

ET516XX - High PSRR Low Noise 300mA LDO

General Description

The ET516XX family are the 300mA LDO with auto discharge function. It uses an advanced CMOS process and a PMOSFET pass device to achieve high power supply rejection ratio (PSRR), low noise, low dropout, low ground current, fast start-up and excellent output accuracy.

The ET516XX family are stable with a 1.0 μ F ceramic output capacitor, uses a precision voltage reference and feedback loop to achieve excellent Regulation and transient response.

The ET516XX family offered in a small SOT23-5、SOT23-3、SC70-5 and DFN4 package, which are ideal for different equipment.

The ET516XX family are available in standard fixed output voltages of 0.8V(ET51608), 1.0V(ET51610), 1.1V(ET51611), 1.2V (ET51612), 1.5V (ET51615), 1.8V (ET51618), 2.4V (ET51624), 2.5V (ET51625), 2.8 (ET51628), 2.85V (ET516285), 2.9V (ET51629), 3.0V (ET51630), 3.3V (ET51633).

Features

- Wide Input Voltage Range from 1.9V to 5.5V
- Up to 300mA Load Current
- Standard Fixed Output Voltage :0.8V,1.0V,1.1V,1.2V, 1.5V, 1.8V, 2.4V, 2.5V, 2.8V, 2.85V, 2.9V, 3.0V and 3.3V etc.
- Very Low I_q is 45 μ A typical
- Low Dropout is typical 190mV@2.8V at 300mA Load
- Very High PSRR: 75dB at 1KHz
- Very Low Noise is 40 μ Vrms at 1.2V output
- Excellent Load/Line Transient Response
- With Auto Discharging Function
- Package Information:

Part No.	Package	MSL
ET516XXB	SOT23-5	Level 3
ET516XXSCB	SC70-5	Level 1
ET516XXYB	DFN4 (1 $\times$ 1)	Level 1
ET516XXF	SOT23-3	Level 3

Applications

- Smart Phones and Cellular Phones
- Digital Still Cameras
- Portable instrument

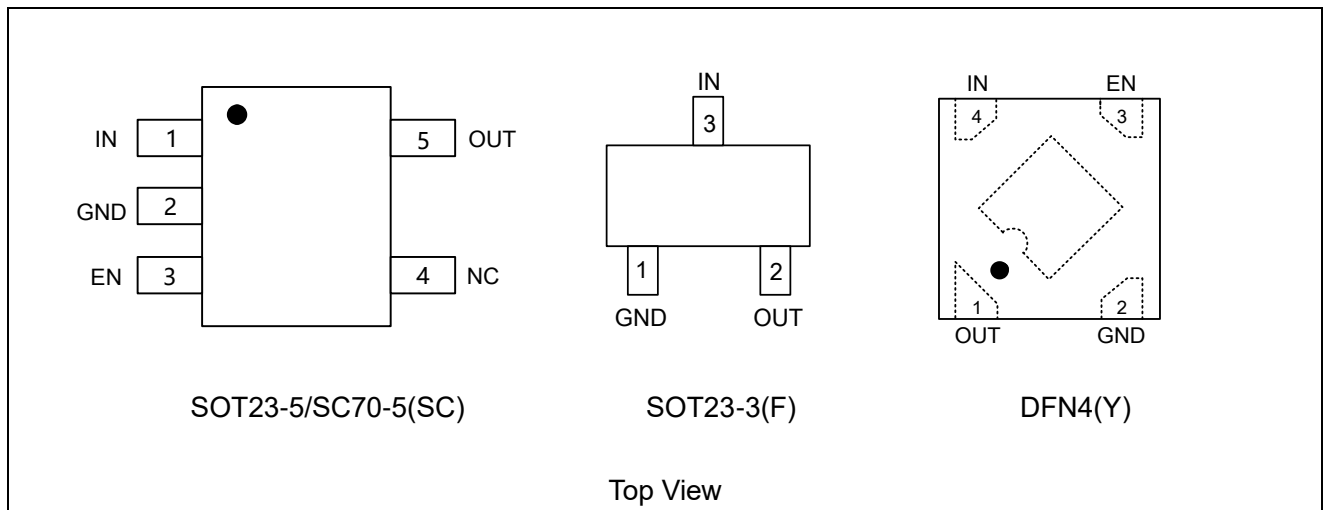
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Device Information

ET 516 XX X B

<u>XX</u>	Output Voltage	<u>X</u>	Package	<u>B</u>	Auto-Discharging Function
XX	Output Voltage For example, 18 is 1.8V output	Y	DFN4(1×1)		B: with Auto-discharging Function
		SC	SC70-5		
		F	SOT23-3		
			SOT23-5		

Pin Configuration

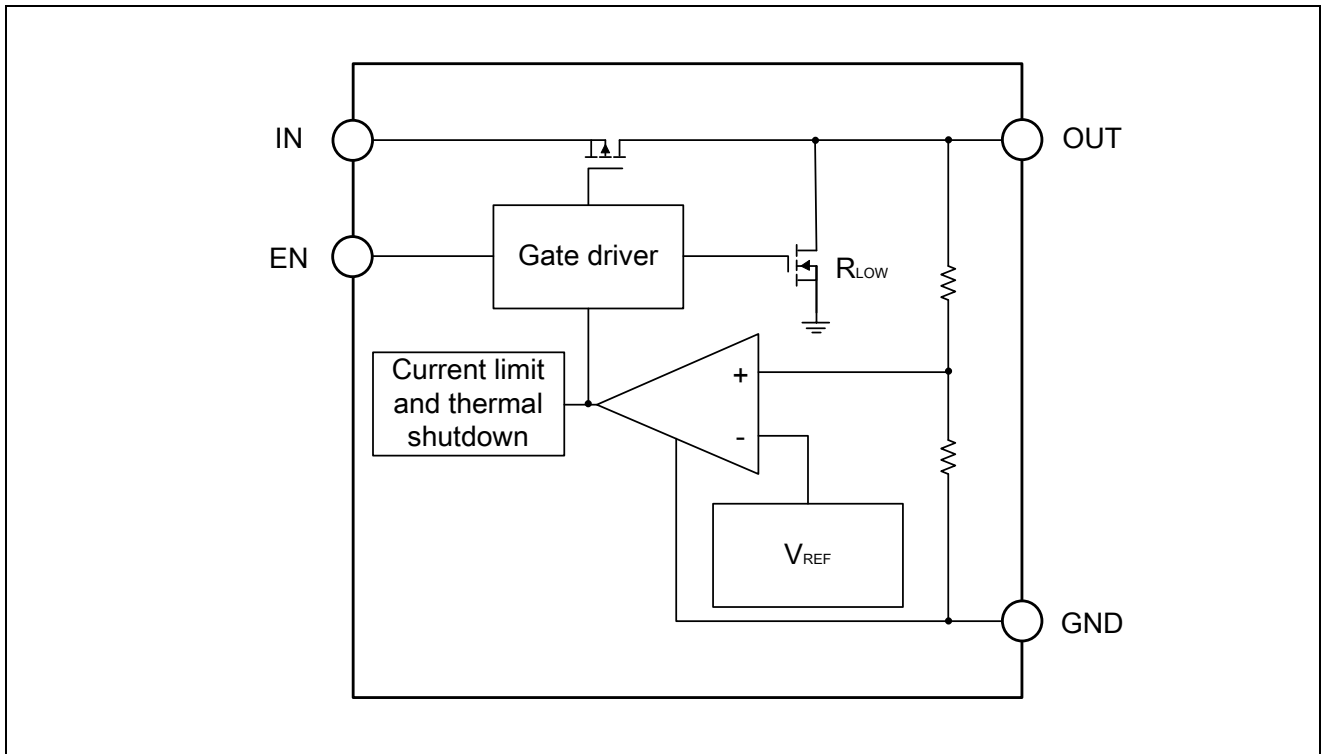


Pin Function

Pin No.			Pin Name	Pin Function
DFN4	SOT23-5 SC70-5	SOT23-3		
1	5	2	OUT	Output pin. A low-ESR capacitor should be connected to this pin to GND.
2	2	1	GND	Ground pin.
3	3	-	EN	Enable control input pin, active high. Do not leave EN floating
4	1	3	IN	Supply input pin. Must be closely decoupled to GND with a ceramic capacitor
-	4	-	Thermal Pad or NC	Thermal pad for DFN4(1×1) package, connect to GND or leave floating. Do not connect to any potential other than GND, NC for SOT23-5 no connection.

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Block Diagram



Functional Description

Input Capacitor

A 1 μ F 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 0.47 μ F to 4.7 μ F, Equivalent Series Resistance (ESR) is from 5m Ω to 100m Ω , and temperature characteristics is 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.

ON/OFF Input Operation

The ET516XX is turned on by setting the EN pin high, and is turned off by pulling it low. If this feature is not used, the EN pin should be tied to IN pin to keep the regulator output on at all time.

Ultra Fast Start-up

After enabled, the ET516XX is able to provide full power in as little as tens of microseconds, typically 80 μ s. This feature will help load circuitry move in and out of standby mode in real time, eventually extend battery life for mobile phones and other portable devices.

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Current Limit Protection

When output current at the OUT pin is higher than current limit threshold or the OUT pin, the current limit protection will be triggered and clamp the output current to approximately 500mA to prevent over-current and to protect the regulator from damage due to overheating.

Thermal shutdown Protection

Thermal protection disables the output when the junction temperature rises to approximately +155°C, allowing the device to cool down. When the junction temperature reduces to approximately +130°C the output circuitry is enabled again. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits the heat dissipation of the regulator, protecting it from damage due to overheating.

Absolute Maximum Ratings

Symbol	Parameters (Items)	Value	Unit
V _{IN}	IN Voltage	-0.3 to 6.5	V
V _{EN}	Input Voltage (EN Pin)	-0.3 to V _{IN} +0.3	V
V _{OUT}	Output Voltage	-0.3 to V _{IN} +0.3	V
I _{MAX}	Maximum Load Current	300	mA
V _{ESD}	Human Body Model (JESD22-A114)	±4000	V
	Charged Device Model (JESD22-C101)	±1500	
T _J	Operating Junction Temperature	-40 to 150	°C
T _{STG}	Storage Temperature	-65 to 150	°C
T _{SL}	Lead Temperature (Soldering, 10 sec)	300	°C

Thermal Characteristics

Symbol	Package	Parameters	Value	Unit
R _{θJA}	SOT23-3	Thermal Resistance, Junction-to-Air	360	°C/W
	DFN4		250	
	SOT23-5		250	
	SC70-5		250	
R _{ψJC} ⁽¹⁾	SOT23-3	Thermal Resistance, Junction-to-Top case	130	°C/W
	DFN4		139	
	SOT23-5		100	
	SC70-5		110	
P _{DMAX}	SOT23-3	Power Dissipation	280	mW
	DFN4		400	
	SOT23-5		400	
	SC70-5		400	

Note1: Test at T_A=25°C with the component mounted on 5*5mm, FR4, 2layer, Top and Bottom layer 1oz.

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Recommended Operating Conditions

Symbol	Parameters	Rating	Unit
V _{IN}	Input Voltage	1.9 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	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⁽²⁾

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

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
V _{IN}	Input Voltage Range		1.9		5.5	V
V _{DROP}	Dropout Voltage	V _{OUT} =0.8V, I _{OUT} =300mA ⁽³⁾		900	1100	mV
		V _{OUT} =1.0V, I _{OUT} =300mA ⁽³⁾		700	900	mV
		V _{OUT} =1.1V, I _{OUT} =300mA ⁽³⁾		600	800	mV
		V _{OUT} =1.2V, I _{OUT} =300mA ⁽³⁾		550	700	mV
		V _{OUT} =1.5V, I _{OUT} =300mA		380	600	mV
		V _{OUT} =1.8V, I _{OUT} =300mA		290	550	mV
		V _{OUT} =2.5V, I _{OUT} =300mA		210	450	mV
		V _{OUT} =2.8V, I _{OUT} =300mA		190	400	mV
		V _{OUT} =3.0V, I _{OUT} =300mA		188	390	mV
		V _{OUT} =3.3V, I _{OUT} =300mA		185	380	mV
I _{Q_ON}	Input Quiescent Current	Active mode: V _{EN} =V _{IN}		45	70	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	%
ΔV _{OUT}	Output Voltage Line Regulation	V _{IN} =V _{OUT} +1V to 5.5V, I _{OUT} =10mA		0.03	0.2	%/V
	Output Voltage Load Regulation	I _{OUT} from 0mA to 300mA		20	40	mV
T _S	Soft-start Time	From enable to power on		80		μs
I _{LIMIT}	Current Limit	R _{LOAD} =1Ω	300			mA
I _{SHORT}	Short Current Limit	V _{OUT} =0V		70		mA
PSRR	Power Supply Rejection Ratio	f=1kHz, C _{OUT} =1μF, I _{OUT} =20mA		75		dB
		f=10kHz, C _{OUT} =1μF, I _{OUT} =30mA		65		dB

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Electrical Characteristics (Continued)⁽²⁾

($V_{IN}=V_{OUT}+1V$, $V_{EN}=1.2V$, $I_{OUT}=1mA$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, $T_A=25^{\circ}C$, unless otherwise stated)

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
e_N	Output Noise	10Hz to 100kHz, $I_{OUT}=200mA$, $V_{OUT}=2.8V$, $C_{OUT}=1\mu F$		60		μV_{RMS}
		10Hz to 100kHz, $I_{OUT}=200mA$, $V_{OUT}=1.2V$, $C_{OUT}=1\mu F$		40		
V_{IL}	EN Low Threshold	$V_{IN}=1.9V$ to $5.5V$, V_{EN} falling until the output is disabled			0.3	V
V_{IH}	EN High Threshold	$V_{IN}=1.9V$ to $5.5V$, V_{EN} rising until the output is enabled	1.2			V
I_{EN}	EN Pin Input Current	$V_{EN}=0V$		0	0.1	μA
R_{PD}	EN pull-down Resistance		0.8	1	1.3	$M\Omega$
R_{LOW}	Output Resistance of Auto Discharge at Off State	$EN=0V$, $V_{IN}=4V$, $I_{OUT}=10mA$		80		Ω
T_{TSD}	Over-temperature Shutdown Threshold	T_J rising		155		$^{\circ}C$
T_{HYS}	Over-temperature Shutdown Hysteresis	T_J falling from shutdown		20		$^{\circ}C$

Note2: Production test at $25^{\circ}C$. Specifications over the temperature range are guaranteed by design and characterization.

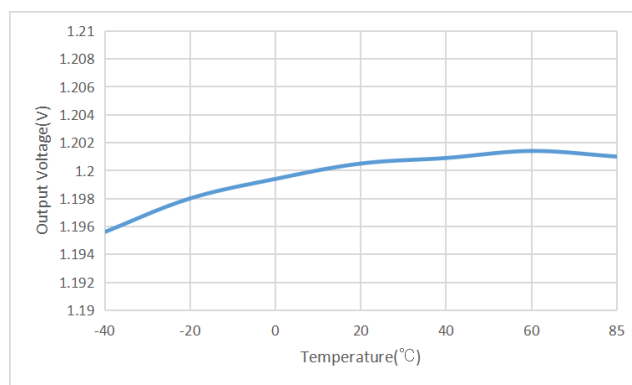
Note3: The minimum operating voltage is $1.9V$. $V_{DROP}=V_{IN}(min)-V_{OUT}$.

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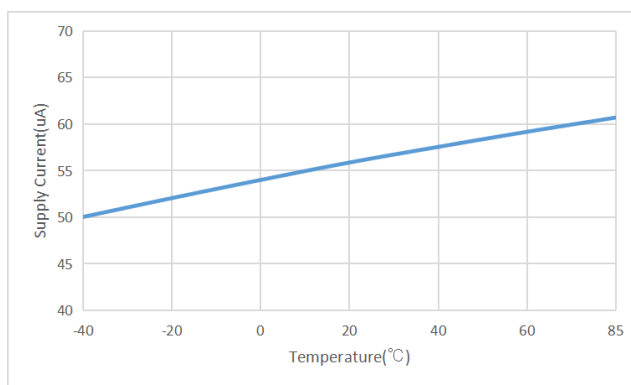
Typical Characteristics

(1) VOLTAGE VERSION 1.2 V

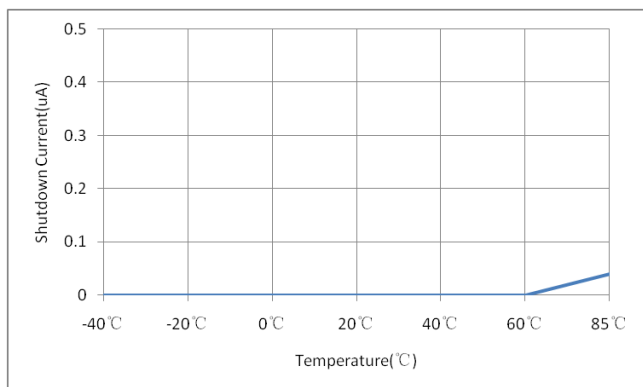
($V_{IN}=2.2V$; $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=1.0\mu F$, unless otherwise noted. Typical values are at $T_A=25^{\circ}C$.)



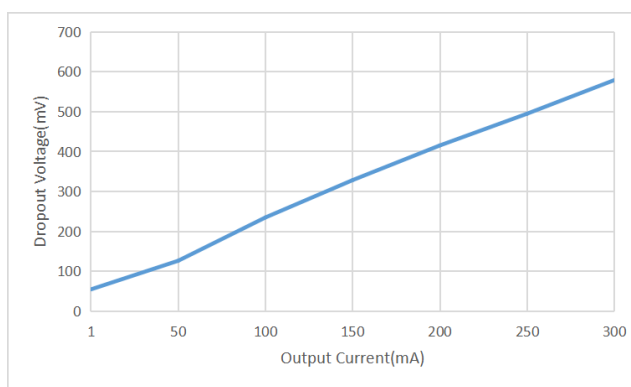
Output Voltage VS Temperature



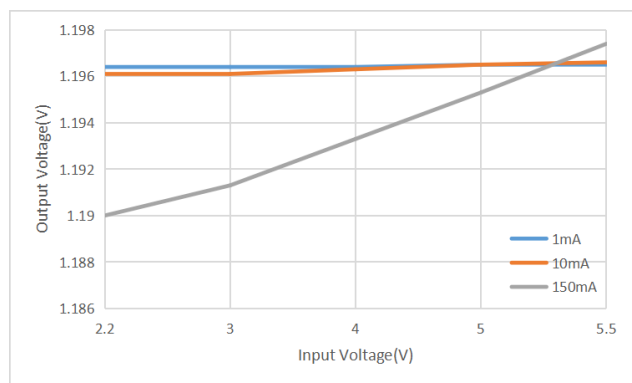
Supply Current VS Temperature



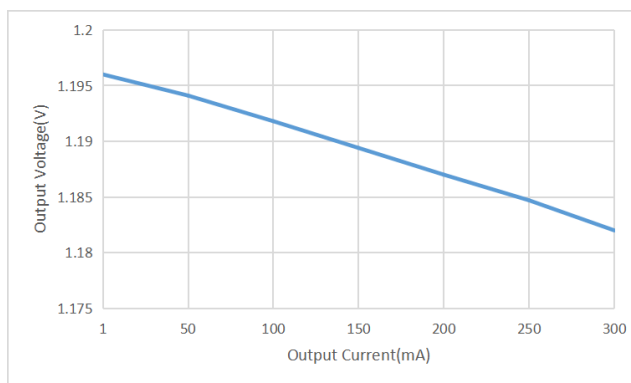
Shutdown Current VS Temperature



Dropout Voltage VS Output Current

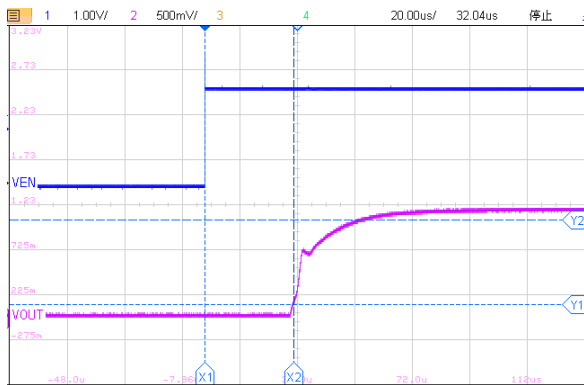


Output Voltage VS Input Voltage

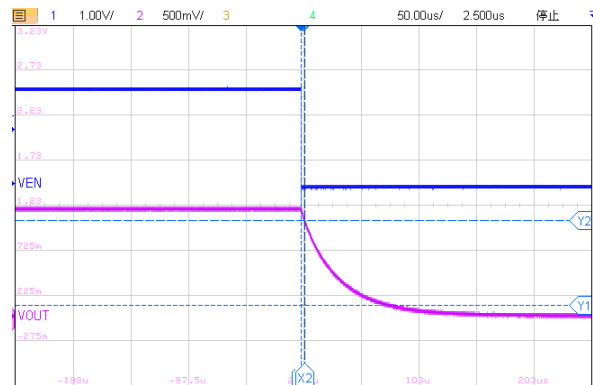


Output Voltage VS Output Current

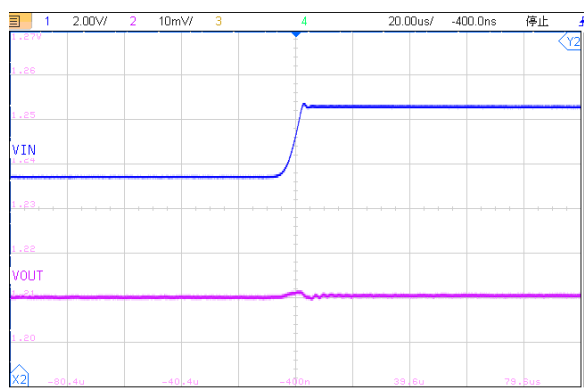
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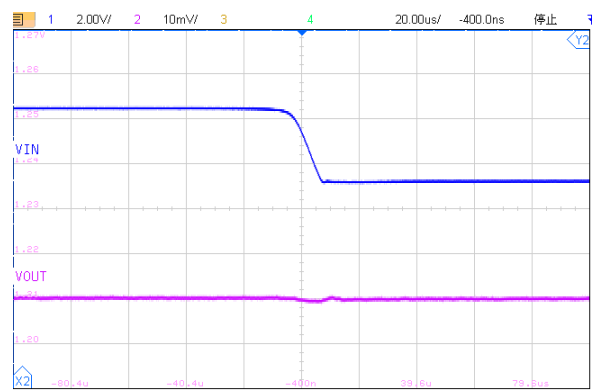
Turn On Speed VS EN Voltage ($I_{OUT}=30mA$)



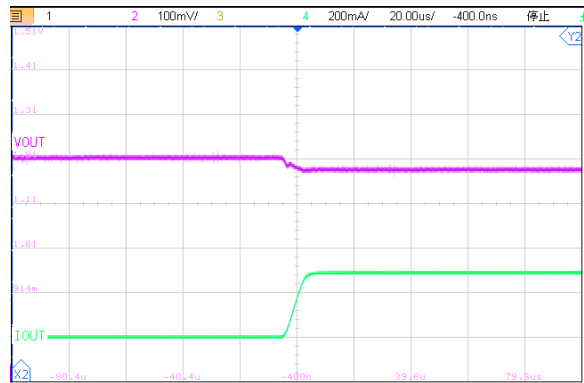
Turn Off Speed VS EN Voltage ($I_{OUT}=30mA$)



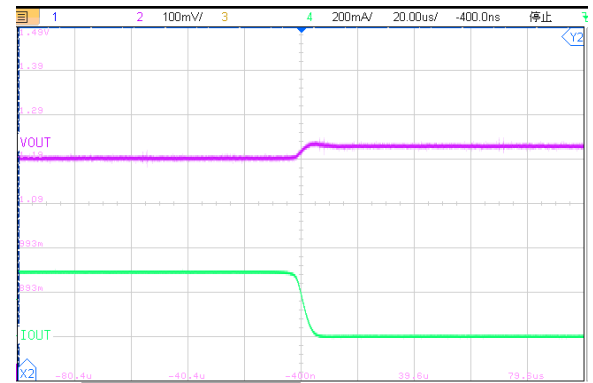
Line Transient Response
 $V_{IN}=2.2V\sim 5.5V$, $V_{OUT}=1.2V$, $I_{OUT}=1mA$



Line Transient Response
 $V_{IN}=5.5V\sim 2.2V$, $V_{OUT}=1.2V$, $I_{OUT}=1mA$

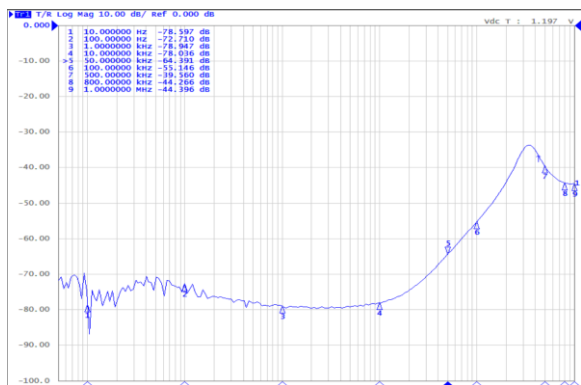


Load Transient Response
 $V_{IN}=2.2V$, $V_{OUT}=1.2V$, $I_{OUT}=1mA\sim 300mA$



Load Transient Response
 $V_{IN}=2.2V$, $V_{OUT}=1.2V$, $I_{OUT}=300mA\sim 1mA$

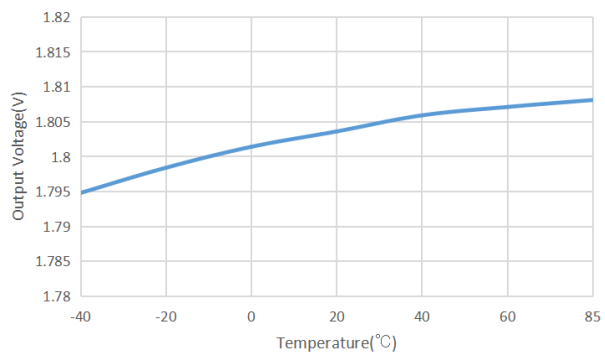
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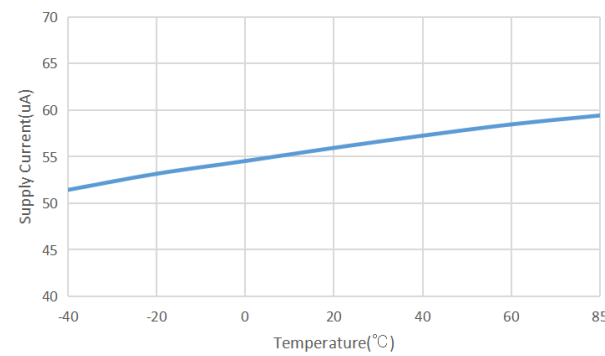
PSRR $I_{OUT}=30mA$

(2) VOLTAGE VERSION 1.8 V

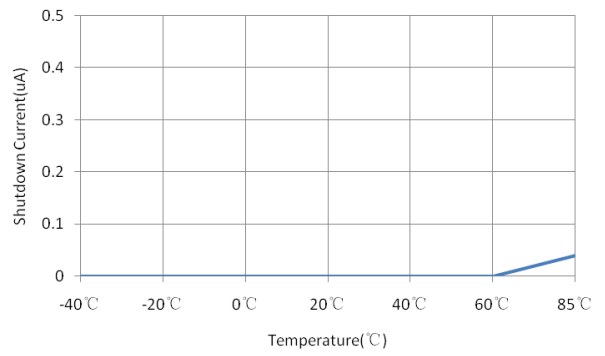
($V_{IN}=2.8V$; $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=1.0\mu F$, unless otherwise noted. Typical values are at $T_A=25^{\circ}C$.)



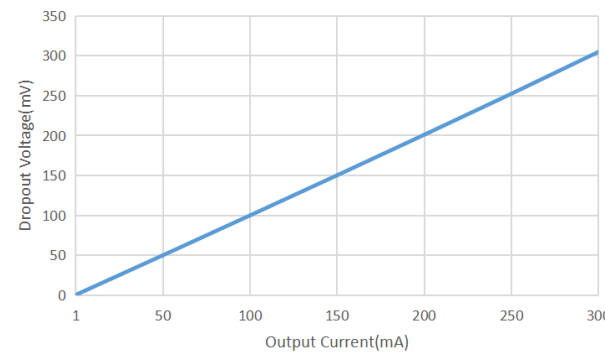
Output Voltage VS Temperature



Supply Current VS Temperature

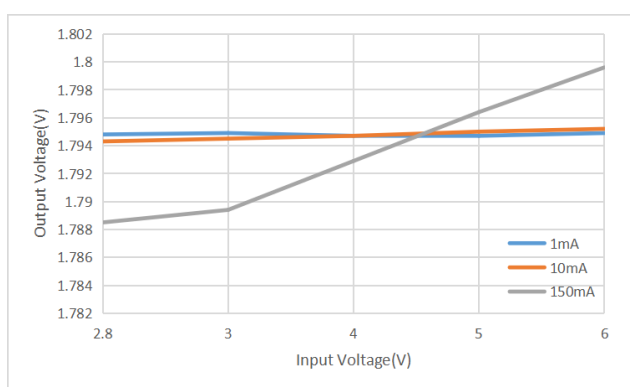


Shutdown Current VS Temperature

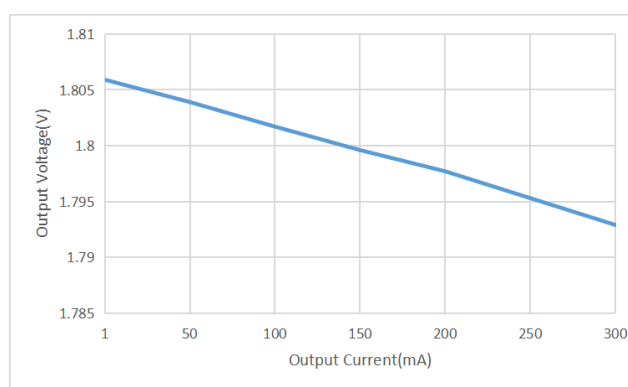


Dropout Voltage VS Output Current

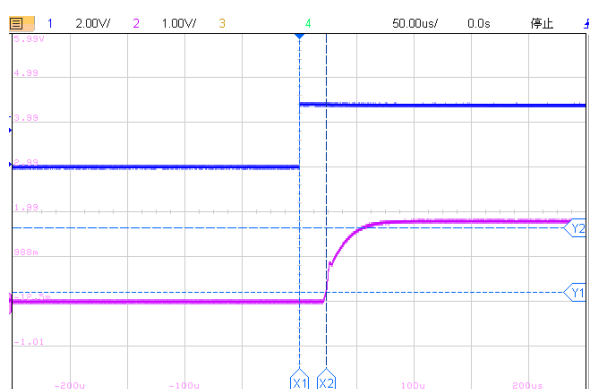
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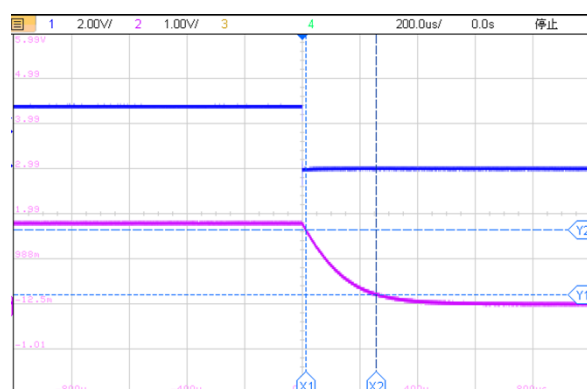
Output Voltage VS Input Voltage



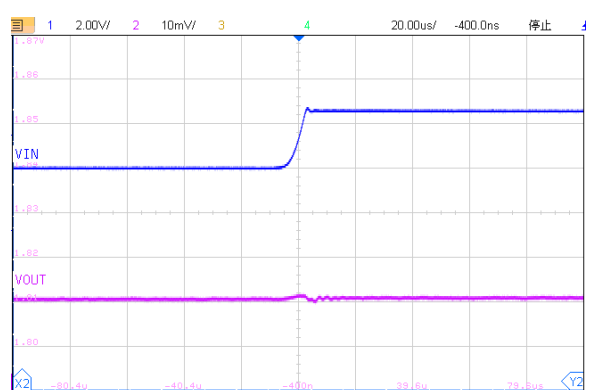
Output Voltage VS Output Current



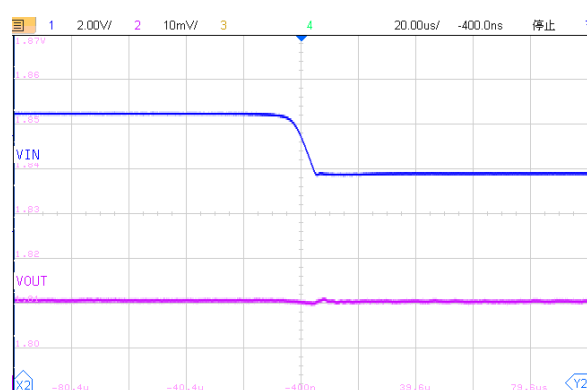
Turn On Speed VS EN Voltage ($I_{OUT}=30mA$)



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

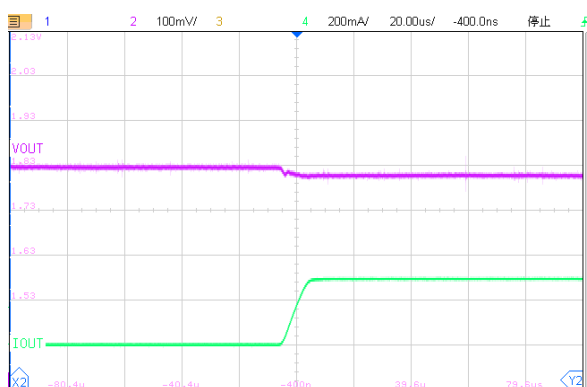


Line Transient Response
 $V_{IN}=2.8V\sim 5.5V$, $V_{OUT}=1.8V$, $I_{OUT}=1mA$

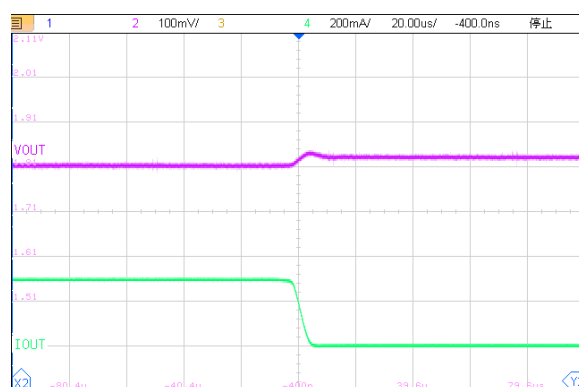


Line Transient Response
 $V_{IN}=5.5V\sim 2.8V$, $V_{OUT}=1.8V$, $I_{OUT}=1mA$

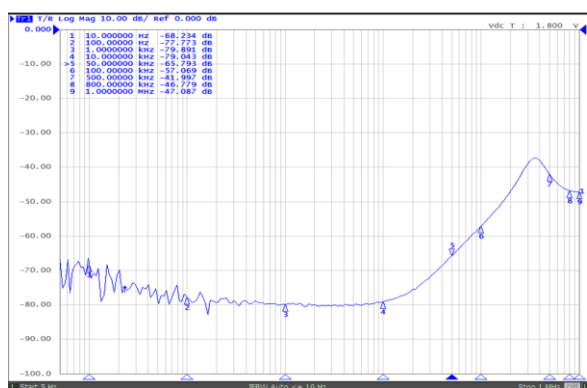
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Load Transient Response
 $V_{IN}=2.8V$, $V_{OUT}=1.8V$, $I_{OUT}=1mA \sim 300mA$



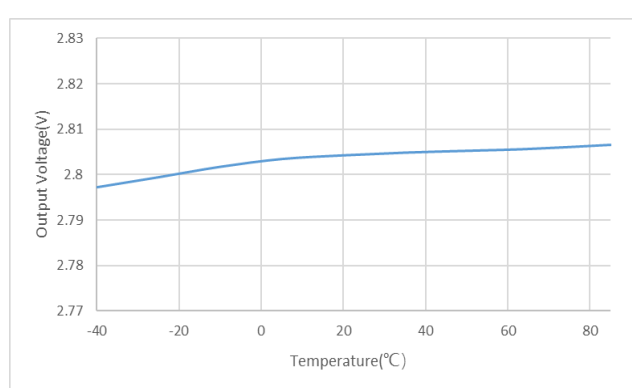
Load Transient Response
 $V_{IN}=2.8V$, $V_{OUT}=1.8V$, $I_{OUT}=300mA \sim 1mA$



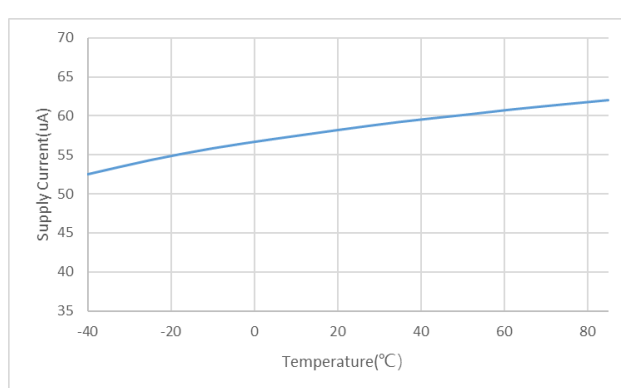
PSRR $I_{OUT}=30mA$

(3) VOLTAGE VERSION 2.8 V

($V_{IN}=3.8V$; $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=1.0\mu F$, unless otherwise noted. Typical values are at $T_A=25^\circ C$.)

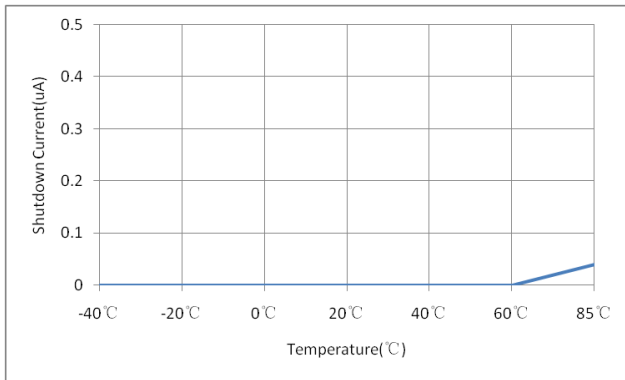


Output Voltage VS Temperature

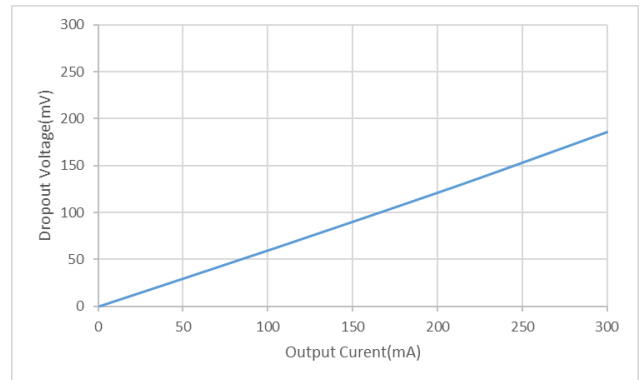


Supply Current VS Temperature

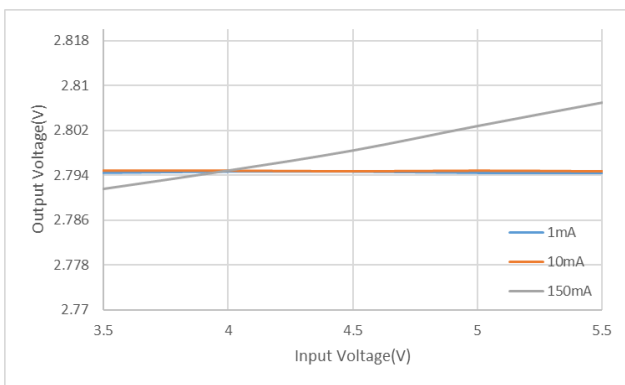
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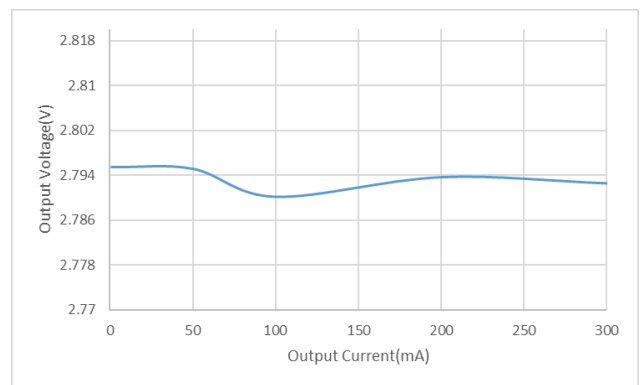
Shutdown Current VS Temperature



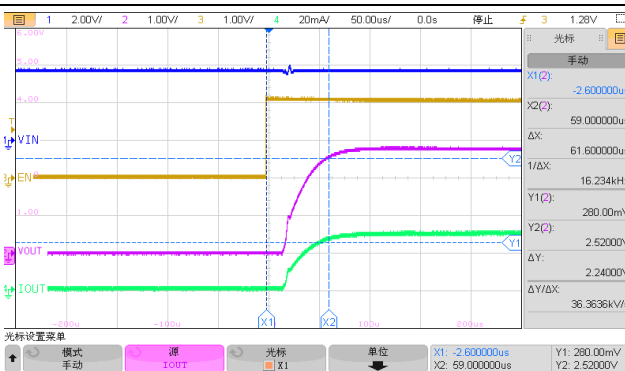
Dropout Voltage VS Output Current



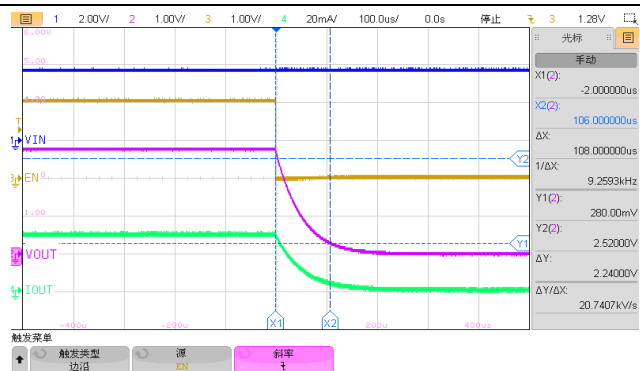
Output Voltage VS Input Voltage



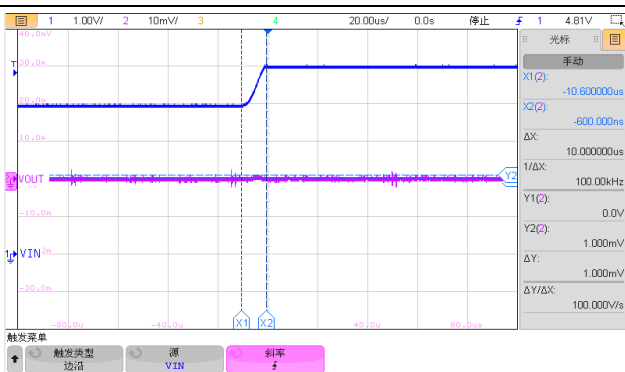
Output Voltage VS Output Current



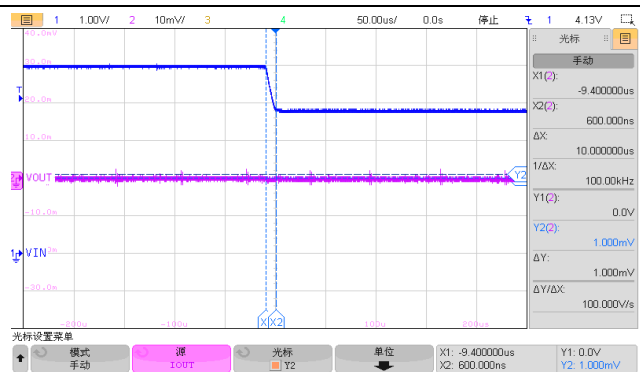
Turn On Speed VS EN Voltage ($I_{OUT}=30mA$)



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

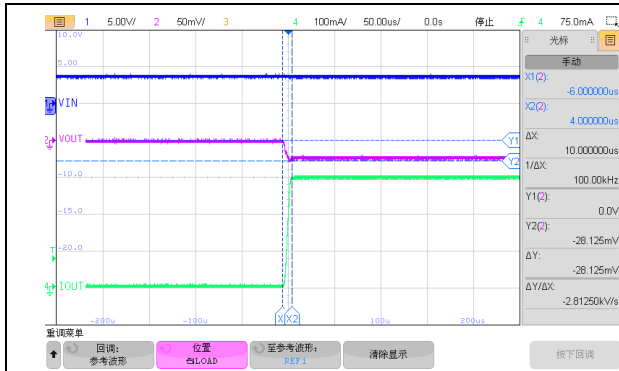


Line Transient Response
 $V_{IN}=3.8V\sim 5.5V$, $V_{OUT}=2.8V$, $I_{OUT}=1mA$

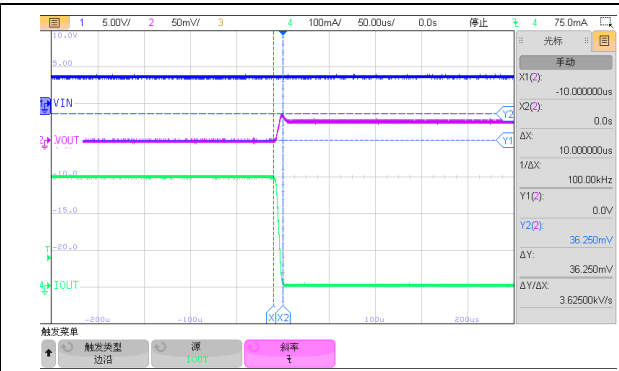


Line Transient Response
 $V_{IN}=5.5V\sim 3.8V$, $V_{OUT}=2.8V$, $I_{OUT}=1mA$

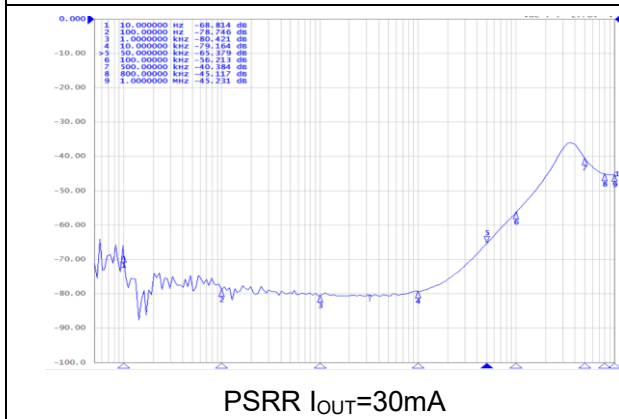
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Load Transient Response
 $V_{IN}=3.8V$, $V_{OUT}=3.3V$, $I_{OUT}=1mA \sim 300mA$



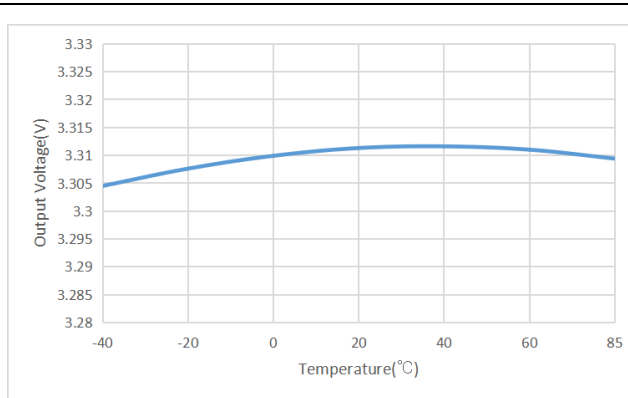
Load Transient Response
 $V_{IN}=3.8V$, $V_{OUT}=2.8V$, $I_{OUT}=300mA \sim 1mA$



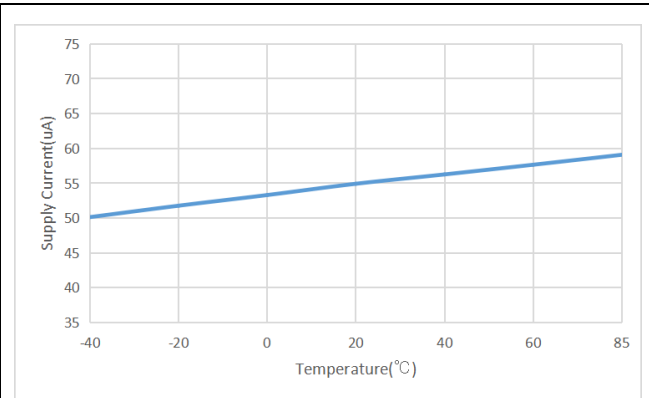
PSRR $I_{OUT}=30mA$

(4) VOLTAGE VERSION 3.3 V

($V_{IN}=4.3V$; $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=1.0\mu F$, unless otherwise noted. Typical values are at $T_A=25^{\circ}C$.)

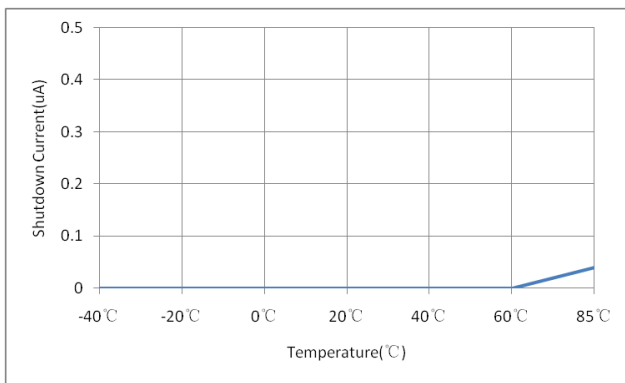


Output Voltage VS Temperature

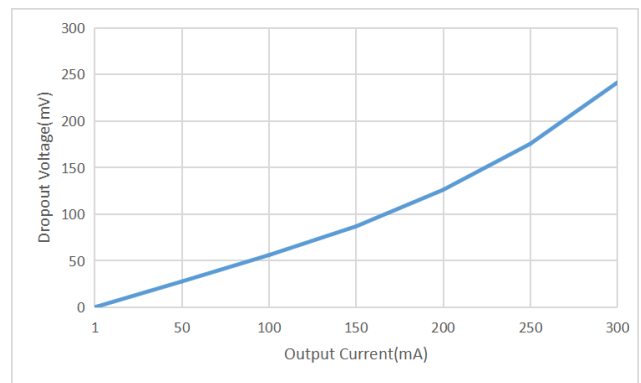


Supply Current VS Temperature

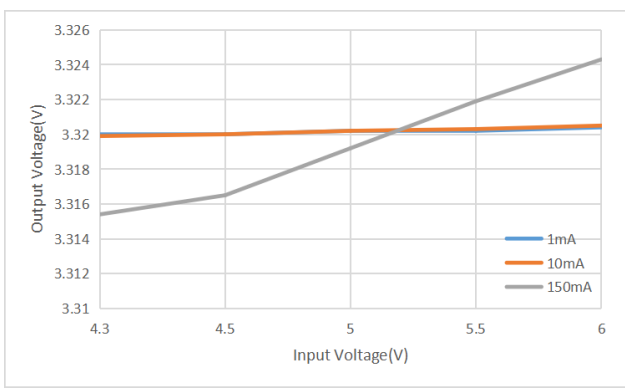
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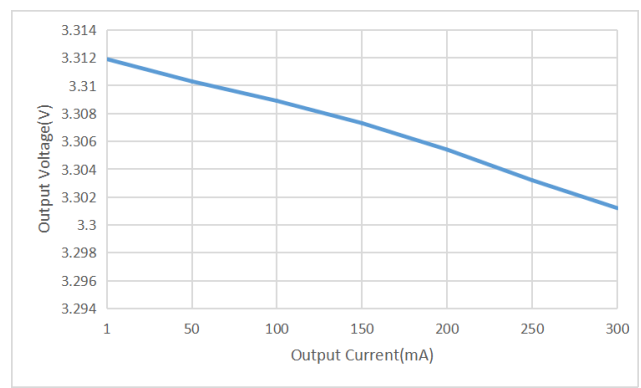
Shutdown Current VS Temperature



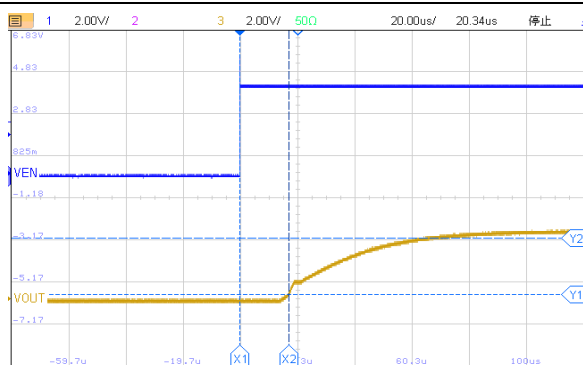
Dropout Voltage VS Output Current



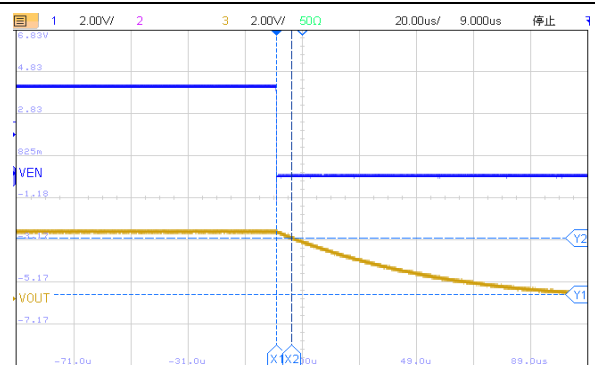
Output Voltage VS Input Voltage



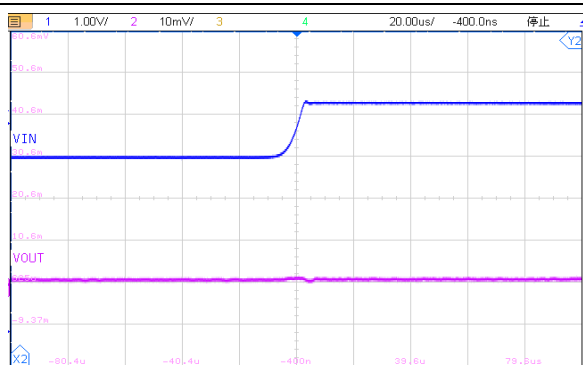
Output Voltage VS Output Current



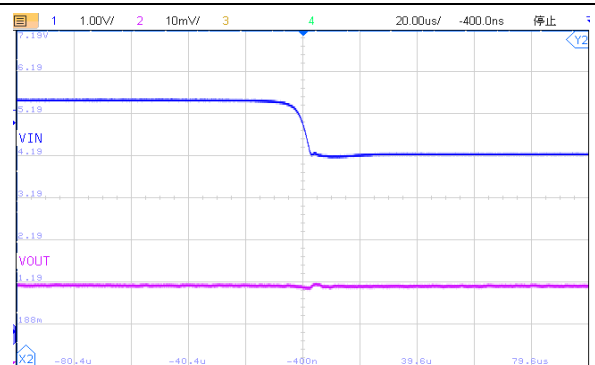
Turn On Speed VS EN Voltage ($I_{OUT}=30mA$)



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

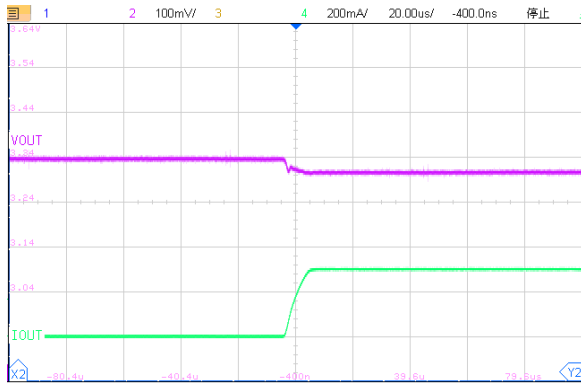


Line Transient Response
 $V_{IN}=4.3V\sim 5.5V$, $V_{OUT}=3.3V$, $I_{OUT}=1mA$



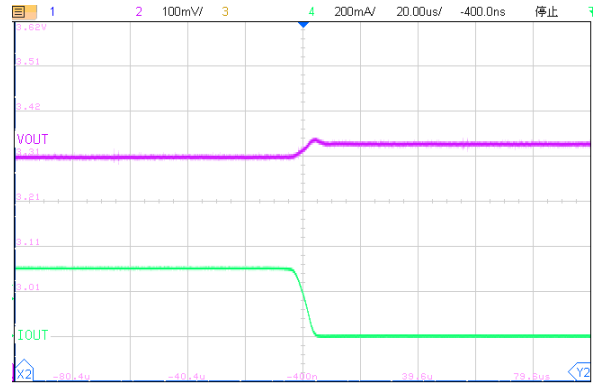
Line Transient Response
 $V_{IN}=5.5V\sim 4.3V$, $V_{OUT}=3.3V$, $I_{OUT}=1mA$

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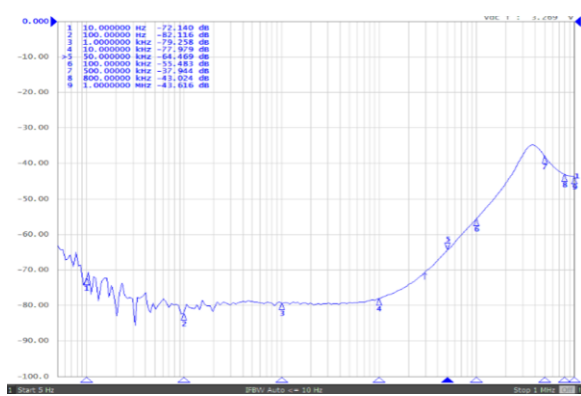
Load Transient Response

$V_{IN}=4.3V$, $V_{OUT}=3.3V$, $I_{OUT}=1mA \sim 300mA$



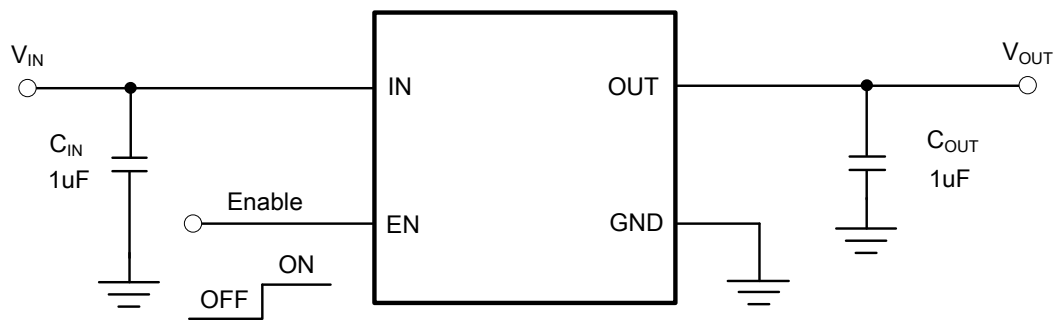
Load Transient Response

$V_{IN}=4.3V$, $V_{OUT}=3.3V$, $I_{OUT}=300mA \sim 1mA$



PSRR $I_{OUT}=30mA$

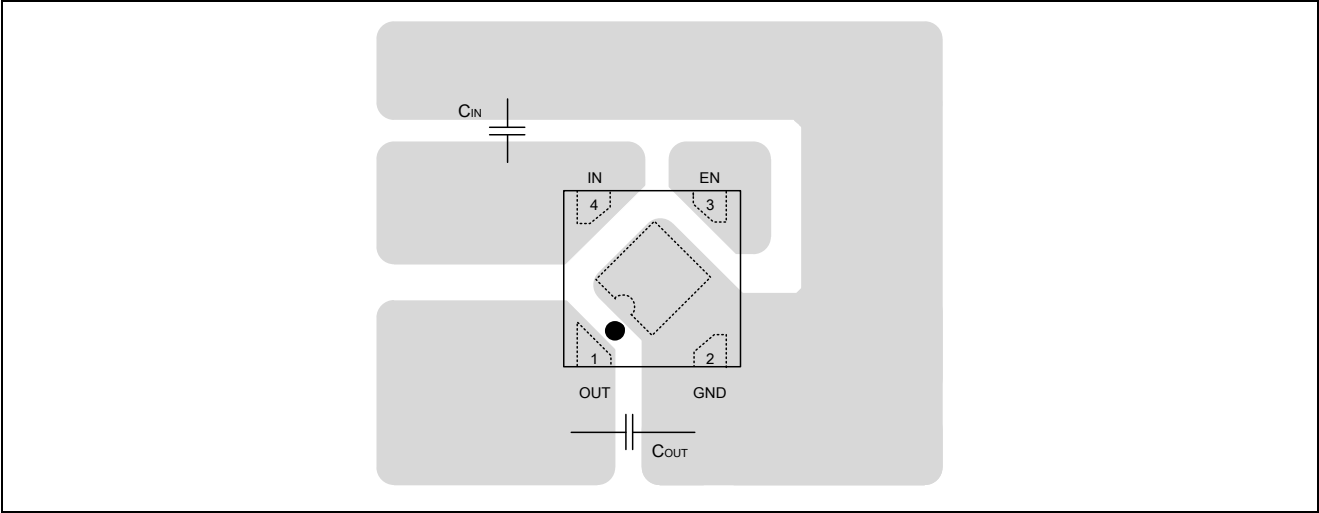
Application Circuits



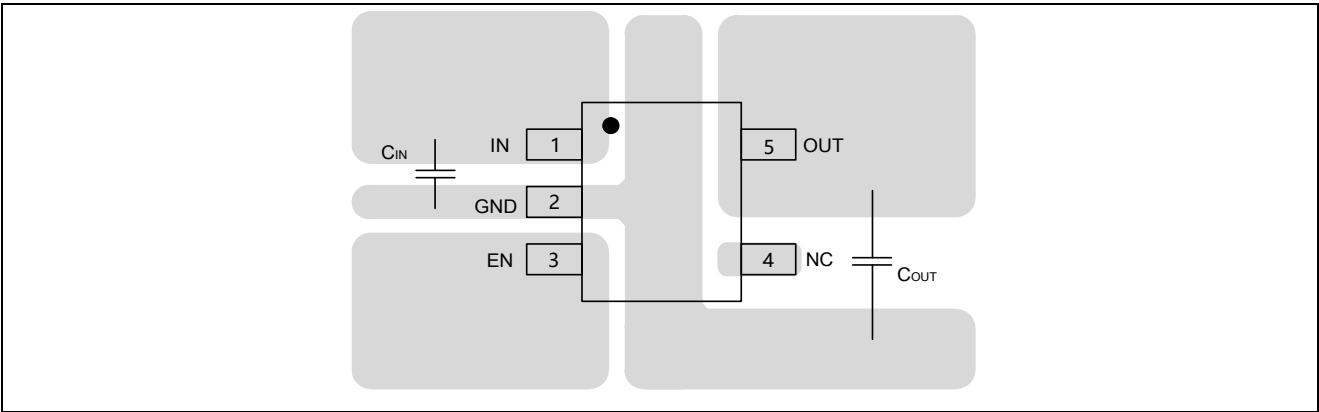
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PCB Layout Guide

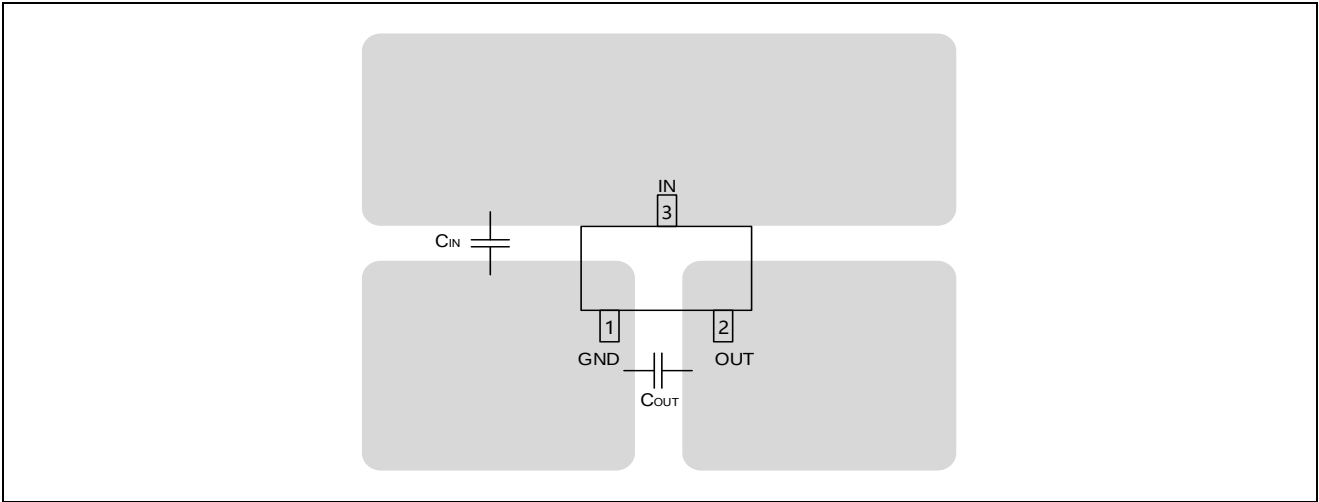
DFN4



SOT23-5/SC70-5



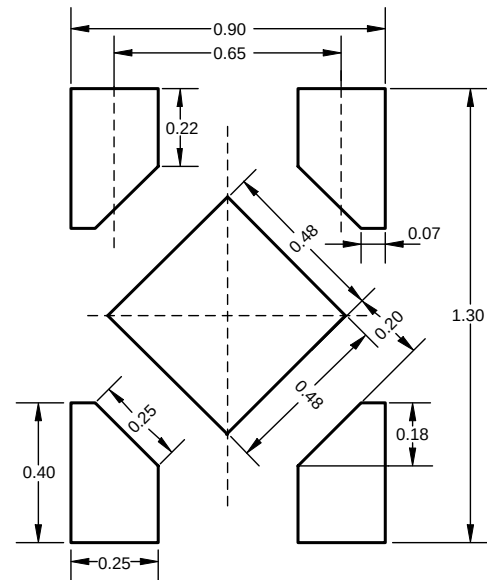
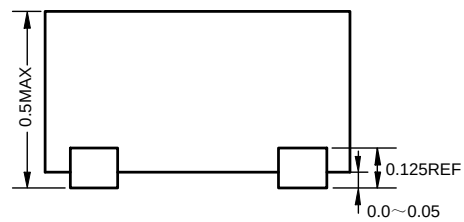
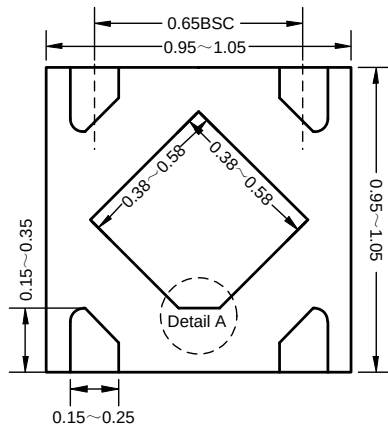
SOT23-3



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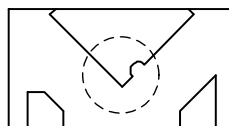
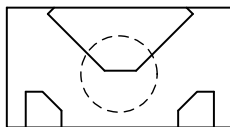
Package Dimension

DFN4



Recommended Land Pattern

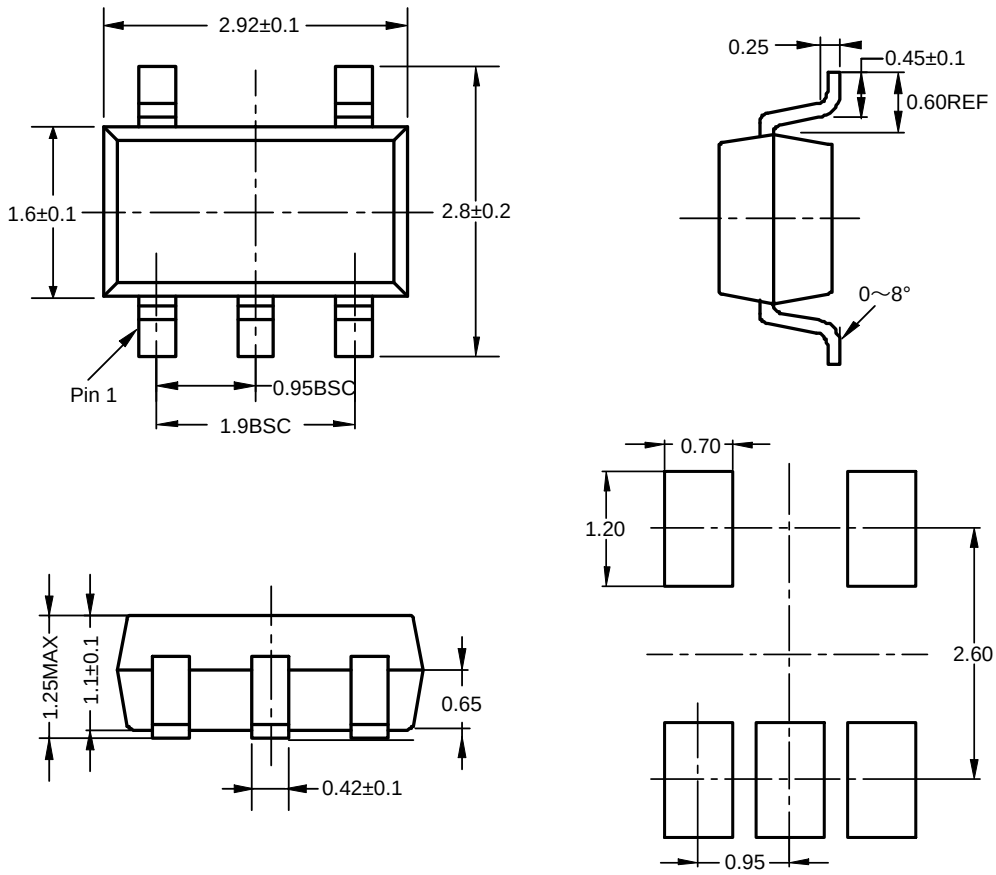
Detail A: (PIN1 shape)



Unit: mm

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SOT23-5

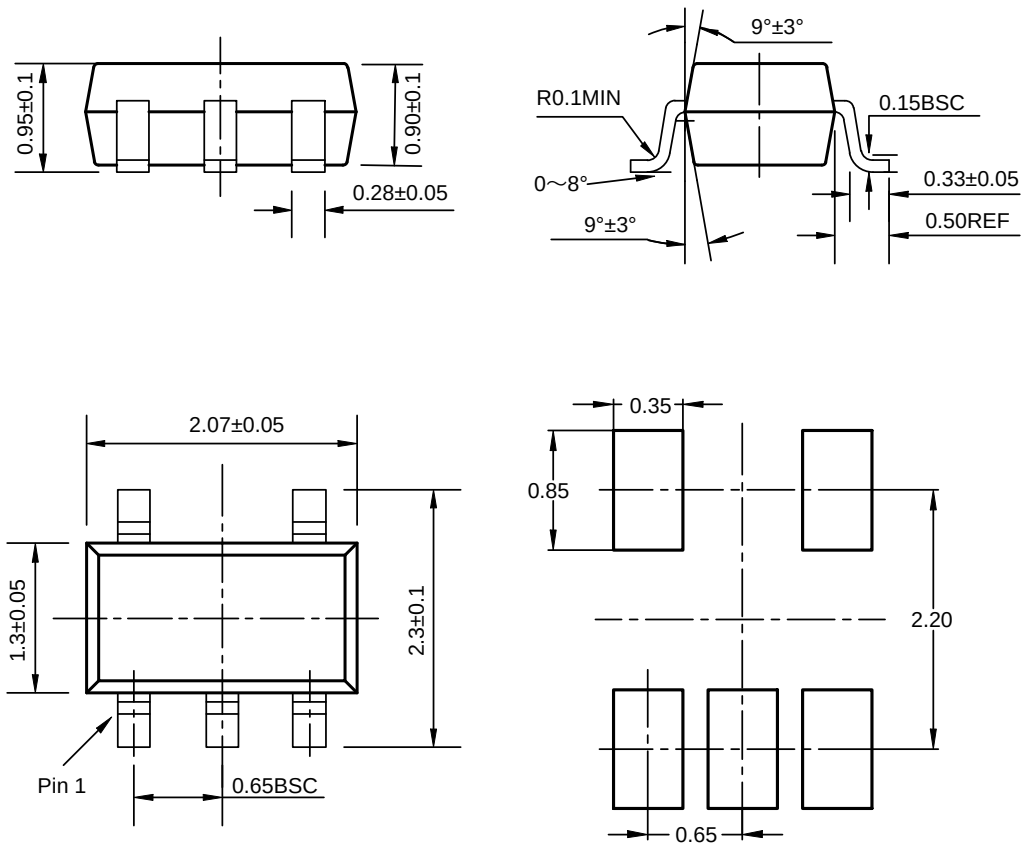


Recommended Land Pattern

Unit: mm

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SC70-5

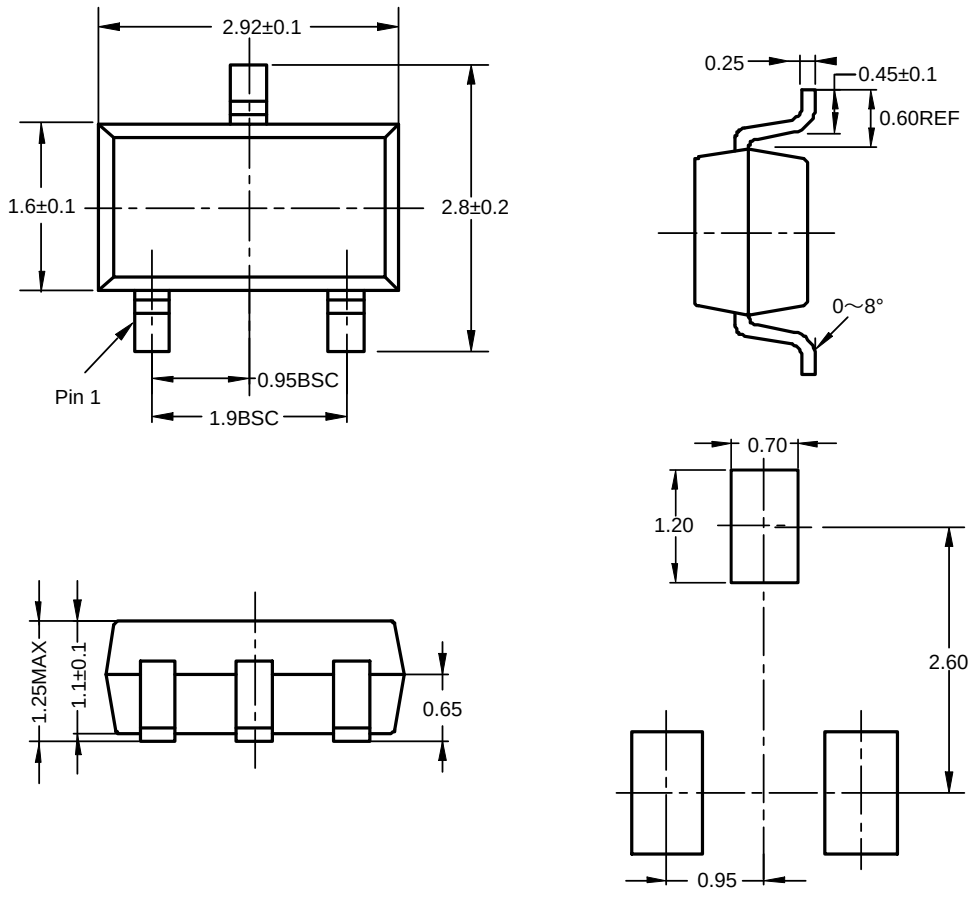


Recommended Land Pattern

Unit: mm

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SOT23-3



Recommended Land Pattern

Unit: mm

Marking

SOT23-5 Package 6XX XXXXX ○ 6 = Part Number XX = V_{OUT} Version XXXXX = Track Number	DFN4 Package XX ○ X⁽¹⁾ = V_{OUT} Version X⁽²⁾ = Track Number
SC70-5 Package XXSCX ○ XX = V_{OUT} Version X = Track Number	

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Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2020-07-08	Original Version	Liuxm	Liuxm	Zhuji
1.1	2021-10-21	Add ESD and R _{θJA} in AMR table	Liuxm	Liuxm	Zhuji
1.2	2021-12-13	Add Typical Characteristic	Liuxm	Liuxm	Zhuji
1.3	2021-12-23	Update V _{DROP} of 0.8V&1.0V Update package dimension	Liuxm	Liuxm	Zhuji
1.4	2022-08-24	Update Typeset	Yang Xiao Xu	Liuxm	Yang Xiao Xu
1.5	2023-01-06	Add Marking	Wang Peng	Liuxm	Wang Peng
1.6	2023-03-28	Add ψ_{JC}	Tu guo zhu	Liuxm	Wang Peng
1.7	2024-1-8	Add 2.8V Characteristic Curve SC70-5 size	Tu guo zhu	Liuxm	Wang Peng
1.8	2024-2-29	Add SOT23-3 package	Shibo	Liuxm	Liuji