5uA Low IQ, 40V 150mA LDO

1.Description

FLD6303 series is a group of positive voltage output 3-terminal linear regulator, capable of delivering 150mA current and working under 40V input voltage. It also features extremely low standby current which is only 5uA, while still keeps very fast load transient response capability. With the extremely low 5uA standby current, FLD6303 can greatly improve natural life of batteries.

FLD6303 includes high accuracy voltage reference, error amplifier, and current limit circuit and output driver module. FLD6303 has well load transient response and good temperature characteristic. And it uses trimming technique to guarantee output voltage accuracy within ±1%,±2%. FLD6303 can provide 3.0V, 3.3V, 3.6V, 4.4V, 5.0V, 9.0V, 12V output value. It also can be customized on command.

FLD6303 is housed in 4 different types of packages, which are SOT-23,SOT-23-3,SOT-23-5 and SOT-89-3L.

2.Features

- Low Power Consumption: 5.0uA (Typ.)
- Maximum Output Current: 150mA
- Small Dropout Voltage
- 740mV @ 100mA (V_{OUT}=3.3V)
- 1300mV @ 150mA (V_{OUT}=3.3V)
- Input Voltage Range: 3V~40V
- Output Voltage Range: 3.0V, 3.3V, 3.6V, 4.4V, 5.0V, 9.0V, 12V
- High Accuracy: ±1%,±2%
- Current Limit and Short Protection
- Over Temperature Protection
- Packages：SOT-23,SOT-23-3,SOT-23-5 and SOT-89-3L

3.Applications

- Wearables
- Toys
- Smart Home Application
- Battery Powered equipment

4.Order Information

Mode	V_{OUT}(V)	Accuracy (%)	Package	Ordering Number	Packing Option
FLD6303-3.0	3.0V	2%	SOT-23	FLD6303-SAA30CT	Tape and Reel,3000
			SOT-23-3	FLD6303-SBA30CT	Tape and Reel,3000
			SOT-23-5	FLD6303-SCB30CT	Tape and Reel,3000
				FLD6303-SCC30CT	Tape and Reel,3000
			SOT-89-3L	FLD6303-SEA30CT	Tape and Reel,1000
				FLD6303-SEB30CT	Tape and Reel,1000
FLD6303-3.3	3.3V	2%	SOT-23	FLD6303-SAA33CT	Tape and Reel,3000
			SOT-23-3	FLD6303-SBA33CT	Tape and Reel,3000
			SOT-23-5	FLD6303-SCB33CT	Tape and Reel,3000
				FLD6303-SCC33CT	Tape and Reel,3000
			SOT-89-3L	FLD6303-SEA33CT	Tape and Reel,1000
				FLD6303-SEB33CT	Tape and Reel,1000
FLD6303-3.6	3.6V	2%	SOT-23	FLD6303-SAA36CT	Tape and Reel,3000
			SOT-23-3	FLD6303-SBA36CT	Tape and Reel,3000
			SOT-23-5	FLD6303-SCB36CT	Tape and Reel,3000
				FLD6303-SCC36CT	Tape and Reel,3000
			SOT-89-3L	FLD6303-SEA36CT	Tape and Reel,1000
				FLD6303-SEB36CT	Tape and Reel,1000
FLD6303-4.4	4.4V	2%	SOT-23	FLD6303-SAA44CT	Tape and Reel,3000
			SOT-23-3	FLD6303-SBA44CT	Tape and Reel,3000
			SOT-23-5	FLD6303-SCB44CT	Tape and Reel,3000
				FLD6303-SCC44CT	Tape and Reel,3000
			SOT-89-3L	FLD6303-SEA44CT	Tape and Reel,1000
				FLD6303-SEB44CT	Tape and Reel,1000
FLD6303-5.0	5.0V	2%	SOT-23	FLD6303-SAA50CT	Tape and Reel,3000
			SOT-23-3	FLD6303-SBA50CT	Tape and Reel,3000
			SOT-23-5	FLD6303-SCB50CT	Tape and Reel,3000
				FLD6303-SCC50CT	Tape and Reel,3000
			SOT-89-3L	FLD6303-SEA50CT	Tape and Reel,1000
				FLD6303-SEB50CT	Tape and Reel,1000
		1%		FLD6303-SEB50BT	Tape and Reel,1000
FLD6303-9.0	9.0V	2%	SOT-23	FLD6303-SAA90CT	Tape and Reel,3000
			SOT-23-3	FLD6303-SBA90CT	Tape and Reel,3000
			SOT-23-5	FLD6303-SCB90CT	Tape and Reel,3000
				FLD6303-SCC90CT	Tape and Reel,3000
			SOT-89-3L	FLD6303-SEA90CT	Tape and Reel,1000
				FLD6303-SEB90CT	Tape and Reel,1000
FLD6303-12	12V	2%	SOT-23	FLD6303-SAA0CCT	Tape and Reel,3000
			SOT-23-3	FLD6303-SBA0CCT	Tape and Reel,3000
			SOT-23-5	FLD6303-SCB0CCT	Tape and Reel,3000
				FLD6303-SCC0CCT	Tape and Reel,3000
			SOT-89-3L	FLD6303-SEA0CCT	Tape and Reel,1000
				FLD6303-SEB0CCT	Tape and Reel,1000

5.Pin Configurations

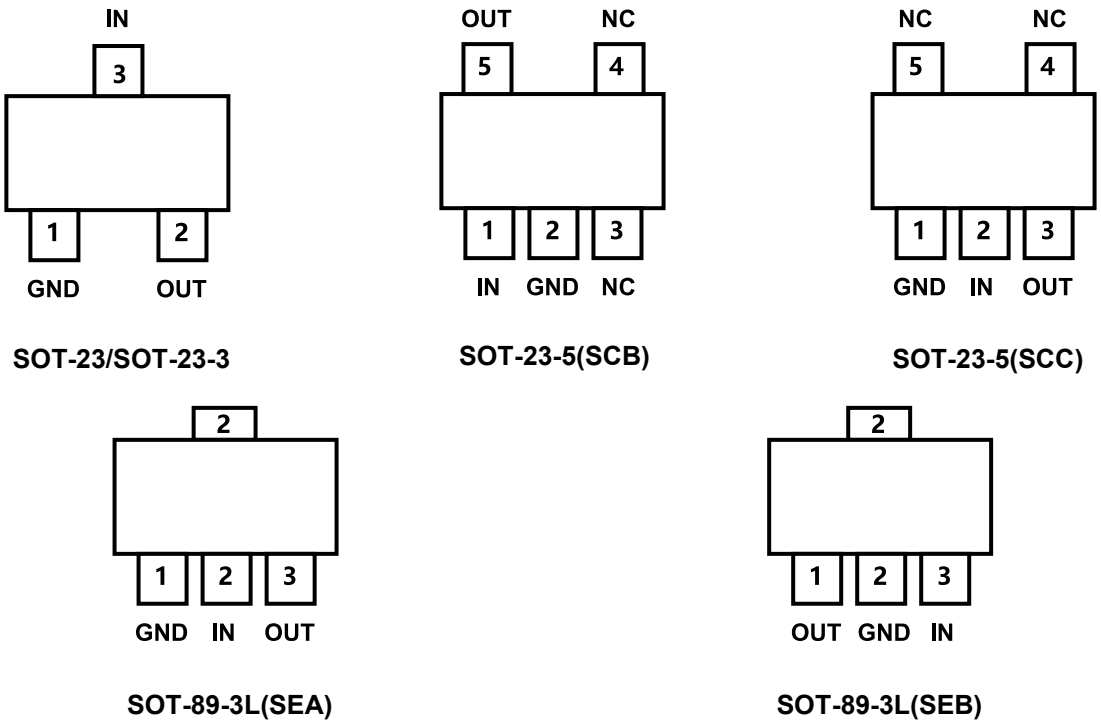


Figure 1. Pin Configuration for FLD6303

6.Pin Description

SOT-23-5		SOT-23	SOT23-3	SOT-89-3L		Name	Description
FLD6303-SCB	FLD6303-SCC	FLD6303-SAA	FLD6303-SAB	FLD6303-SEA	FLD6303-SEB		
2	1	1	1	1	2	GND	Ground
5	3	2	2	3	1	V_{OUT}	Output of the regulator
1	2	3	3	2	3	V_{IN}	Power Supply Input
3/4	4/5	-	-	-	-	NC	No Connection.

7.Typical Application

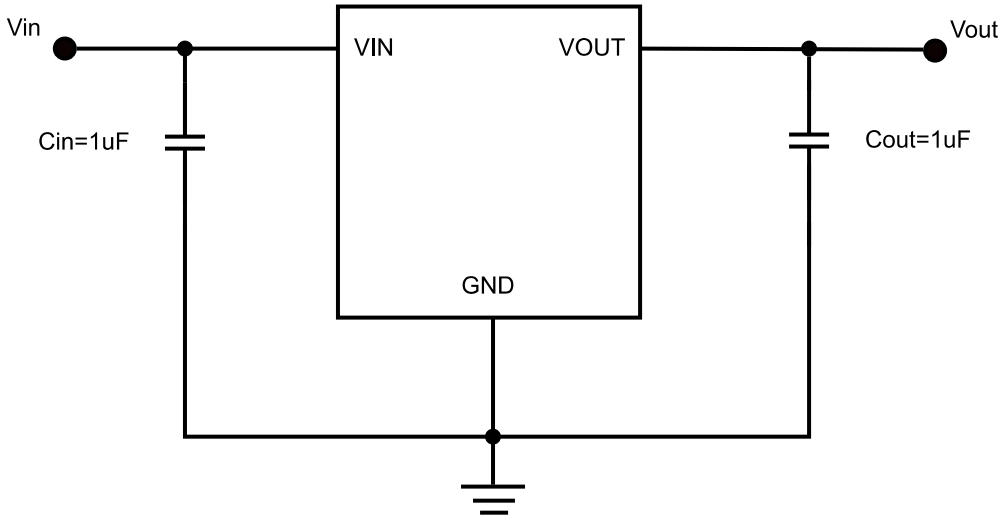


Figure 2. Typical Application for FLD6303

Note: Input capacitor (C_{IN} = 1uF) and Output capacitor (C_{OUT} ≥ 1uF) are recommended in all application circuit.

8.Functional Block Diagram

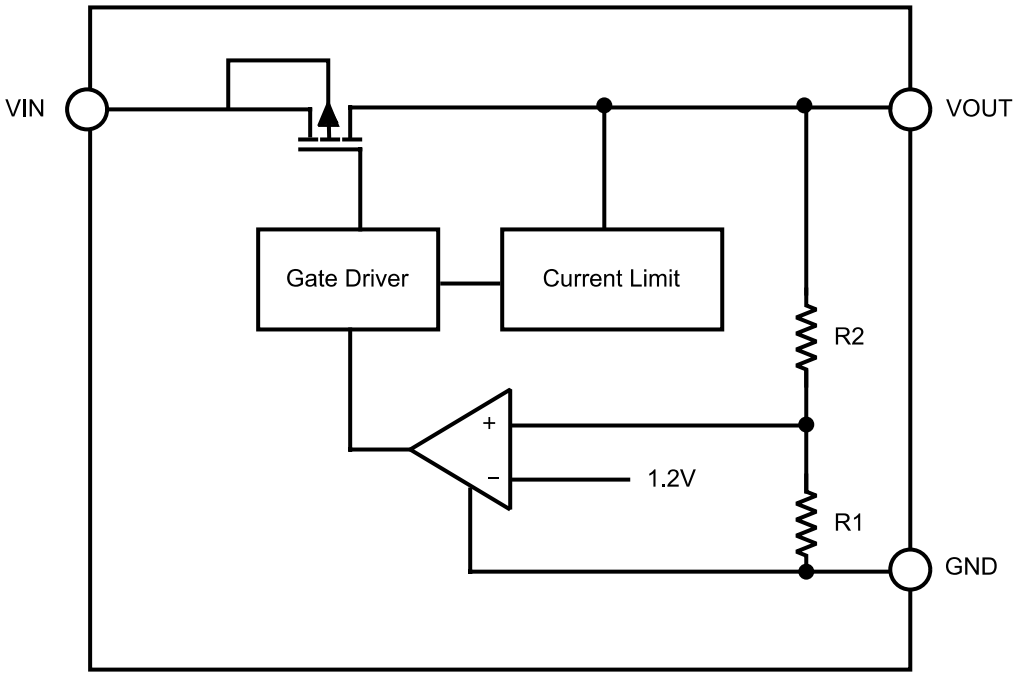


Figure 3. FLD6303 Block Diagram

9.Absolute Maximum Ratings

Parameter		Value
V_{IN} (1)		42V
Out Voltage		-0.3V to +20V
Operating Junction Temperature (T_j)		125 °C
Operating Temperature Range		-40 °C to 85 °C
Storage Temperature Range		-55 °C to 125 °C
Continuous Power Dissipation (T_A = 25 °C)(2)	SOT-89-3L	0.5W
	SOT-23	0.4W
ESD Human body mode		2KV
Lead Temperature & Time		260 °C, 10S

Notes:

Exceeding these ratings may damage the device.

10.Electrical Characteristic

All typical values are at T_j=25 °C (unless otherwise noted).

Parameter	Conditions	Min	Typ	Max	Units
Input Voltage range		3		40	V
Output Voltage range		3		12	V
Output Accuracy		-2		2	%
		-1		1	%
Ground supply current	No load		5	10	μA
Max output current	V_{in}-V_{out}=2V	150			mA
Line regulation	I_{load}=1mA		0.01	0.1	%/V
Load regulation	I_{load}=1-100mA		2	4	%
Dropout Voltage	I_{load}=100mA,V_{out}>3V		740	1000	mV
Current Limit			200		mA
Short current			200		mA
PSRR@100Hz	V_{in}=V_{out}+0.5V,I_{load}=1mA		65		dB
Startup time			500		uS
OTP			165		℃
OTP hysteresis			30		℃

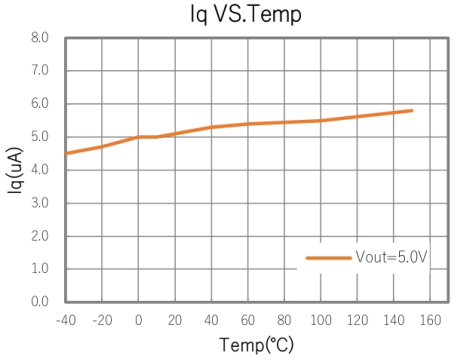
Note1:

All tests are conducted under ambient temperature 25 °C and within a short period of time 20ms.

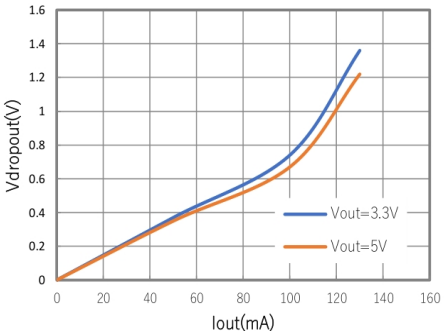
11.Typical Characteristics

C_{IN}=C_{OUT}=1uF, T_A=25 °C, unless otherwise specified.

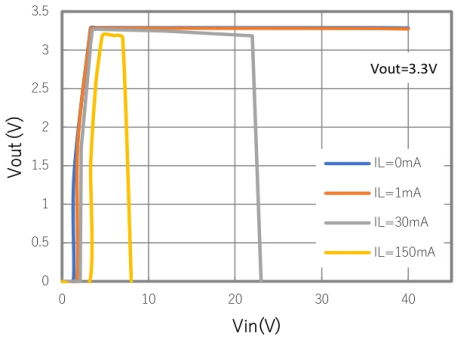
Iq VS.Temp



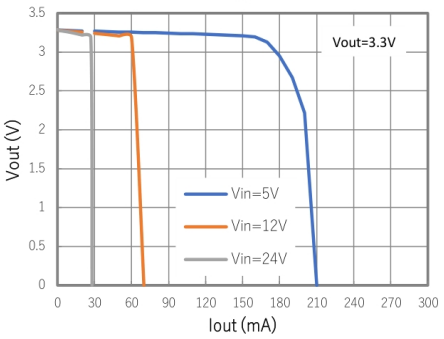
Iout VS. Dropout



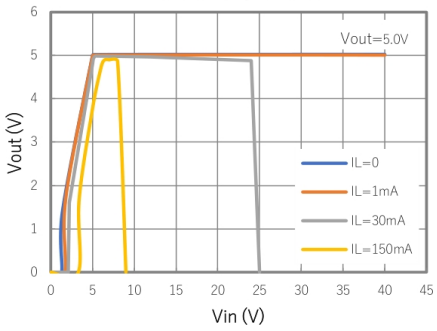
Line Regulation



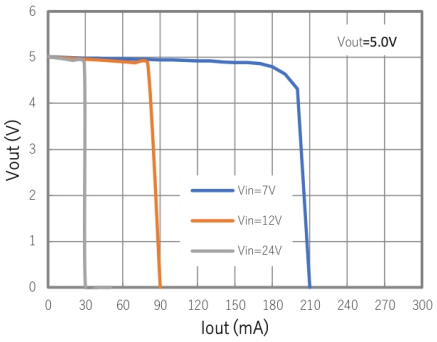
Load Regulation



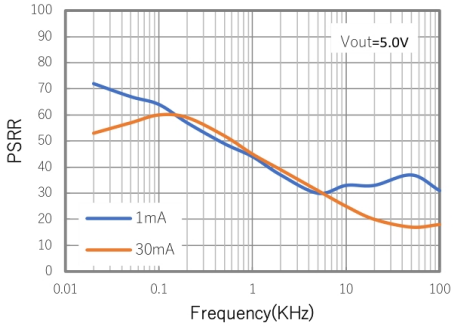
Line Regulation



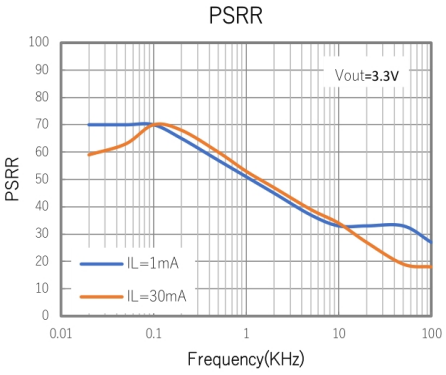
Load Regulation



PSRR



PSRR





V_{in} fast on 150mA, V_{OUT}=3.3V



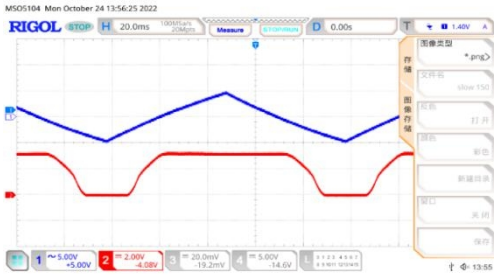
V_{in} fast off 150mA, V_{OUT}=3.3V



V_{in} fast on 150mA, V_{OUT}=5.0V



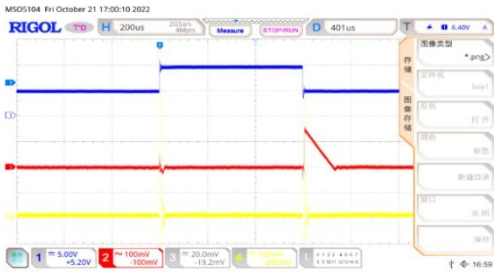
V_{in} fast off 150mA, V_{OUT}=5.0V



V_{in} slow on/off 150mA, V_{OUT}=3.3V



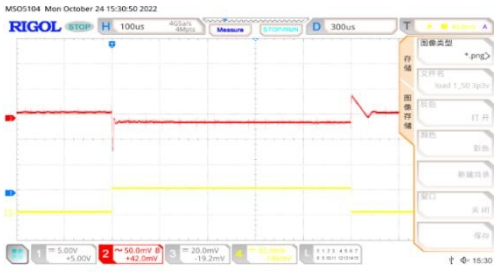
V_{in} slow on/off 150mA, V_{OUT}=5.0V



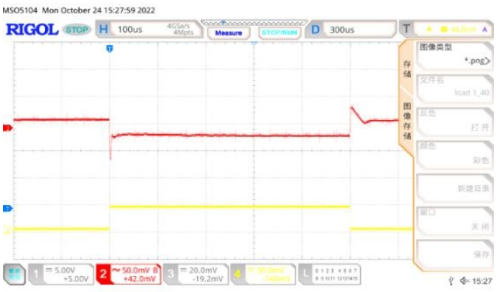
Line transient V_{OUT}=3.3V, I_{OUT}=1mA



Line transient V_{OUT}=5.0V, I_{OUT}=1mA



Load transient V_{OUT}=3.3V, I_{OUT}=1mA-50mA



Load transient V_{OUT}=5.0V, I_{OUT}=1mA-40mA

12.Functional Description

A minimum of 1uF capacitor must be connected from V_{out} to ground to insure stability. Input capacitor of 1uF is recommended to ensure the input voltage does not sag below the minimum dropout voltage during load transient event. V_{in} pin must always be dropout voltage higher than V_{out} in order for the device to regulate properly.

13.Application Information

Like any low-dropout regulators, FLD6303 requires input and output decoupling capacitors. These capacitors must be correctly selected for good performance. Both input and output capacitors are recommended to be placed as close to chip pin as possible.

14.Capacitor Selection

Normally, use a 1uF capacitor on the input and a 1uF capacitor on the output of the FLD6303. Larger input capacitor values and lower ESR (X5R, X7R) provide better supply noise rejection and transient response.

15.Input-Output (Dropout) Voltage

A regulator's minimum input-to-output voltage differential (dropout voltage) determines the lowest usable supply voltage. In battery-powered systems, this determines the useful end-of-life battery voltage. Because the device uses a PMOS, its dropout voltage is a function of drain to source on resistance, RDS (on), multiplied by the load current:

$$Vdropout = Vin - Vout = RDS(on) \times Iout$$

16.Current Limit and Thermal Shutdown Protection

In order to prevent overloading or thermal condition from damaging the device, FLD6303 has internal thermal and current limiting functions designed to protect the device. It will rapidly shut off PMOS pass element during overloading or over temperature condition.

17.Thermal Considerations

The FLD6303 series can deliver a current of up to 150mA over the full operating junction temperature range. However, the maximum output current must be controlled at higher ambient temperature to ensure the junction temperature does not exceed 150 °C.With all possible conditions, the junction temperature must be within the range specified under operating conditions.Power dissipation can be calculated based on the output current and the voltage drop across regulator:

$$Pd = (Vin - Vout) \times Iout.$$

The final operating junction temperature for any set of conditions can be estimated by:

$$Pd\ (max) = (Tj\ (max) - Ta) / \theta ja.$$

Where Tj (max) is the maximum junction temperature of the die (150°C) and Ta is the maximum ambient temperature.

When junction temperature exceeds 150 °C, over temperature protection may be triggered to prevent device from over heat.

18.PCB Layout

An input capacitance of 1 μF is required between the FLD6303 input pin and ground (the capacitance may be increased as needed). This capacitor must be placed within 1 cm of the input pin and return to a clean analog ground. It filters out input voltage spikes caused by the surge current due to the inductive effect of the package pin and the printed circuit board's routing wire; otherwise, the voltage at VIN may exceed the absolute maximum rating. The output capacitor must also be placed within 1 cm of the output pin to a clean analog ground, because it filters out output spikes caused by the surge current due to the inductive effect of the package pin and the printed circuit board's routing wire.

19.Package Outline Dimensions

(1)Package Type : SOT-23

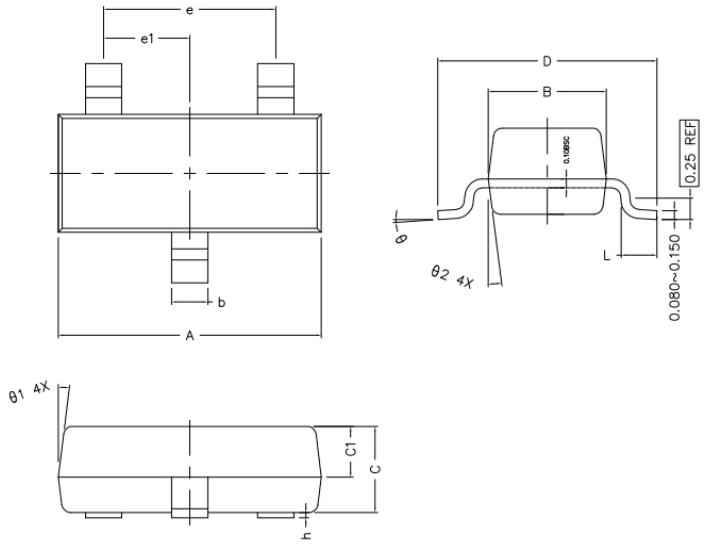
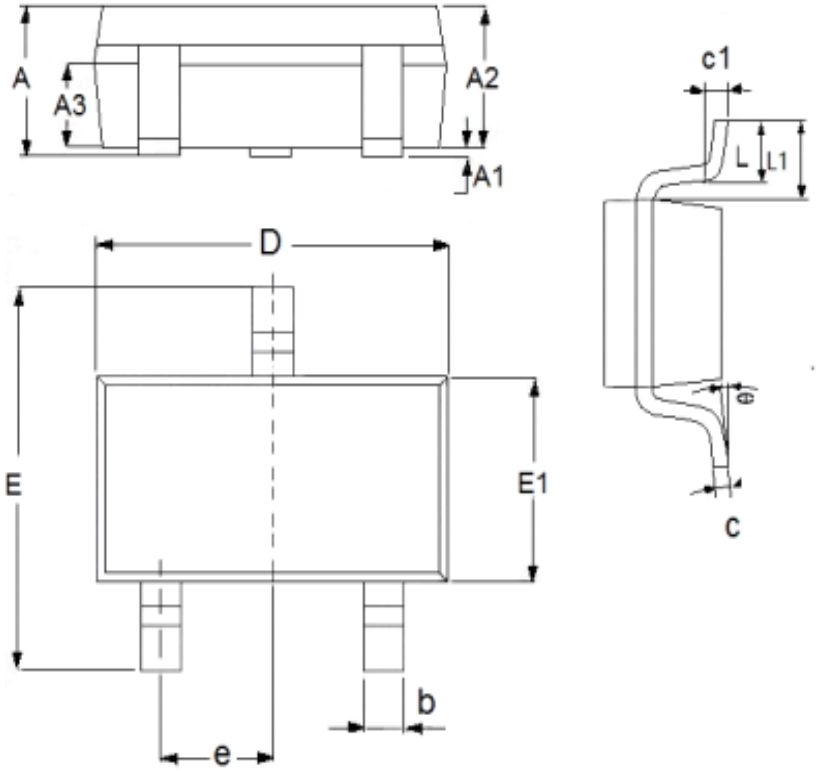


Figure 4. SOT-23 Package Outline

Symbol	MIN	NORM	MAX
A	2.800	2.900	3.000
B	1.200	1.300	1.400
C	0.900	1.000	1.100
C1	0.500	0.550	0.600
D	2.250	2.400	2.550
L	0.300	0.400	0.500
h	0.010	0.050	0.100
b	0.300	0.400	0.500
e	——	1.90	——
e1	——	0.95	——
θ1	——	7°	——
θ2	——	7°	——
θ	0°~7°		

(2)Package Type：SOT-23-3



Symbol	Dimensions (mm)		Dimensions (Inch)	
	Min	Max	Min	Max
A	1.05	1.45	0.0413	0.0571
A1	0	0.15	0.0000	0.0059
A2	0.9	1.3	0.0354	0.0512
A3	0.6	0.7	0.0236	0.0276
b	0.25	0.5	0.0098	0.0197
c	0.1	0.25	0.0039	0.0098
D	2.8	3.1	0.1102	0.1220
E	2.6	3.1	0.1023	0.1220
E1	1.5	1.8	0.0591	0.0709
e	0.95(typical.)		0.0374(typical.)	
L	0.25	0.6	0.0098	0.0236
L1	0.59(typical.)		0.0232(typical.)	
θ	0	8°	0.0000	8°
c1	0.2(typical.)		0.0079(typical.)	

(3)Package Type : SOT-23-5

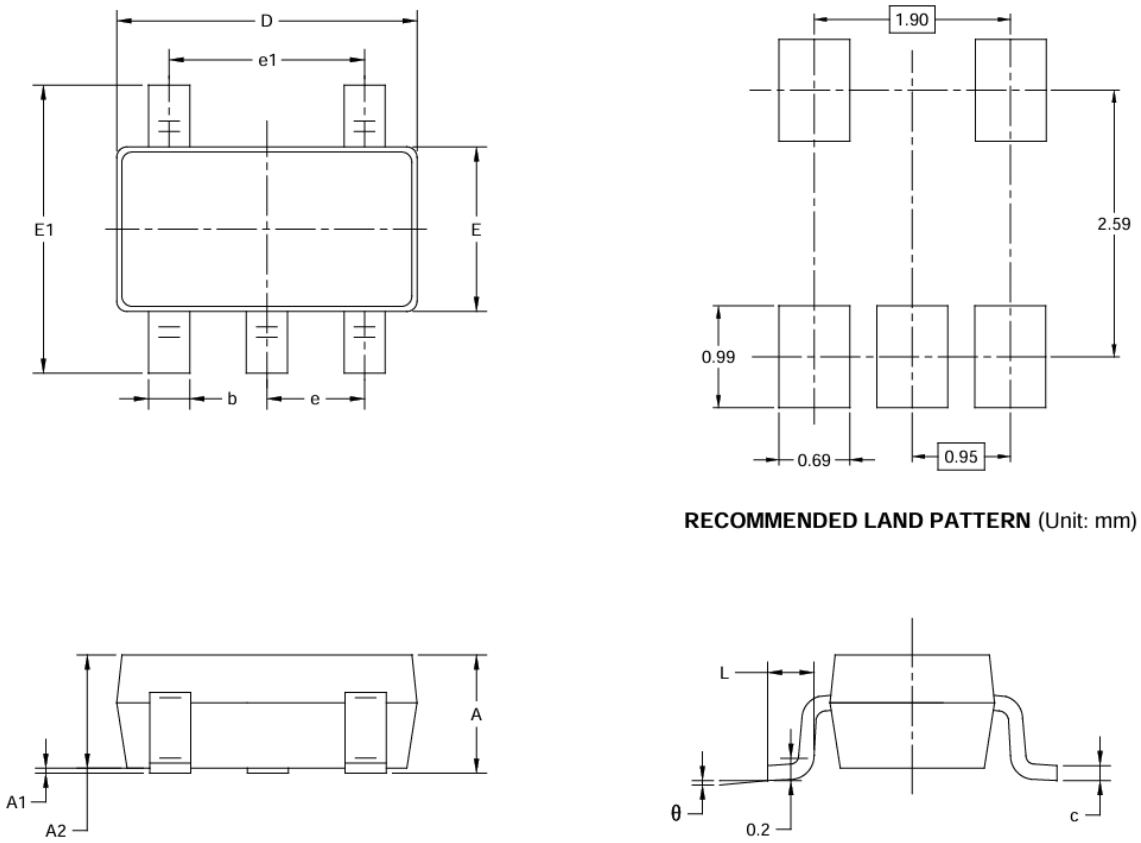


Figure 5. SOT-23-5 Package Outline

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	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

(4)Package Type : SOT-89-3L

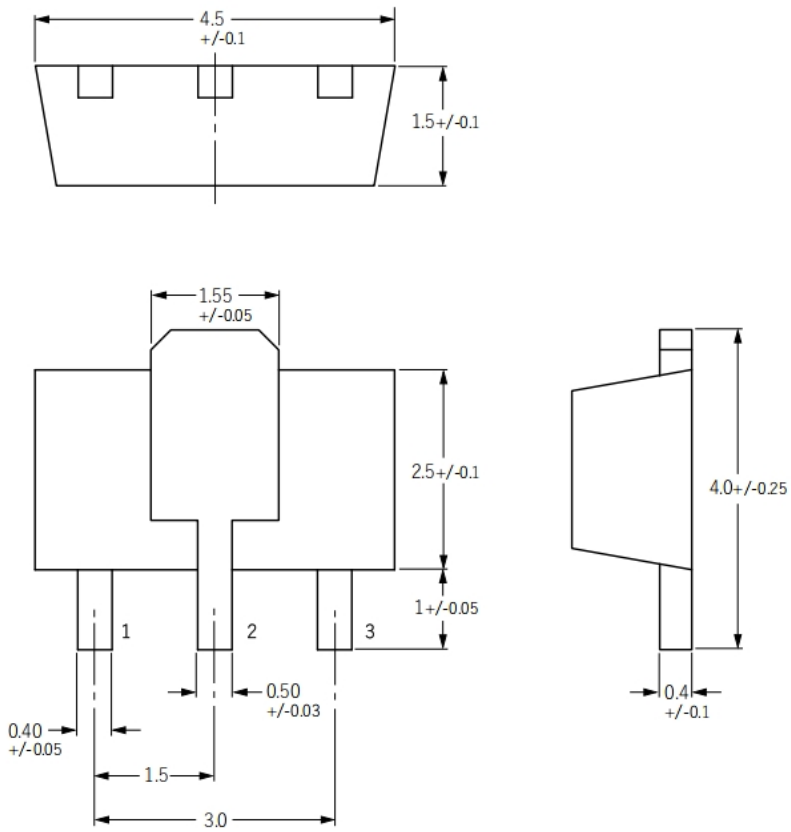


Figure 6. SOT-89-3L Package Outline

20.Important Notice And Disclaimer

- We reserve the right to change the instruction manual without prior notice.
- Any semiconductor product has a certain possibility of failure or malfunction under specific conditions. The buyer is responsible for complying with safety standards and taking safety measures when using our products for system design and overall manufacturing to avoid potential failure risks that may cause personal injury or property damage.
- The improvement of product quality is endless, our company will be dedicated to provide customers with better products.

21.Version Modification Record

Version Number	Revision
first edition	
V1.0	1. Updated Typical Application Circuit.
V1.1	1. Updated Order Information 2. Updated Configurations