ET633XXS - Ultra-Low IQ 300mA LDO

General Description

The ET633XXS 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 0.6uA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

The device is available in small SOT23-3 packages.

Features

- Operating Input Voltage Range From 2.2V to 5.5V
- Fixed Output Voltage 1.2V,1.8V,2.8V,3.0V,3.3V etc, (Range From 1.1V to 3.6V , 0.05V Steps)
- Ultra-Low Quiescent Current Typical 0.6uA
- Low Dropout is Typical 450mV at 300mA@V_{OUT}=1.8V
- High Output Voltage Accuracy ±2%
- Stable with Ceramic Capacitors 1uF
- Over-Current Protection
- Thermal Shutdown Protection
- Available in Small SOT23-3 Packages
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

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

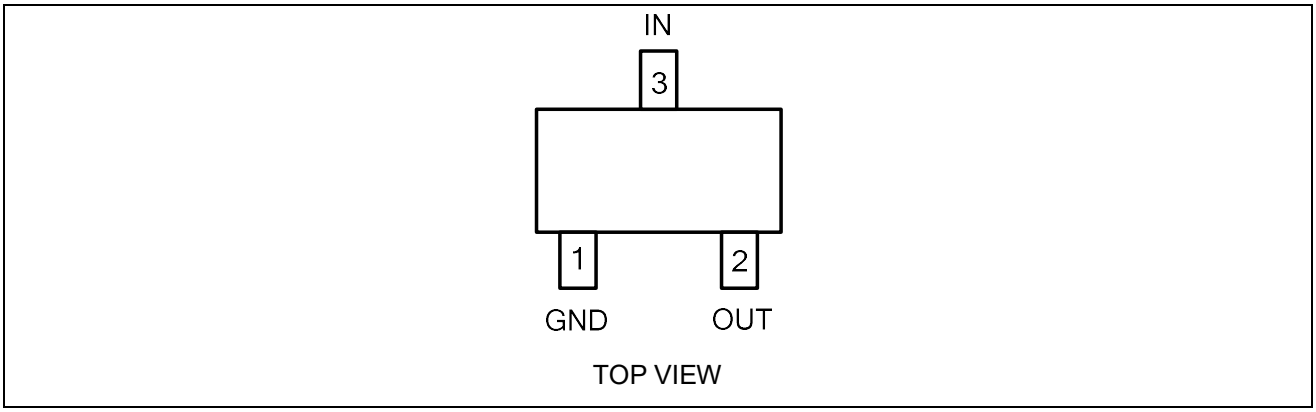
Device Information

Part No.	Package	MSL
ET633XXS	SOT23-3	3

ET 633 XX S

XX Output Voltage		S Package	
XX	Output Voltage For example, 18 is 1.8V output	S	SOT23-3

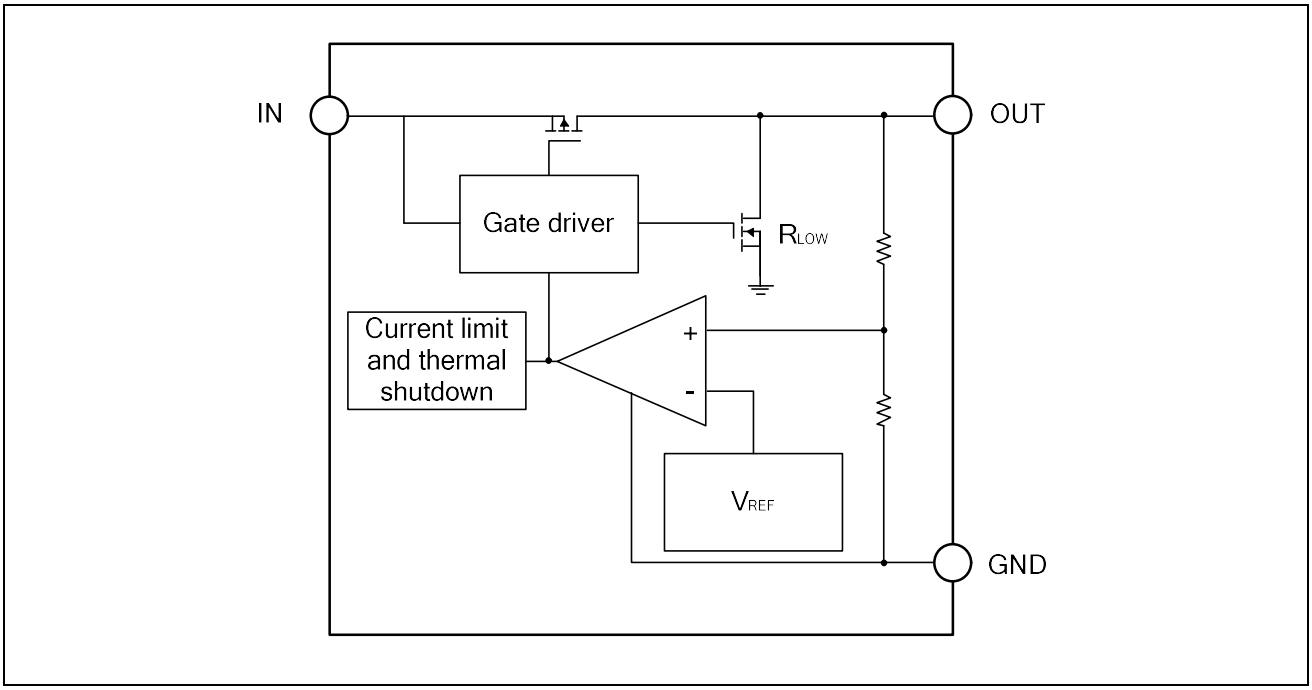
Pin Configuration



Pin Function

Pin No.	Symbol	Description
1	GND	Power Supply Ground
2	OUT	Output Pin
3	IN	Power Supply Input Voltage

Block Diagram



Functional Description

The ET633XXS is a high performance 300mA 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 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 ET633XXS 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.

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_{SD} = 155°C typical) the device goes to disabled state and the output voltage is not delivered until the die temperature decreases to 130°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 ET633XXS 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}	Input Voltage (1)	6.0	V
V_{OUT}	Output Voltage	-0.3 to V_{IN} + 0.3	V
$T_{J(MAX)}$	Maximum Junction Temperature	150	°C
T_{STG}	Storage Temperature	-65 to 150	°C
V_{ESD}	Human Body Model (2)	±2000	V
	Charged Device Model (2)	±1500	V
I_{LU}	Latch up Current Maximum Rating (2)	±200	mA

Note1: Refer to ELECTRICAL CHARACTERISTIS 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 EIA/JESD22-A114
- ESD Charged Device Model tested per JESD22-C101
- Latch up Current Maximum Rating tested per JEDEC78

Thermal Characteristics

Symbol	Rating	Value	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Air package	350	°C/W
P_D	Power Dissipation Max	350	mW

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	2.2 to 5.5	V
I_{OUT}	Output Current	0 to 300	mA
T_A	Operating Ambient Temperature	-40 to 85	°C
C_{IN}	Effective Input Ceramic Capacitor Value	0.47 to 4.7	uF
C_{OUT}	Effective Output Ceramic Capacitor Value	0.47 to 4.7	uF
ESR	Input and Output Capacitor Equivalent Series Resistance	5 to 100	mΩ

Electrical Characteristics

(V_{IN}=V_{OUT}+1V, I_{OUT}=1mA, C_{IN}=C_{OUT}=1.0μF, 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		2.2		5.5	V
V_{OUT}	Output Voltage	−40℃ ≤ T_A ≤ 85℃	-2%		2%	V
$Line_{Reg}$	Line Regulation	2.5V ≤ V_{IN} ≤ 5.5V (V_{OUT}≤1.5V) V_{OUT}+1V ≤ V_{IN} ≤ 5.5V (V_{OUT}≥1.5V) I_{OUT} = 1mA		0.05	0.20	%/V
$Load_{Reg}$	Load Regulation	1mA ≤ I_{OUT} ≤ 300mA, V_{IN} = 2.5V (V_{OUT}≤1.5V) or V_{OUT}+1V(V_{OUT}≥1.5V)		5	20	mV
V_{DROP}	Dropout Voltage[4] [6]	V_{OUT}=1.2V, I_{OUT} = 300mA			1000	mV
		V_{OUT}=1.5V, I_{OUT} = 300mA			700	
		V_{OUT}=1.8V, I_{OUT} = 300mA		450	600	
		V_{OUT}=2.5V, I_{OUT} = 300mA		380	530	
		V_{OUT}=2.8V, I_{OUT} = 300mA		350	500	
		V_{OUT}=3.0V, I_{OUT} = 300mA		330	480	
		V_{OUT}=3.3V, I_{OUT} = 300mA		300	450	
$I_{_LMT}$	Current Limit	T_A = 25℃	350	600	900	mA
I_{SHORT}	Short Circuit Current Limit	V_{OUT} = 0V	70	170	270	mA
I_Q	Quiescent Current	I_{OUT} = 0mA		0.6	0.9	μA
PSRR	Power Supply Rejection Ratio[5]	f = 1kHz, V_{IN} = 2.5V + 200mVpp I_{OUT} =150mA, (V_{OUT}≤1.5V)		55		dB
		f = 1kHz, V_{IN} = V_{OUT}+1V + 200mVpp I_{OUT} =150mA, (V_{OUT}≥1.5V)		45		
e_N	Output Noise Voltage[5]	V_{IN} =2.5V (V_{OUT}≤1.5V) , I_{OUT} = 1mA, f = 10Hz to 100KHz,C_{OUT} = 1μF		55		μV_{RMS}
		V_{IN} =V_{OUT}+1V (1.5V≤V_{OUT}≤2.0V) , I_{OUT} = 1mA, f = 10Hz to 100KHz,C_{OUT} = 1μF		70		
		V_{IN} =V_{OUT}+1V (2.0V≤V_{OUT}≤3.3V) , I_{OUT} = 1mA, f = 10Hz to 100KHz,C_{OUT} = 1μF		90		
T_{SD}	Thermal Shutdown Temperature	Temperature Increasing From T_A= +25℃[5]		155		°C
T_{SDH}	Thermal Shutdown Hysteresis	Temperature Falling from TSD[5]		25		°C

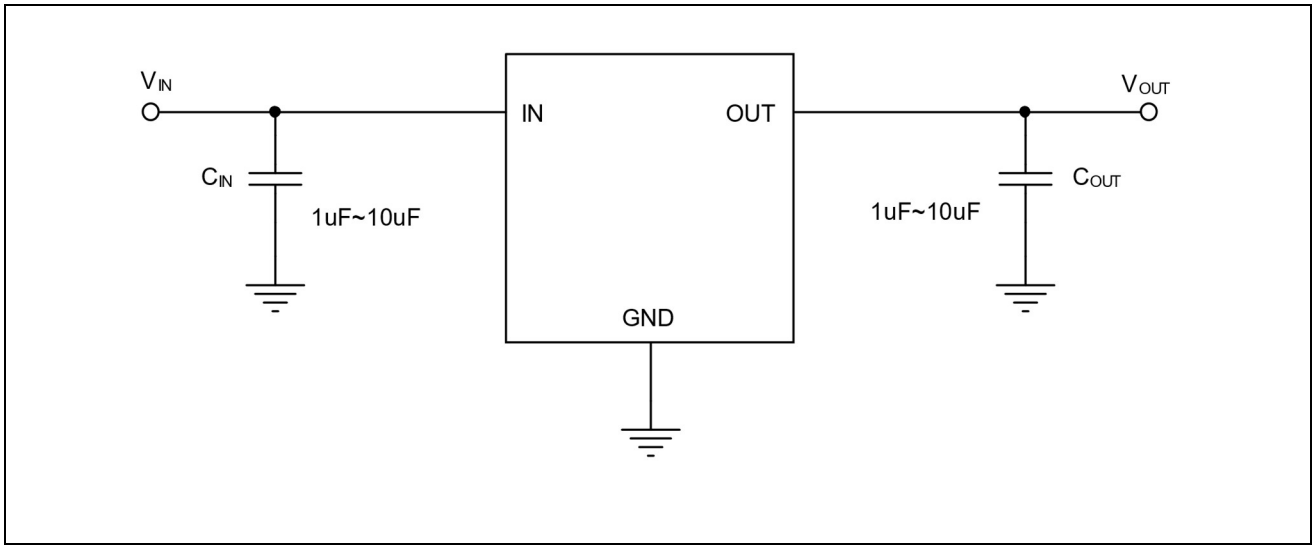
Note3: Here V_{IN} means internal circuit can work normal. If V_{IN} <V_{OUT}, Output voltage follow V_{IN} (I_{OUT}=1mA), circuit is safety.

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

Note5: Guaranteed by design and characterization. Not a FT item.

Note6: The minimum operating voltage is 2.2V.V_{DROP}=V_{IN}(min)-V_{OUT}.

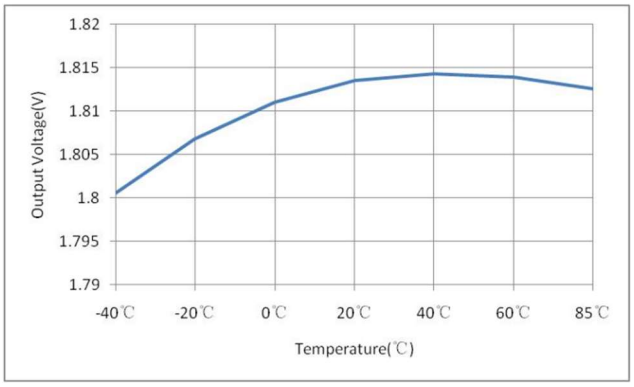
Applications Information



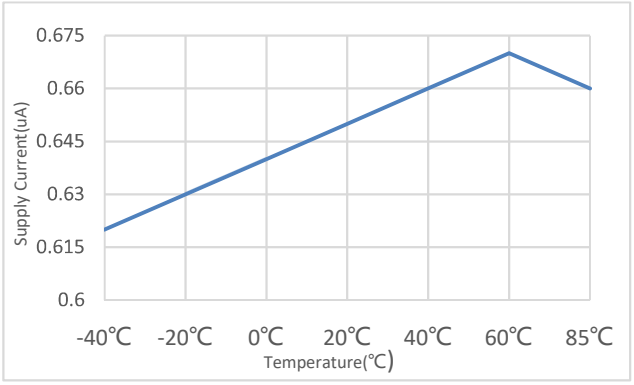
Typical Characteristics

VOLTAGE VERSION 1.8V

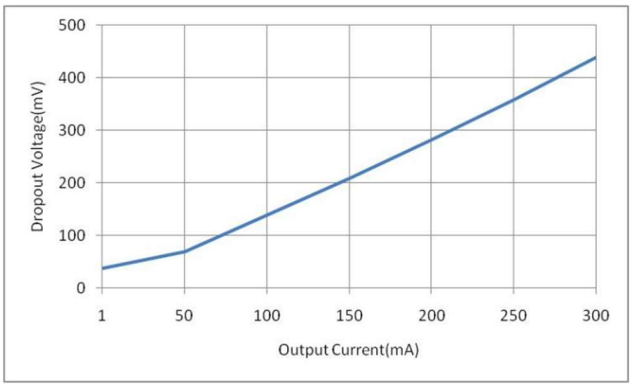
(V_{IN} = 2.8V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0μF, unless otherwise noted. Typical values are at T_A = +25°C.)



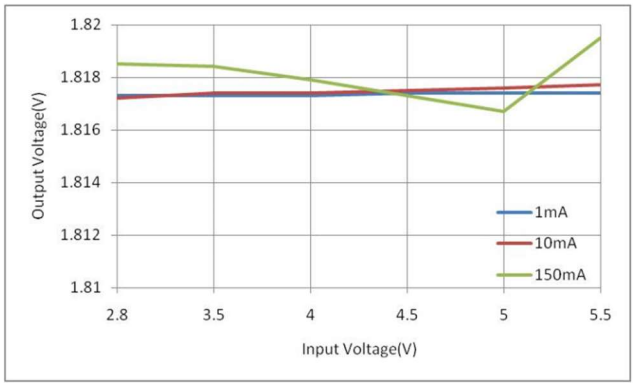
Output Voltage VS Temperature



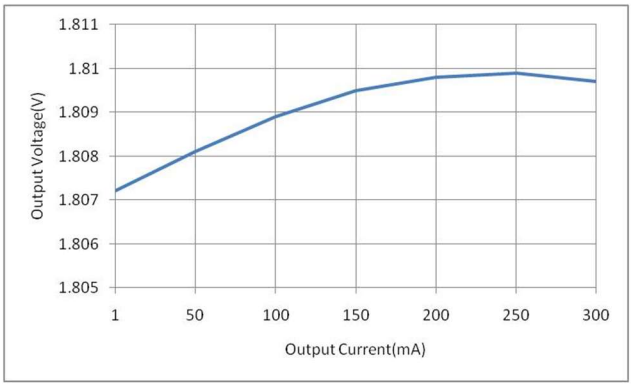
Supply Current VS Temperature



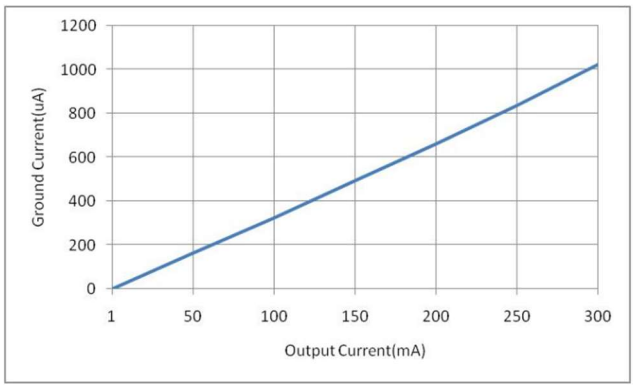
Dropout Voltage VS Output Current



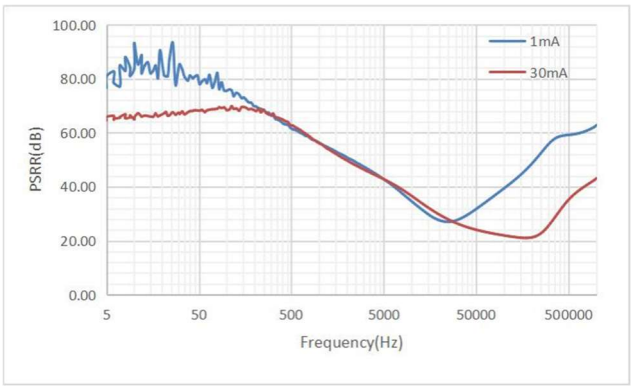
Output Voltage VS Input Voltage



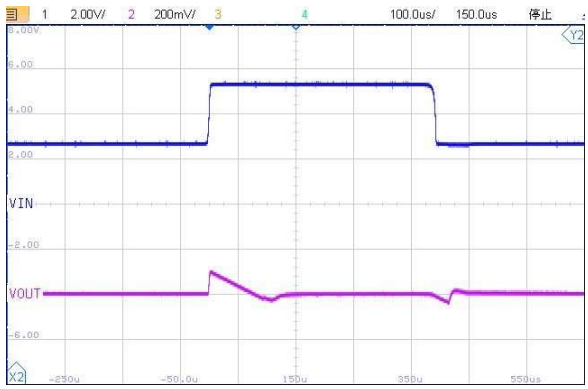
Output Voltage VS Output Current



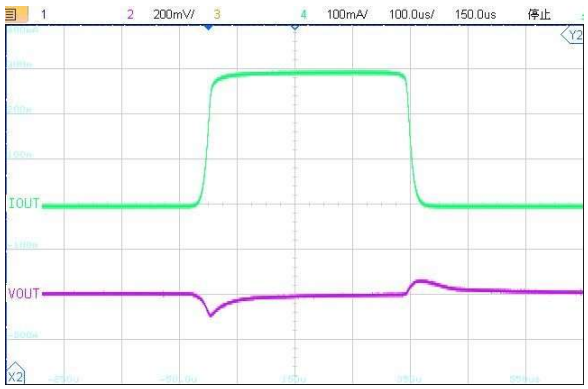
Ground Current VS Output Current



PSRR VS Output Current



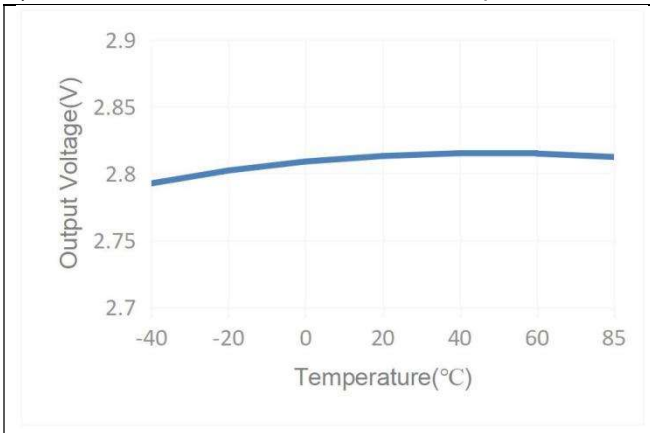
Line Transient Response
V_{IN}=2.8V~5.5V, V_{OUT}=1.8V, I_{OUT}=1mA



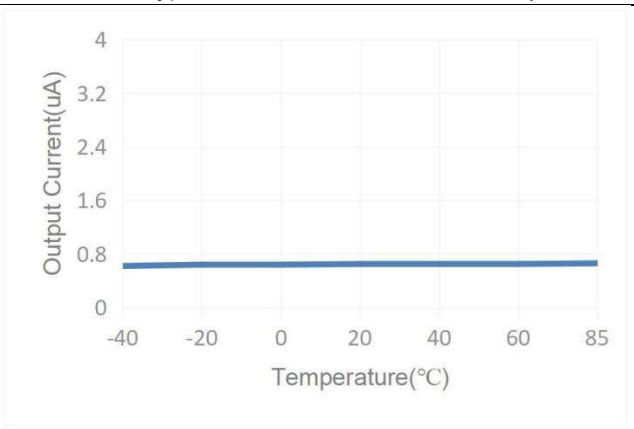
Load Transient Response V_{IN}=2.8V,
V_{OUT}=1.8V, I_{OUT}=1mA~300mA

VOLTAGE VERSION 2.8 V

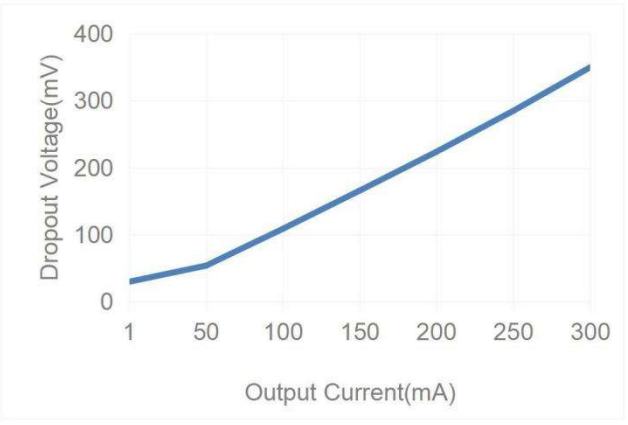
(V_{IN} = 3.8V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0μF, unless otherwise noted. Typical values are at T_A = +25°C.)



Output Voltage VS Temperature



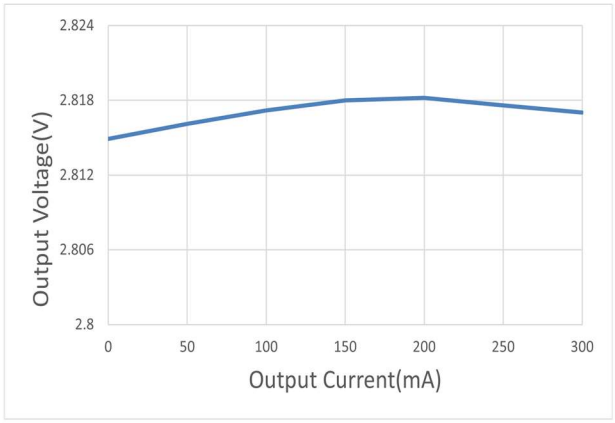
Supply Current VS Temperature



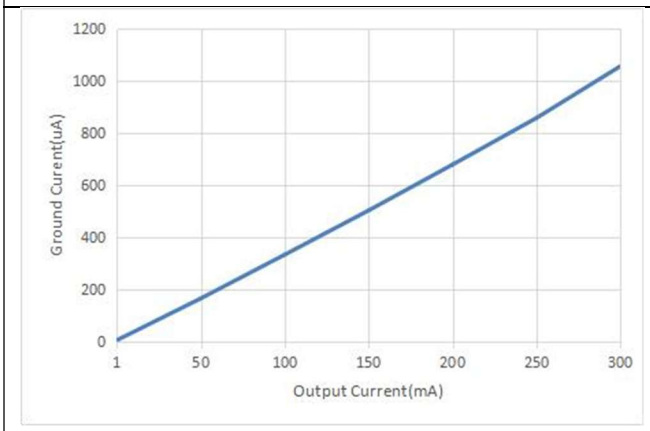
Dropout Voltage VS Output Current



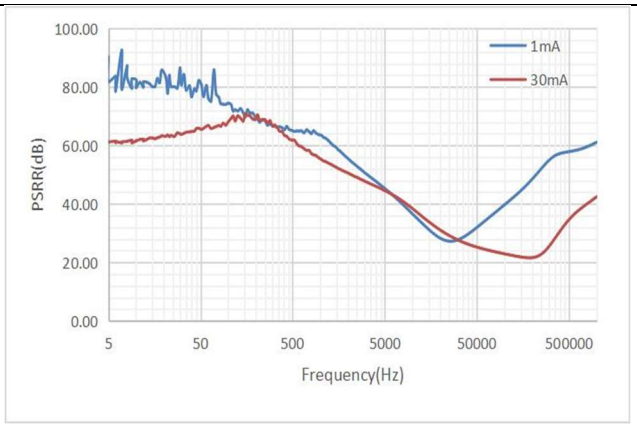
Output Voltage VS Input Voltage



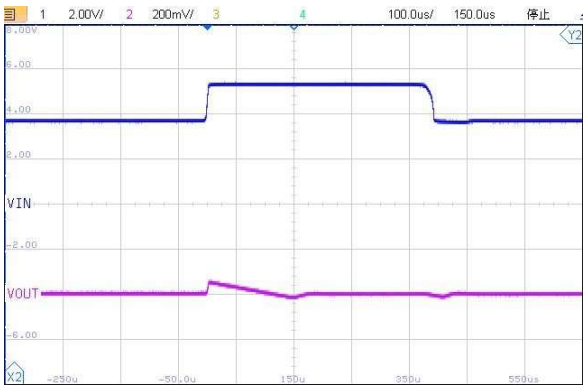
Output Voltage VS Output Current



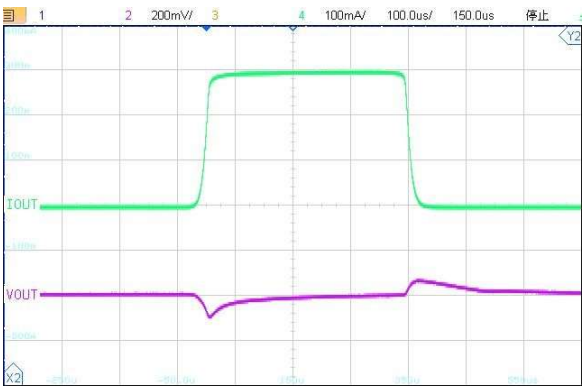
Ground Current VS Output Current



PSRR VS Output Current



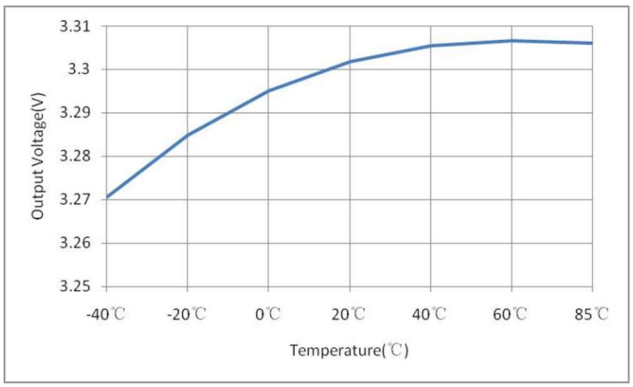
Line Transient Response(I_{OUT}=1mA)
V_{IN}=3.8V~5.5V, V_{OUT}=2.8V, I_{OUT}=1mA



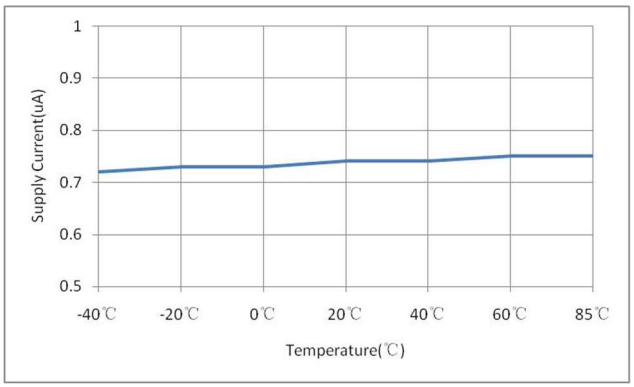
Load Transient Response V_{IN}=3.8V,
V_{OUT}=2.8V, I_{OUT}=1mA~300mA

VOLTAGE VERSION 3.3 V

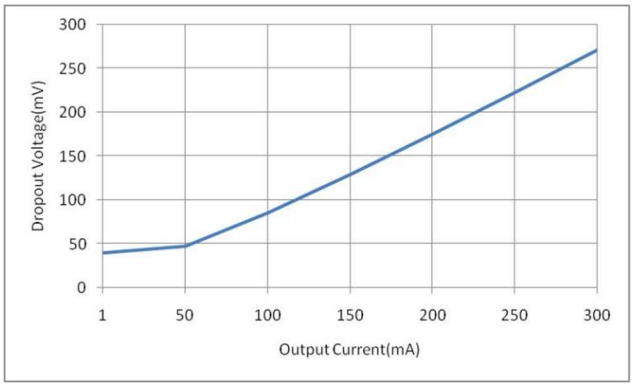
(V_{IN} = 4.3V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0μF, unless otherwise noted. Typical values are at T_A = +25°C.)



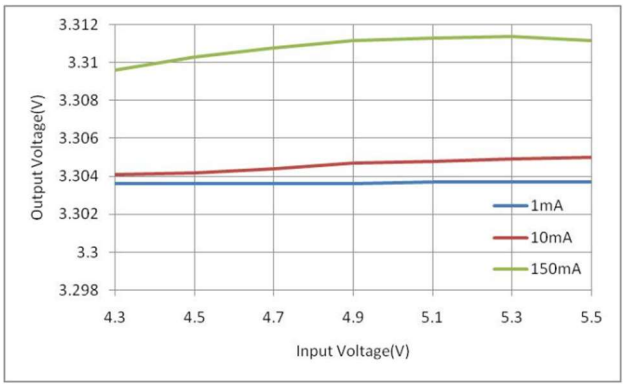
Output Voltage VS Temperature



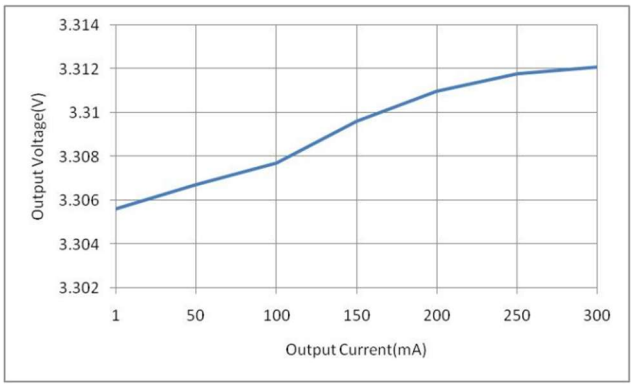
Supply Current VS Temperature



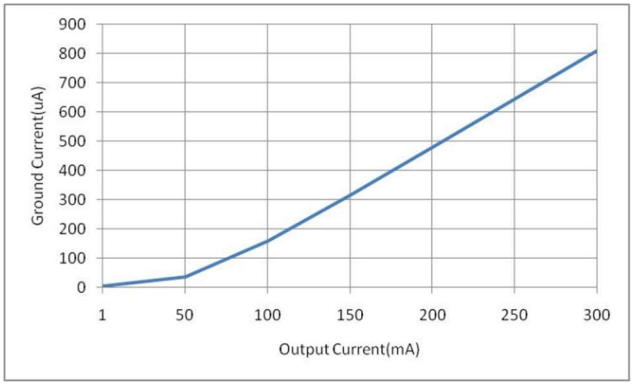
Dropout Voltage VS Output Current



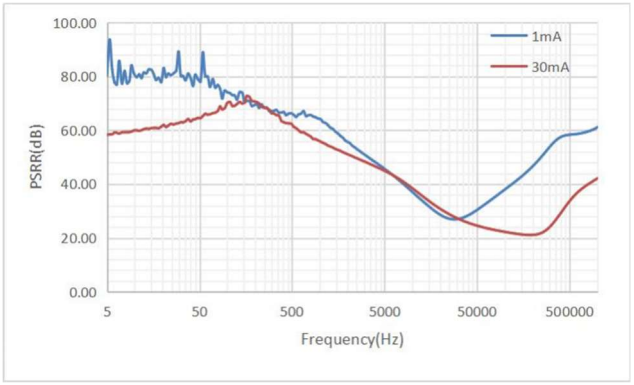
Output Voltage VS Input Voltage



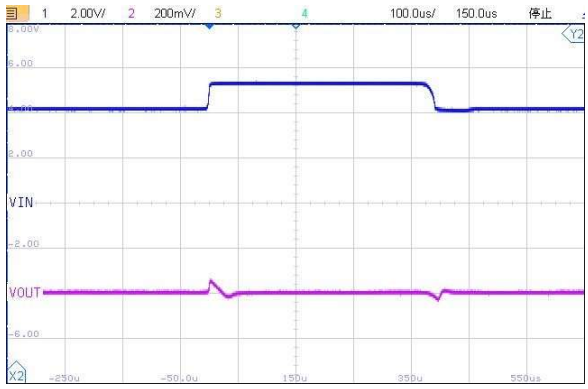
Output Voltage VS Output Current



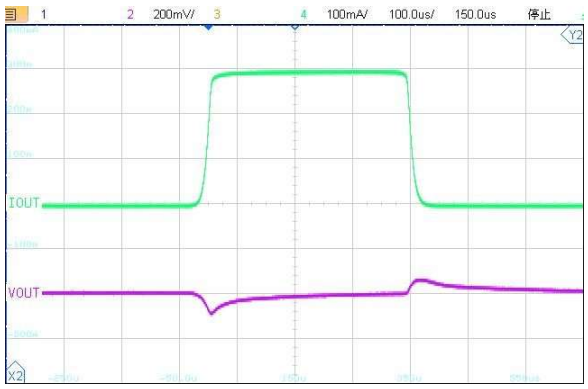
Ground Current VS Output Current



PSRR VS Output Current

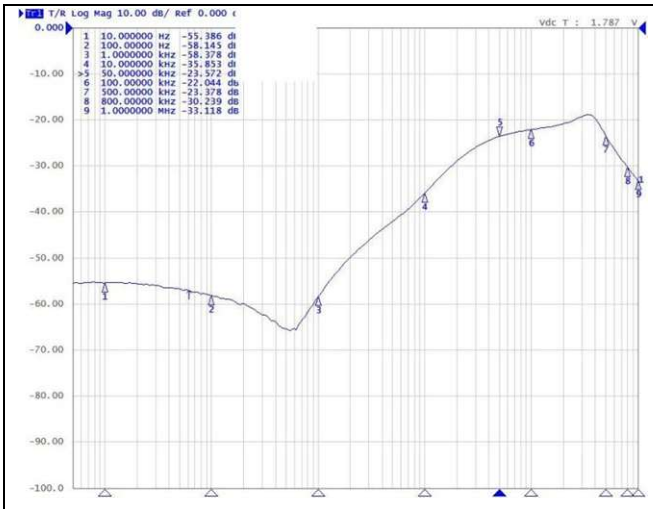


Line Transient Response(I_{OUT}=1mA)
V_{IN}=4.3V~5.5V, V_{OUT}=3.3V, I_{OUT}=1mA

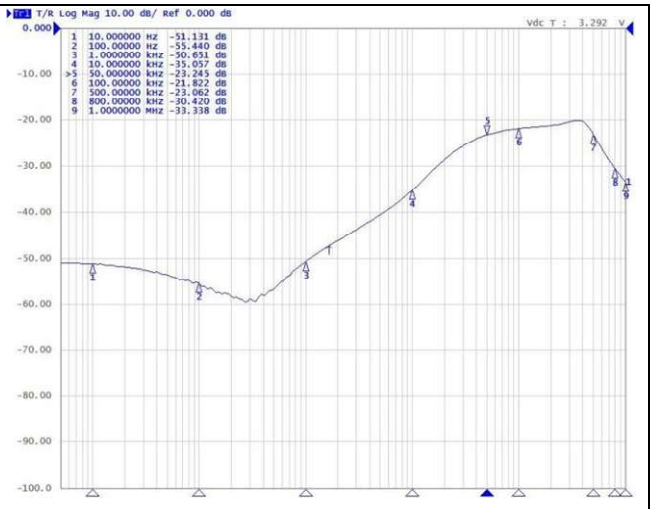


Load Transient Response V_{IN}=4.3V,
V_{OUT}=3.3V, I_{OUT}=1mA~300mA

PSRR



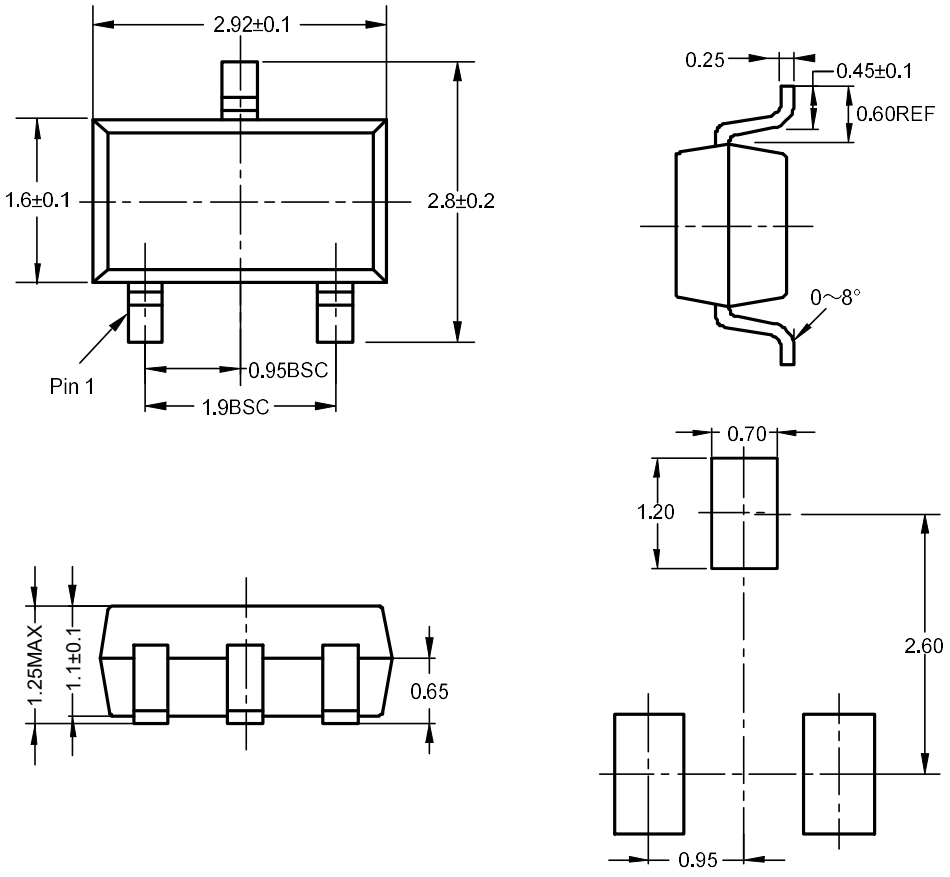
V_{OUT}=1.8V, I_{OUT}=150mA



V_{OUT}=3.3V, I_{OUT}=150mA

Package Dimension

DFN4 (1×1)



Recommended Land Pattern

Unit: mm

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2021-10-21	Preliminary Version	Liuxm	Liuxm	Liujy
1.1	2022-06-07	Initial Version	Shibo	Liuxm	Liujy
1.2	2023-11-23	Update Typeset Update package picture	Shibo	Liuxm	Liujy