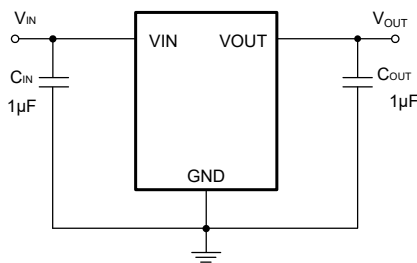


SNE2501 150mA, Low Power Consumption, High Voltage CMOS LDO Regulator

Features

- Low Quiescent Current I_Q : 2 μ A Typical at Light Loads
- 150mA Nominal Output Current
- Low Dropout Voltage
- Low Temperature Coefficient
- High Input Voltage (up to 36V)
- Output Voltage Accuracy: $\pm 2\%$
- Fixed 2.5V, 3.0V, 3.3V, 3.6V and 5.0V Output Voltage
- Over temperature Protection
- Short Circuit Protection
- Packages: SOT23-3 and SOT89-3L

Typical Application



General Description

The SNE2501 series is a set of low power high voltage regulators implemented in CMOS technology. Which can provide 150mA output current. The device allows input voltage as high as 36V. It is very suitable for multi-cell battery systems, bus voltage power supply systems and other high DC voltage systems. Wide input voltage can make it well withstand the impact of surge voltage and ensure the stability of output voltage.

The SNE2501 series only 2 μ A (typical) current is consumed by itself, which is especially important in multi-battery power supply systems and can reduce the standby power consumption of the whole system .

Applications

- Audio/Video Equipment
- Communication Equipment
- Battery-Powered Equipment
- Automotive Head Unit
- Laptop, Palmtops, Notebook Computers

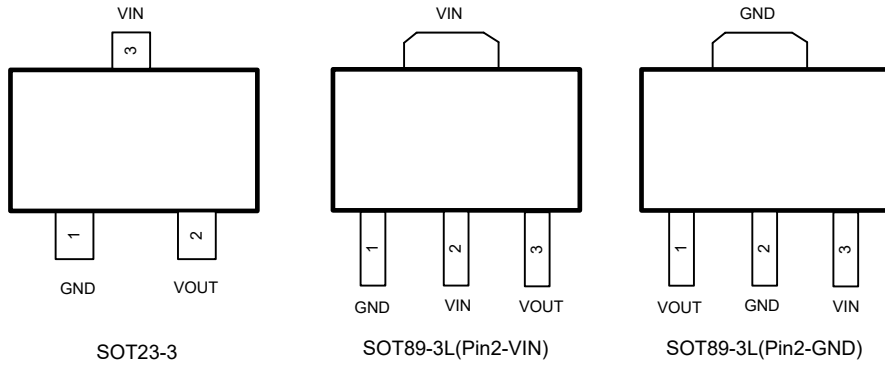
Ordering Information

Part Number	V _{OUT} (V)	Package	Ordering Number	Packing Option
SNE2501	2.5	SOT23-3	SNE250125AB1	Tape and Real, 3000
SNE2501	2.5	SOT89-3L (Pin2-VIN)	SNE250125UAY1	Tape and Real, 1000
SNE2501	2.5	SOT89-3L (Pin2-GND)	SNE250125VAY1	Tape and Real, 1000
SNE2501	3.0	SOT23-3	SNE250130AB1	Tape and Real, 3000
SNE2501	3.0	SOT89-3L (Pin2-VIN)	SNE250130UAY1	Tape and Real, 1000
SNE2501	3.0	SOT89-3L (Pin2-GND)	SNE250130VAY1	Tape and Real, 1000
SNE2501	3.3	SOT23-3	SNE250133AB1	Tape and Real, 3000
SNE2501	3.3	SOT89-3L (Pin2-VIN)	SNE250133UAY1	Tape and Real, 1000
SNE2501	3.3	SOT89-3L (Pin2-GND)	SNE250133VAY1	Tape and Real, 1000
SNE2501	3.6	SOT23-3	SNE250136AB1	Tape and Real, 3000
SNE2501	3.6	SOT89-3L (Pin2-VIN)	SNE250136UAY1	Tape and Real, 1000
SNE2501	3.6	SOT89-3L (Pin2-GND)	SNE250136VAY1	Tape and Real, 1000
SNE2501	5.0	SOT23-3	SNE250150AB1	Tape and Real, 3000
SNE2501	5.0	SOT89-3L (Pin2-VIN)	SNE250150UAY1	Tape and Real, 1000
SNE2501	5.0	SOT89-3L (Pin2-GND)	SNE250150VAY1	Tape and Real, 1000

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1 Pin Description



Pin			Name	Function
SOT23-3	SOT89-3L	SOT89-3L		
3	2	3	VIN	Input Supply Voltage Pin. It is recommended to use a 1 μ F or larger ceramic capacitor from VIN pin to ground. This ceramic capacitor should be placed as close as possible to IN pin.
1	1	2	GND	Ground.
2	3	1	VOUT	Regulator Output Pin. It is recommended to use an output capacitor with effective capacitance in the range of 1 μ F to 10 μ F. The capacitor should be located very close to this pin.

2 Specifications

2.1 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
VIN to GND	V_{IN}	-0.3	40	V
Junction Temperature	T_J	-40	150	°C
Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	Internally Limited		W
Storage Temperature Range	T_{STG}	-65	150	°C

Note: Stress greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

2.2 ESD Ratings

Parameter	Symbol	Value	Unit
Electrostatic discharge	V_{ESD}	Human-body model (HBM)	±4000
		Machine model (MM)	±100



ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

2.3 Recommended Operating Range

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{IN}	2.5	36	V
Output current	I_{OUT}	0	150	mA
Operating Temperature	T_{OPT}	-40	+85	°C

2.4 Thermal Information

Thermal Metric	Symbol	SOP23-3	SOT89-3L	Unit
Junction-to-ambient thermal resistance	$R_{\theta JA}$	185.6	165	°C/W
Junction-to-case (top) thermal resistance	$R_{\theta JC(top)}$	104.3	88.5	°C/W
Junction-to-board thermal resistance	$R_{\theta JB}$	54.5	39.6	°C/W
Junction-to-top characterization parameter	ψ_{JT}	31.0	26.5	°C/W
Junction-to-board characterization parameter	ψ_{JB}	54.5	49.7	°C/W
Junction-to-case (bottom) thermal resistance	$R_{\theta JC(bot)}$	N/A	77.7	°C/W

2.5 Electrical Characteristics, $V_{OUT}=3.3V$

$V_{IN}=V_{OUT}+2V$, $C_{IN}=C_{OUT}=1\mu F$, typical values are at $T_A=+25^\circ C$, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage ^[1]	V_{IN}	$V_{OUT} = 3.3V$			36	V
Output Voltage Accuracy		$I_{OUT} = 10mA$	-2	0	+2	%
Ground Pin Current		No load		2	3	μA
Maximum Output Current ^[2]				150		mA
Dropout Voltage ^[3]	V_{DROP}	$I_{OUT}=100mA, \Delta V_O = 2\%$		526		mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	$V_{IN} = V_{OUT} + 2V$ to 36V, $I_{OUT} = 1mA$		0.05	0.2	%/V
Load Regulation	ΔV_{OUT}	$V_{IN} = V_{OUT} + 2V$, $I_{OUT} = 1mA$ to 150mA		10		mV
Power Supply Rejection Ratio	PSRR	$V_{OUT} = 3.3V$, $I_{OUT} = 10mA$, $f = 100Hz$		55		dB
Output Voltage Temperature Coefficient ^[4]	$\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$	$I_{OUT} = 1mA$		100		ppm/ $^\circ C$
Thermal Protection						
Thermal Shutdown Temperature	T_{SHDN}			150		$^\circ C$

2.6 Electrical Characteristics, $V_{OUT}=5.0V$

$V_{IN}=V_{OUT}+2V$, $C_{IN}=C_{OUT}=1\mu F$, typical values are at $T_A=+25^\circ C$, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage ^[1]	V_{IN}	$V_{OUT} = 5.0V$			36	V
Output Voltage Accuracy		$I_{OUT} = 10mA$	-2	0	+2	%
Ground Pin Current		No load, $V_{IN} = V_{OUT} + 2V$		2	3	μA
Maximum Output Current ^[2]				150		mA
Dropout Voltage ^[3]	V_{DROP}	$I_{OUT}=100mA, \Delta V_O = 2\%$		440		mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	$V_{IN} = V_{OUT} + 2V$ to 36V, $I_{OUT} = 1mA$		0.05	0.2	%/V
Load Regulation	ΔV_{OUT}	$V_{IN} = V_{OUT} + 2V$, $I_{OUT} = 1mA$ to 150mA		10		mV
Power Supply Rejection Ratio	PSRR	$V_{OUT} = 5.0V$, $I_{OUT} = 10mA$, $f = 100Hz$		55		dB
Output Voltage Temperature Coefficient ^[4]	$\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$	$I_{OUT} = 1mA$		100		ppm/ $^\circ C$
Thermal Shutdown Temperature	T_{SHDN}			150		$^\circ C$

Note:

[1] $V_{IN} \geq V_{OUT}$, whichever is greater.

[2] Maximum output current is affected by the PCB layout, size of metal trace, the thermal conduction path between metal layers, ambient temperature and the other environment factors of system. Attention should be paid to the dropout voltage when $V_{IN} < V_{OUT} + V_{DROP}$.

[3] The dropout voltage is defined as $V_{IN} - V_{OUT}$, when V_{OUT} is 100mV below the value of V_{OUT} for $V_{IN} = V_{OUT (NOMINAL)} + 2V$.

[4] Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.

3 Performance Characteristics

$V_{IN} = 5.3V$, $V_{OUT} = 3.0V$, $C_{IN} = C_{OUT} = 1\mu F$, $T_A = +25^\circ C$, unless otherwise noted.

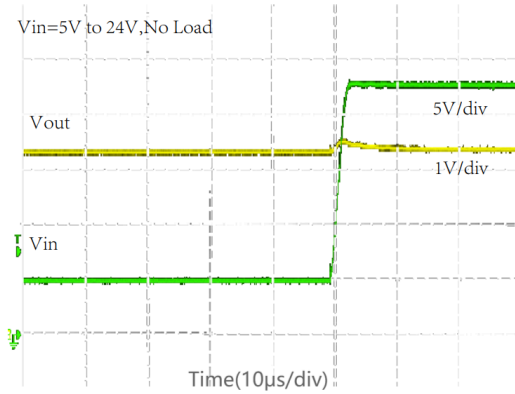


Figure 3-1 Line-Transient Response

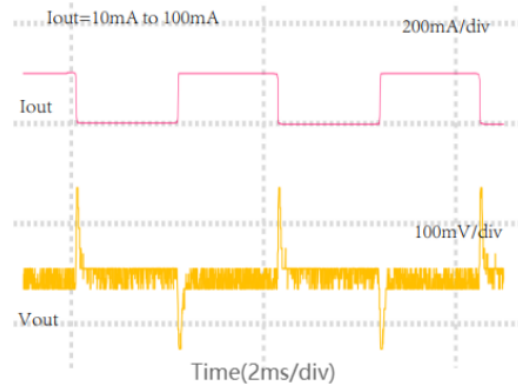


Figure 3-2 Load-Transient Response

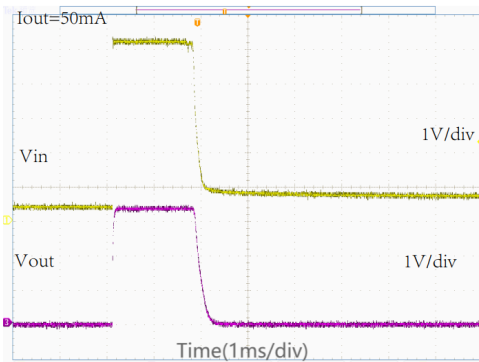


Figure 3-3 Power-Up/Power-Down Output Waveform

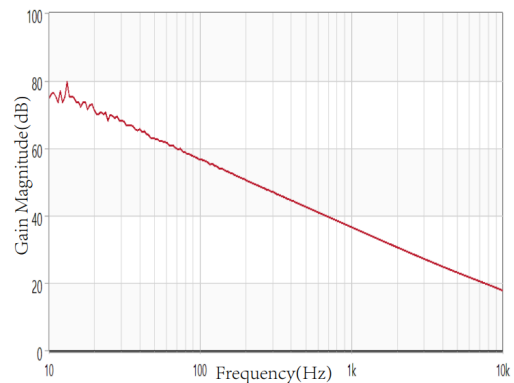


Figure 3-4 PSRR

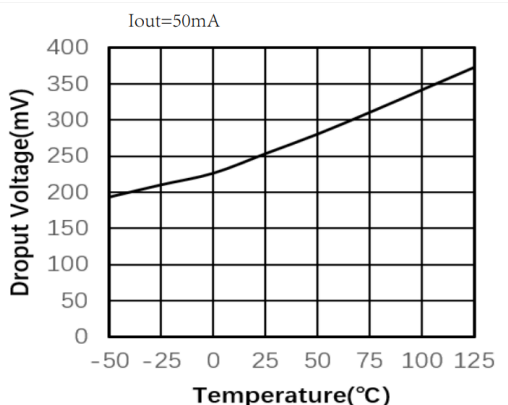


Figure 3-5 Dropout Voltage vs Temperature

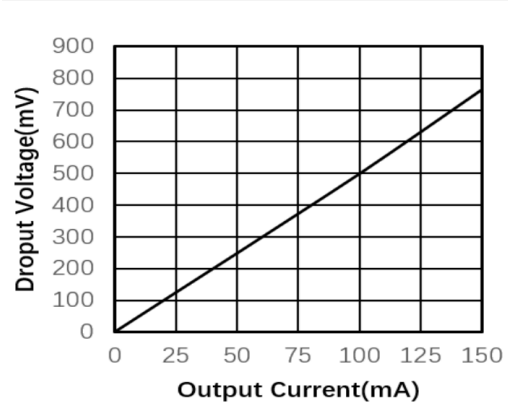


Figure 3-6 Dropout Voltage vs Output Current

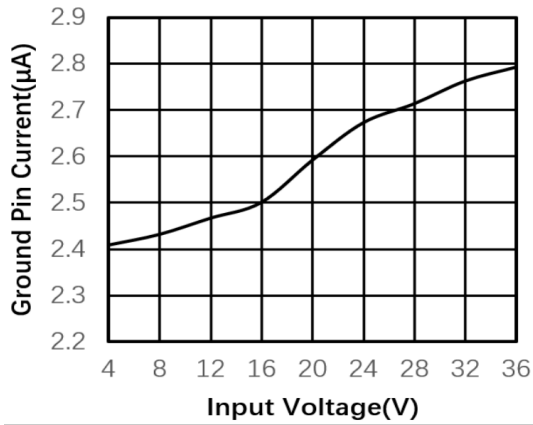


Figure 3-7 Ground Pin Current vs Input Voltage

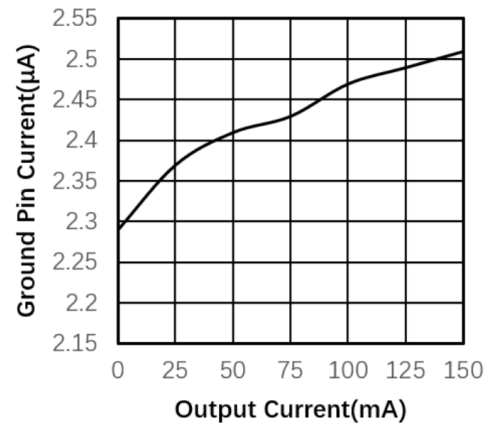


Figure 3-8 Ground Pin Current vs Output Current

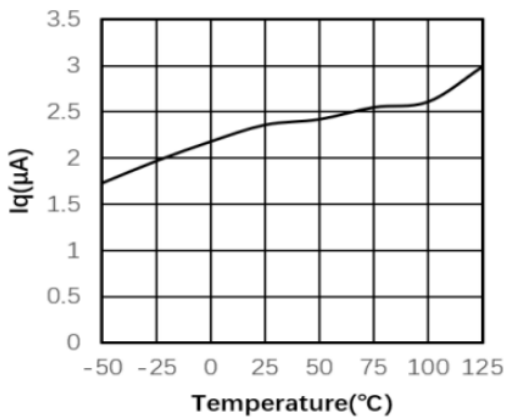


Figure 3-9 Iq vs Temperature

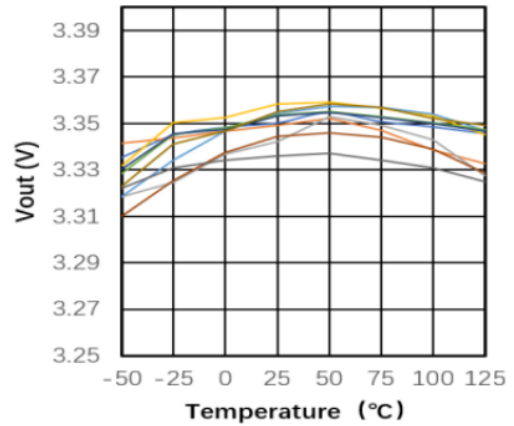


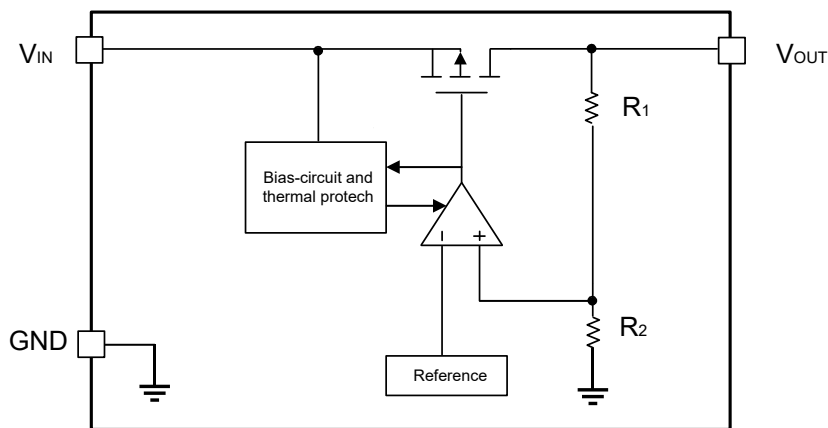
Figure 3-10 Vout vs Temperature

4 Detailed Description

4.1 Overview

The SNE2501 low-dropout regulators (LDO) consumes only 2 μ A of quiescent current at light load and delivers excellent line and load transient performance. These characteristics, combined with low noise and high PSRR, make this device ideal for portable consumer applications.

4.2 Functional Block Diagram



4.3 Thermal Considerations

When the junction temperature is too high, the thermal protection circuitry sends a signal to the control logic that will shut down the IC. The IC will restart when the temperature has sufficiently cooled down. The maximum power dissipation is dependent on the thermal resistance of the case and the circuit board, the temperature difference between the die junction and the ambient air, and the rate of air flow. The GND pin must be connected to the ground plane for proper dissipation.

Note:

[1] The phase compensation circuit and ESR of the output capacitor are used inside the circuit to compensate, so a capacitor larger than 1 μ F must be connected to the ground.

[2] It is recommended to use 1 μ F polar capacitors for input and output, and to keep the capacitors as close to the V_{IN} and V_{OUT} pins of LDO as possible.

[3] Pay attention to the use conditions of input and output voltages and load currents to avoid the power consumption (P_D) inside the IC exceeding the maximum power consumption allowed by the package.

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$$

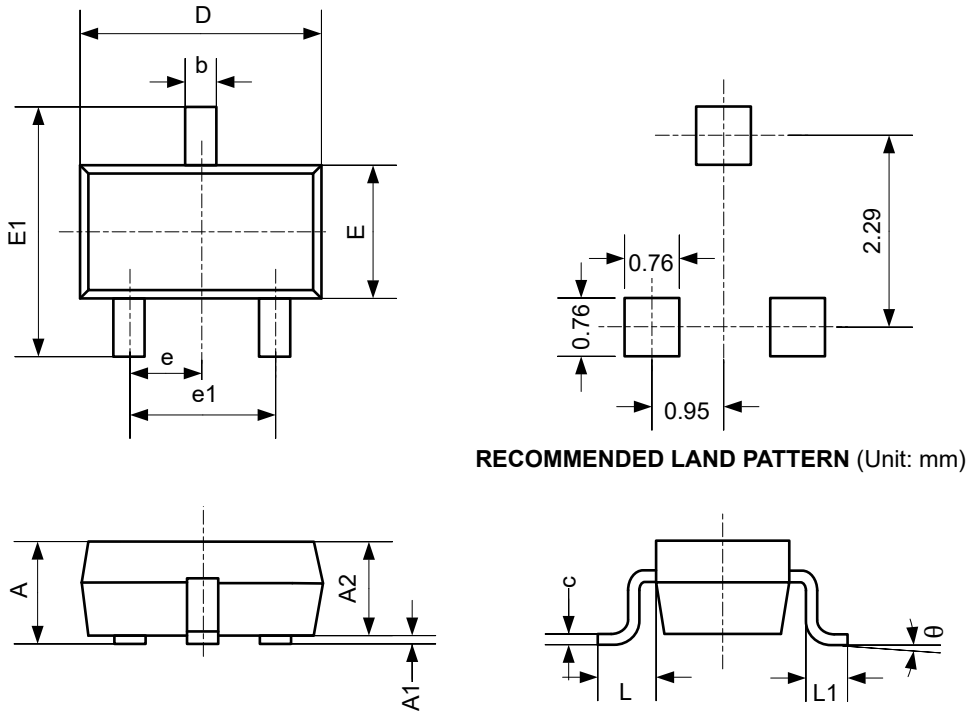
$$T_J = P_D \times R_{\theta JA} + T_A$$

[4] When the input voltage V_{IN} is greater than 2.5V, if V_{IN} is also higher than the output set value plus the device dropout voltage, V_{OUT} is equal to the set value. Otherwise, V_{OUT} is equal to V_{IN} minus the dropout voltage. If V_{IN} lower than 2.5V, the V_{OUT} is:

$$V_{OUT} = V_{IN} - V_{Dropout}$$

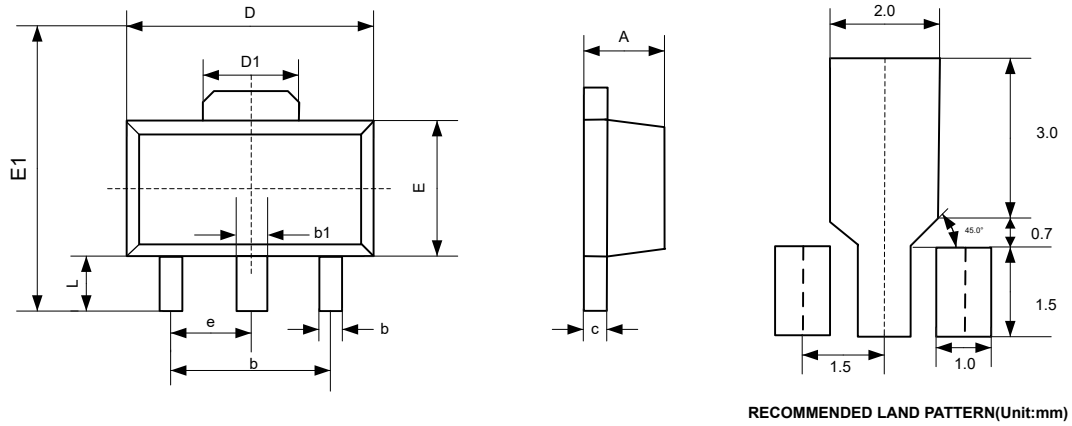
5 Package Outline

5.1 SOT23-3



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 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

5.2 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 TPY		0.060 TPY	
e1	3.000 TPY		0.118 TPY	
L	0.900	1.200	0.035	0.047

6 Revision History

Version	Date	Description
0.1	2022/08/12	Initial release

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