

## GENERAL DESCRIPTION

SE87XX 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 SE87XX 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 SE87XX regulators is available in standard SOT89-3L, SOT23-5L and SOT23-3L packages. Standard products are Pb-free and Halogen-free.

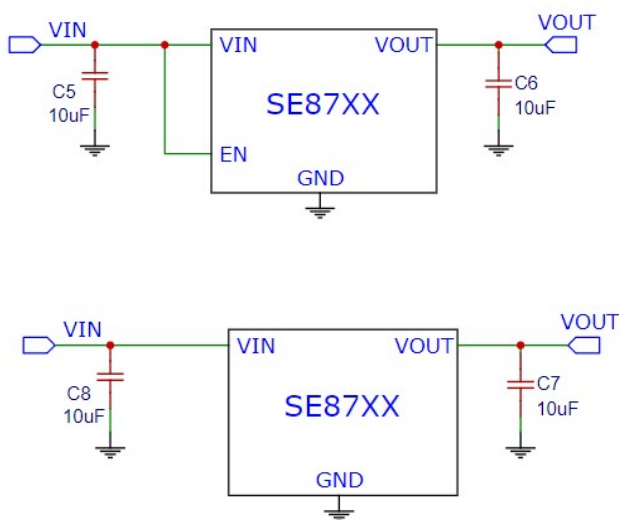
## FEATURES

- 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: 3KV
- 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

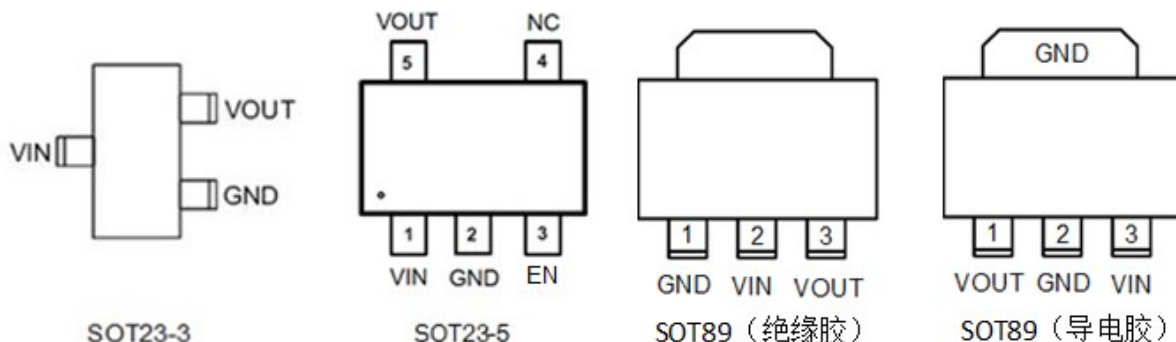


*In plugging in application,  $C_{IN}$  is recommended to use 10uF electrolytic capacitor or 10uF MLCC with 2 ohm serial resistors to prevent large input voltage spike when plugging in. See APPLICATION INFORMATION for more information.*



## PIN CONFIGURATION

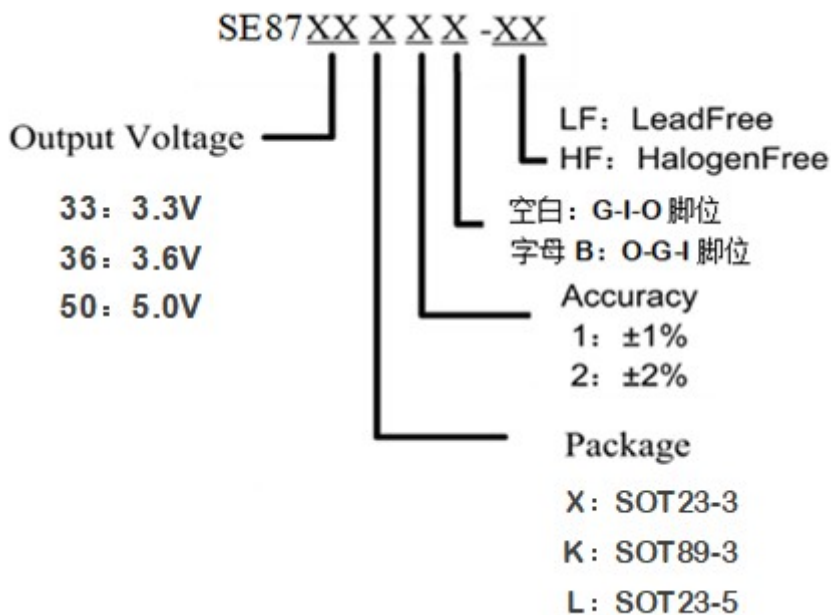
(Customer pin assignments are available)



## PIN DESCRIPTION

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

## ORDERING INFORMATION



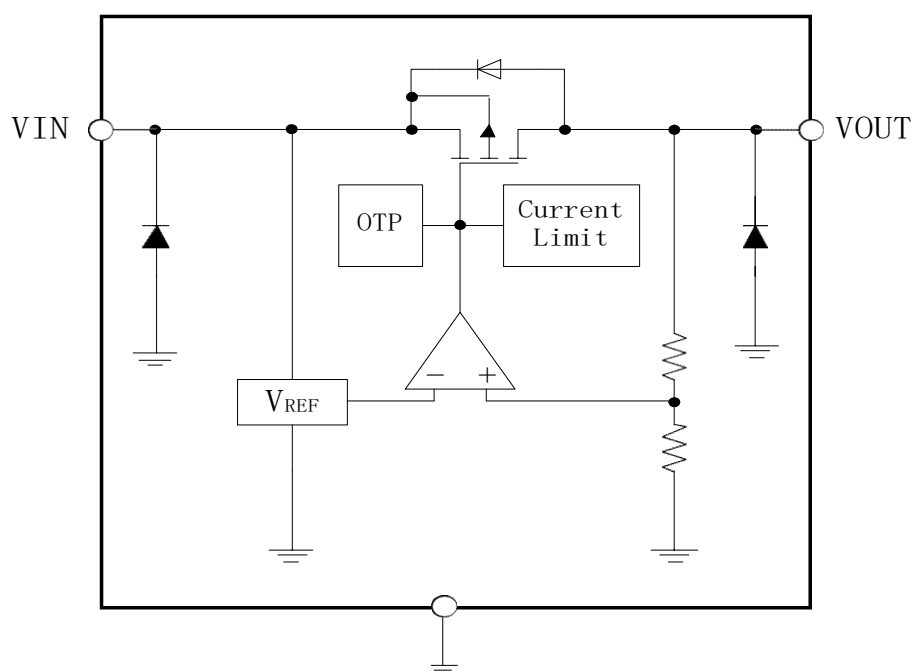
**ABSOLUTE MAXIMUM RATINGS** (Note)

SYMBOL	ITEMS	VALUE	UNIT
$V_{IN}$	Input Voltage	-0.3~45	V
$V_{OUT}$	Output Voltage	-0.3~6.5	V
$P_{DMAX}$	Power Dissipation	OTP limited	W
$T_J$	Junction Temperature	-40~150	°C
$T_{stg}$	Storage Temperature	-55 to 150	°C
$T_{solder}$	Package Lead Soldering Temperature (10s)	260	°C
ESD MM	Machine Mode	200	V
ESD HBM	Human Body Mode	3000	V
$\theta_{JA}$	Thermal Resistance, Junction-to-Ambient	165 (SOT89)	°C/W
		280 (SOT23)	
$P_D$	Power Consumption	750 (SOT89)	mW
		250 (SOT23)	

*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
$V_{IN}$	$V_{IN}$ Supply Voltage	4.5 to 40	V
$R_{\theta JA}$	Thermal Resistance on PCB	45	°C/W
$T_{OPT}$	Operating Temperature	-40 to +105	°C

**SIMPLIFIED BLOCK DIAGRAM**


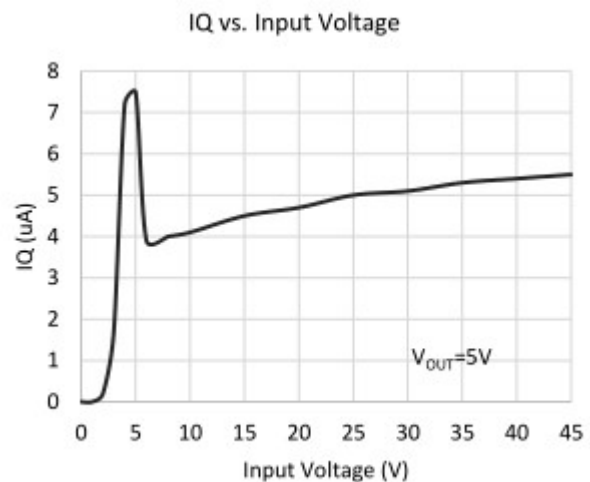
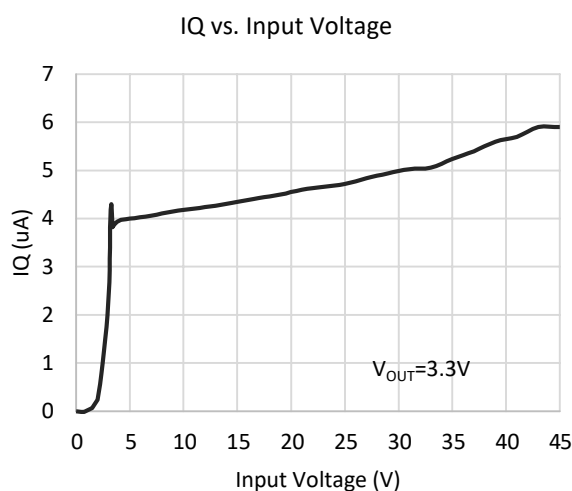
## ELECTRICAL CHARACTERISTICS

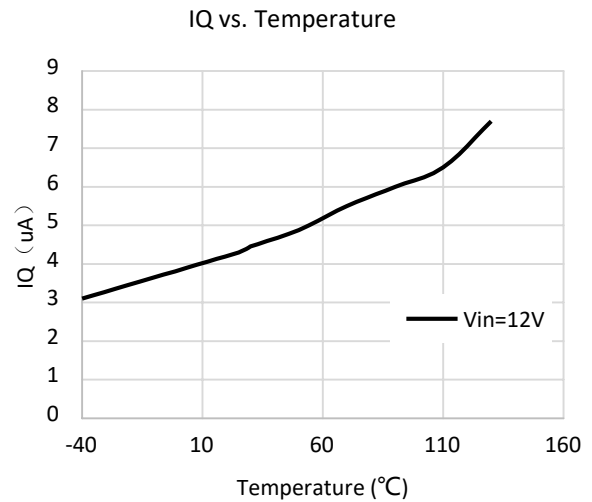
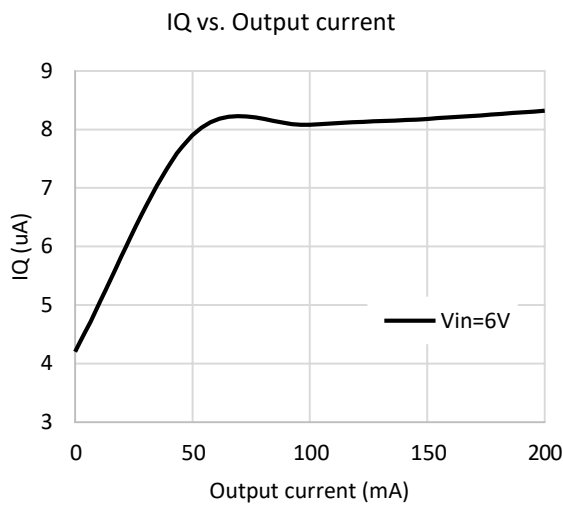
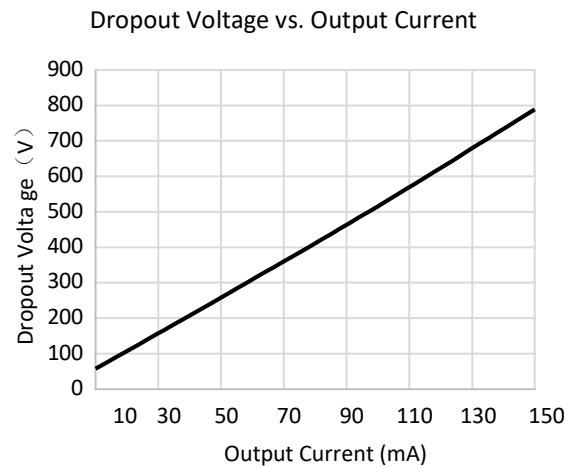
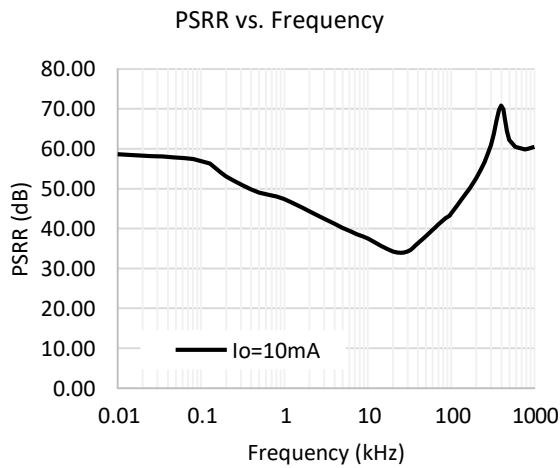
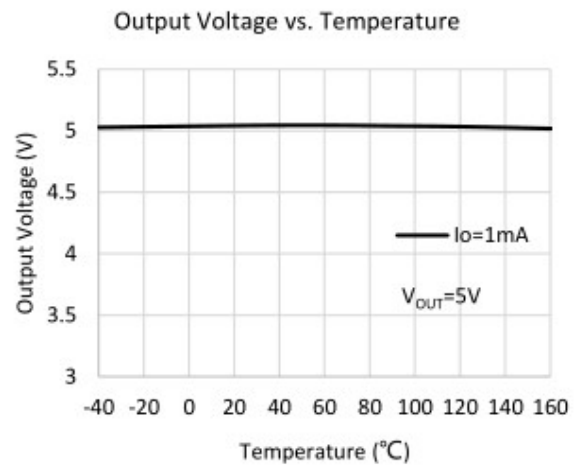
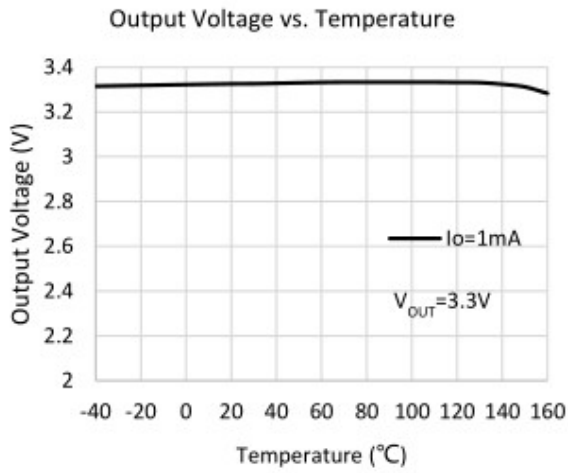
( $V_{IN}=12V$  ;  $T_j=25^{\circ}C$  unless otherwise noted.)

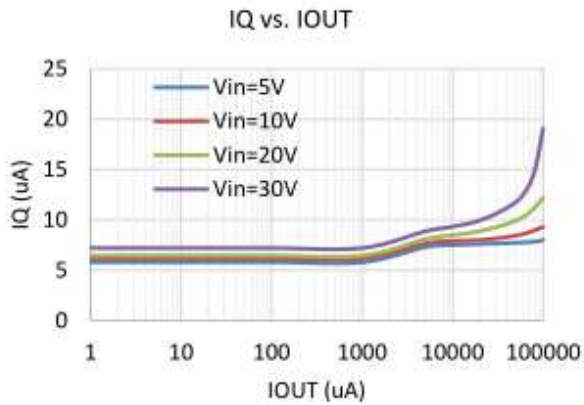
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{IN}$	Input Supply Voltage		4.5		40	V
$V_{OUT}$	Output Voltage Accuracy	$I_{OUT}=10mA$	-1%		1%	V
			-2%		2%	V
$I_Q$	Quiescent Current			4.5	8	$\mu A$
$I_{OUT}$	Output Current		150	200		mA
$V_{DROP}$	Dropout Voltage	$I_{OUT}=10mA$ $\Delta V_{OUT} = -V_{OUT} * 2\%$		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. (SE87XXK2B Package)







**Power ON/OFF**

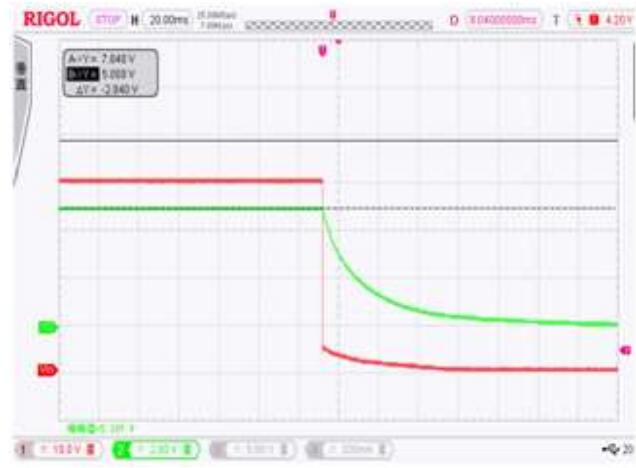
CH1 :  $V_{IN}$

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  $10\mu\text{F}$  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

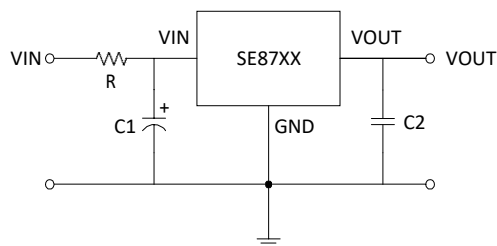
The recommended is  $10\mu\text{F}$  MLCC capacitor. The minimum capacitance for stable and correct operation is  $1\mu\text{F}$ .

### NO-LOAD STABILITY

The SE87XX will remain stable and in regulation with no external load. This is especially important in CMOS RAM keep-alive applications.

### TYPICAL CIRCUIT

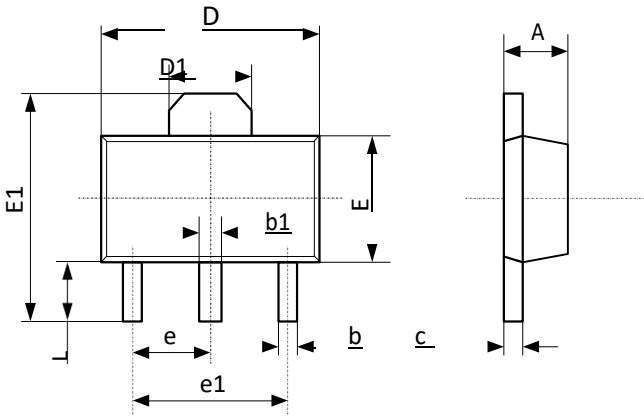
The following figure shows a typical application circuit for the SE87XX devices. Please keep in mind that in-rush current can push up the Vin overshoot by as much as 50%. For example, when  $V_{in}=30\text{V}$ , the in-rush caused spike voltage can be as high as 45V. Therefore the voltage rating of  $C_{in}$  needs to be higher than 50% of the application.



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

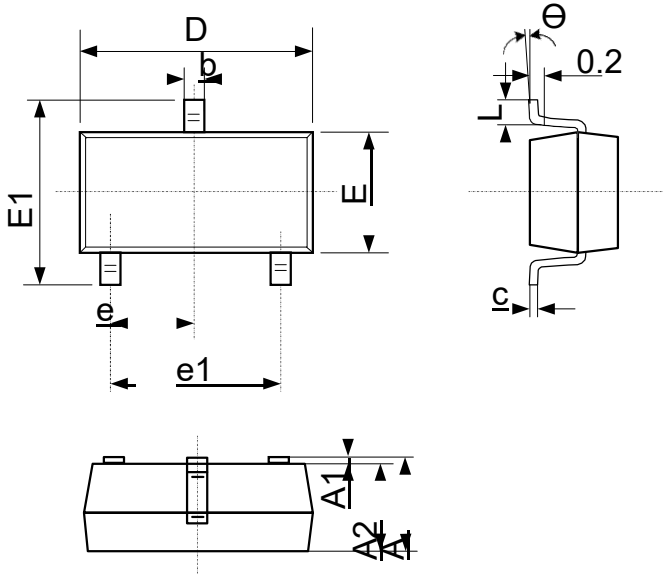
1.  $C1=10\mu\text{F} \sim 100\mu\text{F}$  electrolytic capacitor with maximum voltage greater than 50V,  $R=0$
2. If the average current is known, for example at 10mA, then for an input voltage of 20V, the  $C1=1\mu\text{F} \sim 10\mu\text{F}$  ceramic or electrolytic with maximum voltage greater than 40V and  $R=1\text{K}\Omega$  in the type of 1206 at 1/4W rating can be selected.

**PACKAGE OUTLINE**

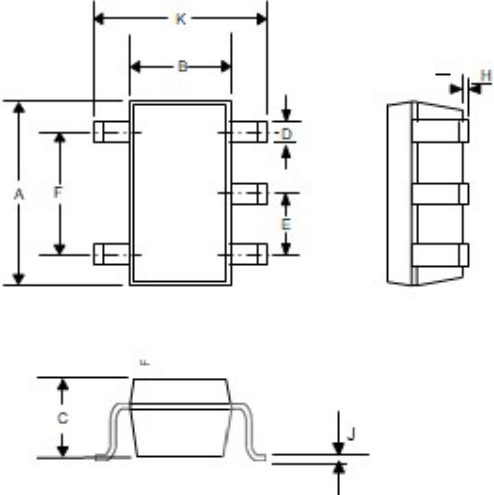
Package	SOT89-3L	Devices per reel	1000Pcs	Unit	mm
Package Dimension:					
					
Symbol	Dimensions In Millimeters		Dimensions In Inches		
	Min	Max	Min	Max	
A	1.400	1.600	0.055	0.063	
b	0.320	0.520	0.013	0.020	
b1	0.400	0.580	0.016	0.023	
c	0.350	0.440	0.014	0.017	
D	4.400	4.600	0.173	0.181	
D1	1.45	1.65	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 OUTLINE**

Package	SOT23-3L	Devices per reel	3000Pcs	Unit	mm
Package Dimension:					
					
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°	

**PACKAGE OUTLINE**

Package	SOT23-5L	Devices per reel	3000Pcs	Unit	mm																																																						
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			<table border="1"> <thead> <tr> <th rowspan="2">DIM<sup>N</sup></th> <th colspan="2">INCHES</th> <th colspan="2">MM</th> </tr> <tr> <th>MIN</th> <th>MAX</th> <th>MIN</th> <th>MAX</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0.110</td> <td>0.120</td> <td>2.80</td> <td>3.05</td> </tr> <tr> <td>B</td> <td>0.059</td> <td>0.070</td> <td>1.50</td> <td>1.75</td> </tr> <tr> <td>C</td> <td>0.036</td> <td>0.051</td> <td>0.90</td> <td>1.30</td> </tr> <tr> <td>D</td> <td>0.014</td> <td>0.020</td> <td>0.35</td> <td>0.50</td> </tr> <tr> <td>E</td> <td>-</td> <td>0.037</td> <td>-</td> <td>0.95</td> </tr> <tr> <td>F</td> <td>-</td> <td>0.075</td> <td>-</td> <td>1.90</td> </tr> <tr> <td>H</td> <td>-</td> <td>0.006</td> <td>-</td> <td>0.15</td> </tr> <tr> <td>J</td> <td>0.0035</td> <td>0.008</td> <td>0.090</td> <td>0.20</td> </tr> <tr> <td>K</td> <td>0.102</td> <td>0.118</td> <td>2.60</td> <td>3.00</td> </tr> </tbody> </table>			DIM <sup>N</sup>	INCHES		MM		MIN	MAX	MIN	MAX	A	0.110	0.120	2.80	3.05	B	0.059	0.070	1.50	1.75	C	0.036	0.051	0.90	1.30	D	0.014	0.020	0.35	0.50	E	-	0.037	-	0.95	F	-	0.075	-	1.90	H	-	0.006	-	0.15	J	0.0035	0.008	0.090	0.20	K	0.102	0.118	2.60	3.00
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