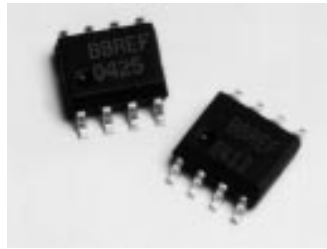




**THE DATASHEET OF
REF1004C-1.2/2K5**





REF1004

1.2V and 2.5V Micropower VOLTAGE REFERENCE

FEATURES

- **INITIAL ACCURACY:**
REF1004-1.2 $\pm 4\text{mV}$
REF1004-2.5 $\pm 20\text{mV}$
- **MINIMUM OPERATING CURRENT:**
REF1004-1.2 $10\mu\text{A}$
REF1004-2.5 $20\mu\text{A}$
- **EXCELLENT LONG TERM TEMPERATURE STABILITY**
- **VERY LOW DYNAMIC IMPEDANCE**
- **OPERATES UP TO 20mA**
- **PACKAGE: 8-Lead SOIC**

APPLICATIONS

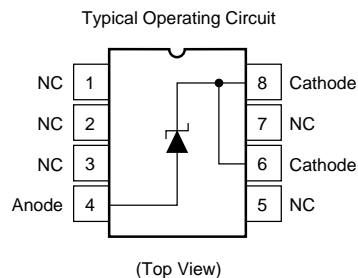
- **BATTERY POWERED TEST EQUIPMENT**
- **PORTABLE MEDICAL INSTRUMENTATION**
- **PORTABLE COMMUNICATIONS DEVICES**
- **A/D AND D/A CONVERTERS**
- **NOTEBOOK AND PALMTOP COMPUTERS**

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 $+85^{\circ}\text{C}$.

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



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

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 REF1004C ⁽¹⁾ REF1004I ⁽²⁾ | I _R = 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} ≤ I _R ≤ 20mA | | 20 | | | 20 | | ppm/°C |
| MINIMUM OPERATION CURRENT ⁽³⁾ | | | 8 | 10 | | 12 | 20 | μA |
| REVERSE BREAKDOWN VOLTAGE CHANGE WITH CURRENT | I _{MIN} ≤ I _R ≤ 1mA 1mA ≤ I _R ≤ 20mA | | | 1 1.5 ⁽³⁾ 10 20 ⁽³⁾ | | | 1 1.5 ⁽³⁾ 10 20 ⁽³⁾ | mV |
| REVERSE DYNAMIC IMPEDANCE ⁽³⁾ | I _R = 100μA | | 0.2 | 0.6 | | 0.2 | 0.6 | Ω |
| WIDE BAND NOISE (RMS) 10Hz ≤ I _R ≤ 10kHz | I _R = 100μA | | 60 | | | 120 | | μV |
| LONG TERM STABILITY T _A = 25°C ± 0.1°C | I _R = 100μA | | 20 | | | 20 | | ppm/KHr |

NOTES: (1) This specification applies over the full operating temperature range of 0°C ≤ T_A ≤ 70°C. (2) This specification applies over the full operating temperature range of 40°C ≤ T_A ≤ +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.

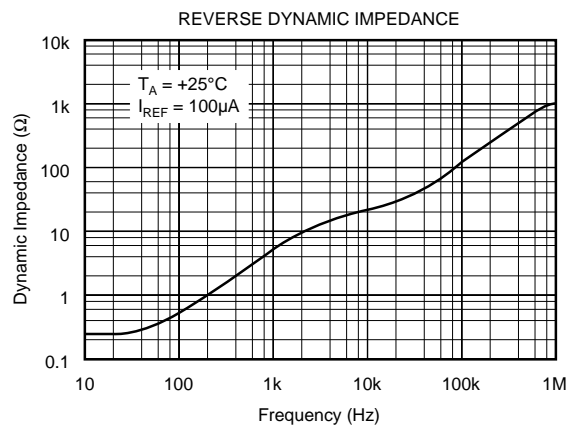
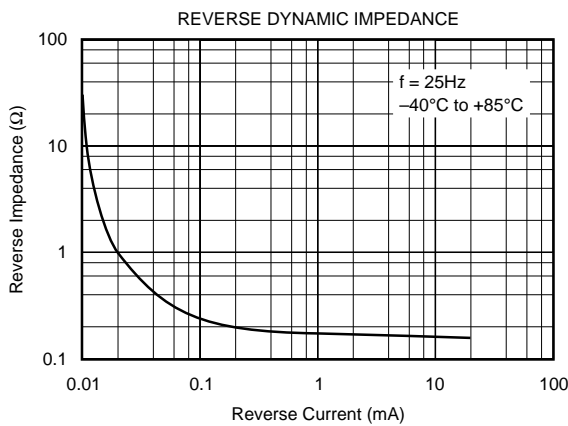
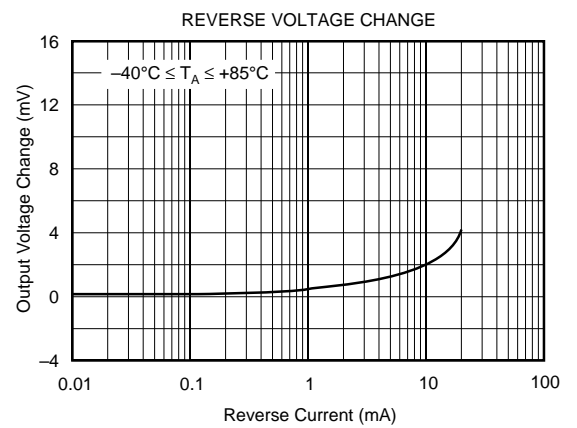
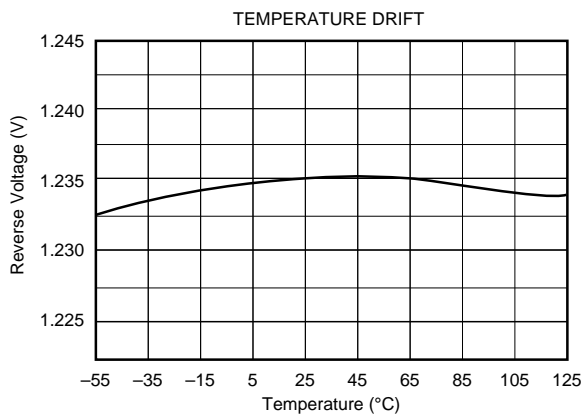
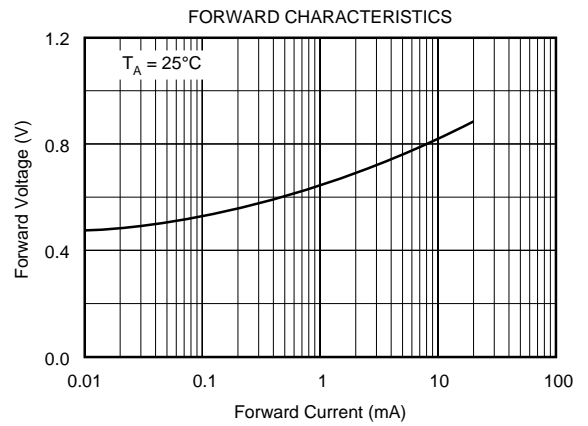
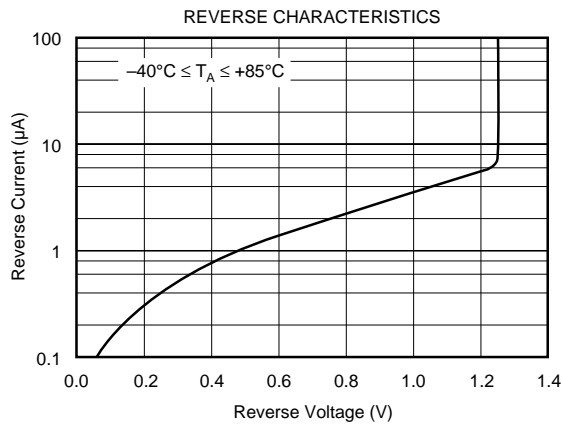
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REF1004

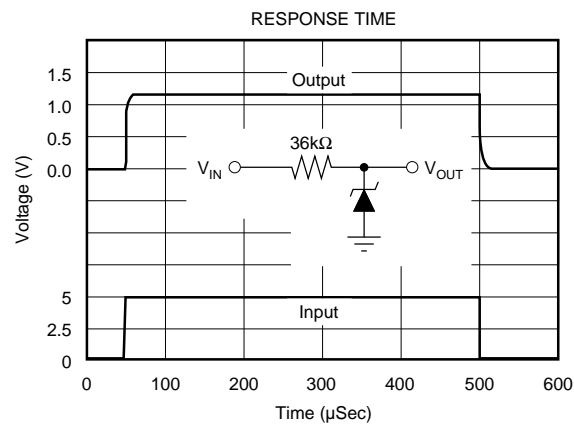
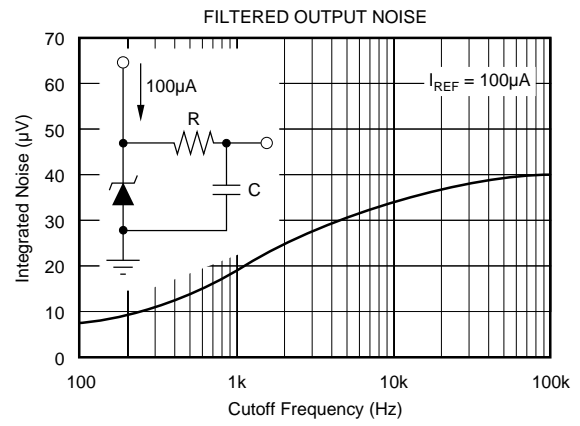
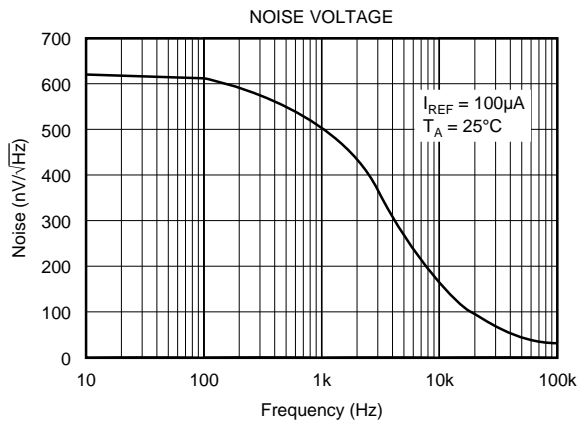
TYPICAL PERFORMANCE CURVES 1.2V

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



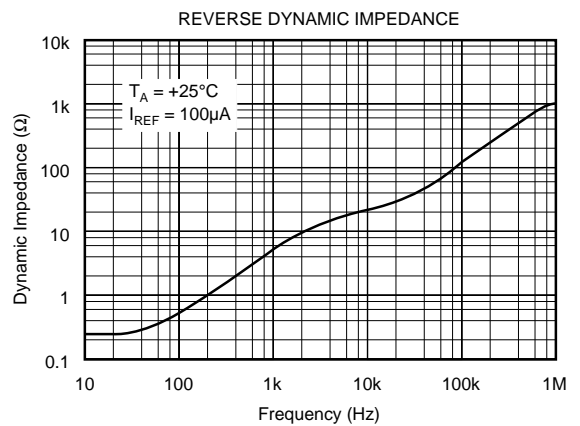
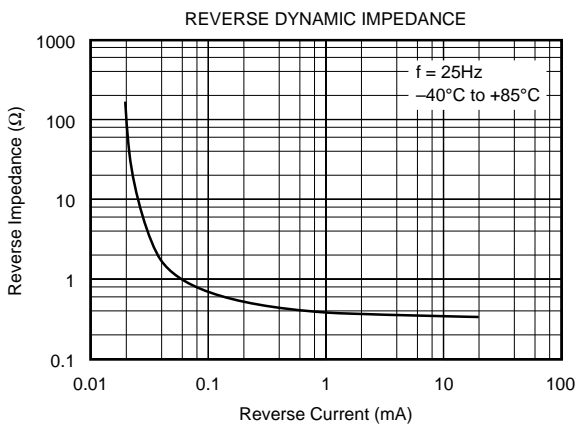
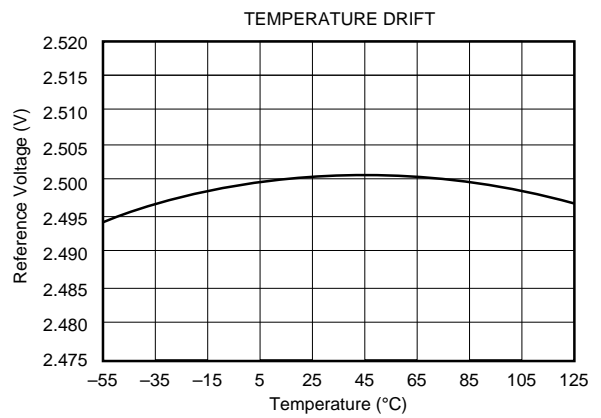
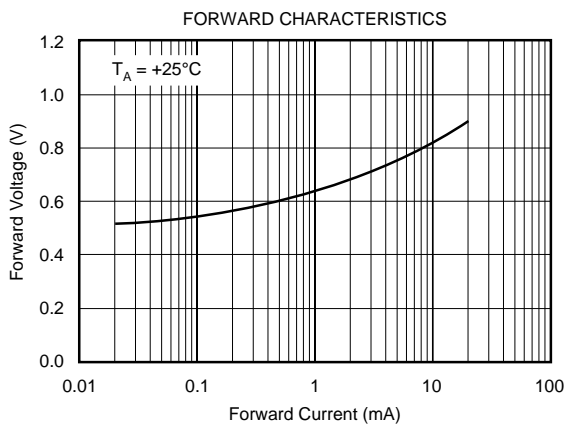
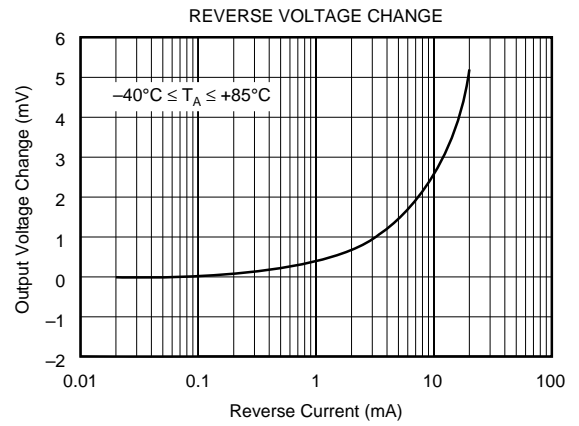
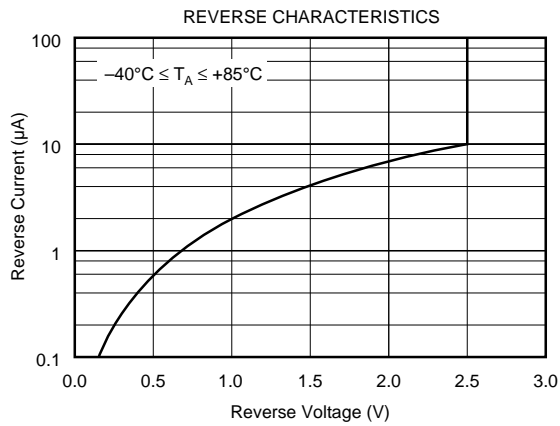
TYPICAL PERFORMANCE CURVES 1.2V (CONT)

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



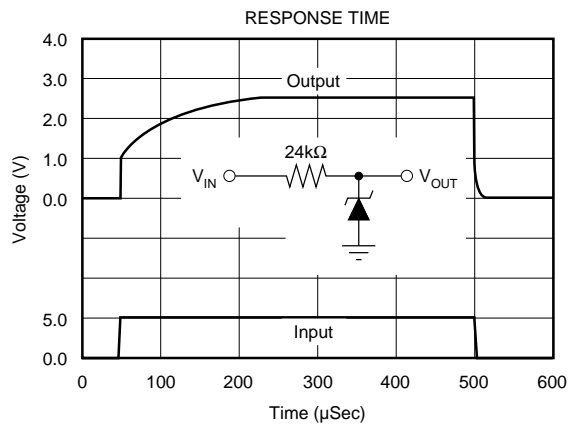
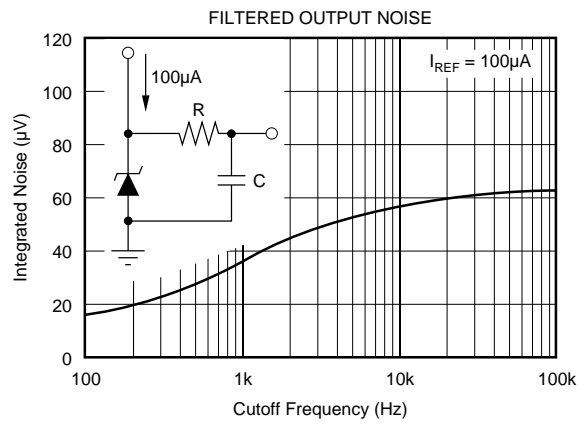
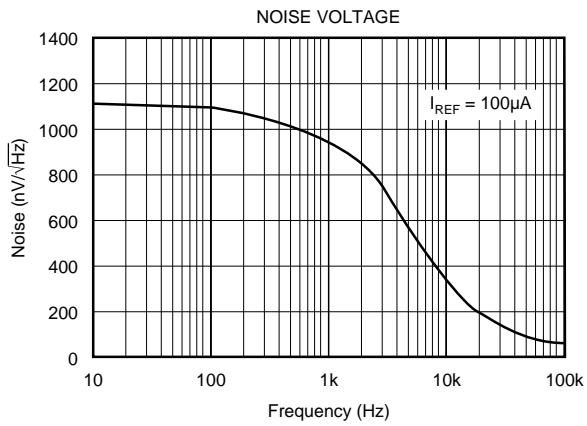
TYPICAL PERFORMANCE CURVES 2.5V

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



TYPICAL PERFORMANCE CURVES 2.5V (CONT)

T_A = +25°C unless otherwise noted.



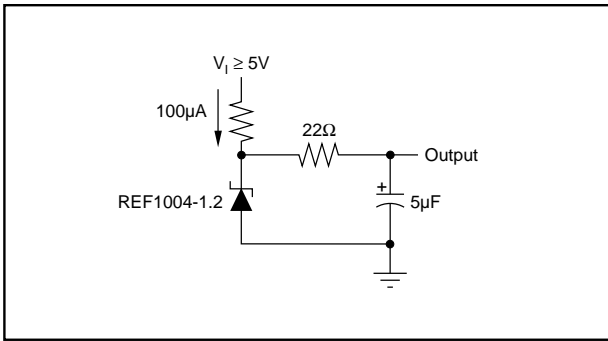


FIGURE 1. Low-Noise Reference.

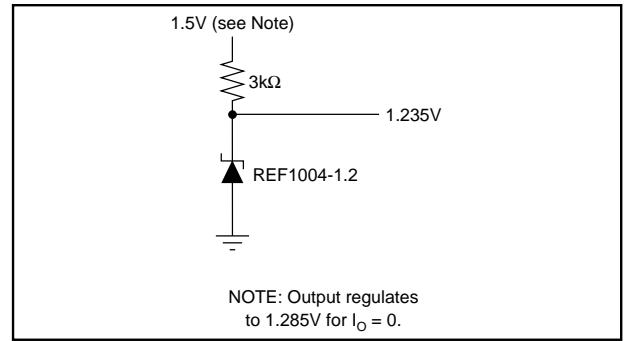


FIGURE 3. 1.2V Reference from 1.5V Battery.

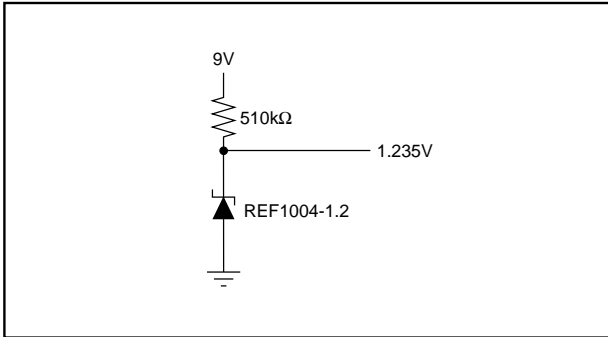


FIGURE 2. Micropower Reference from 9V Battery.

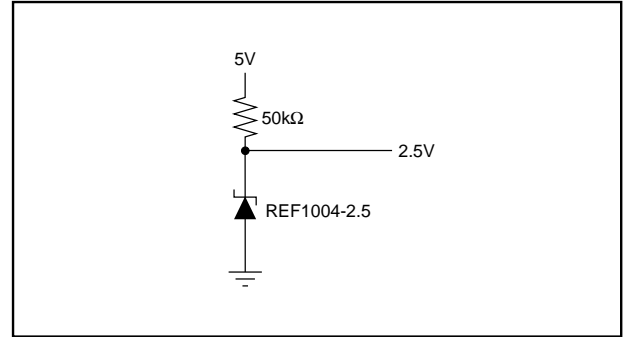


FIGURE 4. 2.5V Reference.

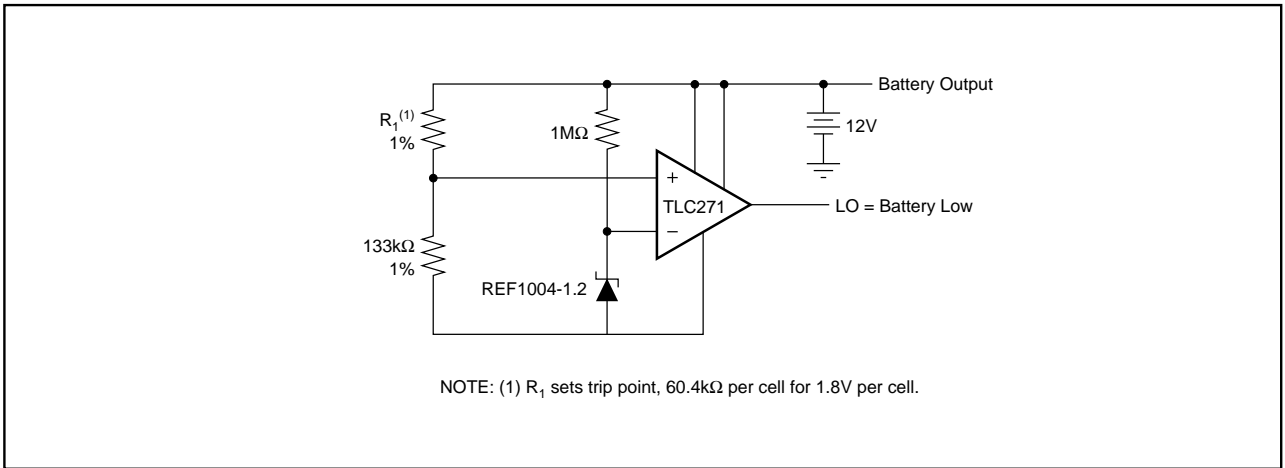


FIGURE 5. Lead-Acid Low-Battery-Voltage Detector.

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 | ACTIVE | SOIC | D | 8 | 75 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | 0 to 70 | REF 0412 | Samples |
| REF1004C-1.2/2K5 | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | 0 to 70 | REF 0412 | Samples |
| REF1004C-2.5 | ACTIVE | SOIC | D | 8 | 75 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | 0 to 70 | REF 0425 | Samples |
| REF1004C-2.5/2K5 | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | 0 to 70 | REF 0425 | Samples |
| REF1004I-1.2 | ACTIVE | SOIC | D | 8 | 75 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | -40 to 85 | REF 0412 | Samples |
| REF1004I-1.2/2K5 | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | -40 to 85 | REF 0412 | Samples |
| REF1004I-1.2E4 | NRND | SOIC | D | 8 | 75 | TBD | Call TI | Call TI | -40 to 85 | | |
| REF1004I-2.5 | ACTIVE | SOIC | D | 8 | 75 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | -40 to 85 | REF 0425 | Samples |
| REF1004I-2.5/2K5 | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | -40 to 85 | REF 0425 | Samples |

(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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TAPE AND REEL INFORMATION

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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