

Ultra-Low IQ 650nA, 400mA Output Current, Low-Dropout Regulator

Features

- **Operating Voltage: 1.6V-7.0V**
- **Ultra-Low Power Consumption: 650nA(Type)**
- **Output Voltage Accuracy: 1%**
- **Output Voltage:**
1.0V, 1.2V, 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 4.0V, 4.2V and 5.0V Optional Fixed
- **Low Dropout Voltage: 450mV@300mA/3.3V**
- **Maximum Output Current: 400mA**
- **Low Temperature Coefficient**
- **Current Limiting Protections**
- **Short Circuit Protections**
- **Stable with 1uF Output Capacitor**
- **Lead Free and Green Device Available (RoHS Compliant), Available in SOT23, SOT23-5L, SOT89-3 and DFN1x1-4L Packages**

Applications

- **Wearables electronics**
- **Battery-Powered Devices**
- **Reference Voltage Sources**
- **Building Security & Video Surveillance Devices**
- **Thermostat, Smoke and heat detectors**

General Description

The SL8610 is an ultra-low 650nA quiescent current low-dropout linear regulator (LDO) that can source maximum 400mA with good transient performance.

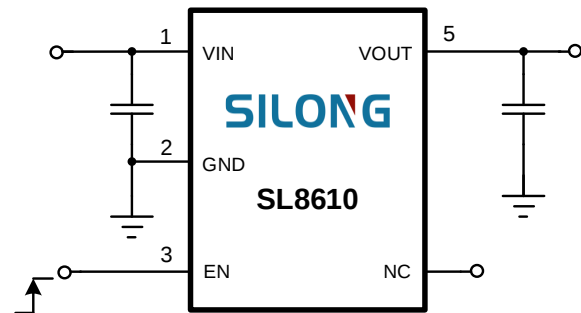
The SL8610 is designed specifically for applications where very-low quiescent current is a critical parameter. This device maintains low IQ consumption even in dropout mode to further increase the battery life.

The SL8610 has an output voltage from 1.0V, 1.2V, 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 3.6V, 4.0V, 4.2V and 5.0V or other voltages applicable as customer specified.

The SL8610 has the current limiter's fold-back circuit operates as a short circuit protection as well as the output current limiter for the output pins.

The SL8610 is available in SOT23, SOT23-5, SOT89-3 and DFN1x1-4L packages.

Typical Application Circuit



Note: EN must NOT be floating

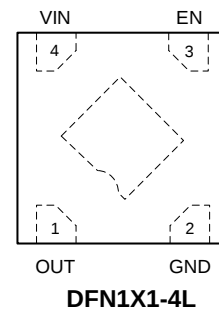
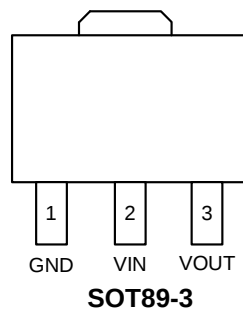
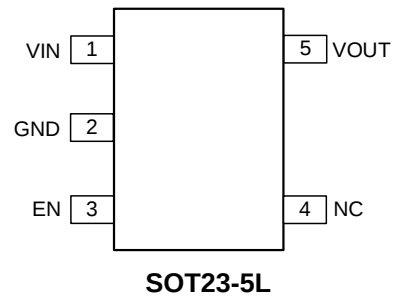
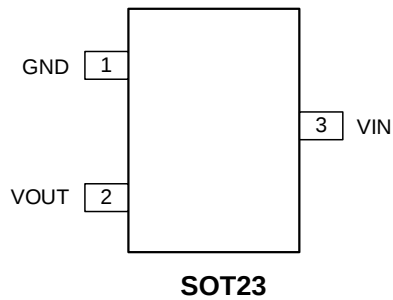
Order and Marking Information

SL8610 Voltage Package Code					Package Code S233: SOT23 S235: SOT23-5L S893: SOT89-3 D114: DFN1X1-4L Voltage (presented by digit) 10: 1.0V 12: 1.2V 15: 1.5V 25: 2.5V 28: 2.8V 30: 3.0V 33: 3.3V 36: 3.6V 40: 4.0V 42: 4.2V 50: 5.2V											
S235: 8610 • xxxY		Y - Voltage(alphabet) X - Data Code			S233: 86XX •		X - Voltage(digit)									
S893: 8610Y • xxxX		Y - Voltage(alphabet) X - Data Code			D114: XX • XY		X - Data Code Y - Voltage(alphabet)									
Voltage (presented by alphabet)					1.0V A	1.2V B	1.5V C	1.8V D	2.5V G	2.8V H	3.0V J	3.3V L	3.6V M	4.0V P	4.2V Q	5.0V S

Note: SILONG lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish, which are fully compliant with RoHS and compatible with both SnPb and lead-free soldering operations. SILONG lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J STD-020C for MSL classification at lead-free peak reflow temperature.

SILONG reserves the right to make changes to improve reliability or manufacturability without notice and advise customers to obtain the latest version of relevant information to verify before placing orders.

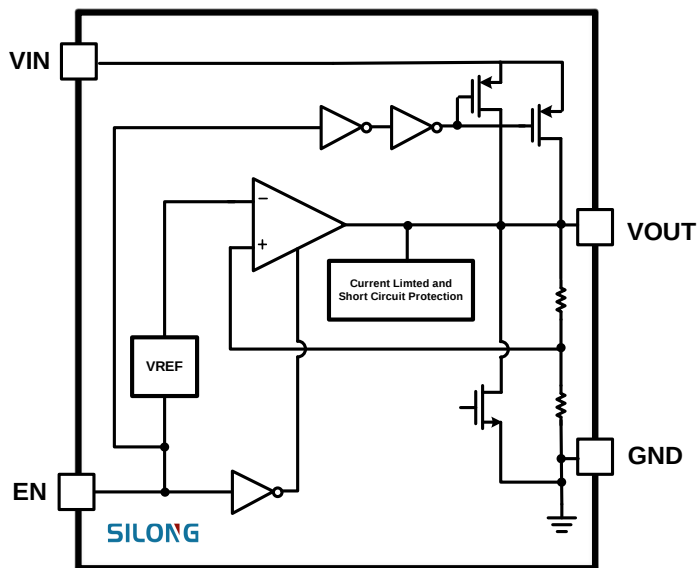
Pin Configuration



Pin Function Description

PIN Number				SYMBOL	DESCRIPTION
SOT23	SOT23-5L	SOT89-3	DFN1X1-4L		
1	1	2	4	VIN	Power Supply Input
12	2	1	2, EP	GND	Ground
--	3	--	3	EN	Chip Enable
--	4	--	--	NC	Not Connected
2	5	3	1	VOUT	Output

Block Diagram



Absolute Maximum Ratings (Note1)

Symbol	Parameter		Rating	Unit
V _{in}	Supply Voltage (VDD to GND)		-0.3 to 9.0	V
V _{out}	VOUT Pin Voltage		-0.3 to (V _{in} +0.3)	
P _d	Maximum Power Dissipation	SOT23-5	400	mW
		DFN1X1-4L	450	
		SOT23	350	
		SOT89-3	550	
PTR	Package Thermal Resistance θ_{JA}	SOT23-5	285	°C/W
		DFN1X1-4L	280	
		SOT23	300	
		SOT89-3	175	
T _J	Junction Temperature Range		-40 to +150	°C
T _{STG}	Storage Temperature Range		-40 to +150	
T _{SDR}	Soldering Temperature Range		260	

Note 1. Absolute Maximum Ratings are those values beyond which the life of a device may be impaired. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Operation above these absolute maximum ratings may cause degradation or permanent damage to the devices. These are stress ratings only and do not necessarily imply functional operation below these limits

Recommended Operating Conditions

Symbol	Items	Value	Unit
V _{in}	Vin Supply Voltage	1.6 to 7.0	V
T _{OPT}	Operating Temperature	-40 to +85	°C

Electrical Characteristics

$V_{IN} = V_{OUT} + 1V$, $V_{OUT} = 3.3V$, $C_{IN} = C_{OUT} = 1\mu F$, $T_A = 25^\circ C$ (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage		1.6		7	V
V_{UVLO}	UVLO threshold			1.2		V
V_{OUT}	Output Accuracy	$I_{OUT} = 1mA$	-1.0		1.0	%
I_{LIM}	Current Limit	$V_{IN} = 5V$	410	530		mA
I_Q	Quiescent Current	$V_{IN} = 5V$, $V_{EN} = 5V$, No Load		0.65	1	μA
I_{SHD}	Shutdown Current	$V_{EN} = 0V$			0.1	μA
V_{DROP}	Dropout Voltage	$I_{OUT} = 100mA$		100		mV
		$I_{OUT} = 300mA$		450		
		$I_{OUT} = 400mA$		850		
S_{LINE}	Line Regulation	$V_{IN} = V_{OUT} + 0.5V$ to $5.5V$, $I_{OUT} = 1mA$		0.15	0.3	%/V
S_{LOAD}	Load Regulation	$V_{IN} = V_{OUT} + 1V$, $1mA < I_{OUT} < 400mA$		0.0035	0.006	%/mA
I_{SHORT}	Short Current	$V_{OUT} = 0V$		90		mA
V_{ENH}	EN High Voltage	$V_{IN} = V_{OUT} + 0.5V$ to $5.5V$, $I_{OUT} = 1mA$	1.5			V
V_{ENL}	EN Low Voltage				0.8	
T_{START}	Startup Time	V_{EN} low to high to $V_{OUT} = 95\%$		800		μS
PSRR	Power Supply Rejection Ratio	$I_{OUT} = 10mA$	Freq=217Hz	53		dB
			Freq=1kHz	50		
			Freq=10kHz	48		
V_{NOISE}	Output Noise Voltage	Freq from 10Hz to 100KHz,		100		μV_{RMS}
T_C	Output Voltage Temperature Coefficient	$I_{OUT} = 10mA$, $T_A = -40$ to $85^\circ C$		0.5		mV/ $^\circ C$
T_{SD}	Overheat Protection	Shut down when temperature increasing		150		$^\circ C$

Characteristic curve test condition (TA=25°C)

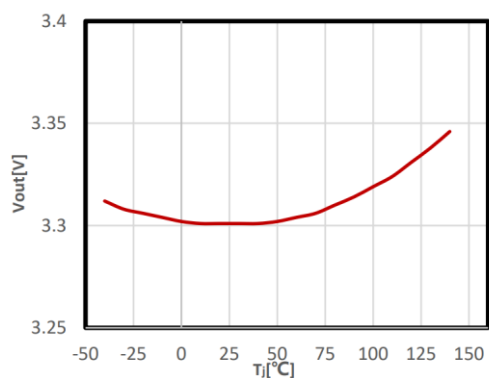


Figure 1. V_{OUT} vs $V_{IN}=5V$, $I_{OUT}=10mA$

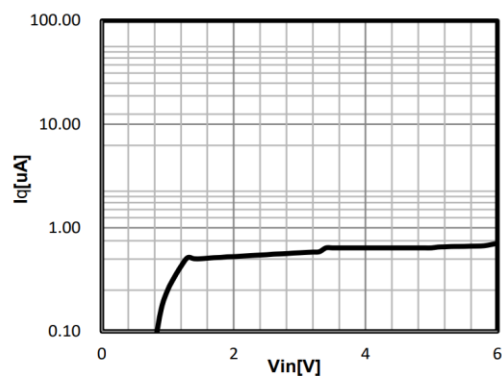


Figure 2. I_Q vs V_{IN}

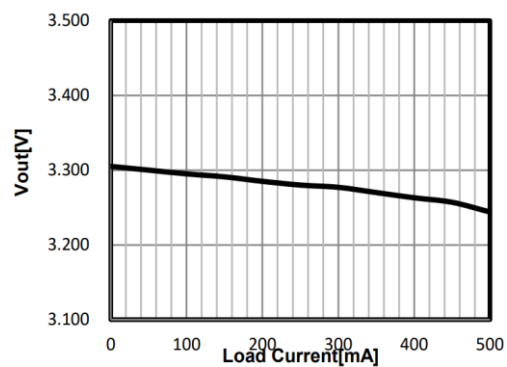


Figure 3. V_{OUT} vs Load Current

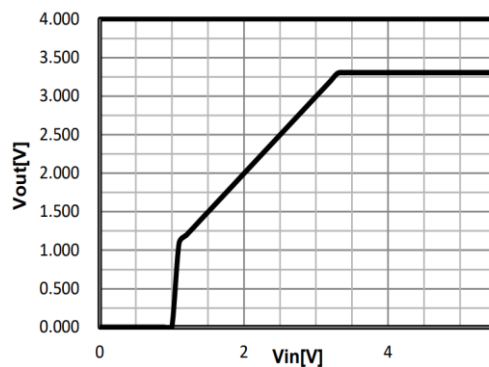


Figure 4. V_{OUT} vs V_{IN}

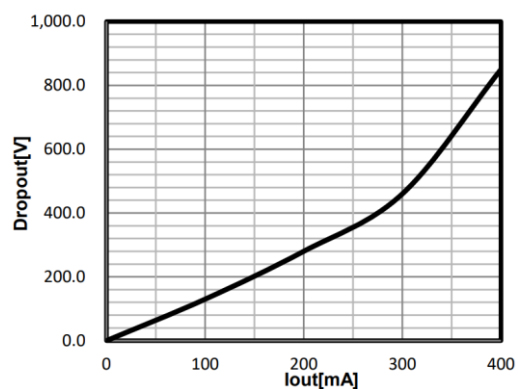


Figure 5. Dropout Voltage vs Load Current

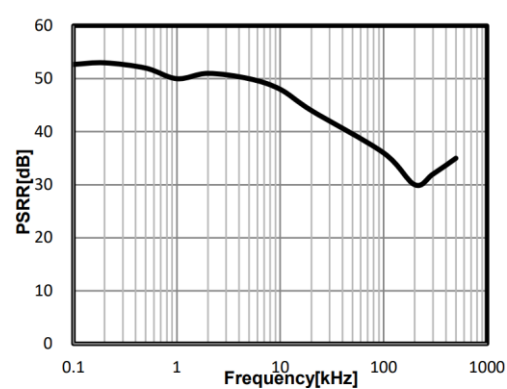


Figure 6. PSRR

Application Information

Input Capacitor Selection

The input capacitors used with the SL8610 must be carefully selected for regulator stability and performance. Using a capacitor whose value is $>1\mu\text{F}$ on the SL8610 input and amount of capacitance can be increased without limit. The input capacitor must be located no more than 0.5-inch distance from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. The capacitor with larger value and lower ESR provides better PSRR and line-transient response.

Output Capacitor Selection

The SL8610 requires surface-mount multi-layer ceramic capacitors. These capacitors are small, inexpensive, and have very low ESR ($<15\Omega$ typical). Tantalum capacitors, and aluminum electrolytic capacitors generally are not recommended for use with SL8610 due to their high ESR compared to ceramic capacitors.

For most applications, ceramic capacitors with an X7R or X5R temperature characteristic are preferred for use with the SL8610. These capacitors have tight capacitance tolerance (as good as $\pm 10\%$) and hold their value over temperature (X7R: $\pm 15\%$ over -55°C to 125°C ; X5R: $\pm 15\%$ over -55°C to 85°C)

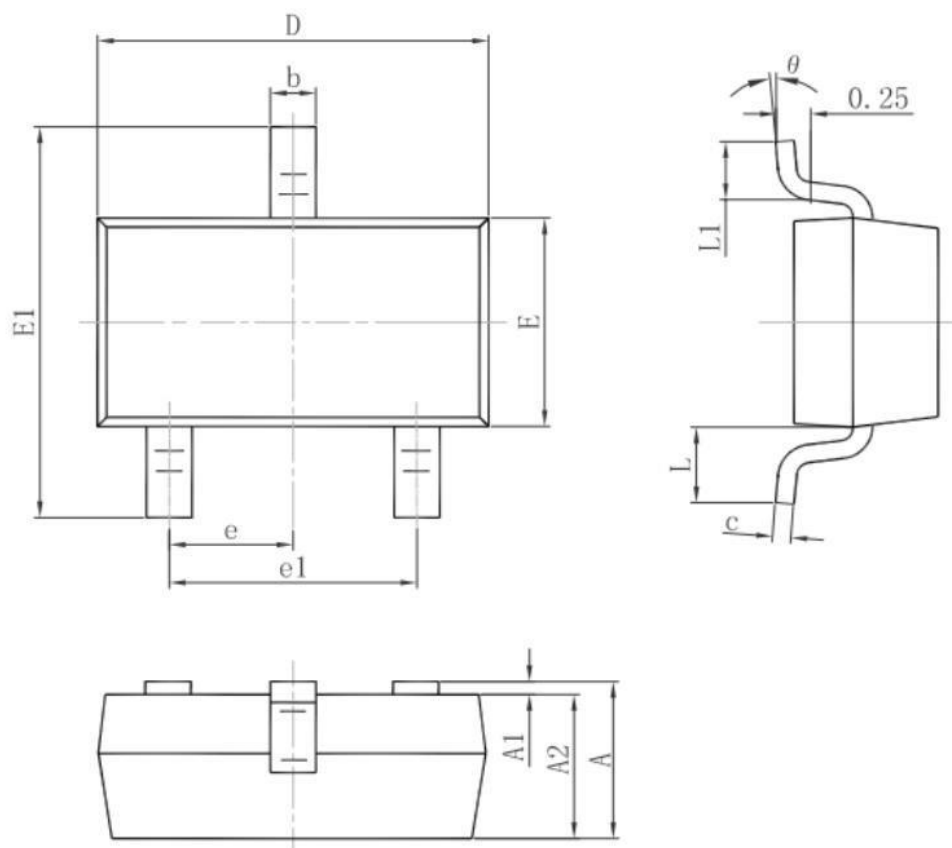
Output capacitor of larger capacitance can reduce noise and improve load transient response, stability, and PSRR. The output capacitor should be located no more than 0.5-inch distance from the Vout Pin of the SL8610 and returned to a clean analog ground.

Layout Considerations

To improve AC performance such as PSRR, output noise, and transient response, it is recommended that the PCB be designed with separate ground planes for Vin and Vout, with each ground plane connected only at the GND pin of the device. A true ground plane and short connections to all capacitors will improve performance and ensure proper regulation under all conditions.

Packaging Information

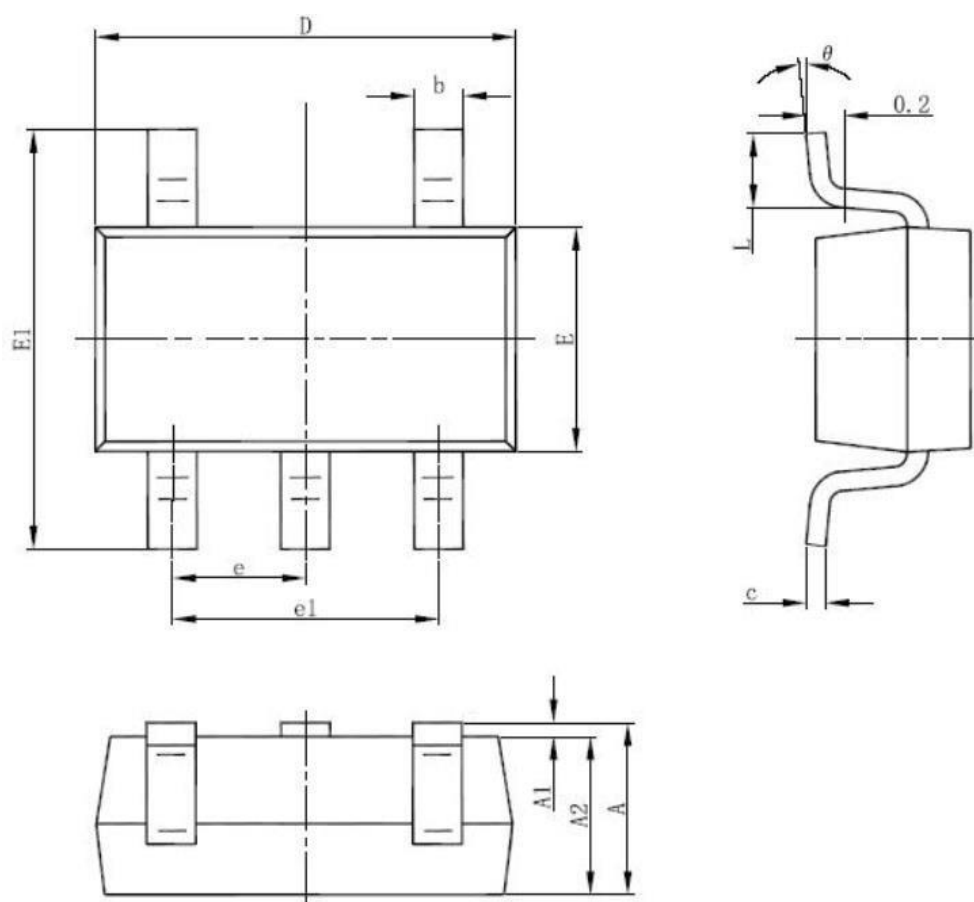
SOT23



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP.		0.037 TYP.	
e1	1.800	2.000	0.071	0.079
L	0.550 REF.		0.022 REF.	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

Packaging Information

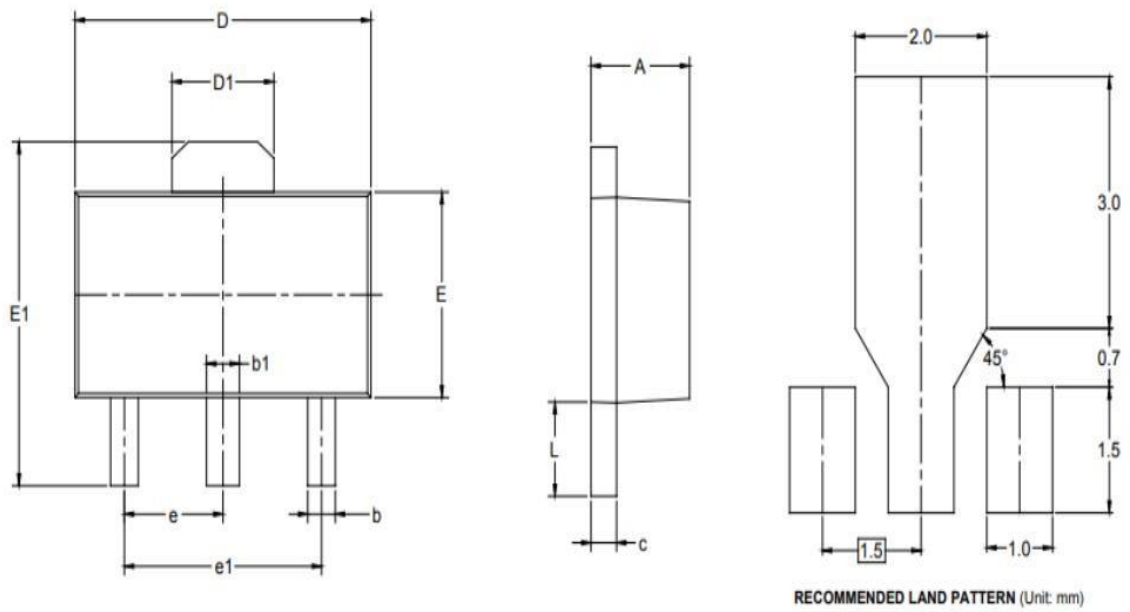
SOT23-5L



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°

Packaging Information

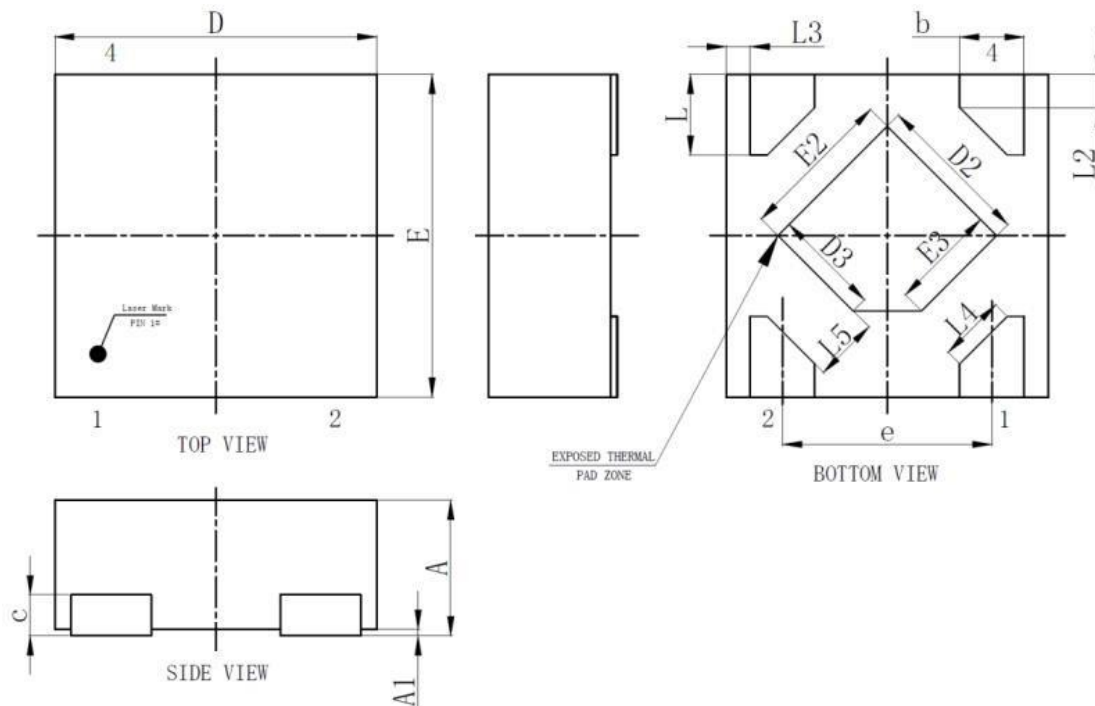
SOT89-3



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060 TYP	
e1	3.000 TYP		0.118 TYP	
L	0.900	1.200	0.035	0.047

Packaging Information

DFN1X1-4L



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.35	-	0.40
A1	0.00	0.02	0.05
b	0.15	0.20	0.25
c	0.127REF		
D	0.95	1.00	1.05
D2	0.38	0.48	0.58
D3	0.23	0.33	0.43
e	0.65BSC		
E	0.95	1.00	1.05
E2	0.38	0.48	0.58
E3	0.23	0.33	0.43
L	0.20	0.25	0.30
L2	0.103REF		
L3	0.075REF		
L4	0.208REF		
L5	0.200REF		