



PRECISION SHUNT VOLTAGE REFERENCE

SC4040

PRELIMINARY - April 13, 1998

TEL:805-498-2111 FAX:805-498-3804 WEB:http://www.semtech.com

DESCRIPTION

The SC4040 is a two terminal precision voltage reference with thermal stability guaranteed over temperature. The SC4040 has a typical dynamic output impedance of 0.25Ω. Active output circuitry provides a very sharp turn on characteristic - the minimum operating current is 60μA, with a maximum of 20mA.

Available with five voltage tolerances (0.1%, 0.2%, 0.5%, 1.0% and 2.0%) and three package outlines (SOT-23, SO-8 and TO-92), this part allows the designer the opportunity to select the optimum combination of cost and performance for their application.

FEATURES

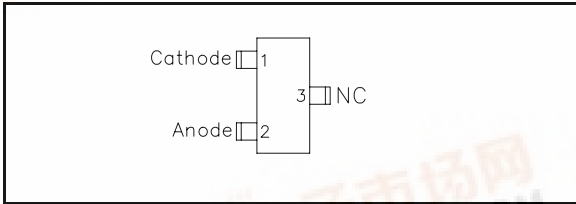
- Trimmed bandgap design (0.2%)
- Wide operating current range 60μA to 20mA
- Low dynamic impedance (0.25Ω)
- Available in SOT-23, TO-92 and SO-8

APPLICATIONS

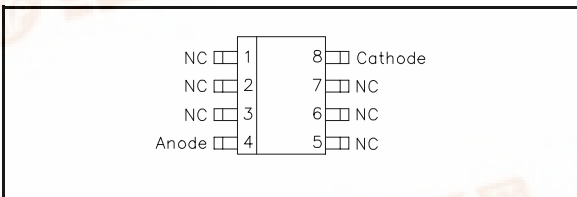
- Cellular telephones
- Portable computers
- Instrumentation
- Automotive

PIN CONFIGURATIONS

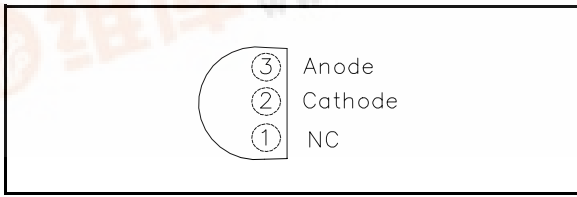
SOT-23-3 Lead (Top View)



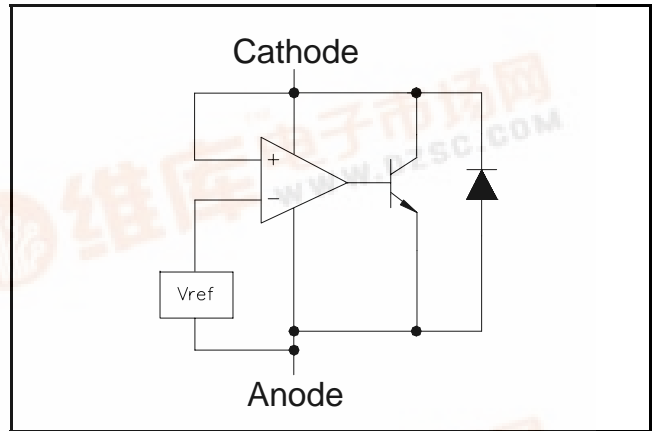
SO-8 Lead (Top View)



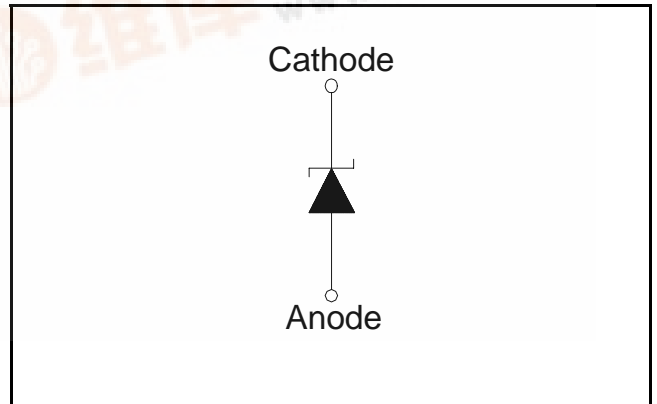
TO-92 (Top View)



BLOCK DIAGRAM



SYMBOL DIAGRAM



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ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Maximum | Units |
|---|------------|------------------|--------------|
| Reverse Current | | 60 μ A to 20 | mA |
| Operating Temperature Range | T_A | -40 to +85 | $^{\circ}$ C |
| Operating Junction Temperature Range | T_J | -40 to +150 | $^{\circ}$ C |
| Storage Temperature Range | T_{STG} | -65 to +150 | $^{\circ}$ C |
| Lead Temperature (Soldering) 10 seconds | T_{LEAD} | 260 | $^{\circ}$ C |
| ESD Rating | ESD | 2 | kV |

ORDERING INFORMATION

| PACKAGE | TOLERANCE | | | | | T/R Quantity |
|--------------------------|-----------|-----------|-----------|-----------|-----------|--------------|
| | 0.1% | 0.2% | 0.5% | 1.0% | 2.0% | |
| SOT-23-3L ⁽¹⁾ | SC4040ASK | SC4040BSK | SC4040CSK | SC4040DSK | SC4040ESK | 3K |
| SO-8 ⁽¹⁾ | SC4040AS | SC4040BS | SC4040CS | SC4040DS | SC4040ES | 2.5K |
| TO-92 ⁽¹⁾⁽²⁾ | SC4040AZ | SC4040BZ | SC4040CZ | SC4040DZ | SC4040EZ | TR=3K, TA=2K |

Notes:

(1) Add suffix 'TR' for Tape & Reel.

(2) Add suffix 'TA' for Tape Ammo.

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ELECTRICAL CHARACTERISTICS

| T _A = 25°C unless otherwise specified. | | | | SC4040A (0.1%) | | | SC4040B (0.2%) | | | |
|---|---------------------------------|---|-------------------------------|----------------|--------|--------|----------------|-------|-------|--------|
| Parameter | Symbol | Condition | | MIN | TYP | MAX | MIN | TYP | MAX | UNITS |
| Reverse Breakdown Voltage | V _Z | I _Z = 100µA | T _A = 25°C | 2.4975 | 2.5000 | 2.5025 | 2.495 | 2.500 | 2.505 | V |
| | | | T _A = -40 to +85°C | 2.481 | 2.500 | 2.519 | 2.479 | 2.500 | 2.521 | V |
| Minimum Operating Current | I _{Z(min)} | | | | 60 | 80 | | 60 | 80 | µA |
| Reverse Breakdown Voltage Temperature Coefficient | $\frac{\Delta V_Z}{\Delta T}$ | I _Z = 10mA I _Z = 1mA I _Z = 100µA | T _A = -40 to +85°C | | | ±100 | | | ±100 | ppm/°C |
| Ratio of Change in V _Z to Change in I _Z | $\frac{\Delta V_Z}{\Delta I_Z}$ | I _{Z(min)} ≤ I _Z ≤ 1mA | T _A = 25°C | | | 0.8 | | | 0.8 | mV |
| | | | T _A = -40 to +85°C | | | 1.0 | | | 1.0 | mV |
| | | 1mA ≤ I _Z ≤ 12mA | T _A = 25°C | | | 6.0 | | | 6.0 | mV |
| | | | T _A = -40 to +85°C | | | 8.0 | | | 8.0 | mV |
| Reverse Dynamic Impedance | Z _R | I _Z = 1mA, f = 120 Hz, I _{AC} = 0.1 I _Z | | | 0.25 | 0.8 | | 0.25 | 0.8 | Ω |
| Wideband Noise (RMS) | e _N | I _Z = 100µA 10Hz ≤ f ≤ 10kHz | | | 35 | | | 35 | | µV |
| Long Term Stability of Reverse Breakdown Voltage | ΔV _Z | t = 1000 hours T = 25°C ± 0.1°C I _Z = 100µA | | | 120 | | | 120 | | ppm |

| T _A = 25°C unless otherwise specified. | | | | SC4040C (0.5%) | | | SC4040D (1.0%) | | | |
|---|---------------------------------|---|-------------------------------|----------------|-------|-------|----------------|-------|-------|--------|
| Parameter | Symbol | Condition | | MIN | TYP | MAX | MIN | TYP | MAX | UNITS |
| Reverse Breakdown Voltage | V _Z | I _Z = 100µA | T _A = 25°C | 2.488 | 2.500 | 2.512 | 2.475 | 2.500 | 2.525 | V |
| | | | T _A = -40 to +85°C | 2.471 | 2.500 | 2.529 | 2.451 | 2.500 | 2.549 | V |
| Minimum Operating Current | I _{Z(min)} | | | | 60 | 80 | | 60 | 80 | µA |
| Reverse Breakdown Voltage Temperature Coefficient | $\frac{\Delta V_Z}{\Delta T}$ | I _Z = 10mA I _Z = 1mA I _Z = 100µA | T _A = -40 to +85°C | | | ±100 | | | ±150 | ppm/°C |
| Ratio of Change in V _Z to Change in I _Z | $\frac{\Delta V_Z}{\Delta I_Z}$ | I _{Z(min)} ≤ I _Z ≤ 1mA | T _A = 25°C | | | 0.8 | | | 1.0 | mV |
| | | | T _A = -40 to +85°C | | | 1.0 | | | 1.2 | mV |
| | | 1mA ≤ I _Z ≤ 12mA | T _A = 25°C | | | 6.0 | | | 8.0 | mV |
| | | | T _A = -40 to +85°C | | | 8.0 | | | 10.0 | mV |
| Reverse Dynamic Impedance | Z _R | I _Z = 1mA, f = 120 Hz, I _{AC} = 0.1 I _Z | | | 0.25 | 0.9 | | 0.25 | 1.1 | Ω |
| Wideband Noise (RMS) | e _N | I _Z = 100µA 10Hz ≤ f ≤ 10kHz | | | 20 | | | 35 | | µV |
| Long Term Stability of Reverse Breakdown Voltage | ΔV _Z | t = 1000 hours T = 25°C ± 0.1°C I _Z = 100µA | | | 120 | | | 120 | | ppm |

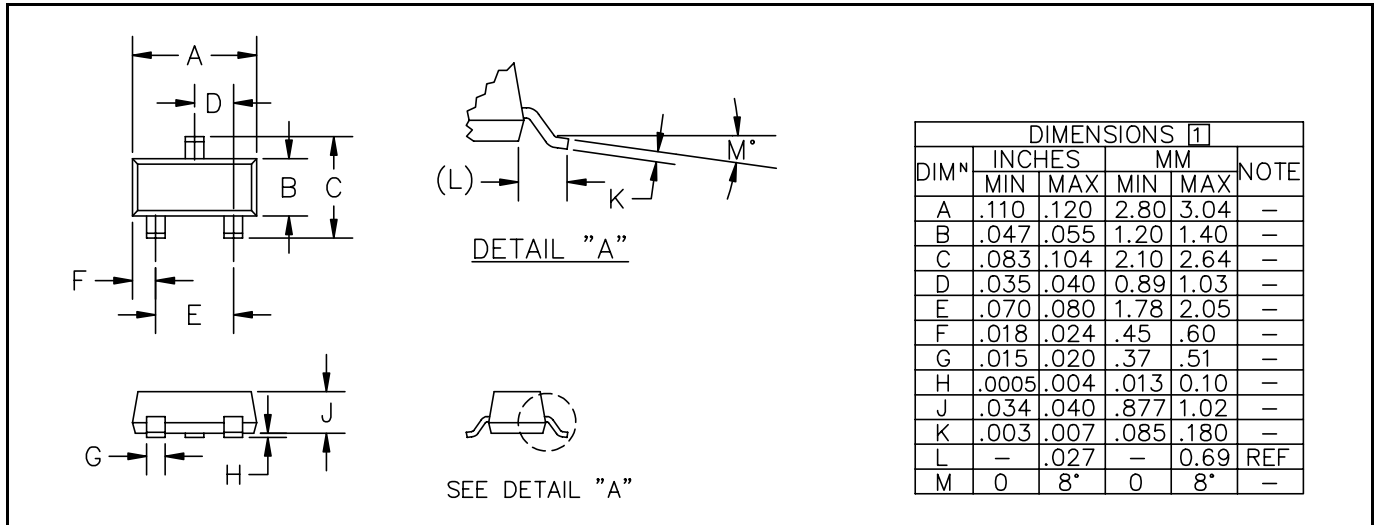
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ELECTRICAL CHARACTERISTICS

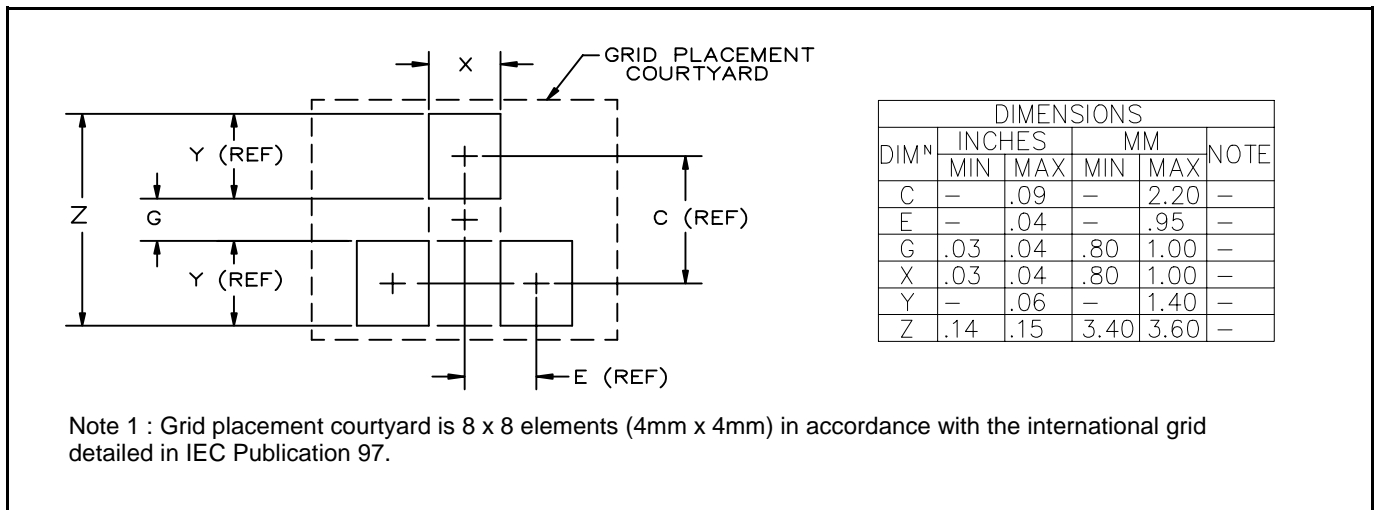
| T _A = 25°C unless otherwise specified. | | | | SC4040E (2.0%) | | | |
|---|---------------------------------|---|-------------------------------|----------------|-------|-------|--------|
| Parameter | Symbol | Condition | | MIN | TYP | MAX | UNITS |
| Reverse Breakdown Voltage | V _Z | I _Z = 100μA | T _A = 25°C | 2.450 | 2.500 | 2.550 | V |
| | | | T _A = -40 to +85°C | 2.426 | 2.500 | 2.574 | V |
| Minimum Operating Current | I _{Z(min)} | | | | 60 | 80 | μA |
| Reverse Breakdown Voltage Temperature Coefficient | $\frac{\Delta V_Z}{\Delta T}$ | I _Z = 10mA I _Z = 1mA I _Z = 100μA | T _A = -40 to +85°C | | | ±150 | ppm/°C |
| Ratio of Change in V _Z to Change in I _Z | $\frac{\Delta V_Z}{\Delta I_Z}$ | I _{Z(min)} ≤ I _Z ≤ 1mA | T _A = 25°C | | | 1.0 | mV |
| | | | T _A = -40 to +85°C | | | 1.2 | mV |
| | | 1mA ≤ I _Z ≤ 12mA | T _A = 25°C | | | 8.0 | mV |
| | | | T _A = -40 to +85°C | | | 10.0 | mV |
| Reverse Dynamic Impedance | Z _R | I _Z = 1mA, f = 120 Hz, I _{AC} = 0.1 I _Z | | | 0.25 | 1.1 | Ω |
| Wideband Noise (RMS) | e _N | I _Z = 100μA 10Hz ≤ f ≤ 10kHz | | | 35 | | μV |
| Long Term Stability of Reverse Breakdown Voltage | ΔV _Z | t = 1000 hours T = 25°C ± 0.1°C I _Z = 100μA | | | 120 | | ppm |

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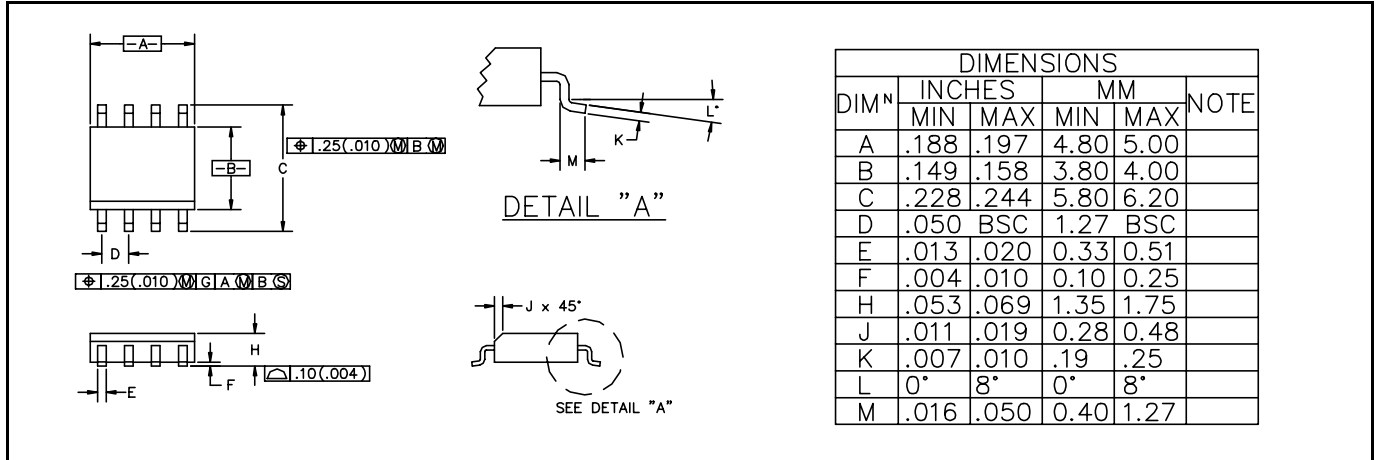
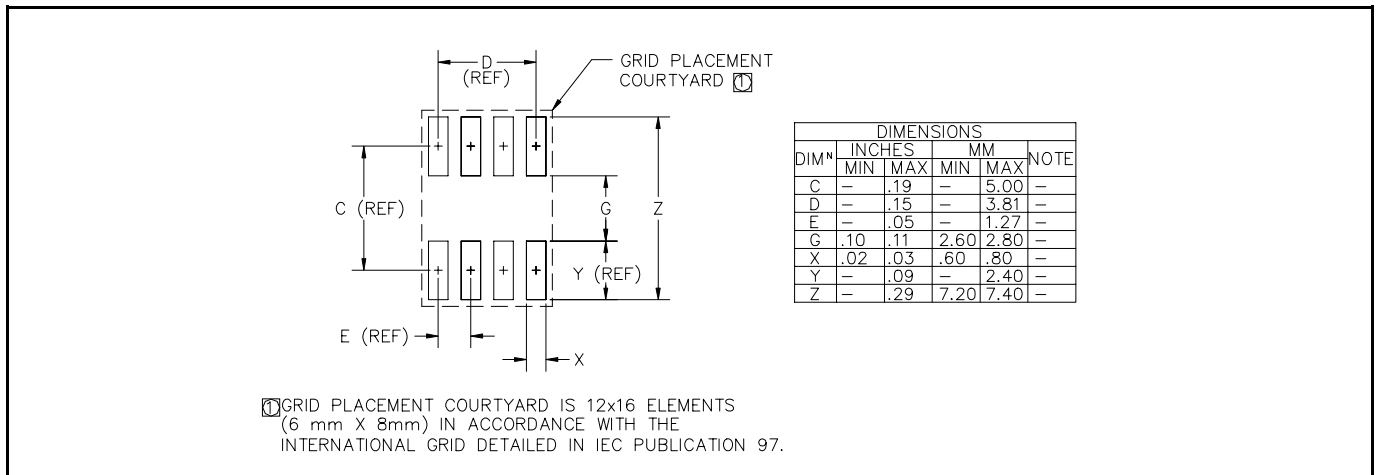
OUTLINE DRAWING SOT-23



LAND PATTERN SOT-23



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OUTLINE DRAWING SO-8

LAND PATTERN SO-8

OUTLINE DRAWING TO-92
