# Constant Current Source and Temperature Sensor

## FEATURES

- 1μA to 10mA Operation
- 0.02%/V Regulation
- 0.8V to 30V Operating Voltage
- Can Be Used as Linear Temperature Sensor
- Draws No Reverse Current

## APPLICATIONS

- Current Mode Temperature Sensing
- Constant Current Source for Shunt References
- Cold Junction Compensation
- Constant-Gain Bias for Bipolar Differential Stage
- Micropower Bias Networks
- Buffer for Photoconductive Cell
- Current Limiter

## DESCRIPTION

The LM334 is a three-terminal current source designed to operate at current levels from 1μA to 10mA, as set by an external resistor. The device operates as a true two-terminal current source, requiring no extra power connections or input signals. Regulation is typically 0.02%/V and terminal-to-terminal voltage can range from 800mV to 30V.

Because the operating current is *directly proportional to absolute temperature* in degrees Kelvin, the device will also find wide applications as a temperature sensor. The temperature dependence of the operating current is +0.336%/°C at room temperature. For example, a device operating at 298μA will have a temperature coefficient of +1μA/°C. The temperature dependence is extremely accurate and repeatable.

If a zero temperature coefficient current source is required, this is easily achieved by adding a diode and a resistor.

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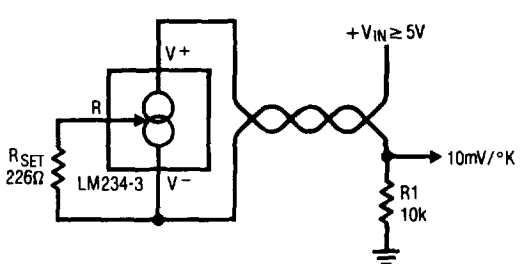
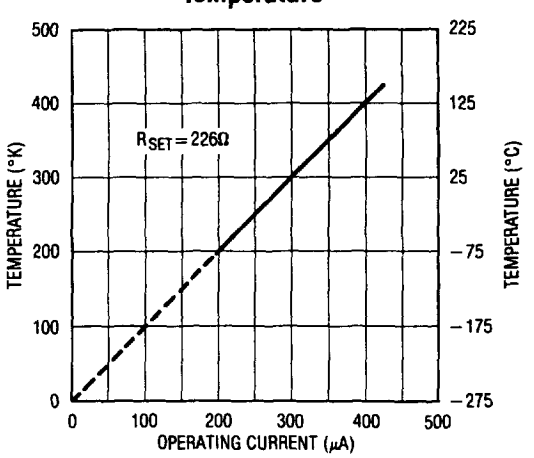
**Remote Temperature Sensor with Voltage Output**



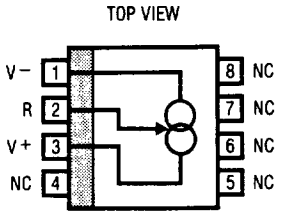

**Operating Current vs Temperature**



## ABSOLUTE MAXIMUM RATINGS

$V^+$ to $V^-$ Forward Voltage ..... 30V
$V^+$ to $V^-$ Reverse Voltage ..... 20V
R Pin to $V^-$ Voltage ..... 5V
Set Current ..... 10mA
Power Dissipation ..... 200mW
Operating Temperature Range ..... 0°C to 70°C
Lead Temperature (Soldering, 10 sec.) ..... 300°C

## PACKAGE/ORDER INFORMATION




S8 PACKAGE
PLASTIC SO

| ORDER PART NUMBER |
|---|
| LM334S8 |
| **PART MARKING** |
| 334 |

## ELECTRICAL CHARACTERISTICS CURRENT SOURCE (Note 1)

| SYMBOL | PARAMETER | CONDITIONS | LM334 MIN | LM334 TYP | LM334 MAX | UNITS |
|---|---|---|---|---|---|---|
| $\Delta I_{SET}$ | Set Current Error, $V^+ = 2.5V$ (Note 2) | $10\mu A \le I_{SET} \le 1mA$ | | | 6 | % |
| | | $1mA < I_{SET} \le 5mA$ | | | 8 | % |
| | | $2\mu A \le I_{SET} < 10\mu A$ | | | 12 | % |
| | Ratio of Set Current to $V^-$ Current | $10\mu A \le I_{SET} \le 1mA$ | 14 | 18 | 26 | |
| | | $1mA \le I_{SET} \le 5mA$ | | 14 | | |
| | | $2\mu A \le I_{SET} \le 10\mu A$ | | 18 | 26 | |
| $V_{MIN}$ | Minimum Operating Voltage | $2\mu A \le I_{SET} \le 100\mu A$ | | 0.8 | | V |
| | | $100\mu A < I_{SET} \le 1mA$ | | 0.9 | | V |
| | | $1mA < I_{SET} \le 5mA$ | | 1.0 | | V |
| $\frac{\Delta I_{SET}}{\Delta V_{IN}}$ | Average Change in Set Current with Input Voltage | $1.5V \le V^+ \le 5V$ $2\mu A \le I_{SET} \le 1mA$ | | 0.02 | 0.1 | %/V |
| | | $5V \le V^+ \le 30V$ | | 0.01 | 0.05 | %/V |
| | | $1.5V \le V \le 5V$ $1mA < I_{SET} \le 5mA$ | | 0.03 | | %/V |
| | | $5V \le V \le 30V$ | | 0.02 | | %/V |
| | Temperature Dependence of Set Current (Note 3) | $25\mu A \le I_{SET} \le 1mA$ | 0.96T | T | 1.04T | |
| $C_S$ | Effective Shunt Capacitance | | | 15 | | pF |

**Note 1:** Unless otherwise specified, tests are performed at $T_j = 25°C$ with pulse testing so that junction temperature does not change during test.

**Note 2:** Set current is the current flowing into the $V^+$ pin. It is determined by the following formula: $I_{SET} = 67.7mV/R_{SET}$ (@25°C). Set current error is expressed as a percent deviation from this amount. $I_{SET}$ increases at 0.336%/°C@$T_j = 25°C$.

**Note 3:** $I_{SET}$ is directly proportional to absolute temperature (°K). $I_{SET}$ at any temperature can be calculated from: $I_{SET} = I_O (T/T_O)$ where $I_O$ is $I_{SET}$ measured at $T_O$ (°K).