High Precision 5 V Reference

AD586

FEATURES

Laser trimmed to high accuracy
5.000 V ±2.0 mV (M grade)
Trimmed temperature coefficient
2 ppm/°C max, 0°C to 70°C (M grade)
5 ppm/°C max, −40°C to +85°C (B and L grades)
10 ppm/°C max, −55°C to +125°C (T grade)
Low noise, 100 nV/√Hz
Noise reduction capability
Output trim capability
MIL-STD-883-compliant versions available
Industrial temperature range SOICs available
Output capable of sourcing or sinking 10 mA

GENERAL DESCRIPTION

The AD586 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 AD586 provides outstanding performance at low cost.

The AD586 offers much higher performance than most other 5 V references. Because the AD586 uses an industry-standard pinout, many systems can be upgraded instantly with the AD586.

The buried Zener approach to reference design provides lower noise and drift than band gap voltage references. The AD586 offers a noise reduction pin that can be used to further reduce the noise level generated by the buried Zener.

The AD586 is recommended for use as a reference for 8-, 10-, 12-, 14-, 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 and, in general, can offer better performance than the standard on-chip references.

The AD586J, AD586K, AD586L, and AD586M are specified for operation from 0°C to 70°C; the AD586A and AD586B are specified for −40°C to +85°C operation; and the AD586S and AD586T are specified for −55°C to +125°C operation.

The AD586J, AD586K, AD586L, and AD586M are available in an 8-lead PDIP; the AD586J, AD586K, AD586L, AD586A, and AD586B are available in an 8-lead SOIC package; and the AD586J, AD586K, AD586L, AD586S, and AD586T are available in an 8-lead CERDIP package.

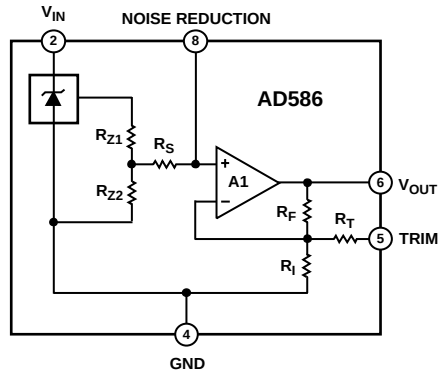


Figure 1.

PRODUCT HIGHLIGHTS

1. Laser trimming of both initial accuracy and temperature coefficients results in very low errors over temperature without the use of external components. The AD586M has a maximum deviation from 5.000 V of ±2.45 mV between 0°C and 70°C, and the AD586T guarantees ±7.5 mV maximum total error between −55°C and +125°C.

2. For applications requiring higher precision, an optional fine-trim connection is provided.

3. Any system using an industry-standard pinout reference can be upgraded instantly with the AD586.

4. Output noise of the AD586 is very low, typically 4 µV p-p. A noise reduction pin is provided for additional noise filtering using an external capacitor.

5. The AD586 is available in versions compliant with MIL-STD-883. Refer to the Analog Devices Military Products Databook or the current AD586/883B data sheet for detailed specifications.

SPECIFICATIONS

AD586J, AD586K/AD586A, AD586L/AD586B

@ T_A = 25°C, V_{IN} = 15 V, unless otherwise noted. Specifications in **boldface** are tested on all production units at final electrical test. Results from those tests are used to calculate outgoing quality levels. All minimum and maximum specifications are guaranteed, although only those shown in **boldface** are tested on all production units, unless otherwise specified.

Table 1.

	AD586J			AD586K/AD586A			AD586L/AD586B			
Parameter	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
OUTPUT VOLTAGE	4.980		5.020	4.995		5.005	4.9975		5.0025	V
OUTPUT VOLTAGE DRIFT[1]										
0°C to 70°C			25			15			5	ppm/°C
−55°C to +125°C										ppm/°C
GAIN ADJUSTMENT	**+6**			**+6**			**+6**			%
	−2			−2			−2			%
LINE REGULATION[1]										
10.8 V < + V_{IN} < 36 V										
T_{MIN} to T_{MAX}			**±100**			**±100**			**±100**	µV/V
11.4 V < +V_{IN} < 36 V										
T_{MIN} to T_{MAX}										µV/V
LOAD REGULATION[1]										
Sourcing 0 mA < I_{OUT} < 10 mA										
25°C			**100**			**100**			**100**	µV/mA
T_{MIN} to T_{MAX}			**100**			**100**			**100**	µV/mA
Sinking −10 mA < I_{OUT} < 0 mA										
25°C			**400**			**400**			**400**	µV/mA
QUIESCENT CURRENT		2	**3**		2	**3**		2	**3**	mA
POWER CONSUMPTION		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		nV/√Hz
LONG-TERM STABILITY		15			15			15		ppm/1000 hr
SHORT-CIRCUIT CURRENT-TO-GROUND		45	**60**		45	**60**		45	**60**	mA
TEMPERATURE RANGE										
Specified Performance[2]	0		70	0	(K grade)	70	0	(L grade)	70	°C
				−40	(A grade)	+85	−40	(B grade)	+85	°C
Operating Performance[3]	−40		+85	−40		+85	−40		+85	°C

[1] Maximum output voltage drift is guaranteed for all packages and grades. CERDIP packaged parts are also 100°C production tested.
[2] Lower row shows specified performance for A and B grades.
[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.

AD586M, AD586S, AD586T

@ T_A = 25°C, V_{IN} = 15 V, unless otherwise noted. Specifications in **boldface** are tested on all production units at final electrical test. Results from those tests are used to calculate outgoing quality levels. All minimum and maximum specifications are guaranteed, although only those shown in **boldface** are tested on all production units, unless otherwise specified.

Table 2.

	AD586M			AD586S			AD586T			
Parameter	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
OUTPUT VOLTAGE	4.998		5.002	4.990		5.010	4.9975		5.0025	V
OUTPUT VOLTAGE DRIFT[1]										
0°C to 70°C			2							ppm/°C
−55°C to +125°C						20			10	ppm/°C
GAIN ADJUSTMENT	**+6**			**+6**			**+6**			%
	−2			−2			−2			%
LINE REGULATION[1]										
10.8 V < +V_{IN} < 36 V										
T_{MIN} to T_{MAX}			**±100**							µV/V
11.4 V < +V_{IN} < 36 V										
T_{MIN} to T_{MAX}						**±150**			**±150**	µV/V
LOAD REGULATION[1]										
Sourcing 0 mA < I_{OUT} < 10 mA										
25°C			**100**			**150**			**150**	µV/mA
T_{MIN} to T_{MAX}			**100**			**150**			**150**	µV/mA
Sinking −10 mA < I_{OUT} < 0 mA										
25°C			**400**			**400**			**400**	µV/mA
QUIESCENT CURRENT		2	**3**		2	**3**		2	**3**	mA
POWER CONSUMPTION		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		nV/√Hz
LONG-TERM STABILITY		15			15			15		ppm/1000 hr
SHORT-CIRCUIT CURRENT-TO-GROUND		45	**60**		45	**60**		45	**60**	mA
TEMPERATURE RANGE										
Specified Performance[2]	0		70	−55		+125	−55		+125	°C
Operating Performance[3]	−40		+85	−55		+125	−55		+125	°C

[1] Maximum output voltage drift is guaranteed for all packages and grades. CERDIP packaged parts are also 100°C production tested.
[2] Lower row shows specified performance for A and B grades.
[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 3.

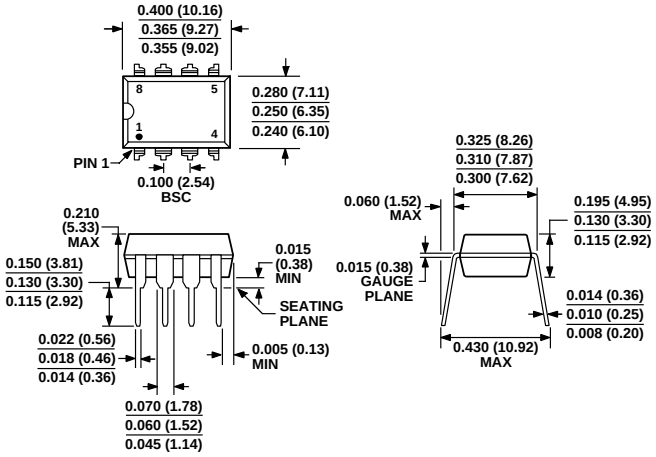
Parameter	Rating
V_{IN} to Ground	36 V
Power Dissipation (25°C)	500 mW
Storage Temperature	−65°C to +150°C
Lead Temperature (Soldering, 10 sec)	300°C
Package Thermal Resistance	
θ_{JC}	22°C/W
θ_{JA}	110°C/W
Output Protection	Output safe for indefinite short to ground or V_{IN}.

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

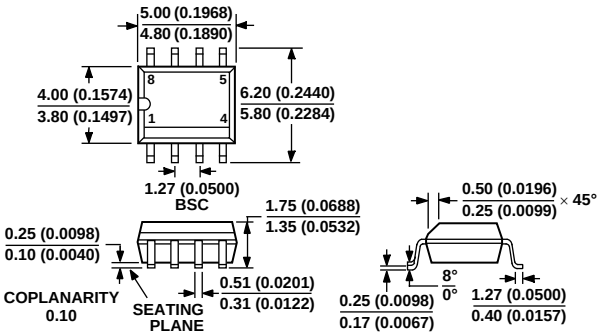
ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to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

OUTLINE DIMENSIONS



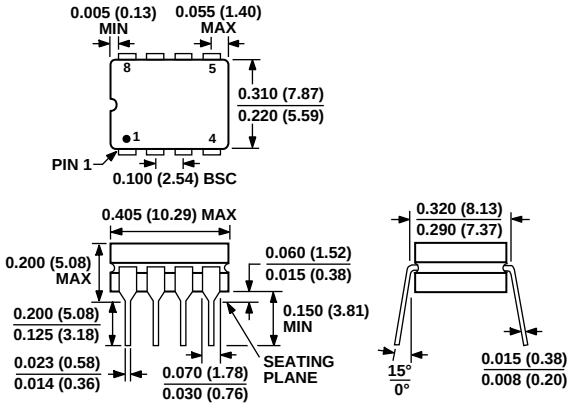
COMPLIANT TO JEDEC STANDARDS MS-001-BA
CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN. CORNER LEADS MAY BE CONFIGURED AS WHOLE OR HALF LEADS.

Figure 26. 8-Lead Plastic Dual In-Line Package [PDIP]
(N-8)
Dimensions shown in inches and (millimeters)



COMPLIANT TO JEDEC STANDARDS MS-012AA
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 28. 8-Lead Standard Small Outline Package [SOIC]
Narrow Body
(R-8)
Dimensions shown in millimeters and (inches)



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 27. 8-Lead Ceramic Dual In-Line Package [CERDIP]
(Q-8)
Dimensions shown in inches and (millimeters)

ORDERING GUIDE

Model	Initial Error	Temperature Coefficient	Temperature Range	Package Description	Package Option	Quantity Per Reel
AD586JN	20 mV	25 ppm/°C	0°C to 70°C	PDIP	N-8	
AD586JNZ[1]	20 mV	25 ppm/°C	0°C to 70°C	PDIP	N-8	
AD586JQ	20 mV	25 ppm/°C	0°C to 70°C	CERDIP	Q-8	
AD586JR	20 mV	25 ppm/°C	0°C to 70°C	SOIC	R-8	
AD586JR-REEL7	20 mV	25 ppm/°C	0°C to 70°C	SOIC	R-8	1,000
AD586JRZ[1]	20 mV	25 ppm/°C	0°C to 70°C	SOIC	R-8	
AD586JRZ-REEL7[1]	20 mV	25 ppm/°C	0°C to 70°C	SOIC	R-8	1,000
AD586KN	5 mV	15 ppm/°C	0°C to 70°C	PDIP	N-8	
AD586KNZ[1]	5 mV	15 ppm/°C	0°C to 70°C	PDIP	N-8	
AD586KQ	5 mV	15 ppm/°C	0°C to 70°C	CERDIP	Q-8	
AD586KR	5 mV	15 ppm/°C	0°C to 70°C	SOIC	R-8	
AD586KR-REEL	5 mV	15 ppm/°C	0°C to 70°C	SOIC	R-8	2,500
AD586KR-REEL7	5 mV	15 ppm/°C	0°C to 70°C	SOIC	R-8	1,000
AD586KRZ[1]	5 mV	15 ppm/°C	0°C to 70°C	SOIC	R-8	
AD586KRZ-REEL[1]	5 mV	15 ppm/°C	0°C to 70°C	SOIC	R-8	2,500
AD586KRZ-REEL7[1]	5 mV	15 ppm/°C	0°C to 70°C	SOIC	R-8	1,000
AD586LN	2.5 mV	5 ppm/°C	0°C to 70°C	PDIP	N-8	
AD586LNZ[1]	2.5 mV	5 ppm/°C	0°C to 70°C	PDIP	N-8	
AD586LR	2.5 mV	5 ppm/°C	0°C to 70°C	SOIC	R-8	
AD586LR-REEL	2.5 mV	5 ppm/°C	0°C to 70°C	SOIC	R-8	2,500
AD586LR-REEL7	2.5 mV	5 ppm/°C	0°C to 70°C	SOIC	R-8	1,000
AD586LRZ[1]	2.5 mV	5 ppm/°C	0°C to 70°C	SOIC	R-8	
AD586LRZ-REEL[1]	2.5 mV	5 ppm/°C	0°C to 70°C	SOIC	R-8	2,500
AD586LRZ-REEL7[1]	2.5 mV	5 ppm/°C	0°C to 70°C	SOIC	R-8	1,000
AD586MN	2 mV	2 ppm/°C	0°C to 70°C	PDIP	N-8	
AD586MNZ[1]	2 mV	2 ppm/°C	0°C to 70°C	PDIP	N-8	
AD586AR	5 mV	15 ppm/°C	−40°C to +85°C	SOIC	R-8	
AD586AR-REEL	5 mV	15 ppm/°C	−40°C to +85°C	SOIC	R-8	2,500
AD586ARZ[1]	5 mV	15 ppm/°C	−40°C to +85°C	SOIC	R-8	
AD586ARZ-REEL[1]	5 mV	15 ppm/°C	−40°C to +85°C	SOIC	R-8	2,500
AD586ARZ-REEL7[1]	5 mV	15 ppm/°C	−40°C to +85°C	SOIC	R-8	1,000
AD586BR	2.5 mV	5 ppm/°C	−40°C to +85°C	SOIC	R-8	
AD586BR-REEL7	2.5 mV	5 ppm/°C	−40°C to +85°C	SOIC	R-8	1,000
AD586BRZ[1]	2.5 mV	5 ppm/°C	−40°C to +85°C	SOIC	R-8	
AD586BRZ-REEL[1]	2.5 mV	5 ppm/°C	−40°C to +85°C	SOIC	R-8	2,500
AD586BRZ-REEL7[1]	2.5 mV	5 ppm/°C	−40°C to +85°C	SOIC	R-8	1,000
AD586LQ	2.5 mV	5 ppm/°C	0°C to 70°C	CERDIP	Q-8	
AD586SQ	10 mV	20 ppm/°C	−55°C to +125°C	CERDIP	Q-8	
AD586TQ	2.5 mV	10 ppm/°C	−55°C to +125°C	CERDIP	Q-8	
AD586TQ/883B[2]	2.5 mV	10 ppm/°C	−55°C to +125°C	CERDIP	Q-8	

[1] Z = Pb-free part.
[2] For details on grade and package offerings screened in accordance with MIL-STD-883, refer to the Analog Devices Military Products Databook or the current AD586/883B data sheet.