

# **REF1004**

# 1.2V and 2.5V Micropower VOLTAGE REFERENCE

## **FEATURES**

- INITIAL ACCURACY: REF1004-1.2 ±4mV REF1004-2.5 ±20mV
- MINIMUM OPERATING CURRENT: REF1004-1.2 10μA REF1004-2.5 20μA
- EXCELLENT LONG TERM TEMPERATURE STABILITY
- VERY LOW DYNAMIC IMPEDANCE
- OPERATES UP TO 20mA
- PACKAGE: 8-Lead SOIC

### **APPLICATIONS**

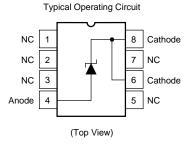
- BATTERY POWERED TEST EQUIPMENT
- PORTABLE MEDICAL INSTRUMENTATION
- PORTABLE COMMUNICATIONS DEVICES
- A/D AND D/A CONVERTERS
- NOTEBOOK AND PALMTOP COMPUTERS

### DESCRIPTION

The REF1004-1.2 and REF1004-2.5 are two terminal bandgap reference diodes designed for high accuracy with outstanding temperature characteristics at low operating currents. Prior to the introduction of the REF1004 Micropower Voltage References, accuracy and stability specifications could only be attained by expensive screening of standard devices. The REF1004 is a cost effective solution when reference voltage accuracy, low power, and long term temperature stability are required.

REF1004 is a drop-in replacement for the LT1004 as well as an upgraded replacement of the LM185/385 series references. The REF1004C is characterized for operation from 0°C to 70°C and the REF1004I is characterized for operation from –40°C to +85°C.

The REF1004 is offered in an 8-lead Plastic SOIC package and shipped in anti-static rails or tape and reel.



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## **SPECIFICATIONS**

#### **ELECTRICAL**

 $T_A = +25^{\circ}C$  unless otherwise noted.

			REF1004-1.2		REF1004-2.5			
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
REFERENCE VOLTAGE REF1004C <sup>(1)</sup> REF1004I <sup>(2)</sup>	I <sub>R</sub> = 100μA	1.231 1.229 1.225	1.235 1.235 1.235	1.239 1.239 1.239	2.490 2.487 2.480	2.500 2.500 2.500	2.511 2.511 2.511	V
AVERAGE TEMPERATURE COEFFICIENT	$I_{MIN} \le I_R \le 20 \text{mA}$		20			20		ppm/°C
MINIMUM OPERATION CURRENT <sup>(3)</sup>			8	10		12	20	μА
REVERSE BREAKDOWN VOLTAGE CHANGE WITH CURRENT	$I_{MIN} \le I_R \le 1mA$ $1mA \le I_R \le 20mA$			1 1.5 <sup>(3)</sup> 10 20 <sup>(3)</sup>			1 1.5 <sup>(3)</sup> 10 20 <sup>(3)</sup>	mV
REVERSE DYNAMIC IMPEDANCE(3)	I <sub>R</sub> = 100μΑ		0.2	0.6		0.2	0.6	Ω
WIDE BAND NOISE (RMS) $10Hz \le I_R \le 10kHz$	I <sub>R</sub> = 100μA		60			120		μV
LONG TERM STABILITY  T <sub>A</sub> = 25°C ± 0.1°C	I <sub>R</sub> = 100μA		20			20		ppm/KH

NOTES: (1) This specification applies over the full operating temperature range of  $0^{\circ}\text{C} \le T_{\text{A}} \le 70^{\circ}\text{C}$ . (2) This specification applies over the full operating temperature range of  $40^{\circ}\text{C} \le T_{\text{A}} \le +85^{\circ}\text{C}$ . (3) Denotes the specifications which apply over the full operating temperature range.

#### **ORDERING INFORMATION**

MODEL	T <sub>A</sub>	V <sub>z</sub>	PACKAGE
REF1004C-1.2	0°C to +70°C	1.2V	8-Lead SOIC
REF1004C-2.5	0°C to +70°C	2.5V	8-Lead SOIC
REF1004I-1.2	-40°C to +85°C	1.2V	8-Lead SOIC
REF1004I-2.5	-40°C to +85°C	2.5V	8-Lead SOIC

NOTE: Available in Tape and Reel, Add -TR to Model Number.

#### **ABSOLUTE MAXIMUM RATINGS**

Reverse Breakdown Current	30mA
Forward Current	10mA
Operating Temperature Range	
REF1004C	0°C to +70°C
REF1004I	40°C to +85°C
Storage Temperature	
REF1004C	—65°C to +150°C
REF1004I	—65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C

#### **ORDERING INFORMATION**

MODEL	PART MARKING		
REF1004C-1.2	BBREF0412		
REF1004C-2.5	BBREF0425		
REF1004I-1.2	BBREF0412		
REF1004I-2.5	BBREF0425		

#### **PACKAGE INFORMATION**

MODEL	PACKAGE	PACKAGE DRAWING NUMBER <sup>(1)</sup>
REF1004C-1.2	8-Pin SOIC	182
REF1004C-2.5	8-Pin SOIC	182
REF1004I-1.2	8-Pin SOIC	182
REF1004I-2.5	8-Pin SOIC	182

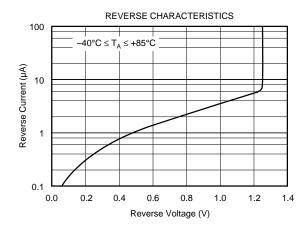
NOTE: (1) For detailed drawing and dimension table, please see end of data sheet, or Appendix D of Burr-Brown IC Data Book.

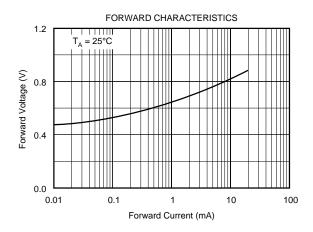
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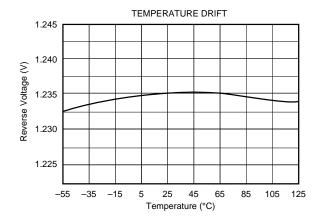


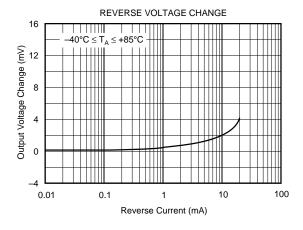
# **TYPICAL PERFORMANCE CURVES 1.2V**

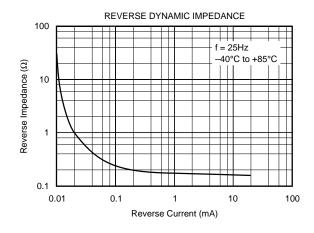
 $T_A = +25$ °C unless otherwise noted.

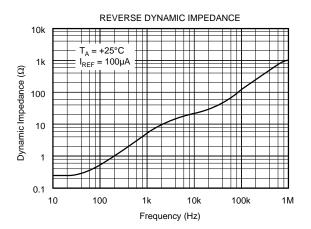






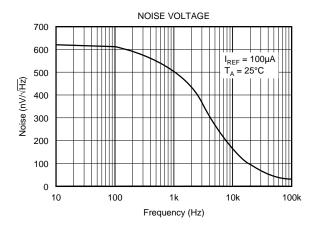


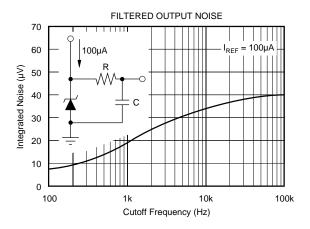


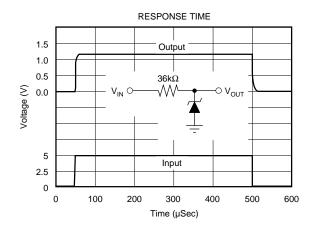


# TYPICAL PERFORMANCE CURVES 1.2V (CONT)

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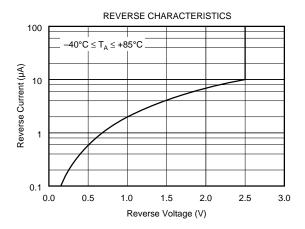


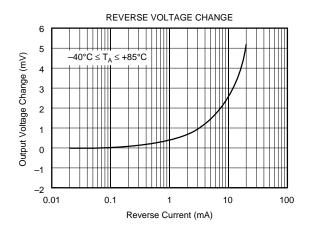


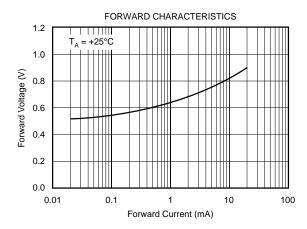


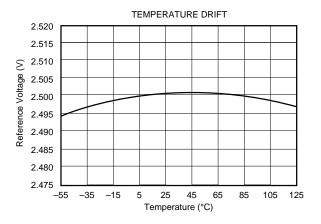
# **TYPICAL PERFORMANCE CURVES 2.5V**

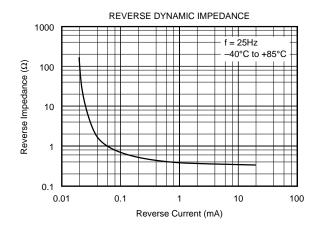
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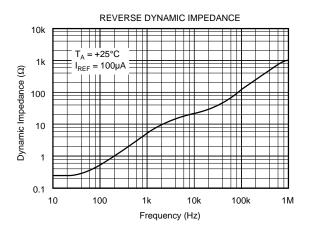






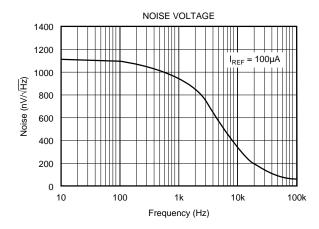


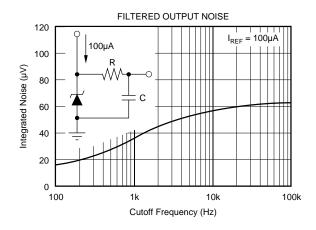


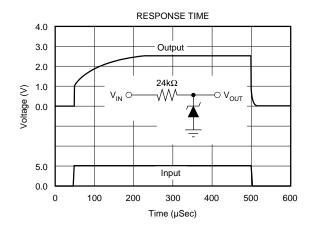


# TYPICAL PERFORMANCE CURVES 2.5V (CONT)

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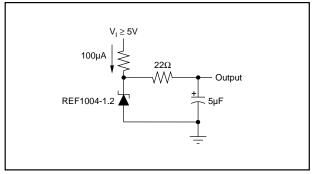


FIGURE 1. Low-Noise Reference.

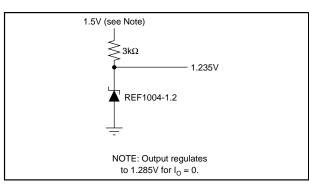


FIGURE 3. 1.2V Reference from 1.5V Battery.

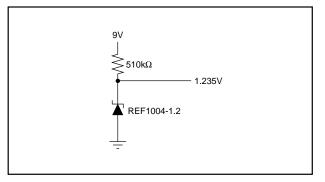


FIGURE2. Micropower Reference from 9V Battery.

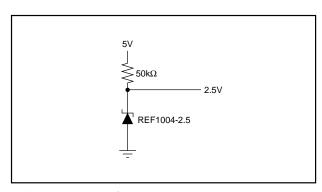


FIGURE 4. 2.5V Reference.

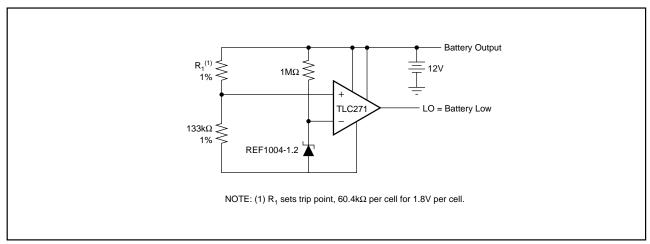


FIGURE 5. Lead-Acid Low-Battery-Voltage Detector.





3-Oct-2003 www.ti.com

#### **PACKAGING INFORMATION**

ORDERABLE DEVICE	STATUS(1)	PACKAGE TYPE	PACKAGE DRAWING	PINS	PACKAGE QTY
REF1004C-1.2	ACTIVE	SOIC	D	8	100
REF1004C-1.2/2K5	ACTIVE	SOIC	D	8	2500
REF1004C-2.5	ACTIVE	SOIC	D	8	100
REF1004C-2.5/2K5	ACTIVE	SOIC	D	8	2500
REF1004I-1.2	ACTIVE	SOIC	D	8	100
REF1004I-1.2/2K5	ACTIVE	SOIC	D	8	2500
REF1004I-2.5	ACTIVE	SOIC	D	8	100
REF1004I-2.5/2K5	ACTIVE	SOIC	D	8	2500

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs. **LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

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