

AD590 **Two-Terminal IC** **Temperature Transducer**

FEATURES

- Linear current output: $1 \mu\text{A}/^\circ\text{K}$
- Wide range: -55°C to $+150^\circ\text{C}$
- Two-terminal device: Voltage in/current out
- Laser trimmed to $\pm 0.5^\circ\text{C}$ calibration accuracy (AD590M)
- Excellent linearity: $\pm 0.5^\circ\text{C}$ over full range (AD590M)
- Wide power supply range: $+4\text{V}$ to $+30\text{V}$
- Sensor isolation from case
- Low cost

GENERAL DESCRIPTION

The AD590 is a two-terminal integrated circuit temperature transducer which produces an output current proportional to absolute temperature. The device acts as a high impedance constant current regulator, passing $1 \mu\text{A}/^\circ\text{K}$ for supply voltages between $+4\text{V}$ and $+30\text{V}$. Laser trimming of the chip's thin film resistors is used to calibrate the device to $298.2 \mu\text{A}$ output at 298.2°K ($+25^\circ\text{C}$).

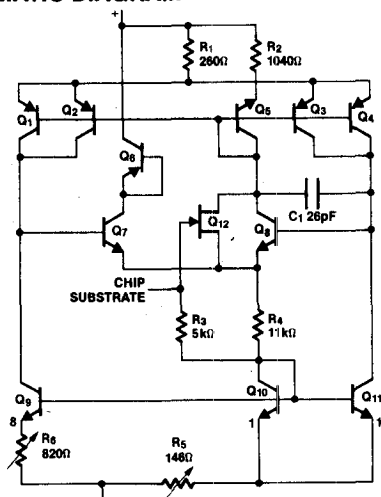
The AD590 should be used in any temperature sensing application between -55°C and $+150^\circ\text{C}$ in which conventional

electrical temperature sensors are currently employed. The inherent low cost of a monolithic integrated circuit combined with the elimination of support circuitry makes the AD590 an attractive alternative for many temperature measurement situations. Linearization circuitry, precision voltage amplifiers, resistance-measuring circuitry and cold junction compensation are not needed in applying the AD590. In the simplest application, a resistor, a power source and any voltmeter can be used to measure temperature.

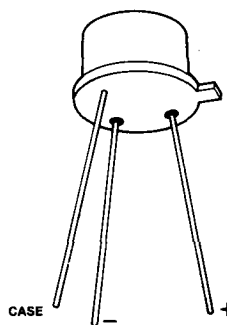
In addition to temperature measurement, applications include temperature compensation or correction of discrete components, and biasing proportional to absolute temperature. The AD590 is available in chip form making it suitable for hybrid circuits and fast temperature measurements in protected environments.

The AD590 is particularly useful in remote sensing applications. The device is insensitive to voltage drops over long lines due to its high impedance current output. Any well-insulated twisted pair is sufficient for operation hundreds of feet from the receiving circuitry. The output characteristics also make the AD590 easy to multiplex: the current can be switched by a CMOS multiplexer or the supply voltage can be switched by a logic gate output.

SCHEMATIC DIAGRAM



PIN CONFIGURATIONS



(Outline Drawing TO-52)



(Outline Drawing DH)

ORDERING INFORMATION

NON-LINEARITY ($^\circ\text{C}$)	TO-52 PACKAGE	CERAMIC PACKAGE
± 3.0	AD590IH	AD590IF
± 1.5	AD590JH	AD590JF
± 0.8	AD590KH	AD590KF
± 0.4	AD590LH	AD590LF
± 0.3	AD590MH	AD590MF

AD590

INTERSIL

ABSOLUTE MAXIMUM RATINGS

($T_A = +25^\circ\text{C}$ unless otherwise noted)

Forward Voltage (V^+ to V^-) +44V
Reverse Voltage (V^+ to V^-) -20V
Breakdown Voltage (Case to V^+ or V^-) $\pm 200\text{V}$

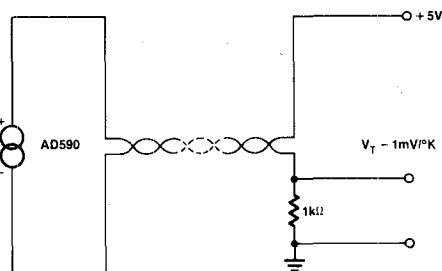
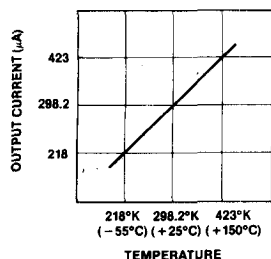
Rated Performance Temperature Range . . -55°C to +150°C
Storage Temperature Range -65°C to +175°C
Lead Temperature (Soldering, 10 sec) +300°C

SPECIFICATIONS (Typical values at $T_A = +25^\circ\text{C}$, $V^+ = 5\text{V}$ unless otherwise noted)

CHARACTERISTICS	AD590I	AD590J	AD590K	AD590L	AD590M	UNITS
Output						
Nominal Output Current @ +25°C (298.2°K)	298.2	298.2	298.2	298.2	298.2	μA
Nominal Temperature Coefficient	1.0	1.0	1.0	1.0	1.0	$\mu\text{A}/^\circ\text{K}$
Calibration Error @ +25°C (Notes)	± 10.0 max	± 5.0 max	± 2.5 max	± 1.0 max	± 0.5 max	$^\circ\text{C}$
Absolute Error (-55°C to +150°C)						$^\circ\text{C}$
Without External Calibration Adjustment	± 20.0 max	± 10.0 max	± 5.5 max	± 3.0 max	± 1.7 max	$^\circ\text{C}$
With External Calibration Adjustment	± 5.8 max	± 3.0 max	± 2.0 max	± 1.6 max	± 1.0 max	$^\circ\text{C}$
Non-Linearity	± 3.0 max	± 1.5 max	± 0.8 max	± 0.4 max	± 0.3 max	$^\circ\text{C}$
Repeatability (Note 2)	± 0.1 max	± 0.1 max	± 0.1 max	± 0.1 max	± 0.1 max	$^\circ\text{C}$
Long Term Drift (Note 3)	± 0.1 max	± 0.1 max	± 0.1 max	± 0.1 max	± 0.1 max	$^\circ\text{C}/\text{month}$
Current Noise	40	40	40	40	40	$\text{pA}/\sqrt{\text{Hz}}$
Power Supply Rejection						$\mu\text{A}/\text{V}$
+4 < V^+ < +5V	0.5	0.5	0.5	0.5	0.5	$\mu\text{A}/\text{V}$
+5 < V^+ < +15V	0.2	0.2	0.2	0.2	0.2	$\mu\text{A}/\text{V}$
+15 < V^+ < +30V	0.1	0.1	0.1	0.1	0.1	$\mu\text{A}/\text{V}$
Case Isolation to Either Lead	10^{10}	10^{10}	10^{10}	10^{10}	10^{10}	Ω
Effective Shunt Capacitance	100	100	100	100	100	pF
Electrical Turn-On Time (Note 1)	20	20	20	20	20	μs
Reverse Bias Leakage Current (Note 4)	10	10	10	10	10	pA
Power Supply Range	+4 to +30	+4 to +30	+4 to +30	+4 to +30	+4 to +30	V

- Notes**
- Does not include self heating effects.
 - Maximum deviation between +25°C reading after temperature cycling between -55°C and +150°C.
 - Conditions: Constant +5V, constant +125°C.
 - Leakage current doubles every +10°C.

TYPICAL APPLICATIONS



Typical Connection