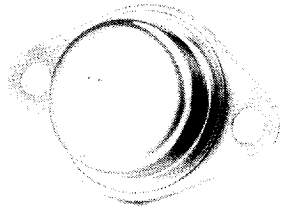
# 1.5 AMP POSITIVE ADJUSTABLE VOLTAGE REGULATORS

**LLM 117, LLM 317**



## FEATURES

- Adjustable output down to 1.2V
- Line regulation typically 0.01%/V
- Load regulation typically 0.1%
- Current limit constant with temperature
- Standard 3-terminal, TO-3 package
- MIL-Temperature performance

## DESCRIPTION

The LLM 117 and LLM 317 voltage regulators are monolithic integrated circuits designed for use in applications requiring a well regulated positive output voltage. Outstanding features include full power usage up to 1.5 amperes of load current, internal current limiting, thermal shutdown, and safe area protection on the die, providing protection of the series pass Darlington, under most operating conditions. Hermetically sealed steel TO-3 packages are utilized for high reliability and low thermal resistance.

The LLM 117 and LLM 317, three terminal adjustable regulators, are available with an output range from +1.2 to +37 Volts. The output voltage is easily set by two external resistors. Since the regulator is "floating", higher output voltages can be obtained as long as the maximum input-output voltage differential is not exceeded.

## ABSOLUTE MAXIMUM RATINGS

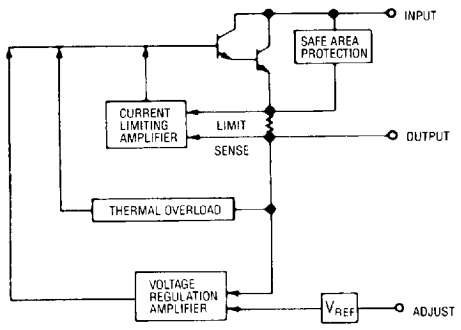
| PARAMETER | SYMBOL | MINIMUM | MAXIMUM | UNITS |
|---|---|---|---|---|
| Input-Output Voltage Differential | $V_{IN} - V_{OUT}$ | | 40 | Volts |
| Power Dissipation | $P_D$ | | Internally Limited(1) | |
| Thermal Resistance Junction to Case | $\theta_{JC}$ | | 3.0 | °C/Watt |
| Operating Junction Temperature Range<br>LLM 117<br>LLM 317 | $T_J$ | <br>−55<br>0 | <br>150<br>125 | °C |
| Storage Temperature Range | $T_{STG}$ | −65 | 150 | °C |
| Lead Temperature (Soldering, 60 Seconds Time Limit) | $T_{LEAD}$ | | 300 | °C |

(1) For LLM 117 operation above 90°C $T_{case}$, derate @ 333mW/°C.
For LLM 317 operation above 65°C $T_{case}$, derate @ 333mW/°C.

## DEVICE SELECTION GUIDE

| DEVICE | OPERATING JUNCTION TEMPERATURE RANGE |
|---|---|
| LLM 117 | −55 TO 150°C |
| LLM 317 | 0 TO 125°C |

## BLOCK DIAGRAM



LLM 117,
LLM 317

# 1.5 AMP POSITIVE ADJUSTABLE VOLTAGE REGULATORS

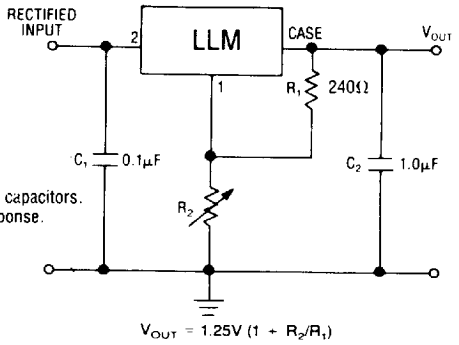
12

## ELECTRICAL CHARACTERISTICS[6]

| Parameter | Test Conditions[1] $V_{IN}$-$V_{OUT}$ | $I_O$ | $T_J$ | Test Limits Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| Line Regulation[2] | | | | | | | |
| LLM 317 | 3V to 40V | 0.5A | 25°C | | 0.01 | 0.04 | %/V |
| LLM 117 | | | 25°C | | 0.01 | 0.02 | %/V |
| LLM 317 | | | | | 0.02 | 0.07 | %/V |
| LLM 117 | | | | | 0.02 | 0.05 | %/V |
| Load Regulation[2] | | | | | | | |
| LLM 317 $V_O \leq 5V$ | 10mA to 1.5A | | 25°C | | 5 | 25 | mV |
| LLM 117 $V_O \leq 5V$ | | | | | 5 | 15 | mV |
| LLM 317 $V_O \geq 5V$ | | | 25°C | | 0.1 | 0.5 | % |
| LLM 117 $V_O \geq 5V$ | | | | | 0.1 | 0.3 | % |
| LLM 317 $V_O \leq 5V$ | | | | | 20 | 70 | mV |
| LLM 117 $V_O \leq 5V$ | | | | | 20 | 50 | mV |
| LLM 317 $V_O \geq 5V$ | | | | | 0.3 | 1.5 | % |
| LLM 117 $V_O \geq 5V$ | | | | | 0.3 | 1.0 | % |
| Thermal Regulation[3] | | | | | | | |
| LLM 317 | 5V | 0.5A | 25°C | | 0.04 | 0.07 | %/W |
| LLM 117 | | | 25°C | | 0.03 | 0.07 | %/W |
| Adjust Pin Current | 5V | 0.5A | | | 50 | 100 | µA |
| Adjust Pin Current Change | | | | | | | |
| LLM 317 | 3.0V to 40V | 10mA to 1.5A | | | 0.2 | 5 | µA |
| LLM 117 | | | | | | | |
| Reference Voltage | 3V to 40V | 10mA to 1.5A | | 1.20 | 1.25 | 1.30 | V |
| Temperature Stability | 5V | 0.5A | | | 1 | | % |
| Minimum Load Current | | | | | | | |
| LLM 317 | 40V | | | | 3.5 | 10.0 | mA |
| LLM 117 | | | | | 3.5 | 5.0 | mA |
| Current Limit | | | | | | | |
| LLM 317/LLM 117 | ≤15V | | | 1.5 | 2.2 | | A |
| LLM 317 | 40V | | 25°C | 0.15 | 0.4 | | A |
| LLM 117 | | | | 0.3 | 0.4 | | A |
| RMS Output Noise[4] | 5V | 0.5A | 25°C | | 0.003 | | % $V_O$ |
| Ripple Rejection Ratio[5] | | | | | | | |
| $C_{ADJ}$ = 10µF | $V_O$ = 10V | 0.5A | | 66 | 65<br>80 | | dB |

(1) Although power dissipation is internally limited, these specifications are applicable for power dissipations of 20 Watts.
(2) Low duty cycle pulse testing with Kelvin connections required. Changes in output voltage due to heating effects are covered under the specification for thermal regulation.
(3) 20mS pulse
(4) BW = 10Hz to 10kHz
(5) 120Hz input ripple
(6) Unless otherwise specified, the following $T_J$ conditions apply:
LLM 117 = −55 TO 150°C
LLM 317 = 0 TO 125°C

## TYPICAL APPLICATION
### ADJUSTABLE VOLTAGE REGULATOR[1,2]




[1] $C_1$ needed if device is far from filter capacitors.
[2] $C_2$ optional - improves transient response.

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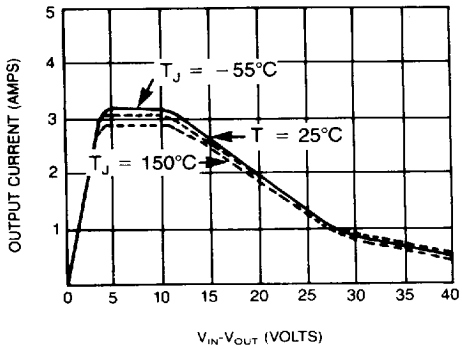
**LLM 117, LLM 317**

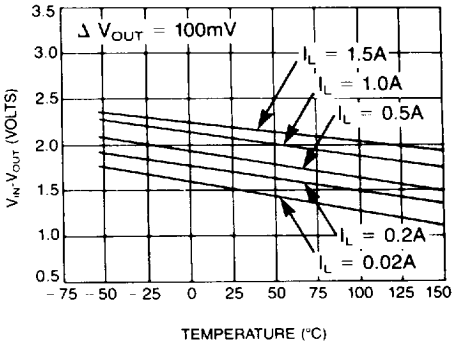


## OPERATIONAL DATA

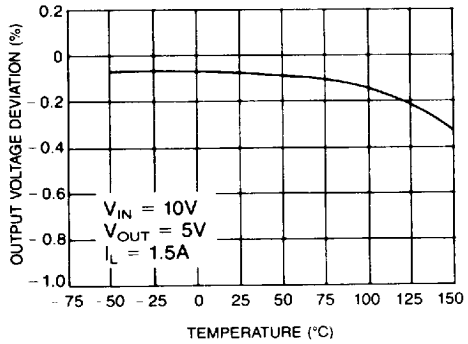
### CURRENT LIMIT



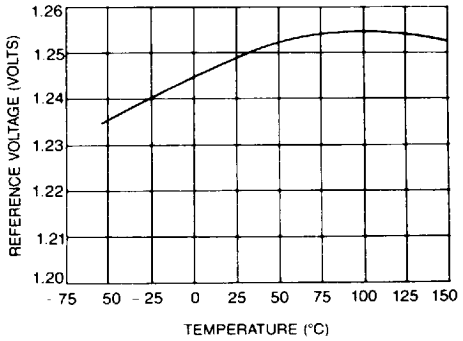

### DROPOUT VOLTAGE



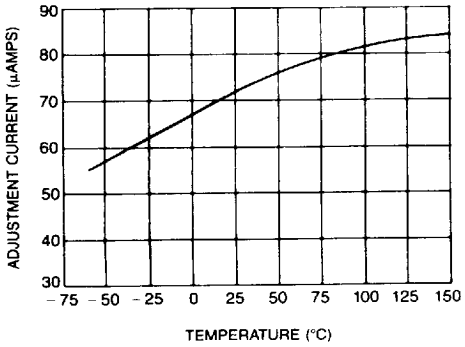

### LOAD REGULATION



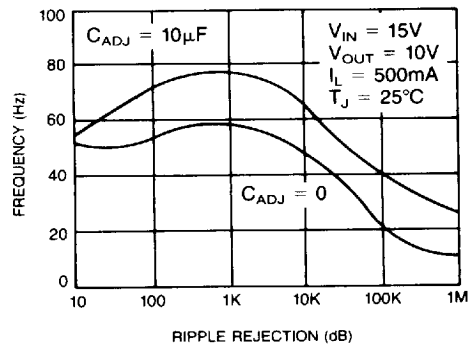

### TEMPERATURE STABILITY




### ADJUSTMENT CURRENT




### RIPPLE REJECTION

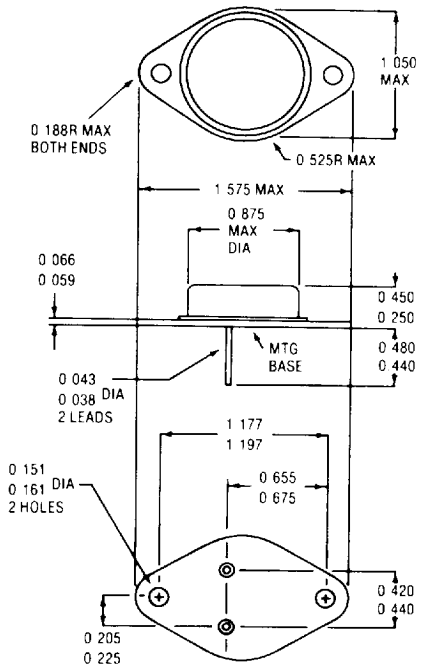


LLM 117,
LLM 317

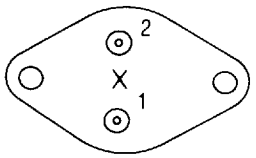
# 1.5 AMP POSITIVE ADJUSTABLE VOLTAGE REGULATORS

12

## DEVICE OUTLINE




**Bottom View**




1 – Adjust
2 – Input
Case is Output

NOTE: Case temperature measured at point X.
All dimensions are in inches.