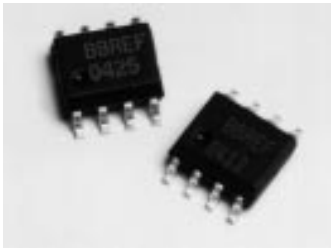
BURR-BROWN®



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**

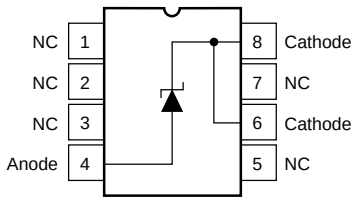
DESCRIPTION

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)

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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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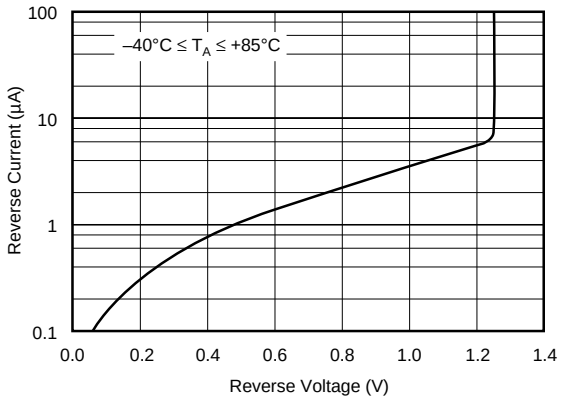
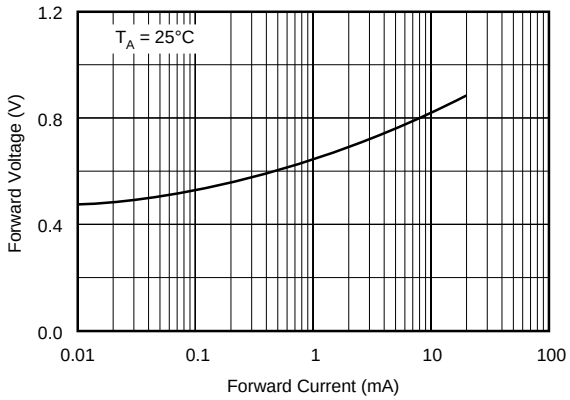
TYPICAL PERFORMANCE CURVES 1.2V

T_A = +25°C unless otherwise noted.

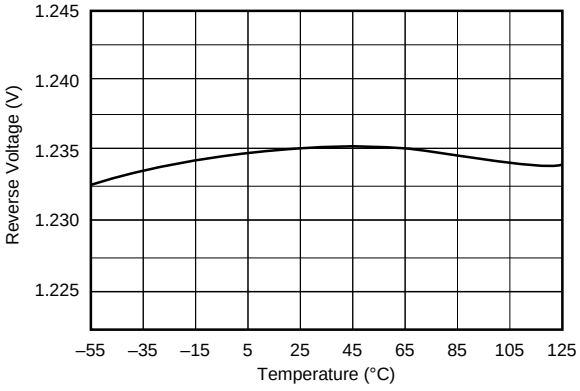
REVERSE CHARACTERISTICS



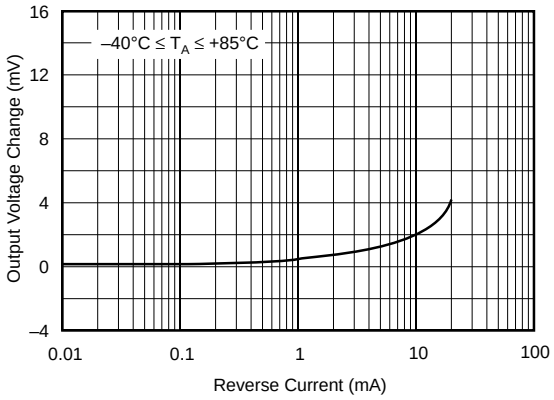
FORWARD CHARACTERISTICS



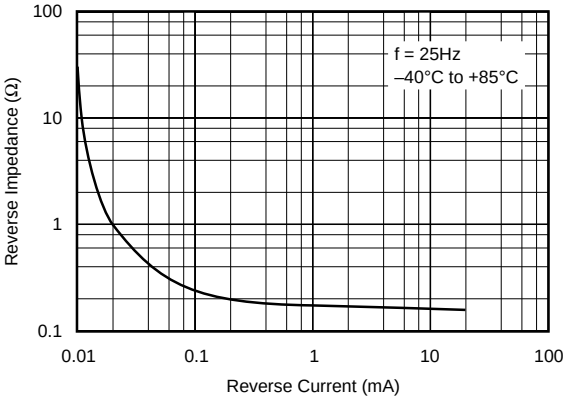
TEMPERATURE DRIFT



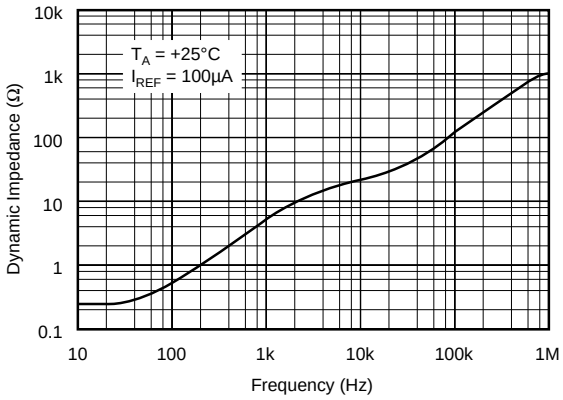
REVERSE VOLTAGE CHANGE



REVERSE DYNAMIC IMPEDANCE



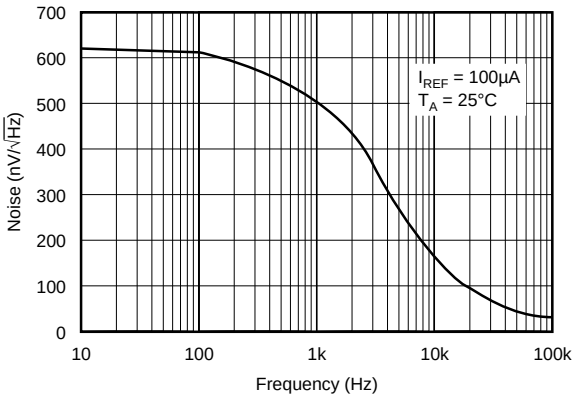
REVERSE DYNAMIC IMPEDANCE



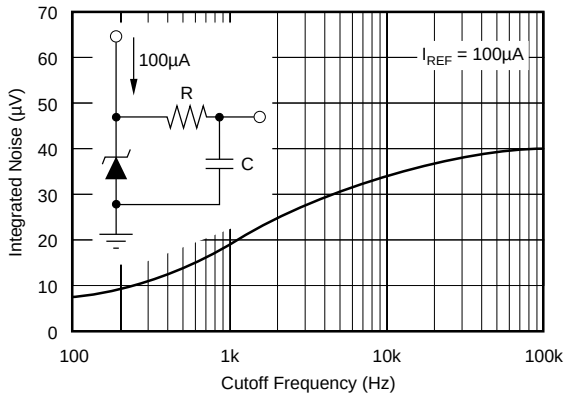
TYPICAL PERFORMANCE CURVES 1.2V (CONT)

T_A = +25°C unless otherwise noted.

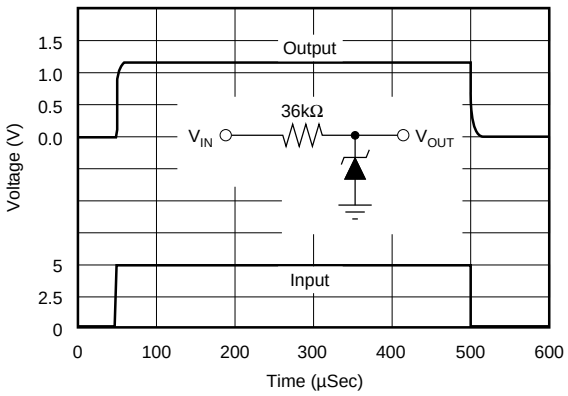
NOISE VOLTAGE



FILTERED OUTPUT NOISE



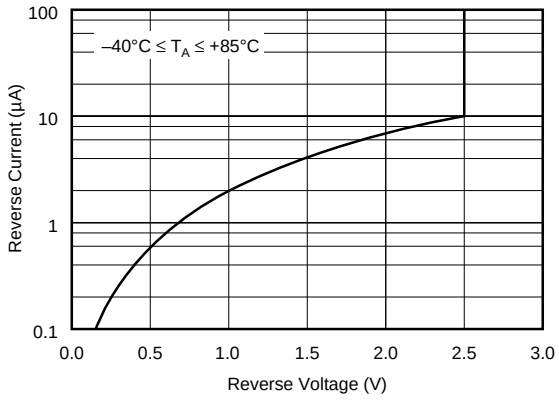
RESPONSE TIME



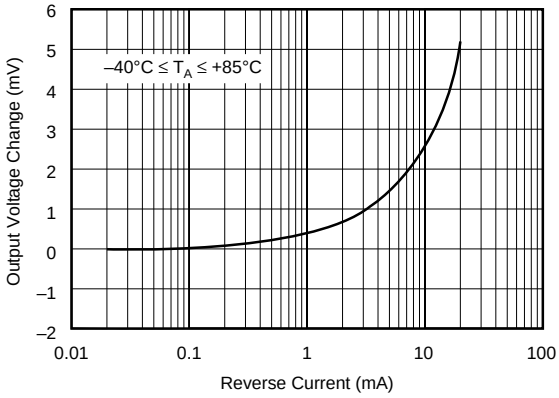
TYPICAL PERFORMANCE CURVES 2.5V

T_A = +25°C unless otherwise noted.

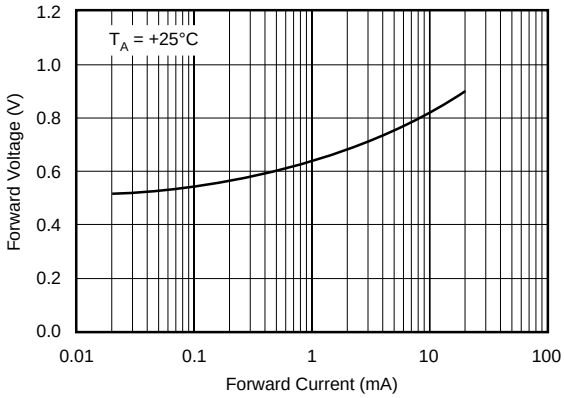
REVERSE CHARACTERISTICS



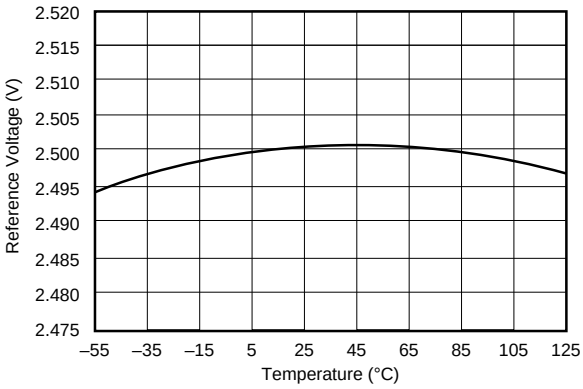
REVERSE VOLTAGE CHANGE



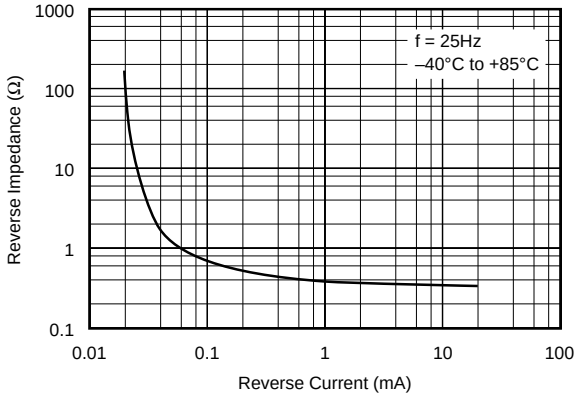
FORWARD CHARACTERISTICS



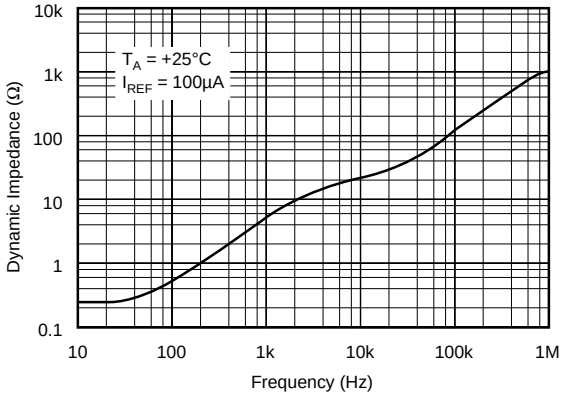
TEMPERATURE DRIFT



REVERSE DYNAMIC IMPEDANCE



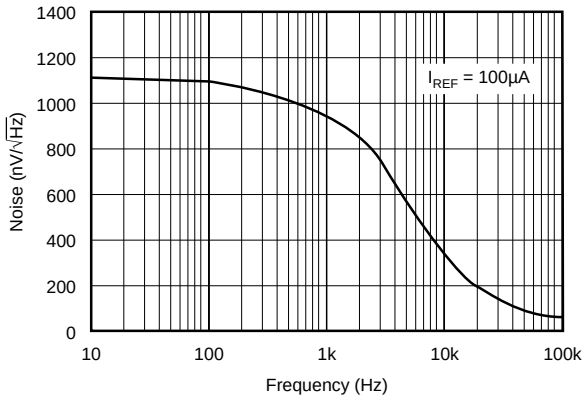
REVERSE DYNAMIC IMPEDANCE



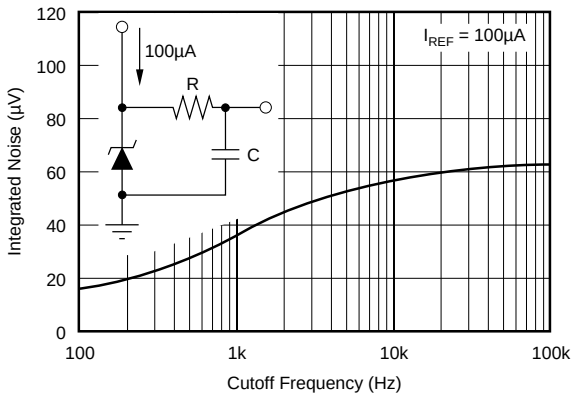
TYPICAL PERFORMANCE CURVES 2.5V (CONT)

T_A = +25°C unless otherwise noted.

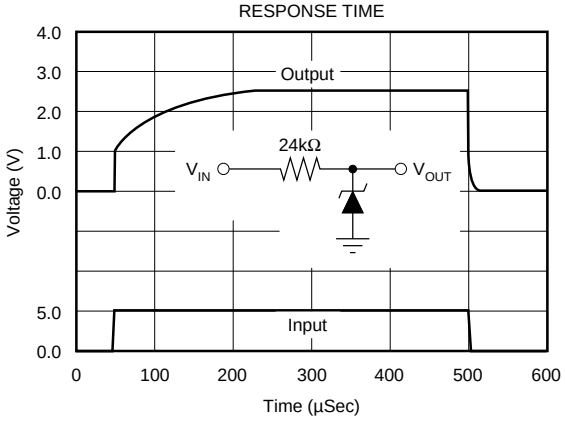
NOISE VOLTAGE



FILTERED OUTPUT NOISE



RESPONSE TIME



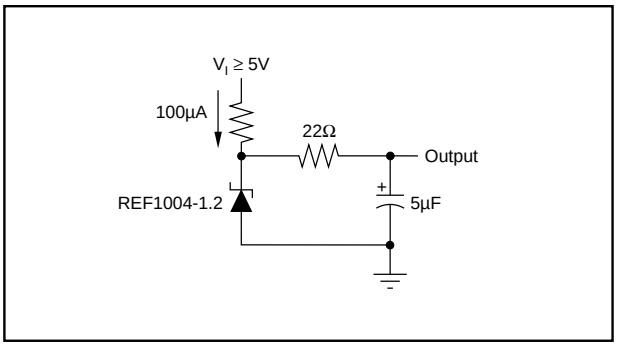


FIGURE 1. Low-Noise Reference.

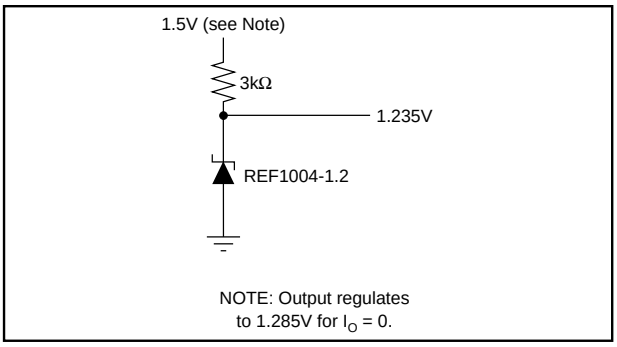


FIGURE 3. 1.2V Reference from 1.5V Battery.

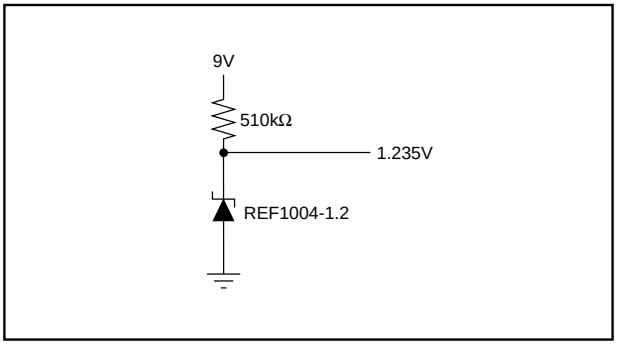


FIGURE2. Micropower Reference from 9V Battery.

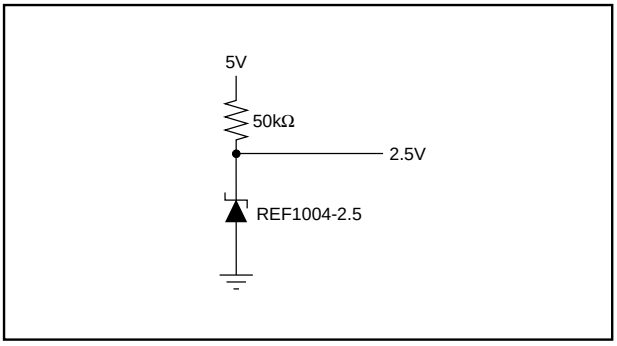


FIGURE 4. 2.5V Reference.

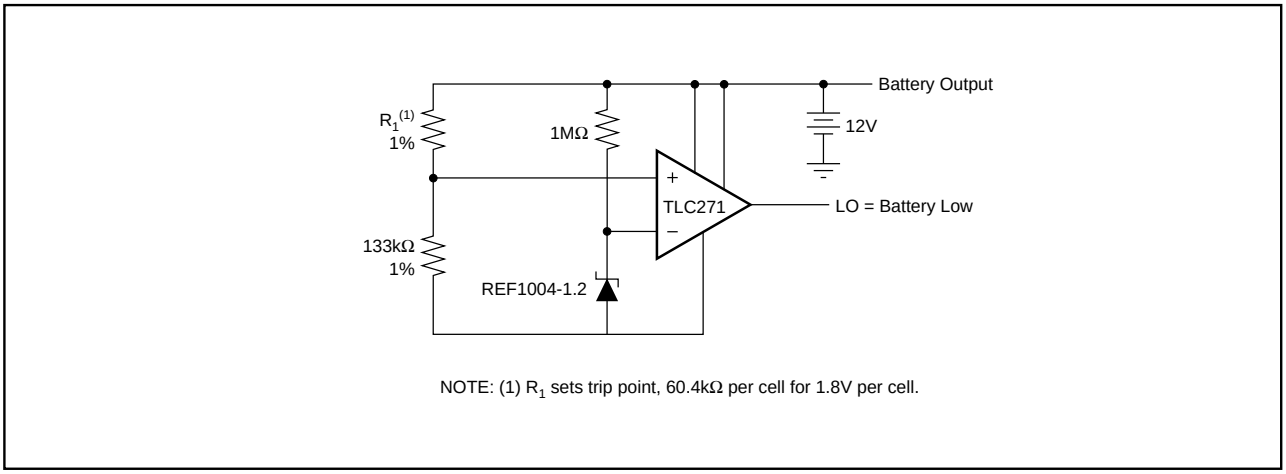


FIGURE 5. Lead-Acid Low-Battery-Voltage Detector.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
REF1004C-1.2	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004C-1.2/2K5	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004C-1.2/2K5E4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004C-1.2E4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004C-2.5	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004C-2.5/2K5	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004C-2.5/2K5E4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004C-2.5E4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004I-1.2	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004I-1.2/2K5	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004I-1.2/2K5E4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004I-1.2E4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004I-2.5	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004I-2.5/2K5	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004I-2.5/2K5E4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
REF1004I-2.5E4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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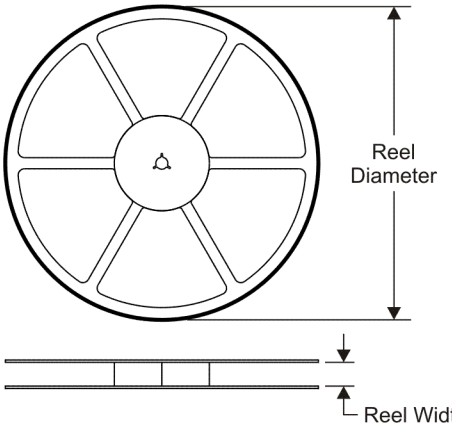
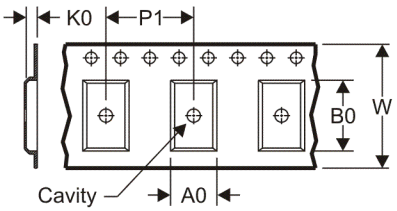
TAPE AND REEL INFORMATION

REEL DIMENSIONS

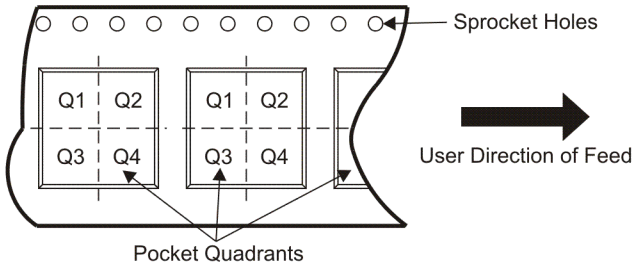


TAPE DIMENSIONS



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

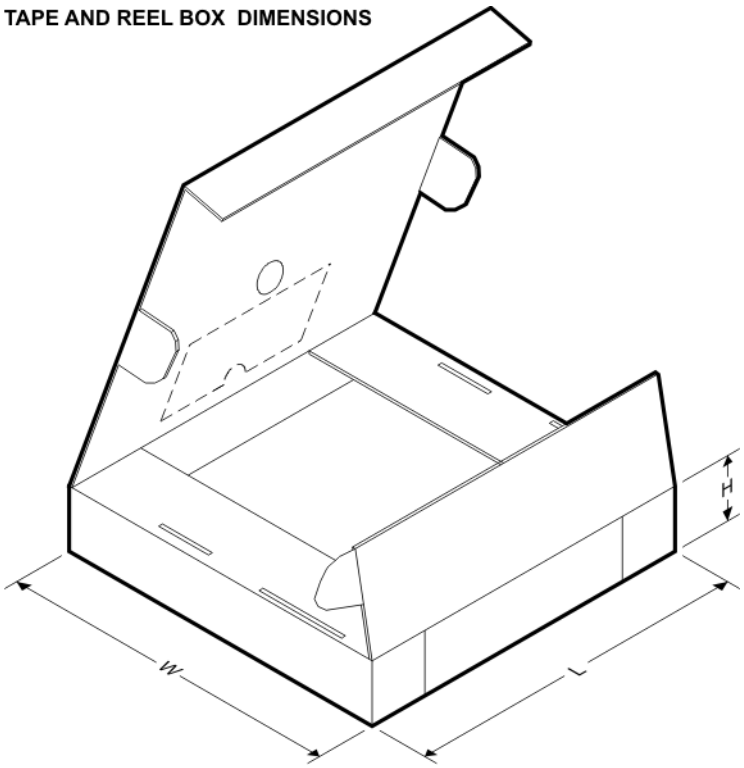
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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	346.0	346.0	29.0
REF1004C-2.5/2K5	SOIC	D	8	2500	346.0	346.0	29.0
REF1004I-1.2/2K5	SOIC	D	8	2500	346.0	346.0	29.0
REF1004I-2.5/2K5	SOIC	D	8	2500	346.0	346.0	29.0

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