SEMTECH
Today's Results...Tomorrow's Vision

PRECISION SHUNT VOLTAGE REFERENCE

SC4040

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)
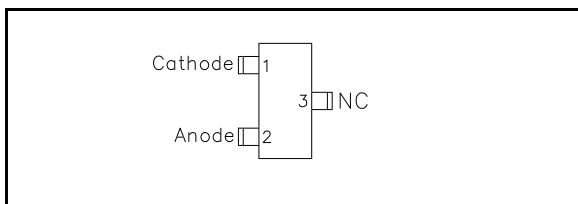
SO-8 Lead (Top View)
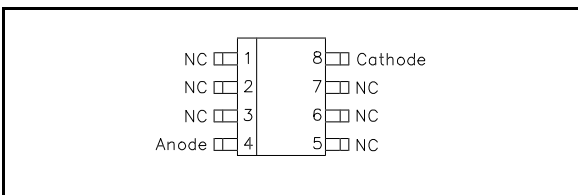
TO-92 (Top View)
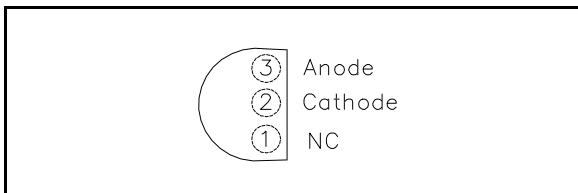
BLOCK DIAGRAM

SYMBOL DIAGRAM

652 MITCHELL ROAD NEWBURY PARK CA 91320
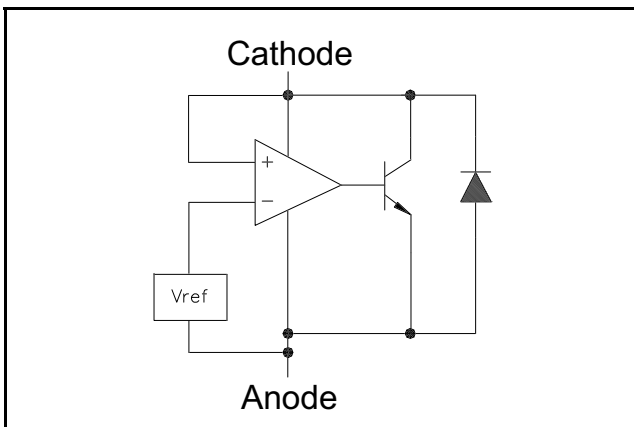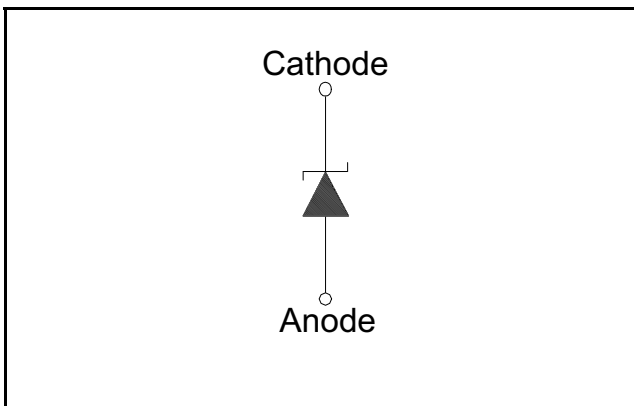
PRELIMINARY - April 13, 1998

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Maximum	Units
Reverse Current		60 µA to 20	mA
Operating 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}	260	°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.

652 MITCHELL ROAD NEWBURY PARK CA 91320

PRELIMINARY - April 13, 1998

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	$\frac{\Delta V_Z}{\Delta I_Z}$	$I_{Z(min)} \le I_Z \le$ 1mA	T_A = 25°C			0.8			0.8	mV
			T_A = -40 to +85°C			1.0			1.0	mV
		1mA $\le I_Z \le$ 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 $\le$ f $\le$ 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	$\frac{\Delta V_Z}{\Delta I_Z}$	$I_{Z(min)} \le I_Z \le$ 1mA	T_A = 25°C			0.8			1.0	mV
			T_A = -40 to +85°C			1.0			1.2	mV
		1mA $\le I_Z \le$ 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 $\le$ f $\le$ 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

3

ELECTRICAL CHARACTERISTICS

T_A = 25°C unless otherwise specified.				SC4040E (2.0%)			
Parameter	Symbol	Condition		MIN	TYP	MAX	UNITS
Reverse Breakdown Voltage	V_Z	$I_Z = 100\mu A$	$T_A = 25°C$	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	$\frac{\Delta V_Z}{\Delta T}$	$I_Z = 10mA$ $I_Z = 1mA$ $I_Z = 100\mu A$	$T_A = -40$ to $+85°C$			±150	ppm/°C
Ratio of Change in V_Z to Change in I_Z	$\frac{\Delta V_Z}{\Delta I_Z}$	$I_{Z(min)} \leq I_Z \leq 1mA$	$T_A = 25°C$			1.0	mV
			$T_A = -40$ to $+85°C$			1.2	mV
		$1mA \leq I_Z \leq 12mA$	$T_A = 25°C$			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	$I_Z = 100\mu A$ $10Hz \leq f \leq 10kHz$			35		µV
Long Term Stability of Reverse Breakdown Voltage	ΔV_Z	t = 1000 hours T = 25°C ± 0.1°C $I_Z = 100\mu A$			120		ppm

4

652 MITCHELL ROAD NEWBURY PARK CA 91320

PRELIMINARY - April 13, 1998

OUTLINE DRAWING SOT-23

DETAIL "A"

SEE DETAIL "A"

DIM^N	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°	–

DIMENSIONS [1]

LAND PATTERN SOT-23

GRID PLACEMENT COURTYARD

DIM^N	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	–

DIMENSIONS

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

5

652 MITCHELL ROAD NEWBURY PARK CA 91320

PRELIMINARY - April 13, 1998

OUTLINE DRAWING SO-8

DIM^N	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

DIM^N	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	–

1 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

DIM^N	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	–

652 MITCHELL ROAD NEWBURY PARK CA 91320