SGM4051C
Precision, Micro Power Shunt Voltage Reference

GENERAL DESCRIPTION

The SGM4051C is a shunt voltage reference. It is a versatile easy-to-use reference suitable for a wide array of applications. The SGM4051C is available in a fixed 1.225V output. It requires no external capacitors for operation and is stable with all capacitive loads. Additionally, the reference offers low dynamic impedance, low noise and low temperature coefficient to ensure a stable output voltage over a wide range of operating currents and temperatures.

Packaged in the space-saving SC70-5 package and requiring low working current of 45μA (TYP), the SGM4051C is also ideal for portable applications. The SGM4051C is specified over an ambient temperature range of -40℃ to +125℃.

FEATURES

- **Fixed Output Voltage: 1.225V**
- **Tight Output Tolerance: 0.5% (MAX)**
- **Low Temperature Coefficient: 15ppm/℃ (TYP)**
- **Low Output Noise: 20μV_{RMS} (TYP)**
- **Wide Operating Current Range: 45μA (TYP) to 12mA**
- **Stable with All Capacitive Loads**
- **No Output Capacitor Required**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green SC70-5 Package**

APPLICATIONS

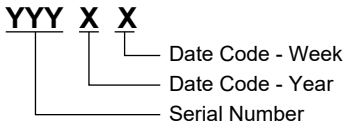
Data Acquisition System
Instrumentation and Test Equipment
Process Control
Precision Audio
Energy Management
Battery-Powered Equipment

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM4051C-1.2	SC70-5	-40℃ to +125℃	SGM4051C-1.2XC5G/TR	R88XX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date Code.



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Package Thermal Resistance
SC70-5, θ_{JA} ..... 237℃/W
Junction Temperature .....+150℃
Storage Temperature Range.....-65℃ to +150℃
Lead Temperature (Soldering, 10s) .....+260℃
ESD Susceptibility
HBM.....5000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range .....-40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

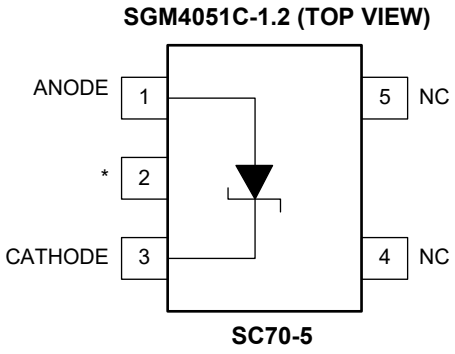
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION



PIN DESCRIPTION

PIN	NAME	I/O	FUNCTION
1	ANODE	O	Anode Pin. Normally connected to ground.
2	*	—	It should be left floating or connected to ANODE.
3	CATHODE	I/O	Shunt Current and Output Voltage.
4, 5	NC	—	No Connection.

ELECTRICAL CHARACTERISTICS

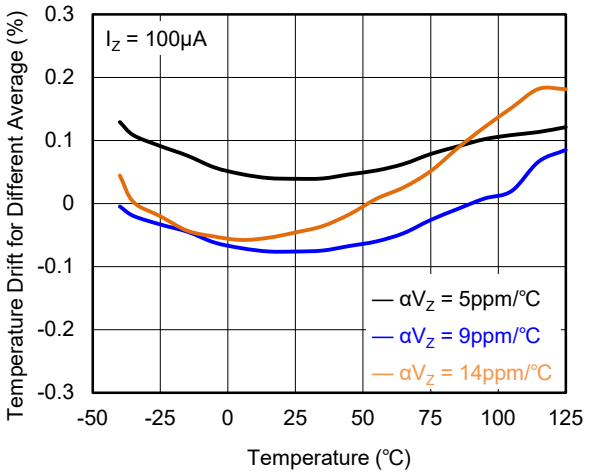
(At T_A = +25℃, Full = -40℃ to +125℃, unless otherwise noted.)

PARAMETER	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Reverse Breakdown Voltage (V_Z)	I_Z = 100μA	+25℃		1.225		V
Reverse Breakdown Voltage Tolerance	I_Z = 100μA	+25℃	-6.1		6.1	mV
		Full	-10.5		10.5	
Minimum Cathode Current ($I_{Z(MIN)}$)		+25℃		45	70	μA
		Full			90	
Average Temperature Coefficient of Reverse Breakdown Voltage (αV_Z)	I_Z = 10mA	Full		20		ppm/℃
	I_Z = 1mA	Full		20		
	I_Z = 100μA	Full		15		
Reverse Breakdown Voltage Change with Cathode Current Change ($\Delta V_Z/\Delta I_Z$)	$I_{Z(MIN)} < I_Z < 1$mA	+25℃		0.55	1.3	mV
		Full			2.8	
	1mA < I_Z < 12mA	+25℃		1.5	3	
		Full			4	
Reverse Dynamic Impedance (Z_Z)	I_Z = 1mA, $I_{AC} = 0.5I_Z$	+25℃		0.5	1.2	Ω
		Full			1.5	
Wideband Noise (e_n)	I_Z = 100μA, 10Hz ≤ f ≤ 10kHz	+25℃		20		μV_{RMS}
Thermal Hysteresis [1] (V_{HYST})	ΔT_A = -40℃ to +125℃			0.3		mV

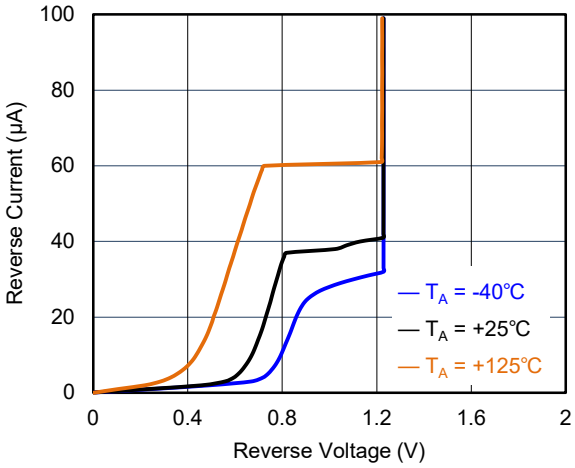
NOTE: 1. Thermal hysteresis is defined as $V_{Z,25℃}$ (after cycling to -40℃) - $V_{Z,25℃}$ (after cycling to +125℃).

TYPICAL PERFORMANCE CHARACTERISTICS

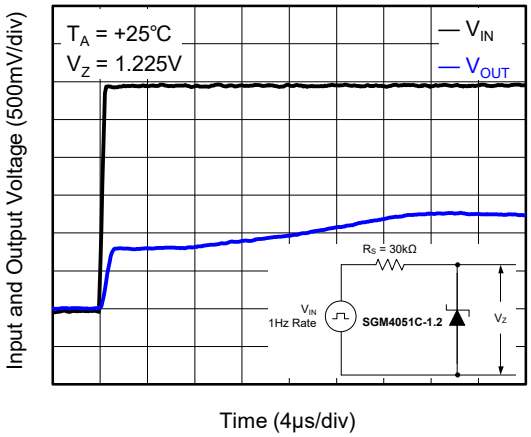
Temperature Drift for Different Average vs. Temperature



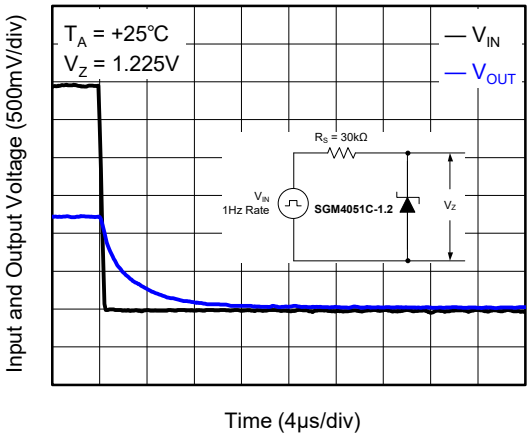
Reverse Current vs. Reverse Voltage



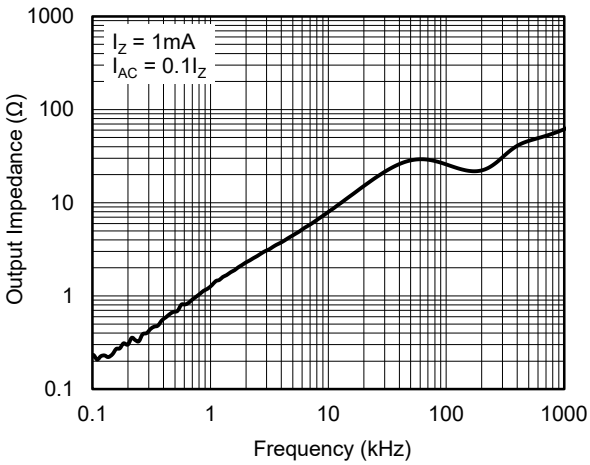
Start-Up Response



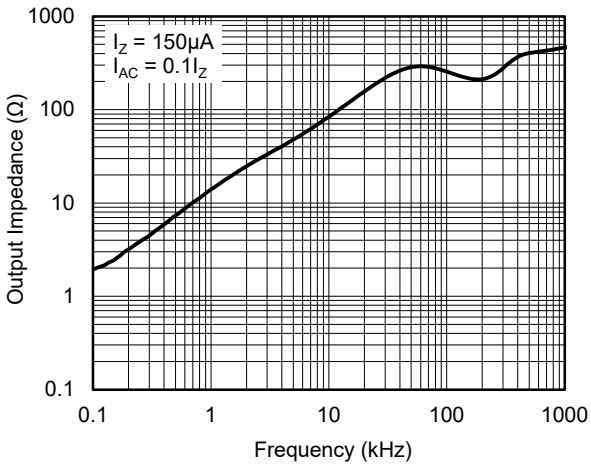
Power-Down Response



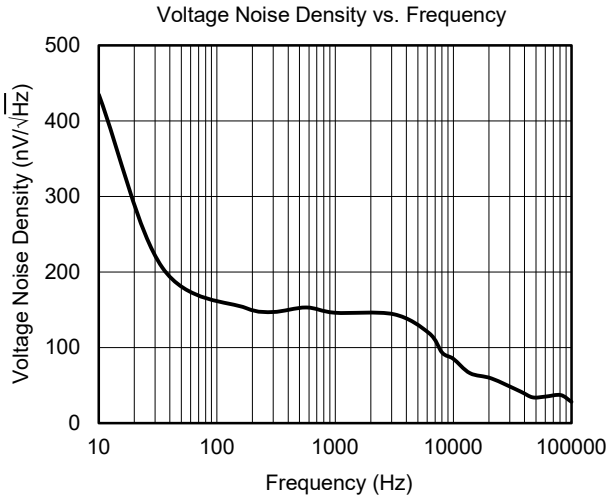
Output Impedance vs. Frequency

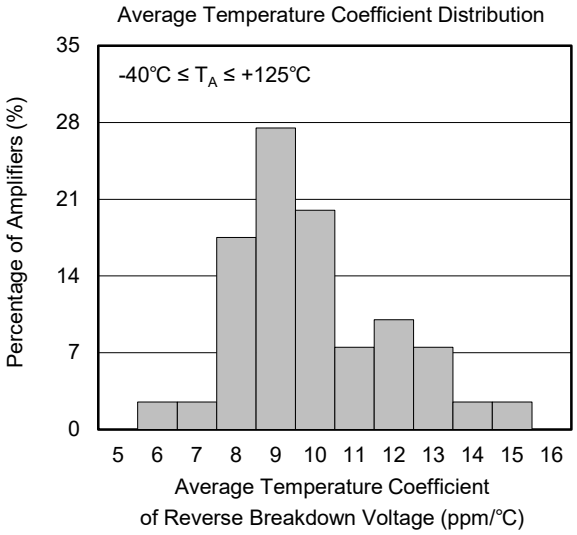


Output Impedance vs. Frequency



TYPICAL PERFORMANCE CHARACTERISTICS (continued)





APPLICATION INFORMATION

Output Capacitor

The SGM4051C does not require an output capacitor across CATHODE pin and ANODE pin for stability. However, if an output bypass capacitor is desired, the SGM4051C is designed to be stable with all capacitive loads.

Cathode and Load Currents

In a typical shunt regulator configuration (see Figure 1), an external resistor, R_S, is connected between the supply and the cathode of the SGM4051C. R_S must be set properly, as it sets the total current available to supply the load (I_L) and bias the SGM4051C (I_Z). In all cases, I_Z must stay within a specified range for proper operation of the reference. Taking into consideration one extreme in the variation of the load and supply voltage (maximum I_L and minimum V_S), R_S must be small enough to supply the minimum I_Z required for operation of the regulator, as given by datasheet parameters. At the other extreme, maximum V_S and minimum I_L, R_S must be large enough to limit I_Z to less than its maximum recommended rating of 12mA.

R_S is calculated as shown in Equation 1.

$$R_S = \frac{V_S - V_Z}{I_L + I_Z} \quad (1)$$

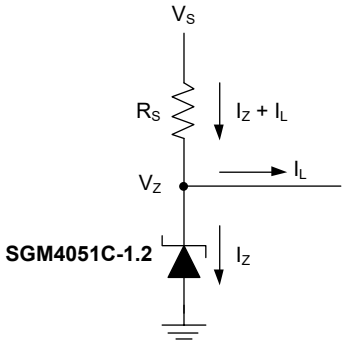
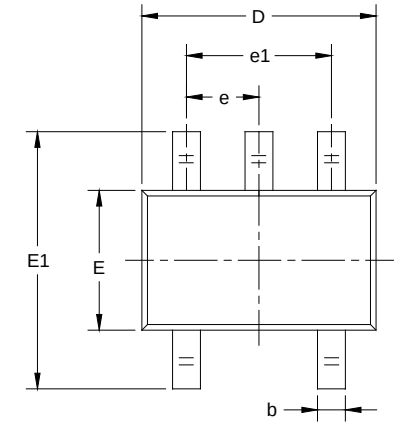
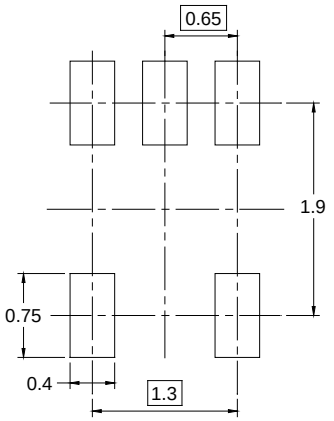


Figure 1. Shunt Regulator

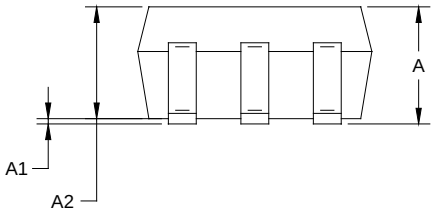
PACKAGE OUTLINE DIMENSIONS

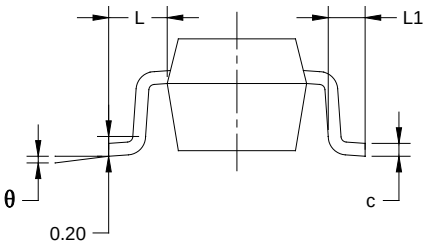
SC70-5





RECOMMENDED LAND PATTERN (Unit: mm)

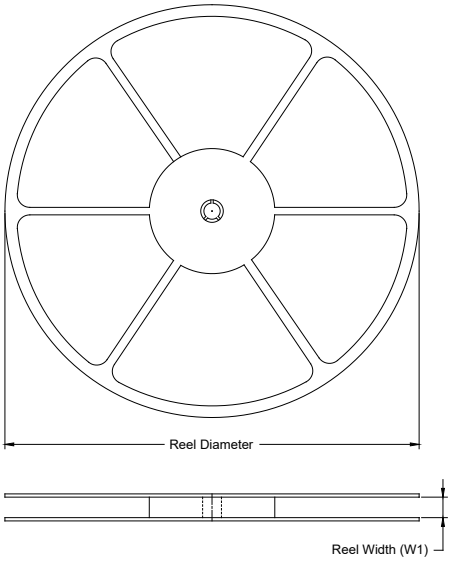




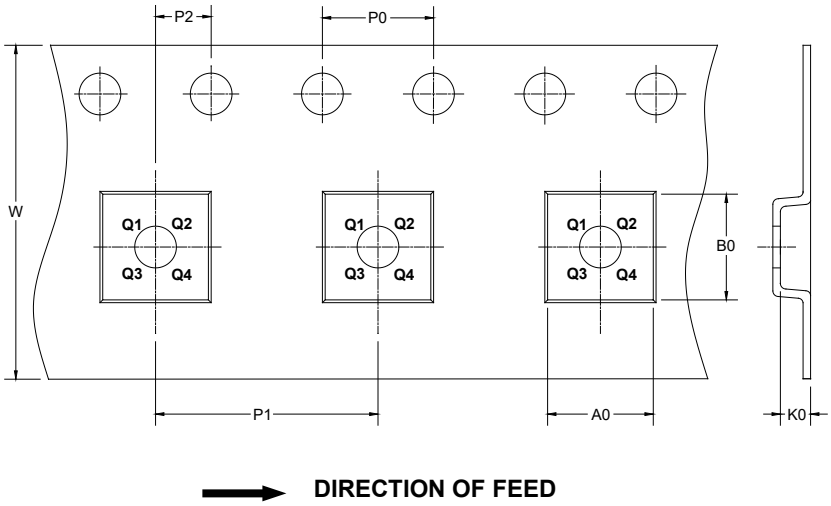
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.800	1.100	0.031	0.043
A1	0.000	0.100	0.000	0.004
A2	0.800	1.000	0.031	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.220	0.003	0.009
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 TYP	
e1	1.300 BSC		0.051 BSC	
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



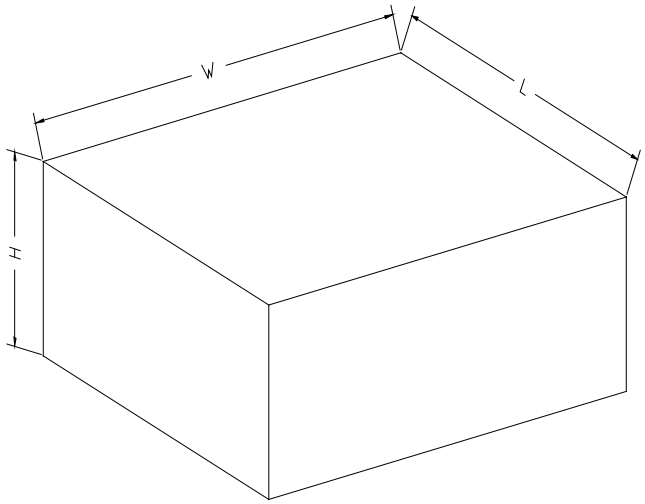
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SC70-5	7″	9.5	2.25	2.55	1.20	4.0	4.0	2.0	8.0	Q3

DD0001

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7″ (Option)	368	227	224	8
7″	442	410	224	18

DD0002