# LM4041
# 1.225V Precision micropower shunt voltage reference

## Description

The LM4041 is a bandgap circuit designed to achieve a precision micro-power voltage reference of 1.225 V. The device is available in the small outline SOT23 surface mount packages which is ideal for applications where space saving is important.

The LM4041 is available to 0.5% C grade for precision applications. Excellent performance is maintained over the 60μA to 12mA operating current range with a typical temperature coefficient of only 20ppm/°C.

The device has been designed to be highly tolerant of capacitive loads so maintaining excellent stability.

This device offers a pin for pin compatible alternative to the LM4041 voltage reference.

## Features

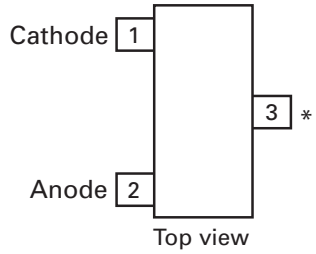
- Small packages: SOT23
- No output capacitor required
- Output voltage tolerance
  - LM4041C ±0.5% at 25°C
  - LM4041D ±1% at 25°C
- Low output noise
  (10 Hz to 10kHz) ..... 60μVrms
- Wide operating current range 60μA to 12mA
- Extended temperature range -40°C to +125°C
- Low temperature coefficient 100ppm/°C (max)

## Applications

- Battery powered equipment
- Precision power supplies
- Portable instrumentation
- Portable communications devices
- Notebook and palmtop computers
- Data acquisition systems

## Pinout information

**LM4041_12F (SOT23)**




* Pin 3 must be left floating or connected to pin 2

## Ordering information

| 25°C tol. | Voltage (V) | Order code | Pack | Part mark | Status | Reel size | Tape width | Quantlty per reel |
|---|---|---|---|---|---|---|---|---|
| 0.5% | 1.225 | LM4041CFTA | SOT23 | R1C | Preview | 7", 180mm | 8mm | 3000 |
| 1% | 1.225 | LM4041DFTA | SOT23 | R1D | Preview | 7", 180mm | 8mm | 3000 |

## Absolute maximum ratings

Continuous reverse current ($I_{KA}$) ..... 20mA

Continuous forward current ($I_{REF}$) ..... 10mA

Operating junction temperature ..... -40°C to 150°C

Storage temperature ..... -55°C to 150°C

Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability.

Unless otherwise stated voltages specified are relative to the ANODE pin.

## Package thermal data

| Package | $\Theta_{JA}$ | $P_{DIS}$ $T_{amb}$ =25°C, $T_J$ = 150°C |
|---|---|---|
| SOT23 | 380°C/W | 330mW |

## Recommended operating conditions

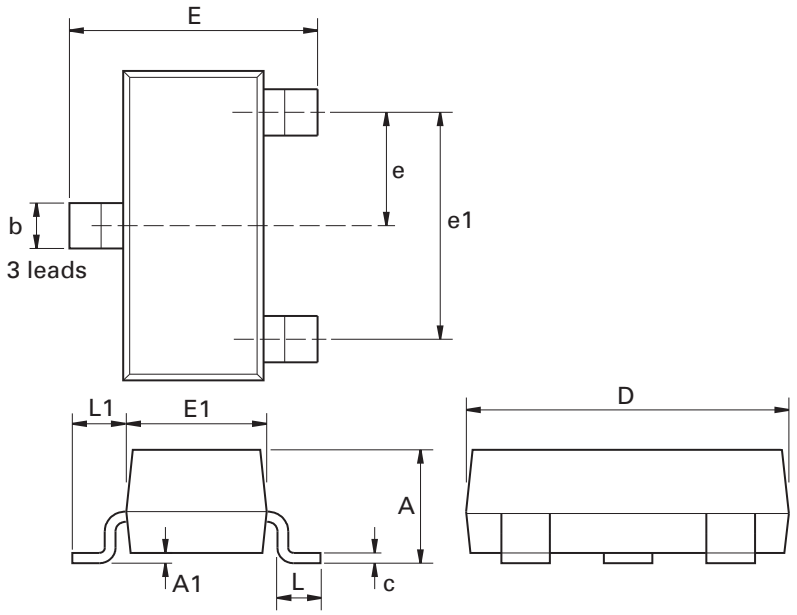
| | Min. | Max. | Units |
|---|---|---|---|
| Reverse current | 0.06 | 15 | mA |
| Operating ambient temperature range | -40 | 125 | °C |

## Electrical characteristics

Over recommended operating conditions, $T_{amb}$ = 25°C, unless otherwise stated. LM4041C and LM4041D have initial tolerances of 0.5% and 1% respectively.

| Symbol | Parameter | Conditions | | Typ. | LM4041C Limits | LM4041D Limits | Units |
|---|---|---|---|---|---|---|---|
| | | | $T_{amb}$ | | | | |
| $V_{REF}$ | Reverse breakdown voltage | $I_R$ = 100 µA | 25°C | 1.225 | | | V |
| | Reverse breakdown voltage tolerance | $I_R$ = 100µA | 25°C | | ±6 | ±12 | mV |
| | | | -40 to 85°C | | ±14 | ±24 | |
| | | | -40 to 125°C | | ±18.4 | ±31 | |
| $I_{RMIN}$ | Minimum operating current | | 25°C | 45 | 60 | 65 | µA |
| | | | -40 to 85°C | | 65 | 70 | |
| | | | -40 to 125°C | | 68 | 73 | |
| $\Delta V_R/\Delta T$ | Average reverse breakdown voltage temperature coefficient | $I_R$ = 10 mA | -40 to 125°C | ±20 | | | ppm/°C |
| | | $I_R$ = 1 mA, | | ±15 | ±100 | ±150 | |
| | | $I_R$ = 100 µA | | ±15 | | | |
| $\Delta V_R/\Delta I_R$ | Reverse breakdown change with current | $I_{RMIN} < I_R <$ 1mA | 25°C | 0.7 | 1.5 | 2.0 | mV |
| | | | -40 to 85°C | | 2.0 | 2.5 | |
| | | | -40 to 125°C | | 2.0 | 2.5 | |
| | | 1mA < $I_R <$ 12 mA | 25°C | 2.5 | 6.0 | 8.0 | |
| | | | -40 to 85°C | | 8.0 | 10.0 | |
| | | | -40 to 125°C | | 8.0 | 10.0 | |
| $Z_R$ | Dynamic output impedance | $I_R$ = 1mA, f = 120Hz<br>$I_{AC} = 0.1I_R$ | | 0.5 | 1.5 | 2.0 | Ω |
| $e_n$ | Noise voltage | $I_R$ = 100µA<br>10Hz < f < 10kHz | | 60 | | | $\mu V_{RMS}$ |
| $\Delta V_R$ | Long term stability (non cumulative) | t = 1000Hrs<br>$I_R$ = 100µA | | 120 | | | ppm |

## Package outline - SOT23




| Dim. | Millimeters | | Inches | | Dim. | Millimeters | | Inches | |
|---|---|---|---|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | | Min. | Max. | Max. | Max. |
| A | - | 1.12 | - | 0.044 | e1 | 1.90 NOM | | 0.075 NOM | |
| A1 | 0.01 | 0.10 | 0.0004 | 0.004 | E | 2.10 | 2.64 | 0.083 | 0.104 |
| b | 0.30 | 0.50 | 0.012 | 0.020 | E1 | 1.20 | 1.40 | 0.047 | 0.055 |
| C | 0.085 | 0.120 | 0.003 | 0.008 | L | 0.25 | 0.62 | 0.018 | 0.024 |
| D | 2.80 | 3.04 | 0.110 | 0.120 | L1 | 0.45 | 0.62 | 0.018 | 0.024 |
| e | 0.95 NOM | | 0.0375 NOM | | - | - | - | - | - |

**Note:** Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

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| | |
|---|---|
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| | |
|---|---|
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