.

Note 3: Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

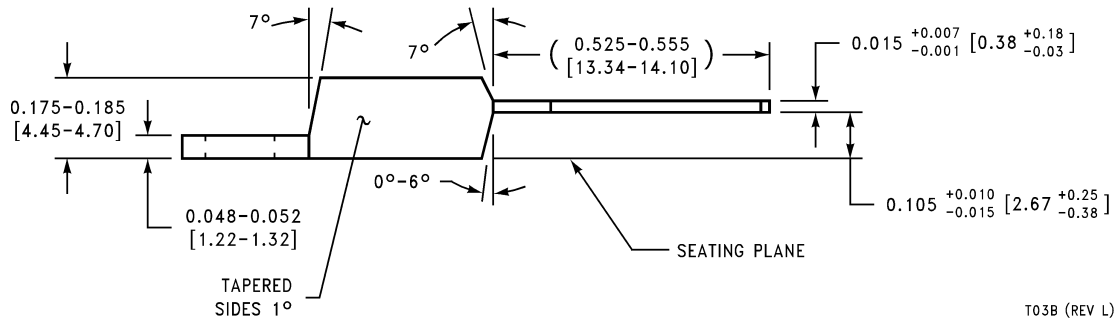
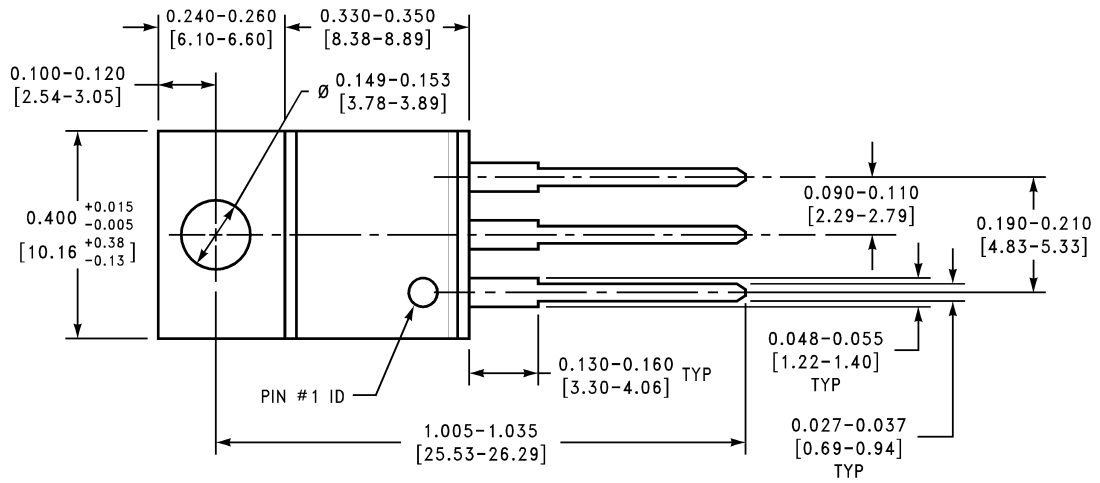
Note 4: Refer to RETS117HVH or RETS117HVK for LM117HVH or LM117HVK military specifications.

Note 5: Human body model, 1.5 k Ω in series with 100 pF.

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



Metal Can Package (K)
Mil-Aero Product
Order Number LM117HVKSTL/883
NS Package Number K02C



Order Number LM317HVT
NS Package Number T03B