

Ultralow Noise, High PSRR, Fast RF Low-Dropout CMOS Voltage Regulator

■ INTRODUCTION

The HG1309 series are a group of positive voltage regulators manufactured by CMOS technologies with high ripple rejection, ultra low noise, low power consumption and low dropout voltage, which can prolong battery life in portable electronics. The HG1309 series work with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications. The HG1309 series consume less than 0.1 μ A in shutdown mode and have fast turn-on time less than 50 μ s. The series are very suitable for the battery-powered equipments, such as RF applications and other systems requiring a quiet voltage source.

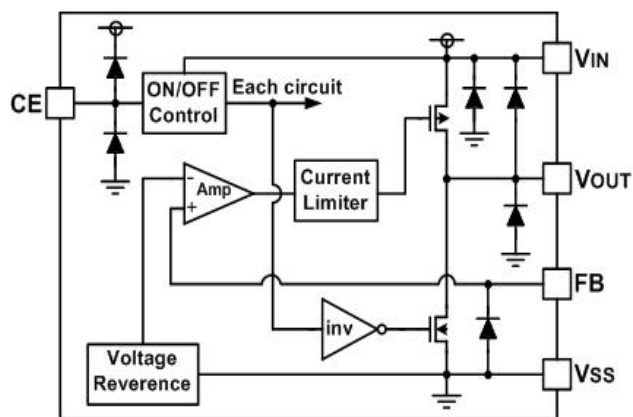
■ APPLICATIONS

- RF: VCOs, Receivers, ADCs
- Cellular and Cordless Telephones
- Handheld Organizers

■ FEATURES

- 500mA RF Low-Dropout Regulator With Enable
- Ultralow-Noise: 40 μ V_{RMS}(10Hz~100kHz)
- High PSRR: 70dB@1kHz
- Fast Start-Up Time (20 μ s)
- Excellent Load/Line Transient Response
- Low Dropout Voltage: 110mV@100mA
- Stable With a 1 μ F Ceramic Capacitor
- Available in Adjustable Voltage Version (0.6V to 5.5V)
- Built-in Current Limiter, Short-Circuit Protection

■ BLOCK DIAGRAM



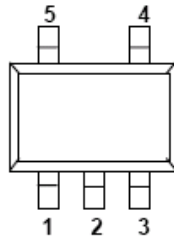
■ ORDER INFORMATION

HG1309①②

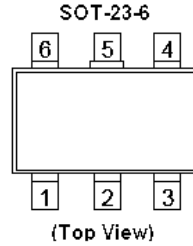
DESIGNATOR	SYMBOL	DESCRIPTION
①	B	High Active, pull-down resistor built in, with C _{OUT} discharge resistor
	C	High Active, No pull-down resistor built in, with C _{OUT} discharge resistor
②	U	Package:SC70-5
	M	Package:SOT-23-5
	E	Package:SOT-23-6

PIN CONFIGURATION

SOT-23-5/ SC-70-5



SOT-23-6



SOT-23-5/ SC-70-5

PIN NUMBER		PIN NAME	FUNCTION
M	U		
1	1	V_{IN}	Power input Pin
2	2	V_{SS}	Ground
3	3	CE	Chip Enable Pin
4	4	FB	Feedback Pin: Used to Set Output Voltage
5	5	V_{OUT}	Output Pin

SOT-23-6

PIN NUMBER		PIN NAME	FUNCTION
E	FC6		
1	6	V_{IN}	Power input Pin
2	3	V_{SS}	Ground
3	4	CE	Chip Enable Pin
5	2	FB	Feedback Pin: Used to Set Output Voltage
6	1	V_{OUT}	Output Pin
4	5	NC	Not Connection
-	7		Thermal Pad

TYPICAL APPLICATION

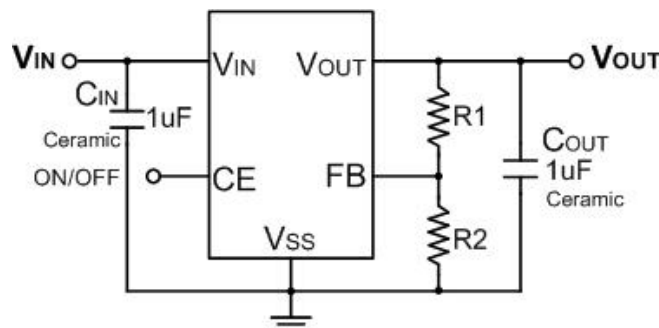


Fig.1 Typical Application Circuit

■ ABSOLUTE MAXIMUM RATINGS

(Unless otherwise specified, $T_A=25^{\circ}\text{C}$)

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		V_{IN}	$V_{SS} - 0.3 \sim V_{SS} + 8$	V
Output Current		I_{OUT}	750	mA
Output Voltage		V_{OUT}	$V_{SS} - 0.3 \sim V_{IN} + 0.3$	V
Power Dissipation	SOT-23-5	P_d	400	mW
	SOT-23-6	P_d	400	mW
Operating Temperature		T_{opr}	$-40 \sim +85$	$^{\circ}\text{C}$
Storage Temperature		T_{stg}	$-40 \sim +125$	$^{\circ}\text{C}$
Soldering Temperature & Time		T_{solder}	$260^{\circ}\text{C}, 10\text{s}$	

■ ELECTRICAL CHARACTERISTICS

HG1309 Series

($V_{IN}=V_{OUT}+1\text{V}$, $C_{IN}=C_{OUT}=1\mu\text{F}$, $T_A=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Input Voltage	V_{IN}	—	1.8 ⁽¹⁾		7.0	V
Output Current	I_{OUT}	$V_{OUT} \geq 1.8\text{V}$	500			mA
Supply Current	I_{SS}	$I_{OUT}=0\text{mA}$		45	80	μA
Standby Current	I_{STBY}	$V_{CE}=0\text{V}$		0.01	1	μA
CE "High" Voltage	V_{CEH}		1.2		V_{IN}	V
CE "Low" Voltage	V_{CEL}				0.3	V
CE pin current		$V_{CE}=0\text{V}$	-1		1	V
FB Voltage	V_{FB}	$I_{OUT}=1\text{mA}$	0.588	0.600	0.612	V
FB pin current		$V_{FB}=1.8\text{V}$			1	μA
Output voltage range			0.6		$5.5 - V_{DO}$	V
Line Regulation	$\frac{\Delta V_{OUT}}{V_{OUT} \times \Delta V_{IN}}$	$I_{OUT}=10\text{mA}$ $V_{OUT}+1\text{V} \leq V_{IN} \leq 7\text{V}$		0.01	0.2	%/V
Load Regulation	ΔV_{OUT}	$V_{IN}=V_{OUT}+1\text{V}$, $1\text{mA} \leq I_{OUT} \leq 100\text{mA}$		1		mV
Dropout Voltage ⁽²⁾	V_{dif}	$I_{OUT}=100\text{mA}$ $V_{OUT} \geq 3.0\text{V}$		110		mV
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta T \times V_{OUT}}$	$I_{OUT}=10\text{mA}$ $-40 \leq T \leq +85$		50		ppm
Current Limit	I_{LIM}		600	750		mA
Short Current	I_{SHORT}	$V_{OUT}=V_{SS}$		20		mA
Power Supply Ripple Rejection	$V_{OUT}=1.2\text{V}$	PSRR	$f=100\text{Hz}$, $I_{OUT}=50\text{mA}$	80		dB
			$f=1\text{kHz}$, $I_{OUT}=50\text{mA}$	70		
			$f=10\text{kHz}$, $I_{OUT}=50\text{mA}$	50		
Output noise voltage		$\text{BW}=10\text{Hz to } 100\text{kHz}$, $I_{OUT}=10\text{mA}$		40		μV_{RMS}
Time, start-up		$I_{OUT}=0\text{mA}$, $C_{OUT}=1\mu\text{F}$		20		μs

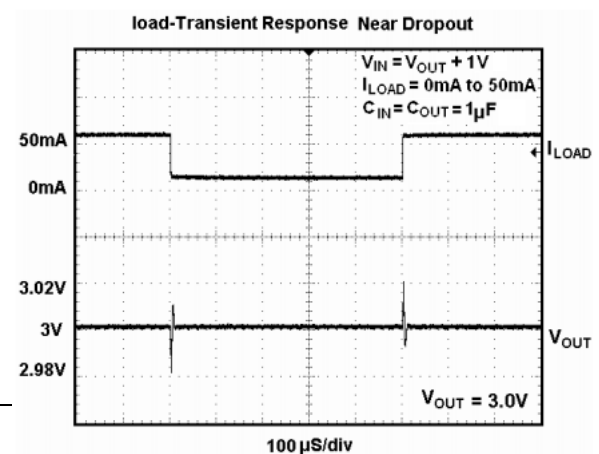
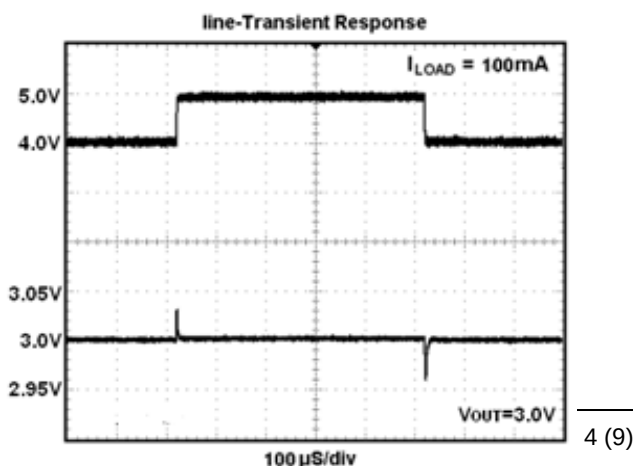
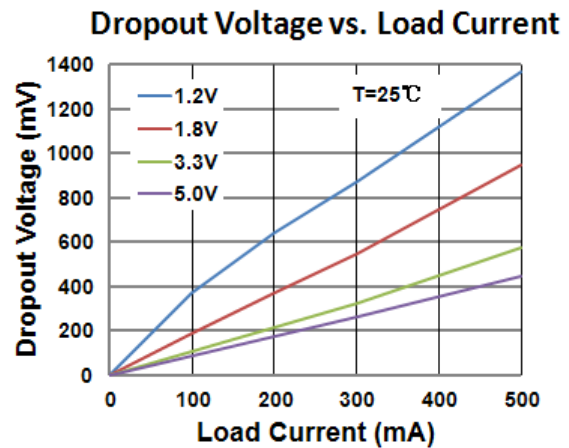
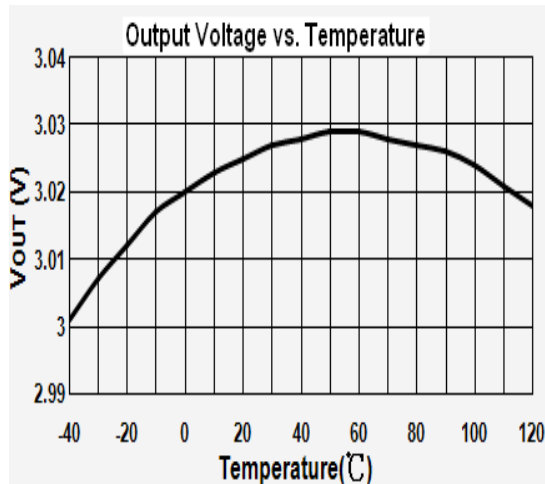
NOTE:

- (1) Minimum V_{IN} is 1.8V or $V_{OUT} + V_{DO}$, whichever is greater.
- (2) V_{dif} : The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 98% of V_{OUT} (E).

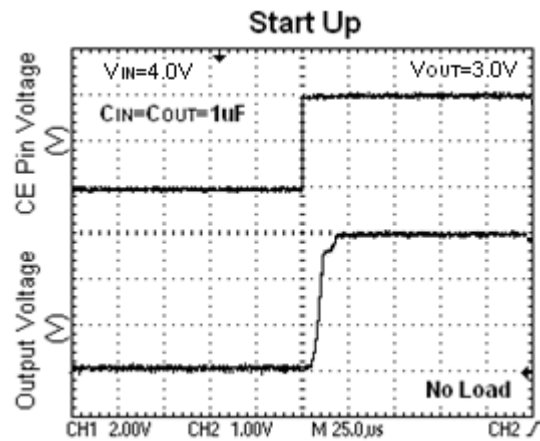
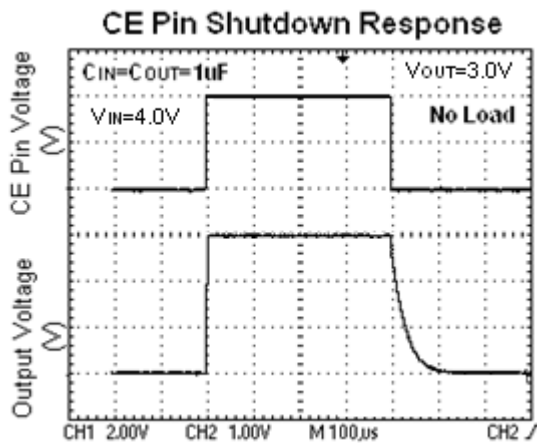
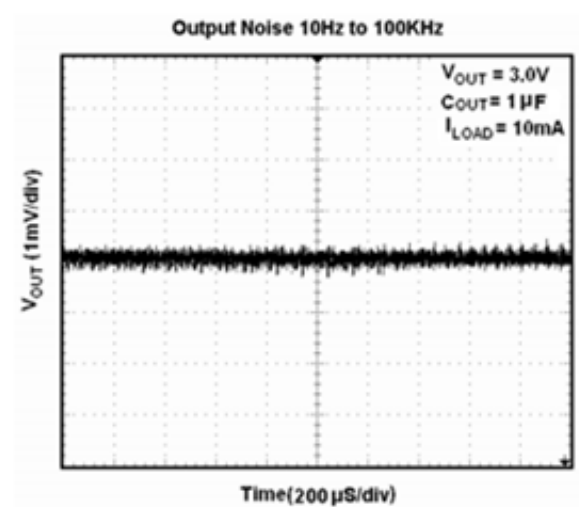
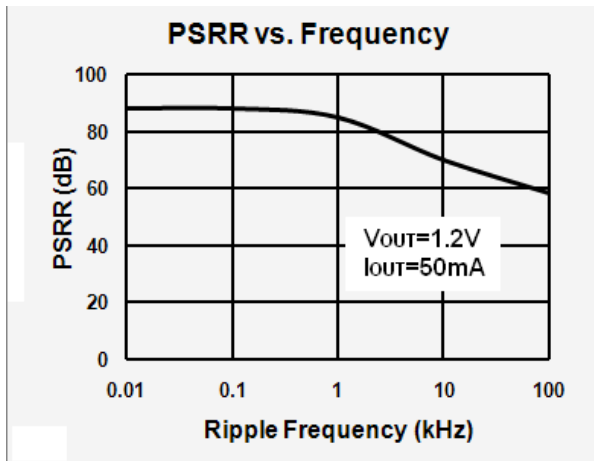
■ DROPOUT VOLTAGE CHART

Setting Output Voltage	Dropout Voltage (mV) Typ.			
$V_{OUT}(V)$	$I_{OUT}=100mA$	$I_{OUT}=200mA$	$I_{OUT}=300mA$	$I_{OUT}=500mA$
1.2	372mV	642mV	876mV	1.368V
1.5	248mV	471mV	681mV	1.128V
1.8	189mV	370mV	550mV	947mV
2.1	157mV	311mV	469mV	820mV
2.5	132mV	265mV	400mV	706mV
2.8	120mV	241mV	365mV	645mV
3.0	111mV	229mV	348mV	612mV
3.3	107mV	214mV	325mV	574mV
3.6	101mV	203mV	307mV	542mV
4.0	98mV	184mV	292mV	506Mv
4.5	93mV	183mV	275mV	474mV
5.0	88mV	173mV	261mV	446mV

■ TYPICAL PERFORMANCE CHARACTERISTICS



■ TYPICAL PERFORMANCE CHARACTERISTICS(Continued)



■ APPLICATION INFORMATION

Setting The Output Voltage

Figure 1 shows the typical application circuit with HG1309. The external resistor sets the output voltage according to the following equation:

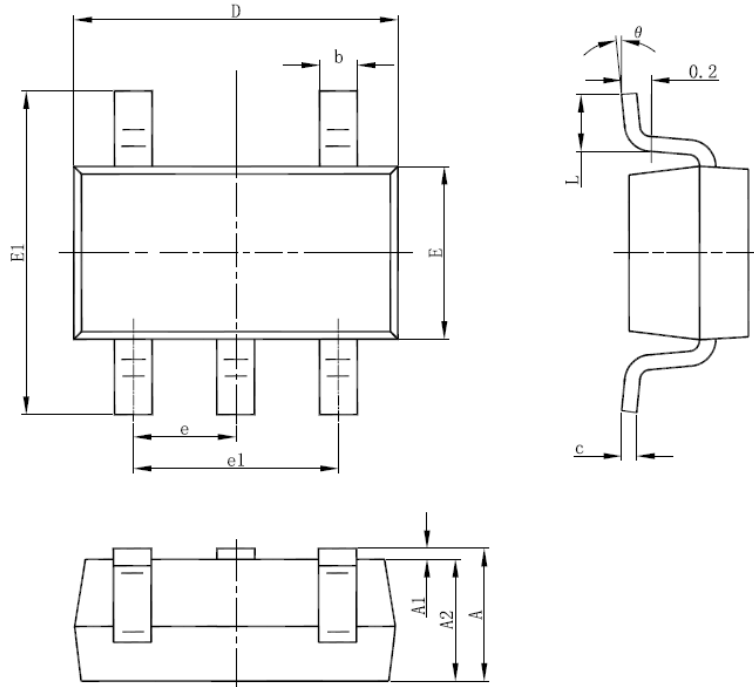
$$V_{OUT} = 0.6V \times \left(1 + \frac{R1}{R2}\right)$$

Table 1. Resistor select for output voltage setting

V_{OUT}	R1	R2
1.2V	30.1K	30.1K
1.5V	45.3K	30.1K
1.8V	60.4K	30.1K
2.5V	95.3K	30.1k
2.8V	110K	30.1k
3.0V	120K	30.1K
3.3V	137K	30.1K
5.0V	221K	30.1k

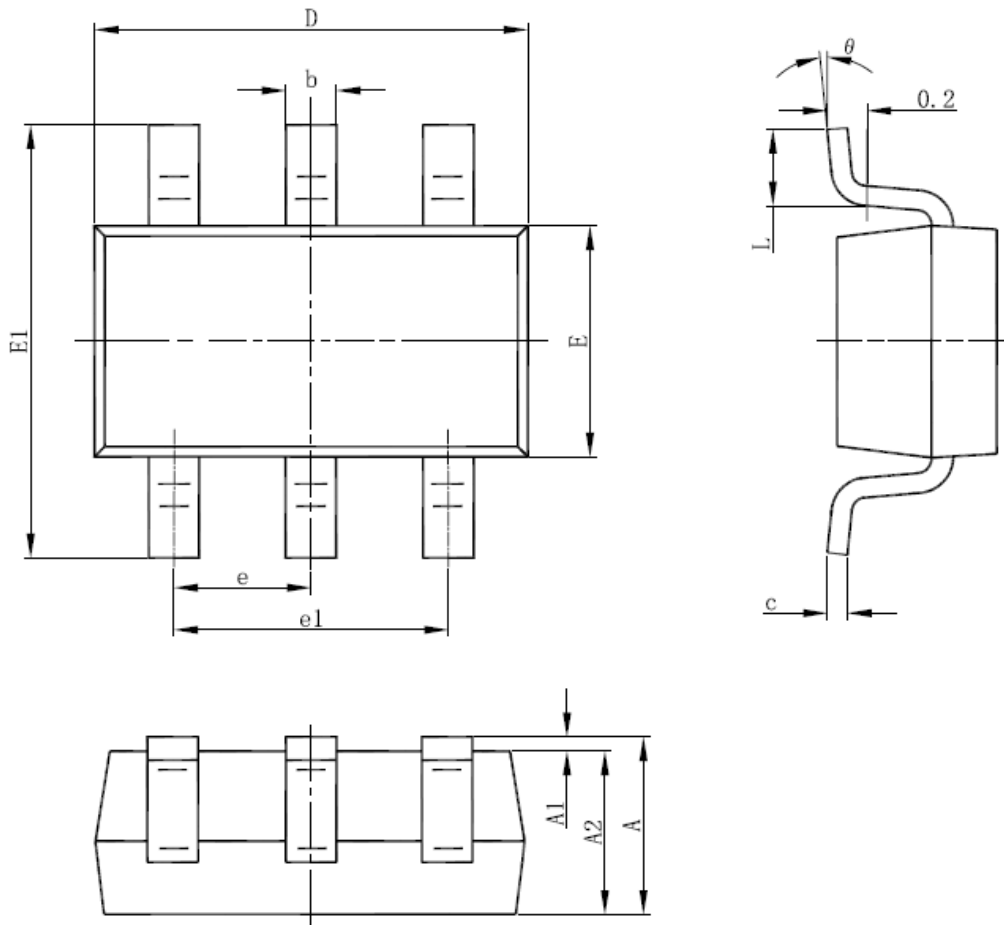
■ PACKAGING INFORMATION

● SOT-23-5 PACKAGE OUTLINE DIMENSIONS



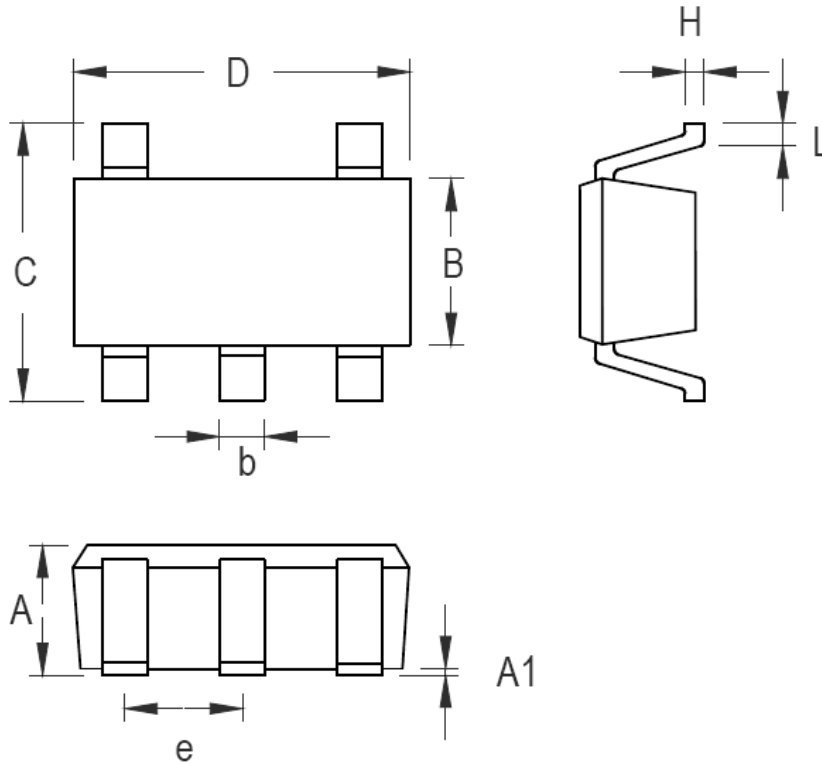
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

• SOT-23 -6 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

●SC-70-5 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimension In Inches	
	Min.	Max.	Min.	Max.
A	0.800	1.100	0.031	0.044
A1	0.000	0.100	0.000	0.004
B	1.100	1.400	0.044	0.055
b	0.150	0.300	0.006	0.012
C	1.950	2.200	0.077	0.087
D	1.800	2.150	0.071	0.085
e	0.650BSC		0.026BSC	
H	0.080	0.260	0.003	0.010
L	0.260	0.460	0.010	0.018