ET5H1XX - High Input Very-Low IQ 150mA LDO

General Description

ET5H1XX series are the high input very low IQ 150mA LDO that operates from 1.8V~5V, is designed specifically for portable battery-powered applications which require ultra-low quiescent current. The very-low consumption of type 1.5uA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

ET5H1XX series are offered SOT89-3, SOT23-5, SOT23-3, DNF4(1x1) packages

Features

- Wide input voltage range from 3V to 30V
- Up to 150mA Load Current
- Very low I_Q is 1.5μA typical
- Fixed Output Voltage are 1.8V,2.5V,3.0V,3.3V,3.6V,5V,etc
- Low dropout is 720mV at 150mA Load @V_{OUT}=5.0V
- Low dropout is 840mV at 150mA Load @V_{OUT}=3.3V
- Short current protection is 100mA
- Excellent load/line transient response
- Packages are SOT89-3, SOT23-5, SOT23-3, DFN4 (1x1)

Device information

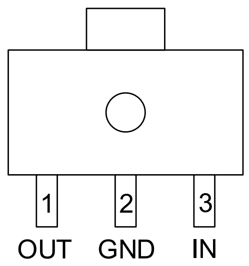
ET 5H1 XX X

XX Output Voltage		X Package	
XX	Output X.X-V For example, 18 is 1.8V output	F	SOT89-3
		Y	DFN4(1×1)
		S	SOT23-3
		T	SOT23-5

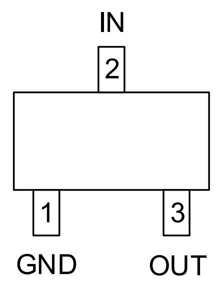
Mark Specification Label

Part No.	Marking				VOUT
	SOT89-3	SOT23-3	DFN4	SOT23-5	
	XXF	XXS	XXY	XXT	
ET5H118	18F	18S	CX	18	1.8V
ET5H125	25F	25S	FX	25	2.5V
ET5H130	30F	30S	GX	30	3.0V
ET5H133	33F	33S	EX	33	3.3V
ET5H136	36F	36S	OX	36	3.6V
ET5H150	50F	50S	5X	50	5.0V

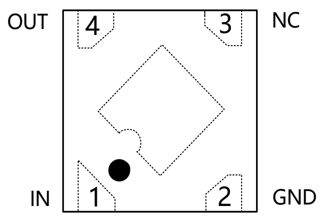
Pin Configuration



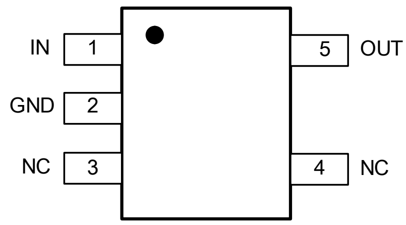
ET5H1XXF(SOT89-3)



ET5H1XXS(SOT23-3)



ET5H1XXY(DFN4)



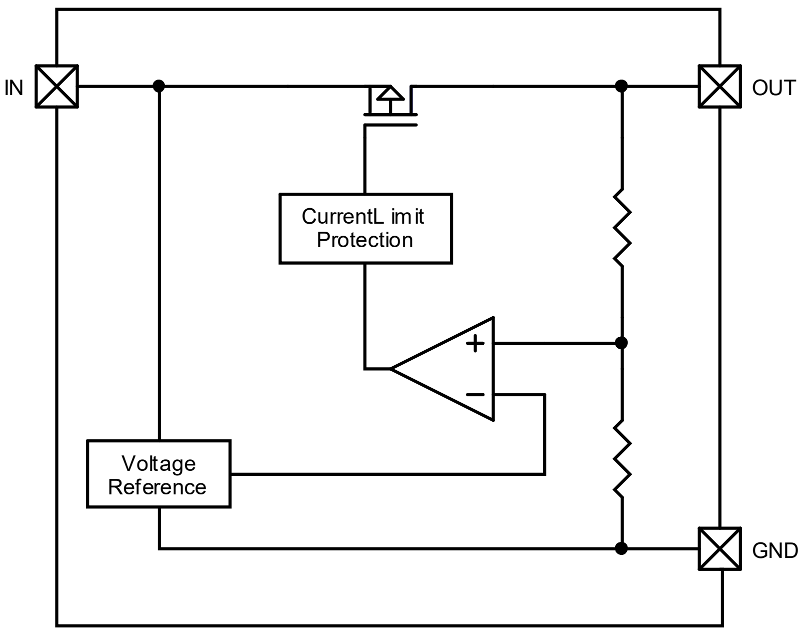
ET5H1XXT(SOT23-5)

Top View

Pin Function

Pin No.				Pin Name	Pin Function
SOT89-3	SOT23-3	DFN4	SOT23-5		
XXF	XXS	XXY	XXT		
3	2	1	1	IN	Supply input pin.
2	1	2	2	GND	Ground.
1	3	4	5	OUT	Output pin.
		3	3,4	NC	No connection.

Block Diagram



Functional Description

Input Capacitor

A 1μF~10uF ceramic capacitor is recommended to connect between VIN 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 VIN and GND.

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.

Dropout Voltage

The ET5H1XX uses a PMOS pass transistor to achieve low dropout. When (V_{IN} – V_{OUT}) is less than the dropout voltage (VDO), 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. VDO 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.

Low Quiescent Current

The ET5H1XX consuming only around 1.5μA for all input range and output loading, provides great power saving in portable and low power applications.

Short Current Limit Protection

When output current at the OUT pin is higher than current limit threshold or the OUT pin is short-circuit to GND, the short current limit protection will be triggered and clamp the output current to approximately 100mA to prevent over-current and to protect the regulator from damage due to overheating.

Layout Guidelines

- Place input and output capacitors as close to the device as possible.
- Use copper planes for device connections in order to optimize thermal performance.
- Place thermal vias around the device to distribute heat.
- Do not place a thermal via directly beneath the thermal pad of the DRV package. A via can wick solder or solder paste away from the thermal pad joint during the soldering process, leading to a compromised solder joint on the thermal pad.

Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V_{IN}	Input Voltage (1)	-0.3~36	V
V_{OUT}	Output Voltage	-0.3~6.0	V
T_J	Maximum Junction Temperature	-40 to 150	°C
T_{STG}	Storage Temperature	-65~150	°C
T_L	Lead Temperature (Soldering, 10 sec)	260	°C
ESD (HBM)	Human Body Model Capability(2)	±2000	V

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Note1. Refer to Electrical Characteristics and Application Information for Safe Operating Area.

Note2. This device series incorporates ESD protection and is tested by the following methods:

ESD Human Body Model tested per ESDA/JEDEC JS-001-2017

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	
	DFN4		250	
P_D	SOT89-3	Power Dissipation@25°C PCB board dimension : 40mm x 40mm (2layer) Copper :1OZ	750	mW
	SOT23-5		400	
	SOT23-3		280	
	DFN4		400	

Recommended Operating Conditions

Symbol	Items	Rating	Unit
V_{IN}	Input Voltage	3.0 to 30	V
I_{OUT}	Output Current	0 to 150	mA
T_A	Operating Ambient Temperature	-40 to 85	°C
C_{IN}	Effective Input Ceramic Capacitor Value	1 to 10	uF
C_{OUT}	Effective Output Ceramic Capacitor Value	1 to 10	uF
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}	Operating Input Voltage(3)		3.0		30	V
V_{OUT}	Output Voltage	I_{OUT}=1mA	-2%		+2%	V
I_Q	Quiescent Current	I_{OUT} = 0mA		1.5	3.0	μA
$Line_{REG}$	Line Regulation	V_{IN} = V_{OUT} +1V to 30V, I_{OUT} = 10mA （ΔV_{OUT} / ΔV_{IN} / V_{OUT}）		0.01	0.04	%/V
V_{DROP}	Dropout Voltage I_{OUT}=150mA(4)	V_{OUT}=1.8V		1300	1450	mV
		V_{OUT} = 2.5V		1200	1350	
		V_{OUT} = 3.0V		840	960	
		V_{OUT} = 3.3V		820	950	
		V_{OUT} = 3.6V		800	930	
		V_{OUT} = 5V		720	900	
V_{DROP}	Dropout Voltage I_{OUT}=100mA(4)	V_{OUT}=1.8V		880	1050	mV
		V_{OUT} = 2.5V		800	1000	
		V_{OUT} = 3.0V		530	700	
		V_{OUT} = 3.3V		520	680	
		V_{OUT} = 3.6V		500	660	
		V_{OUT} = 5V		420	600	
$Load_{REG}$	Load Regulation	1mA ≤ I_{OUT} ≤ 150mA, V_{IN} =V_{OUT}+2V		5	25	mV
I_{OUT}	Current Limit	V_{IN} =V_{OUT}+2V	150			mA
I_{SHORT}	Short Current Protection	OUT short to GND		100		mA
eN	Output Noise Voltage(5)	V_{IN} = V_{OUT}+2V, I_{OUT} = 1mA, f = 10Hz to 100KHz, V_{OUT} =3V,C_{OUT} = 1μF		90		μVrms

Note3. 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.

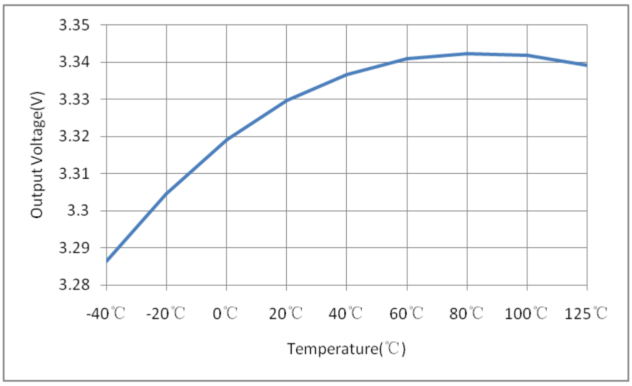
Note4. V_{DROP} FT test method: test the V_{OUT} voltage at V_{SET}+$V_{DROPMAX}$ with 150mA output current.

Note5. Guaranteed by design and characterization. not a FT item.

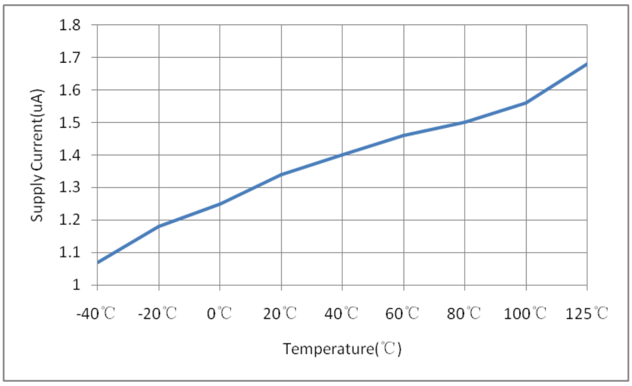
Typical Characteristics

VOLTAGE VERSION 3.3V

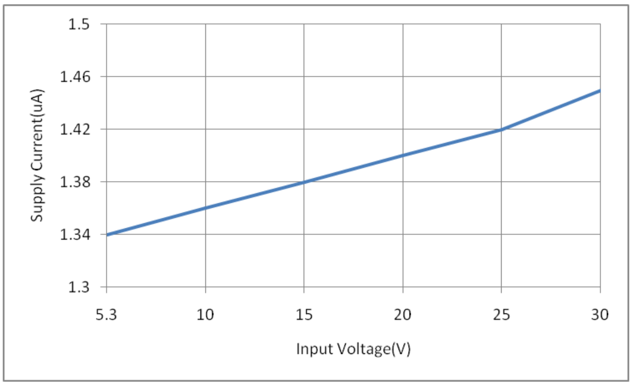
(V_{IN} = 5.3V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0μF, unless otherwise noted. Typical values are at T_A = +25℃.)



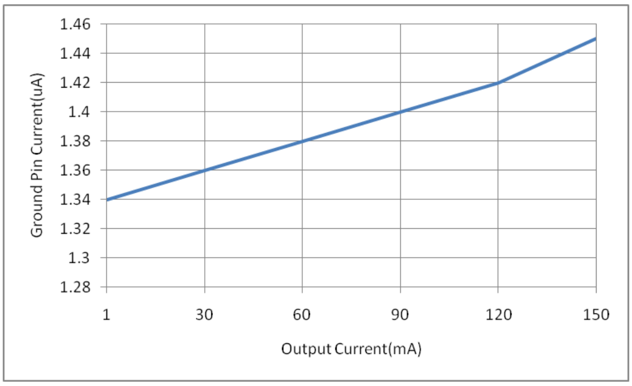
Output Voltage VS Temperature



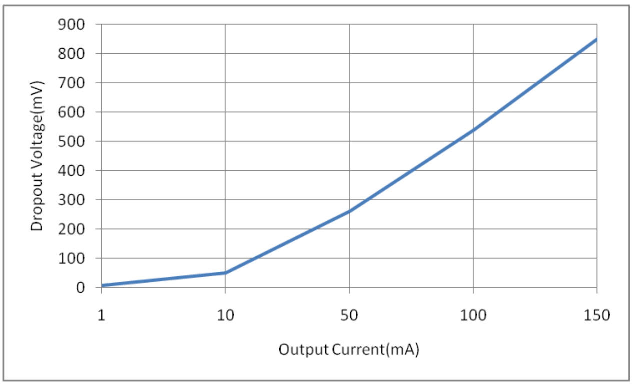
Supply Current VS Temperature



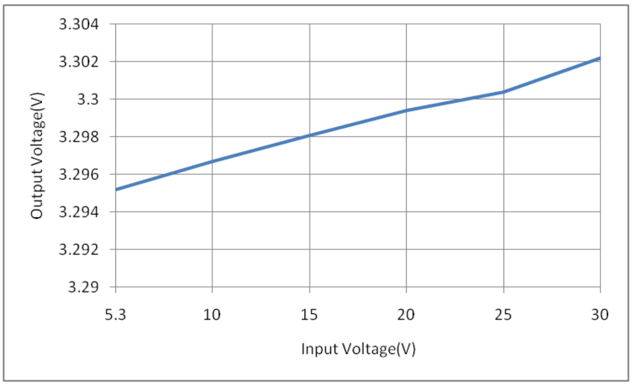
Supply Current VS Input Voltage



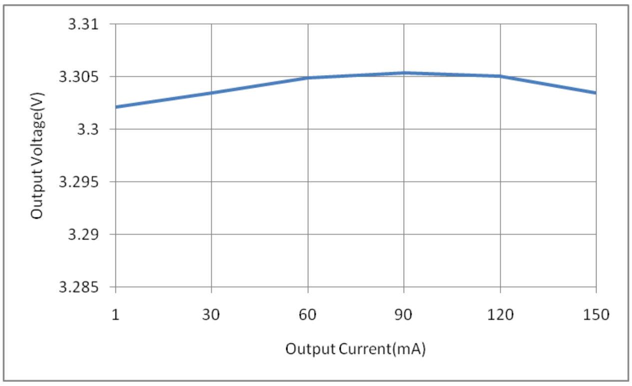
Ground Pin Current VS Output Current



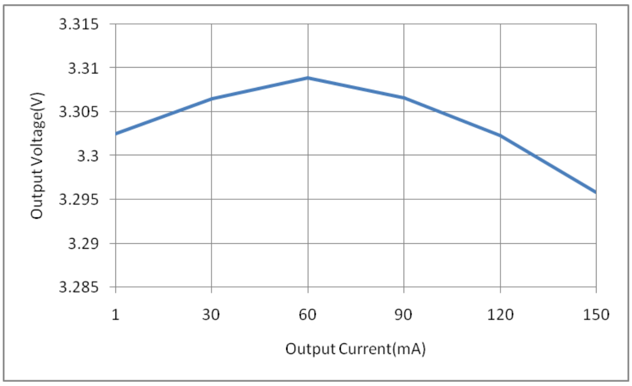
Dropout Voltage VS Output Current



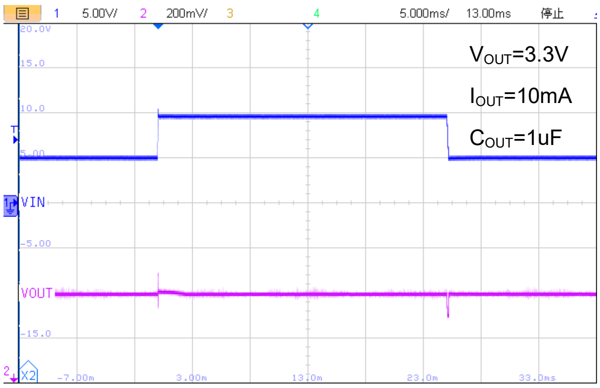
Output Voltage VS Input Voltage



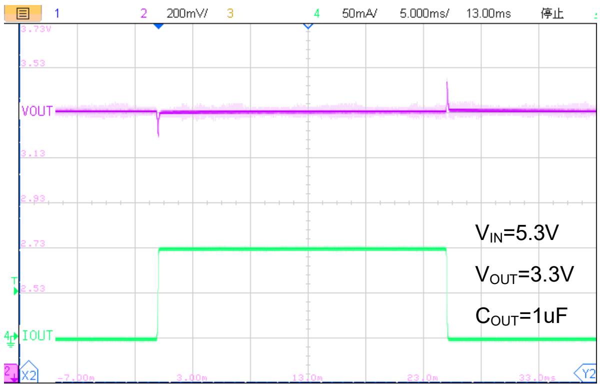
Output Voltage VS Output Current(V_{IN}=5.3V)



Output Voltage VS Output Current(V_{IN}=8V)



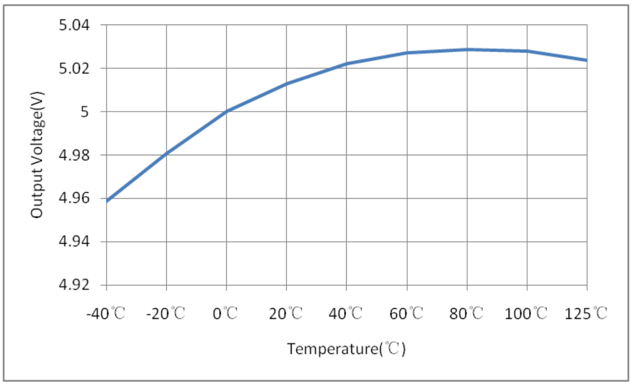
Line Transient Response



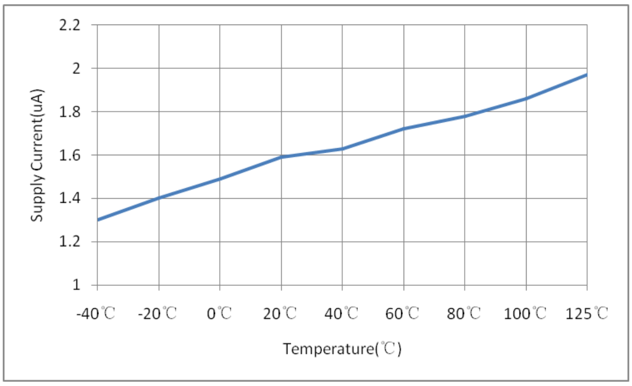
Load Transient Response

VOLTAGE VERSION 5.0V

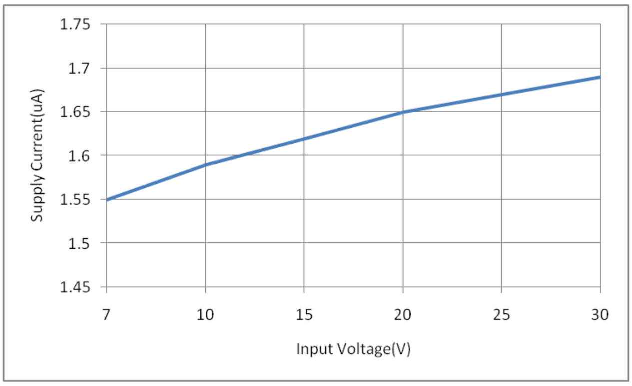
(V_{IN} = 7V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0μF, unless otherwise noted. Typical values are at T_A = +25℃.)



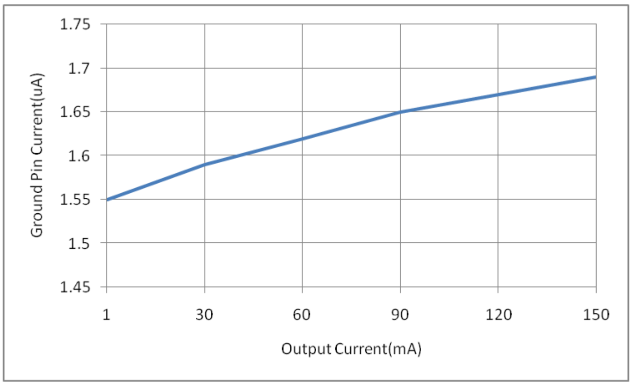
Output Voltage VS Temperature



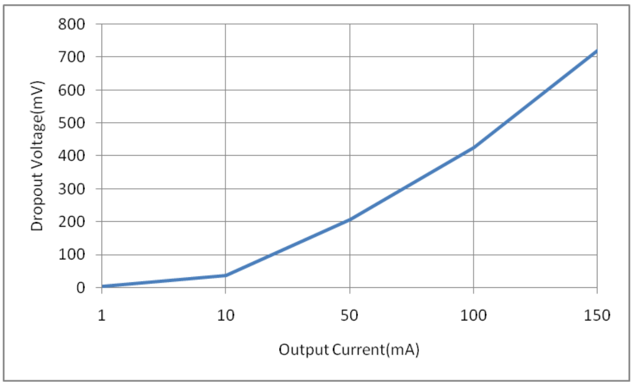
Supply Current VS Temperature



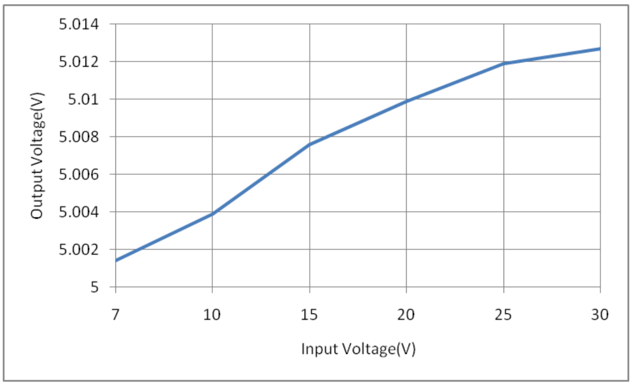
Supply Current VS Input Voltage



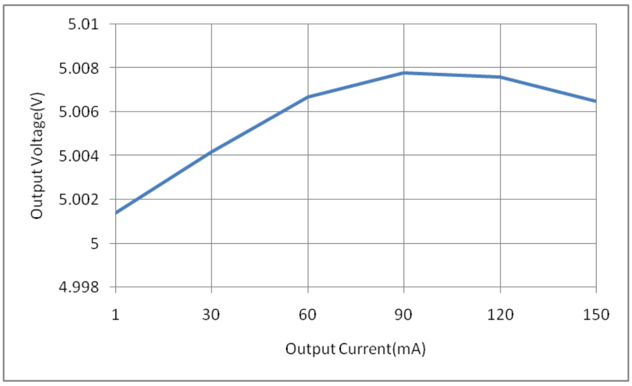
Ground Pin Current VS Output Current



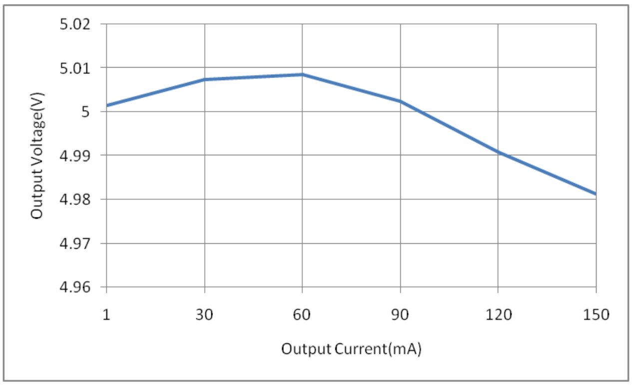
Dropout Voltage VS Output Current



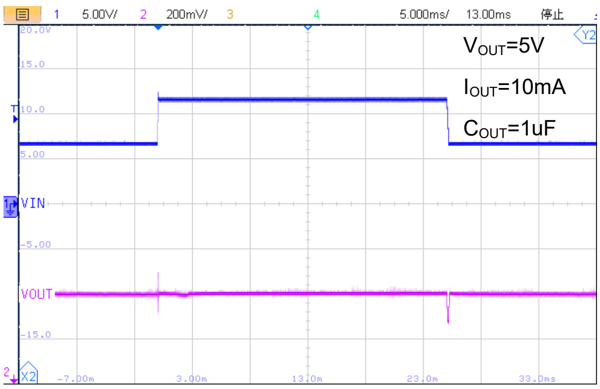
Output Voltage VS Input Voltage



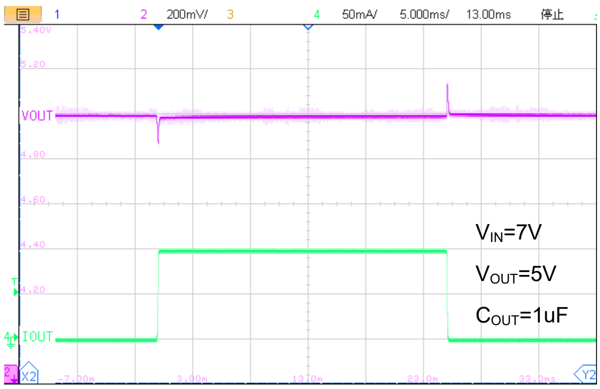
Output Voltage VS Output Current(V_{IN}=7V)



Output Voltage VS Output Current(V_{IN}=10V)

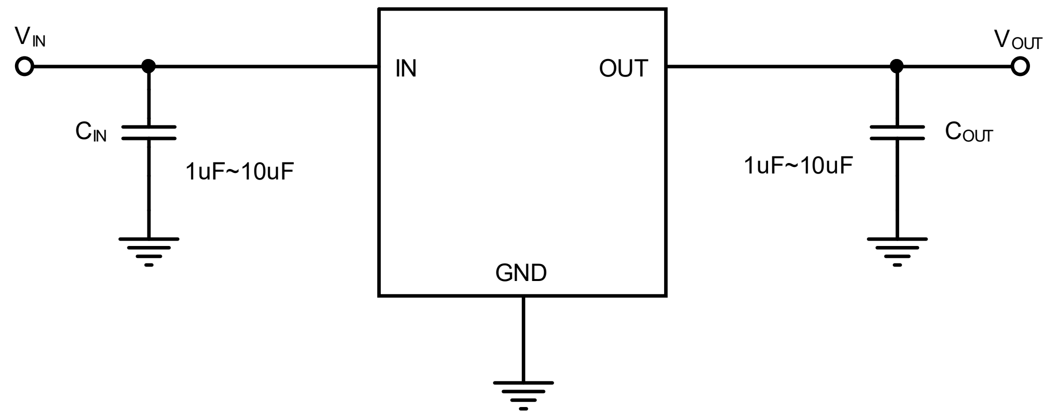


Line Transient Response



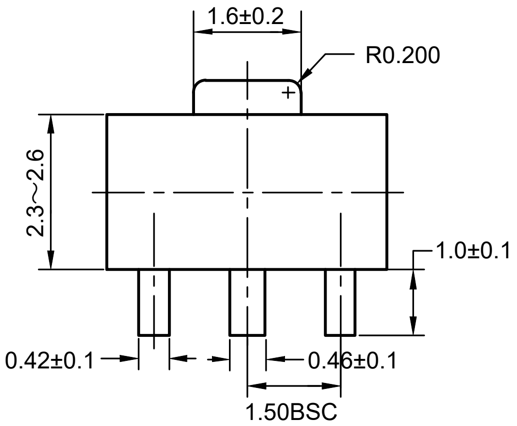
Load Transient Response

Application Circuits

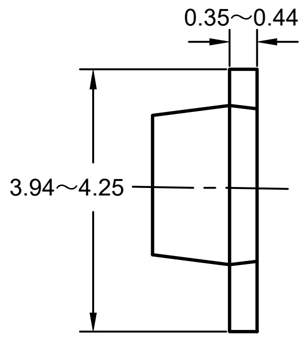


Package Dimension

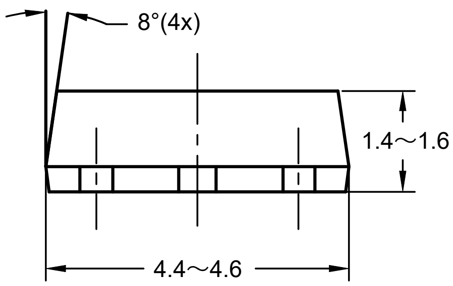
SOT89-3



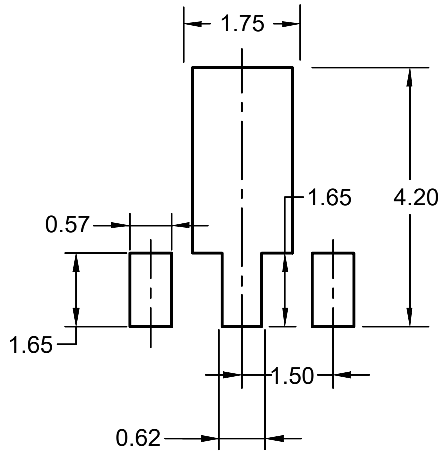
Top View



Side View



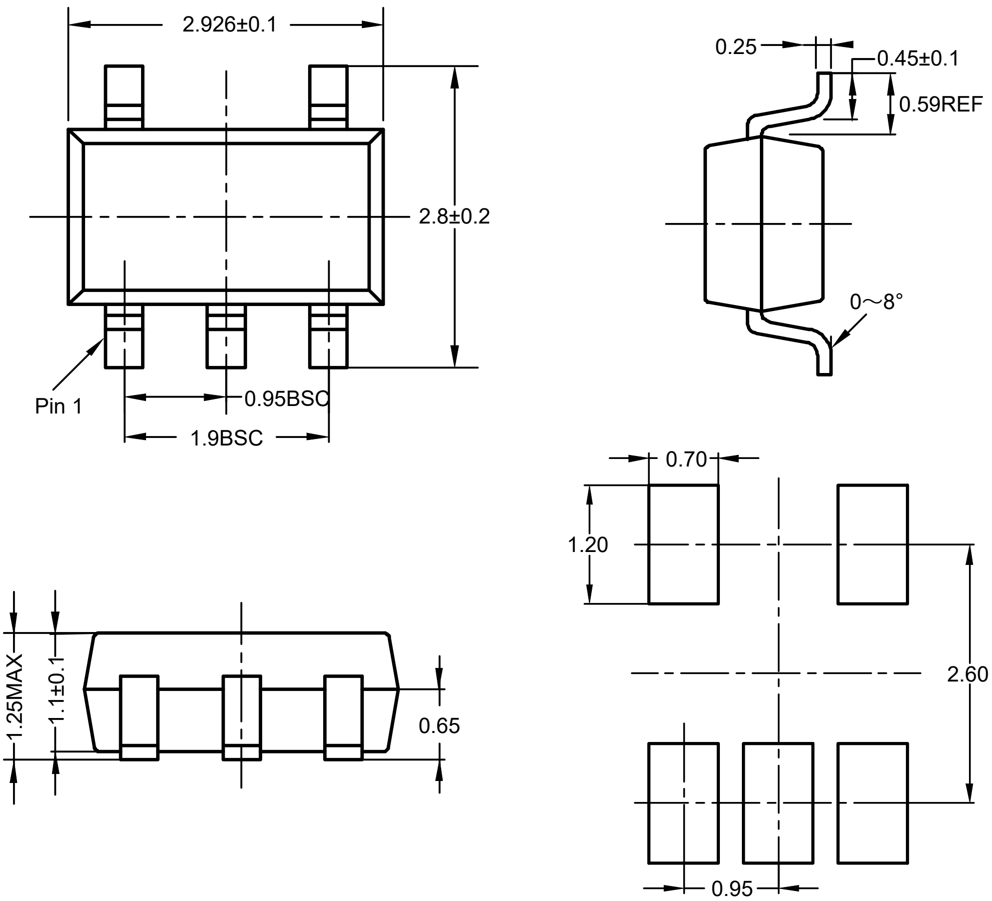
Side View



Recommended Land Pattern

Unit: mm

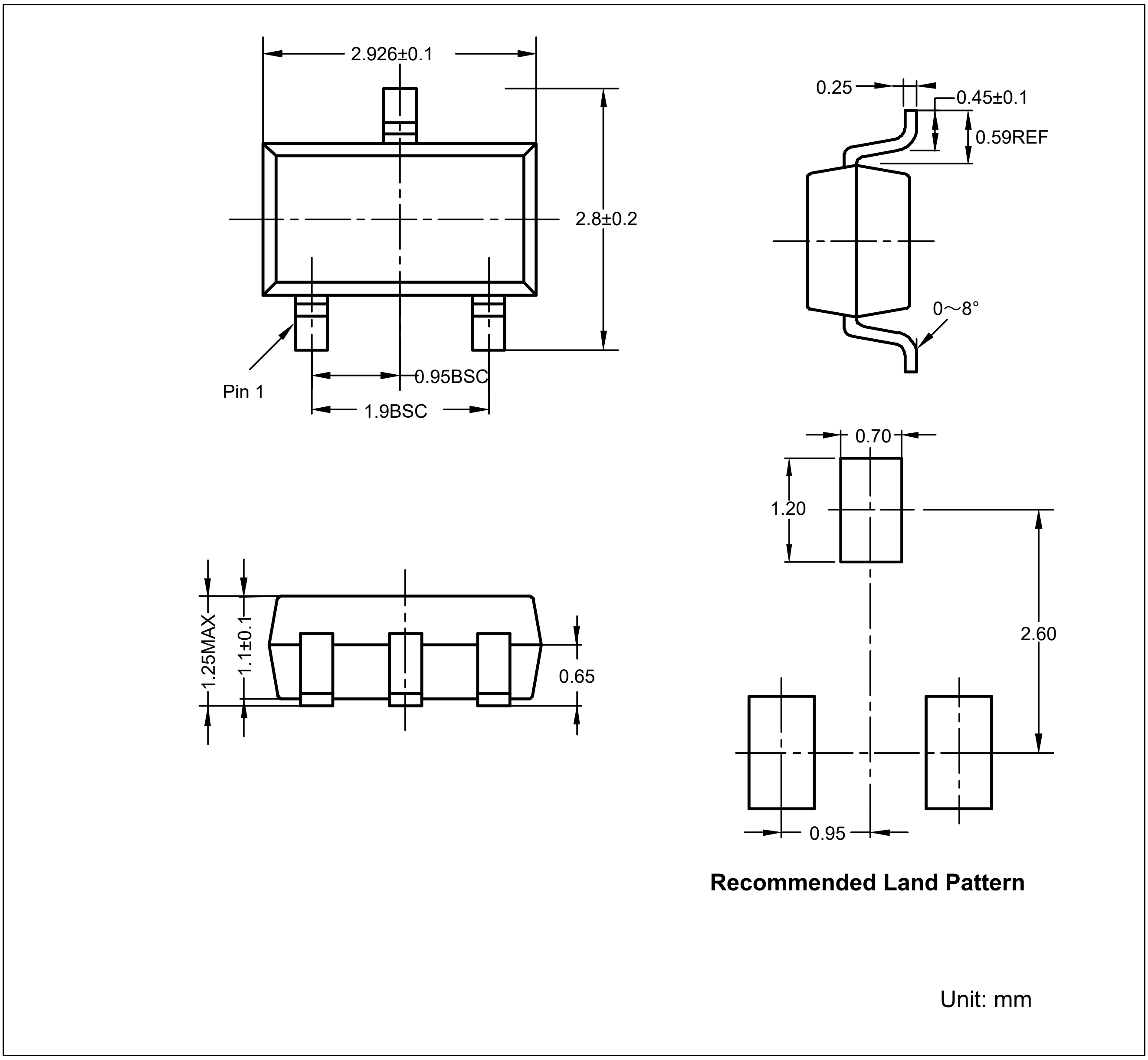
SOT23-5



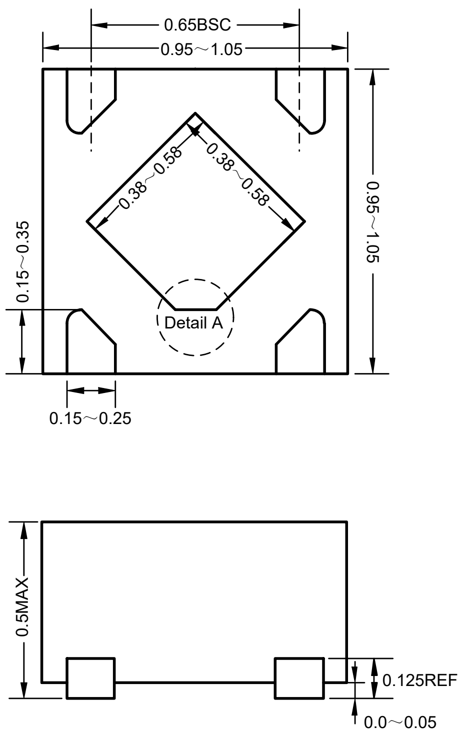
Recommended Land Pattern

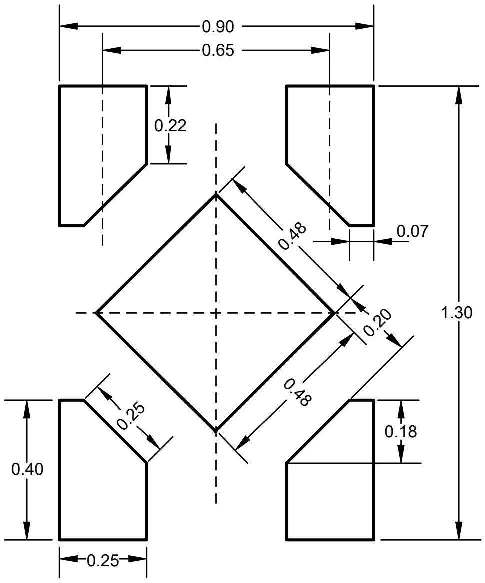
Unit: mm

SOT23-3


2.926±0.1
2.8±0.2
Pin 1
0.95BSC
1.9BSC
0.25
0.45±0.1
0.59REF
0～8°
0.70
1.20
2.60
0.95
1.25MAX
1.1±0.1
0.65
Recommended Land Pattern
Unit: mm

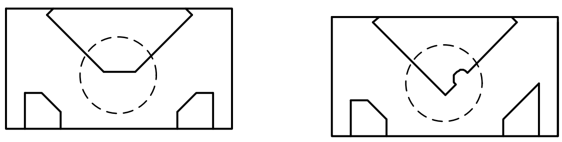
DFN4(1x1)





Recommended Land Pattern

Detail A: (PIN1 shape)



Unit: mm

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2018-08-20	Original Version	Liuxm	Liuxm	Zhujl
1.1	2018-10-11	Add DFN4 package	Liuxm	Liuxm	Zhujl
1.2	2018-11-26	Add SOT23-5	Liuxm	Liuxm	Liujy
1.3	2018-12-27	Change size of SOT23-3&SOT23-5	Liuxm	Liuxm	Liujy
1.4	2019-01-25	Revise dropout voltage	Shib	Shib	Liujy
1.5	2019-01-30	Add Vout in AMR	Liuxm	Liuxm	Liujy
1.6	2019-02-01	Update ESD Result	Wuxj	Wuxj	Liujy
1.7	2019-02-26	Revise Reg_{LINE}& Reg_{LOAD}	Shib	Shib	Liujy
1.8	2019-06-18	Add Vout=3.6V	Liuxm	Liuxm	Liujy
1.9	2019-10-09	Update package size	Liuxm	Liuxm	Liujy
2.0	2021-8-2	Update Marking Information	Liuxm	Liuxm	Liujy
2.1	2023-5-10	Update Typeset	Shibo	Liuxm	Zhujl
2.2	2023-6-5	Update marking	Shibo	Liuxm	Liujy
2.3	2023-10-7	Update package	Shibo		