SC4040
2.5V Precision Shunt Voltage Reference

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 80µA, 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-23-3, SO-8 and TO-92), this part allows the designer the opportunity to select the optimum combination of cost and performance for their application.

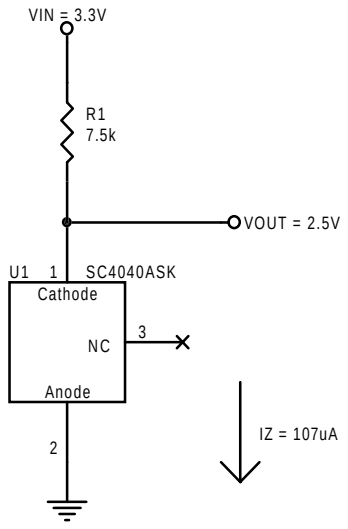
Features

- Trimmed bandgap design (0.1%)
- Wide operating current range 80µA to 20mA
- Low dynamic impedance (0.25Ω)
- Industrial temperature range
- Available in SOT-23-3, TO-92 and SO-8 packages

Applications

- Cellular telephones
- Portable computers
- Instrumentation
- Automotive
- Portable medical instruments

Typical Application Circuit



Absolute Maximum Ratings

Parameter	Symbol	Maximum	Units
Reverse Current	I_Z	60µA to 20	mA
Thermal Impedance, Junction to Ambient SOT-23-3 SO-8 TO-92	θ_{JA}	 336 163 132	°C/W
Operating Ambient Temperature Range	T_A	-40 to +85	°C
Operating Junction Temperature Range	T_J	-40 to +150	°C
Storage Temperature Range	T_{STG}	-65 to +150	°C
Lead Temperature (Soldering) 10 seconds	T_{LEAD}	300	°C
ESD Rating	V_{ESD}	2	kV

Electrical Characteristics

Unless specified: T_A = 25°C. Values in **bold** apply over full operating ambient temperature.

			SC4040A (0.1%)			SC4040B (0.2%)			
Parameter	**Symbol**	**Condition**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**
Reverse Breakdown Voltage	V_Z	I_Z = 100µA	2.4975	2.5000	2.5025	2.495	2.500	2.505	V
			2.4810		**2.5190**	**2.479**		**2.521**	
Minimum Operating Current	$I_{Z(MIN)}$			60	80		60	80	µA
Reverse Breakdown Voltage Temperature Coefficient	$\frac{\Delta V_Z}{\Delta T}$	100µA ≤ I_Z ≤ 10mA			**±100**			**±100**	ppm/°C
Change in V_Z due to Change in I_Z	$\Delta V_{Z(I)}$	$I_{Z(MIN)}$ ≤ I_Z ≤ 1mA			0.8			0.8	mV
					1.0			**1.0**	
		1mA ≤ I_Z ≤ 12mA			6.0			6.0	mV
					8.0			**8.0**	
Reverse Dynamic Impedance	Z_R	I_Z = 1mA, f = 120Hz, I_{AC} = 0.1I_Z		0.25	0.80		0.25	0.80	Ω
Wideband Noise (RMS)	e_N	I_Z = 100µA 10Hz ≤ f ≤ 10kHz		35			35		μV_{RMS}
Long Term Stabillity of Reverse Breakdown Voltage	$\Delta V_{Z(t)}$	t = 1000 hours T = 25°C ± 0.1°C I_Z = 100µA		120			120		ppm

Electrical Characteristics (Cont.)

Unless specified: T_A = 25°C. Values in **bold** apply over full operating ambient temperature.

			SC4040C (0.5%)			SC4040D (1.0%)			
Parameter	**Symbol**	**Condition**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**
Reverse Breakdown Voltage	V_Z	I_Z = 100µA	2.488	2.500	2.512	2.475	2.500	2.525	V
			2.471		**2.529**	**2.451**		**2.549**	
Minimum Operating Current	$I_{Z(MIN)}$			60	80		60	80	µA
Reverse Breakdown Voltage Temperature Coefficient	$\frac{\Delta V_Z}{\Delta T}$	100µA ≤ I_Z ≤ 10mA			**±100**			**±150**	ppm/°C
Change in V_Z due to Change in I_Z	$\Delta V_{Z(I)}$	$I_{Z(MIN)}$ ≤ I_Z ≤ 1mA			0.8			1.0	mV
					1.0			**1.2**	
		1mA ≤ I_Z ≤ 12mA			6.0			8.0	mV
					8.0			**10.0**	
Reverse Dynamic Impedance	Z_R	I_Z = 1mA, f = 120Hz, I_{AC} = 0.1I_Z		0.25	0.90		0.25	1.10	Ω
Wideband Noise (RMS)	e_N	I_Z = 100µA 10Hz ≤ f ≤ 10kHz		35			35		μV_{RMS}
Long Term Stabillity of Reverse Breakdown Voltage	$\Delta V_{Z(t)}$	t = 1000 hours T = 25°C ± 0.1°C I_Z = 100µA		120			120		ppm

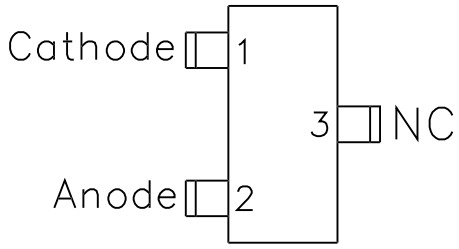
Electrical Characteristics (Cont.)

Unless specified: T_A = 25°C. Values in **bold** apply over full operating ambient temperature.

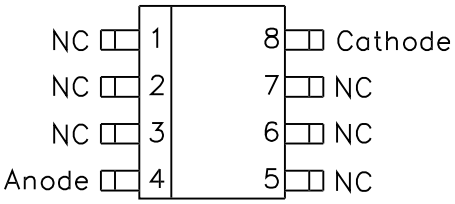
			SC4040E (2.0%)			
Parameter	**Symbol**	**Condition**	**Min**	**Typ**	**Max**	**Units**
Reverse Breakdown Voltage	V_Z	I_Z = 100µA	2.450	2.500	2.550	V
			2.426		**2.574**	
Minimum Operating Current	$I_{Z(MIN)}$			60	80	µA
Reverse Breakdown Voltage Temperature Coefficient	$\frac{\Delta V_Z}{\Delta T}$	100µA ≤ I_Z ≤ 10mA			**±150**	ppm/°C
Change in V_Z due to Change in I_Z	$\Delta V_{Z(I)}$	$I_{Z(MIN)}$ ≤ I_Z ≤ 1mA			1.0	mV
					1.2	
		1mA ≤ I_Z ≤ 12mA			8.0	mV
					10.0	
Reverse Dynamic Impedance	Z_R	I_Z = 1mA, f = 120Hz, I_{AC} = 0.1I_Z		0.25	1.10	Ω
Wideband Noise (RMS)	e_N	I_Z = 100µA, 10Hz ≤ f ≤ 10kHz		35		μV_{RMS}
Long Term Stabillity of Reverse Breakdown Voltage	$\Delta V_{Z(t)}$	t = 1000 hours, T = 25°C ± 0.1°C, I_Z = 100µA		120		ppm

Pin Configurations

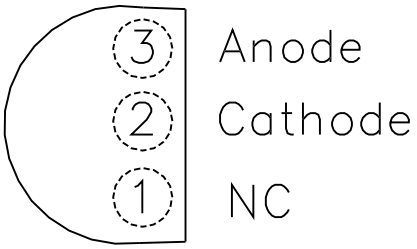
SOT-23-3 (Top View)



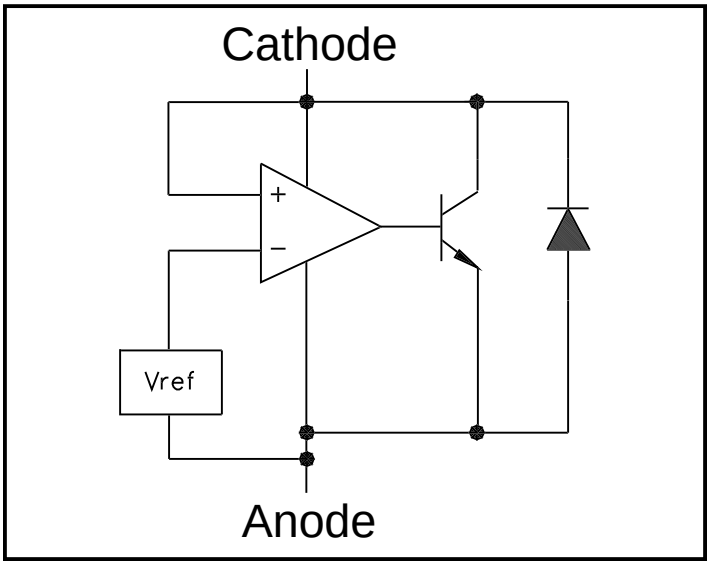
SO-8 (Top View)



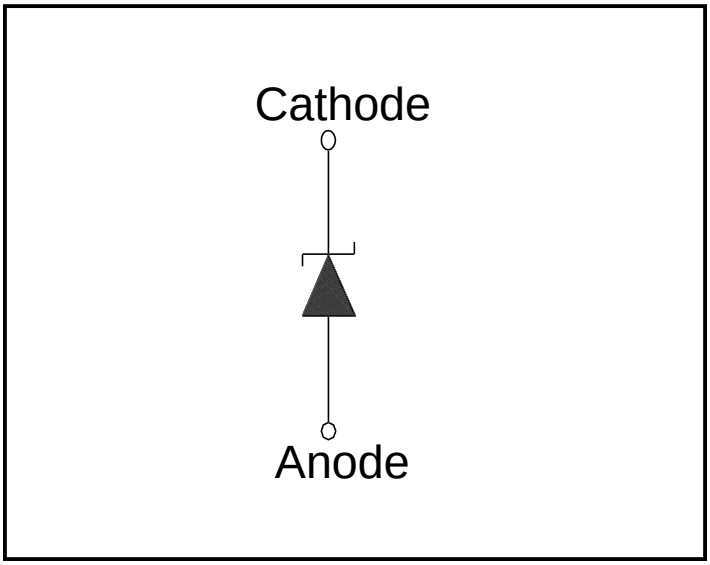
TO-92 (Top View)



Block Diagram



Symbol

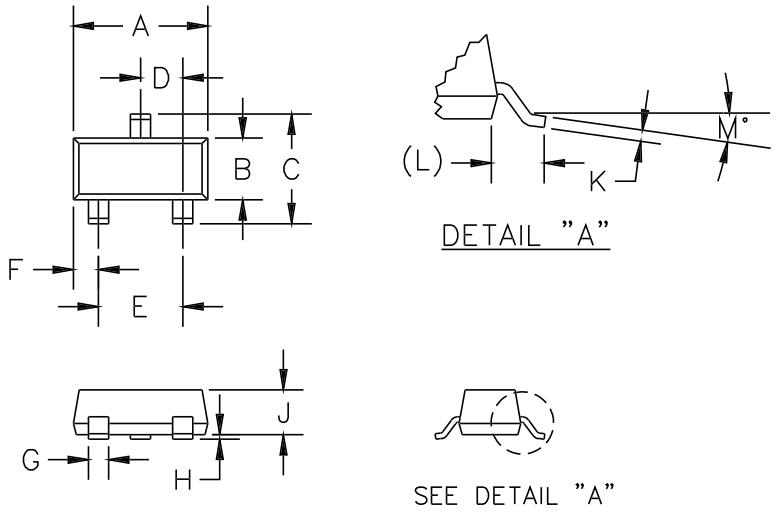


Ordering Information

Package	Tolerance				
	0.1%	**0.2%**	**0.5%**	**1.0%**	**2.0%**
SOT-23-3(1)	SC4040ASK.TR	SC4040BSK.TR	SC4040CSK.TR	SC4040DSK.TR	SC4040ESK.TR
SO-8(2)	SC4040AS.TR	SC4040BS.TR	SC4040CS.TR	SC4040DS.TR	SC4040ES.TR
TO-92(3)	SC4040AZ.TR	SC4040BZ.TR	SC4040CZ.TR	SC4040DZ.TR	SC4040EZ.TR

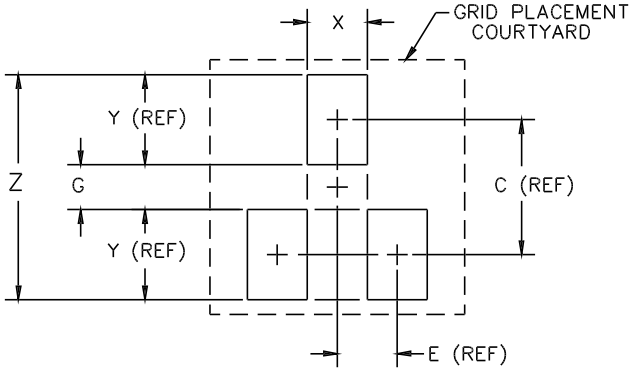
Notes:
(1) Only available in tape and reel packaging. A reel contains 3000 devices.
(2) Only available in tape and reel packaging. A reel contains 2500 devices.
(3) Available in tape and reel packaging (a reel contains 3000 devices) or ammo pack (suffix TA, an ammo pack contains 2000 devices).

Outline Drawing - SOT-23-3



DIMENSIONS [1]					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.110	.120	2.80	3.04	–
B	.047	.055	1.20	1.40	–
C	.083	.104	2.10	2.64	–
D	.035	.040	0.89	1.03	–
E	.070	.080	1.78	2.05	–
F	.018	.024	.45	.60	–
G	.015	.020	.37	.51	–
H	.0005	.004	.013	0.10	–
J	.034	.040	.877	1.02	–
K	.003	.007	.085	.180	–
L	–	.027	–	0.69	REF
M	0	8°	0	8°	–

Land Pattern - SOT-23-3

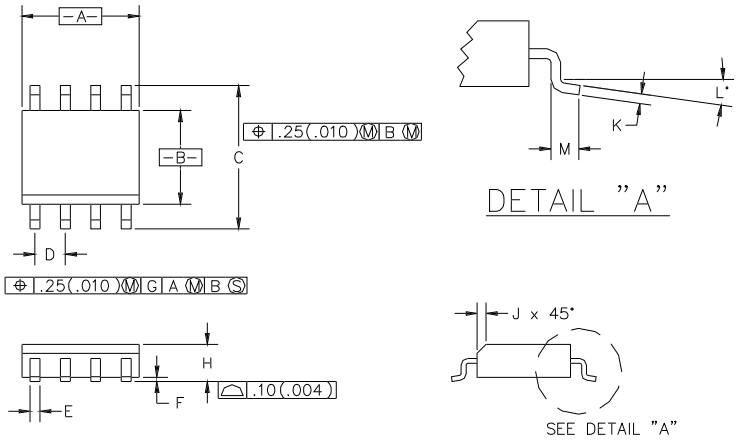


DIMENSIONS					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
C	–	.09	–	2.20	–
E	–	.04	–	.95	–
G	.03	.04	.80	1.00	–
X	.03	.04	.80	1.00	–
Y	–	.06	–	1.40	–
Z	.14	.15	3.40	3.60	–

Note:

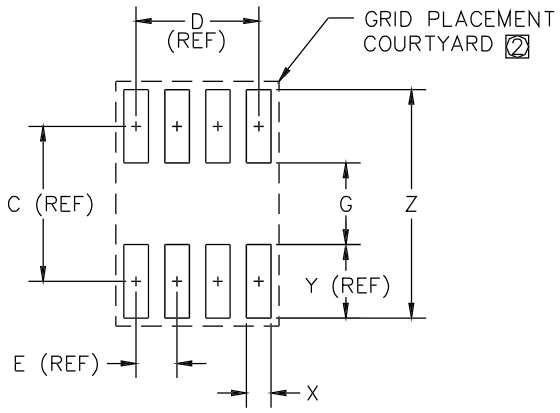
(1) Grid placement courtyard is 8 x 8 elements (4mm x 4mm) in accordance with the international grid detailed in IEC Publication 97.

Outline Drawing - SO-8



DIMENSIONS					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.188	.197	4.80	5.00	
B	.149	.158	3.80	4.00	
C	.228	.244	5.80	6.20	
D	.050	BSC	1.27	BSC	
E	.013	.020	0.33	0.51	
F	.004	.010	0.10	0.25	
H	.053	.069	1.35	1.75	
J	.011	.019	0.28	0.48	
K	.007	.010	.19	.25	
L	0°	8°	0°	8°	
M	.016	.050	0.40	1.27	

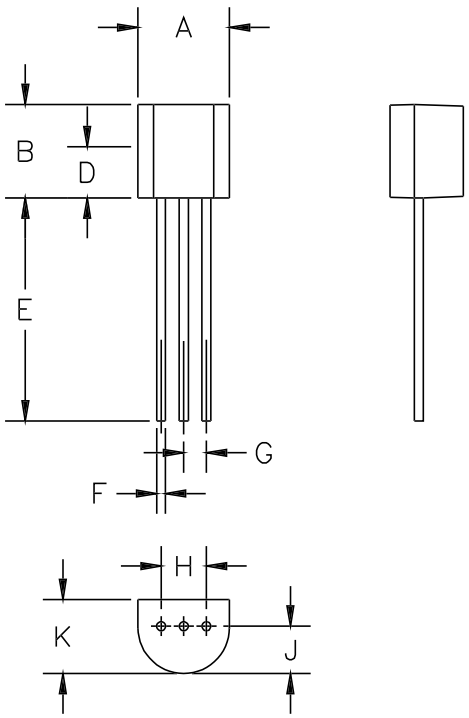
Land Pattern - SO-8



DIMENSIONS					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
C	–	.19	–	5.00	–
D	–	.15	–	3.81	–
E	–	.05	–	1.27	–
G	.10	.11	2.60	2.80	–
X	.02	.03	.60	.80	–
Y	–	.09	–	2.40	–
Z	–	.29	7.20	7.40	–

(2) GRID PLACEMENT COURTYARD IS 12x16 ELEMENTS (6 mm X 8mm) IN ACCORDANCE WITH THE INTERNATIONAL GRID DETAILED IN IEC PUBLICATION 97.

Outline Drawing - TO-92



DIMENSIONS					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.175	.205	4.445	5.207	—
B	.170	.210	4.318	5.334	—
E	.500	.610	12.7	15.5	—
F	.016	.021	.407	.533	—
G	.045	.055	1.143	1.397	—
H	.095	.105	2.413	2.667	—
J	.080	.105	2.032	2.667	—
K	.125	.165	3.175	4.191	—

Contact Information

Semtech Corporation
Power Management Products Division
652 Mitchell Rd., Newbury Park, CA 91320
Phone: (805)498-2111 FAX (805)498-3804