

### General Description

EC87XX series is designed for power sensitive applications. It includes a precision and high voltage input stage, an ultra-low-power bias current branch, and results in a ultra-low-power and low-dropout linear regulator.

The EC87XX operates from an input voltage of  $V_{OUT}+1V$  to 40V, consumes only 2.6 $\mu$ A of quiescent current, and offers 1% initial accuracy and SoftStart function. At power startup, the output voltage overshoot is less than 100mV.

The EC87XX regulators is available in standard SOT89-3L, and SOT23-3L packages.

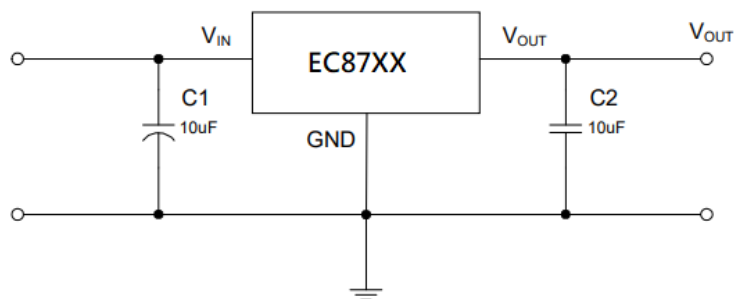
### Features

- Input voltage: 4.5V~40V
- Output voltage: 1.8V~5.7V
- Output accuracy:  $< \pm 1\%$
- Output current: 100mA (Typ.)
- PSRR: 60dB @ 100Hz
- Quiescent current: 4.2 $\mu$ A @  $V_{IN} = 12V$ (Typ.)
- ESD HBM: 8KV
- Recommend capacitor: 10 $\mu$ F
- No overshoot from short circuit recovery
- UVLO at 1.8V

### Applications

- Battery-powered Smoke sensor
- Smoke sensor
- Microcontrollers
- Household appliances and instruments

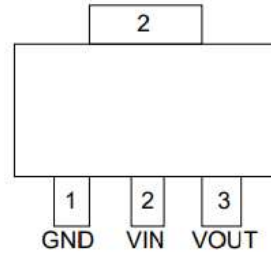
### TYPICAL APPLICATION CIRCUIT



In plugging in application,  $C_{IN}$  is recommended to use 10 $\mu$ F electrolytic capacitor or 10 $\mu$ F MLCC with 2 ohm serial resistors to prevent large input voltage spike when plugging in. See APPLICATION INFORMATION for more information.

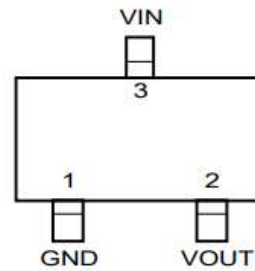
## PIN ASSIGNMENT

### SOT89-3L



SOT89-3L (Top View)

### SOT23-3L

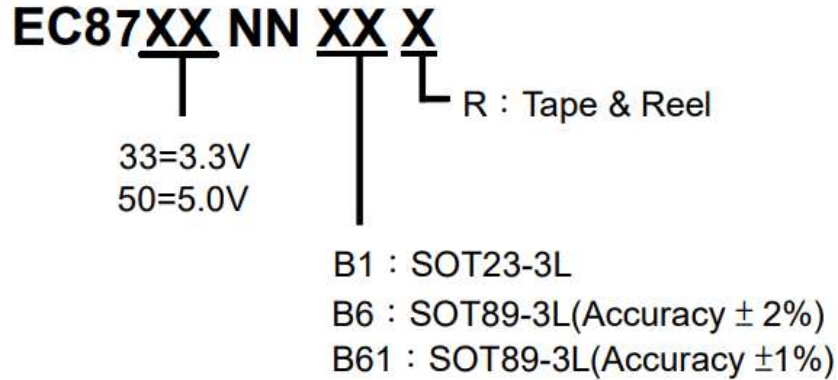


SOT23-3L (Top View)

## PIN DESCRIPTION

SYMBOL	I/O	DESCRIPTION
GND	Ground	Ground
VIN	Power	Input
VOUT	O	Output

**ORDERING INFORMATION**



**ABSOLUTE MAXIMUM RATINGS (Note)**

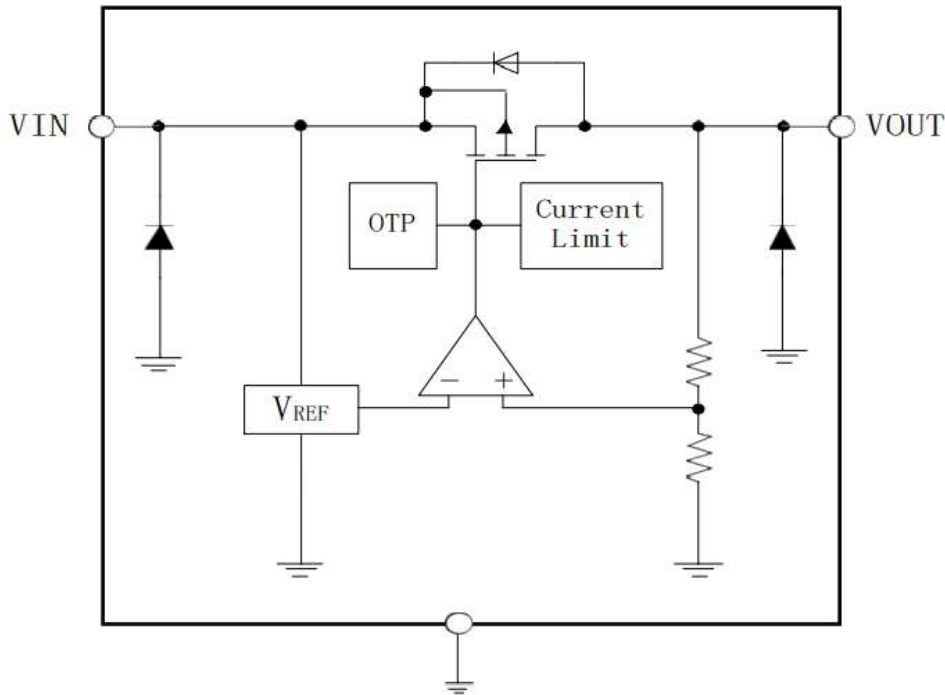
SYMBOL	ITEMS	VALUE	UNIT
V <sub>IN</sub>	Input Voltage	-0.3~45	V
V <sub>OUT</sub>	Output Voltage	-0.3~6.5	V
P <sub>DMAX</sub>	Power Dissipation	OTP limited	W
T <sub>J</sub>	Junction Temperature	-40~150	°C
T <sub>stg</sub>	Storage Temperature	-55 to 150	°C
T <sub>solder</sub>	Package Lead Soldering Temperature (10s)	260	°C
ESD MM	Machine Mode	200	V
ESD HBM	Human Body Mode	8000	V

*Note: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.*

**RECOMMENDED OPERATING RANGE**

SYMBOL	ITEMS	VALUE	UNIT
V <sub>IN</sub>	V <sub>IN</sub> Supply Voltage	4.5 to 40	V
R <sub>θJA</sub>	Thermal Resistance on PCB	45	°C/W
T <sub>OPT</sub>	Operating Temperature	-40 to +105	°C

### SIMPLIFIED BLOCK DIAGRAM



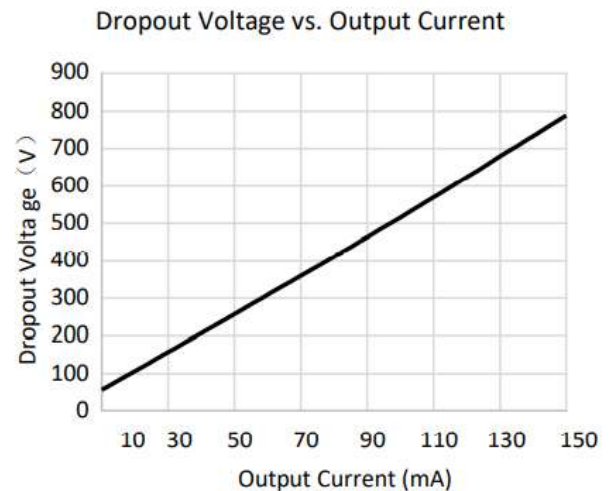
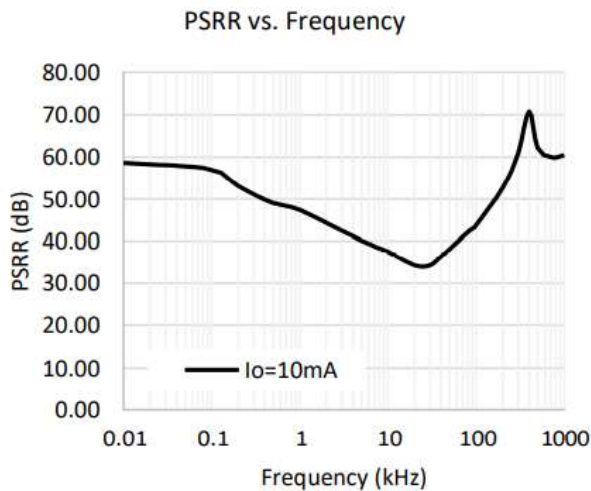
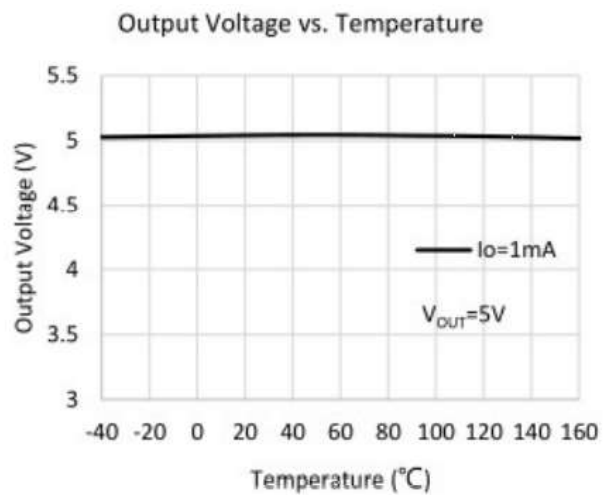
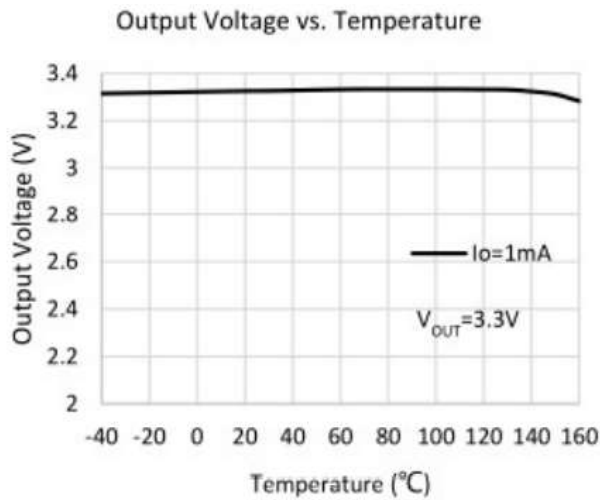
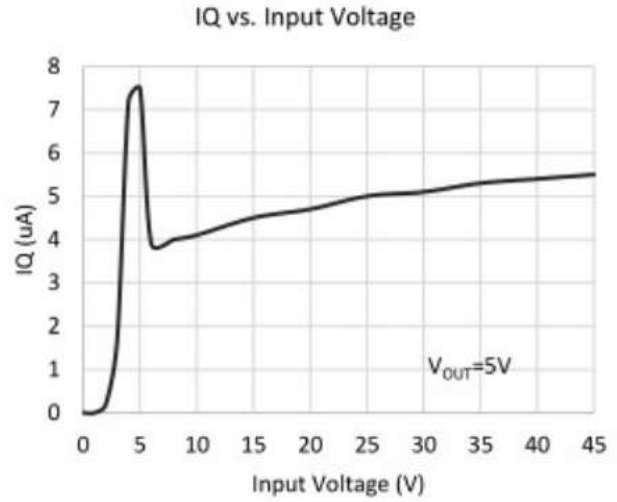
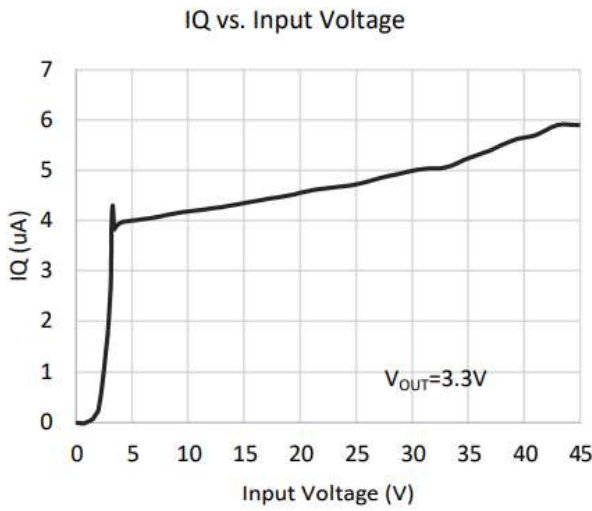
### ELECTRICAL CHARACTERISTICS

(  $V_{IN}=12V$  ;  $T_j=25^{\circ}C$  unless otherwise noted. )

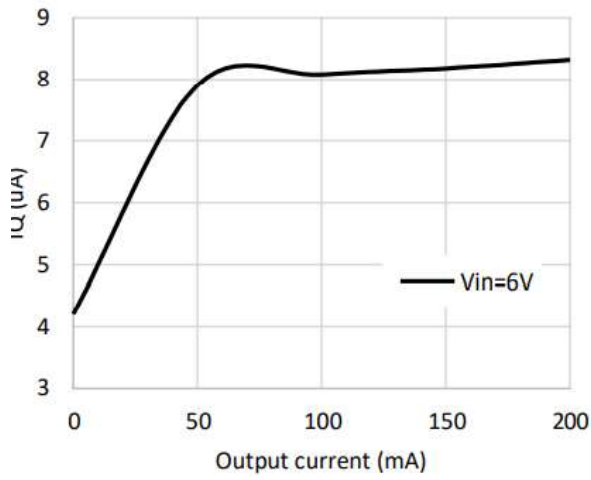
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{IN}$	Input Supply Voltage		4.5		40	V
$V_{OUT}$	Output Voltage Accuracy	$I_{OUT}=10mA$	-1%		1%	V
			-2%		2%	V
$I_Q$	Quiescent Current			4.5	8	$\mu A$
$I_{OUT}$	Output Current		150	200		mA
$V_{DROP}$	Dropout Voltage	$I_{OUT}=10mA$ $\Delta V_{OUT} = -V_{OUT} * 2\%$		60		mV
		$I_{OUT}=100mA$ $\Delta V_{OUT} = -V_{OUT} * 2\%$		600		mV
$V_{LR}$	Load Regulation	$1mA \leq I_{OUT} \leq 100mA$		20		mV
$V_{SR}$	Line Regulation	$I_{OUT}=1mA$ , $V_{IN}=(V_{OUT}+4V)$ to 45V		0.08		%/V
PSRR	Power Supply Rejection Ratio ( $V_{in}=10V$ , $V_{pp}=0.5V$ , $I_{out}=1mA$ )	Freq=100Hz		60		dB
		Freq=1KHz		50		dB
		Freq=10KHz		40		dB
$I_{LIMIT}$	Current Limit	$V_{IN}=(V_{OUT}+1V)$ to 30V $R_{LOAD}=V_{OUT}/1A$		350		mA
$T_{SHDN}$	Thermal Protection			165		$^{\circ}C$
$TC_{VOUT}$	Output Voltage Temperature Coefficient	$I_{OUT}=10mA$ $-40^{\circ}C \leq T_{AMB} \leq 100^{\circ}C$		$\pm 100$		ppm/ $^{\circ}C$

**TYPICAL PERFORMANCE CHARACTERISTICS**

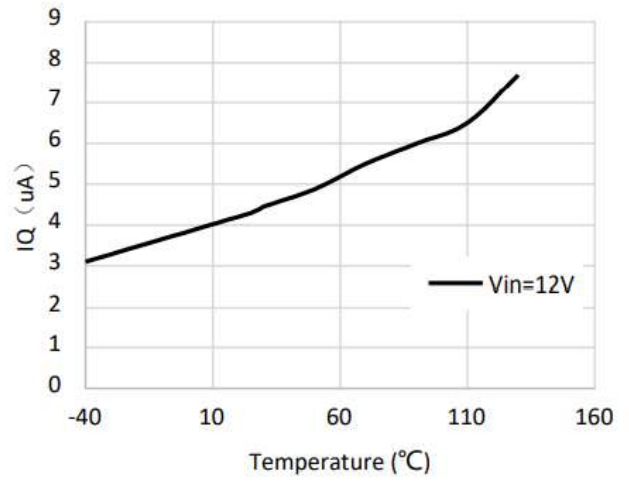
$C_{IN} = 10\mu F$ ,  $C_{OUT} = 10\mu F$ ,  $T_{OPT} = 25^{\circ}C$ , unless specified otherwise. ( EC87XXK2B Package )



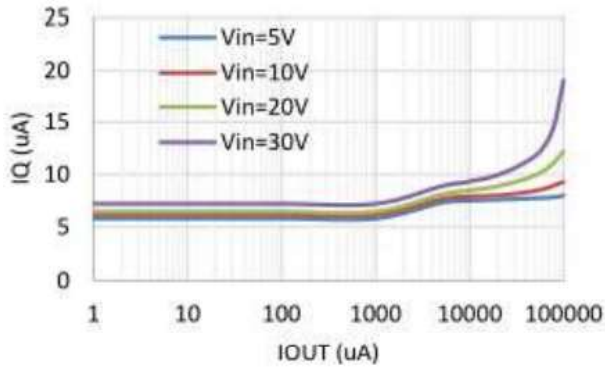
IQ vs. Output current



IQ vs. Temperature

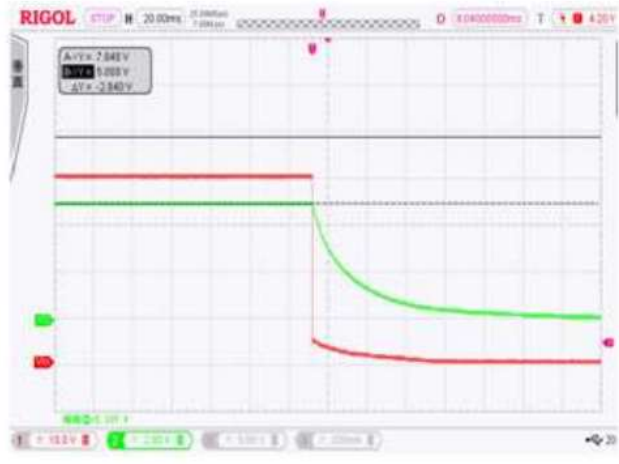


IQ vs. IOU



### Power ON/OFF

CH1 :  $V_{IN}$       CH2 :  $V_{OUT}$   
 $V_{IN}=40V$        $I_{OUT}=1mA$        $V_{OUT}=5V$



### Line Transient

CH1:  $V_{IN}$       CH2:  $V_{OUT}$   
 $V_{IN}=6V-12V$        $I_{OUT}=1mA$        $V_{OUT}=5V$



$V_{IN}=6V-12V$        $I_{OUT}=10mA$        $V_{OUT}=5V$





### APPLICATION INFORMATION

#### INPUT CAPACITOR

An input capacitor of 10 $\mu$ F is required between the VIN and GND pin. The capacitor shall be placed as close as possible to VIN pin, and the use of electrolytic capacitors is recommended.

#### OUTPUT CAPACITOR

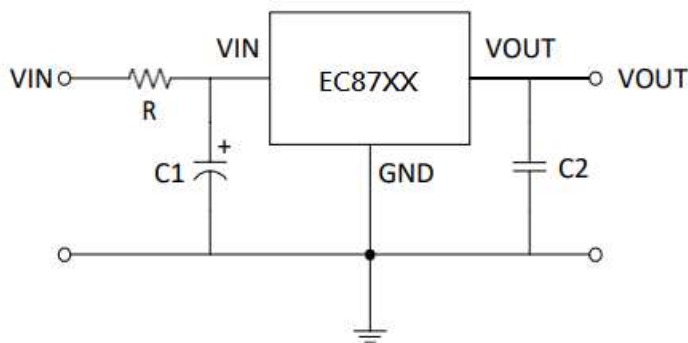
The recommended is 10 $\mu$ F MLCC capacitor. The minimum capacitance for stable and correct operation is 1 $\mu$ F.

#### NO-LOAD STABILITY

The EC87XX will remain stable and in regulation with no external load. This is especially important in CMOS RAM keep-alive applications.

#### TYPICAL CIRCUIT

The following figure shows a typical application circuit for the EC87XX devices. Please keep in mind that in-rush current can push up the Vin overshoot by as much as 50%. For example, when Vin=30V, the in-rush caused spike voltage can be as high as 45V. Therefore the voltage rating of Cin needs to be higher than 50% of the application.



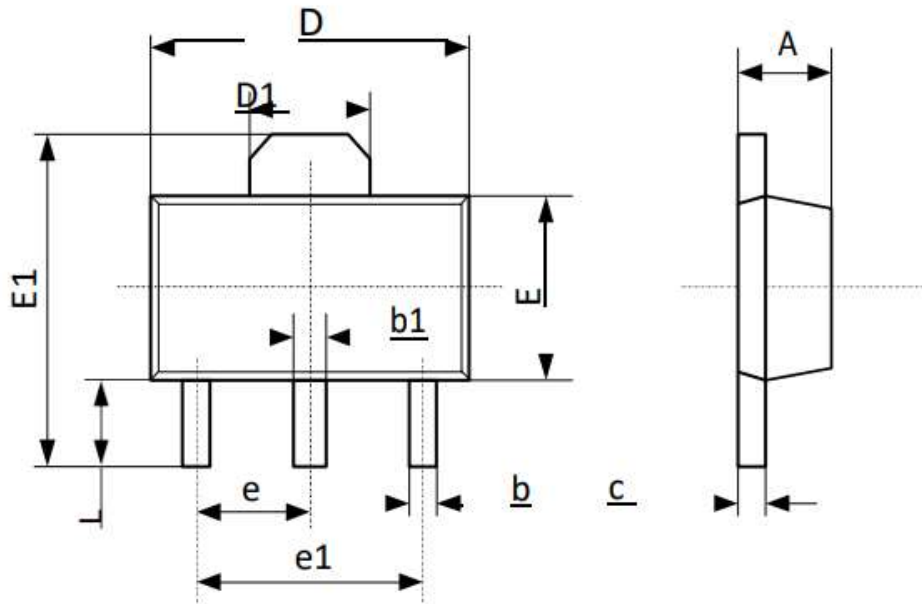
In live insertion application, it is suggested that R, C1 are selected as following:

1. C1=10 $\mu$ F ~ 100 $\mu$ F electrolytic capacitor with maximum voltage greater than 50V, R=0
2. C1=1 $\mu$ F ~ 10 $\mu$ F MLCC with maximum voltage greater than 50V and R=2 $\Omega$  in the type of 1206



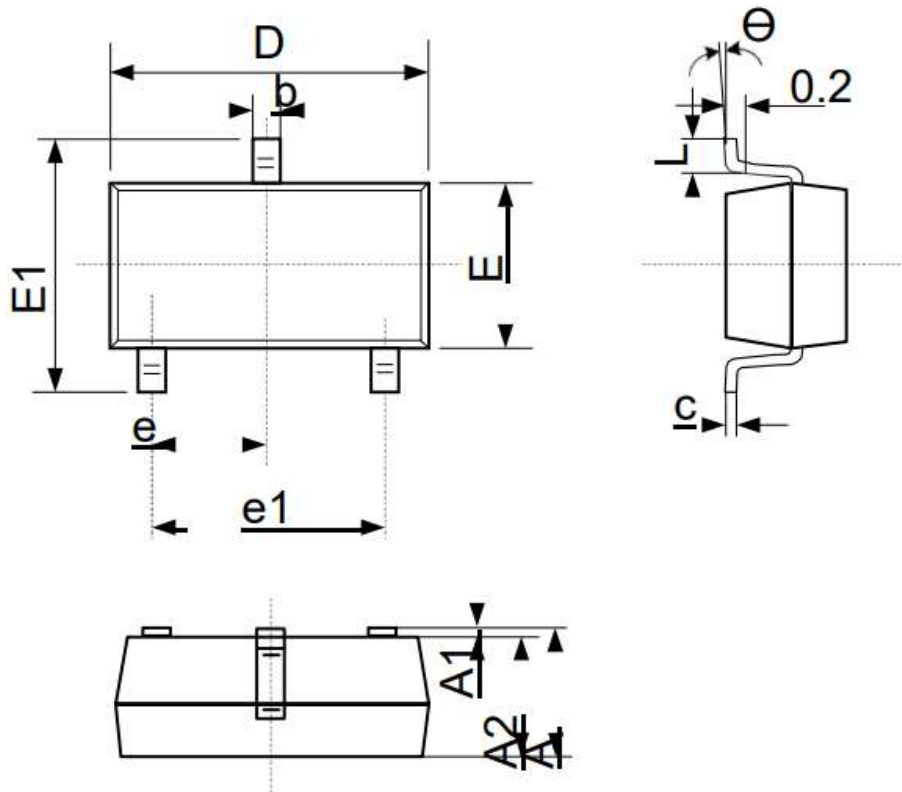
**PACKAGE OUTLINE**

Package	SOT89-3L	Devices per reel	1000Pcs	Unit	mm
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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	1.45	1.65	0.057	0.065
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

Package	SOT23-3L	Devices per reel	3000Pcs	Unit	mm
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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°C	8°C	0°C	8°C