ET634XX - Ultra-Low IQ 250mA LDO

General Description

The ET634XX 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 0.8uA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

The ET634XX family offered in small SOT23-5, DFN4(1mm×1mm) and DFN4(0.8mm×0.8mm) packages.

Features

- Operating Input Voltage Range from 1.8V to 5.5V
- Standard Fixed Output Voltage: 1.2V, 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V and 3.6V etc.
- Ultra-Low Quiescent Current Typical 0.8uA
- Low Dropout is Typical 330mV at 250mA@V_{OUT}=3.0V
- High Output Voltage Accuracy ±2%
- Stable with Ceramic Capacitors 0.1uF
- Over-Current Protection
- Thermal Shutdown Protection
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant
- With Auto-Discharging Function
- Offered SOT23-5, DFN4(1mm×1mm) and DFN4(0.8mm×0.8mm) packages

Applications

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

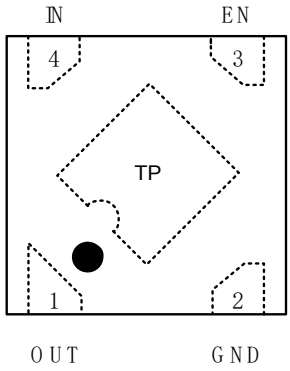
Device Information

ET 634 XX XX

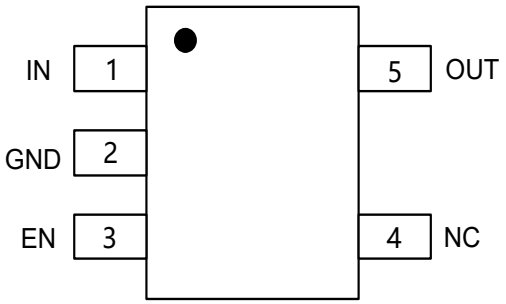
XX Output Voltage		XX Package Information	
XX	Output Voltage X.XV For example, 18 is 1.8V output	YB	DFN4(1mm×1mm)
		Y1B	DFN4(0.8mm×0.8mm)
		Blank	SOT23-5

Part No.	Package	Packing Option	MSL
ET634XXYB	DFN4(1mm×1mm)	Tape and Reel, 10K	1
ET634XXY1B	DFN4(0.8mm×0.8mm)	Tape and Reel, 10K	1
ET634XX	SOT23-5	Tape and Reel, 3K	3

Pin Configuration



DFN4(1×1) & DFN4(0.8×0.8)



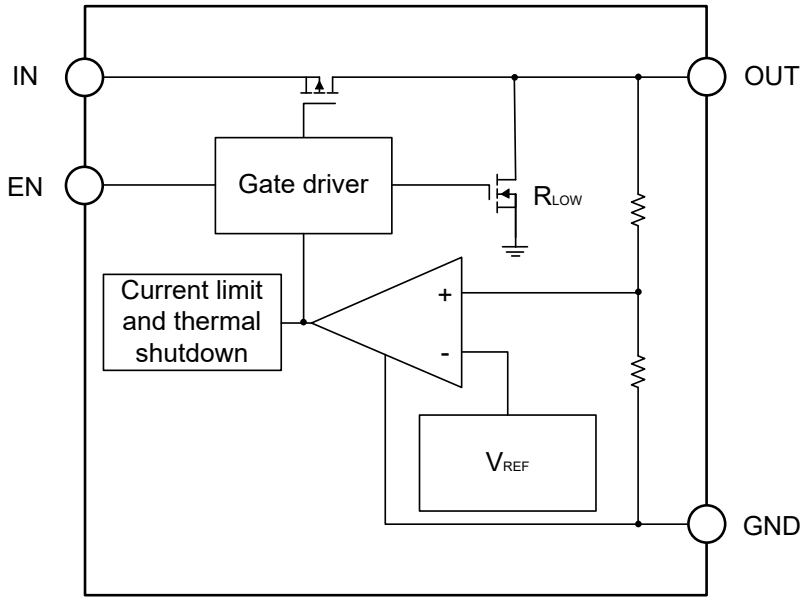
SOT23-5

Top View

Pin Function

Pin No.		Pin Name	Pin Function
DFN4	SOT23-5		
1	5	OUT	Output pin. A low-ESR capacitor should be connected to this pin to GND.
2	2	GND	Ground pin.
3	3	EN	Enable control input pin, active high. Do not leave EN floating
4	1	IN	Supply input pin. Must be closely decoupled to GND with a ceramic capacitor
TP		Thermal Pad	Thermal pad for DFN4 package, connect to GND or leave floating. Do not connect to any potential other than GND.
	4	NC	No connection.

Block Diagram



Functional Description

General

The ET634XX is a high performance 250mA linear regulator with ultra-Low IQ. 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 IQ consumption at no-load state. These parameters make this device very suitable for various battery powered applications.

Input Capacitor

It is recommended to connect at least a 0.1μF 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 Capacitor

It is recommended to connect at least a 0.1μF Ceramic X5R or X7R capacitor between OUT 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.

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

ON/OFF Input Operation

The ET634XX 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 0.4V the device is guaranteed to be disable. The active discharge transistor at the devices with Active Discharge Feature is activated and the output voltage V_{OUT} is pulled to GND through an internal circuitry with effective resistance about 80Ω.

If the EN pin voltage is higher than 1.4V 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 550mA to prevent over-current and to protect the regulator from damage due to overheating.

Thermal shutdown Protection

When the die temperature exceeds the Thermal Shutdown point (T_{TSD} = 150°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 ET634XX device can handle is given by:

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{R_{\theta JA}}$$

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	Parameters (Items)	Value	Unit
V_{IN}	IN pin Voltage(1)	-0.3 to 6.0	V
V_{EN}	EN Pin Voltage	-0.3 to 6.0	V
V_{OUT}	OUT pin Voltage	-0.3 to 5.0	V
T_{JMAX}	Maximum Junction Temperature	150	°C
T_{STG}	Storage Temperature	-65 to 150	°C
V_{ESD}	Human Body Model ESD(JESD22-A114)	±2000	V
	Charged Device Model ESD(JESD22-C101)	±1000	
I_{LU}	Latch up Current Maximum Rating (JESD78E)	±200	mA

***Note1*:** Refer to Electrical Characteristic and Application Information for safe operating area.

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	DFN4(1mm×1mm)	Thermal Characteristics, Thermal Resistance, Junction-to-Air	250	°C/W
	DFN4(0.8mm×0.8mm)		330	
	SOT23-5		250	
P_D	DFN4(1mm×1mm)	Power Dissipation in Still Air at 25°C	400	mW
	DFN4(0.8mm×0.8mm)		300	
	SOT23-5		400	

Recommended Operating Conditions

Symbol	Parameters	Rating	Unit
V_{IN}	Input Voltage	1.8 to 5.5	V
I_{OUT}	Output Current	0 to 250	mA
T_A	Operating Ambient Temperature	-40 to 85	ºC
C_{IN}	Effective Input Ceramic Capacitor Value	0.1 to 4.7	μF
C_{OUT}	Effective Output Ceramic Capacitor Value	0.1 to 4.7	μF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

Electrical Characteristics

(V_{IN}=V_{OUT}+1V, V_{EN} =1.2V, I_{OUT}=1mA, C_{IN}=0.1μF, C_{OUT}=0.1μF, T_A=25°C, unless otherwise stated) [2]

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage Range		1.8		5.5	V
V_{DROP}	Dropout Voltage	V_{OUT}=1.8V, I_{OUT}=250mA		430	650	mV
		V_{OUT}=3.0V, I_{OUT}=250mA		330	500	mV
I_{Q_ON}	Input Quiescent Current	Active mode: V_{EN}=V_{IN}		0.8		μA
$I_{Q\ OFF}$	Input Shutdown Current	V_{EN}=0V		0.01	1	μA
V_{OUT}	Regulated Output Voltage	I_{OUT}=1mA, -40°C≤T_A≤85°C	-2		2	%
Reg_{LINE}	Output Voltage Line Regulation	V_{IN}=V_{OUT}+1V to 5.5V, I_{OUT}=10mA		0.01	0.2	%/V
Reg_{LOAD}	Output Voltage Load Regulation	I_{OUT} from 0mA to 250mA		15	30	mV
t_S	Soft-start Time	V_{OUT}=1.8V		350		μs
		V_{OUT}=3.0V		500		
I_{LIMIT}	Current Limit		250	550		mA
I_{SHORT}	Short Current Limit	V_{OUT}=0V		120		mA
PSRR[3]	Power Supply Rejection Ratio	f=1kHz, C_{OUT}=0.1μF, I_{OUT}=20mA		62		dB
		f=10kHz, C_{OUT}=0.1μF, I_{OUT}=20mA		50		dB
e_N[3]	Output Noise	10Hz to 100kHz, I_{OUT}=20mA, V_{OUT}=3.0V		80		$μV_{RMS}$
V_{IL}	EN Low Threshold	V_{IN}=1.8V to 5.5V, V_{EN} falling until the output is disabled			0.4	V
V_{IH}	EN High Threshold	V_{IN}=1.8V to 5.5V, V_{EN} rising until the output is enabled	1.4			V
I_{EN}	EN Pin Input Current	V_{EN}=0V		0	0.1	μA
R_{LOW}	Output Resistance of Auto Discharge at Off State	EN=0V, V_{IN}=4V, I_{OUT}=1mA		2.5		kΩ
T_{SD}[3]	Over-temperature Shutdown Threshold	T_J rising		150		°C
T_{HYS}[3]	Over-temperature Shutdown Hysteresis	T_J falling from shutdown		25		°C

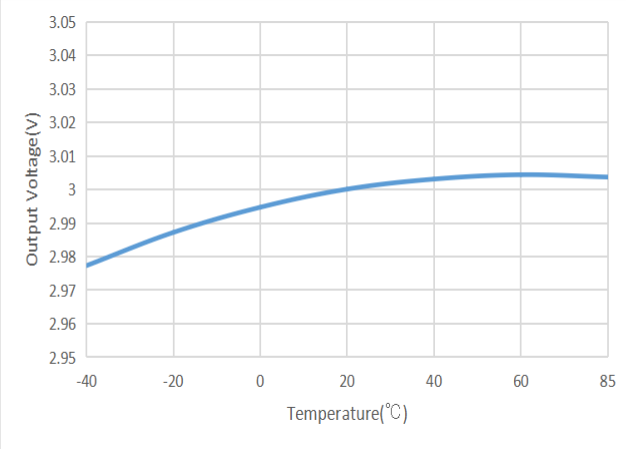
***Note2*:** Production test at 25°C. Specifications over the temperature range are guaranteed by design and characterization.

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

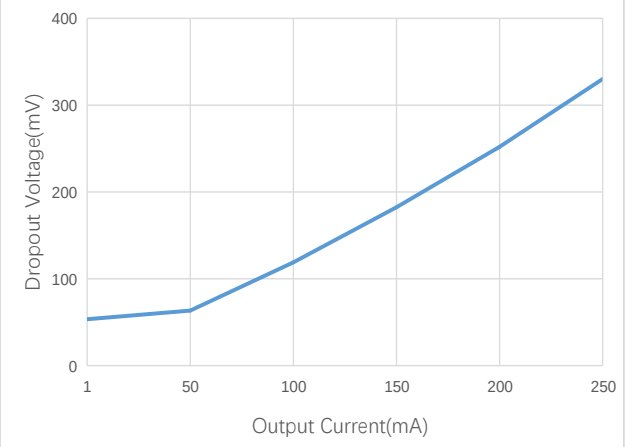
Typical Characteristics

ET63430 VERSION

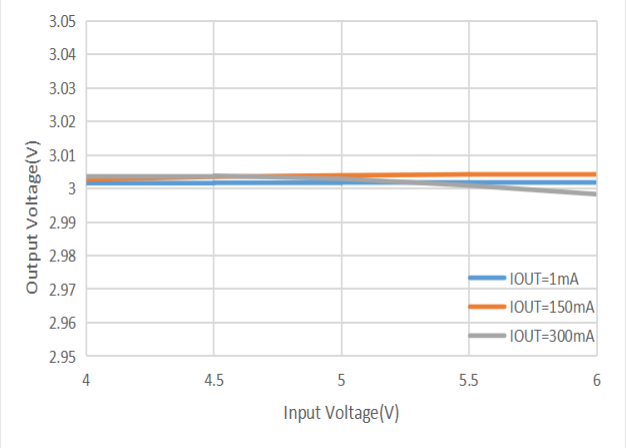
(V_{IN}=4.0V, I_{OUT}=1mA, C_{IN}=C_{OUT}=0.1μF, unless otherwise noted. Typical values are at T_A=+25°C.)



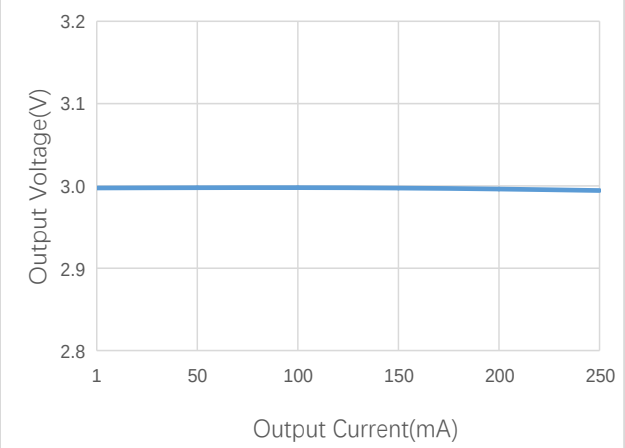
Output Voltage VS Temperature



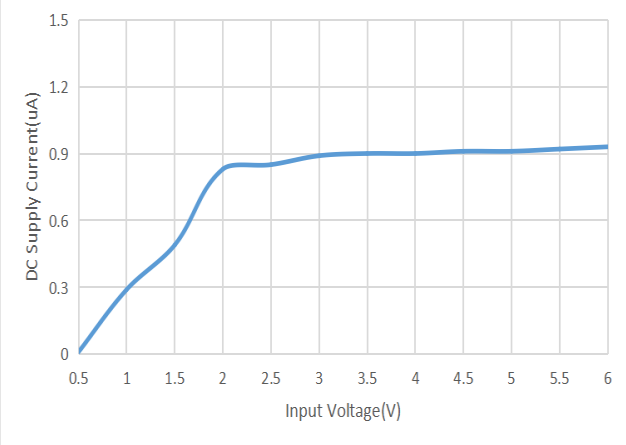
Dropout Voltage VS Output Current



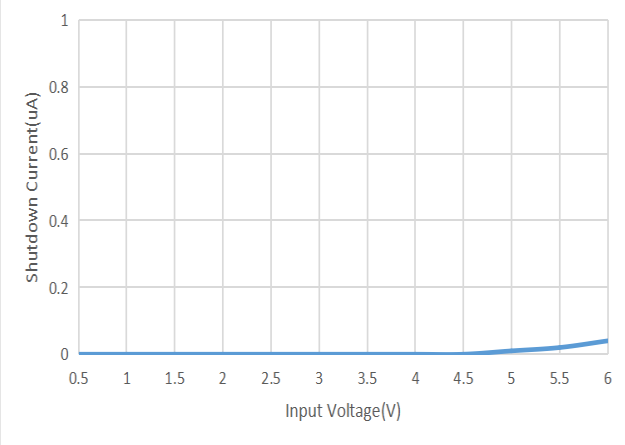
Output Voltage VS Input Voltage



Output Voltage VS Output Current

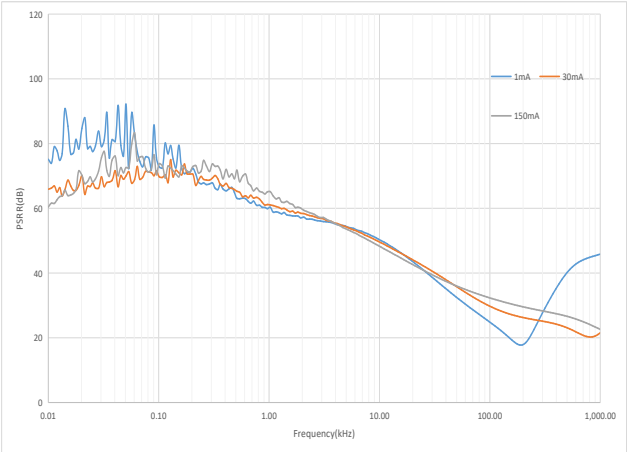


Supply Current VS Input Voltage

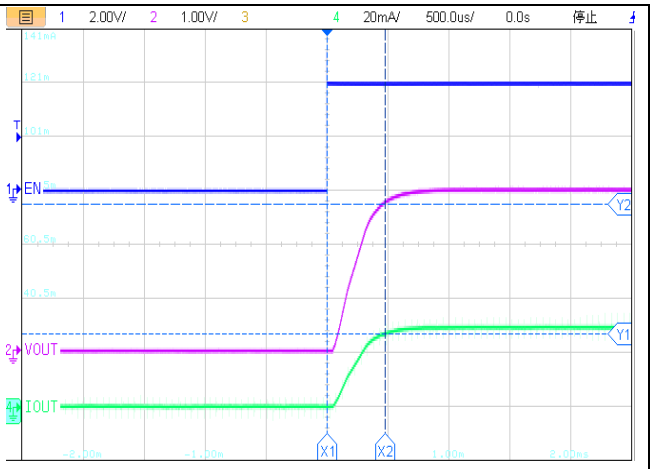


Shutdown Current VS Input Voltage

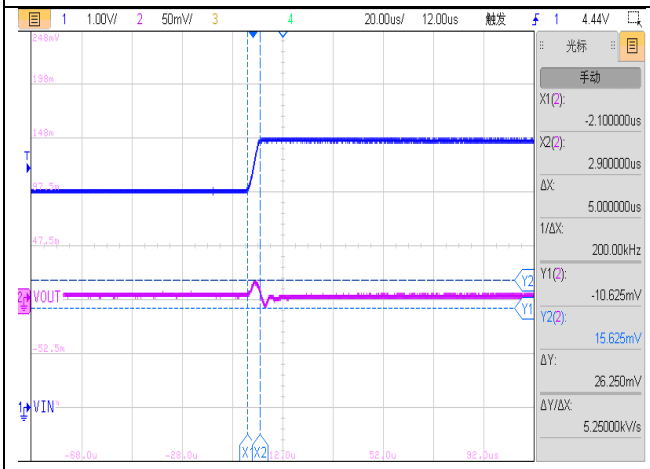
Typical Characteristics (Continued)



PSRR VS Output Current

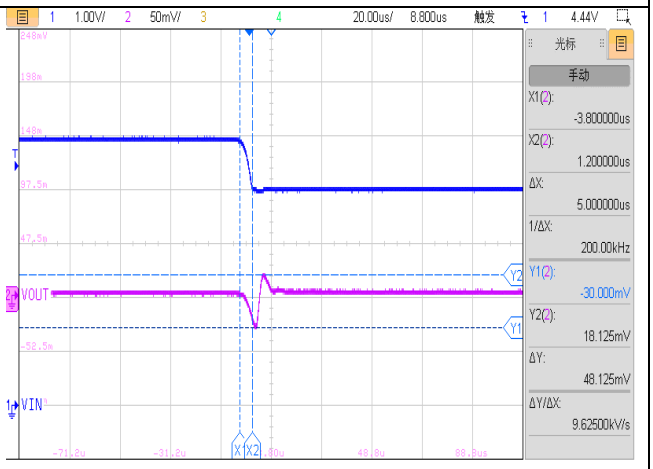


Turn On Speed VS EN Voltage (I_{OUT}=30mA)



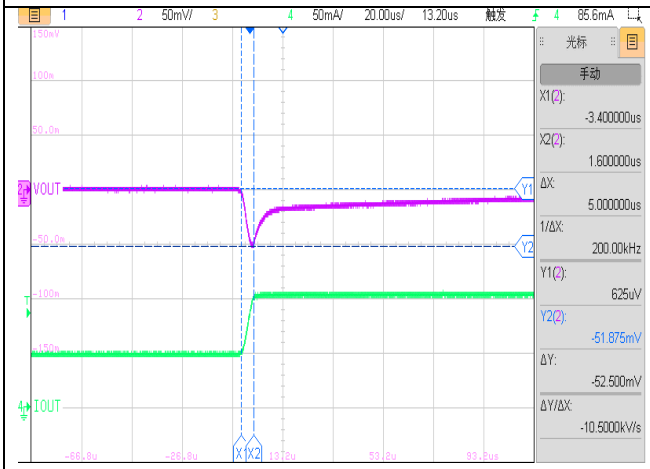
Line Transient Response

V_{IN}=4V~5.5V, V_{OUT}=3.3V, I_{OUT}=1mA



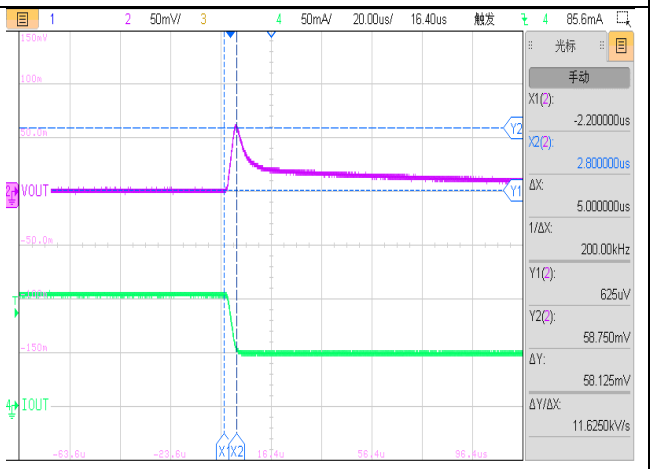
Line Transient Response

V_{IN}=5.5V~4V, V_{OUT}=3.3V, I_{OUT}=1mA



Load Transient Response

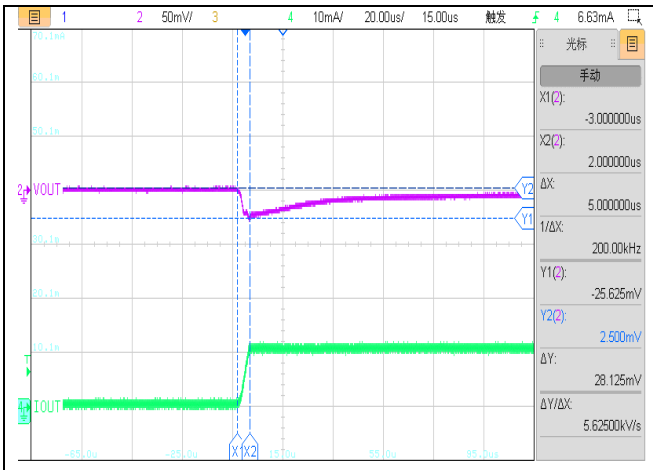
V_{IN}=4V, V_{OUT}=3V, I_{OUT}=5mA~100mA, t=5us



Load Transient Response

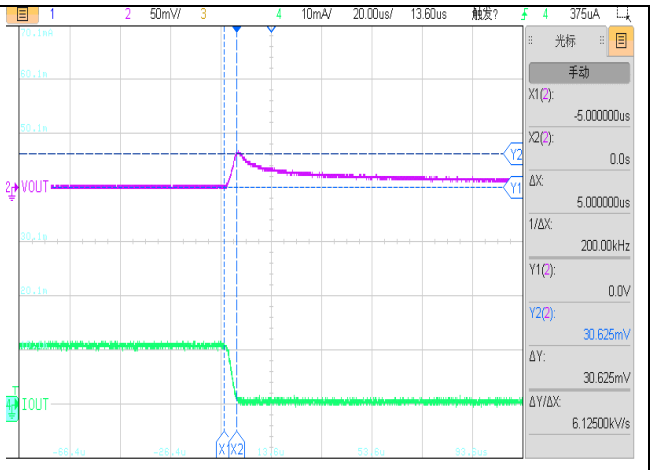
V_{IN}=4V, V_{OUT}=3V, I_{OUT}=100mA~50mA, t=5us

Typical Characteristics (Continued)



Load Transient Response

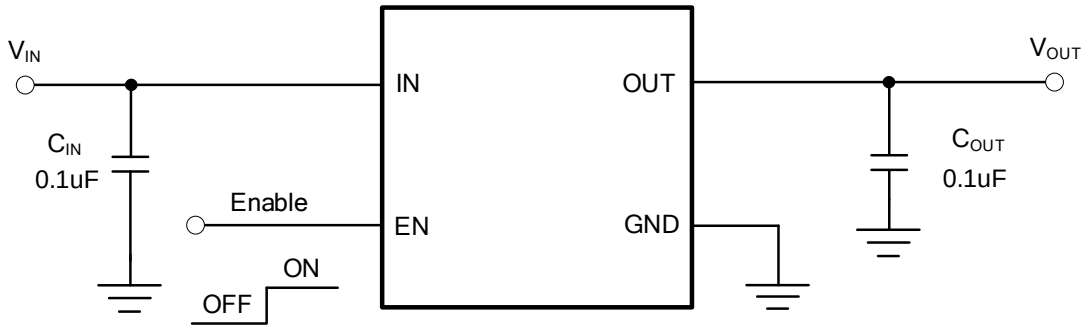
V_{IN}=4V, V_{OUT}=3V, I_{OUT}=1mA~10mA, t=5us



Load Transient Response

V_{IN}=4V, V_{OUT}=3V, I_{OUT}=10mA~1mA, t=5us

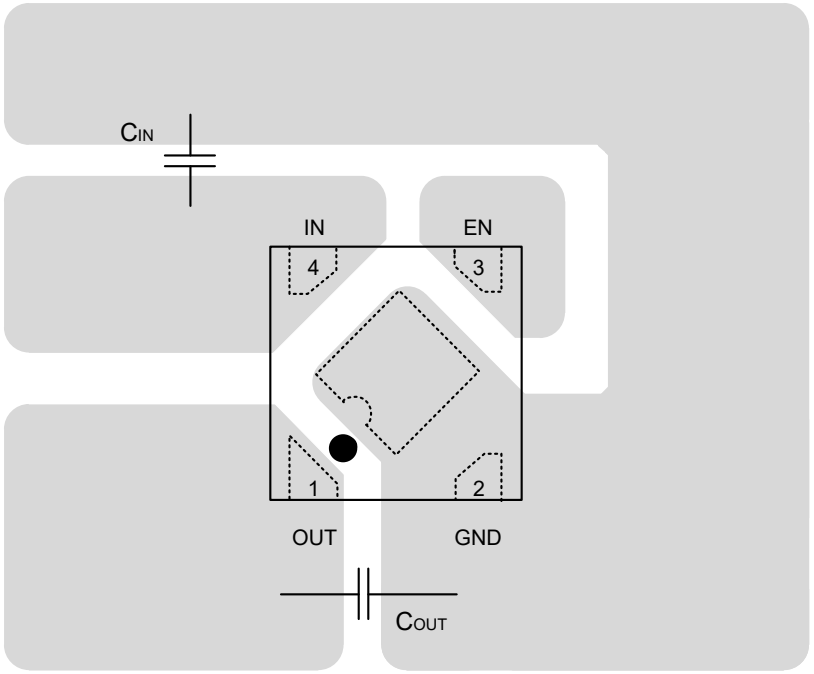
Application Circuits



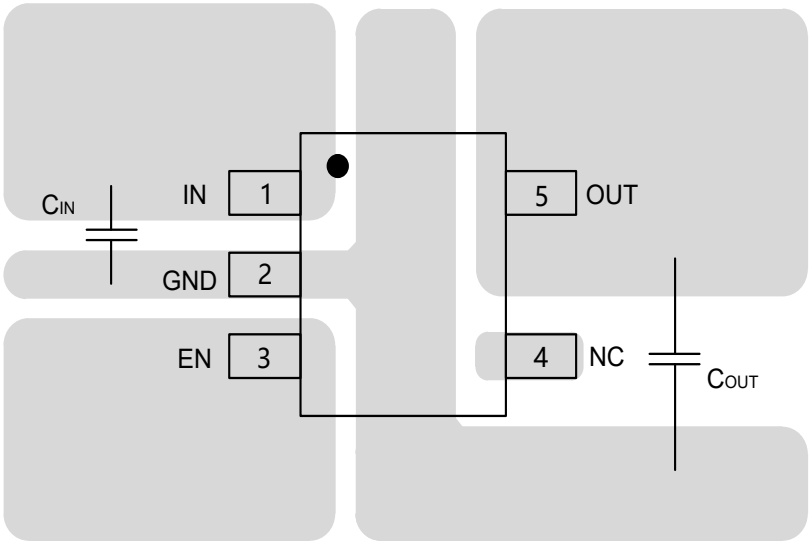
Reference Application Circuit

PCB Layout Guide

DFN4

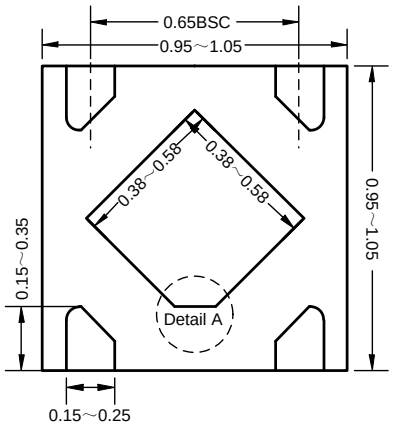


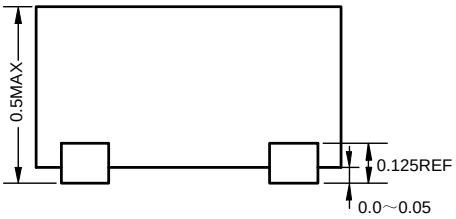
SOT23-5

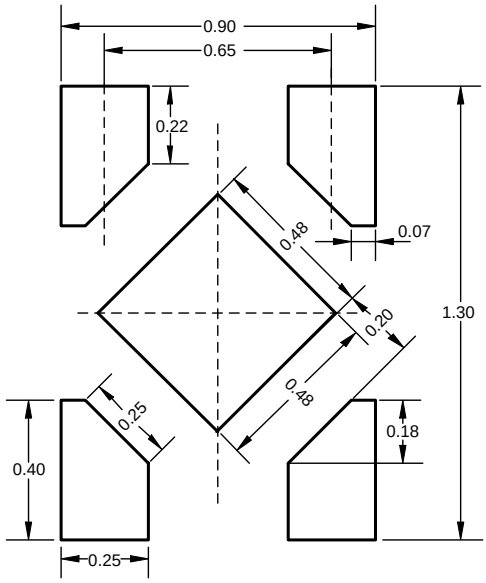


Package Dimension

DFN4(1.0×1.0)

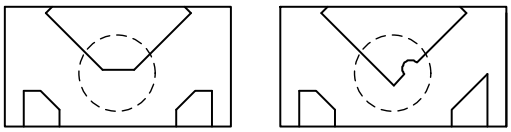






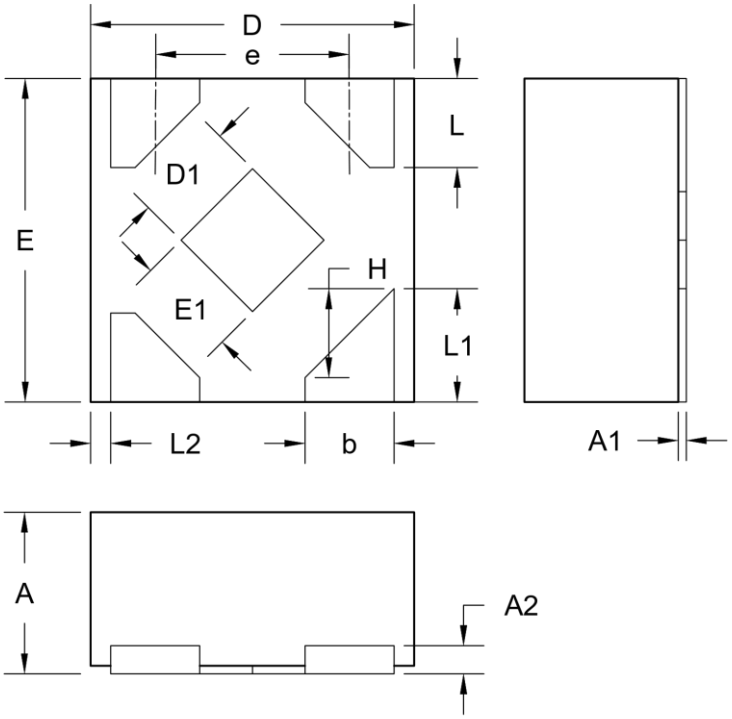
Recommended Land Pattern

Detail A: (PIN1 shape)



Unit: mm

DFN4(0.8×0.8)

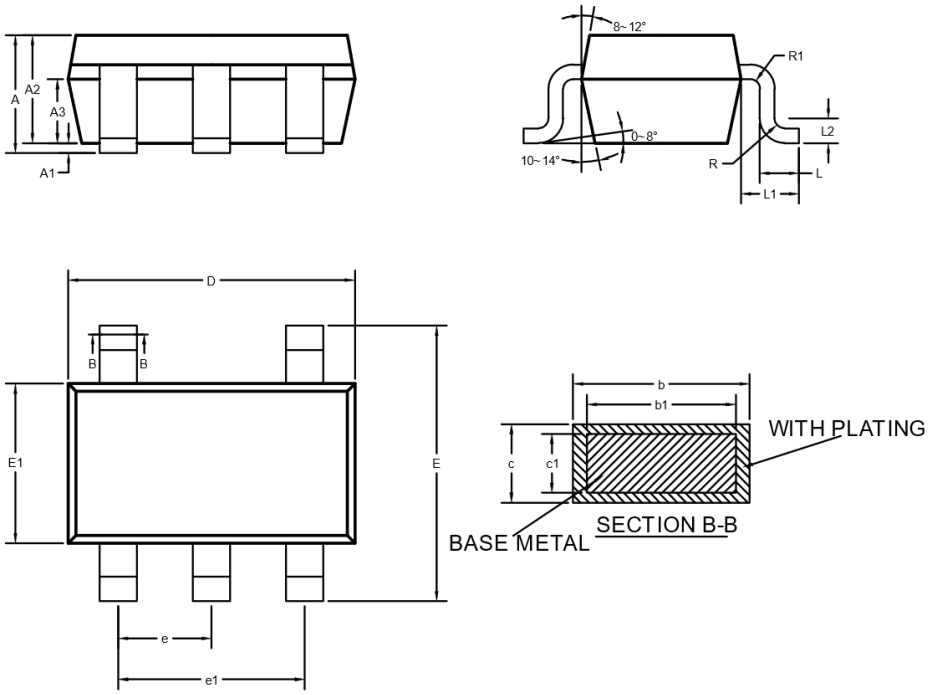


COMMON DIMENSIONS

(Unit: mm)

SYMBOL	MIN	NOM	MAX
A	0.34	0.37	0.40
A1	0.00	0.02	0.05
A3		0.10REF	
b	0.17	0.22	0.27
D	0.75	0.80	0.85
E	0.75	0.80	0.85
D1	0.20	0.25	0.30
E1	0.20	0.25	0.30
e	0.43	0.48	0.53
H		0.22REF	
L	0.17	0.22	0.27
L1	0.18	0.28	0.38
L2		0.05REF	

SOT23-5

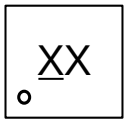
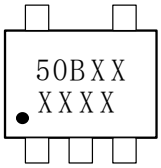


COMMON DIMENSIONS

(Unit: mm)

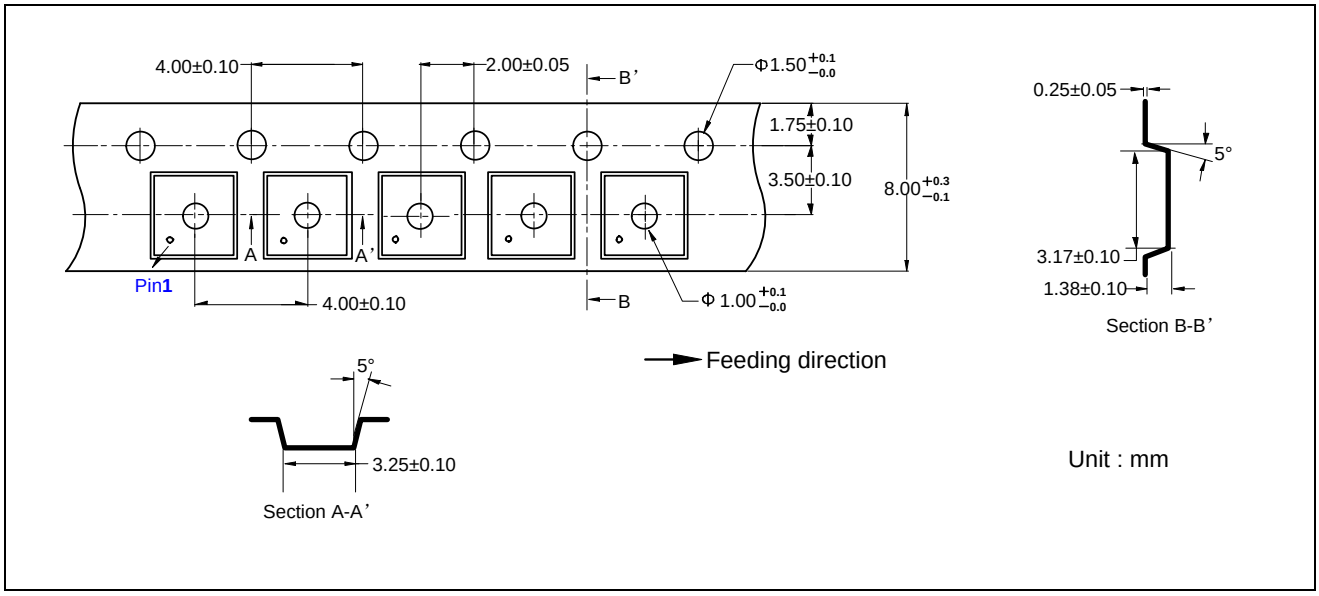
SYMBOL	MIN	NOM	MAX
A	—	—	1.250
A1	0	—	0.150
A2	1.000	1.100	1.200
A3	0.600	0.650	0.700
b	0.360	—	0.450
b1	0.350	0.380	0.410
c	0.140	—	0.200
c1	0.140	0.150	0.160
D	2.826	2.926	3.026
E	2.600	2.800	3.000
E1	1.526	1.626	1.726
e	0.900	0.950	1.000
e1	1.800	1.900	2.000
L	0.300	0.300	0.500
L1	0.590REF		
L2	0.250BSC		
R	0.050	—	0.200
R1	0.050	—	0.200

Marking

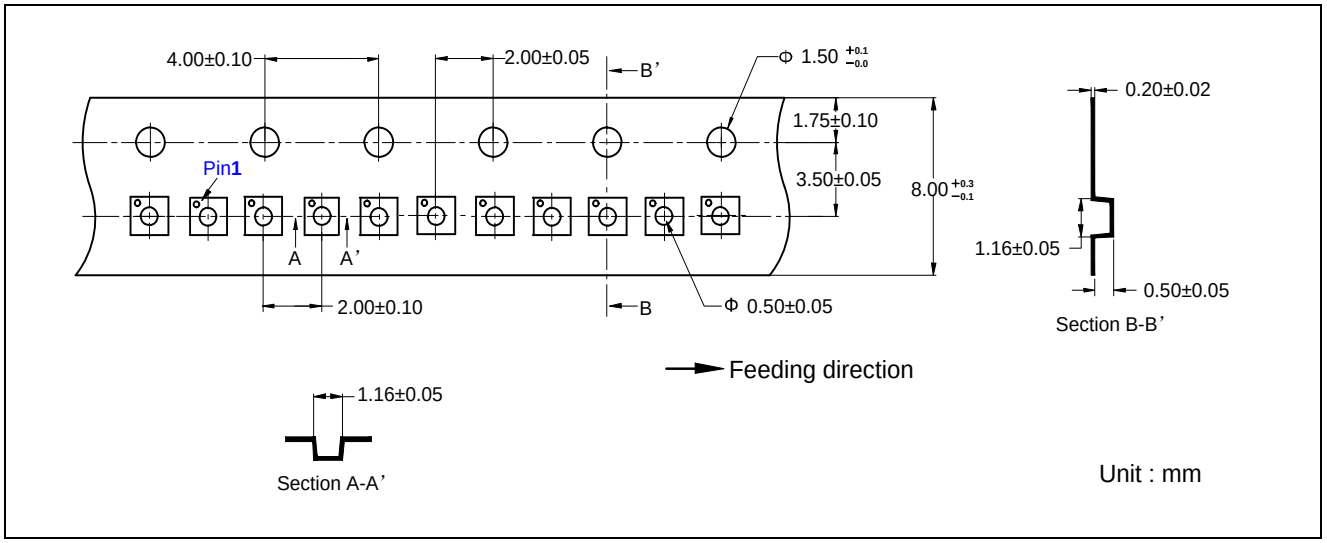
DFN4	SOT23-5
	
$X^{(1)}$ = Track Number $X^{(2)}$ = V_{OUT} Version	50BXX - Part Number. (XX=V_{OUT} Version) XXXX - Tracking Number.

Tape Information

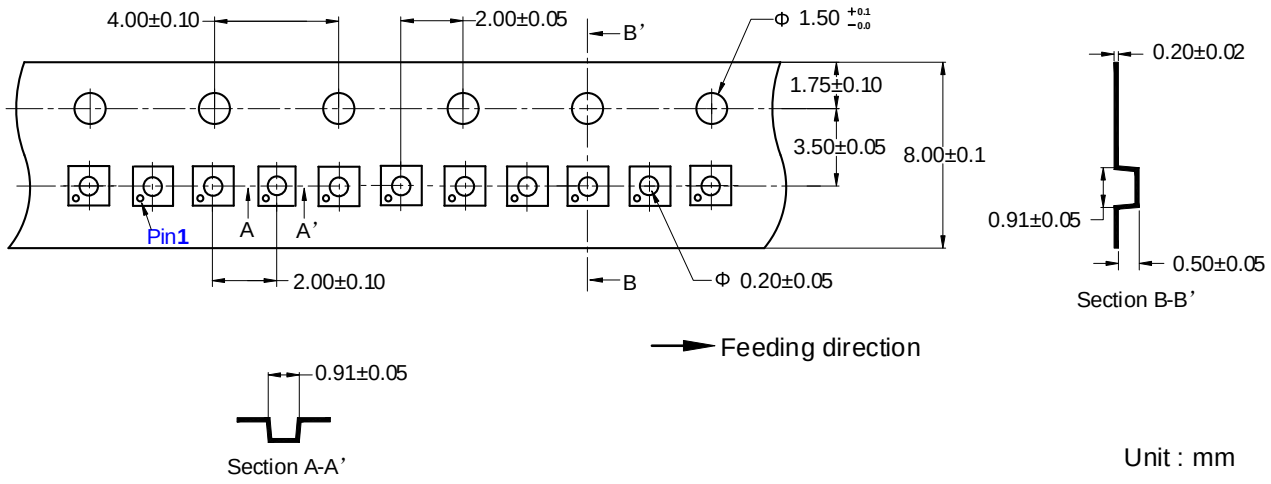
SOT23-5



DFN4(1.0×1.0)



DFN4(0.8×0.8)



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2023-04-25	Preliminary Version	Licheng	Liuxm	Liujy
1.0	2023-07-08	Official Version	Licheng	Liuxm	Liujy
1.1	2023-08-08	Update Date	Tugz	Liuxm	Liujy
1.2	2023-10-9	Update Package	Tugz	Liuxm	Liujy
1.3	2023-10-16	Add Tape Information DFN4（0.8*0.8）	Yang xiaoxu	Liuxm	Liujy
1.4	2025-04-23	Add Packing Option	Yang xiaoxu	Liuxm	Liujy
1.5	2025-10-23	Add SOT23-5 Marking	Pengjj	Liuxm	Liujy