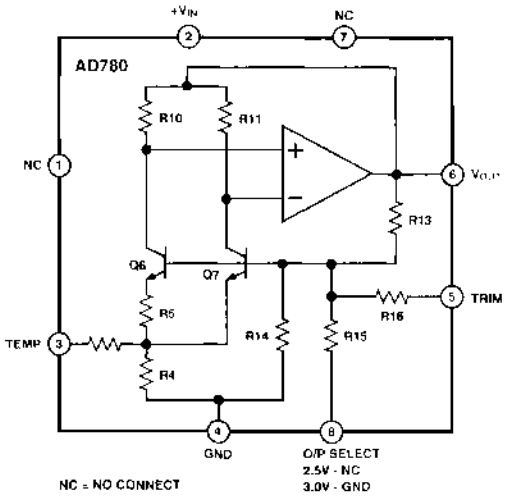
2.5 V/3.0 V High Precision Reference

AD780

FEATURES
Pin-Programmable 2.5 V or 3.0 V Output
Ultralow Drift: 3 ppm/°C max
High Accuracy: 2.5 V or 3.0 V ± 1 mV max
Low Noise: 100 nV/√Hz
Noise Reduction Capability
Low Quiescent Current: 1 mA max
Output Trim Capability
Plug-In Upgrade for Present References
Temperature Output Pin
Series or Shunt Mode Operation (±2.5 V, ±3.0 V)

FUNCTIONAL BLOCK DIAGRAM



PRODUCT DESCRIPTION

The AD780 is an ultrahigh precision bandgap reference voltage which provides a 2.5 V or 3.0 V output from inputs between 4.0 V and 36 V. Low initial error and temperature drift combined with low output noise and the ability to drive any value of capacitance make the AD780 the ideal choice for enhancing the performance of high resolution ADCs and DACs and for any general purpose precision reference application. A unique low headroom design facilitates a 3.0 V output from a 5.0 V ± 10% input, providing a 20% boost to the dynamic range of an ADC. over performance with existing 2.5 V references

The AD780 can be used to source or sink up to 10 mA and can be used in series or shunt mode, thus allowing positive or negative output voltages without external components. This makes it suitable for virtually any high performance reference application. Unlike some competing references, the AD780 has no "region of possible instability." The part is stable under all load conditions when a 1 μF bypass capacitor is used on the supply.

A temperature output pin is provided on the AD780. This provides an output voltage that varies linearly with temperature, allowing the AD780 to be configured as a temperature transducer while providing a stable 2.5 V or 3.0 V output.

The AD780 is a pin-compatible performance upgrade for the LT1019(A) 2.5 and the AD680. The latter is targeted toward low power applications.

The AD780 is available in two grades in plastic DIP, SOIC and cerdip packages. The AD780AN, AD780AR, AD780BN and AD780BR are specified for operation from −40°C to +85°C. The AD780SQ and AD780SQ/883B are specified for −55°C to +125°C operation.

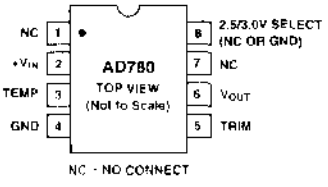
ORDERING GUIDE

Model	Initial Error	Temperature Coefficient	Temperature Range	Package Options*
AD780AN	5 mV	7 ppm/°C	−40°C to +85°C	N-8
AD780AR	5 mV	7 ppm/°C	−40°C to +85°C	SO-8
AD780BN	1 mV	3 ppm/°C	−40°C to +85°C	N-8
AD780BR	1 mV	3 ppm/°C	−40°C to +85°C	SO-8
AD780SQ	5 mV	20 ppm/°C	−55°C to +125°C	Q-8
AD780SQ/883B	5 mV	20 ppm/°C	−55°C to +125°C	Q-8

*For outline information, see Package Information section.

PIN CONFIGURATION

8-Pin Plastic DIP, SOIC and Cerdip Packages



AD780—SPECIFICATIONS (T_A = +25°C, V_{IN} = +5 V unless otherwise noted)

Parameter	AD780AN/AR/SQ Min	Typ	Max	AD780BN/HR Min	Typ	Max	Units
OUTPUT VOLTAGE							
2.5 V Out	2.495		2.505	2.499		2.501	Volts
3.0 V Out	2.995		3.005	2.999		3.001	Volts
OUTPUT VOLTAGE DRIFT[1]							
-40°C to +85°C			7			3	ppm/°C
55°C to +125°C			20				ppm/°C
LINE REGULATION							
2.5 V Output, 4 V ≤ $+V_{IN}$ ≤ 36 V							
T_{MIN} to T_{MAX}			10			*	μV/V
3.0 V Output, 4.5 V ≤ $+V_{IN}$ ≤ 36 V							
T_{MIN} to T_{MAX}			10			*	μV/V
LOAD REGULATION, SERIES MODE							
Sourcing 0 < I_{OUT} < 10 mA			50			*	μV/mA
T_{MIN} to T_{MAX}			75			*	μV/mA
Sinking -10 < I_{OUT} < 0 mA			75			*	μV/mA
-40°C to +85°C			75			*	μV/mA
55°C to +125°C			150			*	μV/mA
LOAD REGULATION, SHUNT MODE							
I < I_{SHUNT} < 10 mA			75			*	μV/mA
QUIESCENT CURRENT, 2.5 V SERIES MODE[2]							
-40°C to +85°C		0.75	1.0		*	*	mA
55°C to +125°C		0.8	1.3		*	*	mA
MINIMUM SHUNT CURRENT		0.7	1.0		*	*	mA
OUTPUT NOISE							
0.1 Hz to 10 Hz		4			*	*	μV p-p
Spectral Density, 100 Hz		100			*	*	nV/√Hz
LONG TERM STABILITY[3]		20			*		±ppm/1000 Hr
TRIM RANGE	4.0			*			±%
TEMPERATURE PIN							
Voltage Output @ 25°C	500	560	620	*	*	*	mV
Temperature Sensitivity		1.9			*		mV/°C
Output Resistance		3			*		kΩ
SHORT CIRCUIT CURRENT TO GROUND		30			*		mA
TEMPERATURE RANGE							
Specified Performance (A, B)	-40		+85	*		*	°C
Operating Performance (A, B)[4]	-55		+125	*		*	°C
Specified Performance (S)	-55		+125	*		*	°C
Operating Performance (S)	-55		+125	*		*	°C

NOTES

[1]Maximum output voltage drift is guaranteed for all packages.

[2]3.0 V mode typically adds 100 μA to the quiescent current. Also, Iq increases by 2 μA/V above an input voltage of 5 V.

[3]The long term stability specification is noncumulative. The drift in subsequent 1000 hr. periods is significantly lower than in the first 1000 hr. period.

[4]The operating temperature range is defined as the temperature extremes at which the device will still function. Parts may deviate from their specified performance outside their specified temperature range.

*Same as AD780AN/AR/SQ specification.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS*

V_{IN} to Ground . . . . . 36 V
Trim Pin to Ground . . . . . 36 V
Temp Pin to Ground . . . . . 36 V
Power Dissipation (25°C) . . . . . 500 mW
Storage Temperature . . . . . -65°C to +150°C
Lead Temperature (Soldering, 10 sec) . . . . . 300°C
Output Protection: Output safe for indefinite short to ground and momentary short to V_{IN}.
ESD Classification . . . . . Class 1 (1000 V)

*Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any conditions above those indicated in the operational specifications is not implied. Exposure to absolute maximum specifications for extended periods may affect device reliability.

CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the AD780 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.