

### FEATURES

- Guaranteed Operation at +1.2V
- Op Amp and Reference on Single Chip
- Low Supply Current 400 $\mu$ A
- Capable of Floating Mode Operation
- Low Reference Drift 20ppm/ $^{\circ}$ C
- Low Offset Voltage
- Output Swings to Within 15mV of Rails

### APPLICATIONS

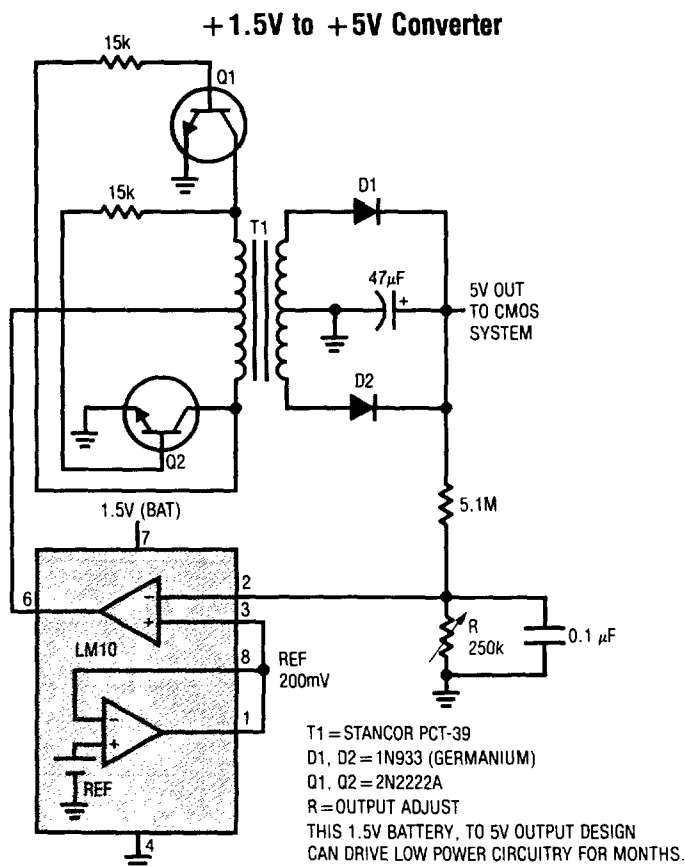
- Remote Signal Conditioner / Transmitter
- Battery Operated Instruments
- Precision Current Regulators
- Precision Voltage Regulators
- Thermocouple Transmitter

### DESCRIPTION

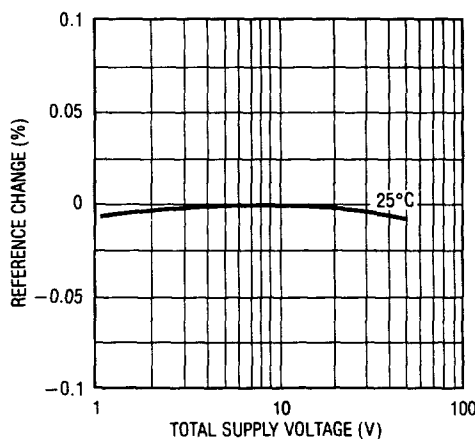
The LM10 combines a precision reference, a reference buffer amplifier and an independent, high quality op amp on a single chip. The device is capable of operation from a single supply as low as 1.1V, from dual supplies up to  $\pm 20$ V and typically draws 270 $\mu$ A supply current. Input voltage range for the op amp includes ground, while the unloaded output can swing to within 15mV of each rail. Further, the LM10 will deliver 20mA output current and still swing within  $\pm 400$ mV of the supply rails.

With its low operating current and floating operation capability, the LM10 is ideal for two wire analog transmitter circuits where the processed signal is carried on the same line used for power. The LM10 is suggested for portable battery powered equipment and is fully specified for operation from a single 1.2V battery. Other applications include precision current and voltage regulators, operating from very low voltages to several hundred volts.

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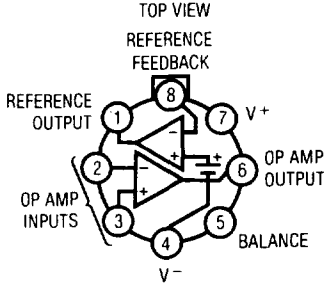
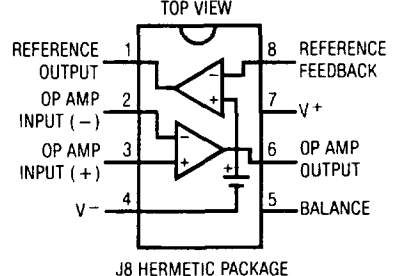
**Line Regulation**



## ABSOLUTE MAXIMUM RATINGS

|                                           |                                           |
|-------------------------------------------|-------------------------------------------|
| Total Supply Voltage                      |                                           |
| LM10/LM10B/LM10C                          | 45V                                       |
| LM10BL/LM10CL                             | 7V                                        |
| Differential Input Voltage (Note 1)       |                                           |
| LM10/LM10B/LM10C                          | $\pm 40V$                                 |
| LM10BL/LM10CL                             | $\pm 7V$                                  |
| Output Short Circuit Duration             |                                           |
| Indefinite                                |                                           |
| Operating Temperature Range (Note 2)      |                                           |
| LM10                                      | $-55^{\circ}C \leq T_A \leq 125^{\circ}C$ |
| LM10B/LM10BL                              | $-25^{\circ}C \leq T_A \leq 85^{\circ}C$  |
| LM10C/LM10CL                              | $0^{\circ}C \leq T_A \leq 70^{\circ}C$    |
| Storage Temperature Range                 |                                           |
| $-65^{\circ}C \leq T_A \leq 150^{\circ}C$ |                                           |
| Lead Temperature (Soldering, 10 sec.)     |                                           |
| 300°C                                     |                                           |

## PACKAGE/ORDER INFORMATION

| TOP VIEW<br>REFERENCE<br>FEEDBACK                                                                                                        | ORDER<br>PART NUMBER                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
|                                                                                                                                          |                                                                                 |
|  <p>METAL CAN H PACKAGE</p>                            | LM10H<br>LM10BH<br>LM10CH<br>LM10BLH<br>LM10CLH                                 |
|  <p>J8 HERMETIC PACKAGE<br/>N8 PLASTIC DIP PACKAGE</p> | LM10CN8<br>LM10CLN8<br>LM10CJ8<br>LM10CLJ8<br><br>LM10J8<br>LM10BJ8<br>LM10BLJ8 |

## OP AMP ELECTRICAL CHARACTERISTICS (Note 3)

| SYMBOL                              | PARAMETER                    | CONDITIONS                                                                                                      |   | LM10/LM10B |     |     | LM10C |     |     | UNITS             |
|-------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------|---|------------|-----|-----|-------|-----|-----|-------------------|
|                                     |                              |                                                                                                                 |   | MIN        | TYP | MAX | MIN   | TYP | MAX |                   |
| $V_{OS}$                            | Input Offset Voltage         |                                                                                                                 | • | 0.3        | 2.0 |     | 0.5   | 4.0 |     | mV                |
| $\frac{\Delta V_{OS}}{\Delta Temp}$ | Average Offset Voltage Drift |                                                                                                                 | • | 2.0        |     |     | 5.0   |     |     | $\mu V/^{\circ}C$ |
| $I_{OS}$                            | Input Offset Current         | (Note 4)                                                                                                        | • | 0.25       | 0.7 |     | 0.4   | 2.0 |     | nA                |
| $\frac{\Delta I_{OS}}{\Delta Temp}$ | Offset Current Drift         |                                                                                                                 | • | 2.0        | 1.5 |     | 5.0   |     |     | $pA/^{\circ}C$    |
| $I_B$                               | Input Bias Current           |                                                                                                                 | • | 10         | 20  |     | 12    | 30  |     | nA                |
| $\frac{\Delta I_B}{\Delta Temp}$    | Bias Current Drift           |                                                                                                                 | • | 60         | 30  |     | 90    | 40  |     | $pA/^{\circ}C$    |
| $A_{VOL}$                           | Large Signal Voltage Gain    | $V_S = \pm 20V, I_{OUT} = 0, V_{OUT} = \pm 19.95V$                                                              | • | 120        | 400 |     | 80    | 400 |     | V/mV              |
|                                     |                              |                                                                                                                 | • | 80         |     |     | 50    |     |     | V/mV              |
|                                     |                              | $V_S = \pm 20V, V_{OUT} = \pm 19.4V$<br>$I_{OUT} = \pm 20mA$<br>$I_{OUT} = \pm 15mA$                            | • | 50         | 130 |     | 25    | 130 |     | V/mV              |
|                                     |                              |                                                                                                                 | • | 20         |     |     | 15    |     |     | V/mV              |
|                                     |                              | $V_S = \pm 0.6V, I_{OUT} = \pm 2mA$<br>$V_{OUT} = \pm 0.4V, V_{CM} = -0.4V$                                     |   | 1.5        | 3.0 |     | 1.0   | 3.0 |     | V/mV              |
|                                     |                              | $V_S = \pm 0.65V, I_{OUT} = \pm 2mA$<br>$V_{OUT} = \pm 0.3V, V_{CM} = -0.4V$                                    | • | 0.5        |     |     | 0.75  |     |     | V/mV              |
|                                     | Shunt Gain (Note 5)          | $0.1mA \leq I_{OUT} \leq 5mA, R_L = 1.1k\Omega$<br>$1.2V \leq V_{OUT} \leq 40V$<br>$1.3V \leq V_{OUT} \leq 40V$ | • | 14         | 33  |     | 10    | 33  |     | V/mV              |
|                                     |                              |                                                                                                                 | • | 6          |     |     | 6     |     |     | V/mV              |
|                                     |                              | $0.1mA \leq I_{OUT} \leq 20mA, R_L = 250\Omega$<br>$1.5V \leq V^+ \leq 40V$                                     | • | 8          | 25  |     | 6     | 25  |     | V/mV              |
|                                     |                              |                                                                                                                 | • | 4          |     |     | 4     |     |     | V/mV              |

# OP AMP ELECTRICAL CHARACTERISTICS (Note 3)

| SYMBOL       | PARAMETER                    | CONDITIONS                                                                       |   | LM10/LM10B |     |     | LM10C |     |     | UNITS      |
|--------------|------------------------------|----------------------------------------------------------------------------------|---|------------|-----|-----|-------|-----|-----|------------|
|              |                              |                                                                                  |   | MIN        | TYP | MAX | MIN   | TYP | MAX |            |
| CMRR         | Common-Mode Rejection Ratio  | $V_S = \pm 20V$<br>$-20V \leq V_{CM} \leq 19.15V$<br>$-20V \leq V_{CM} \leq 19V$ |   | 93         | 102 |     | 90    | 102 |     | dB         |
|              |                              |                                                                                  | ● | 87         |     |     | 87    |     |     | dB         |
| PSRR         | Power Supply Rejection Ratio | $-0.2V \geq V^- \geq -39V$<br>$V^+ = 1.0V$<br>$V^+ = 1.1V$                       |   | 90         | 96  |     | 87    | 96  |     | dB         |
|              |                              |                                                                                  | ● | 84         |     |     | 84    |     |     | dB         |
|              |                              | $V^- = -0.2V$<br>$1.0V \leq V^+ \leq 39.8V$<br>$1.1V \leq V^+ \leq 39.8V$        |   | 96         | 106 |     | 93    | 106 |     | dB         |
|              |                              |                                                                                  | ● | 90         |     |     | 90    |     |     | dB         |
| $R_{IN}$     | Input Resistance             | (Note 6)                                                                         |   | 250        | 500 |     | 150   | 400 |     | k $\Omega$ |
|              |                              |                                                                                  | ● | 150        |     |     | 115   |     |     | k $\Omega$ |
| $I_S$        | Supply Current               |                                                                                  |   |            | 270 | 400 |       | 300 | 500 | $\mu A$    |
|              |                              |                                                                                  | ● |            |     | 500 |       |     | 570 | $\mu A$    |
| $\Delta I_S$ | Supply Current Change        | $1.2V \leq V_S \leq 40V$<br>$1.3V \leq V_S \leq 40V$                             |   |            | 15  | 75  |       | 15  | 75  | $\mu A$    |
|              |                              |                                                                                  | ● |            |     | 75  |       |     | 75  | $\mu A$    |

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# REFERENCE AMPLIFIER ELECTRICAL CHARACTERISTICS (Note 3)

| SYMBOL                               | PARAMETER                | CONDITIONS                                                                                            |   | LM10/LM10B |       |       | LM10C |       |       | UNITS           |
|--------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------|---|------------|-------|-------|-------|-------|-------|-----------------|
|                                      |                          |                                                                                                       |   | MIN        | TYP   | MAX   | MIN   | TYP   | MAX   |                 |
| $V_{REF}$                            | Feedback Sense Voltage   | Voltage at Pin 1 with Pin 1 Connected to Pin 8                                                        |   | 195        | 200   | 205   | 190   | 200   | 210   | mV              |
|                                      |                          |                                                                                                       | ● | 194        | 200   | 206   | 189   | 200   | 211   | mV              |
| $\frac{\Delta V_{REF}}{\Delta Temp}$ | Reference Drift          |                                                                                                       | ● |            | 0.002 |       |       | 0.003 |       | % / $^{\circ}C$ |
|                                      | Feedback Current         | Current into Pin 8                                                                                    |   |            | 20    | 50    |       | 22    | 75    | nA              |
|                                      |                          |                                                                                                       | ● |            |       | 65    |       |       | 90    | nA              |
|                                      | Line Regulation          | $0 \leq I_{REF} \leq 1mA$ , $V_{REF} = 200mV$<br>$1.2V \leq V_S \leq 40V$<br>$1.3V \leq V_S \leq 40V$ |   |            | 0.001 | 0.003 |       | 0.001 | 0.008 | % / V           |
|                                      |                          |                                                                                                       | ● |            | 0.001 | 0.006 |       | 0.001 | 0.01  | % / V           |
|                                      | Load Regulation          | $0 \leq I_{REF} \leq 1mA$<br>$V^+ - V_{REF} \geq 1.0V$<br>$V^+ - V_{REF} \geq 1.1V$                   |   |            | 0.01  | 0.1   |       | 0.01  | 0.15  | %               |
|                                      |                          |                                                                                                       | ● |            | 0.01  | 0.15  |       | 0.01  | 0.20  | %               |
|                                      | Reference Amplifier Gain | $0.2V \leq V_{REF} \leq 35V$                                                                          |   | 50         | 75    |       | 25    | 70    |       | V/mV            |
|                                      |                          |                                                                                                       | ● | 23         |       |       | 15    |       |       | V/mV            |

# OP AMP ELECTRICAL CHARACTERISTICS (Note 3)

| SYMBOL                              | PARAMETER                    | CONDITIONS                                                                                                           |   | LM10BL     |     |            | LM10CL      |     |            | UNITS                    |
|-------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------|---|------------|-----|------------|-------------|-----|------------|--------------------------|
|                                     |                              |                                                                                                                      |   | MIN        | TYP | MAX        | MIN         | TYP | MAX        |                          |
| $V_{OS}$                            | Input Offset Voltage         |                                                                                                                      | ● |            | 0.3 | 2.0<br>3.0 |             | 0.5 | 4.0<br>5.0 | mV<br>mV                 |
| $\frac{\Delta V_{OS}}{\Delta Temp}$ | Average Offset Voltage Drift |                                                                                                                      | ● |            | 2.0 |            |             | 5.0 |            | $\mu V/^{\circ}C$        |
| $I_{OS}$                            | Input Offset Current         | (Note 4)                                                                                                             | ● |            | 0.1 | 0.7<br>1.5 |             | 0.2 | 2.0<br>3.0 | nA<br>nA                 |
| $\frac{\Delta I_{OS}}{\Delta Temp}$ | Offset Current Drift         |                                                                                                                      | ● |            | 2.0 |            |             | 5.0 |            | $pA/^{\circ}C$           |
| $I_B$                               | Input Bias Current           |                                                                                                                      | ● |            | 10  | 20<br>30   |             | 12  | 30<br>40   | nA<br>nA                 |
| $\frac{\Delta I_B}{\Delta Temp}$    | Bias Current Drift           |                                                                                                                      | ● |            | 60  |            |             | 90  |            | $pA/^{\circ}C$           |
| $A_{VOL}$                           | Large Signal Voltage Gain    | $V_S = \pm 3.25V, I_{OUT} = 0, V_{OUT} = \pm 3.2V$                                                                   | ● | 60<br>40   | 300 |            | 40<br>25    | 300 |            | V/mV<br>V/mV             |
|                                     |                              | $V_S = \pm 3.25V, V_{OUT} = \pm 2.75V$<br>$I_{OUT} = \pm 10mA$                                                       | ● | 10<br>4    | 25  |            | 5<br>3      | 25  |            | V/mV<br>V/mV             |
|                                     |                              | $I_{OUT} = \pm 2mA, V_{CM} = -0.4V$<br>$V_S = \pm 0.6V, V_{OUT} = \pm 0.4V$<br>$V_S = \pm 0.65V, V_{OUT} = \pm 0.3V$ | ● | 1.5<br>0.5 | 3.0 |            | 1.0<br>0.75 | 3.0 |            | V/mV<br>V/mV             |
|                                     |                              |                                                                                                                      |   |            |     |            |             |     |            |                          |
|                                     | Shunt Gain (Note 5)          | $0.1mA \leq I_{OUT} \leq 10mA, R_L = 500\Omega$<br>$1.5V \leq V^+ \leq 6.5V$                                         | ● | 8<br>4     | 30  |            | 6<br>4      | 30  |            | V/mV<br>V/mV             |
| CMRR                                | Common-Mode Rejection Ratio  | $V_S = \pm 3.25V$<br>$-3.25V \leq V_{CM} \leq 2.4V$<br>$-3.25V \leq V_{CM} \leq 2.25V$                               | ● | 89<br>83   | 102 |            | 80<br>74    | 102 |            | dB<br>dB                 |
|                                     |                              |                                                                                                                      |   |            |     |            |             |     |            |                          |
| PSRR                                | Power Supply Rejection Ratio | $-0.2V \geq V^- \geq -5.4V$<br>$V^+ = 1.0V$<br>$V^+ = 1.2V$                                                          | ● | 86<br>80   | 96  |            | 80<br>74    | 96  |            | dB<br>dB                 |
|                                     |                              |                                                                                                                      |   |            |     |            |             |     |            |                          |
| PSRR                                |                              | $V^- = -0.2V$<br>$1.0V \leq V^+ \leq 6.3V$<br>$1.1V \leq V^+ \leq 6.3V$                                              | ● | 94<br>88   | 106 |            | 80<br>74    | 106 |            | dB<br>dB                 |
|                                     |                              |                                                                                                                      |   |            |     |            |             |     |            |                          |
| $R_{IN}$                            | Input Resistance             | (Note 6)                                                                                                             | ● | 250<br>150 | 500 |            | 150<br>115  | 400 |            | k $\Omega$<br>k $\Omega$ |
|                                     |                              |                                                                                                                      |   |            |     |            |             |     |            |                          |
| $I_S$                               | Supply Current               |                                                                                                                      | ● |            | 260 | 400<br>500 |             | 280 | 500<br>570 | $\mu A$<br>$\mu A$       |

# REFERENCE AMPLIFIER ELECTRICAL CHARACTERISTICS (Note 3)

| SYMBOL                               | PARAMETER                | CONDITIONS                                                                                                                                          |   | LM10BL |     |     | LM10CL |     |     | UNITS |
|--------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|-----|-----|--------|-----|-----|-------|
|                                      |                          |                                                                                                                                                     |   | MIN    | TYP | MAX | MIN    | TYP | MAX |       |
| $V_{REF}$                            | Feedback Sense Voltage   | Voltage at Pin 1 with Pin 1 Connected to Pin 8                                                                                                      | ● | 195    | 200 | 205 | 190    | 200 | 210 | mV    |
|                                      |                          |                                                                                                                                                     | ● | 194    | 200 | 206 | 189    | 200 | 211 | mV    |
| $\frac{\Delta V_{REF}}{\Delta Temp}$ | Reference Drift          |                                                                                                                                                     | ● | 0.002  |     |     | 0.003  |     |     | %/°C  |
|                                      | Feedback Current         | Current into Pin 8                                                                                                                                  | ● | 20     |     |     | 22     |     |     | nA    |
|                                      |                          |                                                                                                                                                     | ● | 50     |     |     | 75     |     |     | nA    |
|                                      |                          |                                                                                                                                                     | ● | 65     |     |     | 90     |     |     | nA    |
|                                      | Line Regulation          | $0 \leq I_{REF} \leq 0.5\text{mA}$ , $V_{REF} = 200\text{mV}$<br>$1.2\text{V} \leq V_S \leq 6.5\text{V}$<br>$1.3\text{V} \leq V_S \leq 6.5\text{V}$ | ● | 0.001  |     |     | 0.001  |     |     | %/V   |
|                                      |                          |                                                                                                                                                     | ● | 0.01   |     |     | 0.02   |     |     | %/V   |
|                                      |                          |                                                                                                                                                     | ● | 0.001  |     |     | 0.03   |     |     | %/V   |
|                                      | Load Regulation          | $0 \leq I_{REF} \leq 0.5\text{mA}$<br>$V^+ - V_{REF} \geq 1.0\text{V}$<br>$V^+ - V_{REF} \geq 1.1\text{V}$                                          | ● | 0.01   |     |     | 0.01   |     |     | %     |
|                                      |                          |                                                                                                                                                     | ● | 0.1    |     |     | 0.15   |     |     | %     |
|                                      |                          |                                                                                                                                                     | ● | 0.01   |     |     | 0.20   |     |     | %     |
|                                      | Reference Amplifier Gain | $0.2\text{V} \leq V_{REF} \leq 5.5\text{V}$                                                                                                         | ● | 30     | 70  |     | 20     | 70  |     | V/mV  |
|                                      |                          |                                                                                                                                                     | ● | 20     |     |     | 15     |     |     | V/mV  |

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

**Note 1:** The input voltage can exceed the supply voltages as long as the voltage from the input to any other terminal does not exceed the maximum differential voltage, and the maximum junction temperature is not exceeded due to the excess power dissipation that occurs when the input voltage is less than the negative supply voltage.

**Note 2:** The maximum operating junction temperatures are: 150°C for the LM10; 100°C for the LM10B and LM10BL; and 85°C for the LM10C and LM10CL. Package derating factors will be found on the back page of this data sheet.

**Note 3:** These specifications apply for the following conditions unless otherwise noted:

at 25°C

over temperature

(a)  $V^- \leq V_{CM} \leq V^+ - 0.85\text{V}$   $V^- \leq V_{CM} \leq V^+ - 1.0\text{V}$

(b)  $1.2\text{V} \leq V_S \leq V_{MAX}$   $1.3\text{V} \leq V_S \leq V_{MAX}$

$V_{REF} = 0.2\text{V}$  and  $0 \leq I_{REF} \leq 1.0\text{mA}$  where  $V_{MAX} = 40\text{V}$  for the LM10, LM10B and LM10C and  $V_{MAX} = 6.5\text{V}$  for the LM10BL and LM10CL. The specifications do not include errors due to thermal gradients ( $\tau_1 \approx 20\text{ms}$ ), die heating ( $\tau_2 \approx 0.2\text{ sec}$ ) or package heating.

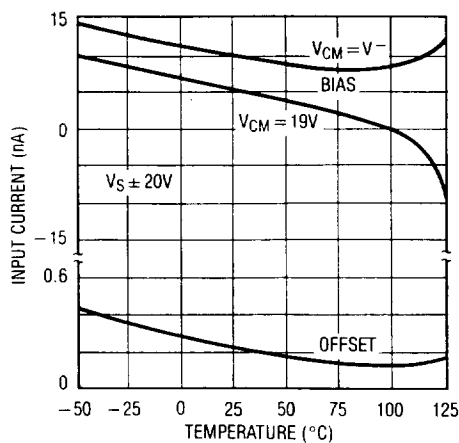
**Note 4:** For  $T_J > 90^\circ\text{C}$ ,  $I_{OS}$  may exceed 1.5nA when  $V_{CM} = V^-$ . When the common-mode input voltage is within 100mV of the negative supply and  $T_J = 125^\circ\text{C}$ , the offset current will be less than 5nA.

**Note 5:** Shunt gain defines the operation in floating applications when the output is connected to the  $V^+$  terminal and input common-mode is referred to  $V^-$  (see typical applications). The effects of larger output voltage swing with higher load resistance can be accounted for by adding the positive supply rejection error.

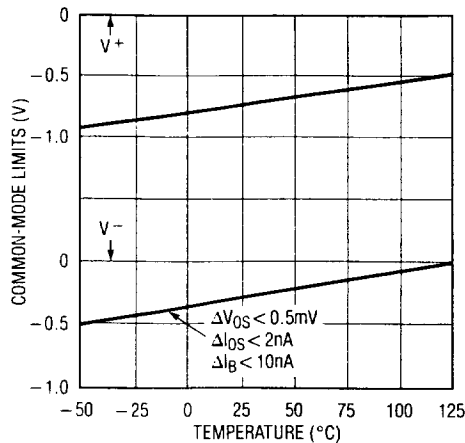
**Note 6:** Guaranteed by design.

# TYPICAL PERFORMANCE CHARACTERISTICS (Op Amp)

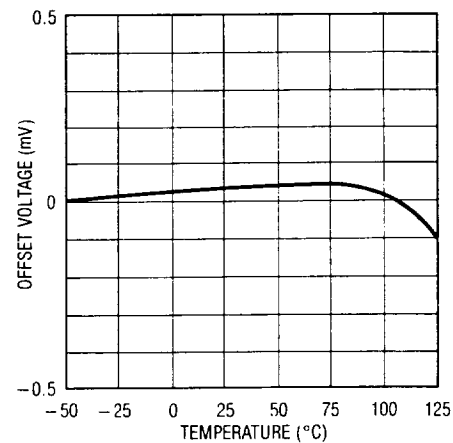
Input Current



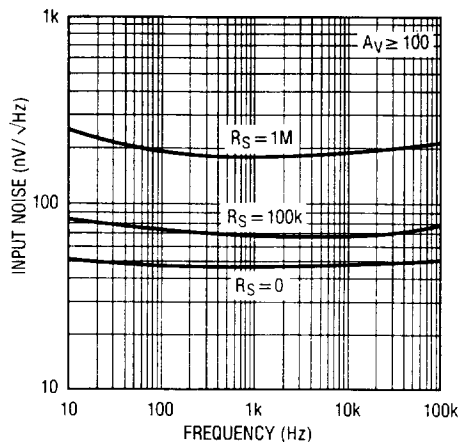
Common-Mode Limits



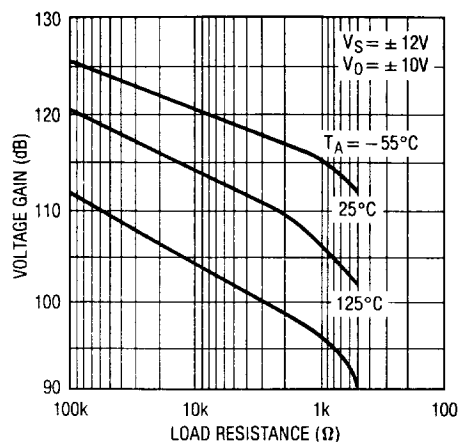
Offset Voltage Drift



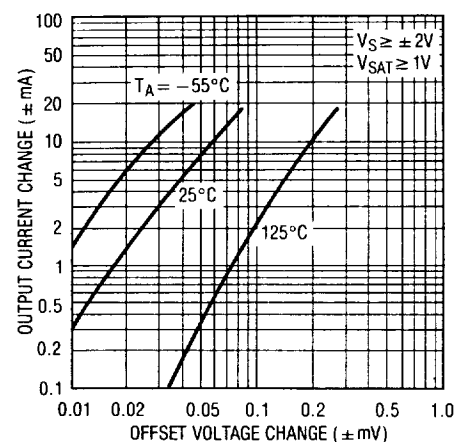
Input Noise Voltage



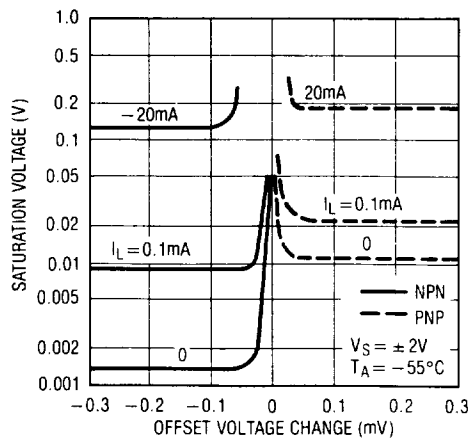
DC Voltage Gain



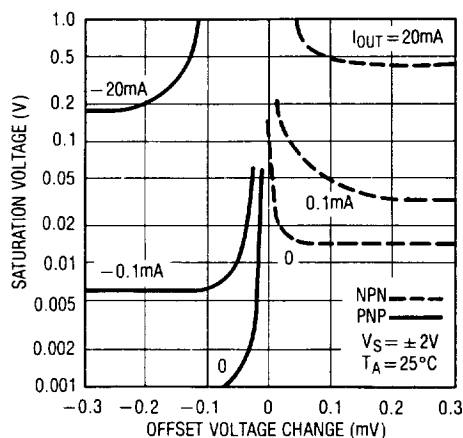
Transconductance



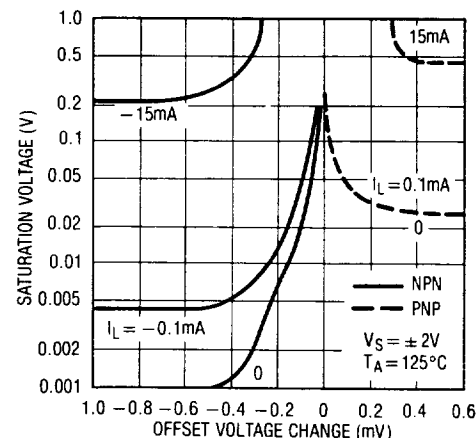
Output Saturation Characteristics



Output Saturation Characteristics

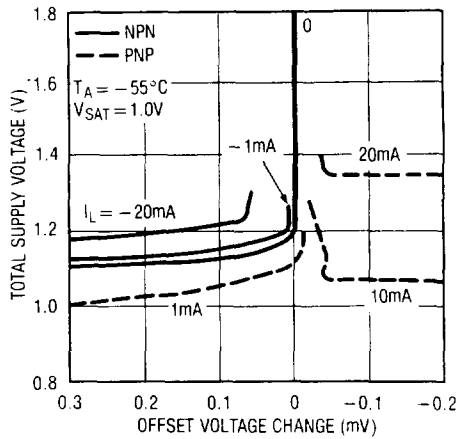


Output Saturation Characteristics

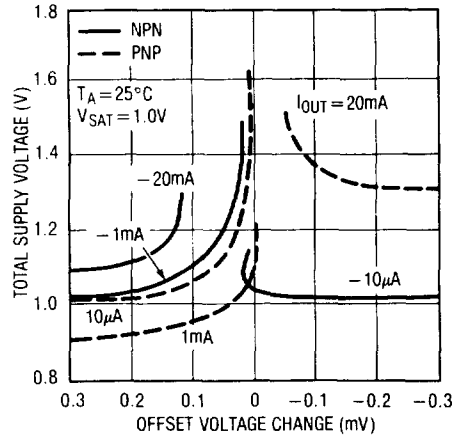


# TYPICAL PERFORMANCE CHARACTERISTICS (Op Amp)

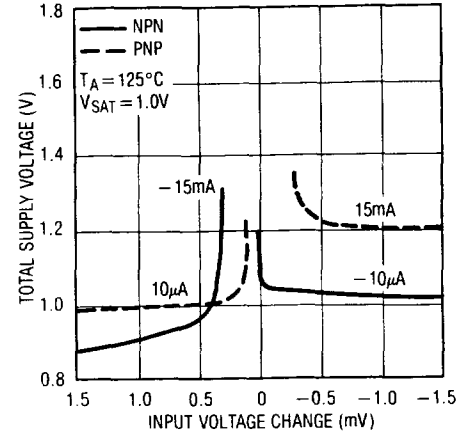
Minimum Supply Voltage



Minimum Supply Voltage

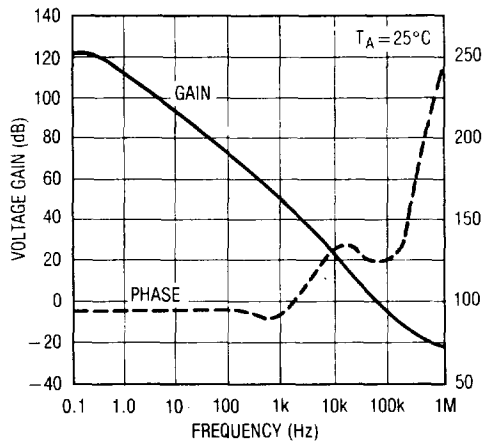


Minimum Supply Voltage

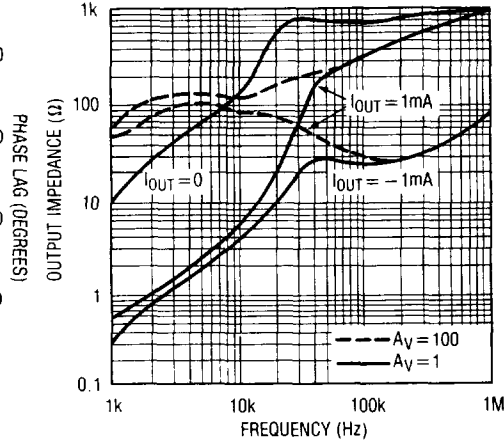


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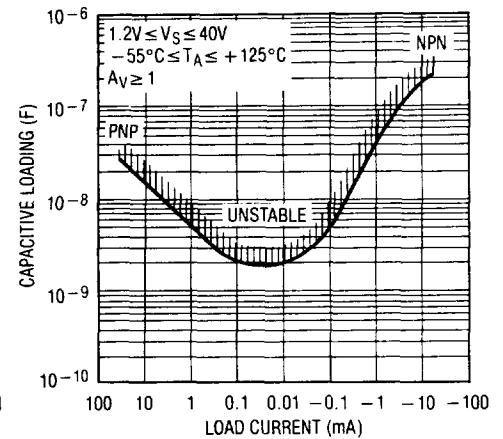
Frequency Response



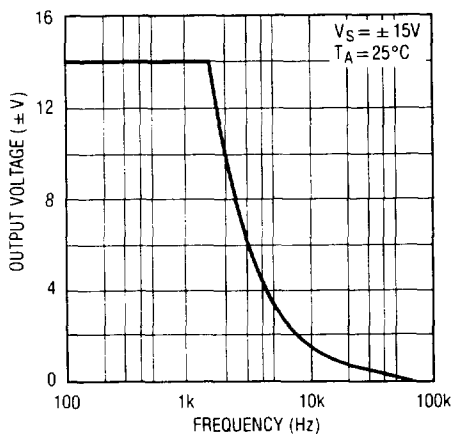
Output Impedance



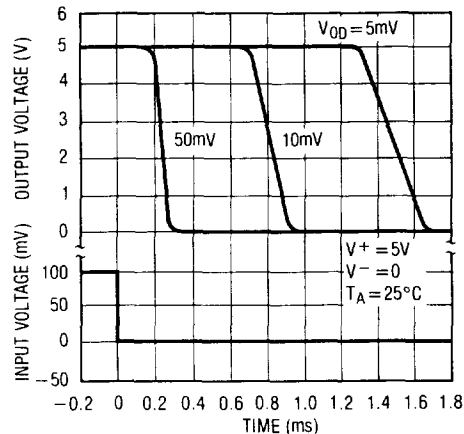
Typical Stability Range



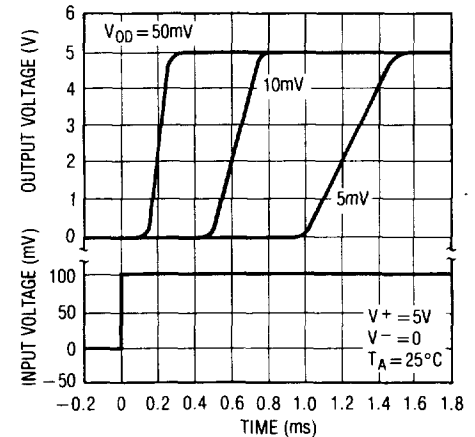
Large Signal Response



Comparator Response Time for Various Input Overdrives

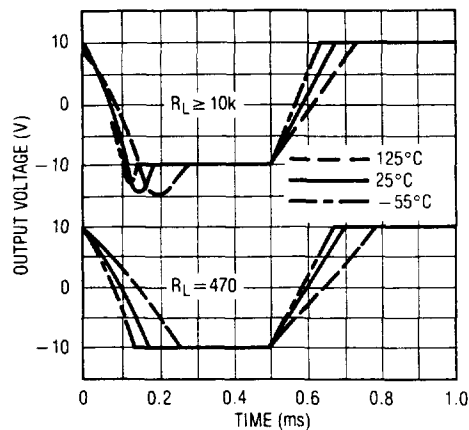


Comparator Response Time for Various Input Overdrives

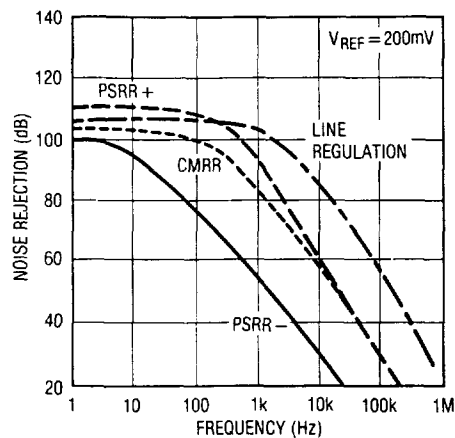


## TYPICAL PERFORMANCE CHARACTERISTICS

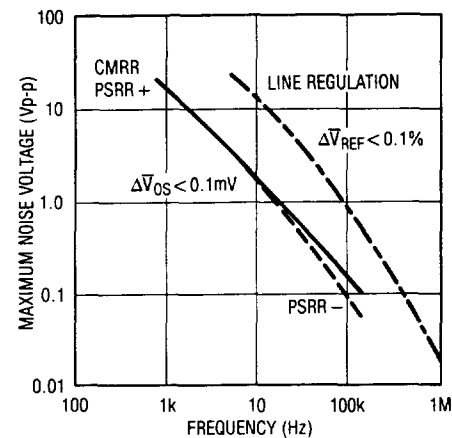
Follower Pulse Response



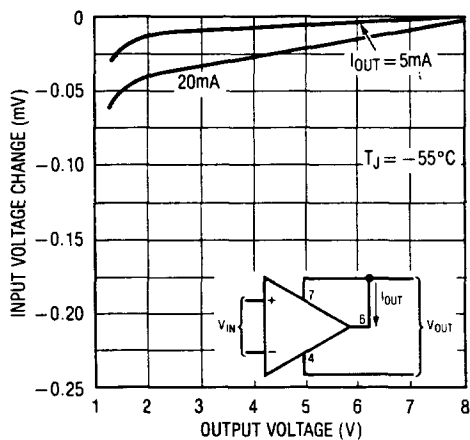
Noise Rejection



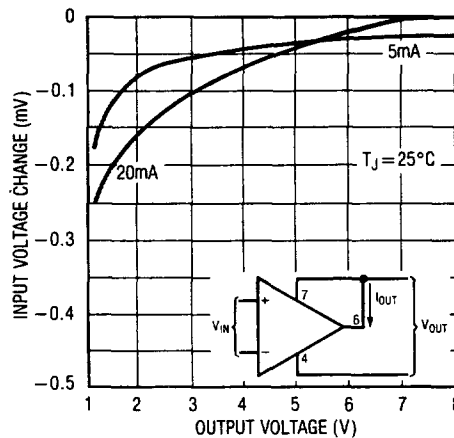
Rejection Slew Limiting



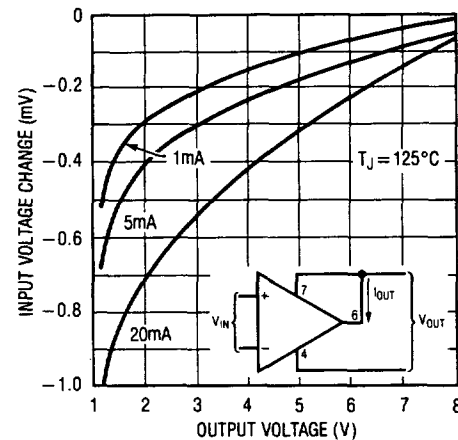
Shunt Gain



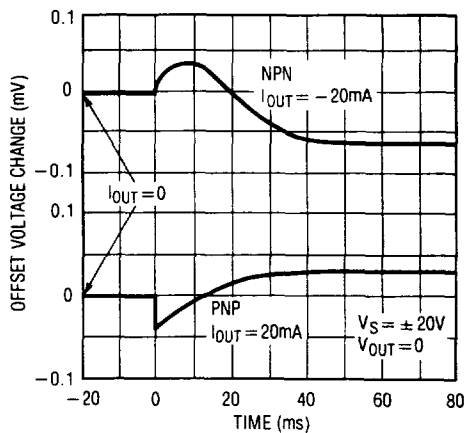
Shunt Gain



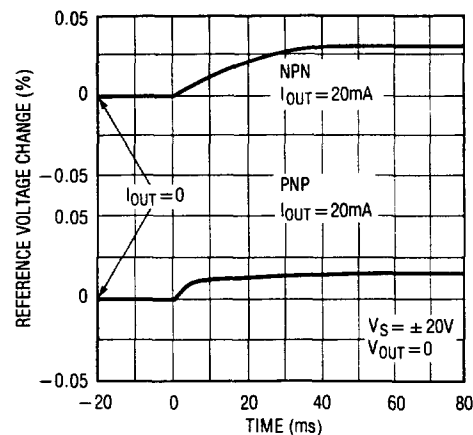
Shunt Gain



Thermal Gradient Feedback

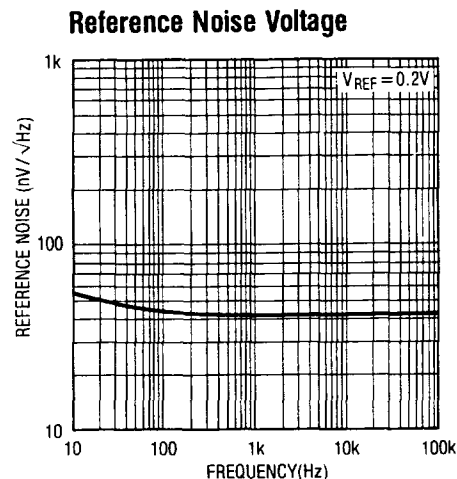
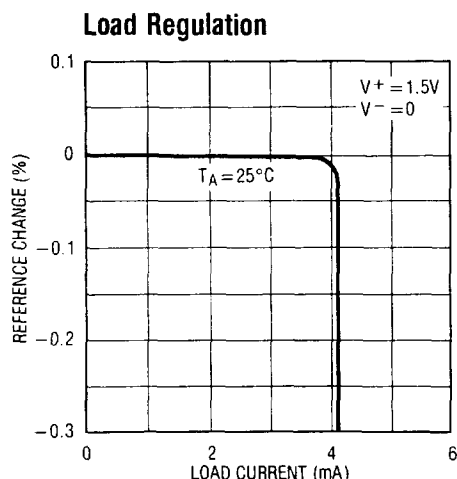
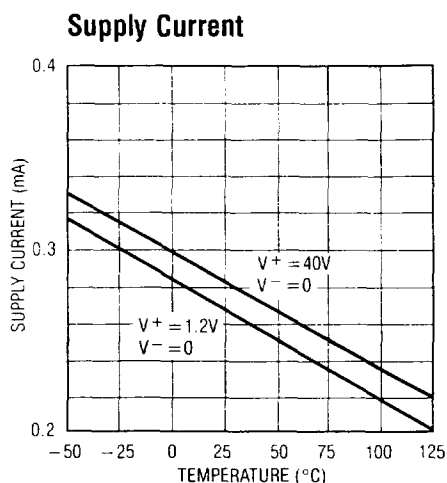


Change in Reference Op Amp Loading

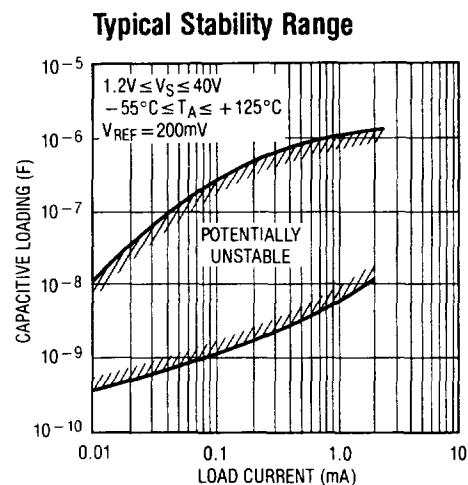
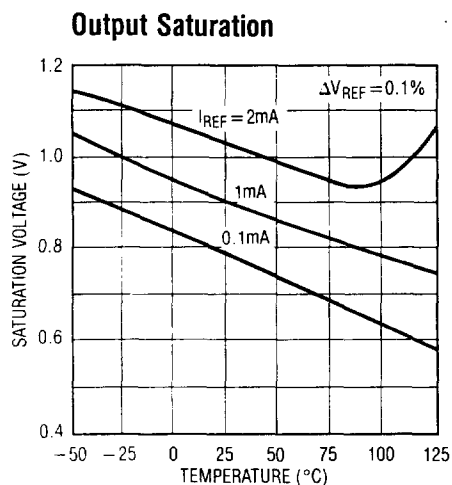
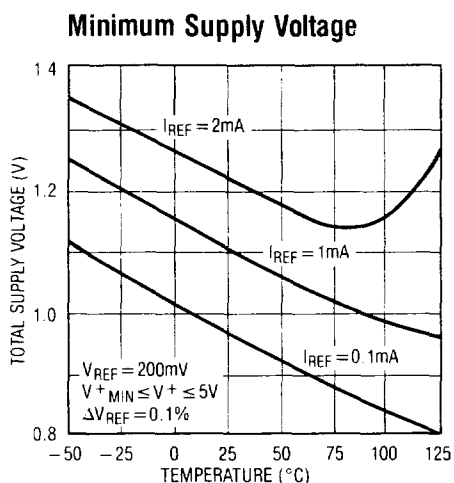




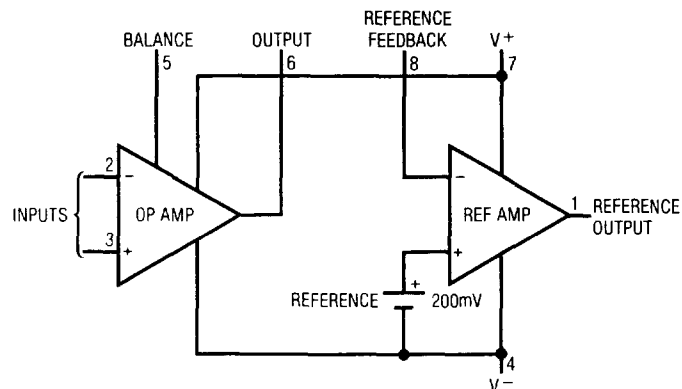
## TYPICAL PERFORMANCE CHARACTERISTICS (Reference)



2



## BLOCK DIAGRAM



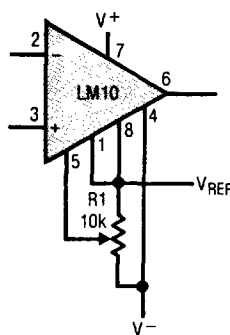
## APPLICATION HINTS

With heavy amplifier loading to  $V^-$ , resistance drops in the  $V^-$  lead can adversely affect reference regulation.

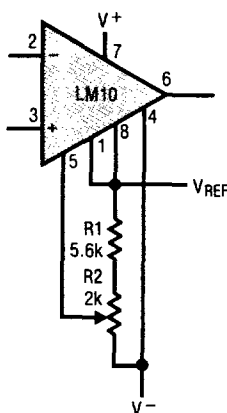
Lead resistance can approach  $1\Omega$ . Therefore, the common to the reference circuitry should be connected as close as possible to the package.

## TYPICAL APPLICATIONS

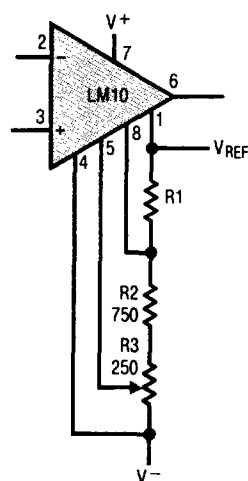
**Standard  
Offset Adjustment**



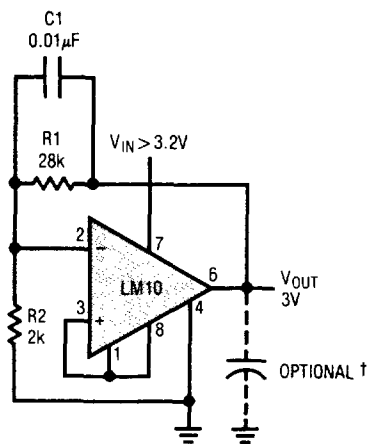
**Limited Range  
Offset Adjustment**



**Limited Range Offset Adjustment  
with Boosted Reference**

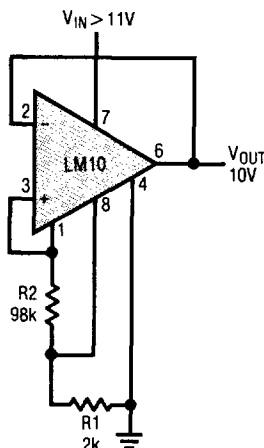


**Low Voltage Regulator**

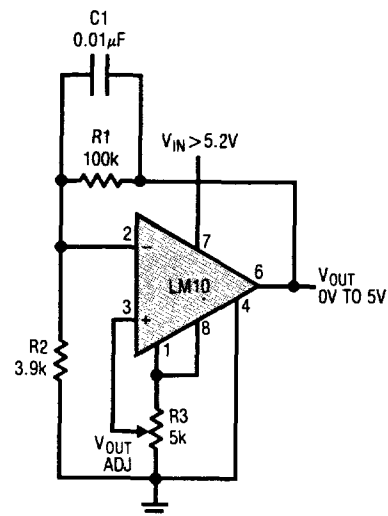


† USE ELECTROLYTIC OUTPUT CAPACITORS

**Best Regulation**

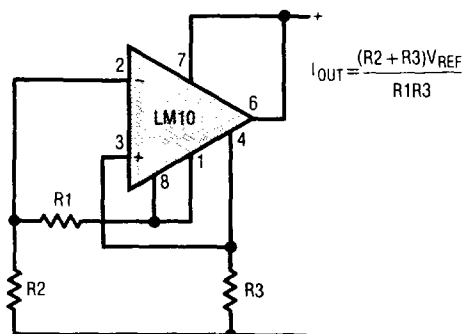


**0V to 5V Regulator**

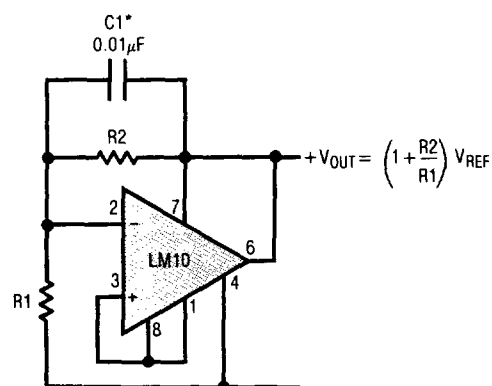


## TYPICAL APPLICATIONS

Two-Terminal Current Regulator



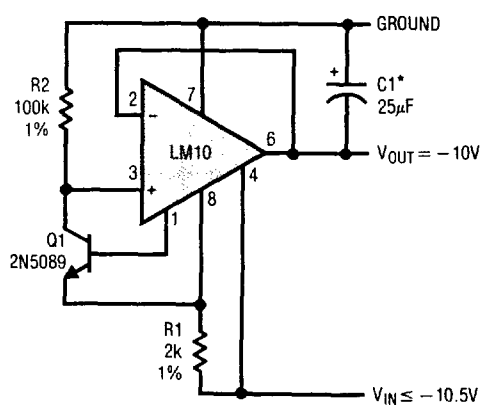
Shunt Regulator



\*REQUIRED FOR CAPACITIVE LOADING

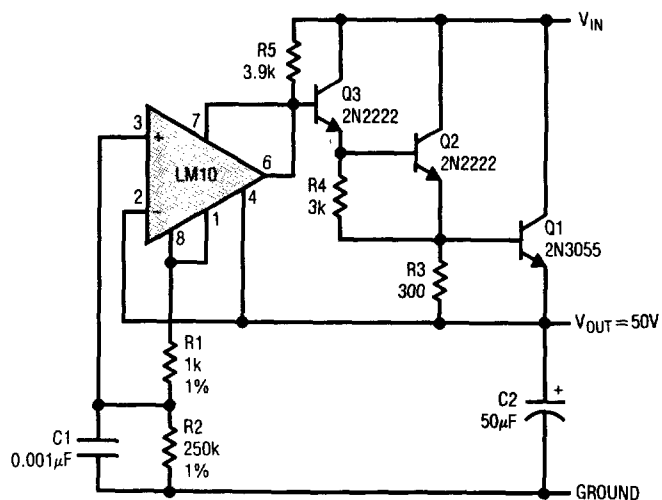
2

Negative Regulator



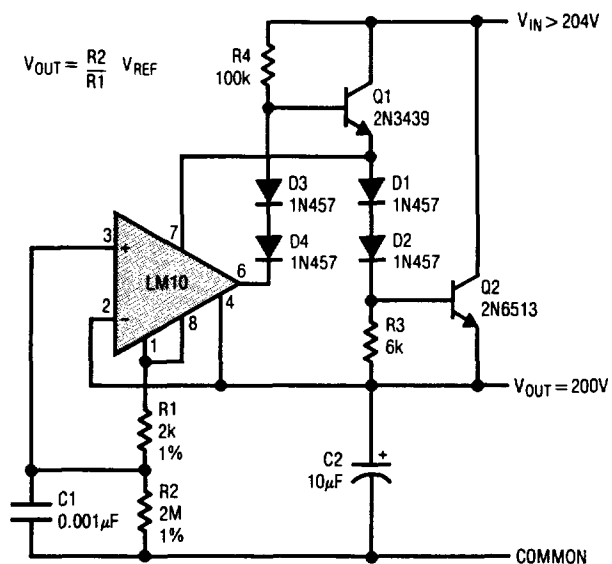
\*ELECTROLYTIC

Floating Regulator

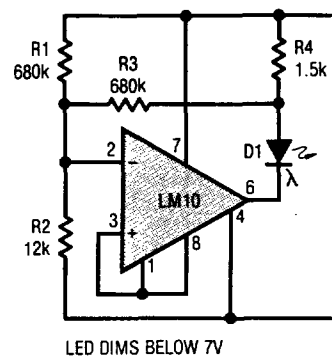


## TYPICAL APPLICATIONS

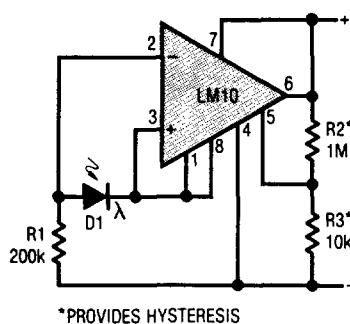
High Voltage Regulator



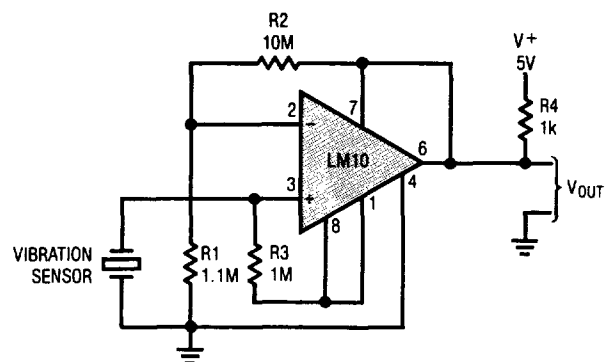
6V Battery-Level Indicator



Light Level Sensor

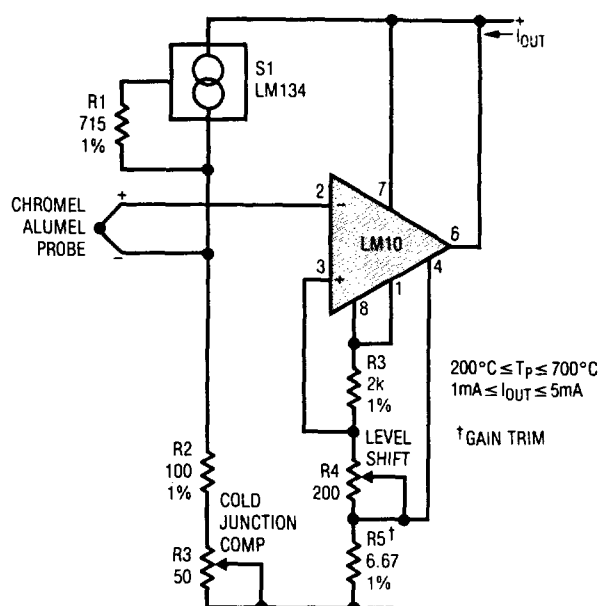


Transducer Amplifier

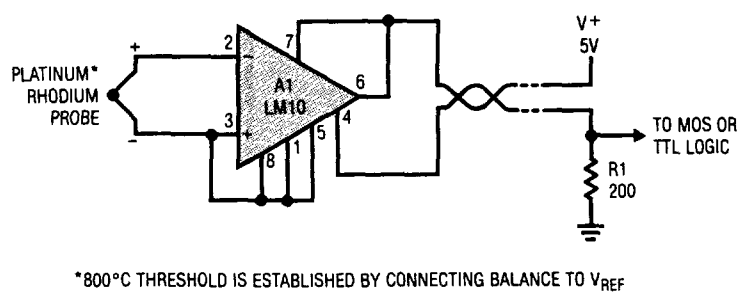


## TYPICAL APPLICATIONS

Thermocouple Transmitter

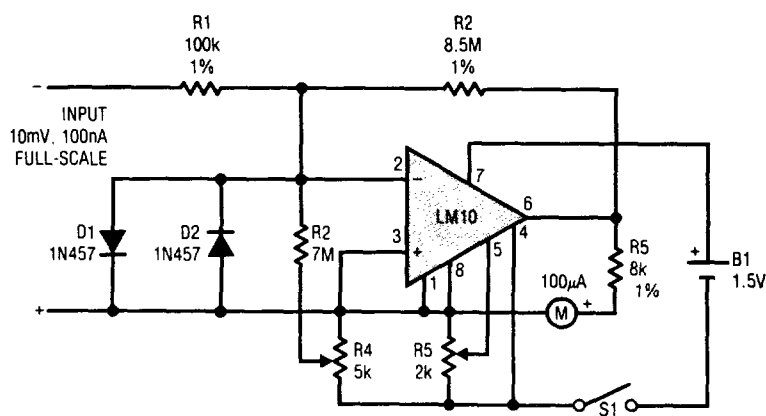


Flame Detector

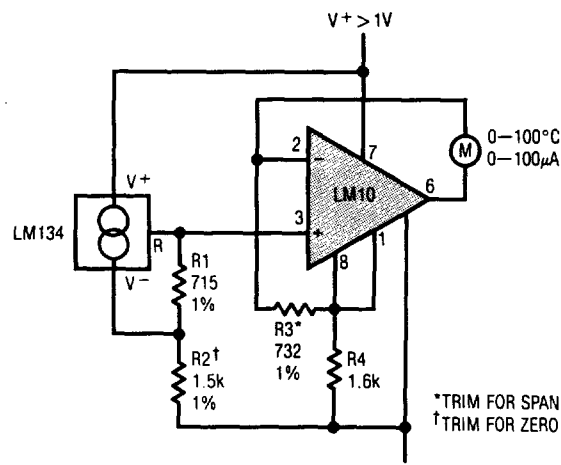


2

Meter Amplifier

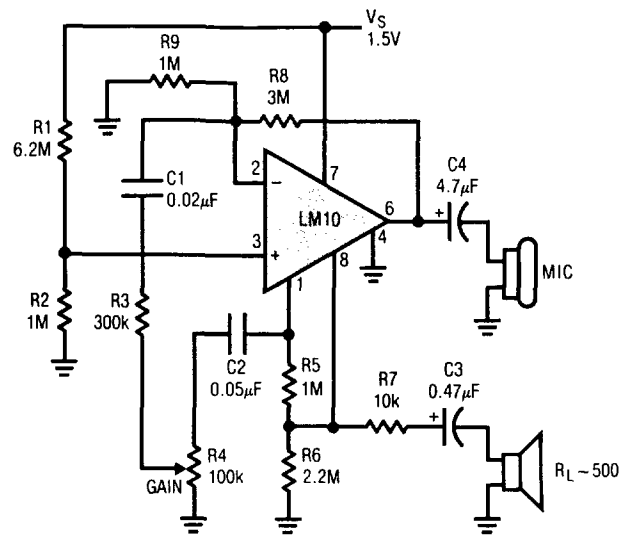


Thermometer

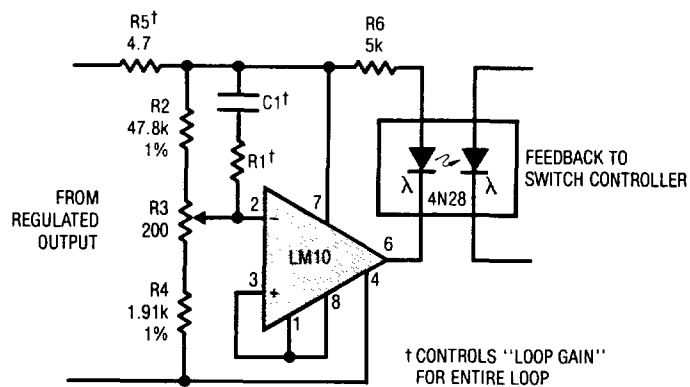


## TYPICAL APPLICATIONS

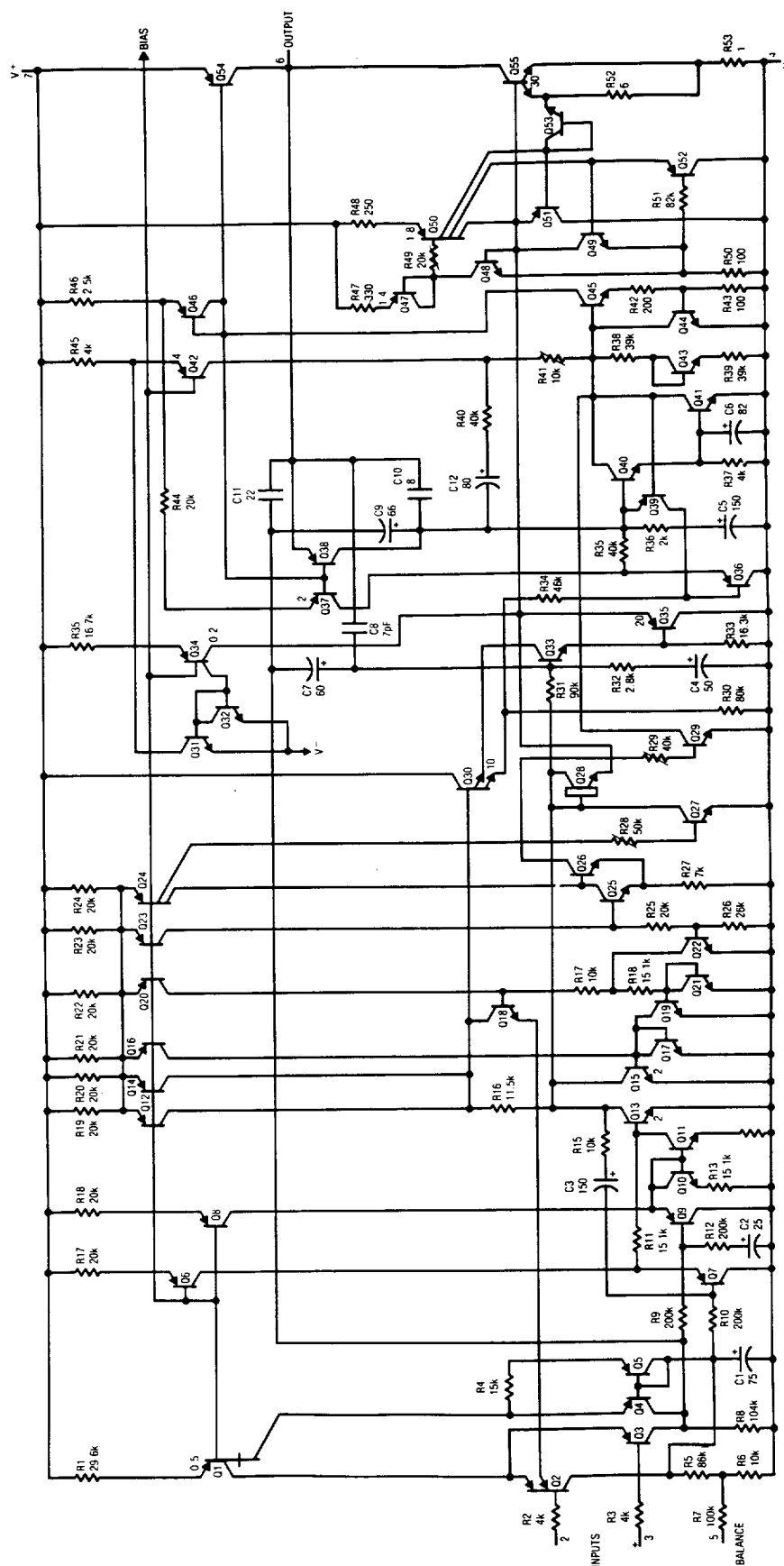
Microphone Amplifier  
 $A_v \approx 1k$



Isolated Voltage Sensor  
 for Switching Regulators

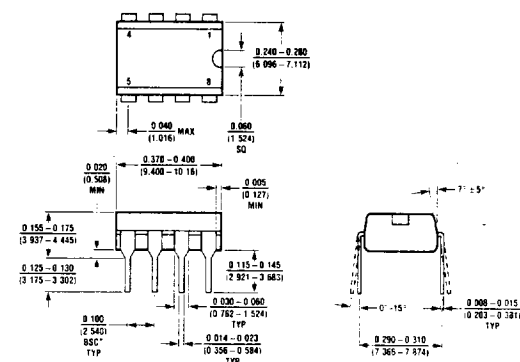


## OP AMP SCHEMATIC DIAGRAM





**N8 Package  
8 Lead Plastic**



NOTE: DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED  
 \*LEADS WITHIN 0.002 OF TRUE POSITION (TP) AT GAUGE PLANE

|            |               |
|------------|---------------|
| $T_{jmax}$ | $\theta_{ja}$ |
| 100°C      | 130°C/W       |