

Super-Small Package VFM Control Step-up Switching Regulator

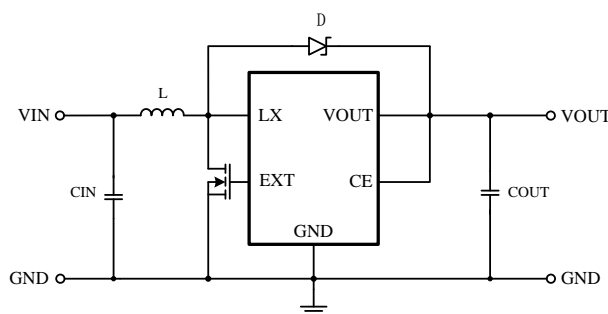
■ General Description

The LN2351 Series is a CMOS VFM-control step-up switching regulator that mainly consists of a reference voltage source, an oscillator, and a comparator. enabling products with a low ripple over a wide range, high efficiency, and high output current. Products with a fixed duty ratio of 75 % (Lower Output Voltage) or 88%(Higher Output Voltage) are also available. With the LN2351 Series, a step-up switching regulator can be configured by using an external coil, capacitor, and diode. A protection circuit turns off the built-in MOS FET when the voltage at the CONT pin exceeds the limit to prevent it from being damaged. This feature, along with the mini package and low current consumption, makes the LN2351 Series ideal for applications such as the power supply unit of portable equipment.

■ Package

- SOT23-5L
- SOT23-3L/B
- SOT89-3L

■ Typical Application Circuit

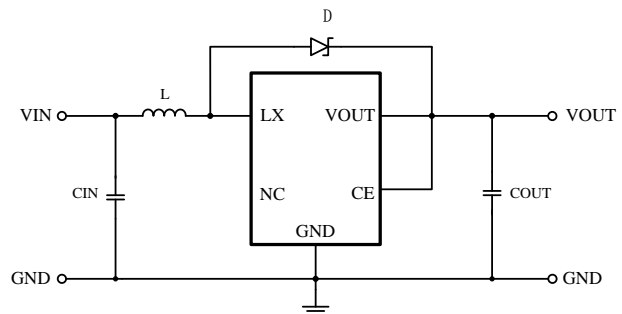


■ Features

- Low voltage operation: Start up at 0.9 V (IOUT=1 mA)
- Low input current: During maximum operation: 6.5 μ A (VOUT=3.3 V, typ.)
- Duty ratio: 77 % Built-in fixed-type PFM controller
- External parts: Coil, capacitor, and diode
- Output voltage: Settable to between 1.8V to 5.0V ,accuracy of 2%

■ Applications

- Power supply for portable equipment such as digital cameras, electronic notebooks, and PDA
- Power supply for audio equipment such as portable CD/MD players
- Constant voltage power supply for cameras, video equipment and communications equipment
- Power supply for microcomputers



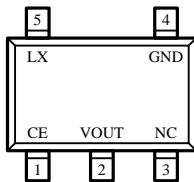
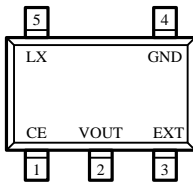
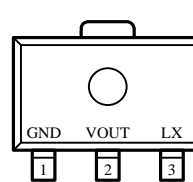
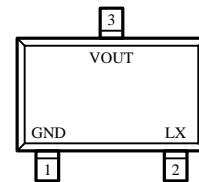
Components Normal Value: $C_{IN}=10\mu F$ 、 $C_{OUT}=47\mu F$ 、 $L=22\mu H$ 、 $D=SS14$

■ Ordering Information

LN2351P①②③④⑤-⑥

Designator	Symbol	Description
① ②	18-50	Output voltage: Eg: ②=3, ③=3 represents 3.3V
③	2	Output Voltage: Accuracy e.g. 2: $\pm 2\%$
④		Package type
	M	SOT23-3L
	N	SOT23-3B
	P	SOT89-3L
	S	SOT23-5L(A)
	K	SOT23-5L(B)
⑤		Device orientation
	R	Embossed Tape: Standard Feed
	L	Embossed Tape: Reverse Feed
⑥	G	Green epoxy molding compound

■ Pin Configuration


 SOT23-5L(A)
 (TOP VIEW)

 SOT23-5L(B)
 (TOP VIEW)

 SOT89-3L
 (TOP VIEW)

 SOT23-3L/B
 (TOP VIEW)

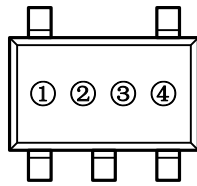
■ Pin Assignment

Pin Number				Pin Name	Function
SOT23-5L(A)	SOT23-5L(B)	SOT23-3B	SOT89-3L		
1	1	-	-	CE	Chip Enable
2	2	3	2	VOUT	Output

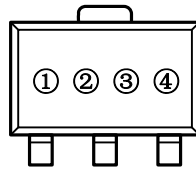
3	-	-	-	NC	No Connect
4	4	1	1	GND	Ground
5	5	2	3	LX	External Coil Connection
-	3	-	-	EXT	Connect External MOS

■ Marking Rule

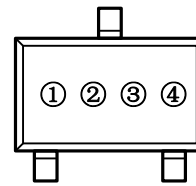
- SOT23-5L, SOT89-3L, SOT23-3L/B



SOT23-5L
(TOP VIEW)



SOT89-3L
(TOP VIEW)



SOT23-3L/B
(TOP VIEW)

- ① Represents the product name

Symbol	Product Name
A	LN2351P*****

- ② Represents the type of regulator

Voltage(V)	0.1~3.0	3.1~6.0
300KHz	5	6
120KHz	3	-

- ③ Represents the output voltage

Symbol	Output Voltage(V)			Symbol	Output Voltage(V)		
0	-	3.1	-	F	1.6	4.6	-
1	-	3.2	-	H	1.7	4.7	-
2	-	3.3	-	K	1.8	4.8	-
3	-	3.4	-	L	1.9	4.9	-
4	-	3.5	-	M	2	5.0	-
5	-	3.6	-	N	2.1	5.1	-
6	-	3.7	-	P	2.2	5.2	-
7	-	3.8	-	R	2.3	5.3	-
8	-	3.9	-	S	2.4	5.4	-
9	-	4	-	T	2.5	5.5	-
A	-	4.1	-	U	2.6	5.6	-

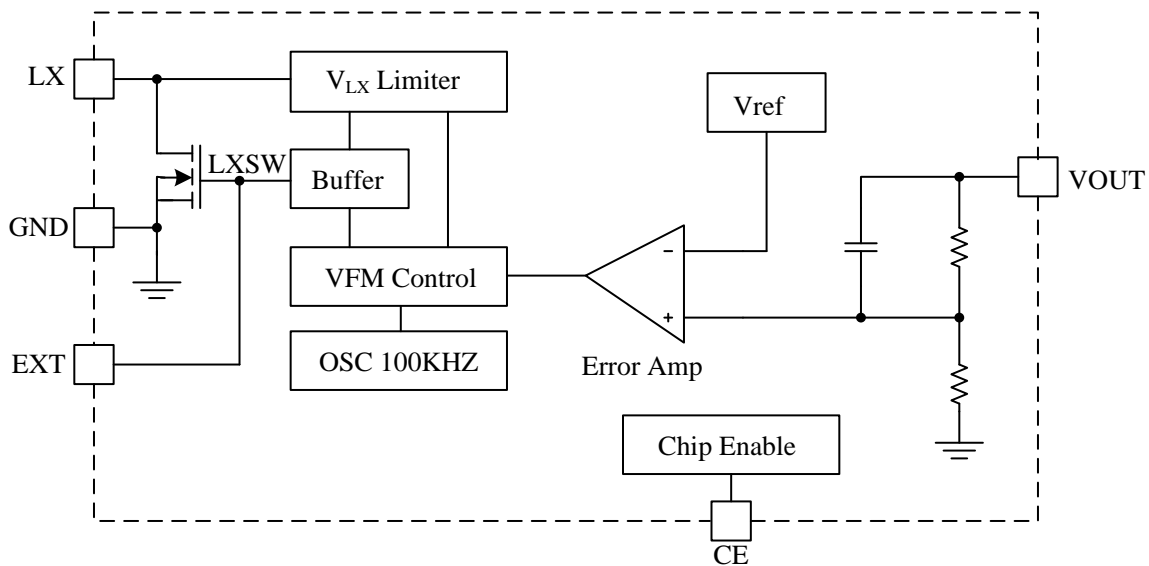
B	-	4.2	-	V	2.7	5.7	-
C	-	4.3	-	X	2.8	5.8	-
D	-	4.4	-	Y	2.9	5.9	-
E	1.5	4.5	-	Z	3	6.0	-

④ Represents the assembly lot No.

0-9, A-Z; 0-9, A-Z mirror writing, repeated (G, I, J, O, Q, W exception)

Eg: A6TX represents LN2351P, output voltage is 5.5V.

■ Function Block Diagram



■ Absolute Maximum Ratings

Parameter	Symbol	Maximum Rating	Unit	
Input voltage	VDD	$V_{ss}-0.3 \sim V_{ss}+6.5$		
Output voltage	VOUT	$V_{ss}-0.3 \sim V_{ss}+6.5$	V	
	VCONT	$V_{ss}-0.3 \sim V_{ss}+6.5$		
Output Current	ILX	1000	mA	
Power dissipation	PD	SOT23-3B	150	mW
		SOT89-3L	500	
		SOT23-3/5L	250	
Operating ambient temperature	Topr	$-40 \sim +80$	$^{\circ}\text{C}$	
Storage ambient	Tstg	$-40 \sim +125$		

temperature			
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Caution The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

■ Electrical Characteristics

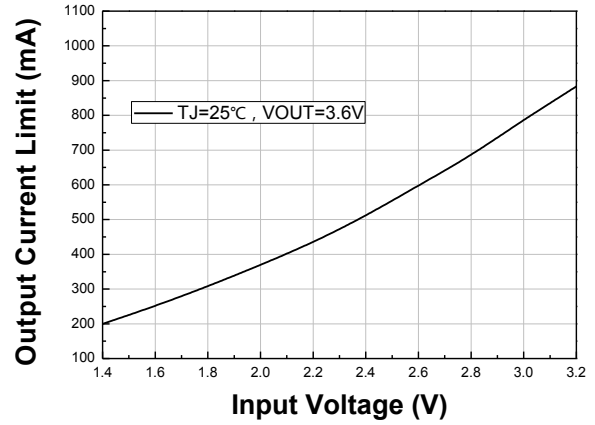
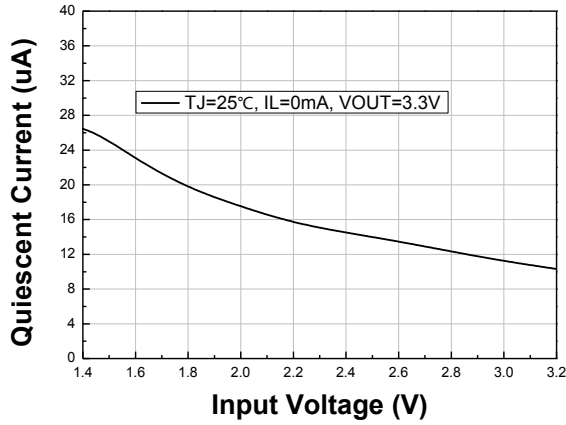
(Ta=25°C, VIN=1.5V, VOUT=3.3V unless otherwise noted)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	VOUT	-	VOUT(s) ×0.98	VOUT(s)	VOUT(S) ×1.02	V
Input Voltage	VIN	-	-	-	6.5	
Operation start voltage	VST1	IOUT=1mA	-	0.9	1.1	
Active current	Iact	VOUT=Output Voltage×0.9		40	55	uA
Input current without load	I _{ss}	VOUT=Output Voltage×1.1	-	6.5	7.5	
Line regulation	Δ VOUT1	IOUT=30mA	-	0.22	0.4	%
Load regulation	Δ VOUT2	IOUT=10uA—100mA	-	0.35	0.5	
Output voltage temperature coefficient	$\frac{\Delta V_{OUT}}{\Delta T_a \times V_{OUT}}$	Ta=-40°C~+85°C	-	±40	-	ppm/°C
Maximum oscillation frequency	fosc	VOUT=Output Voltage×0.95	225	300	375	kHz
Duty ratio	Duty	VOUT=Output Voltage×0.95	70	77	84	%
Efficiency	EFFI	-	-	88	-	%

Remarks: VOUT(S) specified above is the set output voltage value, and VOUT is the typical value of the actual output voltage. fo is the working frequency.

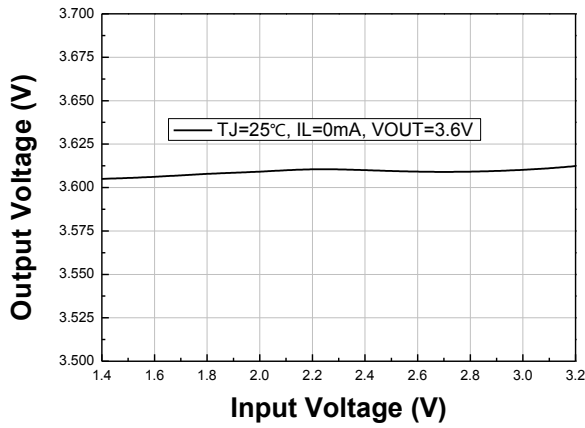
■ Typical Performance Characteristics

1. Active Current VS Input Voltage

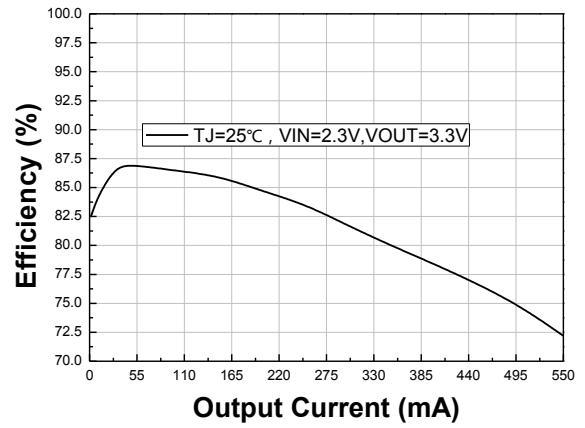


2. Current Limit VS Vin

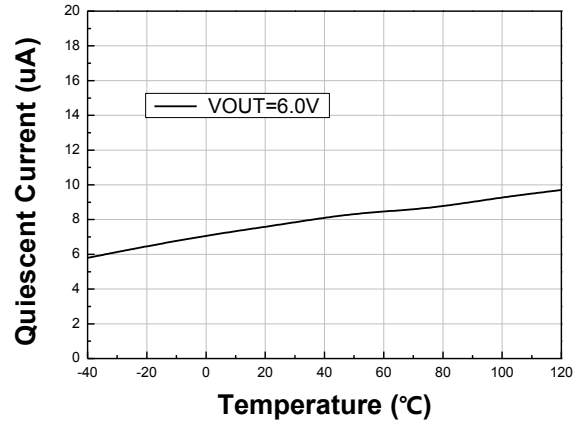
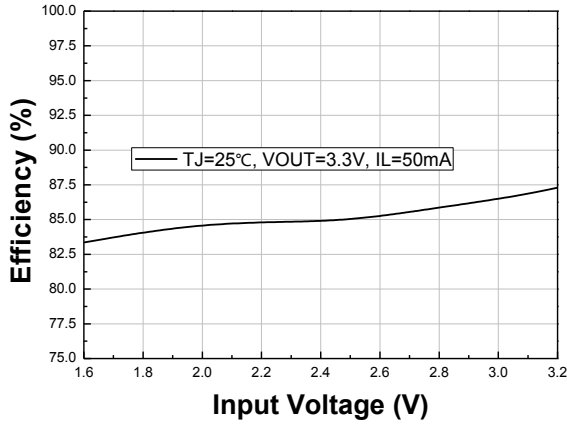
3. Output Voltage VS Input Voltage



4. Efficiency VS Output Current

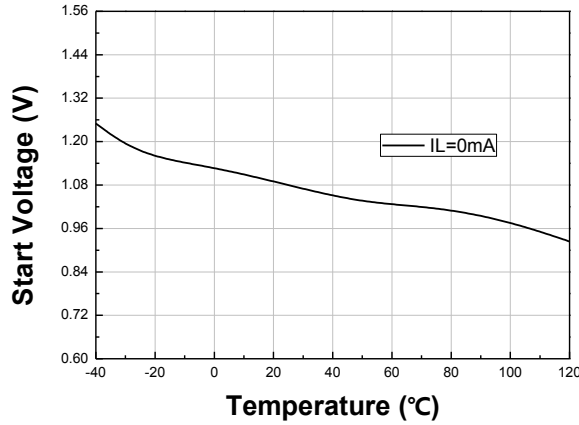


5. Efficiency VS Output Current

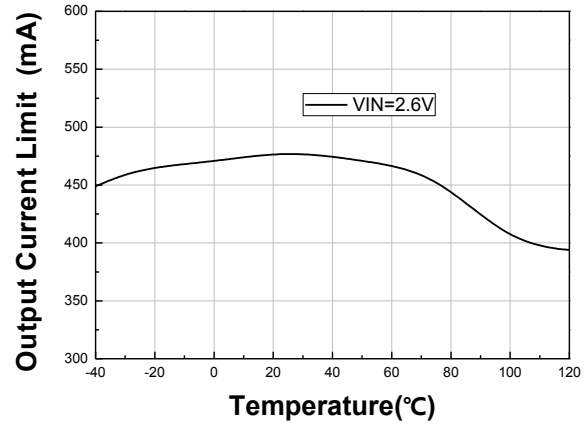


6. Quiescent Current VS Temperature

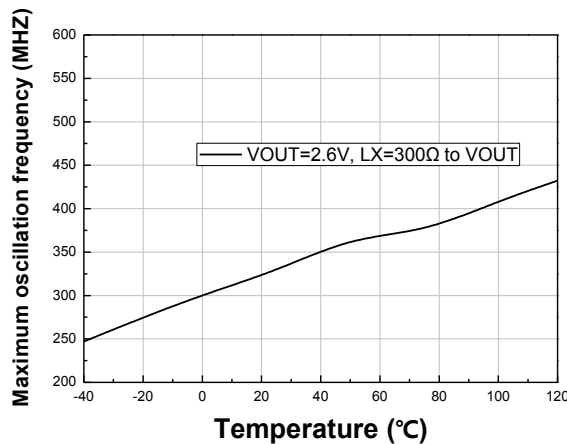
7. Start Voltage VS Temperature



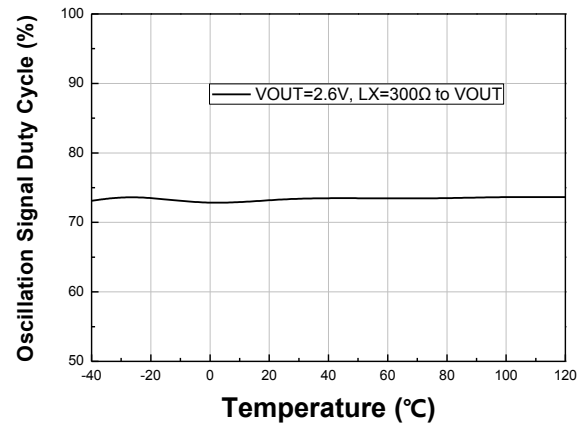
8. Output Current Limit VS Temperature



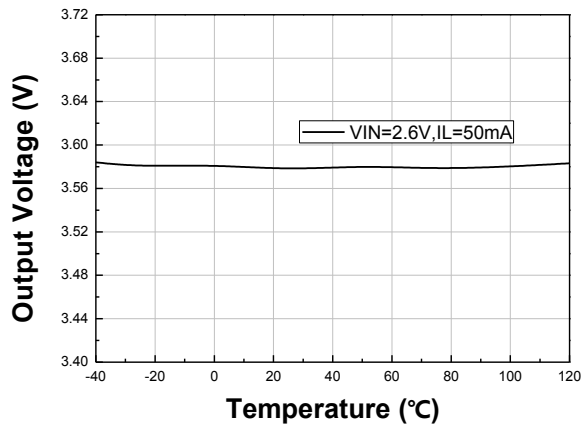
9. Maximum oscillation frequency VS Temperature



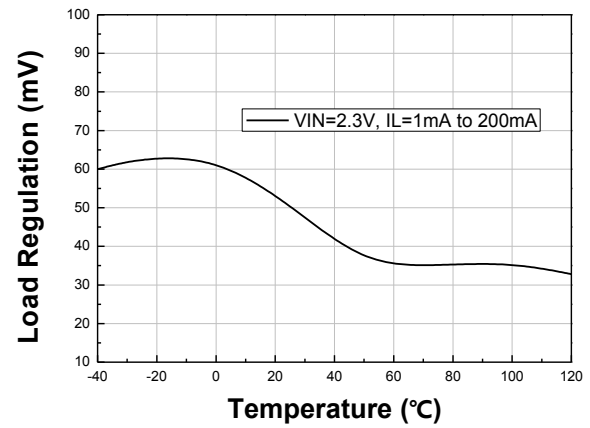
10. Oscillation Signal Duty Cycle VS Temperature



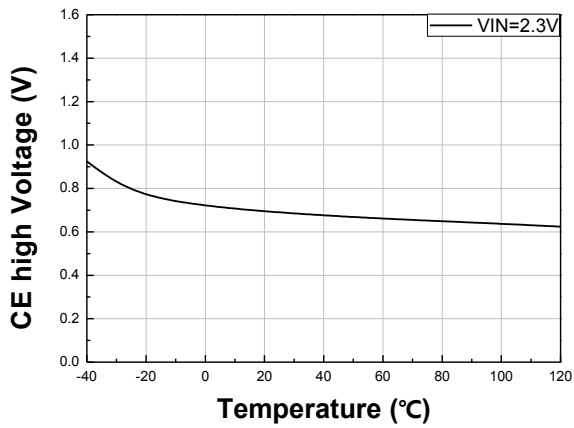
11. Output Voltage VS Temperature



12. Load Regulation VS Temperature

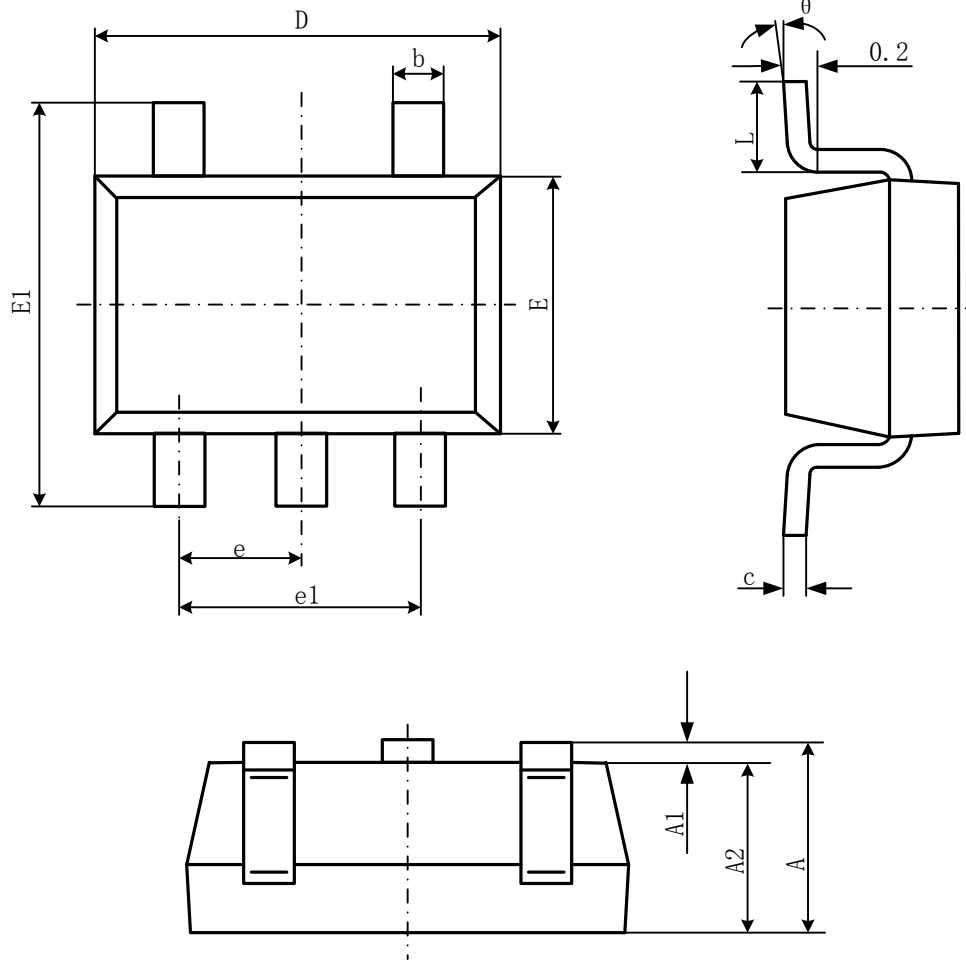


13. CE high Voltage VS Temperature



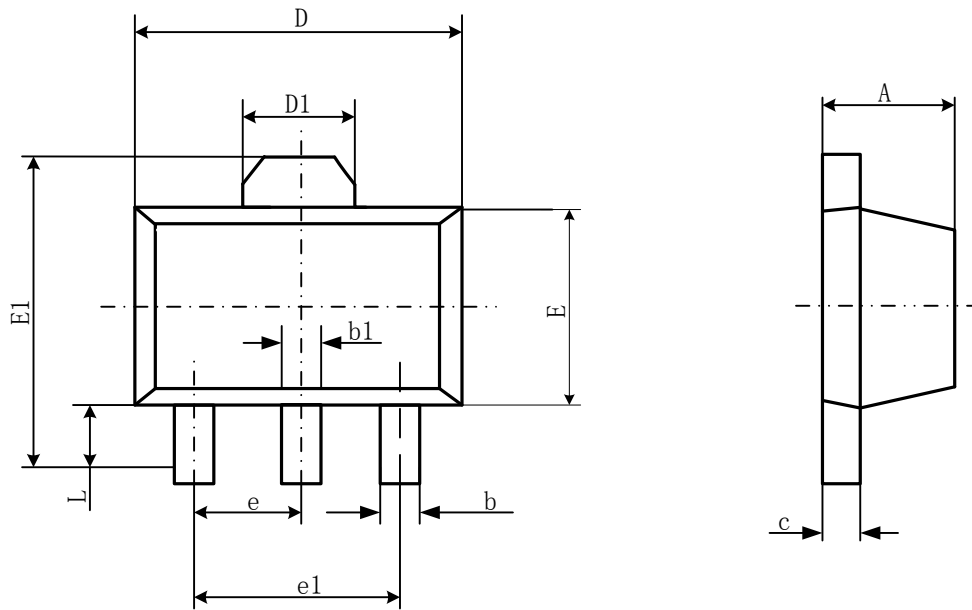
■ Package Information

- SOT23-5L



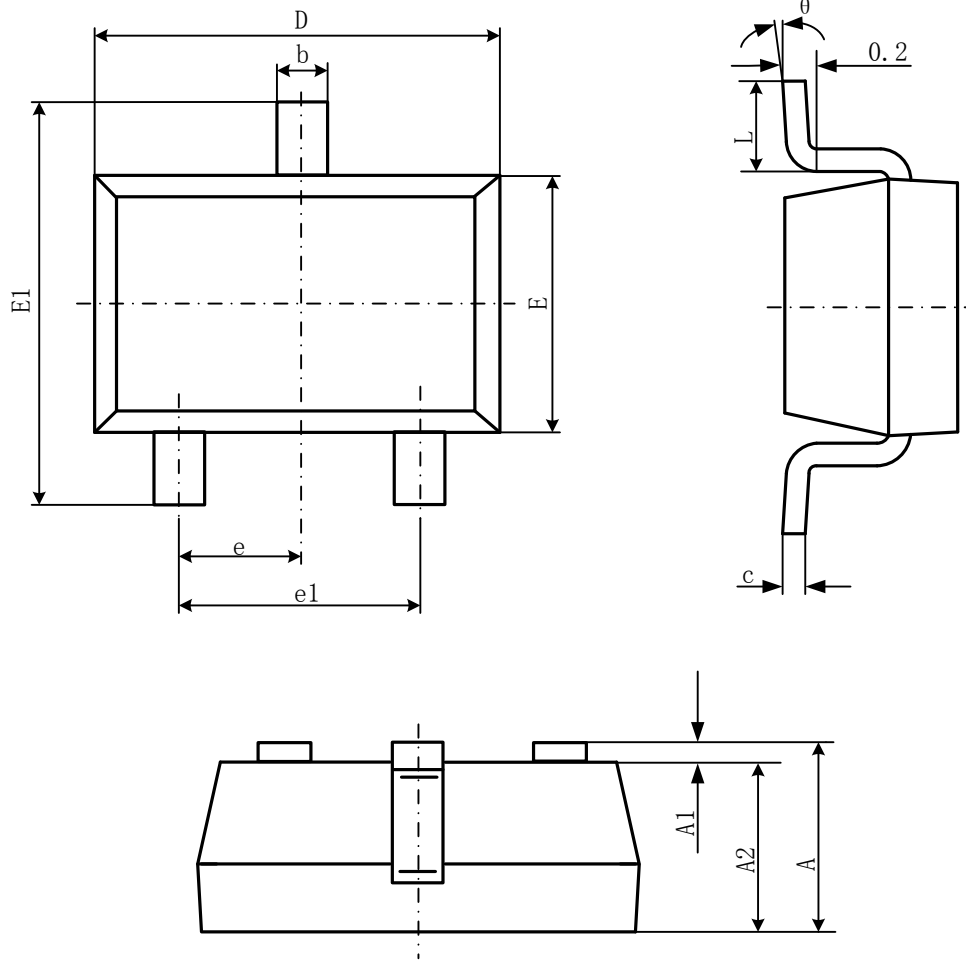
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)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

- SOT89-3L



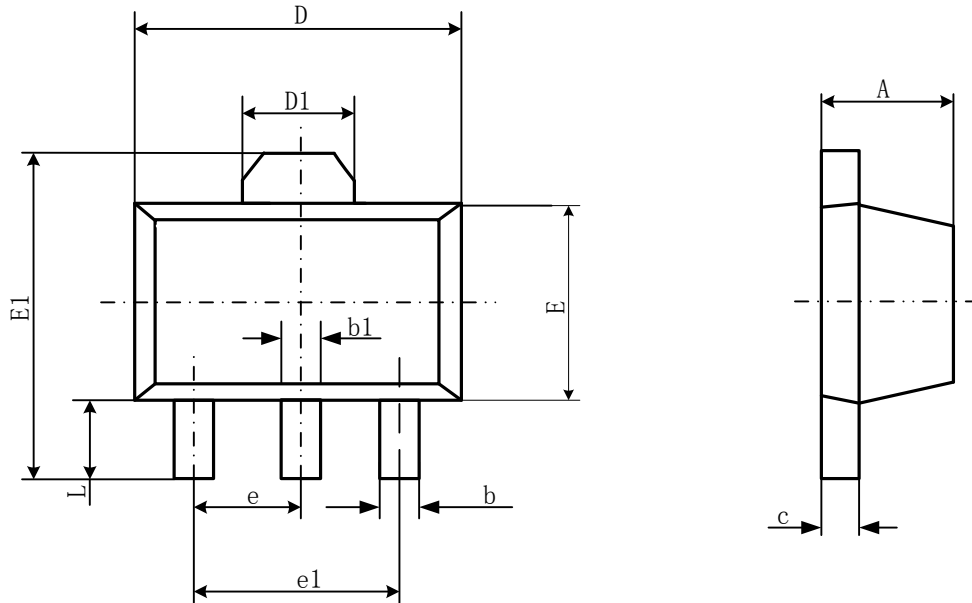
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.400	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550REF.		0.061REF.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP		0.060TYP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

- SOT23-3L



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°

● **SOT23-3B**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.041	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.041	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	1.800	2.000	0.071	0.079
L1	0.550REF.		0.022REF.	
L	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°