Advanced Monolithic Systems

AMSREF-02

+5V PRECISION VOLTAGE REFERENCE

FEATURES

- **5 Volt Output …….…….. ± 0.3% Max**
- **Temperature Voltage Output …….. 2.1mV/°C**
- **Adjustment Range …… ± 3% Min**
- **Excellent Temperature Stability…… 8.5ppm/°C**
- **Low Noise …….. 15µV_{P-P} Max**
- **Low Supply Current ……. 650µA Typ**
- **Wide Input Voltage Range ……. 7V to 40V**
- **High Load-Driving Capability**
- **No External Components**
- **Short -Circuit Proof**

APPLICATIONS

- **A/D, D/A Converters**
- **Portable Instrumentation**
- **Digital Voltmeters**
- **Current Sources**

GENERAL DESCRIPTION

The AMSREF-02 is a precision voltage reference, which provides a stable +5V, which can be adjusted over a ± 6% range with minimal effect on temperature stability. Careful design of this device improved its bandgap and as a result excellent temperature stability is achieved. The operating supply range is 7V to 40V with a typical current drain of 650µA.
Low cost, low noise and low power makes the AMSREF-02 an excellent choice whenever a stable voltage reference is required. Applications include D/A and A/D converters, portable instrumentation and digital voltmeters. The versatility of AMSREF-02 is enhanced by its use as a monolithic temperature transducer.

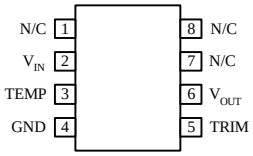
The AMSREF-02 is operational in the full industrial temperature range of -40°C to 85°C and is available in the 8 lead SOIC and plastic dip (PDIP) packages.

ORDERING INFORMATION:

TOL.	PACKAGE TYPE		OPERATING TEMPERATURE RANGE
	8 LEAD SOIC	8 LEAD PDIP	
±15mV	AMSREF-02ES	AMSREF-02EP	-40 to 85° C
±25mV	AMSREF-02HS	AMSREF-02HP	-40 to 85° C
±50mV	AMSREF-02CS	AMSREF-02CP	-40 to 85° C

PIN CONNECTIONS

8L SOIC/ 8L PDIP



Top View

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ABSOLUTE MAXIMUM RATINGS (Note1)

Input Voltage	40V	Storage temperature	-65°C to +125°C
Output Short Circuit Duration		Soldering information (60 sec)	300°C
(to Ground or V_{IN})	Indefinite	Thermal Resistance	
Operating Temperature Range	-40°C to 85°C	8 L SOIC	160°C/W
Junction Temperature	-65°C to +150°C	8 L PDIP	110°C/W

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at V_{IN} =+15V and T_A = +25°C unless otherwise specified.

Parameter	Conditions	AMSREF-02E			AMSREF-02 H			AMSREF-02 C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Output Voltage	I_L = 0	4.985	5.000	5.015	4.975	5.000	5.025	4.950	5.000	5.050	V
Output Adjustment Range	R_P =10kΩ	± 3.0	± 6.0		± 3.0	± 6.0		± 2.7	± 6.0		%
Output Voltage Noise	0.1Hz to 10Hz		10	15		10	15		12	18	μV_{P-P}
Line Regulation (Note 5)	V_{IN} = 8V to 33V		0.006	0.010		0.006	0.010		0.009	0.015	% V
Load Regulation (Note 5)	I_L = 0 to 10 mA,		0.005	0.010		0.006	0.010		0.006	0.015	% mA
Turn-on Setting Time	T_O ± 0.1% of final value		5			5			5		µs
Quiescent Supply Current	No Load		0.65	1.0		0.65	1.0		0.65	1.0	mA
Load Current		10	21		10	21		8	21		mA
Sink Current	(Note 6)	-5	-10		-5	-10		-5	-10		mA
Short Circuit Current	V_O = 0		30			30			30		mA
Temperature Voltage Output	(Note 7)		630			630			630		mV

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at V_{IN}= 15, I_L = 0mA, and -40°C ≤ T_A ≤ +85°C unless otherwise specified.

Parameter	Conditions	AMSREF-02E			AMSREF-02 H			AMSREF-02 C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Output Voltage Change with Temp.	(Notes 2,3)		0.02	0.06		0.07	0.17		0.14	0.45	%
Output Voltage Temp. Coefficient	(Note 4)		3	8.5		10	25		20	65	ppm/°C
Change in V_O Temp. Coefficient with Output Adjustment	R_L = 10kΩ		0.7			0.7			0.7		ppm/°C
Line Regulation (Note 5)	V_{IN} = 8V to 33V		0.007	0.012		0.007	0.012		0.011	0.018	% V
Load Regulation (Note 5)	I_L = 0 to 8 mA,		0.006	0.010		0.007	0.012		0.008	0.018	% mA
Temperature Voltage Output Temperature Coefficient	(Note 7)		2.1			2.1			2.1		mV/°C

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed.

Note 2: The output voltage change with temperature (ΔV_{OT}) is defined as the absolute difference between the maximum output voltage and the minimum output voltage over the specified temperature range expressed as a percentage of 5V:

$$\Delta V_{OT} = [(V_{MAX} - V_{MIN})/ 5V] \times 100$$

Note 3: ΔV_{OT} specification applies trimmed to +5.000V or untrimmed

Note 4: TCV_O is defined as ΔV_{OT} divided by the temperature range: TCV_O (-40°C to +85°C)= [ΔV_{OT} (-40°C to +85°C)] / 125°C

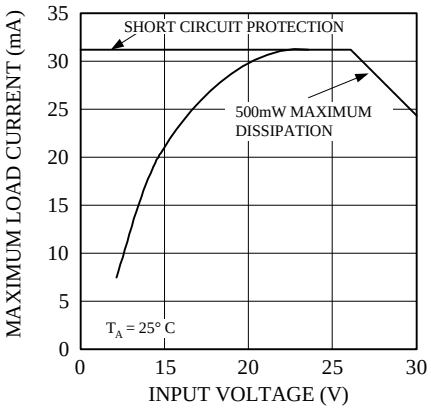
Note 5: Line and Load Regulation specifications include the effect of self heating.

Note 6: During sink current test, the device meets the output voltage specified.

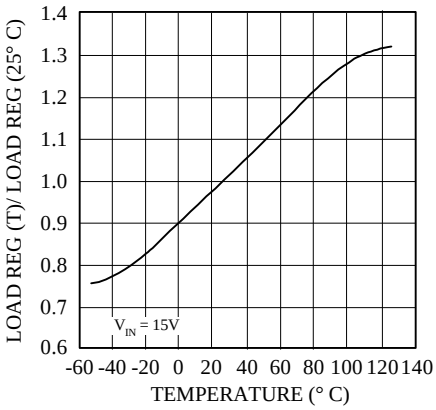
Note 7: Limit current in or out of pin 3 to 50nA and capacitance on pin 3 to 30pF.

TYPICAL PERFORMANCE CHARACTERISTICS

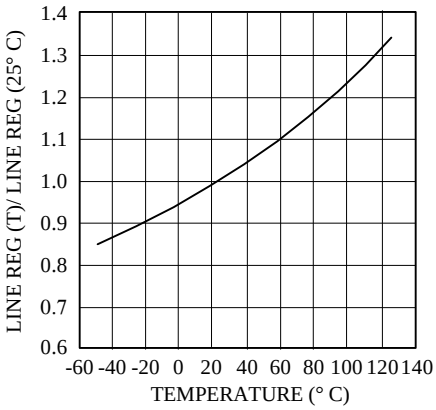
Maximum Load Current vs Input Voltage



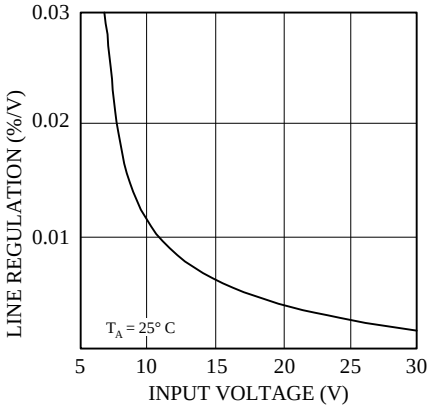
Normalized Load Regulation (ΔI_L = 10mA) vs Temperature



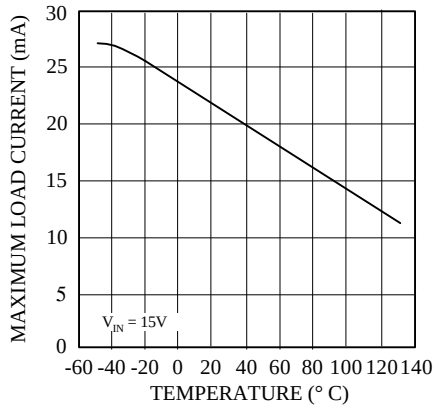
Normalized Line Regulation vs Temperature



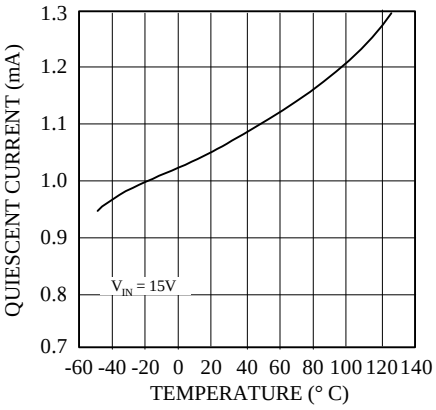
Line Regulation vs Supply Voltage



Maximum Load Current vs Temperature

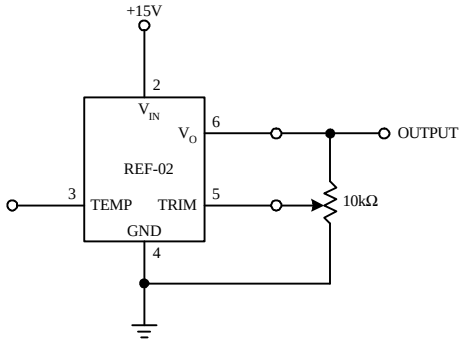


Quiescent Current vs Temperature



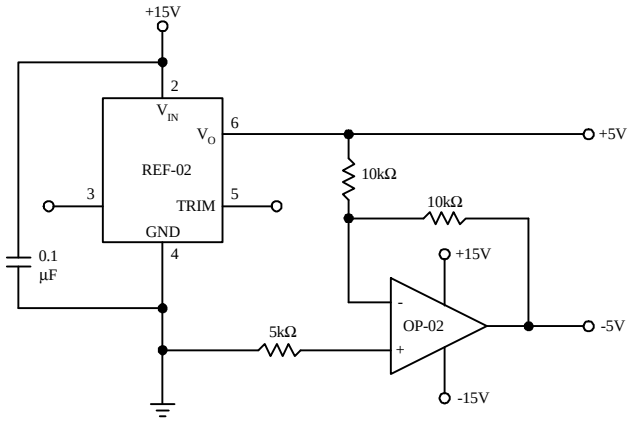
OUTPUT ADJUSTMENT

The REF-02 trim terminal can be used to adjust the 5 Volt output voltage ± 300mV. This feature allows the system designer to trim system errors by setting the reference to a voltage other than 5V. The system can also be set exactly 5.000V, or to 5.12V for binary applications.
Adjustment of the output does not significantly affect the temperature performance of the device. The temperature coefficient change is approximately 0.7ppm/°C for 100mV of output adjustment.



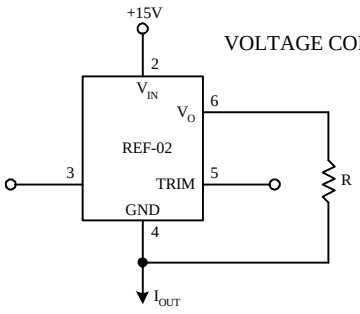
TYPICAL APPLICATIONS

± 5V Reference



Supply Bypassing
For best results, it is recommended that the power supply pin is bypassed with a 0.1µF disk ceramic capacitor.

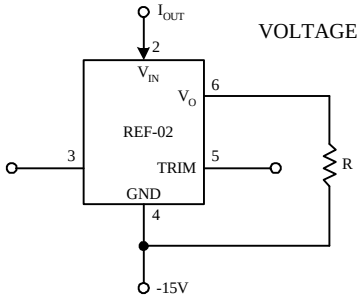
Current Source



VOLTAGE COMPLIANCE: -25V TO +8V

I_{OUT}= (5.0V/R)+1mA

Current Sink

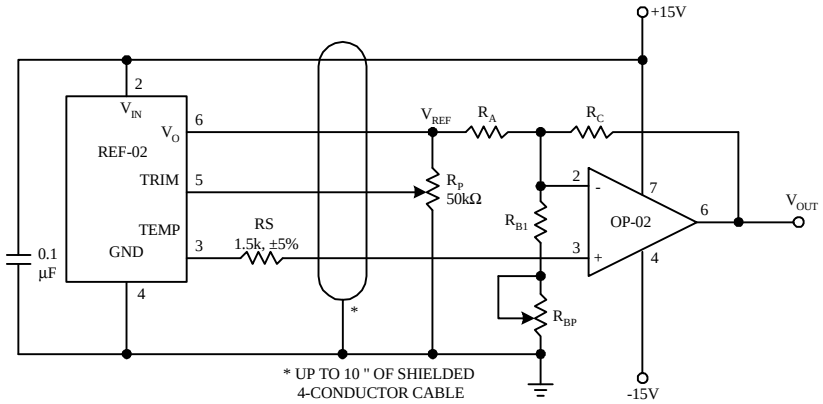


VOLTAGE COMPLIANCE: -8V TO +25V

I_{OUT}= (5.0V/R)+1mA

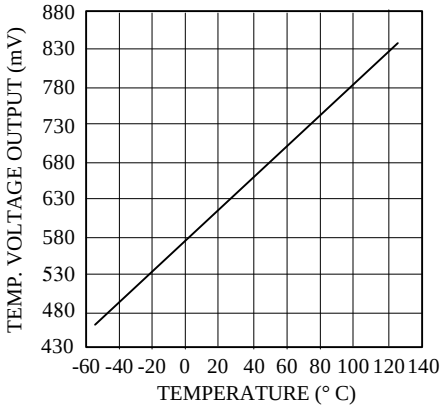
TYPICAL APPLICATIONS (Continued)

Precision Temperature Transducer with Remote Sensor



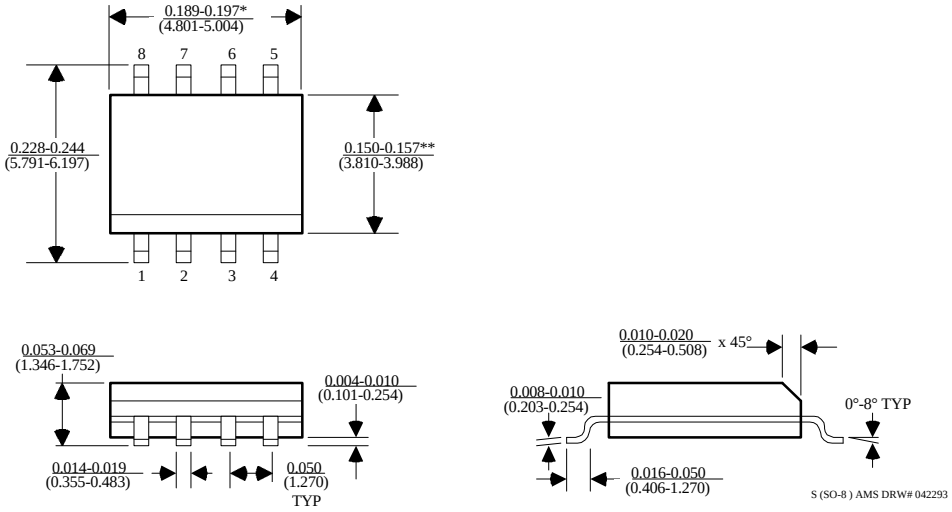
RESISTOR VALUES		
TCV_{OUT} SLOPE(S)	10mV/°C	100mV/°C
TEMPERATURE RANGE	-40°C to +85°C	-40°C to +85°C
OUTPUT VOLTAGE RANGE	-0.40V to +0.85V	-0.40V to +0.85V
ZERO SCALE	0V @ 0°C	0V @ 0°C
R_A (± 1% resistor)	9.09kΩ	15kΩ
R_{B1}(± 1% resistor)	1.5kΩ	1.82kΩ
R_{BP} (Potentiometer)	200kΩ	500kΩ
R_C (± 1% resistor)	5.11kΩ	84.5kΩ

Typical Temperature Voltage Output vs Temperature



PACKAGE DIMENSIONS inches (millimeters) unless otherwise noted.

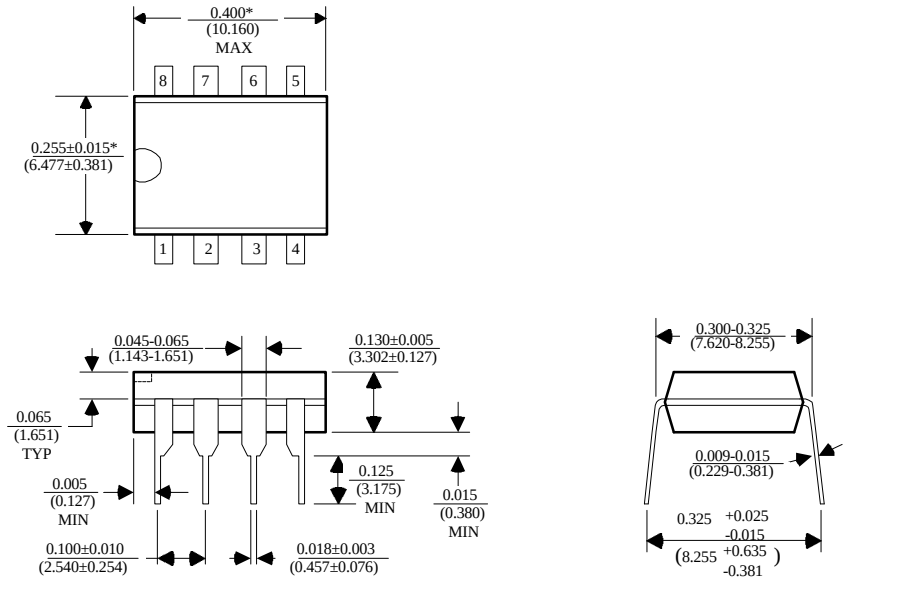
8 LEAD SOIC PLASTIC PACKAGE (S)



*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

8 LEAD PLASTIC DIP PACKAGE (P)



*DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTUSIONS. MOLD FLASH OR PROTUSIONS SHALL NOT EXCEED 0.010" (0.254mm)