300mA, Low Power Consumption, High Voltage CMOS LDO Regulator

FEATURES

- **Low Quiescent Current I_Q: 3μA (Typ.)**
- **300mA Nominal Output Current**
- **Low Dropout Voltage**
- **Low Temperature Coefficient**
- **High Input Voltage (up to 45V)**
- **Output Voltage Accuracy: ±2%**
- **Fixed Output Voltage: 1.8V, 2.5, 3.0, 3.3V 3.6V and 5.0V**
- **Current Limit Protection**
- **Over Temperature Protection**
- **SOT23-3 and SOT89-3L Packages**

APPLICATIONS

- **Smart Power Network Equipment**
- **Portable Power Tools**
- **BMS systems**
- **Motor control system/Industrial control system**
- **Power Meter/Instrument**
- **White Goods**
- **Vehicle-mounted system**
- **Battery-Powered Equipment**
- **Automotive Head Unit**
- **Security Equipment**
- **Communication Equipment**

DESCRIPTION

The RS73xx-1 series is a set of low power high voltage regulators implemented in CMOS technology. Which can provide 300mA output current. The device allows input voltage as high as 45V.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 RS73xx-1 series only consume 3uA (typical), Which is particularly important in battery power system, can reduce the standby power consumption of the whole system .

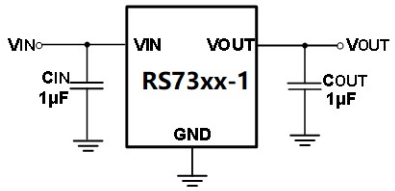
The RS73xx-1 is available in Green SOT23-3 and SOT89-3L packages, for the different application's requirements.

Device Information (1)

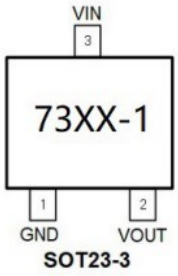
PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS73xx-1	SOT23-3(3)	1.60mm×2.92mm
	SOT89-3L(3)	2.45mm×4.50mm

(1) For all available packages, see the orderable addendum at the next page of the data sheet.

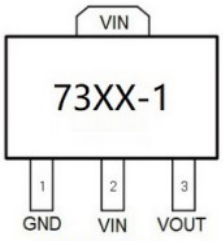
Typical Application Schematic



Pin Configuration and Functions (Top View)



SOT23-3



SOT89-3L(L-Type)

NOTE: XX indicate Output Voltage, xx indicate Data Code
For example: 7333-1(V_{OUT}=3.3V)

PIN DESCRIPTION

NAME	PIN		FUNCTION
	SOT23-3	SOT89-3L (L-Type)	
GND	1	1	Ground
VOUT	2	3	Regulator Output. Recommended output capacitor range:1μF to 10μF.
VIN	3	2	Regulator Input. Up to 45V input voltage. At least 1μF supply bypass capacitor is recommended.
EN	/	/	Enable pin. Drive this pin high to enable the device, Low to put the device into low current shutdown.
NC	/	/	No internal connection

PACKAGE/ORDERING INFORMATION

PRODUCT	ORDERING NUMBER	V_{OUT}(V)	PACKAGE LEAD	PACKAGE MARKING	PACKAGE OPTION
RS7318-1	RS7318-1YF3	1.8	SOT23-3	7318	Tape and Reel,3000
	RS7318-1YE3L	1.8	SOT89-3L (L-Type)	7318	Tape and Reel,1000
RS7325-1	RS7325-1YF3	2.5	SOT23-3	7325	Tape and Reel,3000
	RS7325-1YE3L	2.5	SOT89-3L (L-Type)	7325	Tape and Reel,1000
RS7330-1	RS7330-1YF3	3.0	SOT23-3	7330	Tape and Reel,3000
	RS7330-1YE3L	3.0	SOT89-3L (L-Type)	7330	Tape and Reel,1000
RS7333-1	RS7333-1YF3	3.3	SOT23-3	7333	Tape and Reel,3000
	RS7333-1YE3L	3.3	SOT89-3L (L-Type)	7333	Tape and Reel,1000
RS7336-1	RS7336-1YF3	3.6	SOT23-3	7336	Tape and Reel,3000
	RS7336-1YE3L	3.6	SOT89-3L (L-Type)	7336	Tape and Reel,1000
RS7350-1	RS7350-1YF3	5.0	SOT23-3	7350	Tape and Reel,3000
	RS7350-1YE3L	5.0	SOT89-3L (L-Type)	7350	Tape and Reel,1000

NOTE:

1.Date Code and Vendor Code also marking in package.

Specifications

Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1)(2)

		MIN	MAX	UNIT
V_{IN}	Input voltage	-0.3	48	V
V_{EN}	Enable input voltage	-0.3	V_{IN}	V
T_J	Junction temperature	-40	175	°C
P_D	Continuous power dissipation (3)	Internally Limited		W
T_{stg}	Storage temperature	-65	150	°C

(1) Stresses beyond 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-rated conditions for extended periods may affect device reliability.

(2) All voltages are with respect to the GND pin.

(3) Internal thermal shutdown circuitry protects the device from permanent damage.

ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM)	4000	V
		Charge device model (CDM)	1500	V

Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted) (1)

		MIN	MAX	UNIT
V_{IN}	Input supply voltage	2.5	45	V
I_{OUT}	Output current	0	300	mA
C_{IN}	Capacitor of Vin pin	1	10	uF
C_{OUT}	Capacitor of Vout pin	1	10	uF
ESR	Equivalent series resistance	5	100	mΩ
T_A	Operating temperature	-40	+85	°C

(1) All voltages are with respect to the GND pin.

Thermal Information

THERMAL METRIC		RS73xx-1		UNIT
		SOT23-3	SOT89-3L (L-Type)	
		3 PINS	3 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	185.6	165	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	104.3	88.5	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	54.5	39.6	°C/W
ψ_{JT}	Junction-to-top characterization parameter	31.0	26.5	°C/W
ψ_{JB}	Junction-to-board characterization parameter	54.5	49.7	°C/W
$R_{JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	77.7	°C/W

ELECTRICAL CHARACTERISTICS

(V_{IN} = V_{OUT} + 2V, C_{IN} = C_{OUT} = 1μF, V_{OUT} = 3.3V, Full = -40°C to +85°C, typical values are at T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Input Voltage	V_{IN}			+25°C	2.5(1)		45	V
Output Voltage Accuracy		I_{OUT} = 10mA		+25°C	-2.0		2.0	%
Ground Pin Current	I_Q	No load		+25°C		3.0	4.0	uA
Shutdown Current	I_{Q-OFF}	V_{EN} =0V		+25°C		0.1	1.0	uA
Max Output Current (2)				+25°C	300	350	-	mA
Dropout Voltage (3)	V_{DROP} I_{OUT}= 100mA	V_{OUT} =1.8V		+25°C	-	450	550	mV
		V_{OUT} =2.5V			-	385	485	
		V_{OUT} =3.0V			-	350	450	
		V_{OUT} =3.3V			-	335	435	
		V_{OUT} =5.0V			-	300	400	
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN} = V_{OUT} + 2V to 36V, I_{OUT} = 1mA		+25°C	-	0.05	0.2	%/V
Load Regulation	ΔV_{OUT}	V_{IN} =V_{OUT}+1V, I_{OUT} = 1mA to 50mA		+25°C	-	5	20	mV
Output Current Limit	I_LMT	V_{IN} =V_{OUT}+1V		+25°C	300	450	-	mA
Short Current	Ishort	V_{OUT} = 0		+25°C	-	100	-	mA
Power Supply Rejection Ratio	PSRR	V_{OUT} = 3.3V, I_{OUT} = 10mA	f = 217Hz	+25°C	-	72	-	dB
			f = 1KHz		-	77	-	
			f = 10KHz		-	60	-	
EN Input Threshold	V_{ENH}			+25°C	1.2	-	-	V
	V_{ENL}				-	-	0.4	V
Output Voltage Temperature Coefficient (4)	$\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$	I_{OUT} = 1mA		FULL	-	100	-	ppm/°C
Output Noise Voltage	eN	V_{IN} =V_{OUT}+1V, I_{OUT} = 1mA， V_{OUT}=3.0V f = 10Hz~100KHz			-	100	-	uVrms
Thermal Shutdown Temperature	T_{SHDN}				-	170	-	°C
Thermal Shutdown Hysteresis	T_{SDH}				-	20	-	°C

NOTES:

1. V_{IN} >= $V_{OUT\ (NOMINAL)}$, whichever is greater.

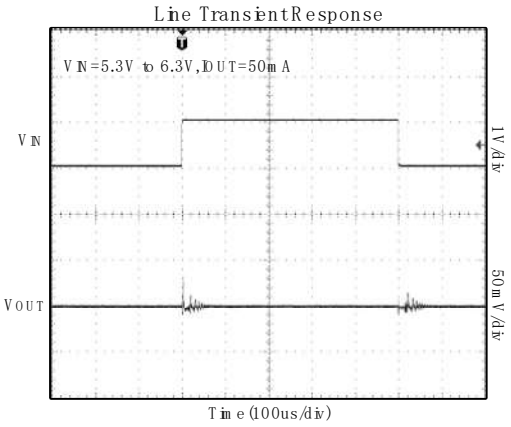
2. Maximum output current is affected by the PCB layout, size of metal trace, the thermal conduction path between metal layers, ambient temperature and the other environment factors of system. Attention should be paid to the dropout voltage when V_{IN} < V_{OUT} + V_{DROP}.

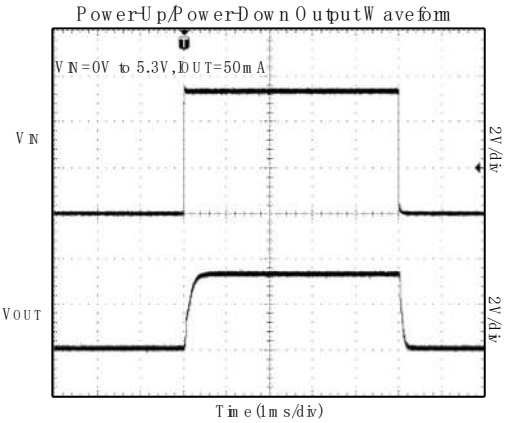
3. The dropout voltage is defined as V_{IN} - V_{OUT}, when V_{OUT} is 100mV below the value of V_{OUT} for V_{IN} = $V_{OUT\ (NOMINAL)}$ + 2V.

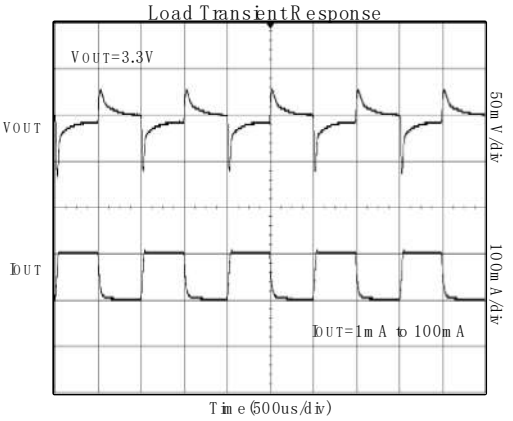
4. Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.

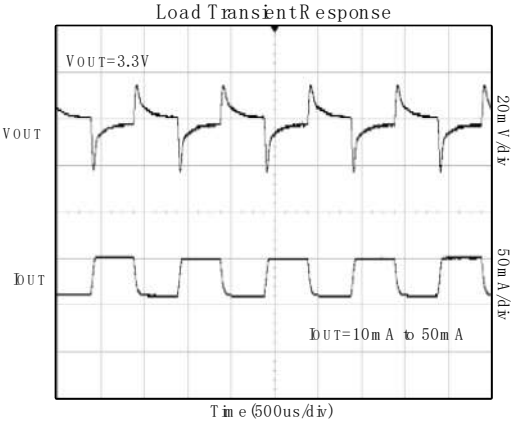
TYPICAL CHARACTERISTICS

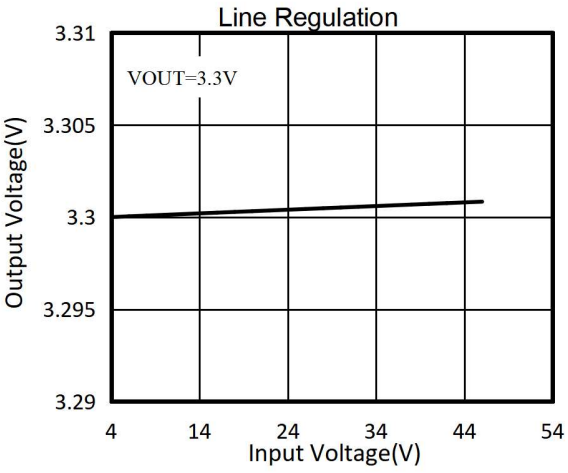
(V_{IN} = V_{OUT} + 2V, C_{IN} = C_{OUT} = 1μF, V_{OUT} = 3.3V, Full = -40°C to +85°C, typical values are at T_A = +25°C, unless otherwise noted.)

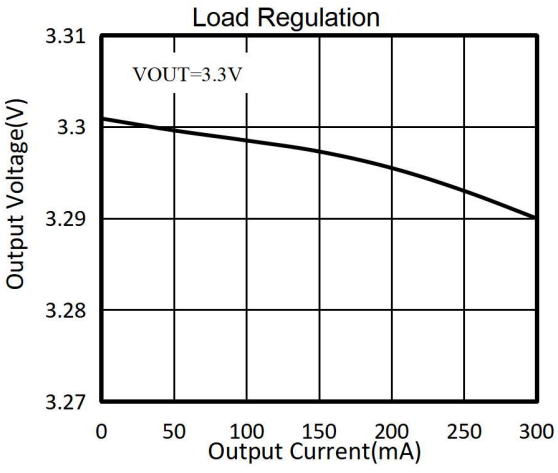












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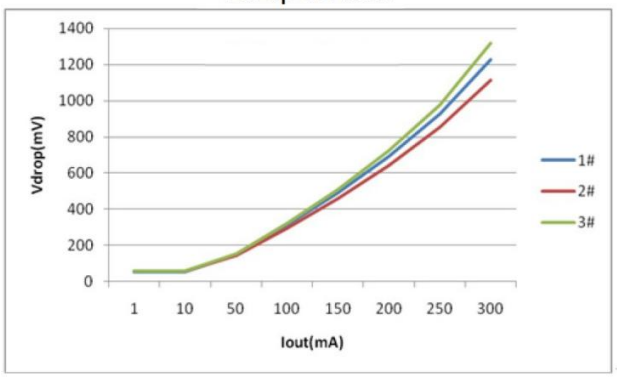
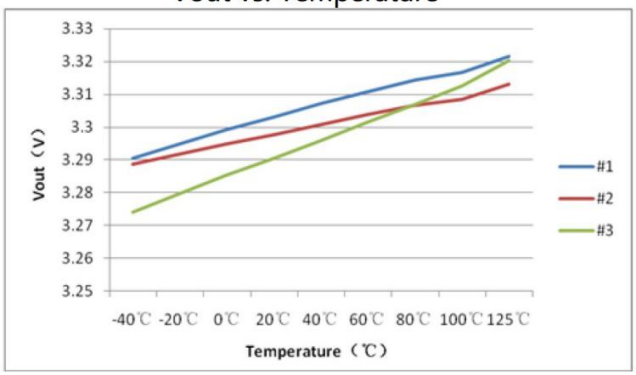
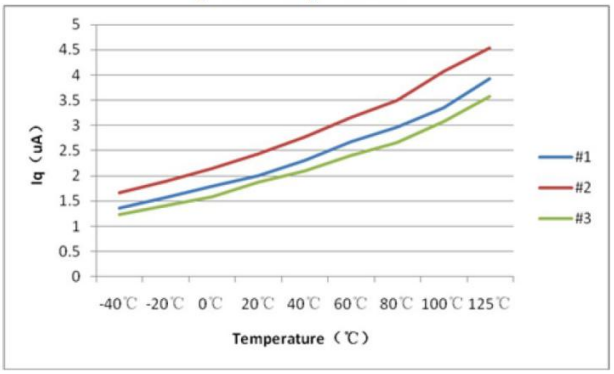
Vdrop vs. Iout



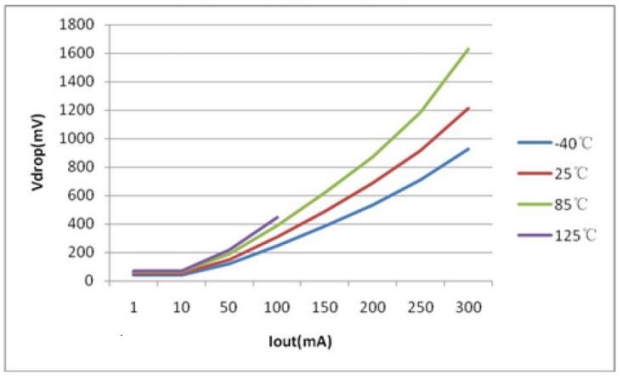
Vout vs. Temperature



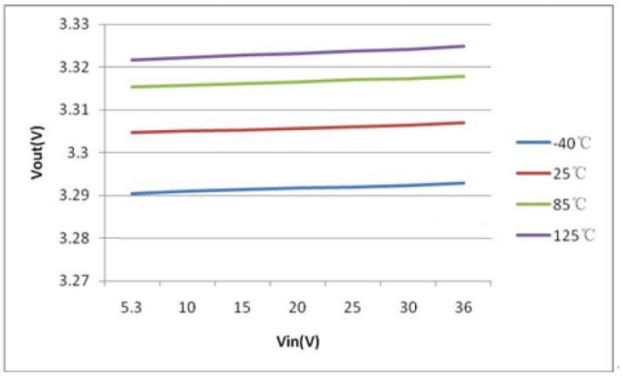
Iq vs. Temperature



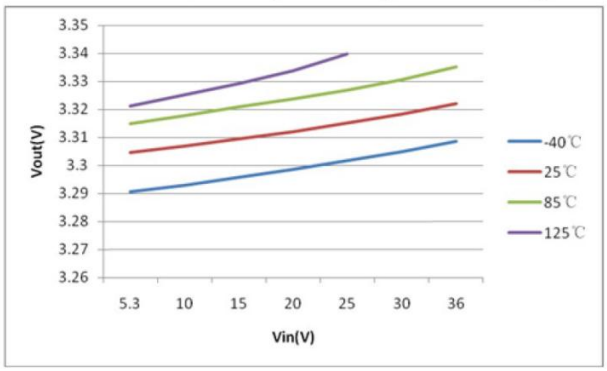
Vdrop - Iout vs. Temperature



Vout - Vin vs. Temperature (Iout = 1mA)



Vout - Vin vs. Temperature (Iout = 10mA)



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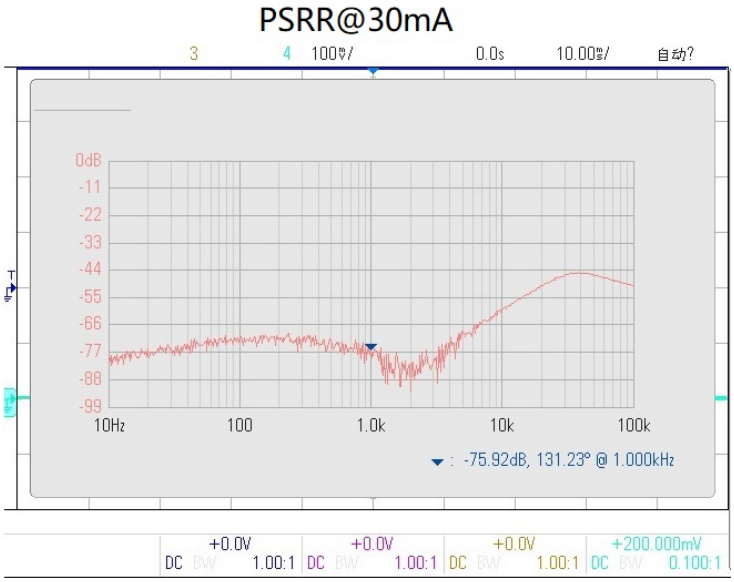
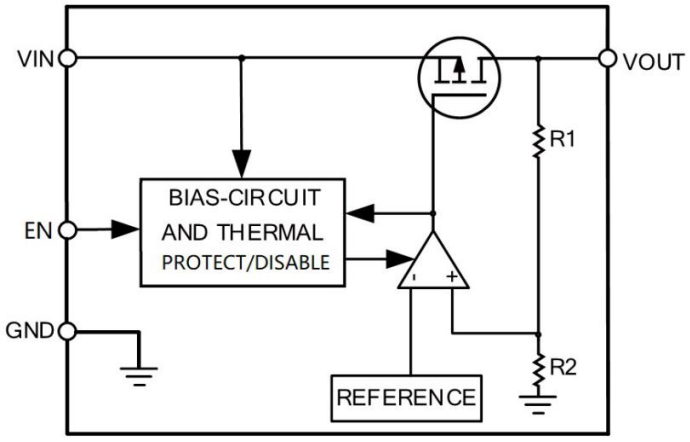


DETAILED DESCRIPTION

Overview

The RS73xx-1 low-dropout regulators (LDO) consumes only 3μA of quiescent current at light load and delivers excellent line and load transient performance. These characteristics, combined with low noise and good PSRR with low dropout voltage, make this device ideal for portable consumer applications.

Functional Block Diagram



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.

Applications Note:

1）The phase compensation circuit and ESR of the output capacitor are used inside the circuit to compensate, so a capacitor larger than 1.0uF must be connected to the ground.

2）It is recommended to use 1uF polar capacitors for input and output, and to keep the capacitors as close to the VIN 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 (PD) inside the IC exceeding the maximum power consumption allowed by the package.

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

$$T_{PN} = PD\times R_{\theta JA}+T$$

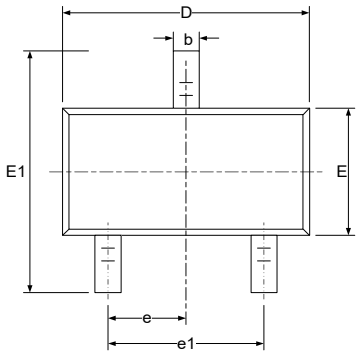
T_{PN} is junction temperature

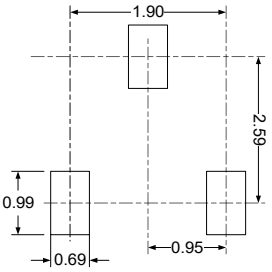
T is ambient temperature。

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:

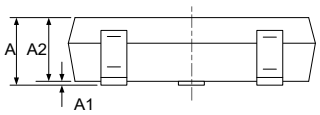
$$V_{OUT} = V_{IN} - V_{Dropout}$$

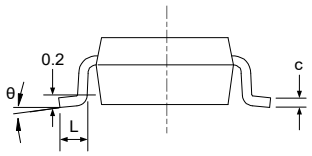
PACKAGE OUTLINE DIMENSIONS
SOT23-3





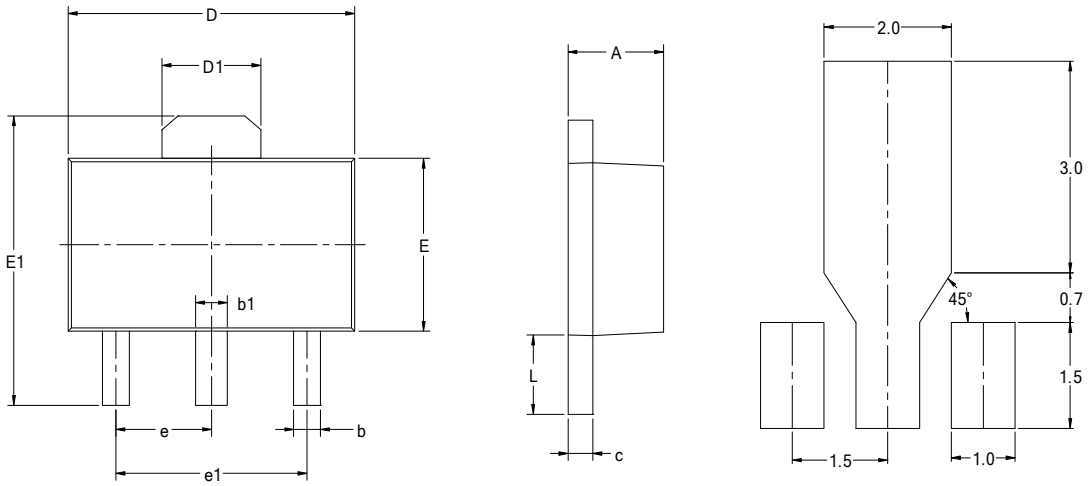
RECOMMENDED LAND PATTERN (Unit: mm)





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



RECOMMENDED LAND PATTERN (Unit: mm)

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 BSC		0.060 BSC	
e1	3.000 BSC		0.118 BSC	
L	0.900	1.200	0.035	0.047

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