ET7H1XX - 16V Input 1μA 300mA LDO

General Description

ET7H1XX series are a 1μA quiescent current and 300mA output LDO, It uses an advanced CMOS process and a PMOSFET pass device to achieve low noise, fast start-up and excellent output accuracy. The dynamic transient boost feature improves device transient response for wireless communication applications.

ET7H1XX series are offered SOT89-3, SOT23-5, SOT23-3, DNF4(1×1) packages.

Features

- Wide Input Voltage Range from 2.5V to 16V
- Up to 300mA Load Current
- Very Low I_Q is 1μA typical
- Fixed Output Voltage:1.2~5.5V@50mV/Step
- Dropout is 600mV typical at 300mA load @V_{OUT}=5.0V
- Short current protection is 120mA
- Excellent line / load regulation
- Packages are SOT89-3, SOT23-5, SOT23-3, DFN4(1×1)

Device information

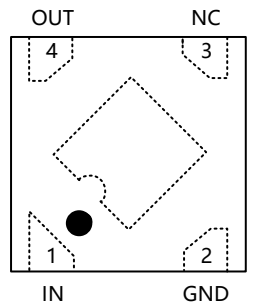
ET 7H1 XX X

XX Output Voltage		**X Package**	
XX	Output X.XV For example, 18 is 1.8V output	F	SOT89-3
		Y	DFN4(1X1)
		S	SOT23-3
		T	SOT23-5
		/	SOT23-5 (Default)

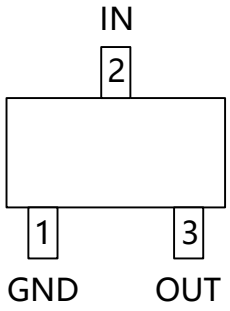
Mark Specification Label

Part No.	Marking				V_{OUT}
	SOT89-3	SOT23-3	DFN4	SOT23-5(T)	
ET7H112	12F	12S	AX	12T	1.2V
ET7H118	18F	18S	CX	18T	1.8V
ET7H130	30F	30S	GX	30T	3.0V
ET7H133	33F	33S	EX	33T	3.3V
ET7H136	36F	36S	OX	36T	3.6V
ET7H150	50F	50S	5X	50T	5.0V

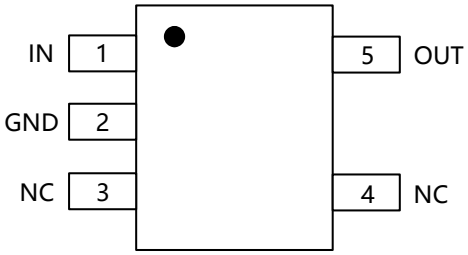
Pin Configuration



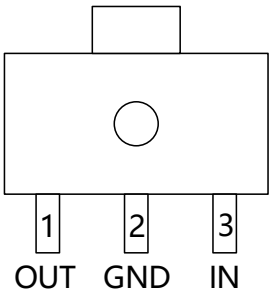
ET7H1XXY(DFN4)



ET7H1XXS(SOT23-3)



ET7H1XXT(SOT23-5)



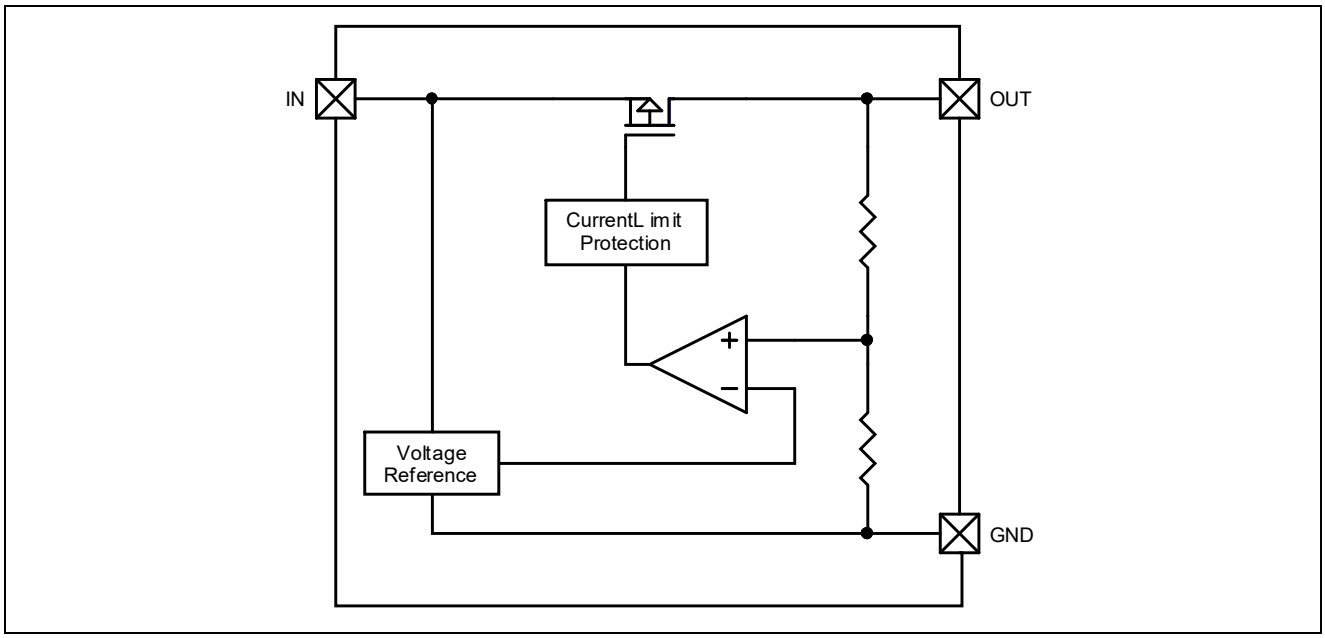
ET7H1XXF(SOT89-3)

Top View

Pin Function

Pin No.				Pin Name	Pin Function
SOT89-3 (F)	SOT23-5 (T)	SOT23-3 (S)	DFN4 (Y)		
2	2	1	2	GND	Ground pin.
3	1	2	1	IN	Supply input pin. Need a 1μF or greater capacitor closely decoupled to GND
1	5	3	4	OUT	Output pin. Bypass a 1μF or greater capacitor from this pin to ground.
-	3	-	3	NC	No connection.
-	4	-	-	NC	No connection.

Block Diagram



Functional Description

Input Capacitor

A 0.47μF~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 0.47μF 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.

Low Quiescent Current

The ET7H1XX consuming only around 1μA for all input range and output loading, provides great power saving in portable and low power applications.

Dropout Voltage

The ET7H1XX 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 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 :

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

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}.

Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V_{IN} (1)	Input Voltage	-0.3~24	V
V_{OUT}	Output Voltage	-0.3~6	V
T_{JMAX}	Maximum Junction Temperature	150	°C
T_{STG}	Storage Temperature	-65~150	°C
ESD (2)	HBM Capability	±4000	V
	CDM Capability	±1500	V
L_U (2)	Latch Up Current Maximum Rating	±200	mA

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 HBM tested per EIA/JESD22-A114;

ESD CDM tested per JESD22-C101;

Latch up current tested per JEDEC78.

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 : 50mm x 50mm (2layer) Copper :1oz	750	mW
	SOT23-5		400	
	SOT23-3		280	
	DFN4		400	

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	2.5 to 16	V
I_{OUT}	Output Current	0 to 300	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	0.47 to 10	μF
C_{OUT}	Effective Output Ceramic Capacitor Value	0.47 to 10	μF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

Electrical Characteristics

(V_{IN}= V_{OUT}+2V, T_A = 25℃，C_{IN}=10μF，C_{OUT}=10μF unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}[3]	Input Voltage Operation Range		2.5		16	V
V_{DROP}[4]	Dropout Voltage	V_{OUT}= 1.2V, I_{OUT} = 150mA		650	800	mV
		V_{OUT}= 1.2V, I_{OUT} = 300mA		1300	1600	
		V_{OUT}= 1.8V, I_{OUT} = 150mA		500	750	
		V_{OUT}= 1.8V, I_{OUT} = 300mA		1000	1300	
		V_{OUT}= 3.0V, I_{OUT} = 150mA		350	500	
		V_{OUT}= 3.0V, I_{OUT} = 300mA		700	1000	
		V_{OUT}= 5.0V, I_{OUT} = 150mA		300	450	
		V_{OUT}= 5.0V, I_{OUT} = 300mA		600	900	
I_Q	DC Supply Quiescent Current			1.0	2.0	μA
V_{OUT}	Regulated Output Voltage	I_{OUT}=1mA	-2%		+2%	V
Reg_{LINE}	Output Voltage Line Regulation	V_{IN} = V_{OUT} +1V to 16V, I_{OUT} = 10mA （$\Delta V_{OUT}/\Delta V_{IN}/V_{OUT}$）		0.01	0.1	%/V
Reg_{LOAD}	Output Voltage Load Regulation	I_{OUT} from 1mA to 300mA V_{IN}=V_{OUT}+2V		100	180	mV
I_{SHORT}	Short Current Limit	V_{OUT}=0V		120		mA
e_N[5]	Output Noise	10Hz to 100kHz, I_{OUT} = 20mA		80* V_{OUT}		μV_{RMS}

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.

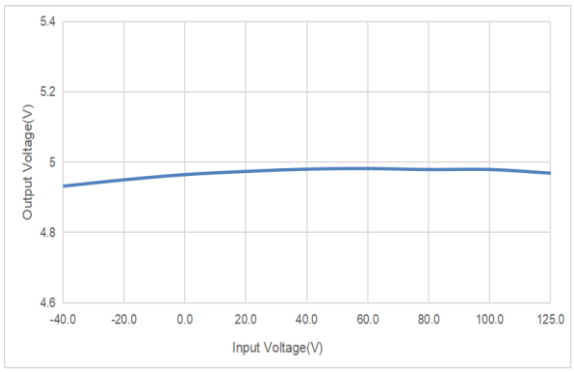
Note4. V_{DROP} FT test method: test the V_{OUT} voltage at V_{OUT}+$V_{DROPMAX}$ with 300mA output current.

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

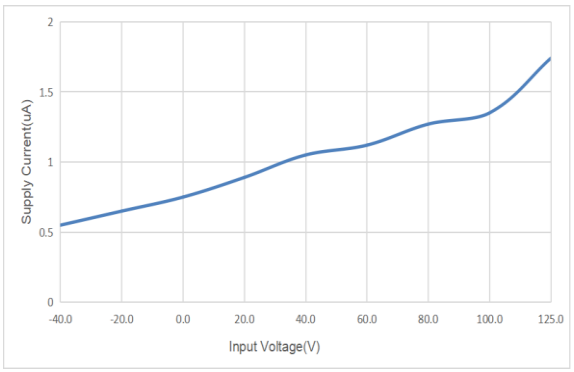
Typical Characteristics

VOLTAGE VERSION 5V

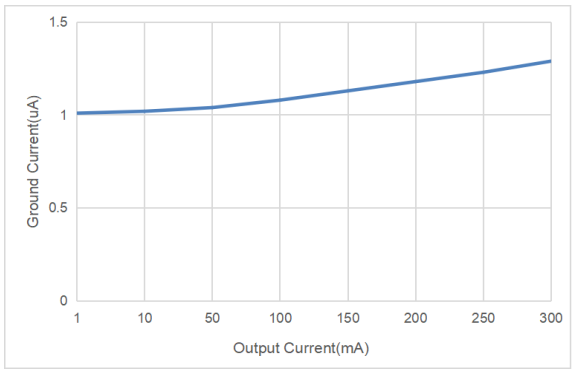
(V_{OUT} =5V, V_{IN} =7V, C_{IN} = C_{OUT} = 10μF, unless otherwise noted.Typical values are at T_A = +25°C.)



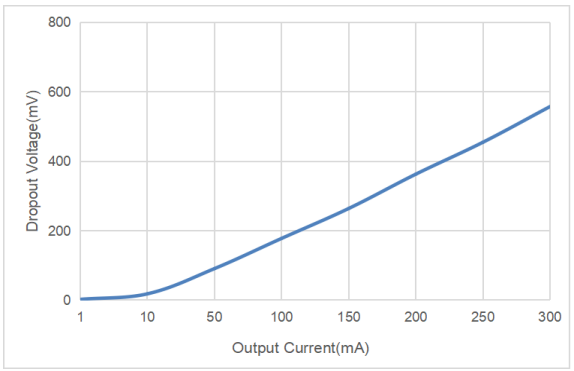
Output Voltage VS Temperature



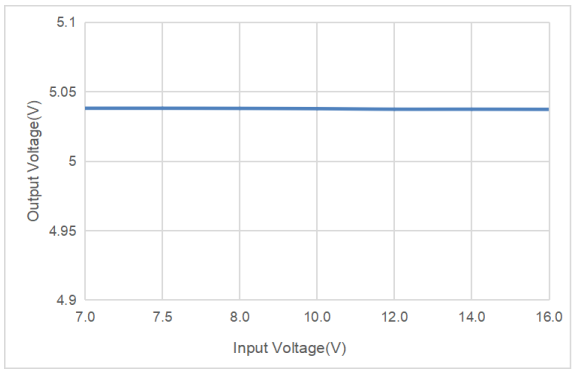
Quiescent Current VS Temperature



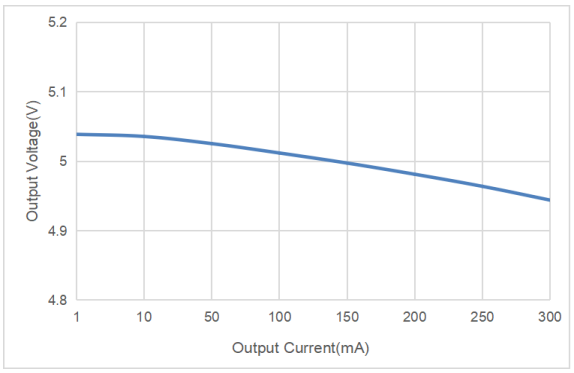
Ground Current VS Output Current



Dropout Voltage VS Output Current



Output Voltage VS Input Voltage

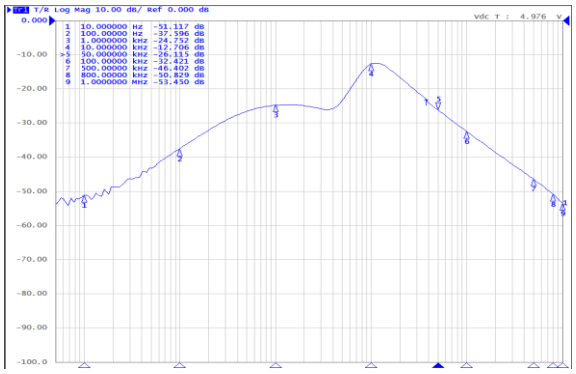


Output Voltage VS Output Current

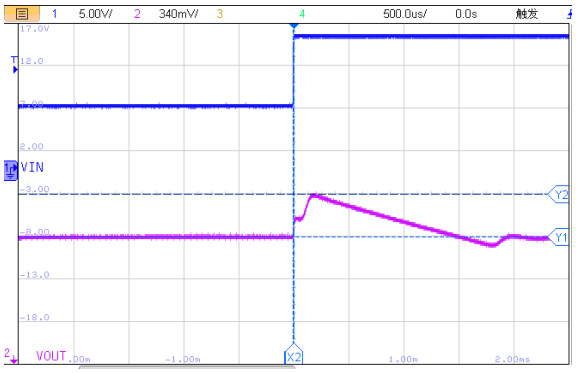
Typical Characteristics(Continued)

VOLTAGE VERSION 5V

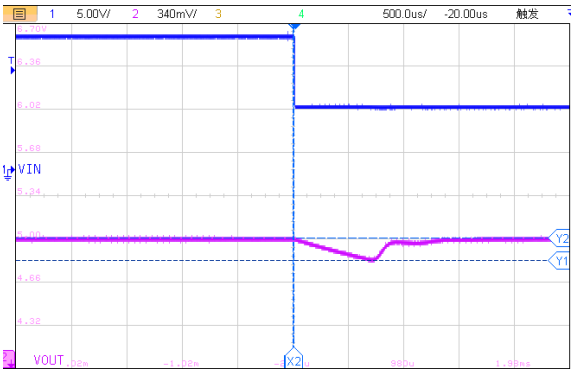
(V_{OUT} =5V, V_{IN} =7V, C_{IN} = C_{OUT} = 10μF, unless otherwise noted.Typical values are at T_A = +25°C.)



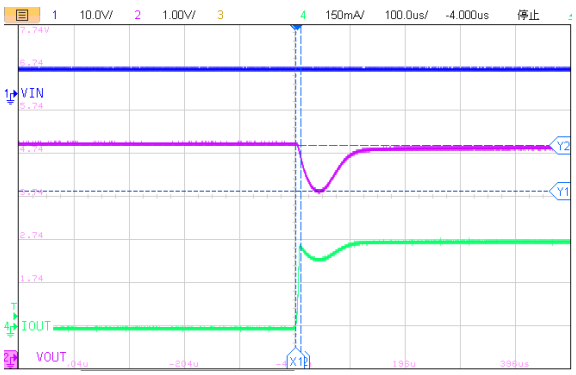
PSRR VS Output Current



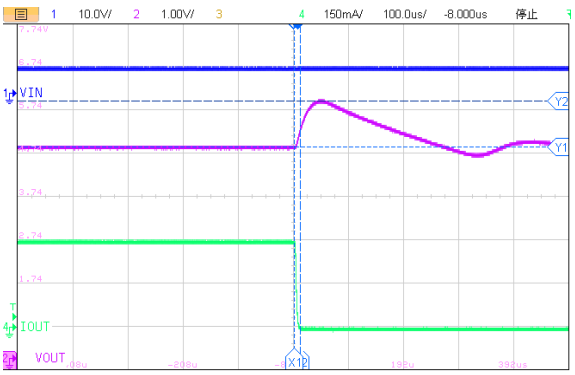
Input Transient (7~16V t=10μs 1mA)



Input Transient (16~7V t=10μs 1mA)

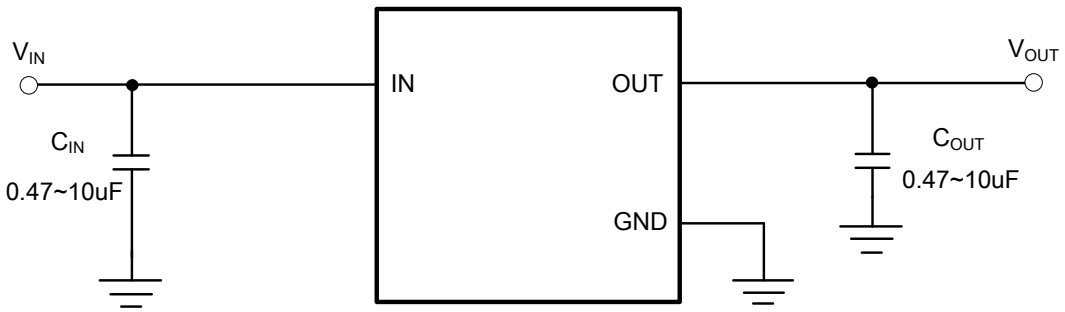


Load Transient (1mA~300mA t=10μs)



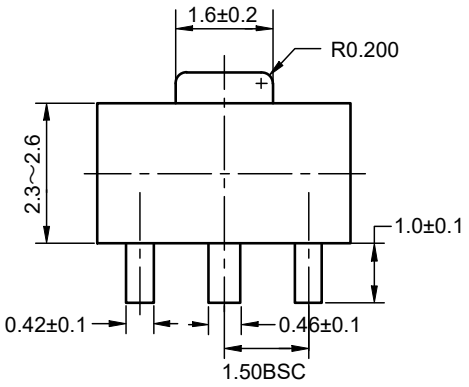
Load Transient (300mA~1mA t=10μs)

Application Circuits

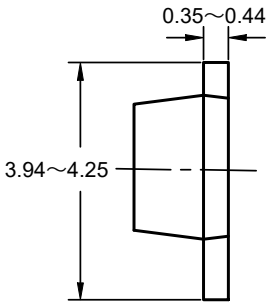


Package Dimension

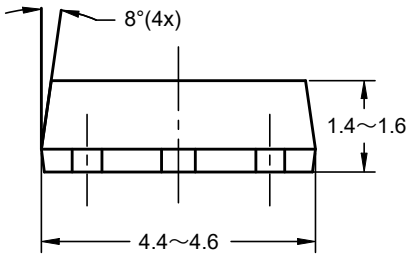
SOT89-3



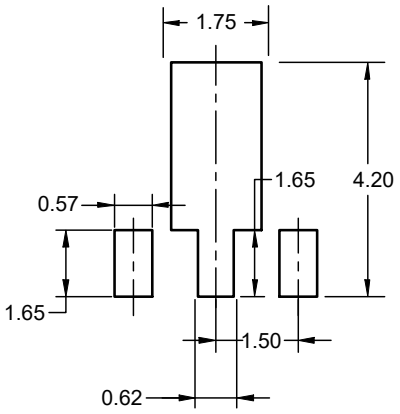
Top View



Side View



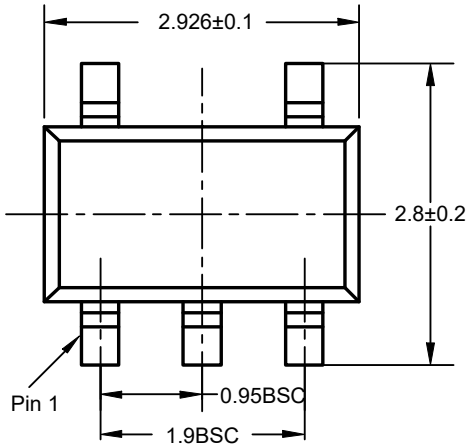
Side View

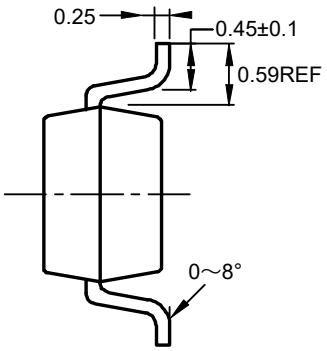


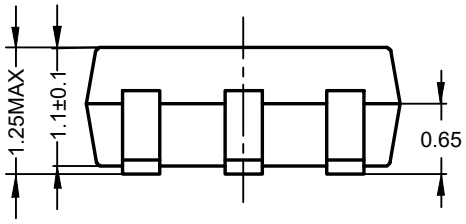
Recommended Land Pattern

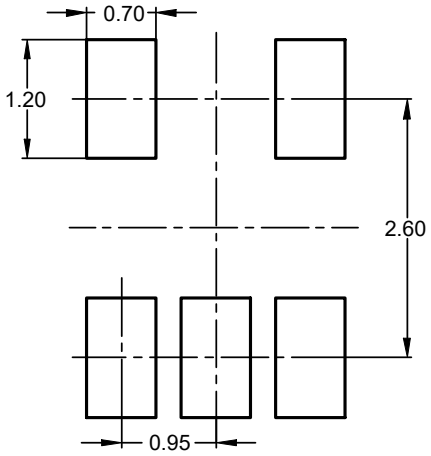
Unit: mm

SOT23-5





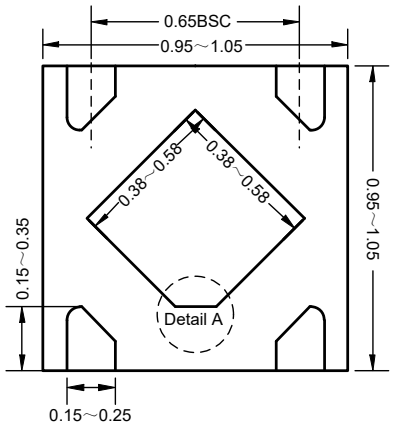


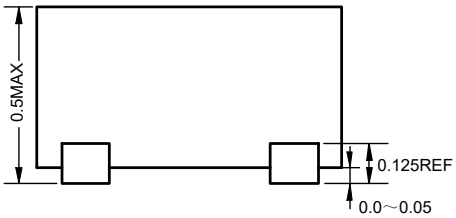


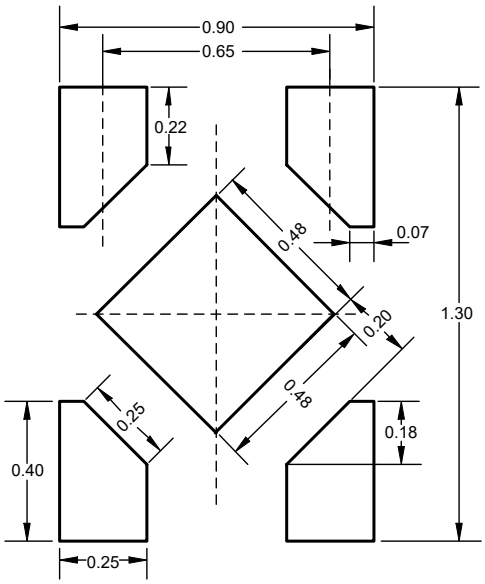
Recommended Land Pattern

Unit: mm

DFN4(1x1)

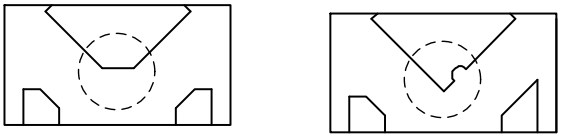






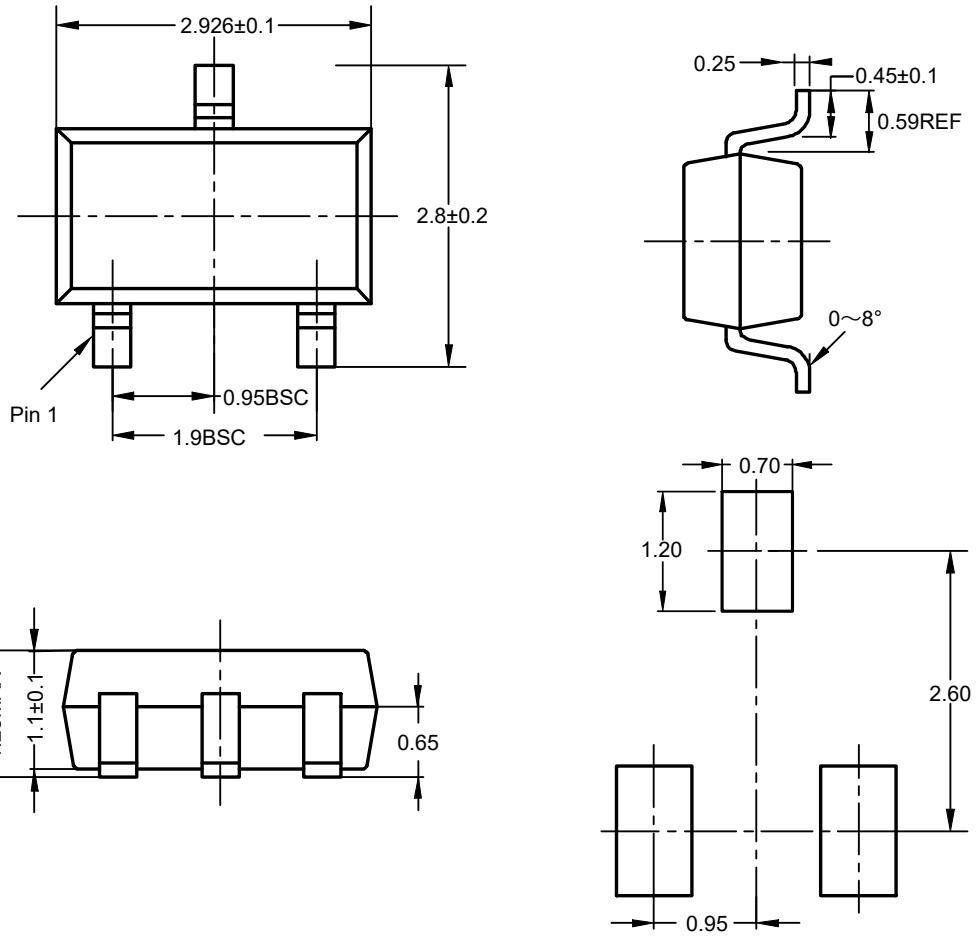
Recommended Land Pattern

Detail A: (PIN1 shape)



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
0.1	2022-3-21	Preliminary Version	Wuhang shibo	Liuxm	Liujy
0.2	2022-3-29	Update error	shibo		
1.0	2023-7-13	Official Version	Pengjunjie	Liuxm	Liujy
1.1	2023-10-7	Update package	Shibo		