

FEATURES

- Laser trimmed to high accuracy**
10.000 V \pm 5 mV (U grade)
- Trimmed temperature coefficient**
5 ppm/ $^{\circ}$ C maximum (U grade)
- Noise-reduction capability**
- Low quiescent current: 4 mA maximum**
- Output trim capability**
- MIL-STD-883-compliant versions available**

GENERAL DESCRIPTION

The AD587 represents a major advance in state-of-the-art monolithic voltage references. Using a proprietary ion-implanted buried Zener diode and laser wafer trimming of high stability thin-film resistors, the AD587 provides outstanding performance at low cost.

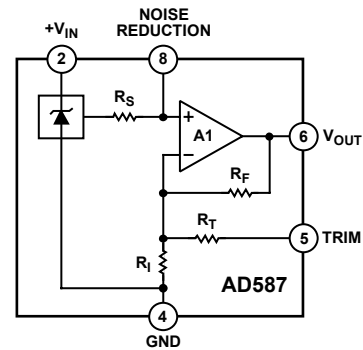
The AD587 offers much higher performance than most other 10 V references. Because the AD587 uses an industry-standard pinout, many systems can be upgraded instantly with the AD587.

The buried Zener approach to reference design provides lower noise and drift than band gap voltage references. The AD587 offers a noise-reduction pin that can be used to further reduce the noise level generated by the buried Zener.

The AD587 is recommended for use as a reference for 8-bit, 10-bit, 12-bit, 14-bit, or 16-bit DACs that require an external precision reference. The device is also ideal for successive approximation or integrating ADCs with up to 14 bits of accuracy. In general, it offers better performance than standard on-chip references.

The AD587J and AD587K are specified for operation from 0 $^{\circ}$ C to 70 $^{\circ}$ C, and the AD587U is specified for operation from -55 $^{\circ}$ C to +125 $^{\circ}$ C. The AD587JQ and AD587UQ models are available in 8-lead CERDIP. Other models are available in an 8-lead SOIC package for surface-mount applications, or in an 8-lead PDIP.

FUNCTIONAL BLOCK DIAGRAM



NOTE
PIN 1, PIN 3, AND PIN 7 ARE INTERNAL TEST POINTS. NO CONNECTIONS TO THESE POINTS.

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Figure 1.

PRODUCT HIGHLIGHTS

1. Laser trimming of both initial accuracy and temperature coefficients. This laser trimming results in very low errors over temperature without the use of external components. The AD587U guarantees \pm 14 mV maximum total error between -55 $^{\circ}$ C and +125 $^{\circ}$ C.
2. Optional fine trim connection. This connection is designed for applications requiring higher precision.
3. Instant upgrade of any system using an industry-standard pinout 10 V reference.
4. Very low output noise. AD587 output noise is typically 4 μ V p-p. A noise-reduction pin is provided for additional noise filtering using an external capacitor.
5. MIL-STD-883-compliant versions available. Refer to the Analog Devices *Military/Aerospace Reference Manual* for detailed specifications.

SPECIFICATIONS

$T_A = 25^\circ\text{C}$, $V_{IN} = 15\text{ V}$, unless otherwise noted.

Table 1.

Parameter	AD587J			AD587K			AD587U			Unit
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
OUTPUT VOLTAGE	9.990		10.010	9.995		10.005	9.995		10.005	V
OUTPUT VOLTAGE DRIFT ¹										
0°C to 70°C			20			10			5	ppm/ $^\circ\text{C}$
-55°C to $+125^\circ\text{C}$			20			10			5	ppm/ $^\circ\text{C}$
GAIN ADJUSTMENT	+3			+3			+3			%
	-1			-1			-1			%
LINE REGULATION ¹										
$13.5\text{ V} \leq +V_{IN} \leq 36\text{ V}$										
T_{MIN} to T_{MAX}			± 100			± 100			± 100	$\mu\text{V}/\text{V}$
LOAD REGULATION ¹										
Sourcing $0\text{ mA} < I_{OUT} < 10\text{ mA}$										
T_{MIN} to T_{MAX}			± 100			± 100			± 100	$\mu\text{V}/\text{mA}$
Sourcing $-10\text{ mA} < I_{OUT} < 0\text{ mA}$ ²										
T_{MIN} to T_{MAX}			± 100			± 100			± 100	$\mu\text{V}/\text{mA}$
QUIESCENT CURRENT		2	4		2	4		2	4	mA
POWER DISSIPATION		30			30			30		mW
OUTPUT NOISE										
0.1 Hz to 10 Hz		4			4			4		μV p-p
Spectral Density, 100 Hz		100			100			100		$\text{nV}/\sqrt{\text{Hz}}$
LONG-TERM STABILITY		± 15			± 15			± 15		ppm/1000 hr
SHORT-CIRCUIT CURRENT-TO-GROUND		30	70		30	70		30	70	mA
SHORT-CIRCUIT CURRENT-TO- $+V_{IN}$		30	70		30	70		30	70	mA
TEMPERATURE RANGE										
Specified Performance (J, K)	0		70	0		70	0		70	$^\circ\text{C}$
Operating Performance (J, K) ³	-40		+85	-40		+85	-40		+85	$^\circ\text{C}$
Specified Performance (U)	-55		+125	-55		+125	-55		+125	$^\circ\text{C}$
Operating Performance (U) ³	-55		+125	-55		+125	-55		+125	$^\circ\text{C}$

¹ Specification is guaranteed for all packages and grades. CERDIP-packaged parts are 100% production tested.

² Load regulation (sinking) specification for SOIC (R-8) package is $\pm 200\ \mu\text{V}/\text{mA}$.

³ 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.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
+V _{IN} to Ground	36 V
Power Dissipation (25°C)	500 mW
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 sec)	300°C
Package Thermal Resistance	
θ _{JC}	22°C/W
θ _{JA}	110°C/W
Output Protection	
Short to Ground	Indefinite ¹
Short to +V _{IN}	Momentary ¹

¹ Period for which output is safe.

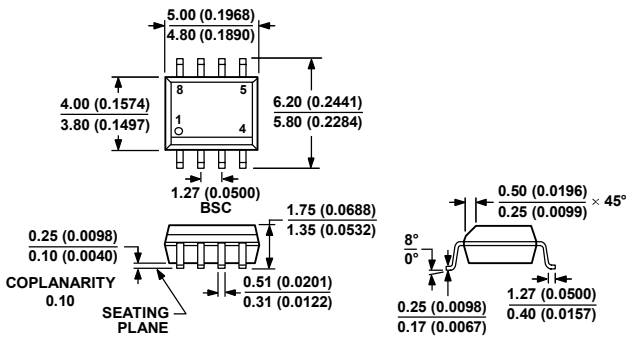
Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute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

ESD CAUTION



ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

OUTLINE DIMENSIONS

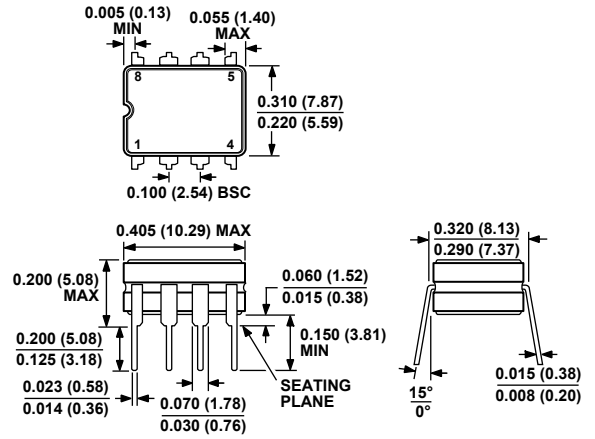


COMPLIANT TO JEDEC STANDARDS MS-012-AA

CONTROLLING DIMENSIONS ARE IN MILLIMETERS; INCH DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF MILLIMETER EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN.

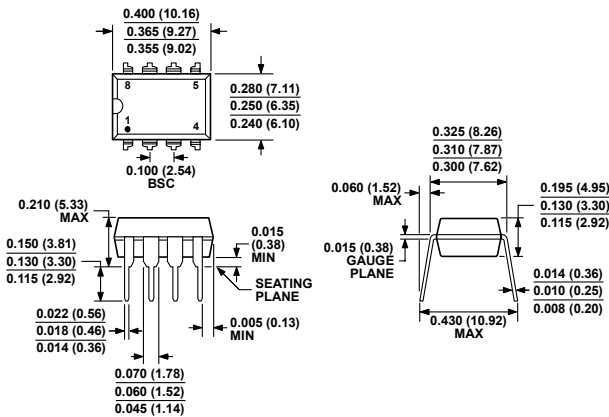
Figure 23. 8-Lead Standard Small Outline Package [SOIC_N] Narrow Body (R-8)
Dimensions shown in millimeters and (inches)

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CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN.

Figure 25. 8-Lead Ceramic Dual In-Line Package [CERDIP] (Q-8)
Dimensions shown in inches and (millimeters)



COMPLIANT TO JEDEC STANDARDS MS-001

CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN. CORNER LEADS MAY BE CONFIGURED AS WHOLE OR HALF LEADS.

Figure 24. 8-Lead Plastic Dual In-Line Package [PDIP] Narrow Body (N-8)
Dimensions shown in inches and (millimeters)

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AD587

ORDERING GUIDE

Model	Initial Error	Temperature Coefficient	Temperature Range	Package Description	Package Option
AD587JQ	10 mV	20 ppm/°C	0°C to 70°C	8-Lead CERDIP	Q-8
AD587JR	10 mV	20 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587JR-REEL	10 mV	20 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587JR-REEL7	10 mV	20 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587JRZ ¹	10 mV	20 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587JRZ-REEL ¹	10 mV	20 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587JRZ-REEL7 ¹	10 mV	20 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587JN	10 mV	20 ppm/°C	0°C to 70°C	8-Lead PDIP	N-8
AD587JNZ ¹	10 mV	20 ppm/°C	0°C to 70°C	8-Lead PDIP	N-8
AD587KR	5 mV	10 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587KR-REEL	5 mV	10 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587KR-REEL7	5 mV	10 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587KRZ ¹	5 mV	10 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587KRZ-REEL ¹	5 mV	10 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587KRZ-REEL7 ¹	5 mV	10 ppm/°C	0°C to 70°C	8-Lead SOIC_N	R-8
AD587KN	5 mV	10 ppm/°C	0°C to 70°C	8-Lead PDIP	N-8
AD587KNZ ¹	5 mV	10 ppm/°C	0°C to 70°C	8-Lead PDIP	N-8
AD587UQ	5 mV	5 ppm/°C	-55°C to +125°C	8-Lead CERDIP	Q-8

¹ Z = RoHS Compliant Part.