ET61H61XX - High Input Very-Low IQ 150mA LDO

General Description

ET61H61XX are the high input very low I_Q 150mA LDO with high power supply rejection ratio (PSRR).

It operates from 5V~60V. The quiescent current is 2.1uA with no load. The devices feature integrated short-circuit, over-current and over-temperature protection. They are quite suitable for standby microprocessor control-unit systems.

ET61H61XX have a fast response to line transients and load transients, and ensure that no overshoot voltage during start-up and short-circuit recovery of the ET61H61XX.

The ET61H61XX family are available in standard fixed output voltages of 3.0V (ET61H6130), 3.3V (ET61H6133), 3.6V (ET61H6136), 5.0V (ET61H6150), 12V (ET61H61120) and etc.

ET61H61XX family are offered SOT89-3, SOT23-5, SOT23-3 packages.

Features

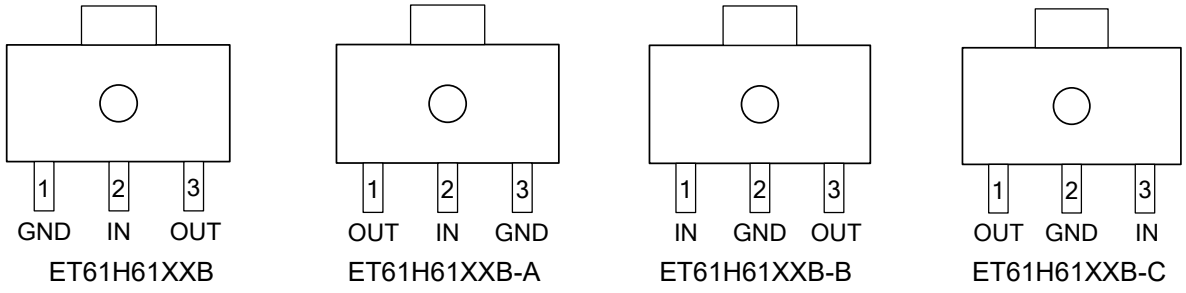
- Wide Input Voltage Range: 5V to 60V
- Up to 150mA Load Current
- Standard Fixed Output Voltage Options are 3.0V, 3.3V, 3.6V, 5.0V, and 12V
- Very Low I_Q: 2.1μA
- Other Output Voltage Options Available on Request
- Low Dropout: Low Dropout is 600mV at 100mA Load@VOUT=5V
- Very High PSRR: 70dB at 1KHz
- Over-Temperature Protection
- Current-Limit Protection
- Short-Circuit Protection
- Excellent Load/Line Transient Response
- Packages are SOT89-3, SOT23-5, SOT23-3

Device information

ET 61H61 XX X

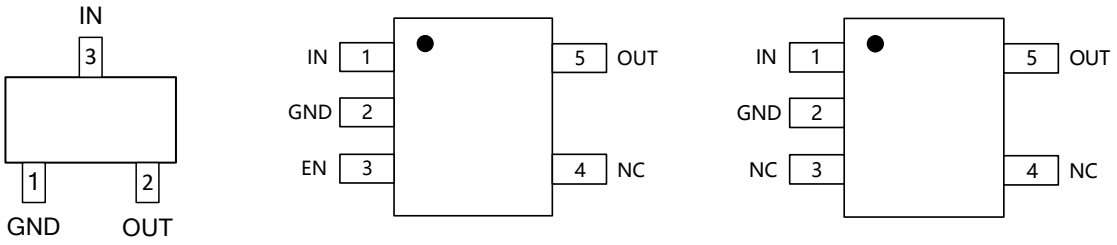
XX Output Voltage		**X Package**	
XX	Output X.X V	B	SOT89-3
		S	SOT23-3
		T	SOT23-5
		E	SOT23-5

Pin Configuration



ET61H61XXB　ET61H61XXB-A　ET61H61XXB-B　ET61H61XXB-C

SOT89-3



ET61H61XXS　ET61H61XXT　ET61H61XXE

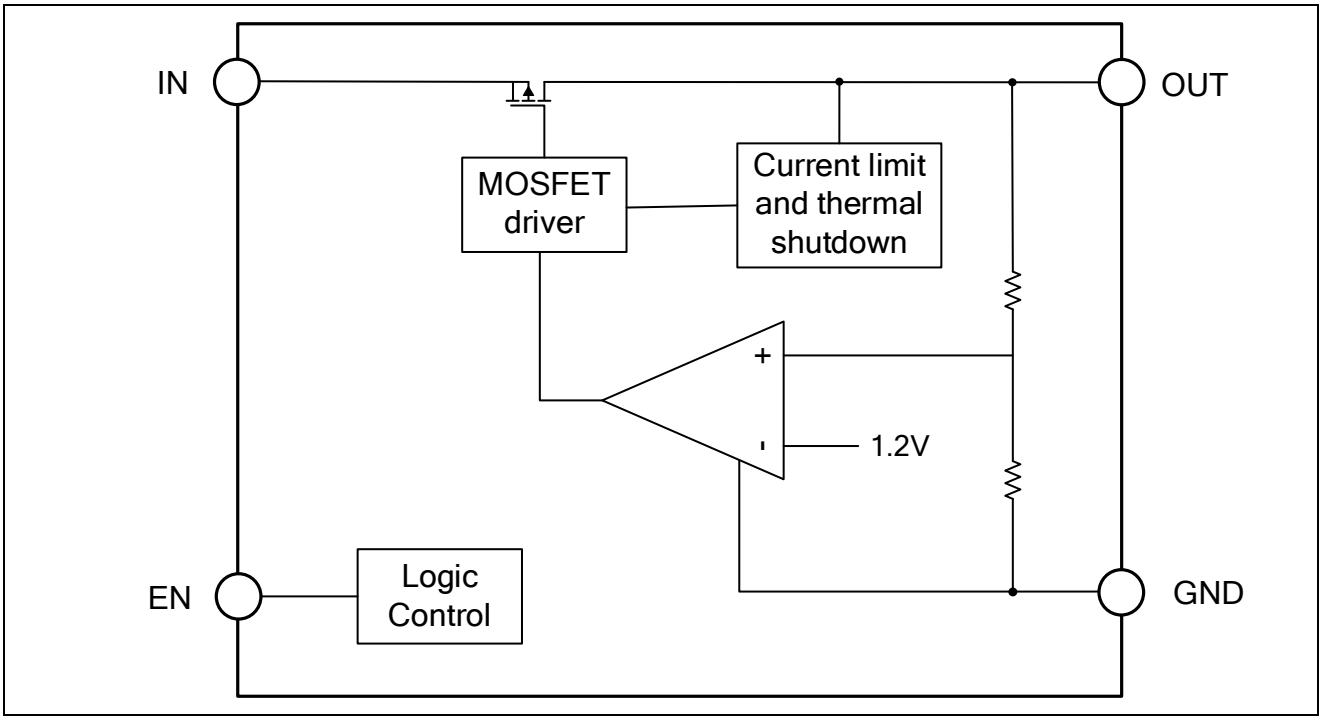
SOT23-3　**SOT23-5**　**SOT23-5**

Top View

Pin Function

Pin No.							Pin Name	Pin Function
SOT89-3				SOT23-3	SOT23-5			
XXB	XXB-A	XXB-B	XXB-C	XXS	XXT	XXE		
1	3	2	2	1	2	2	GND	Ground.
2	2	1	3	3	1	1	IN	Supply input pin.
3	1	3	1	2	5	5	OUT	Output pin.
					3		EN	Enable control input, active high.
					4	3/4	NC	No connection.

Block Diagram



Functional Description

Input Capacitor

It is recommended to connect a 1μF capacitor between the VIN and GND pins to eliminate input power fluctuations and reduce output ripple. This input capacitor must be as close to the chip as possible to ensure stable input and output. For PCB layout, note that both VIN and GND require wide copper wires. For high-voltage input (V_{IN} ≥18V) applications, you are advised to use an electrolytic capacitor at the input end or connect a resistor of at least 1 ohm in series at the front end of the input capacitor (the resistor must be adjusted according to the actual application) to prevent chip failure caused by input overshoot.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1μF to 10μF, Equivalent Series Resistance (ESR) is from 5mΩ to 100mΩ, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to OUT and GND pins.

Enable

The ET61H61XX (Only SOT23-5 package) delivers the output power when it is set to enable state. When it works in disable state, there is no output power and the operation quiescent current is almost zero. The enable pin (EN) is active high.

Dropout Voltage

The ET61H61XX uses a PMOS pass transistor to achieve low dropout. When (V_{IN} – V_{OUT}) is less than the dropout voltage (V_{DROP}), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(ON)}$ of the PMOS pass element. V_{DROP} scales approximately with output current because the PMOS device behaves like a resistor in dropout mode. As with any linear regulator, PSRR and transient response degrade as (V_{IN} – V_{OUT}) approaches dropout operation.

Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 150°C.Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 125°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the LDO from damage as a result of overheating. Activating the thermal shutdown feature usually indicates excessive power dissipation as a result of the product of the (V_{IN} – V_{OUT}) voltage and the load current. For reliable operation, limit junction temperature to 125°C maximum.

Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction to ambient thermal resistance. The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance, θ_{JA}.

Current-Limit Protection

The ET61H61XX provides current limit function to prevent the device from damages during over-load or shorted-circuit condition. This current is detected by an internal sensing transistor.

Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V_{IN}	Input Voltage	-0.3~80	V
V_{OUT}	Output Voltage	-0.3~12	V
V_{IN}-V_{OUT}	Input to Output Voltage	75	V
V_{EN}	Chip Enable Input	-0.3~80 & ≤V_{IN}	V
$T_{J(MAX)}$	Maximum Junction Temperature	150	°C
T_{STG}	Storage Temperature	-40~150	°C
V_{ESD}	Human Body Model HBM (ESDA/JEDEC JS-001-2017)	±4000	V
	Charged Device Model (ESDA/JEDEC JS-002-2014)	±200	V
I_{LU}	Latch up Current Maximum Rating (JESD78E)	TBD	mA

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	SOT89-3	Thermal Characteristics,	130	°C/W
	SOT23-5	Thermal Resistance,	200	
	SOT23-3	Junction-to-Air	200	
P_D	SOT89-3	Power Dissipation@25°C	900	mW
	SOT23-5	PCB board dimension:	600	
	SOT23-3	50mm x 50mm (2layer) Copper :1oz	600	

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	5 to 60	V
I_{OUT}	Output Current	0 to 150	mA
T_A	Operating Ambient Temperature	-40 to 85	°C
T_J	Operating Junction Temperature	-40 to 125	°C
C_{IN}	Effective Input Ceramic Capacitor Value	1~10	μF
C_{OUT}	Effective Output Ceramic Capacitor Value	1~10	μF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

Electrical Characteristics

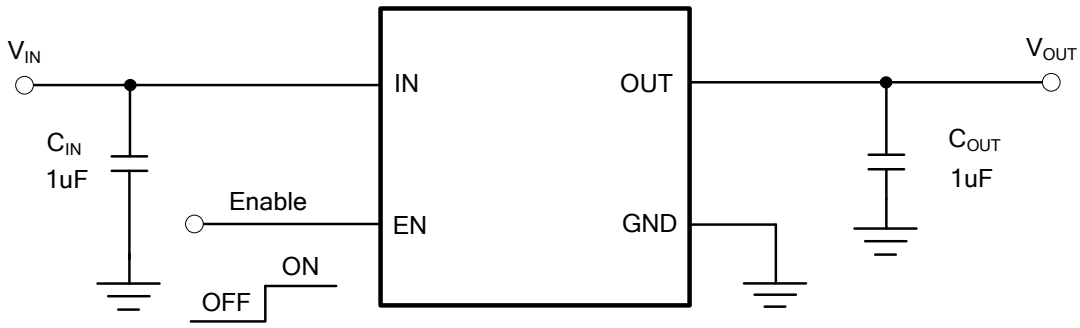
(V_{IN} =V_{OUT}+2V; I_{OUT} = 10mA, C_{IN} = 1.0μF, C_{OUT} = 10μF, unless otherwise noted. Typical values are at T_A = +25°C.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Operating Input Voltage		5		60	V
V_{OUT}	Output Voltage	V_{IN}=12V, I_{OUT} = 10mA	-2%		+2%	V
I_{Q_ON}	Quiescent Current	V_{IN}=12V, I_{OUT} = 0mA	1.9	2.1	2.3	μA
Reg_{Line}	Line Regulation	V_{IN} = V_{OUTNOM} +0.5V to 60V, I_{OUT} = 1mA		0.1		mV/V
V_{DROP}[(1)]	Dropout Voltage	I_{OUT}=10mA, V_{OUT}=3.3V T_A = +25°C		70		mV
		I_{OUT}=100mA, V_{OUT}=3.3V T_A = +25°C		650		
		I_{OUT}=10mA, V_{OUT}=5.0V T_A = +25°C		60		
		I_{OUT}=100mA, V_{OUT}=5.0V T_A = +25°C		600		
Reg_{LOAD}	Load Regulation	1mA ≤ I_{OUT} ≤ 150mA, V_{IN} =V_{OUT}+2V		0.1		mV/mA
I_{LMT}	Current Limit			250		mA
I_{SHORT}	Short Current Limit	V_{IN} =12V, V_{OUT}=0V		80		mA
PSRR[(2)]	Power Supply Rejection Ratio	f = 1 kHz, V_{IN} =10V I_{OUT} = 10mA, V_{OUT} =3.3V		70		dB
T_{TSD} [(2)]	Thermal Shutdown Temperature	Temperature Increasing from T_A= +25°C		150		°C
T_{HYS} [(2)]	Thermal Shutdown Hysteresis	Temperature Falling from T_{TSD}		35		°C

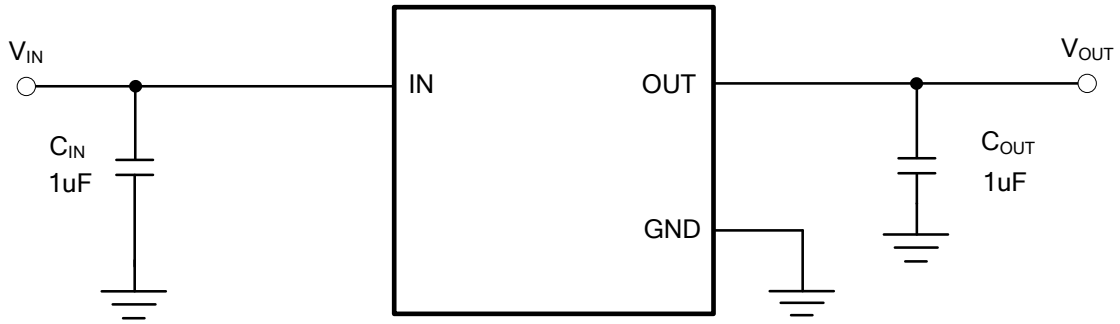
Note1. V_{DROP} FT test method: test the V_{OUT} voltage at V_{OUT}+$V_{DROPMAX}$ with 150mA output current.

Note2. Guaranteed by design and characterization. not a FT item.

Application Circuits



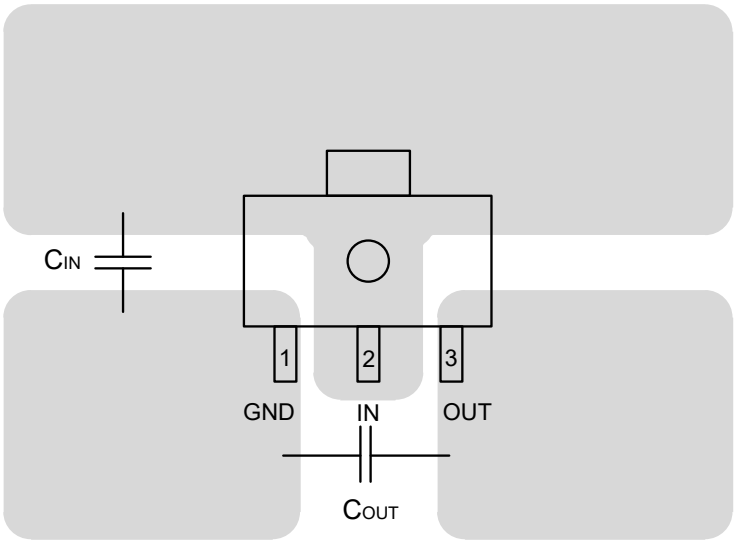
With EN Function



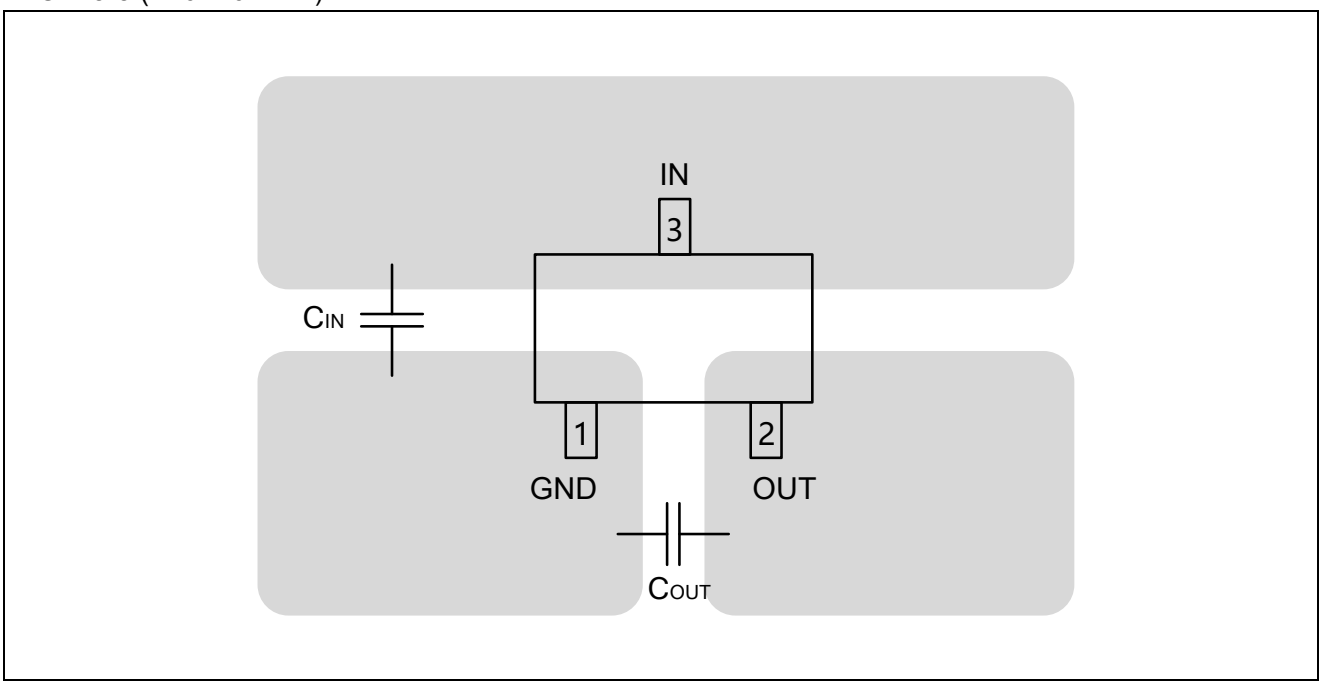
Without EN Function

PCB Layout Guide

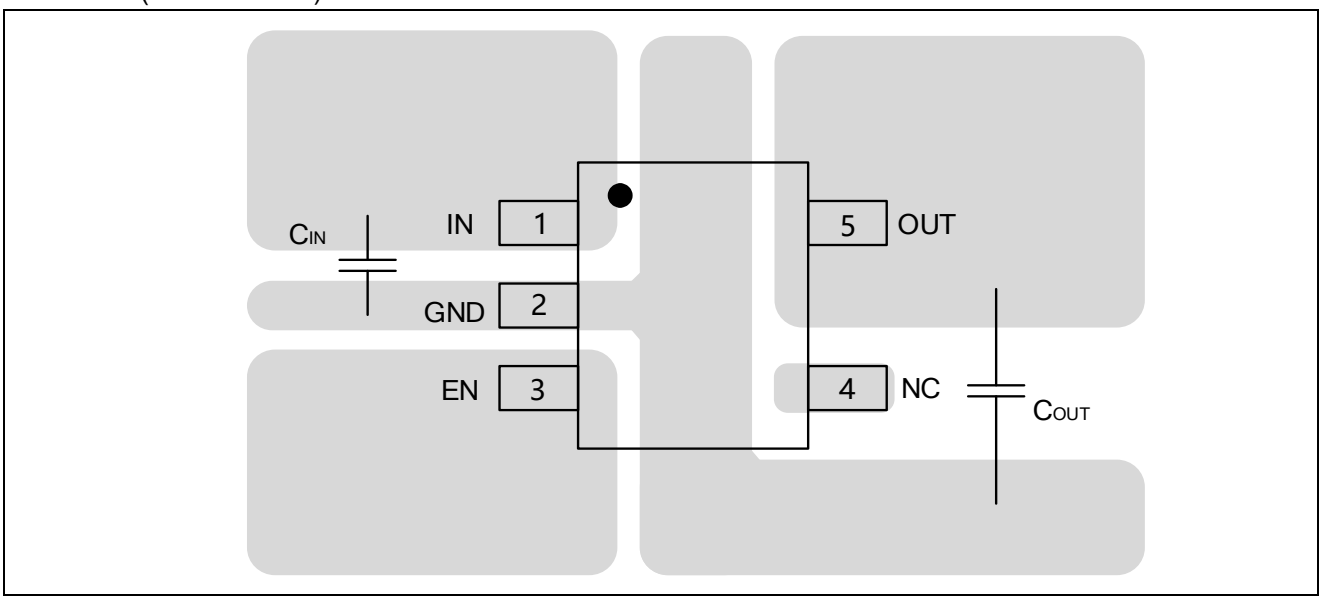
SOT89-3 (ET61H61XXB)



SOT23-3 (ET61H61XXS)

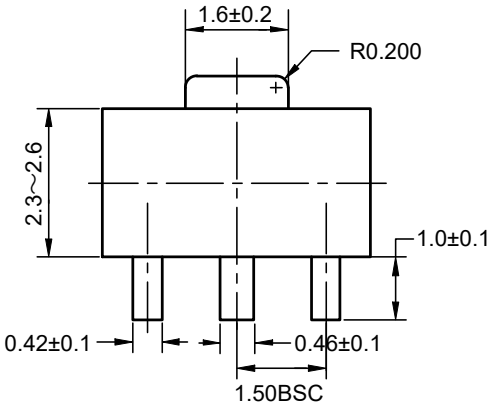


SOT23-5 (ET61H61XXT)

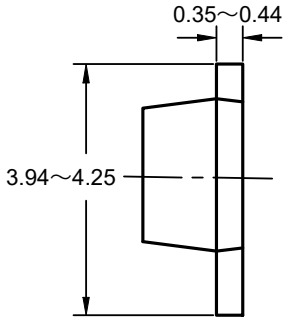


Package Dimension

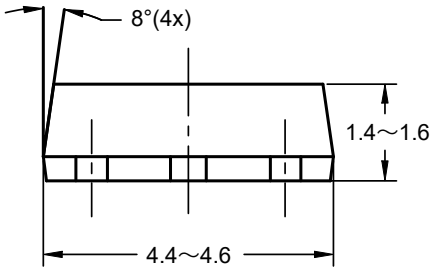
SOT89-3



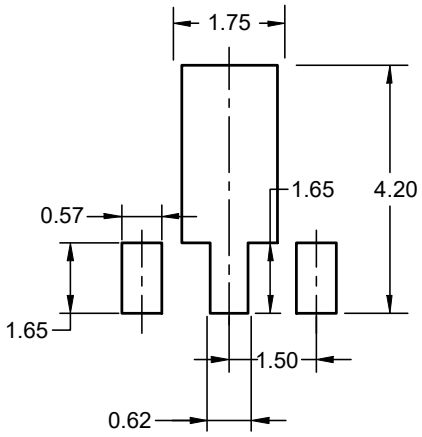
Top View



Side View



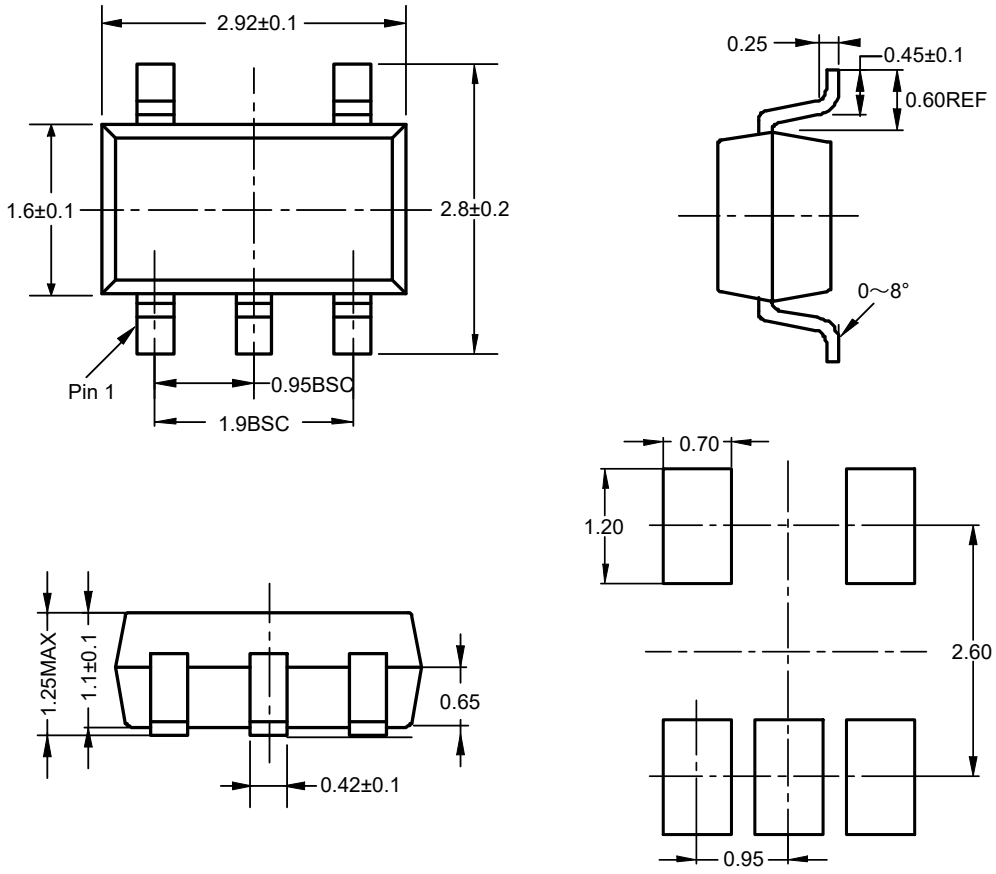
Side View



Recommended Land Pattern

Unit: mm

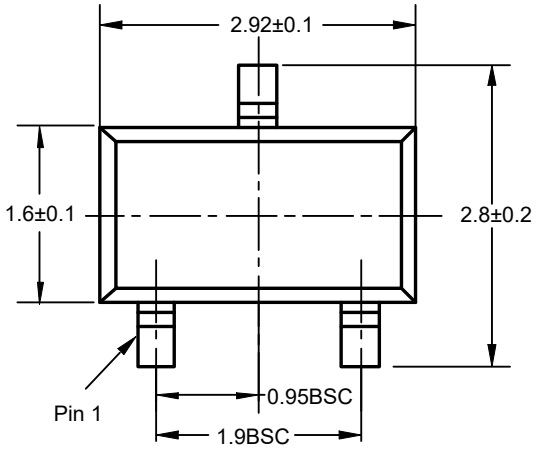
SOT23-5

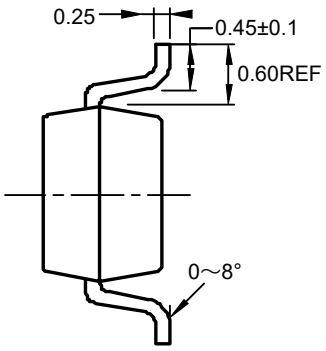


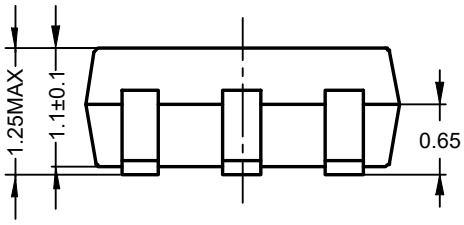
Recommended Land Pattern

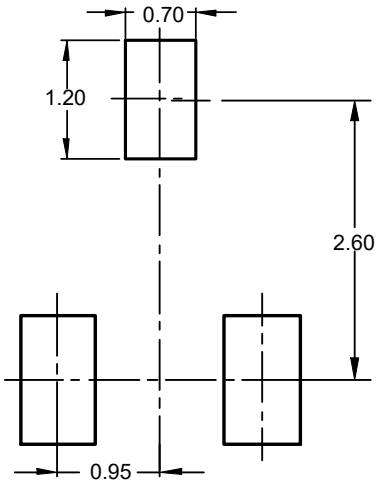
Unit: mm

SOT23-3









Recommended Land Pattern

Unit: mm

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2023-12-17	Preliminary Version	Marj	Tugz	Liujy
1.0	2024-1-12	Offered Version	Marj	Tugz	Liujy