ET639XX - Ultra-Low I_Q 300mA LDO

General Description

The ET639XX series of CMOS low dropout regulators are designed specifically for portable battery-powered applications which require ultra-low quiescent current. The ultra-low consumption of type 0.6μA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

The device is available in small DFN4(1mm × 1mm), SOT23-5 and SOT23-3 packages.

Features

- Operating Input Voltage Range From 1.8V to 6V
- Output Voltage Range:1.1V, 1.2V, 1.5V, 1.6V, 1.8V, 2.5V, 2.8V, 3V, 3.1V and 3.3V
- Ultra-Low Quiescent Current Typical 0.6μA
- Low Noise is Typical 90μV_{RMS}@V_{OUT} = 1.8V
- Low Dropout is Typical 400mV at 300mA@V_{OUT} = 1.8V
- Stable with Ceramic Capacitors 1μF
- Over-Current Protection
- Thermal Shutdown Protection
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant
- Package Information

Part No.	Package	Packing Option	MSL
ET639XXYB	DFN4 (1mm × 1mm)	Tape and Reel, 10K/Reel	1
ET639XXYBQ1		Tape and Reel, 5K/Reel	
ET639XX	SOT23-5	Tape and Reel, 3K/Reel	3
ET639XXS	SOT23-3	Tape and Reel, 3K/Reel	3

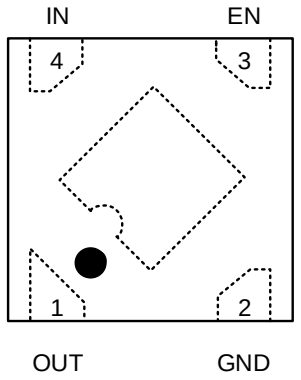
Applications

- Battery Powered Equipment
- Portable Communication Equipment
- Cameras, Image Sensors and Camcorders
- Label Information

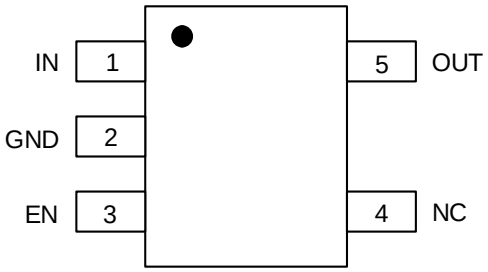
Mark Specification

Part No.	Marking			V_{OUT}	Auto Discharge Function
	DFN4	SOT23-5	SOT23-3		
	XX	69X	69XS		
ET63911	XI	69I	69IS	1.1V	Y
ET63912	XA	69A	69AS	1.2V	Y
ET63915	XB	69B	69BS	1.5V	Y
ET63916	XN	69N	69NS	1.6V	Y
ET63918	XC	69C	69CS	1.8V	Y
ET63925	XF	69F	69FS	2.5V	Y
ET63928	XD	69D	69DS	2.8V	Y
ET63930	XG	69G	69GS	3.0V	Y
ET63931	XZ	69Z	69ZS	3.1V	Y
ET63933	XE	69E	69ES	3.3V	Y

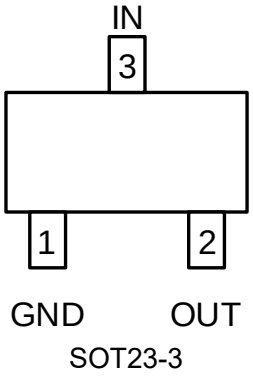
Pin Configuration



DFN4



SOT23-5



SOT23-3

Figure1. Pin Configuration

Pin Function

Pin No.			Symbol	Pin Description
DFN4	SOT23-5	SOT23-3		
1	5	2	OUT	Output Pin
2	2	1	GND	Power Supply Ground
3	3	/	EN	Chip Enable Pin (Active “H”)
4	1	3	IN	Power Supply Input Voltage
TP	4	/	Thermal Pad / NC	Thermal pad for DFN4(1mm × 1mm) package, Connect to GND or Leave Floating. Do not Connect to any Potential other than GND. NC for SOT23-5 no Connection.

Block Diagram

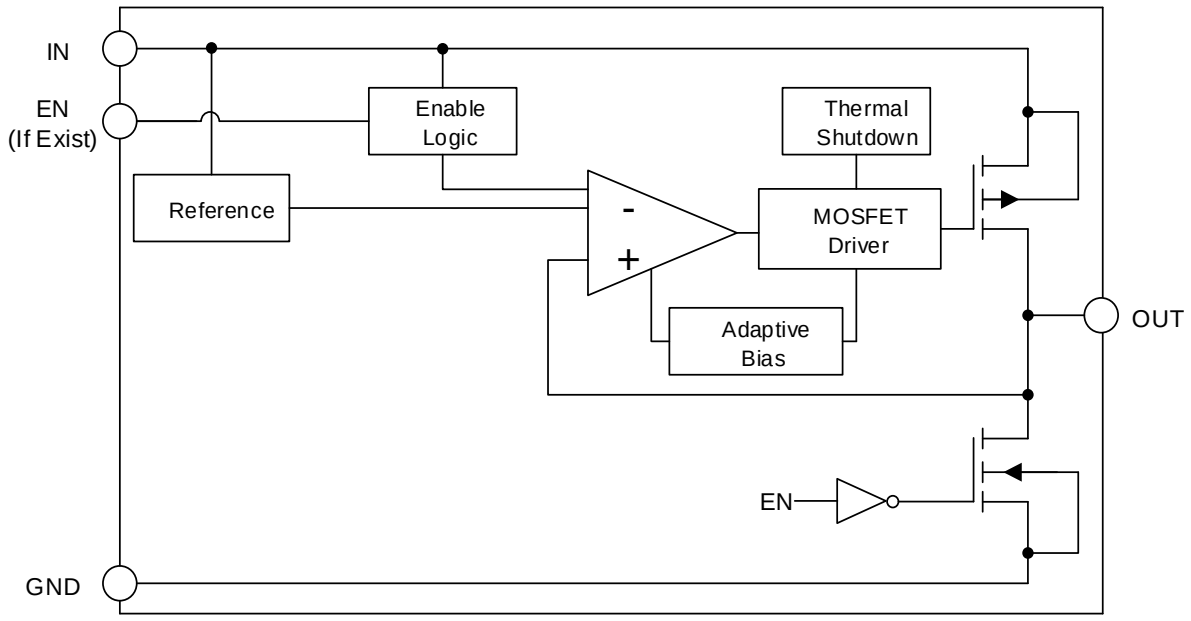


Figure2. Block Diagram

Functional Description

The ET639XX is a high performance 300mA Linear Regulator with Ultra Low I_Q. This device delivers low Noise and High-Power Supply Rejection Ratio with excellent dynamic performance due to employing the Dynamic Quiescent Current adjustment which assure ultra-low I_Q consumption at no-load state. These parameters make this device very suitable for various battery powered applications.

Input Decoupling

It is recommended to connect at least a 1μF Ceramic X5R or X7R capacitor between IN and GND pins of the device. This capacitor will provide a low impedance path for any unwanted AC signals or Noise superimposed onto constant Input Voltage. The good input capacitor will limit the influence of input trace inductances and source resistance during sudden load current changes. Higher capacitance and lower ESR Capacitors will improve the overall line transient response.

Output Decoupling

The ET639XX does not require a minimum Equivalent Series Resistance (ESR) for the output capacitor. The X5R and X7R types have the lowest capacitance variations over temperature thus they are recommended.

There is recommended connect the output capacitor as close as possible to the output pin of the regulator.

Enable Operation (If EN PIN Exist)

The ET639XX uses the EN pin to enable /disable its device and to activate /deactivate the active discharge function at devices with this feature. If the EN pin voltage is pulled below 0.3V the device is guaranteed to be disable.

If the EN pin voltage is higher than 1.5V the device is guaranteed to be enabled. The internal active discharge circuitry is switched off and the desired output voltage is available at output pin. In case the Enable function is not required the EN pin should be connected directly to input pin.

Current Limit Protection

When output current at the OUT pin is higher than current limit threshold, the current limit protection will be triggered and clamp the output current to approximately 300mA to prevent over-current and to protect the regulator from damage due to overheating.

Thermal Shutdown

When the die temperature exceeds the Thermal Shutdown point (T_{TSD} = 155°C typical) the device goes to disabled state and the output voltage is not delivered until the die temperature decreases to 125°C. The Thermal Shutdown feature provides a protection from a catastrophic device failure at accidental overheating. This protection is not intended to be used as a substitute for proper heat sinking.

Power Dissipation and Heat sinking

The maximum power dissipation supported by the device is dependent upon board design and layout. Mounting pad configuration on the PCB, the board material and the ambient temperature affect the rate of junction temperature rise for the part. The maximum power dissipation the ET639XX device can handle is given by:

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

Absolute Maximum Ratings

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.

Symbol	Parameter	Rating	Unit
V_{IN} (1)	Input Voltage	-0.3 to 6.5	V
V_{OUT}	Output Voltage	-0.3 to V_{IN} + 0.3	V
V_{EN}	Enable Voltage(If EN PIN Exist)	-0.3 to V_{IN} + 0.3	V
$T_{J(MAX)}$	Maximum Junction Temperature	125	°C
T_{STG}	Storage Temperature	-65 to 150	°C
V_{ESD} (2)	Human Body Model	±4000	V
	Charged Device Model	±2000	V
I_{LU} (2)	Latch up Current Maximum Rating	±100	mA

Note1: Refer to ELECTRICAL CHARACTERISTIS for Safe Operating Area.

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

--ESD Human Body Model tested per JEDEC JS-001

--ESD Charged Device Model tested per JEDEC JS-002

--Latch up Current Maximum Rating tested per JEDEC JESD78F.

Thermal Characteristics

Symbol	Package	Parameters	Value	Unit
$R_{\theta JA}$	DFN4	Thermal Resistance, Junction-to-Air	166	°C/W
	SOT23-5/ SOT23-3		166	
P_{DMAX}	DFN4	Power Dissipation	600	mW
	SOT23-5/ SOT23-3		600	

Recommended Operating Conditions

Symbol	Parameters	Rating	Unit
V_{IN}	Input Voltage	1.8 to 6	V
I_{OUT}	Output Current	0 to 300	mA
T_A	Operating Ambient Temperature	-40 to 85	ºC
C_{IN}	Effective Input Ceramic Capacitor Value	0.47 to 4.7	µF
C_{OUT}	Effective Output Ceramic Capacitor Value	0.47 to 4.7	µF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

Electrical Characteristics

(V_{IN} = V_{OUTNOM} + 1V, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, unless otherwise noted. Typical values are at T_A = 25°C.)[3]

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_{IN}	Operating Input Voltage			1.8		6	V
V_{OUT}	Output Voltage	I_{OUT} = 1mA		-2		2	%
Reg_{LINE}	Line Regulation	I_{OUT} = 1mA, V_{OUTNOM} + 1V ≤ V_{IN} ≤ 6V			0.05	0.2	%/V
Reg_{LOAD}	Load Regulation	V_{IN} = V_{OUTNOM} + 1V, T_A = 25°C, 1mA ≤ I_{OUT} ≤ 300mA			5	20	mV
V_{DROP} [4]	Dropout Voltage	I_{OUT} = 300mA, T_A = 25°C	V_{OUT} = 1.1V		750	1170	mV
			V_{OUT} = 1.8V		400	600	
			V_{OUT} = 2.8V		260	500	
			V_{OUT} = 3.0V		240	480	
			V_{OUT} = 3.3V		220	460	
I_{LIMIT}	Current Limit	V_{IN} = V_{OUTNOM} + 1V		350	700	1000	mA
I_{SC}	Short Current Limit	V_{OUT} = 0V		50			mA
I_{Q_ON}	Quiescent Current	V_{IN} = V_{EN}, T_A = 25°C			0.6	1.5	μA
		V_{IN} = 6V, V_{EN} = 1.8V, T_A = 25°C				11	μA
I_{Q_OFF}	Shutdown Current	V_{EN} = 0V, T_A = 25°C (If EN PIN Exist)			0.01	0.1	μA
V_{ENH}	EN Pin Threshold Voltage	EN Input Voltage “H” (If EN PIN Exist)		1.2			V
V_{ENL}	EN Pin Threshold Voltage	EN Input Voltage “L” (If EN PIN Exist)				0.4	V
I_{EN}	EN Pin leakage Current	V_{EN} = 4.3V (If EN PIN Exist)			0.02	1.0	μA
PSRR [5]	Power Supply Rejection Ratio	f = 1kHz, V_{IN} = 2.8V, I_{OUT} = 20mA			75		dB
e_N	Output Noise	10Hz to 100kHz, I_{OUT} = 20mA			50* V_{OUT}		μV_{RMS}
T_{TSD} [5]	Thermal Shutdown Temperature	Temperature Increasing From T_A = 25°C			155		°C
T_{SDH} [5]	Thermal Shutdown Hysteresis	Temperature Falling from T_{TSD}			30		°C

Note3: Here V_{IN} means internal circuit can work normal. If V_{IN} < V_{OUT}, Output voltage follows V_{IN} (I_{OUT} = 1mA), circuit is safety.

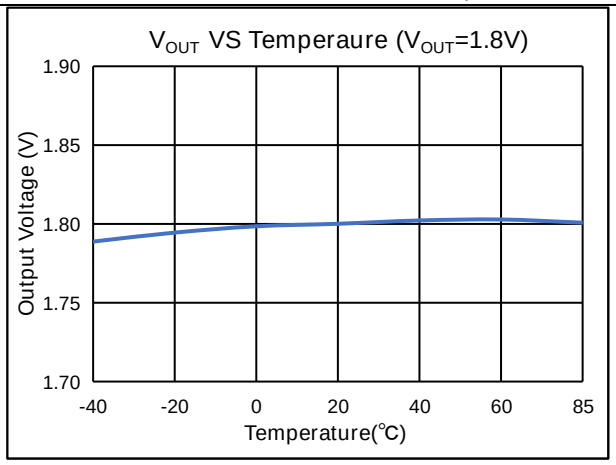
Note4: V_{DROP} FT test method: Test the V_{OUT} voltage at V_{SET} + $V_{DROPMAX}$ with 300mA output current.

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

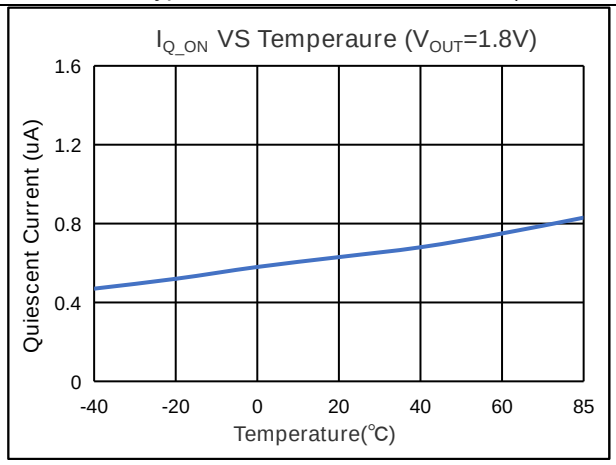
Typical Characteristics

1.VOLTAGE VERSION 1.8V

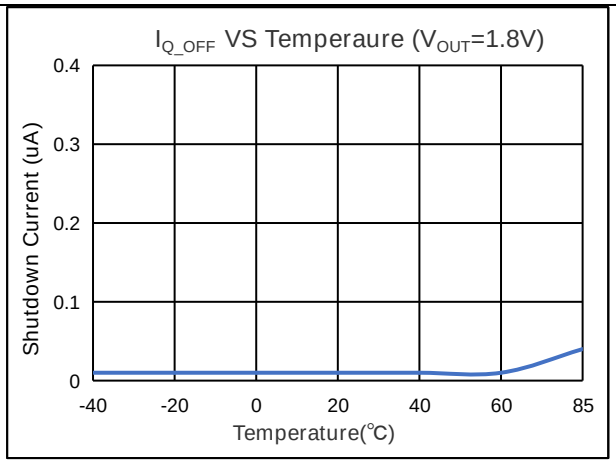
(V_{IN} = 2.8V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0μF, unless otherwise noted. Typical values are at T_A = 25°C.)



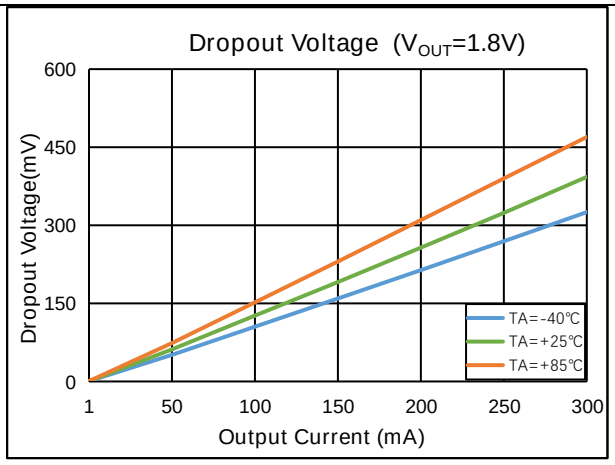
Output Voltage VS Temperature



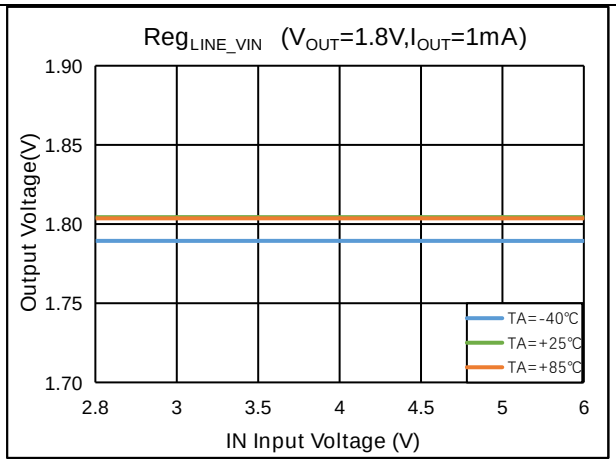
Supply Current VS Temperature



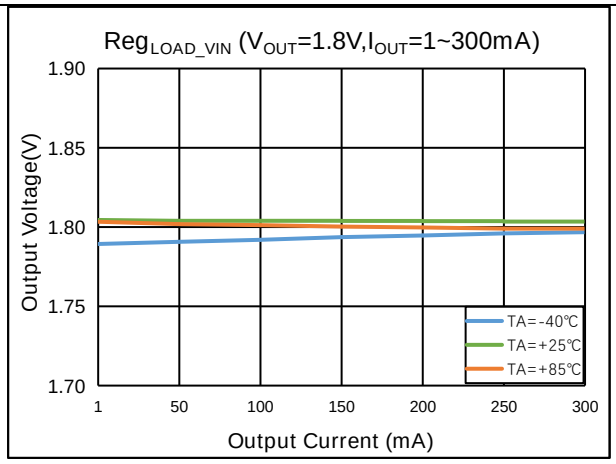
Shutdown Current VS Temperature



Dropout Voltage VS Output Current



Output Voltage VS Input Voltage

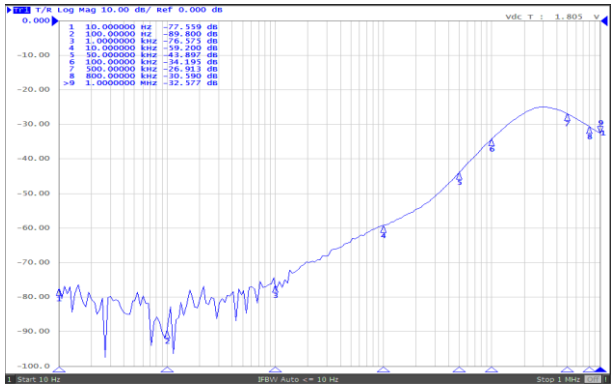


Output Voltage VS Output Current

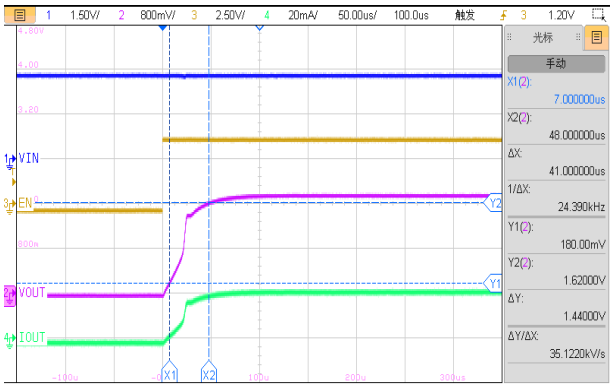
Typical Characteristics(Continued)

1.VOLTAGE VERSION 1.8V

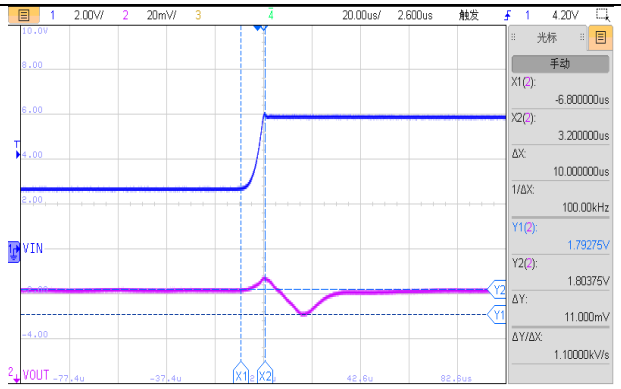
(V_{IN} = 2.8V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0μF, unless otherwise noted. Typical values are at T_A = 25°C.)



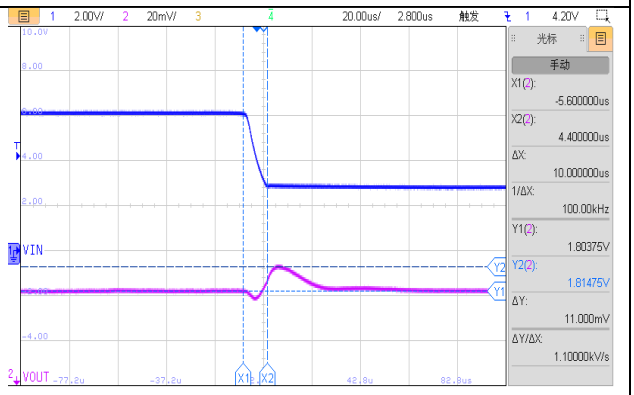
PSRR VS Output Current (I_{OUT} = 20mA)



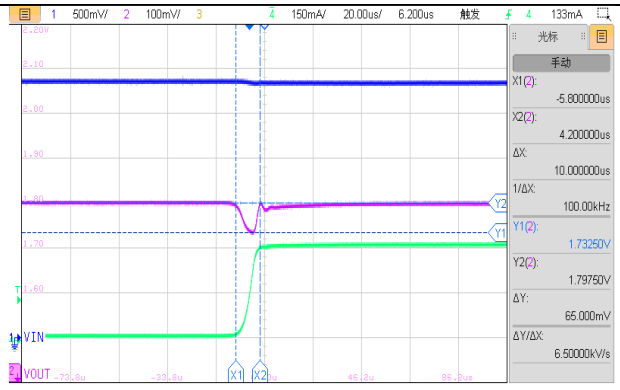
Turn On Speed VS EN Voltage (I_{OUT} = 20mA)



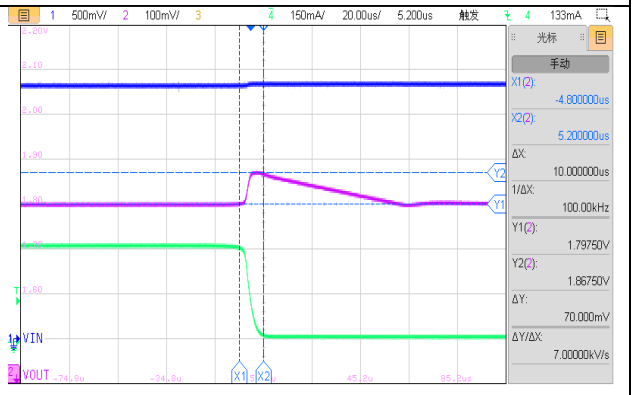
Line Transient Response
V_{IN} = 2.8V~6.0V, V_{OUT} = 1.8V, I_{OUT} = 1mA



Line Transient Response
V_{IN} = 6.0V~2.8V, V_{OUT} = 1.8V, I_{OUT} = 1mA



Load Transient Response
V_{IN} = 2.8V, V_{OUT} = 1.8V, I_{OUT} = 1mA~300mA

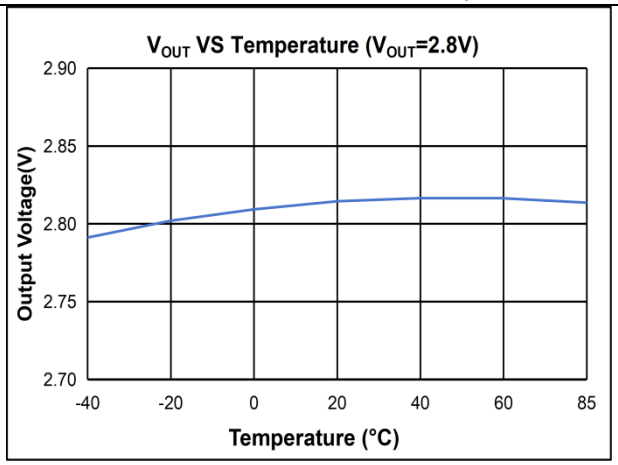


Load Transient Response
V_{IN} = 2.8V, V_{OUT} = 1.8V, I_{OUT} = 300mA~1mA

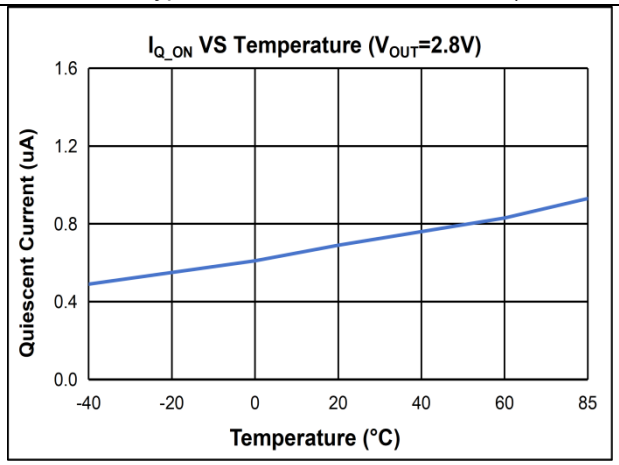
Typical Characteristics(Continued)

2.VOLTAGE VERSION 2.8V

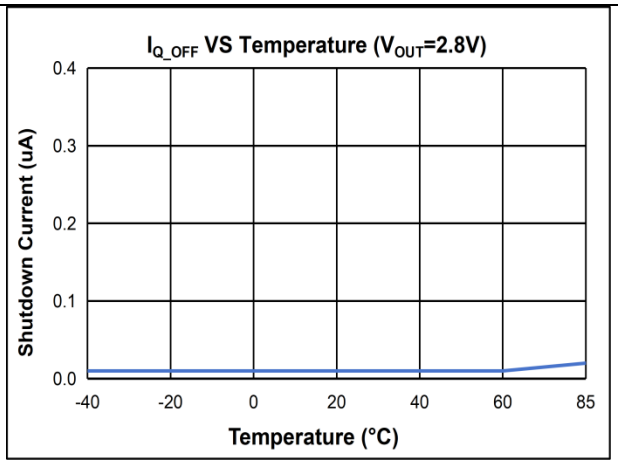
(V_{IN} = 3.8V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0μF, unless otherwise noted. Typical values are at T_A = 25°C.)



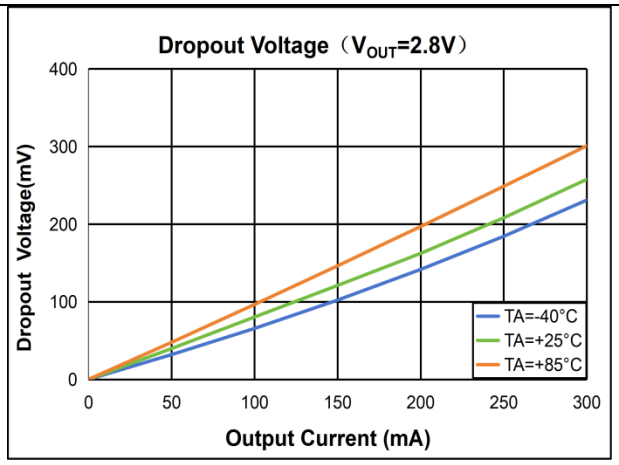
Output Voltage VS Temperature



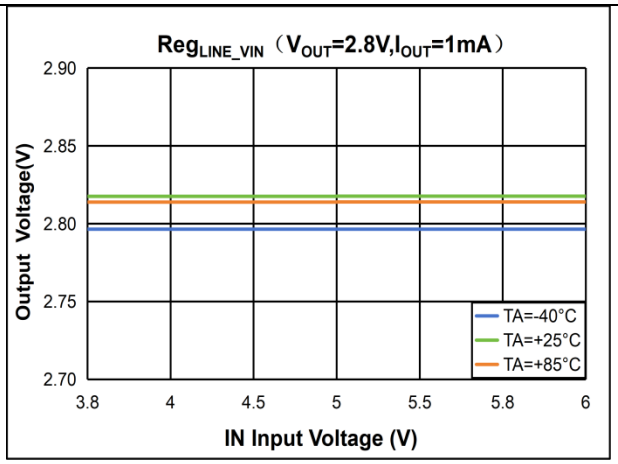
Supply Current VS Temperature



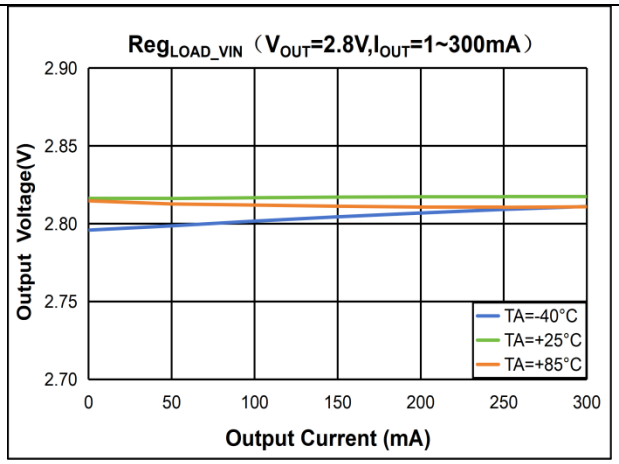
Shutdown Current VS Temperature



Dropout Voltage VS Output Current



Output Voltage VS Input Voltage

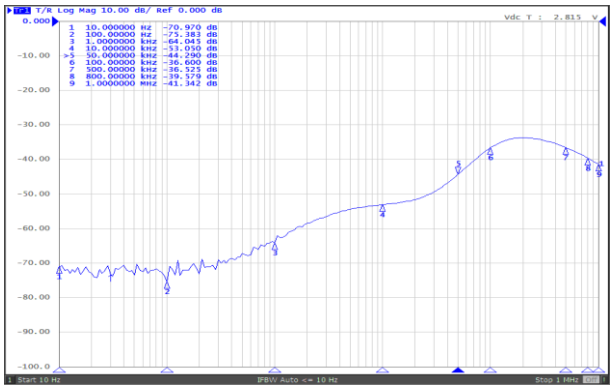


Output Voltage VS Output Current

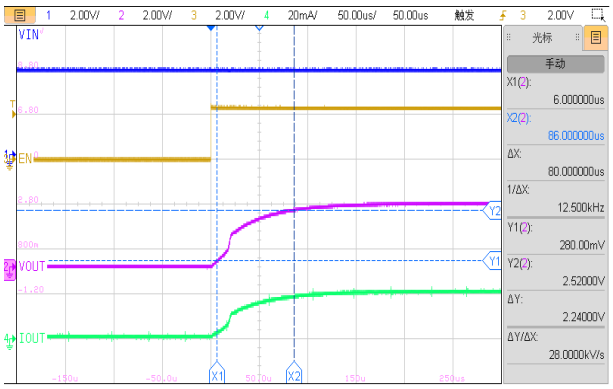
Typical Characteristics(Continued)

2.VOLTAGE VERSION 2.8V

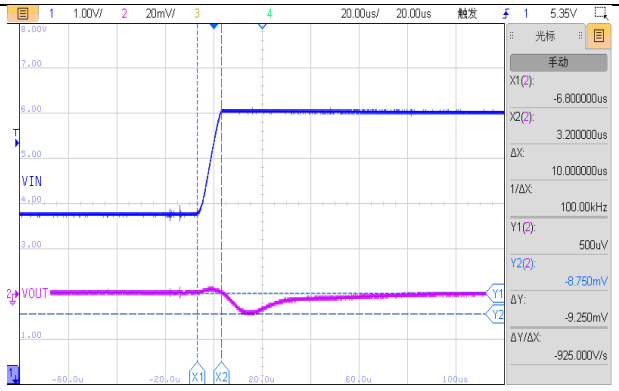
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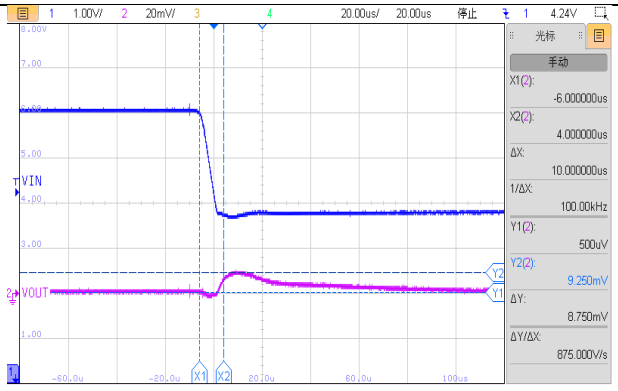
PSRR VS Output Current (I_{OUT} = 20mA)



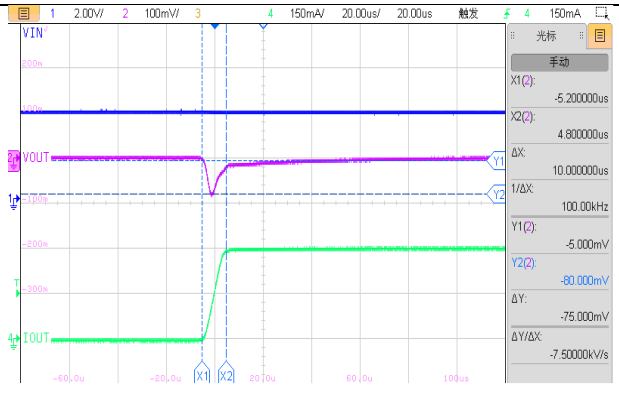
Turn On Speed VS EN Voltage (I_{OUT} = 20mA)



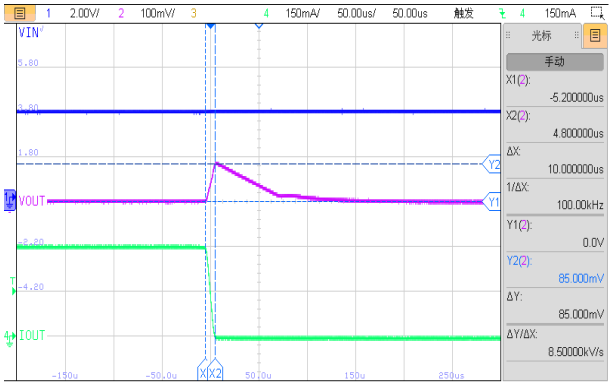
Line Transient Response
V_{IN} = 3.8V~6.0V, V_{OUT} = 2.8V, I_{OUT} = 1mA



Line Transient Response
V_{IN} = 6.0V~3.8V, V_{OUT} = 2.8V, I_{OUT} = 1mA

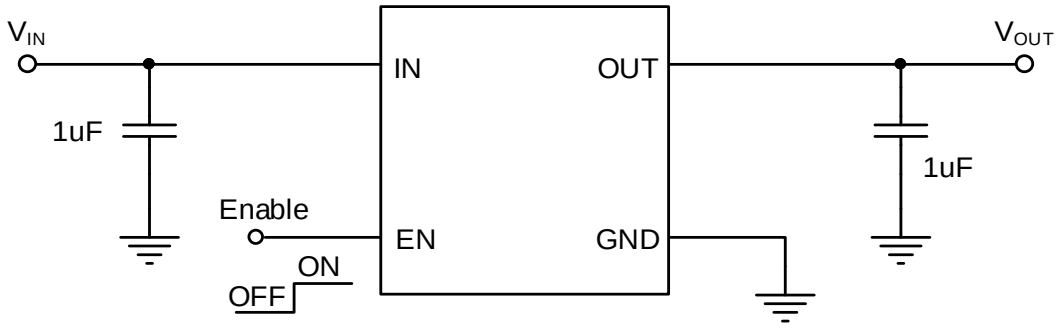


Load Transient Response
V_{IN} = 3.8V, V_{OUT} = 2.8V,
I_{OUT} = 1mA~300mA

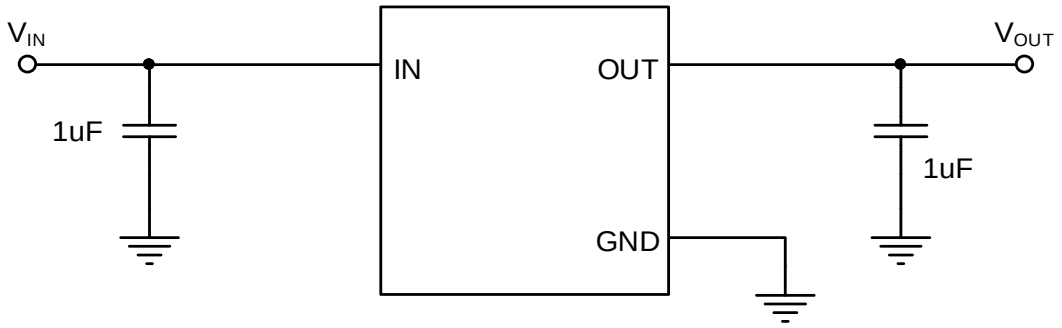


Load Transient Response
V_{IN} = 3.8V, V_{OUT} = 2.8V, I_{OU} = 300mA~1mA

Applications Information



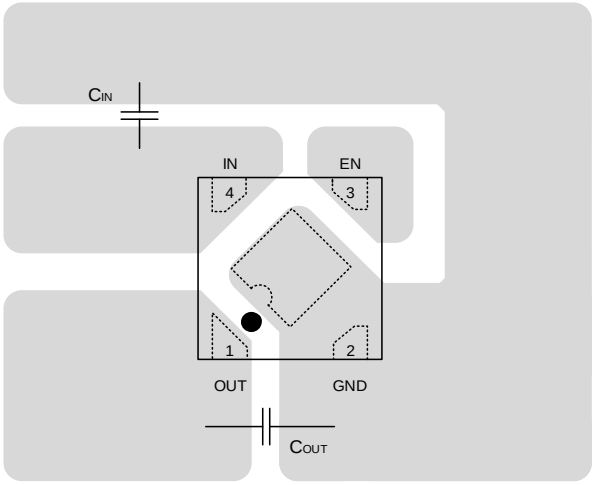
With EN function



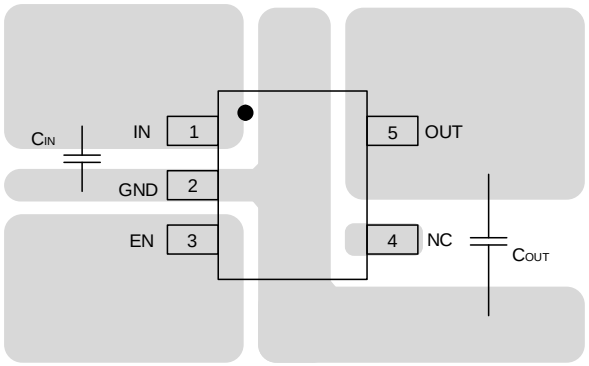
Without EN function

Figure3. Applications Information

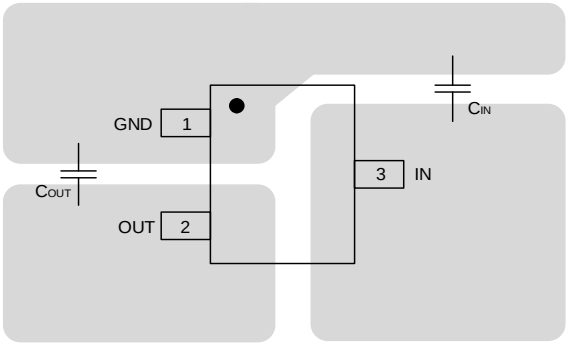
PCB Layout Guide



DFN4



SOT23-5

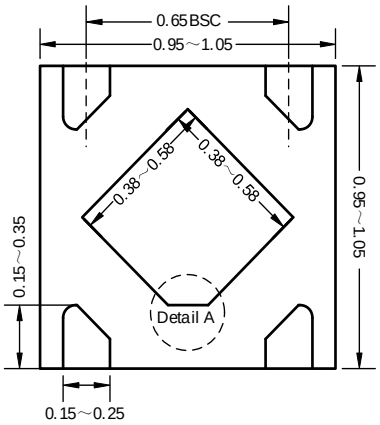


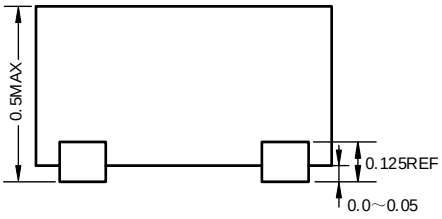
SOT23-3

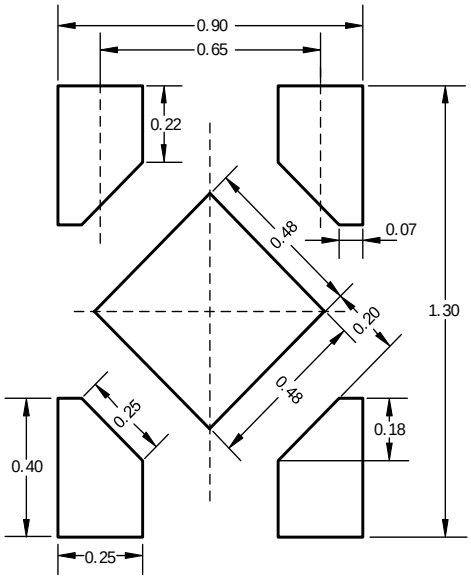
Figure. PCB Layout Guide

Package Dimension

DFN4 (1mm × 1mm)

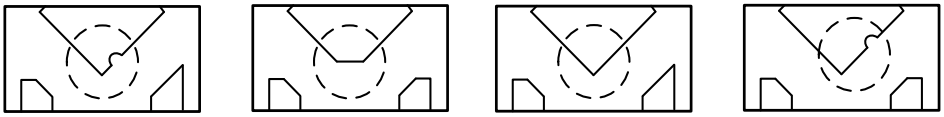






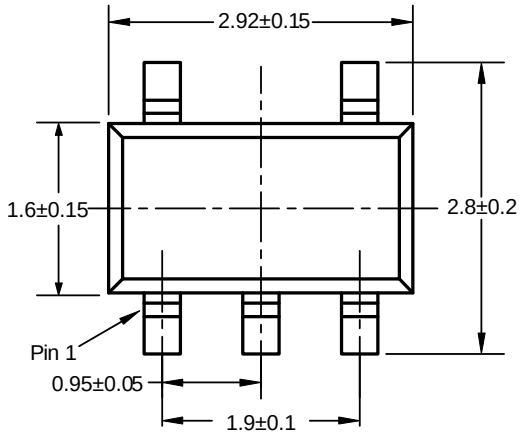
Recommended Land Pattern

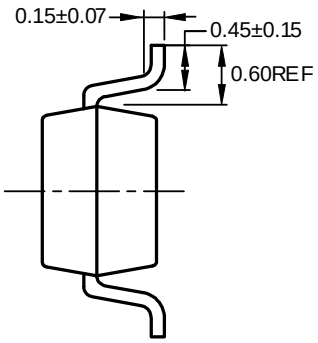
Detail A: (PIN1 shape)

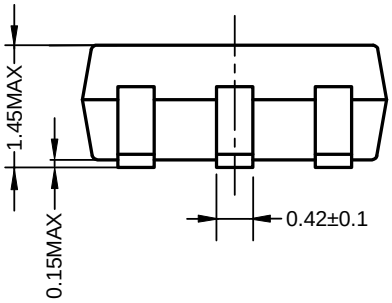


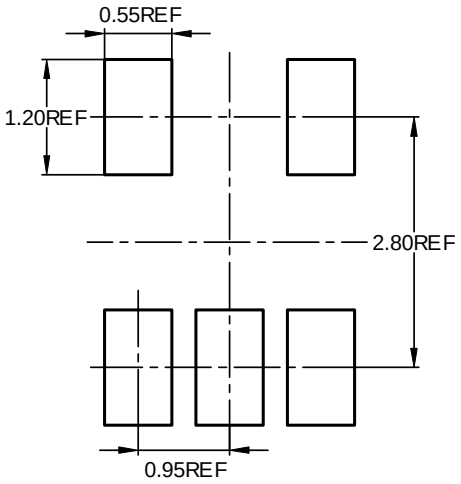
Unit: mm

SOT23-5





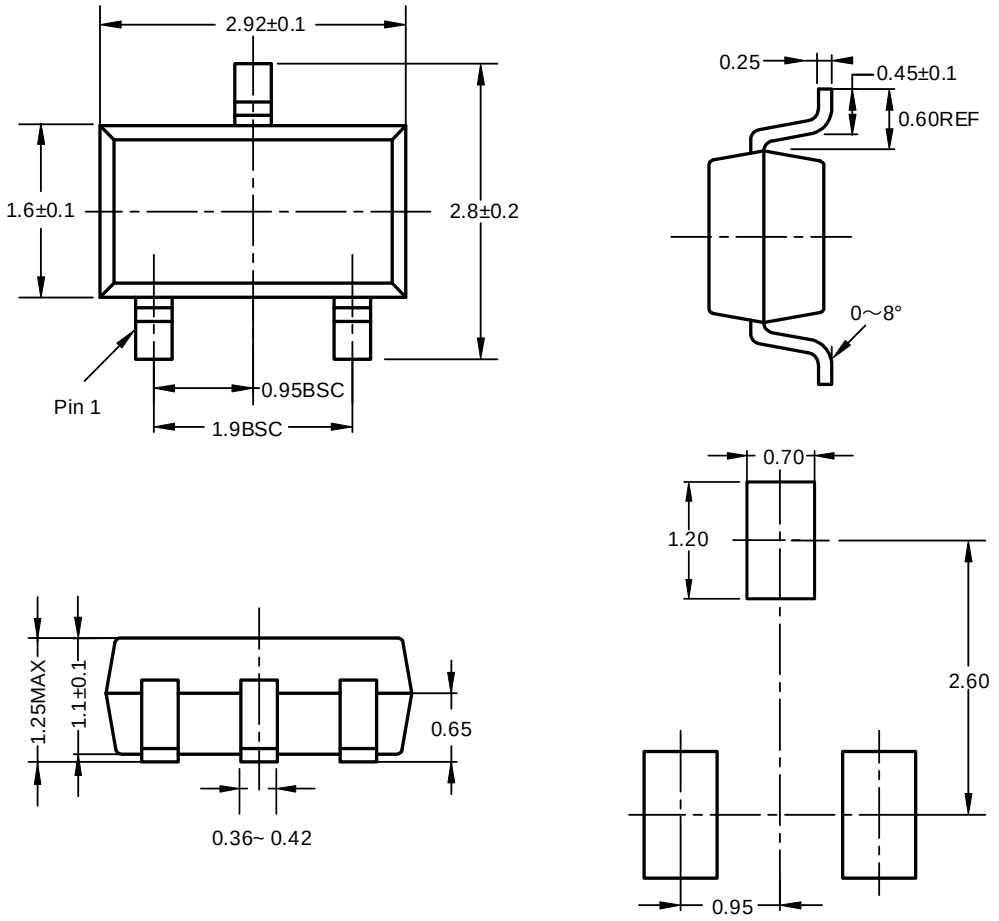




Recommended Land Pattern

Unit: mm

SOT23-3

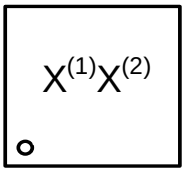


Recommended Land Pattern

Unit: mm

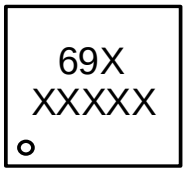
Marking

DFN4 Package



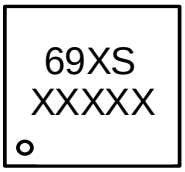
$X^{(1)}$ = Tracking Number
$X^{(2)}$ = V_{OUT} Version

SOT23-5 Package



X = V_{OUT} Version
XXXXX = Tracking Number

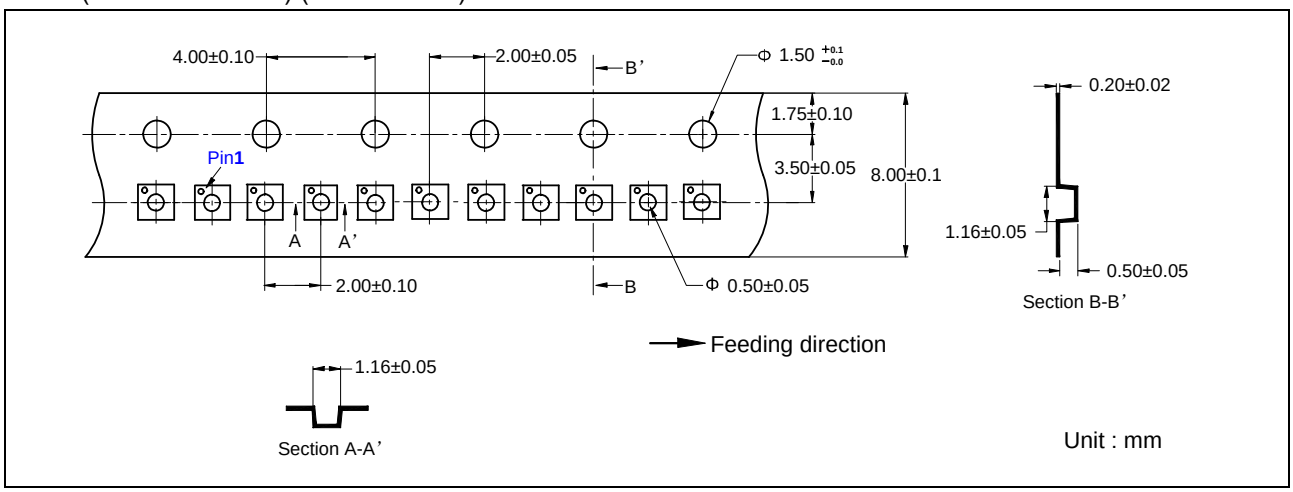
SOT23-3 Package



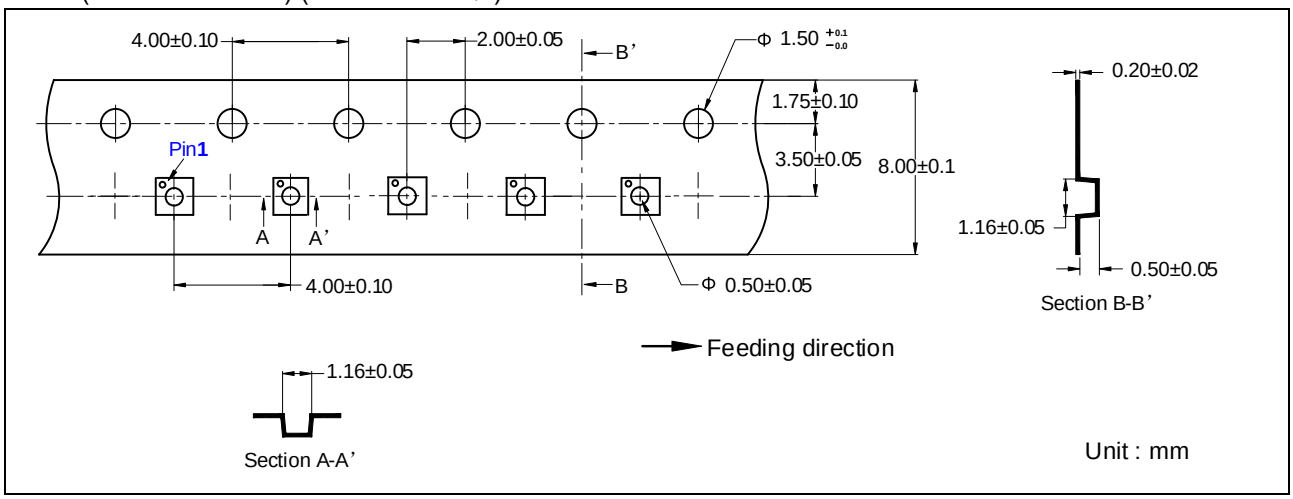
X = V_{OUT} Version
XXXXX = Tracking Number

Tape Information

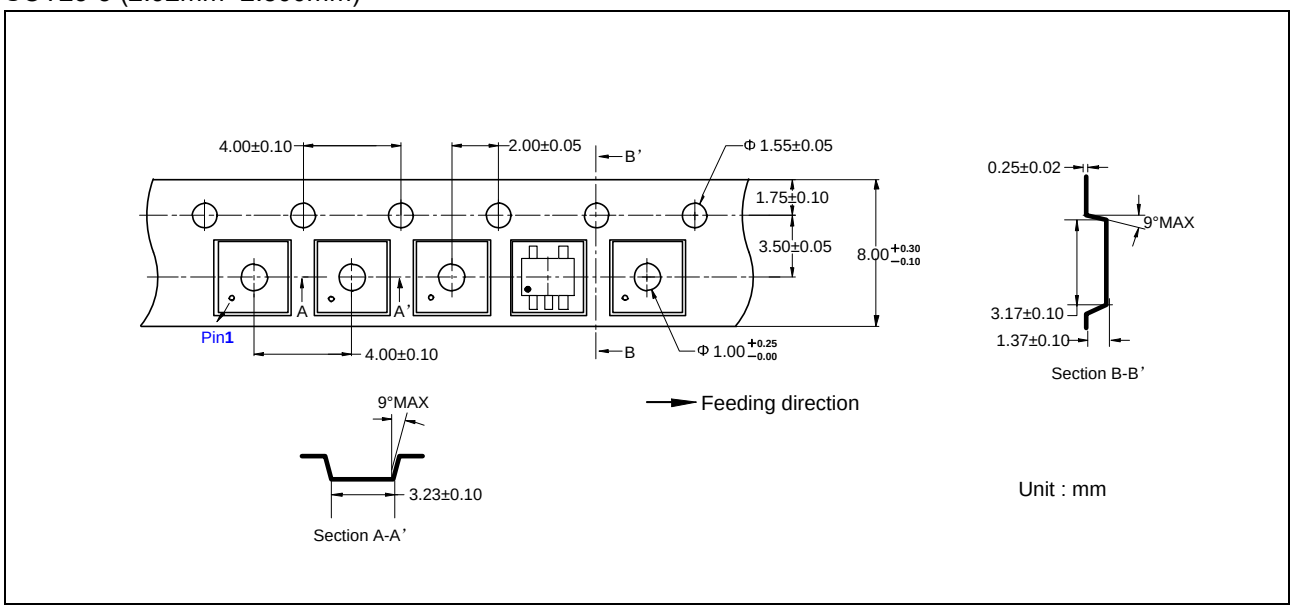
DFN4 (1.0mm × 1.0mm) (ET639XXYB)



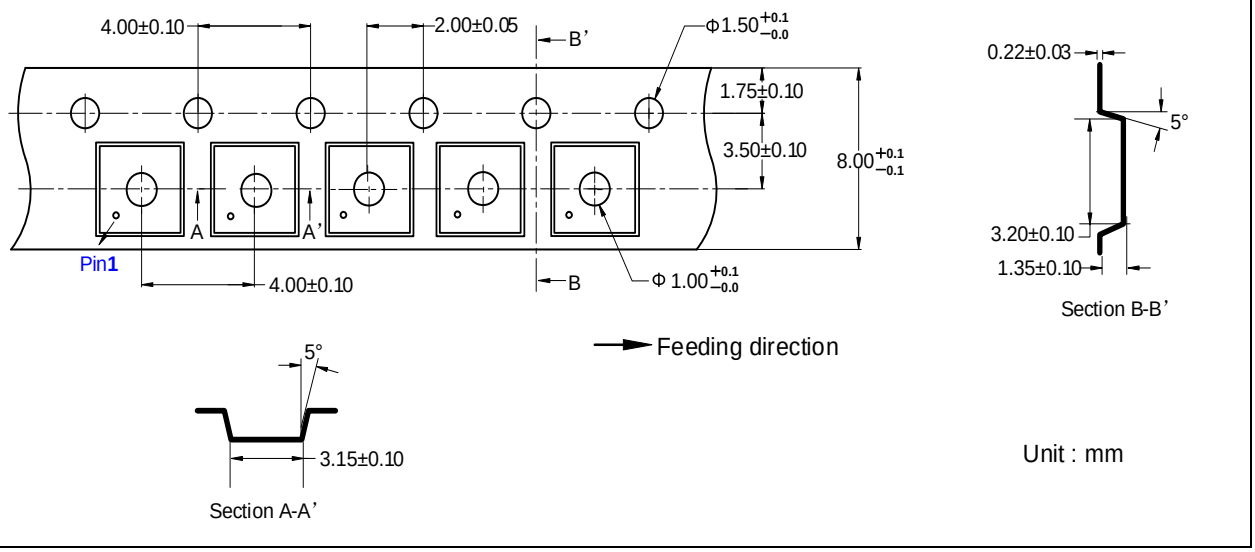
DFN4 (1.0mm × 1.0mm) (ET639XXYBQ1)



SOT23-5 (2.92mm×2.800mm)



SOT23-3



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2025-09-09	Official Version	Yangxiaoxu	Liuxm	Liujy
1.1	2026-01-07	Add Typical Characteristics	Wangqifan	Liuxm	Liujy
1.2	2026-01-20	Update Electrical Characteristics	Marj	Liuxm	Liujy
1.3	2026-03-02	Add Mark Specification	Wangqifan	Liuxm	Liujy
1.4	2026-05-28	Update Electrical Characteristics	Licheng	Liuxm	Liujy
1.4.a	2026-07-08	Add DFN4 Q1 Tape Type	Licheng	Liuxm	Liujy