

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  $0.25\Omega$ . Active output circuitry provides a very sharp turn on characteristic - the minimum operating current is  $60\mu\text{A}$ , with a maximum of  $20\text{mA}$ .

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.

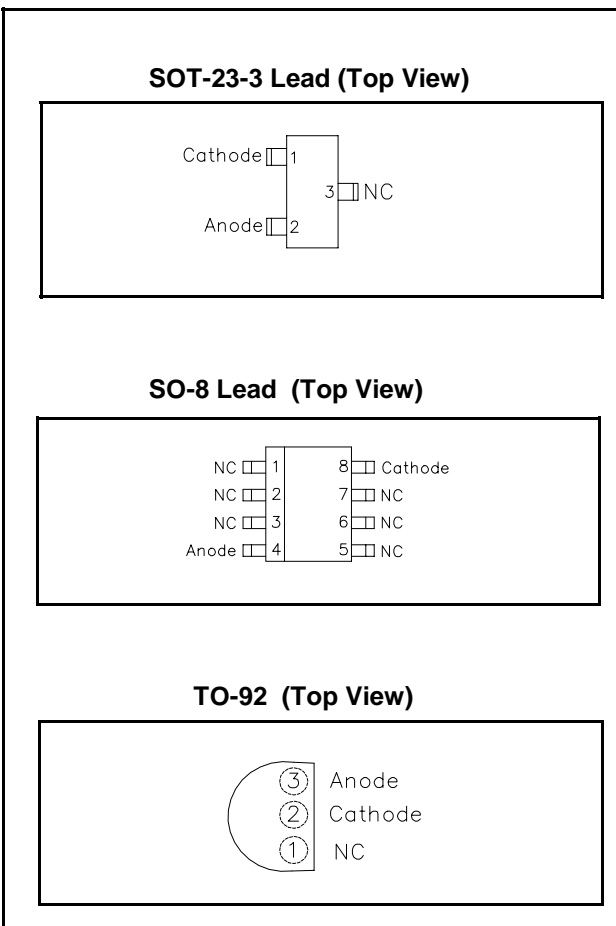
### FEATURES

- Trimmed bandgap design (0.2%)
- Wide operating current range  $60\mu\text{A}$  to  $20\text{mA}$
- Low dynamic impedance ( $0.25\Omega$ )
- Available in SOT-23, TO-92 and SO-8

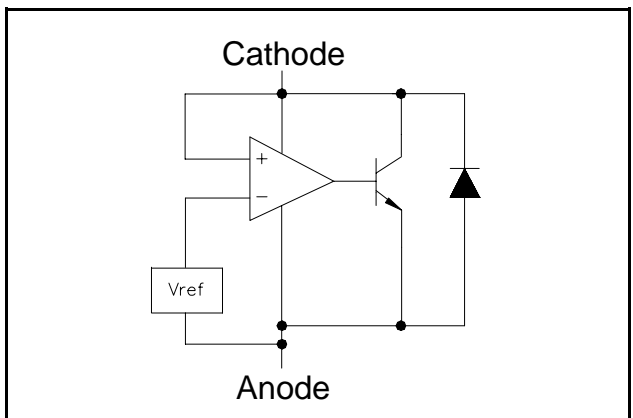
### APPLICATIONS

- Cellular telephones
- Portable computers
- Instrumentation
- Automotive

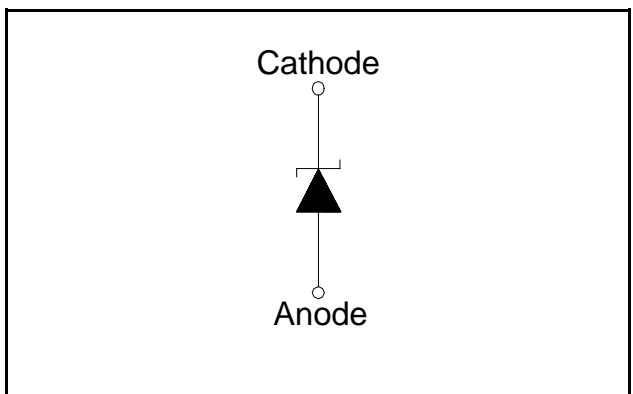
### PIN CONFIGURATIONS



### BLOCK DIAGRAM



### SYMBOL DIAGRAM



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**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Maximum	Units
Reverse Current		60 $\mu$ 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 <sup>(1)</sup>	SC4040ASK	SC4040BSK	SC4040CSK	SC4040DSK	SC4040ESK	3K
SO-8 <sup>(1)</sup>	SC4040AS	SC4040BS	SC4040CS	SC4040DS	SC4040ES	2.5K
TO-92 <sup>(1)(2)</sup>	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 <sub>A</sub> = 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 <sub>Z</sub>	I <sub>Z</sub> = 100µA	T <sub>A</sub> = 25°C	2.4975	2.5000	2.5025	2.495	2.500	2.505	V
			T <sub>A</sub> = -40 to +85°C	2.481	2.500	2.519	2.479	2.500	2.521	V
Minimum Operating Current	I <sub>Z(min)</sub>				60	80		60	80	µA
Reverse Breakdown Voltage Temperature Coefficient	$\frac{\Delta V_Z}{\Delta T}$	I <sub>Z</sub> = 10mA I <sub>Z</sub> = 1mA I <sub>Z</sub> = 100µA	T <sub>A</sub> = -40 to +85°C			±100			±100	ppm/°C
Ratio of Change in V <sub>Z</sub> to Change in I <sub>Z</sub>	$\frac{\Delta V_Z}{\Delta I_Z}$	I <sub>Z(min)</sub> ≤ I <sub>Z</sub> ≤ 1mA	T <sub>A</sub> = 25°C			0.8			0.8	mV
			T <sub>A</sub> = -40 to +85°C			1.0			1.0	mV
		1mA ≤ I <sub>Z</sub> ≤ 12mA	T <sub>A</sub> = 25°C			6.0			6.0	mV
			T <sub>A</sub> = -40 to +85°C			8.0			8.0	mV
Reverse Dynamic Impedance	Z <sub>R</sub>	I <sub>Z</sub> = 1mA, f = 120 Hz, I <sub>AC</sub> = 0.1 I <sub>Z</sub>			0.25	0.8		0.25	0.8	Ω
Wideband Noise (RMS)	e <sub>N</sub>	I <sub>Z</sub> = 100µA 10Hz ≤ f ≤ 10kHz			35			35		µV
Long Term Stability of Reverse Breakdown Voltage	ΔV <sub>Z</sub>	t = 1000 hours T = 25°C ± 0.1°C I <sub>Z</sub> = 100µA			120			120		ppm

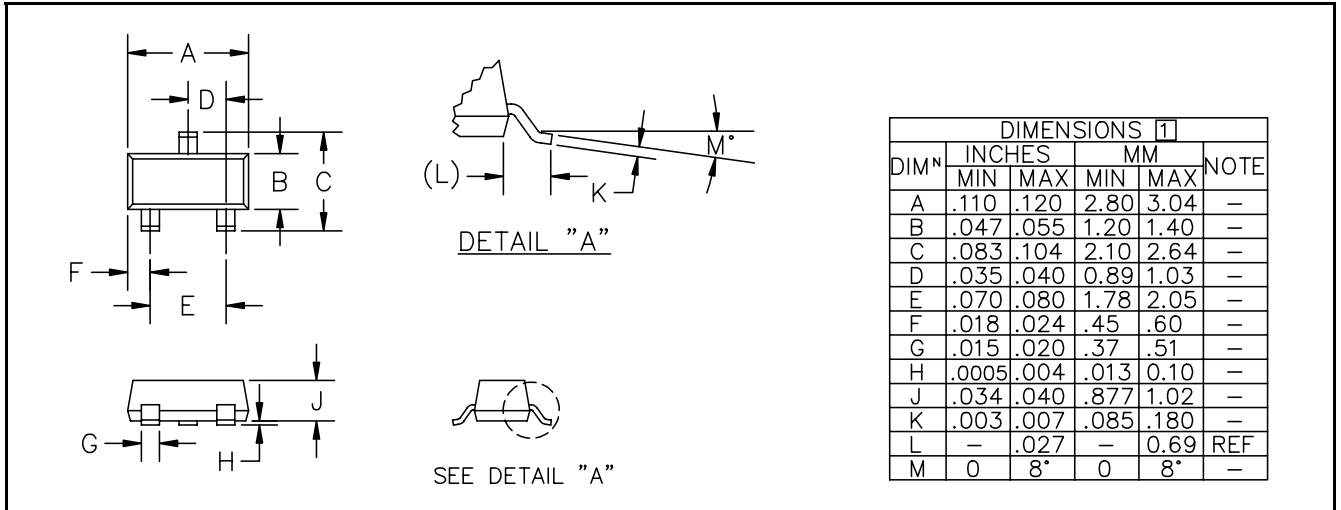
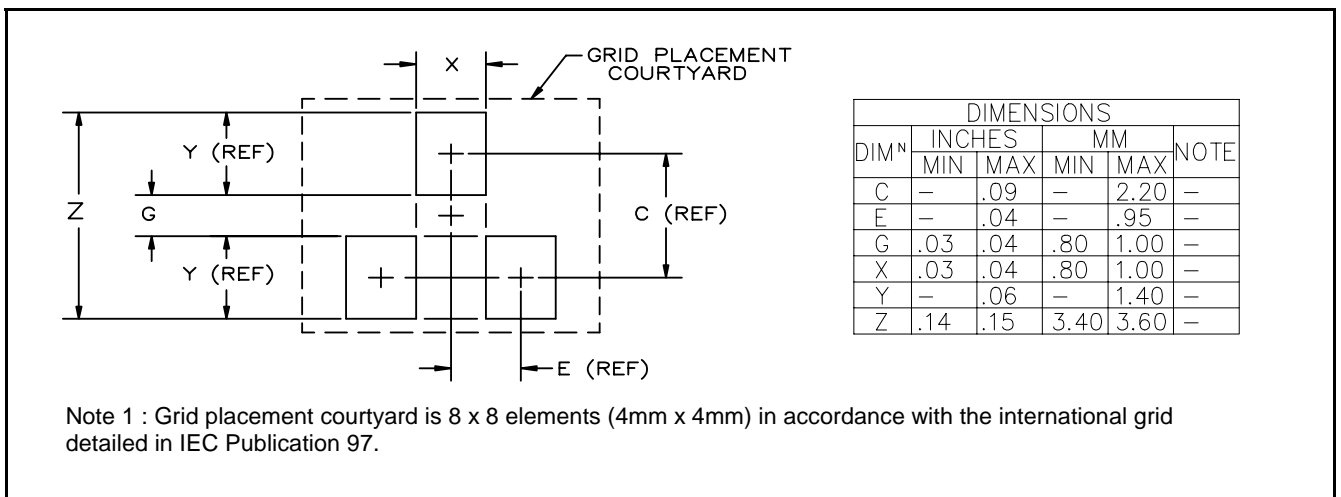
T <sub>A</sub> = 25°C unless otherwise specified.				SC4040C (0.5%)			SC4040D (1.0%)			
Parameter	Symbol	Condition		MIN	TYP	MAX	MIN	TYP	MAX	UNITS
Reverse Breakdown Voltage	V <sub>Z</sub>	I <sub>Z</sub> = 100µA	T <sub>A</sub> = 25°C	2.488	2.500	2.512	2.475	2.500	2.525	V
			T <sub>A</sub> = -40 to +85°C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

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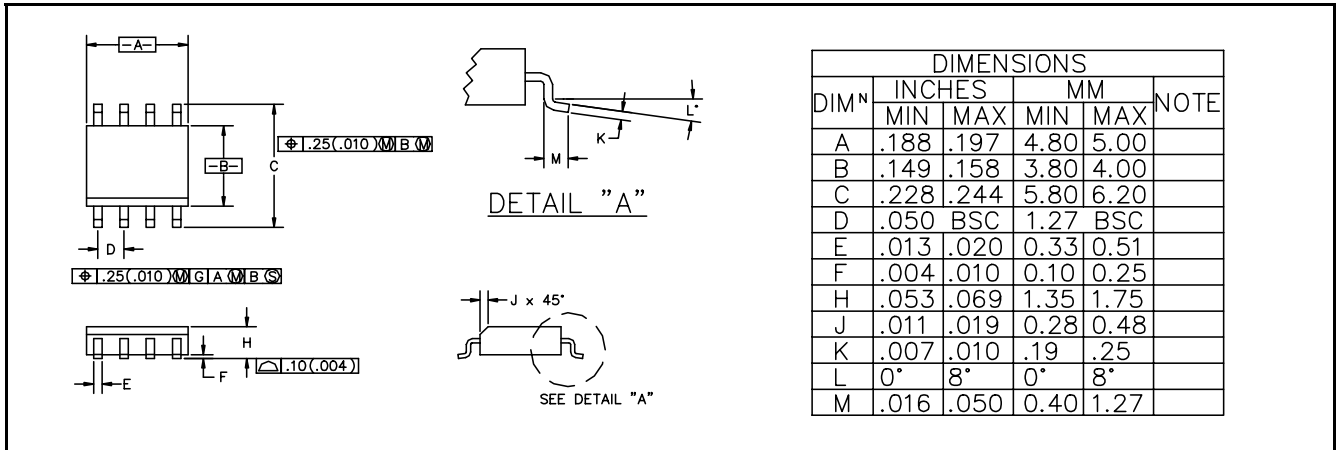
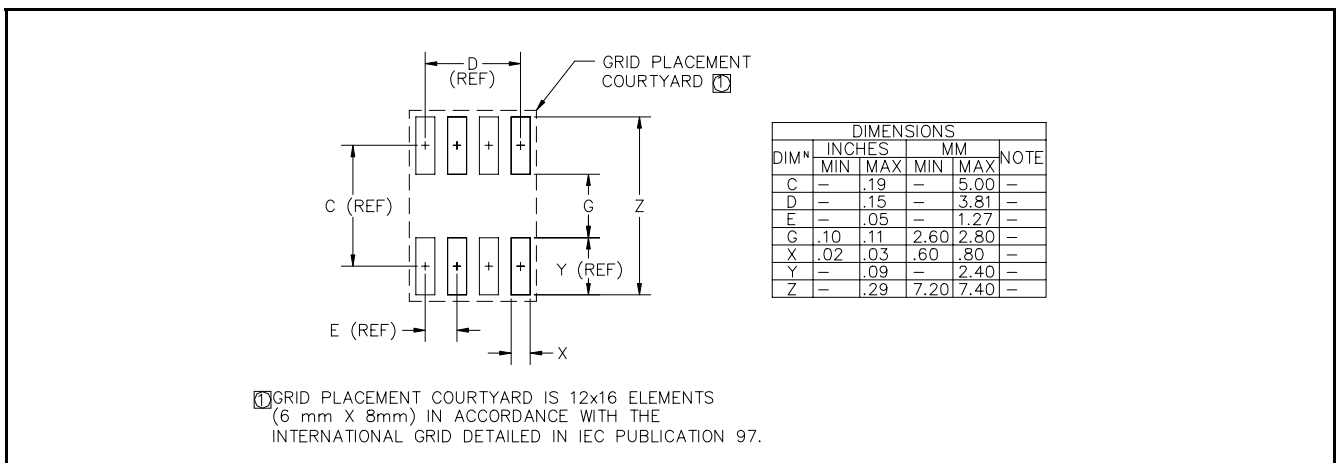
**ELECTRICAL CHARACTERISTICS**

$T_A = 25^\circ\text{C}$ unless otherwise specified.				<b>SC4040E (2.0%)</b>			
Parameter	Symbol	Condition		MIN	TYP	MAX	UNITS
Reverse Breakdown Voltage	$V_Z$	$I_Z = 100\mu\text{A}$	$T_A = 25^\circ\text{C}$	2.450	2.500	2.550	V
			$T_A = -40$ to $+85^\circ\text{C}$	2.426	2.500	2.574	V
Minimum Operating Current	$I_{Z(\text{min})}$				60	80	$\mu\text{A}$
Reverse Breakdown Voltage Temperature Coefficient	$\frac{\Delta V_Z}{\Delta T}$	$I_Z = 10\text{mA}$ $I_Z = 1\text{mA}$ $I_Z = 100\mu\text{A}$	$T_A = -40$ to $+85^\circ\text{C}$			$\pm 150$	ppm/ $^\circ\text{C}$
Ratio of Change in $V_Z$ to Change in $I_Z$	$\frac{\Delta V_Z}{\Delta I_Z}$	$I_{Z(\text{min})} \leq I_Z \leq 1\text{mA}$	$T_A = 25^\circ\text{C}$			1.0	mV
			$T_A = -40$ to $+85^\circ\text{C}$			1.2	mV
		$1\text{mA} \leq I_Z \leq 12\text{mA}$	$T_A = 25^\circ\text{C}$			8.0	mV
			$T_A = -40$ to $+85^\circ\text{C}$			10.0	mV
Reverse Dynamic Impedance	$Z_R$	$I_Z = 1\text{mA}$ , $f = 120\text{ Hz}$ , $I_{AC} = 0.1 I_Z$			0.25	1.1	$\Omega$
Wideband Noise (RMS)	$e_N$	$I_Z = 100\mu\text{A}$ $10\text{Hz} \leq f \leq 10\text{kHz}$			35		$\mu\text{V}$
Long Term Stability of Reverse Breakdown Voltage	$\Delta V_Z$	$t = 1000$ hours $T = 25^\circ\text{C} \pm 0.1^\circ\text{C}$ $I_Z = 100\mu\text{A}$			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**
