ET65H11XX - High Input Very-Low IQ 500mA LDO

General Description

ET65H11XX are the high input very low I_Q 500mA LDO with high power supply rejection ratio (PSRR), is designed specifically for portable battery-powered applications which require ultra-low quiescent current. The very-low consumption of type 1μA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

The ET65H11XX family are available in standard fixed output voltages of 1.8V (ET65H1118) , 2.5V (ET65H1125) , 2.8V (ET65H1128), 3.0V (ET65H1130), 3.3V (ET65H1133), 3.6V (ET65H1136), 4.0V (ET65H1140), 5.0V ET65H1150), and custom voltage options (50mV step options).

ET65H11XX is offered SOT89-3, SOT23-5, SOT23-3 packages.

Features

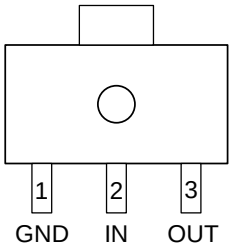
- Wide Input Voltage Range: 1.8V to 12V
- Up to 500mA Load Current
- Standard Fixed Output Voltage Options: 1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 3.6V, 4.0V, and 5.0V
- Very Low I_Q: 1μA
- Other Output Voltage Options Available On Request
- Low Dropout: 750mV @ 500mA / V_{OUT}=3.3V
- Very High PSRR: 80dB at 1KHz
- Excellent Load/Line Transient Response
- Packages are SOT89-3, SOT23-5, SOT23-3

Device information

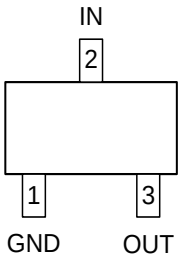
ET 65H11 XX X

XX Output Voltage		**X Package**	
XX	Output X.X V	B	SOT89-3
		S	SOT23-3
		/	SOT23-5 (Default)

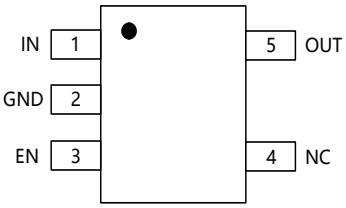
Pin Configuration



ET65H11XXB(SOT89-3)



ET65H11XXS(SOT23-3)



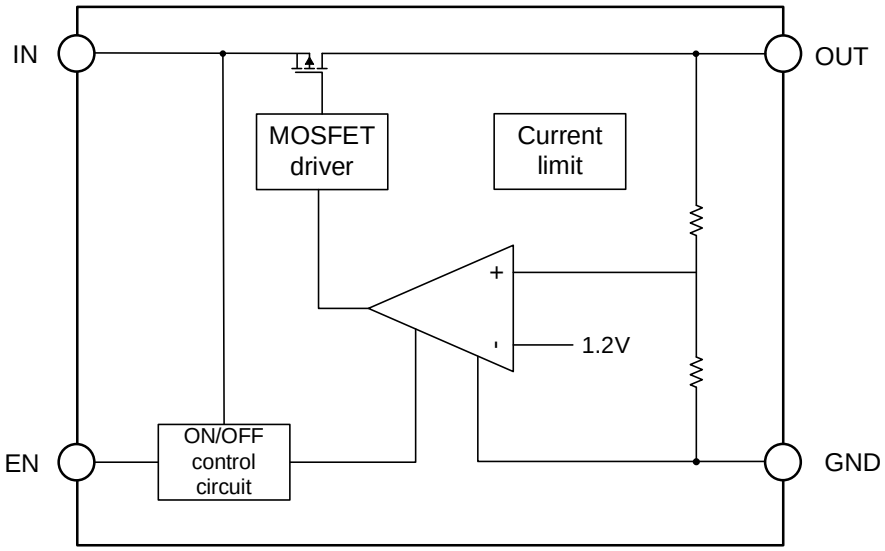
ET65H11XX(SOT23-5)

Top View

Pin Function

Pin No.			Pin Name	Pin Function
SOT89-3	SOT23-3	SOT23-5		
XXB	XXS	XX		
1	1	2	GND	Ground.
2	2	1	IN	Supply Input Pin.
3	3	5	OUT	Output Pin.
		3	EN	Enable Control Input, Active High.
		4	NC	No Connection.

Block Diagram



Functional Description

Input Capacitor

A 1.0μF ~ 10μF ceramic capacitor is recommended to connect between IN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both IN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1.0μF ~ 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 ET65H11XX 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 ET65H11XX 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 ET65H11XX 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	-0.3~16	V
V_{OUT}	Output Voltage	-0.3~7	V
V_{EN}	Enable Input Voltage	-0.3~16	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)	±1500	V
I_{LU}	Latch up Current Maximum Rating (JESD78E)	±200	mA

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	SOT89-3	Thermal Characteristics, Thermal Resistance, Junction-to-Air	135	°C/W
	SOT23-5		250	
	SOT23-3		360	
P_D	SOT89-3	Power Dissipation@25°C PCB board dimension : 50mm x 50mm (2layer) Copper :1oz	920	mW
	SOT23-5		500	
	SOT23-3		420	

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	1.8 to 12	V
I_{OUT}	Output Current	0 to 500	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}=C_{OUT}= 1.0μF, unless otherwise noted.Typical values are at T_A = +25°C.)

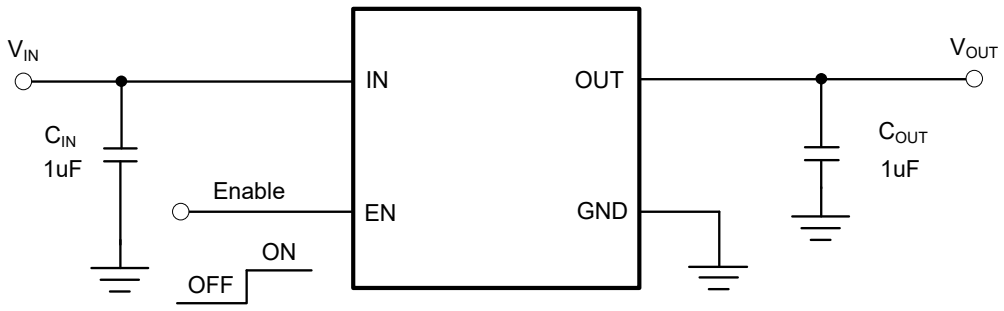
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}[(1)]	Operating Input Voltage		3.0		12	V
V_{OUT}	Output Voltage	T_A = +25°C	-2%		+2%	V
I_{Q_ON}	Quiescent Current	I_{OUT} = 0mA		1.0	2.0	μA
I_{Q_OFF}	Standby Current	V_{EN} = 0V, T_A = +25°C		0.2	0.5	μA
Reg_{Line}	Line Regulation	V_{IN} = V_{OUT} +1V to 12V, I_{OUT} = 10mA		0.02	0.1	%/V
Reg_{LOAD}	Load Regulation	1mA ≤ I_{OUT} ≤ 500mA, V_{IN} =V_{OUT}+1V		15	45	mV
V_{DROP}[(2)]	Dropout Voltage	V_{OUT}=3.0V, I_{OUT}=100mA		120	200	mV
		V_{OUT}=3.0V, I_{OUT}=300mA		380	580	
		V_{OUT}=3.0V, I_{OUT}=500mA		750	980	
		V_{OUT}=3.3V, I_{OUT}=100mA		115	190	
		V_{OUT}=3.3V, I_{OUT}=300mA		375	560	
		V_{OUT}=3.3V, I_{OUT}=500mA		730	960	
		V_{OUT}=5.0V, I_{OUT}=100mA		110	180	
		V_{OUT}=5.0V, I_{OUT}=300mA		370	550	
		V_{OUT}=5.0V, I_{OUT}=500mA		720	950	
I_{LMT}	Current Limit	V_{IN} =V_{OUT}+2V		1050	1450	mA
I_{SHORT}	Short Current Limit	V_{IN} =V_{OUT}+2V, V_{OUT}=0V		150	240	mA
V_{ENH}	EN Pin Threshold Voltage	EN Input Voltage Rising	1.4			V
V_{ENL}	EN Pin Threshold Voltage	EN Input Voltage Falling			0.4	V
I_{EN}	EN Pin Current	V_{EN}=0~12V		0.1	1	μA
PSRR[(3)]	Power Supply Rejection Ratio	f = 1 kHz,V_{IN} =V_{OUT}+2V I_{OUT} = 20mA		80		dB
e_N[(3)]	Output Noise Voltage	V_{IN} = V_{OUT}+2V, I_{OUT} = 1mA, f = 10Hz to 100KHz, V_{OUT} = 3.3V,C_{OUT} = 1μF		90		μVrms
T_{ON}	Turn-On Time	From assertion of V_{EN} to V_{OUT}=90%$V_{OUT(NOM)}$		1		ms
T_{TSD} [(3)]	Thermal Shutdown Temperature	Temperature Increasing from T_A= +25°C		155		°C
T_{HYS} [(3)]	Thermal Shutdown Hysteresis	Temperature Falling from T_{TSD}		25		°C

Note1. Here V_{IN} means internal circuit can work normal. If V_{IN}<V_{OUT}, Output voltage follow V_{IN}(I_{OUT}=1mA), circuit is safety.

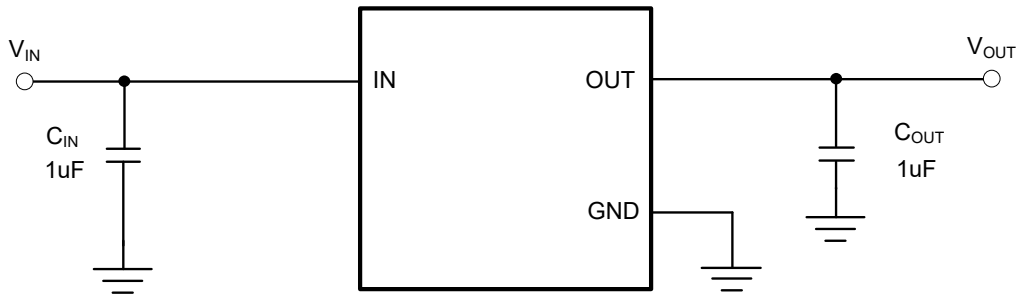
Note2. V_{DROP} FT test method: test the V_{OUT} voltage at V_{OUT}+$V_{DROPMAX}$ with 300mA output current.

Note3. Guaranteed by design and characterization. Not a FT item.

Application Circuits



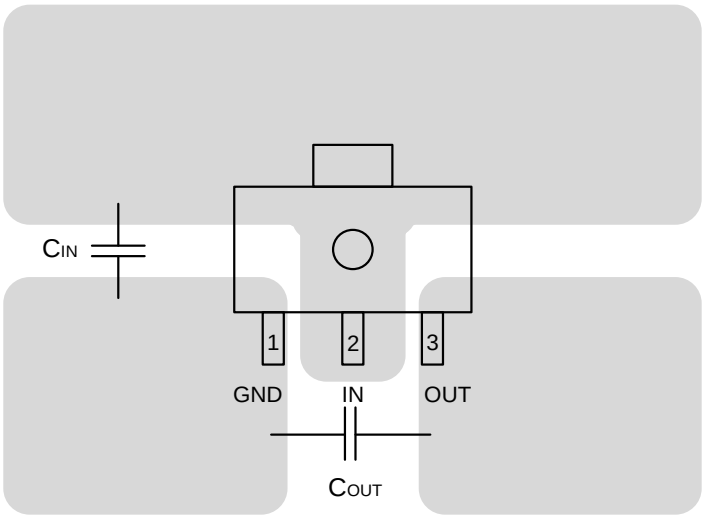
With EN Function



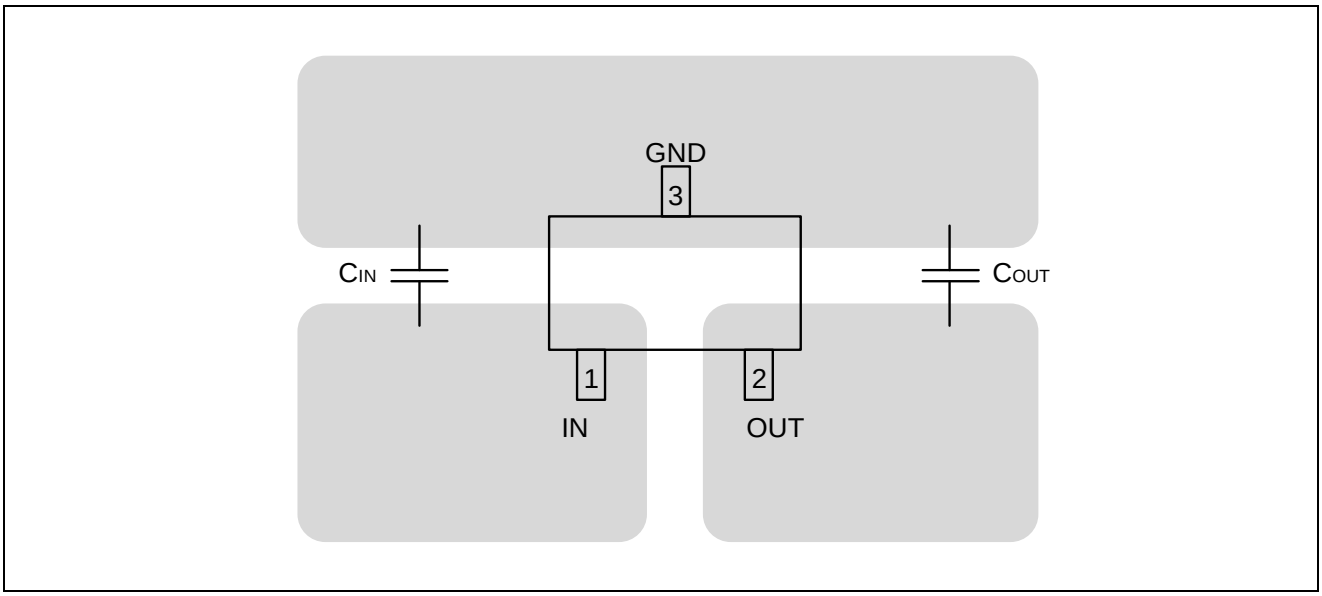
Without EN Function

PCB Layout Guide

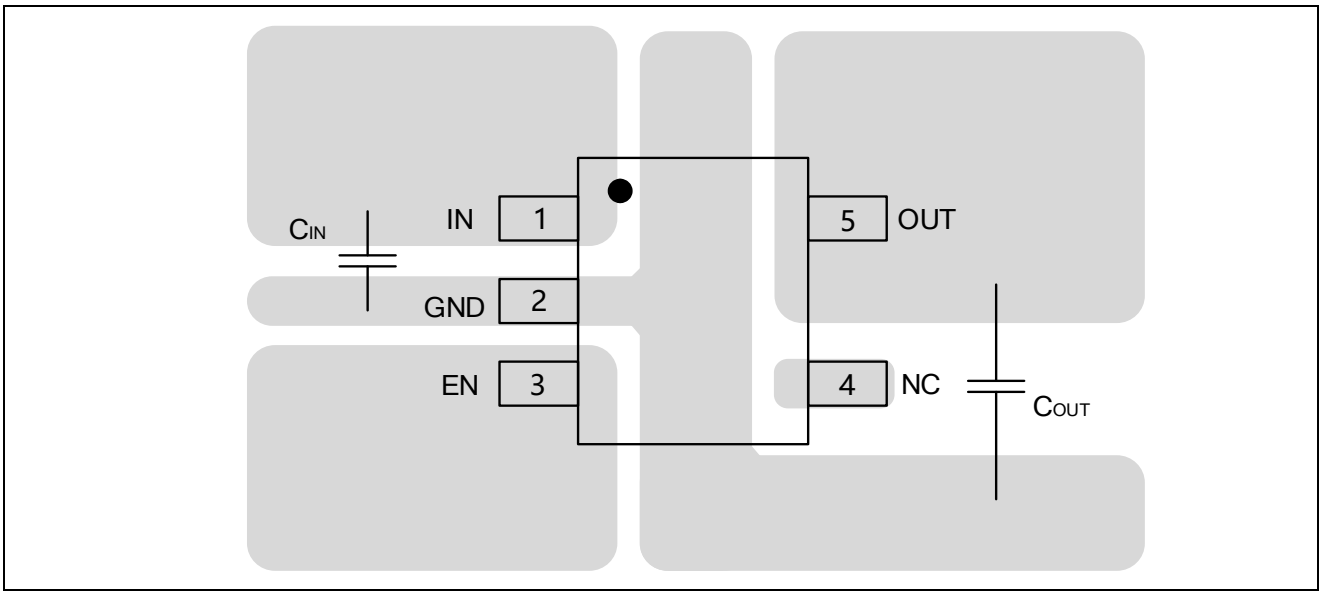
SOT89-3



SOT23-3



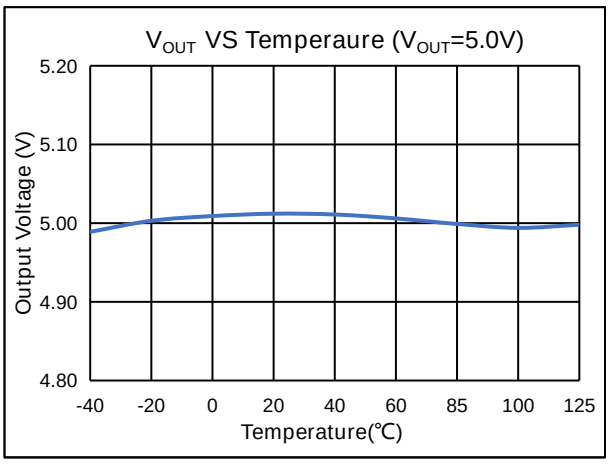
SOT23-5

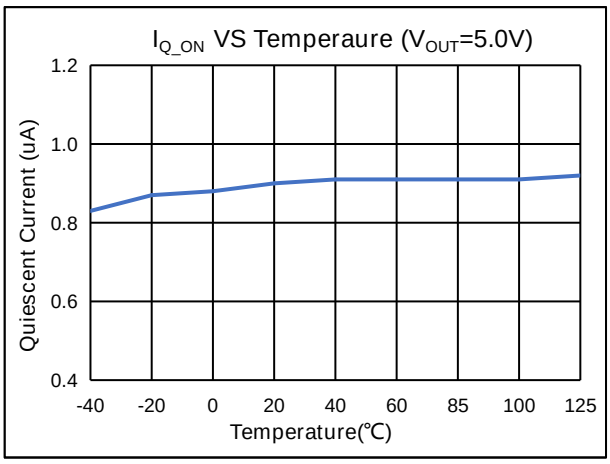


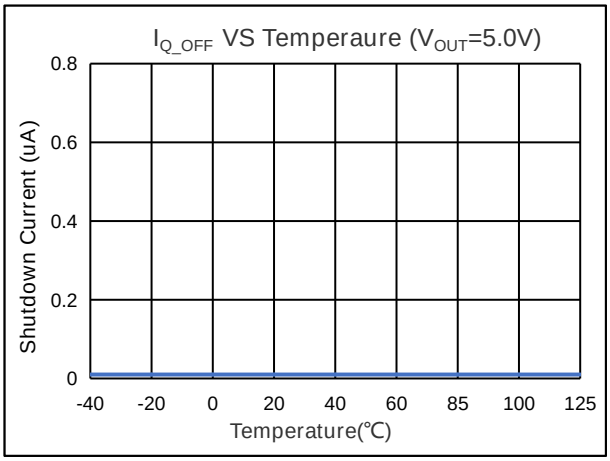
Typical Characteristics

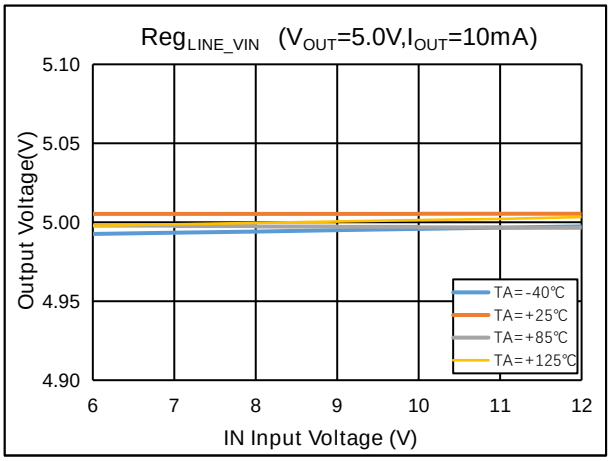
VOLTAGE VERSION 5.0 V

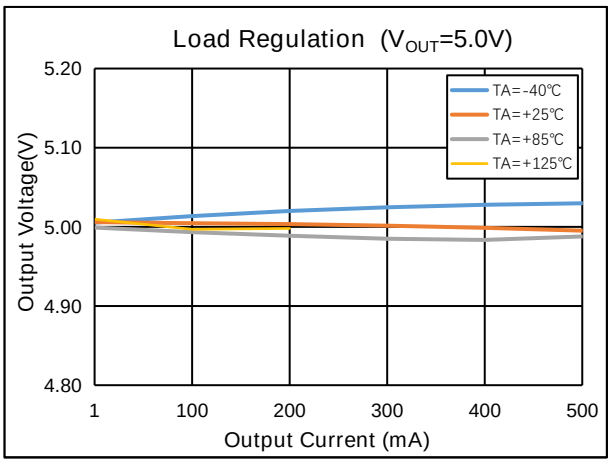
(V_{IN}=7.0V; C_{IN}=C_{OUT} =1.0μF, unless otherwise noted. Typical values are at T_A=25°C.)

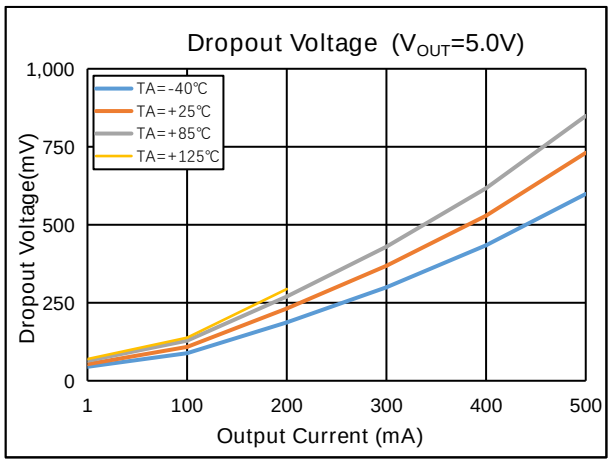






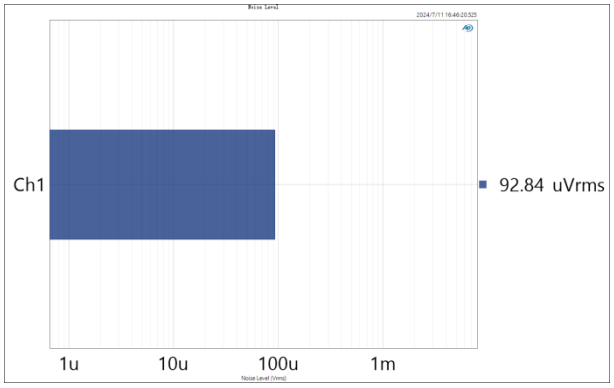




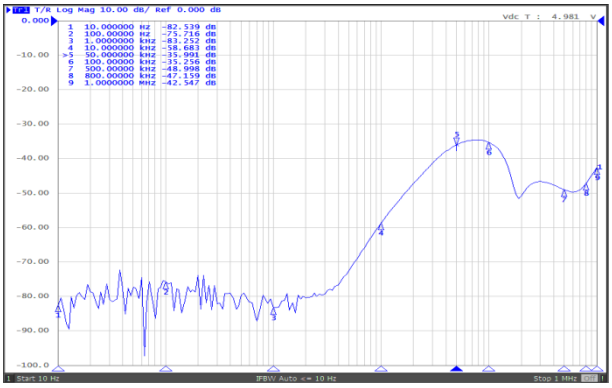


VOLTAGE VERSION 5.0 V(Continued)

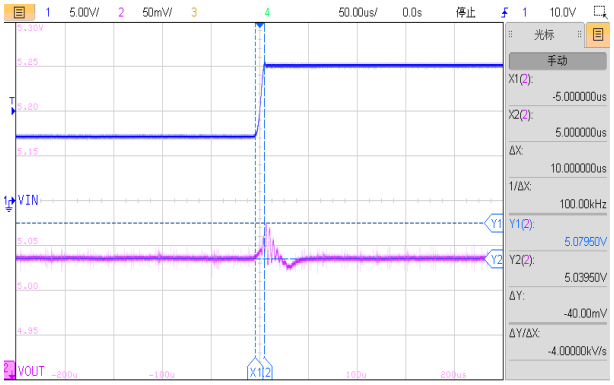
(V_{IN}=7.0V; C_{IN}=C_{OUT}=1.0μF, unless otherwise noted. Typical values are at T_A=25°C.)



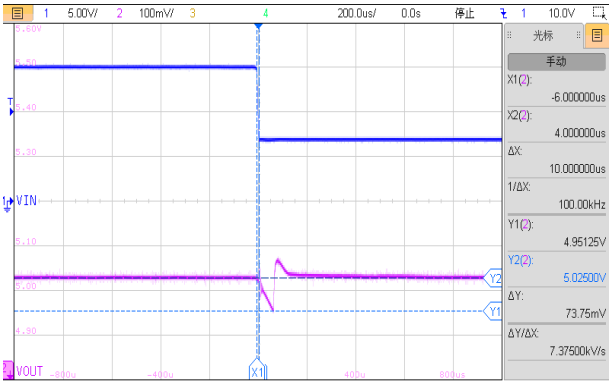
Noise(V_{IN}=7.0V I_{OUT}=20mA)



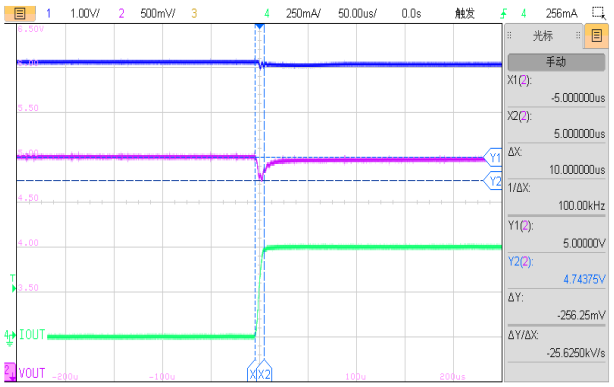
PSRR(V_{IN}=7.0V I_{OUT}=20mA)



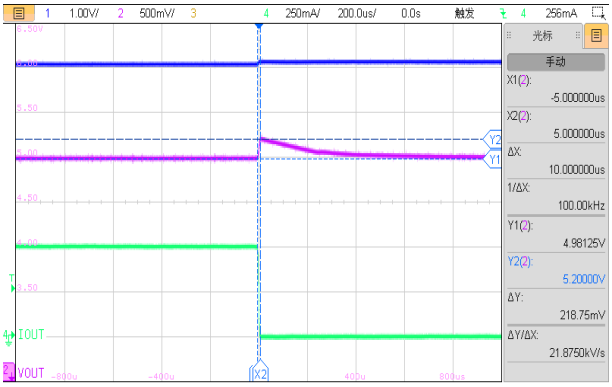
Line Transient(V_{IN}=7.0~15V I_{OUT}=1mA)



Line Transient(V_{IN}=15~7.0V I_{OUT}=1mA)



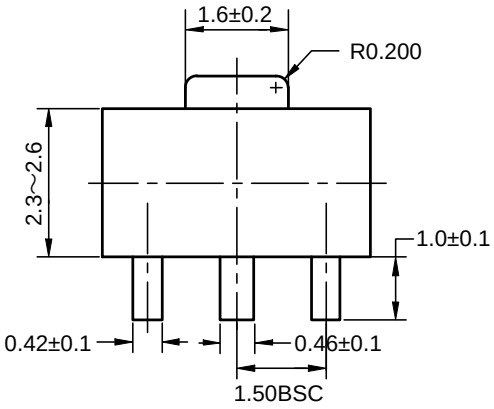
Load Transient(V_{IN}=7.0V I_{OUT}=1~500mA)



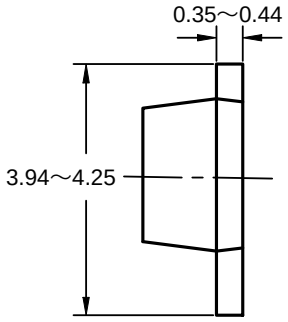
Load Transient(V_{IN}=7.0V I_{OUT}=500~1mA)

Package Dimension

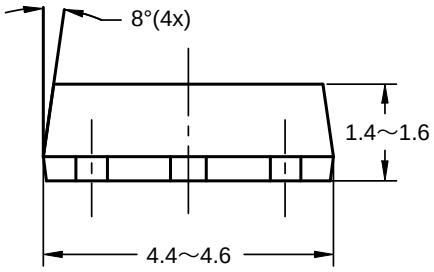
SOT89-3



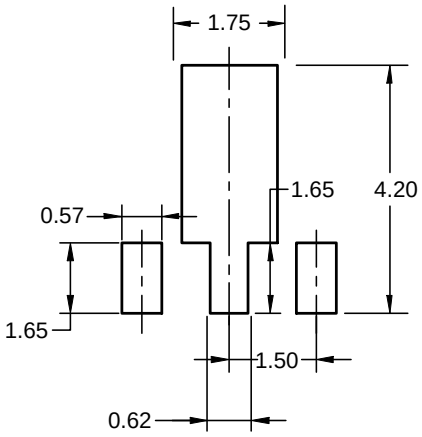
Top View



Side View



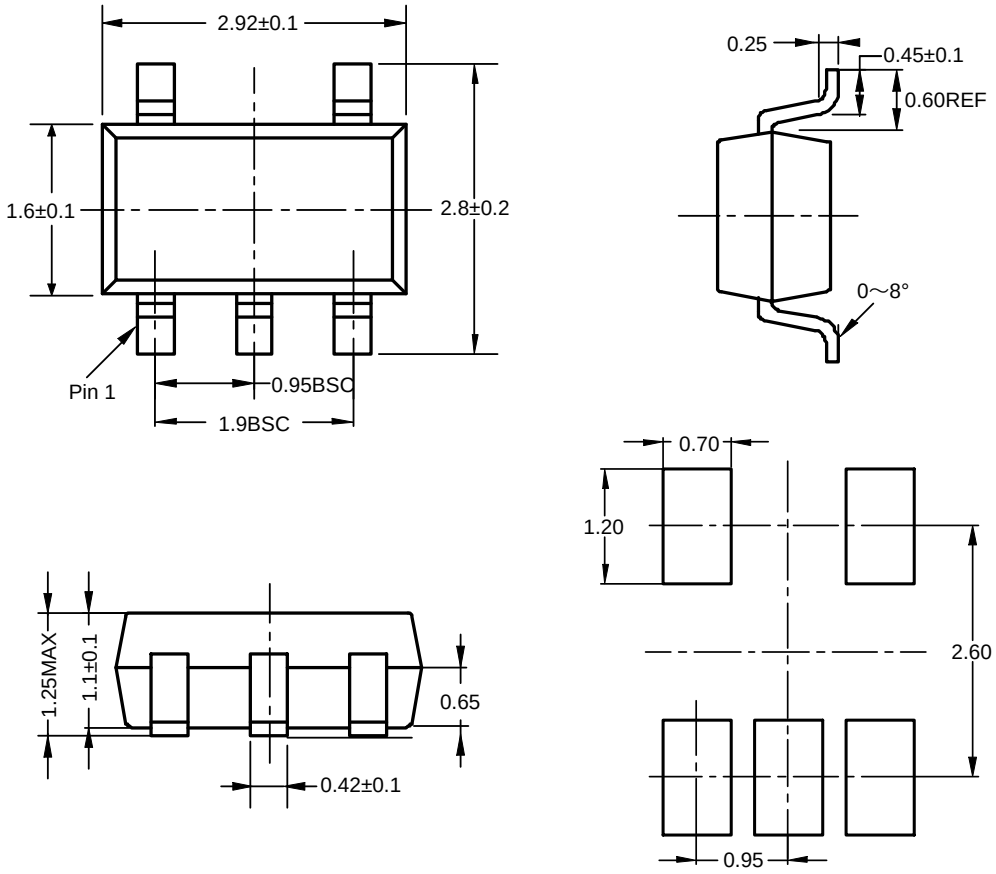
Side View



Recommended Land Pattern

Unit: mm

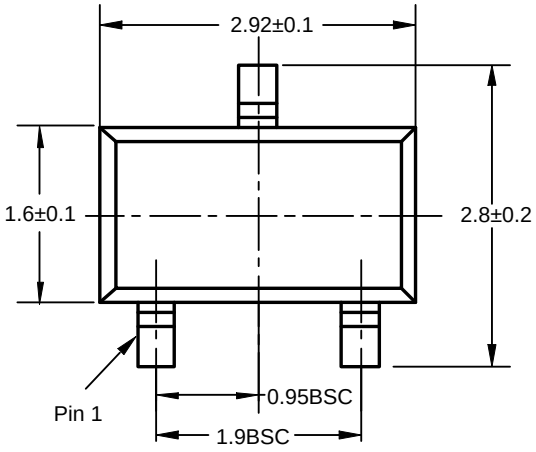
SOT23-5

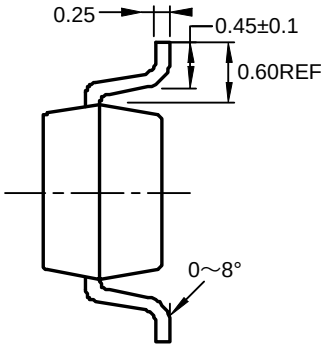


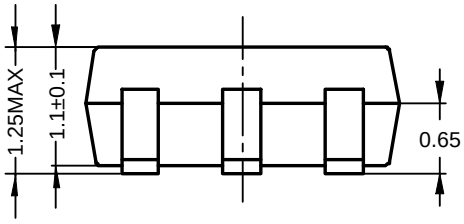
Recommended Land Pattern

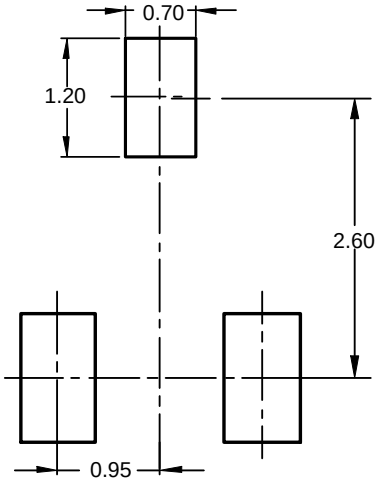
Unit: mm

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	2024-02-21	Preliminary Version	Pengjj	Liuxm	Liujy
1.0	2024-08-03	Official Version	Tugz	Liuxm	Liujy
1.1	2024-09-19	Update Vdrop	Tugz	Liuxm	Liujy