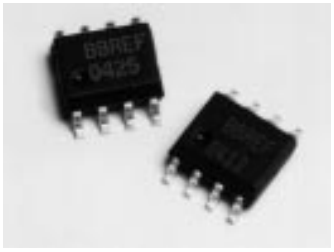
BURR-BROWN®



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**

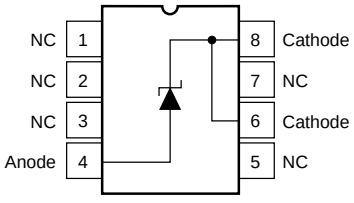
DESCRIPTION

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.

Typical Operating Circuit



(Top View)

International Airport Industrial Park • Mailing Address: PO Box 11400 • Tucson, AZ 85734 • Street Address: 6730 S. Tucson Blvd. • Tucson, AZ 85706
Tel: (520) 746-1111 • Twx: 910-952-1111 • Cable: BBRCORP • Telex: 066-6491 • FAX: (520) 889-1510 • Immediate Product Info: (800) 548-6132

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PDS-1172 Printed in U.S.A. October, 1993

SBVS002

SPECIFICATIONS

ELECTRICAL

T_A = +25°C unless otherwise noted.

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

NOTES: (1) This specification applies over the full operating temperature range of 0°C $\le T_A \le$ 70°C. (2) This specification applies over the full operating temperature range of 40°C $\le T_A \le$ +85°C. (3) Denotes the specifications which apply over the full operating temperature range.

ORDERING INFORMATION

MODEL	T_A	V_Z	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[1]
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

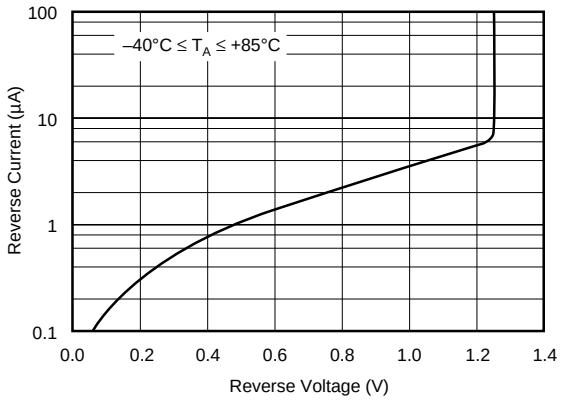
NOTE: (1) For detailed drawing and dimension table, please see end of data sheet, or Appendix D of Burr-Brown IC Data Book.

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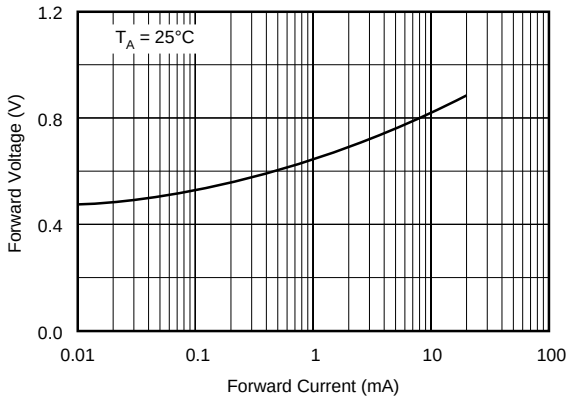
TYPICAL PERFORMANCE CURVES 1.2V

T_A = +25°C unless otherwise noted.

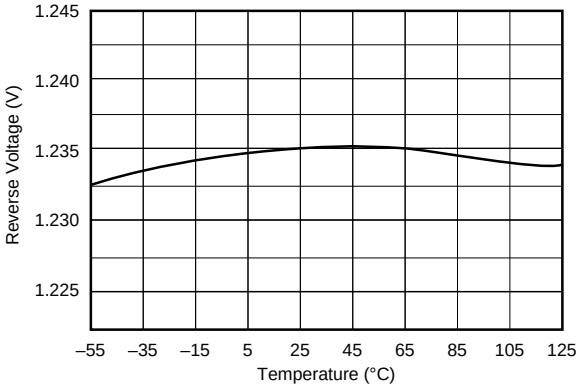
REVERSE CHARACTERISTICS



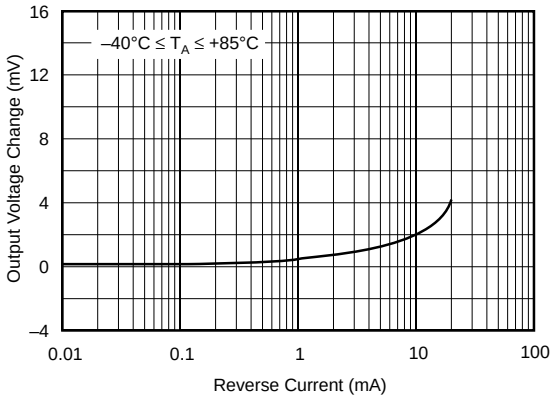
FORWARD CHARACTERISTICS



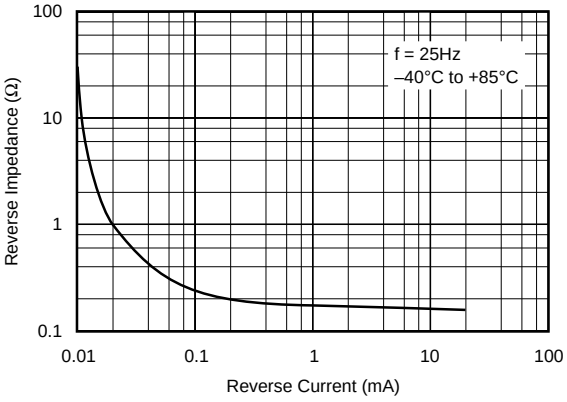
TEMPERATURE DRIFT



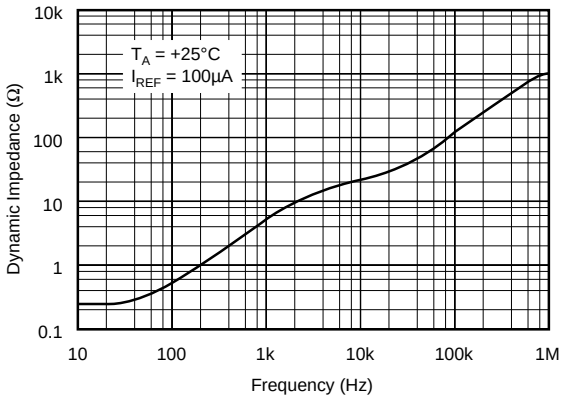
REVERSE VOLTAGE CHANGE



REVERSE DYNAMIC IMPEDANCE



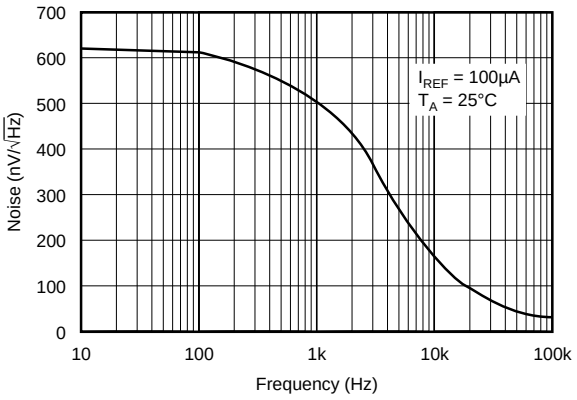
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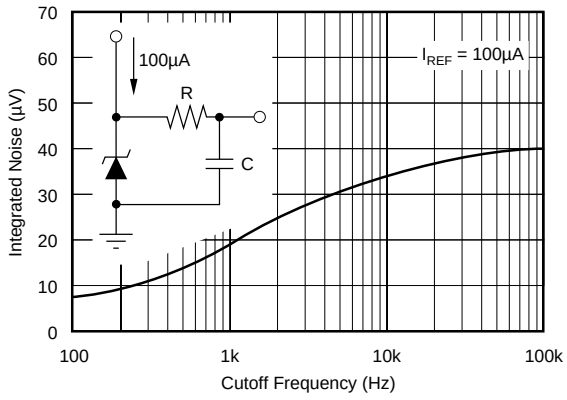
TYPICAL PERFORMANCE CURVES 1.2V (CONT)

T_A = +25°C unless otherwise noted.

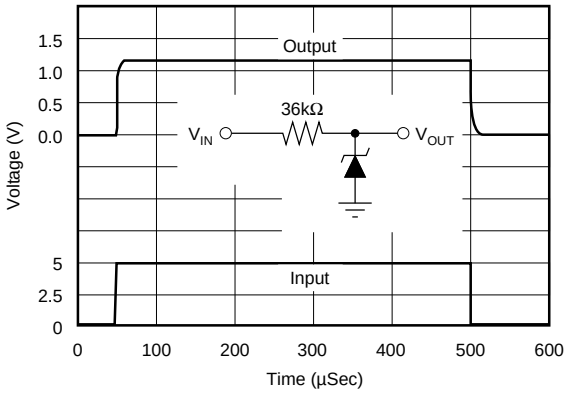
NOISE VOLTAGE



FILTERED OUTPUT NOISE



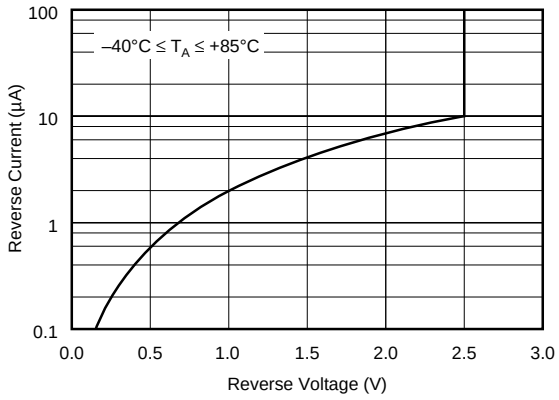
RESPONSE TIME



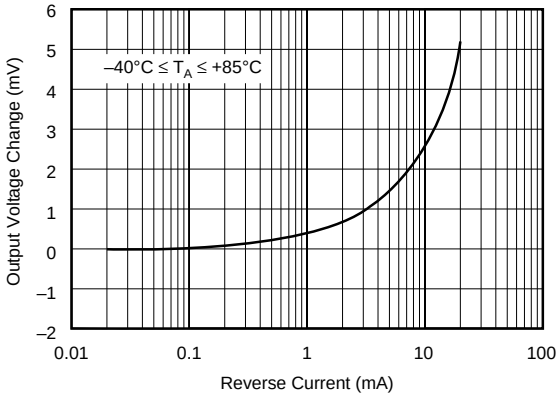
TYPICAL PERFORMANCE CURVES 2.5V

T_A = +25°C unless otherwise noted.

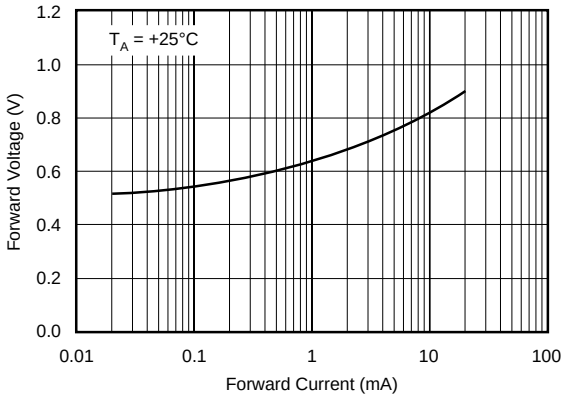
REVERSE CHARACTERISTICS



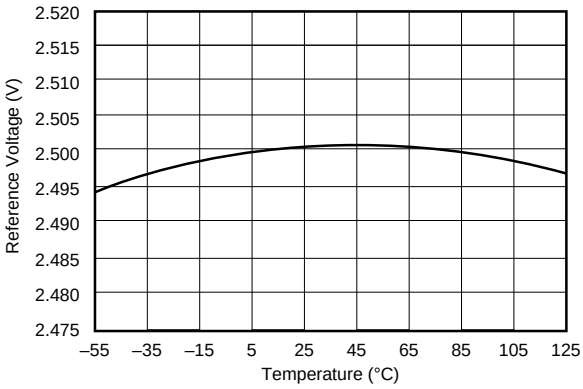
REVERSE VOLTAGE CHANGE



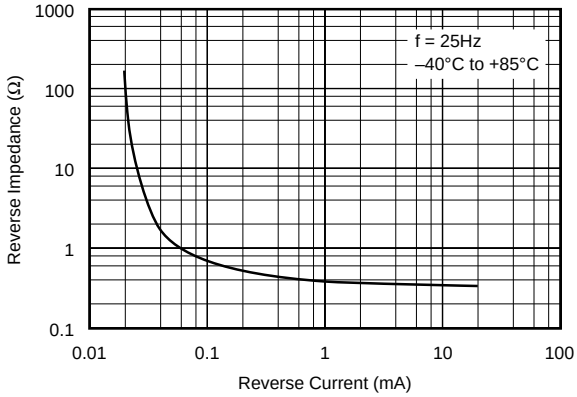
FORWARD CHARACTERISTICS



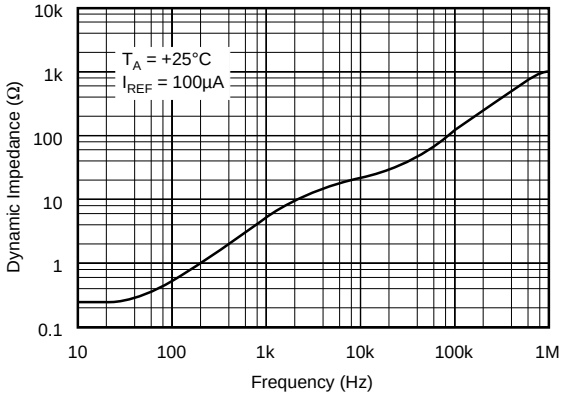
TEMPERATURE DRIFT



REVERSE DYNAMIC IMPEDANCE



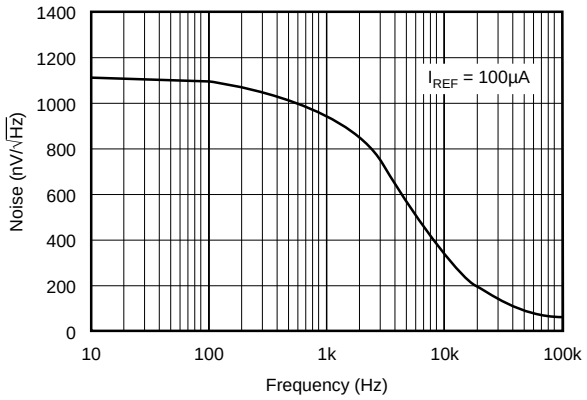
REVERSE DYNAMIC IMPEDANCE



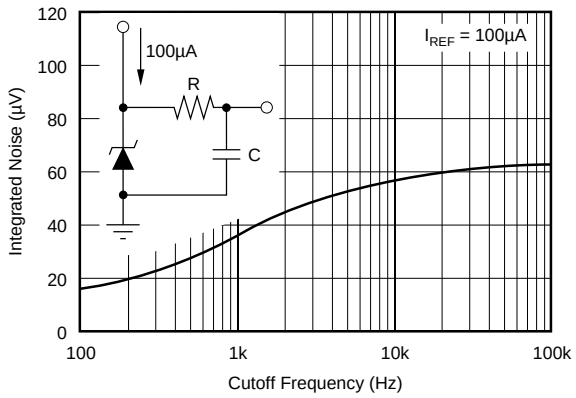
TYPICAL PERFORMANCE CURVES 2.5V (CONT)

T_A = +25°C unless otherwise noted.

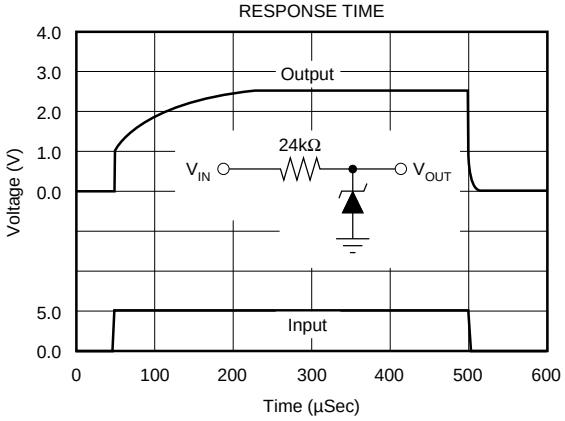
NOISE VOLTAGE



FILTERED OUTPUT NOISE



RESPONSE TIME



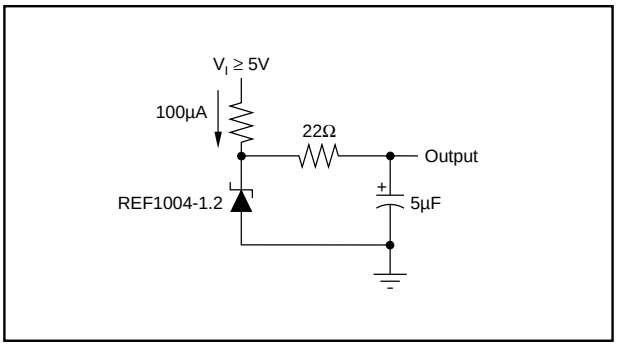


FIGURE 1. Low-Noise Reference.

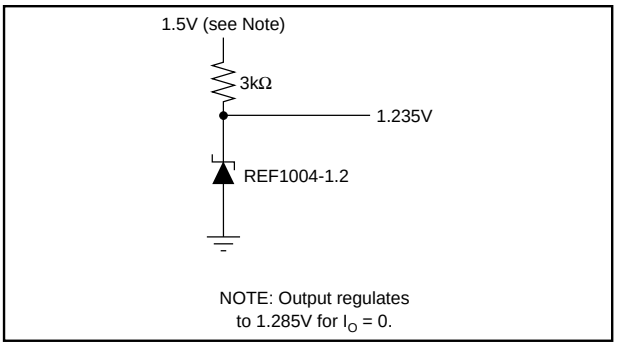


FIGURE 3. 1.2V Reference from 1.5V Battery.

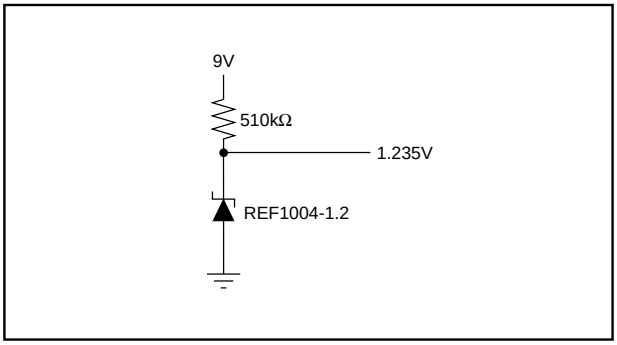


FIGURE2. Micropower Reference from 9V Battery.

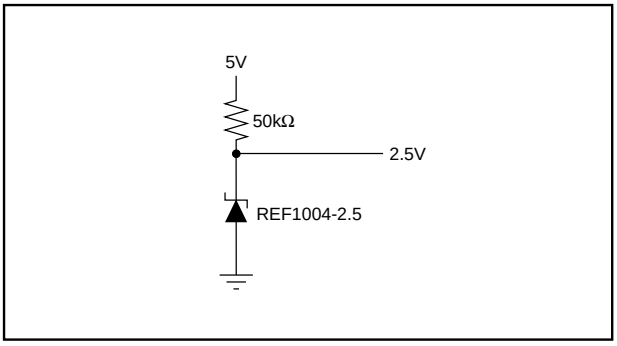


FIGURE 4. 2.5V Reference.

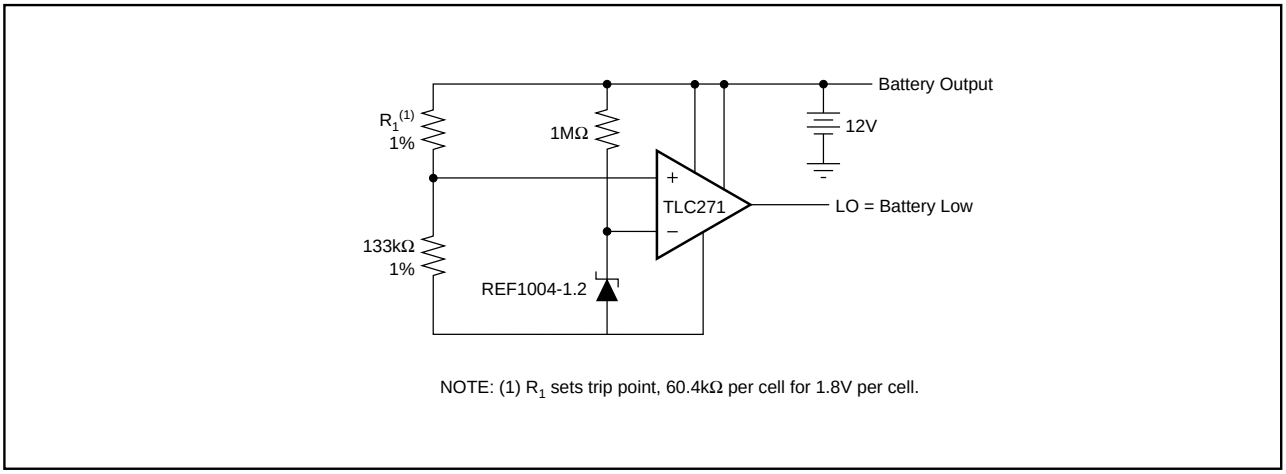


FIGURE 5. Lead-Acid Low-Battery-Voltage Detector.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
REF1004C-1.2	LIFEBUY	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-3-260C-168 HR	0 to 70	REF 0412	
REF1004C-1.2/2K5	LIFEBUY	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-3-260C-168 HR	0 to 70	REF 0412	
REF1004C-2.5	LIFEBUY	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-3-260C-168 HR	0 to 70	REF 0425	
REF1004C-2.5/2K5	LIFEBUY	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-3-260C-168 HR	0 to 70	REF 0425	
REF1004I-1.2	LIFEBUY	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 85	REF 0412	
REF1004I-1.2/2K5	LIFEBUY	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 85	REF 0412	
REF1004I-2.5	LIFEBUY	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 85	REF 0425	
REF1004I-2.5/2K5	LIFEBUY	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 85	REF 0425	

(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.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

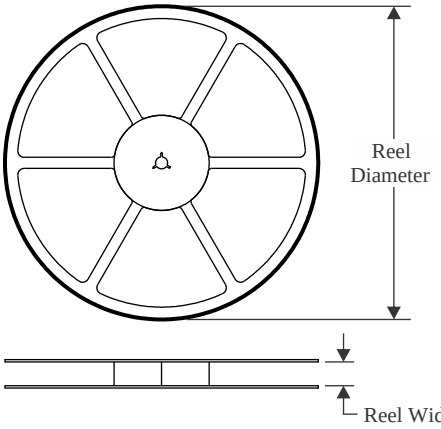
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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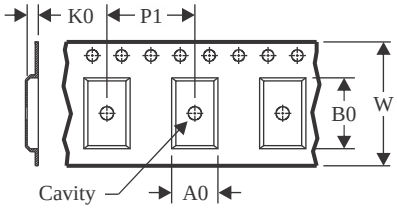
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

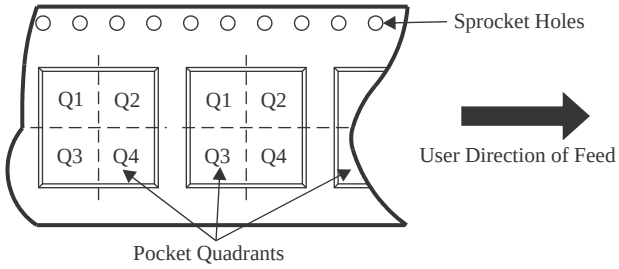


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

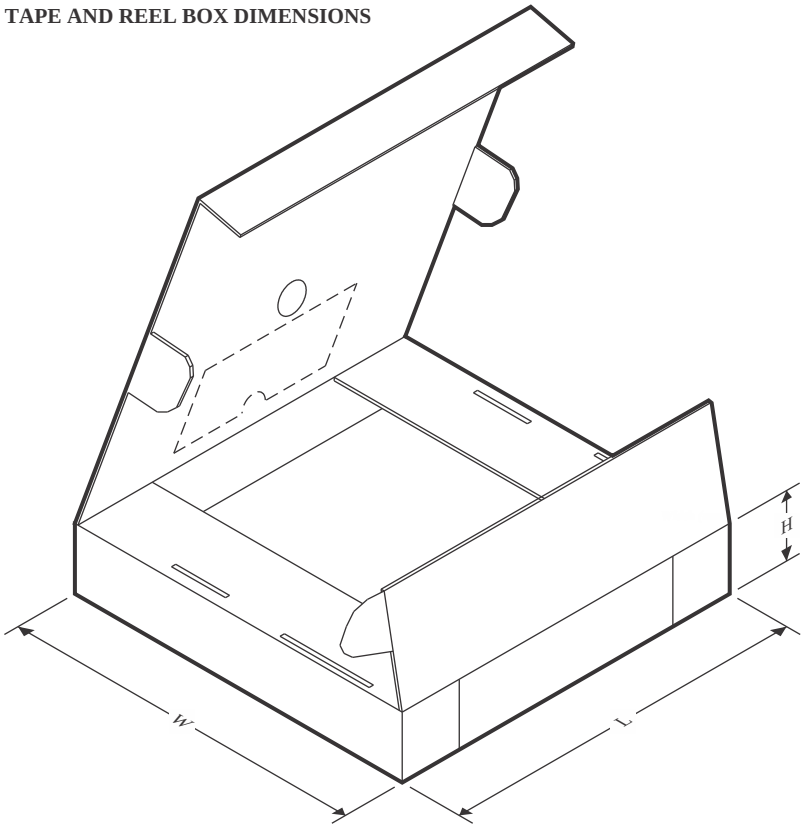
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
REF1004C-1.2/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
REF1004C-2.5/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
REF1004I-1.2/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
REF1004I-2.5/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

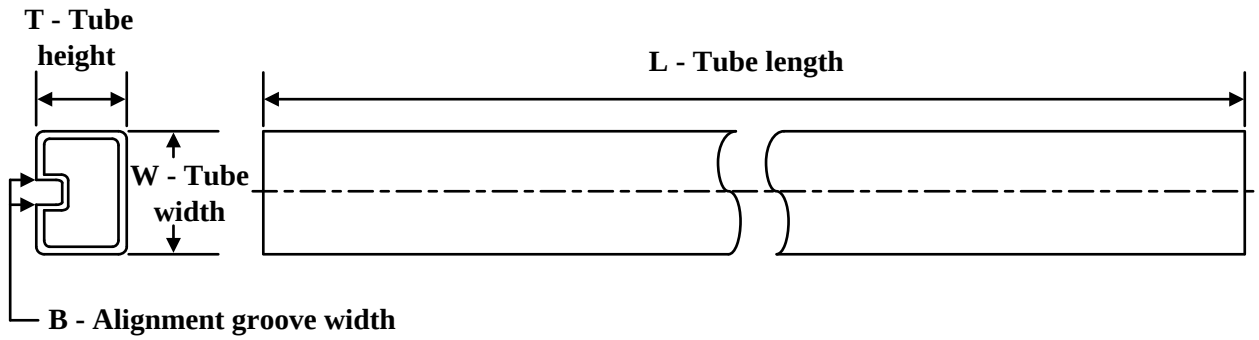
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
REF1004C-1.2/2K5	SOIC	D	8	2500	356.0	356.0	35.0
REF1004C-2.5/2K5	SOIC	D	8	2500	356.0	356.0	35.0
REF1004I-1.2/2K5	SOIC	D	8	2500	356.0	356.0	35.0
REF1004I-2.5/2K5	SOIC	D	8	2500	356.0	356.0	35.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
REF1004C-1.2	D	SOIC	8	75	506.6	8	3940	4.32
REF1004C-2.5	D	SOIC	8	75	506.6	8	3940	4.32
REF1004I-1.2	D	SOIC	8	75	506.6	8	3940	4.32
REF1004I-2.5	D	SOIC	8	75	506.6	8	3940	4.32

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