Very High PSRR Low Noise 300mA LDO

General Description

The ET536XXYB family are the high performance 300mA LDO with auto discharge function, It uses an advanced CMOS process and a PMOSFET pass device to achieve very high power supply rejection ratio (PSRR) ,ultra low noise, very low dropout ,very low ground current, fast start-up and excellent output accuracy.

The ET536XXYB family are stable with a 1.0μF ceramic input and output capacitor, uses a precision voltage reference and feedback loop to achieve high excellent Regulation and transient response.

The ET536XXYB family are available in standard fixed output voltages of 1.05V (ET536105YB) , 1.1V (ET53611YB) , 1.2V (ET53612YB), 1.8V (ET53618YB), 2.0V (ET53620YB), 2.2V (ET53622YB),2.8V (ET53628YB), 2.85V (ET536285YB), 3.0V (ET53630YB), 3.1V (ET53631YB), 3.3V (ET53633YB) and custom voltage options (50mV step options).

The ET536XXYB family are offered small DFN4(1mm x 1mm)package, which is ideal for small form factor portable equipment .

Features

- Wide Input Voltage Range from 1.6V to 5.5V
- Up to 300mA Load Current
- Standard Fixed Output Voltage Options are 1.05V, 1.1V, 1.2V, 1.8V, 2.0V, 2.2V, 2.8V, 2.85V, 3.0V, 3.1V, and 3.3V
- Other Output Voltage Options Available On Request
- Very Low I_Q is 45μA Typical
- Ultra Low Dropout: 130mV at 300mA Load @V_{OUT} = 2.8V
- Very high PSRR up to 78dB at 1kHz
- Ultra Low Noise is 20uVrms at 1.2V Output (load=1mA)
- Excellent Load/Line Transient Response
- Line Regulation is 0.03%/V Typical
- With Auto Discharge Function
- Part No. and Package

Part No.	Package	MSL
ET536XXYB	DFN4(1mm x 1mm)	Level 1

Applications

- Smart Phones and Cellular Phones
- PDAs
- MP3/MP4 Player
- Digital Still Cameras
- Portable Instrument

Mark Specification

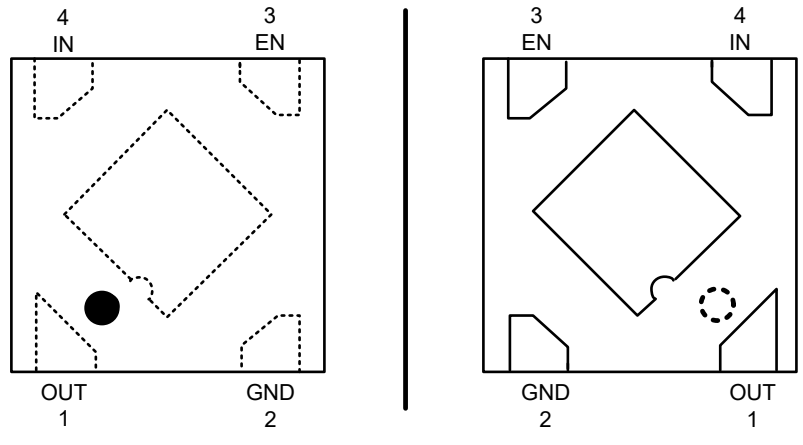
Part No.	Marking	V_{OUT}	Auto Discharge Function
ET536105YB	UX	1.05V	Y
ET53611YB	IX	1.1V	Y
ET53612YB	AX	1.2V	Y
ET53618YB	CX	1.8V	Y
ET53618YB	2X	2.0V	Y
ET53622YB	QX	2.2V	Y
ET53628YB	DX	2.8V	Y
ET536285YB	HX	2.85V	Y
ET53630YB	GX	3.0V	Y
ET53631YB	ZX	3.1V	Y
ET53633YB	EX	3.3V	Y

Device information

ET 536 XX X **B**

XX Output Voltage		**X** Package		**B** Auto-discharge Function	
XX	V_{OUT} =X.XV Range: 0.8~3.3V	Y	DFN4 (1mm x 1mm)	B	Auto-discharge

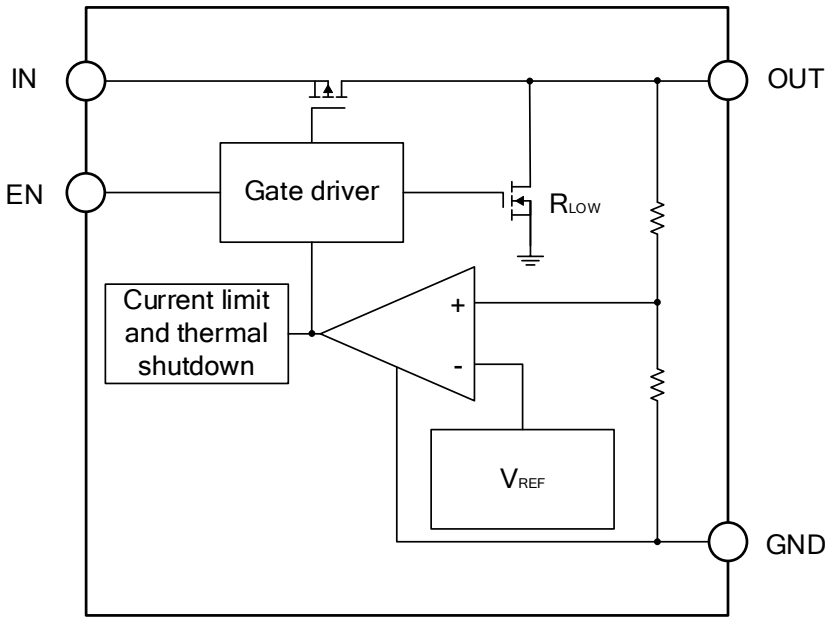
Pin Configuration



Pin Function

Pin No.	Pin Name	Pin Function
4	IN	Supply input pin. Must be closely decoupled to GND with a 1μF or greater ceramic capacitor.
2	GND	Ground.
3	EN	Enable control input, active high. Do not leave EN floating.
1	OUT	Output pin. Bypass a 1μF ceramic capacitor from this pin to ground.
	Thermal Pad	Thermal pad connect to GND or leave floating. Do not connect to any potential other than GND.

Block Diagram



Functional Description

Input Capacitor

A 1μF 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 4.7μF, 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.

ON/OFF Input Operation

The ET536XXYB 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.

High PSRR and Low Noise

In order to provide good audio quality, the audio power supply for hand-free, game, MP3, and multimedia applications in cellular phones, require low-noise and high PSRR at audio frequency range (20Hz-20kHz).

The ET536XXYB, with PSRR of 78dB at 1KHz, is suitable for most of these applications that require high PSRR and low noise.

Ultra Fast Start-up

After enabled, the ET536XXYB is able to provide full power in as little as tens of microseconds, typically 25μs. 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.

Fast Transient Response

The ET536XXYB's fast transient response from 0 to 300mA provides stable voltage supply for fast DSP and GSM chipset with fast changing load.

Low Quiescent Current

The ET536XXYB consuming only around 45μA for all input range and output loading, provides great power saving in portable and low power applications.

Current Limit Protection

When output current at the OUT pin is higher than current limit threshold or the OUT pin is short-circuit to GND, 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	V
V_{EN}	Input Voltage (EN Pin)		-0.3 to 6	V
V_{OUT}	Output Voltage		-0.3 to V_{IN}+0.3	V
I_{MAX}	Maximum Load Current		500	mA
P_D	Maximum Power Consumption	DFN4	400	mW
ESD	Human Body Model (JEDEC JS-001)		±4000	V
	Charged Device Model(JEDEC JS-002)		±1500	V
$R_{\theta JA}$	Junction-to-ambient thermal resistance		250	°C/W
T_J	Operating Junction Temperature		-40 to 150	°C
T_{STG}	Storage Temperature		-65 to 150	°C
T_{SLOD}	Lead Temperature (Soldering, 10 sec)		300	°C

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	1.6 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	5 to 100	mΩ

Electrical Characteristics

(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 Operation Range		1.6		5.5	V
V_{DROP}[1]	Dropout Voltage	V_{OUT} = 1.05V, I_{OUT} = 300mA	280	360	550	mV
		V_{OUT} = 1.1V, I_{OUT} = 300mA	220	240	280	
		V_{OUT} = 1.2V, I_{OUT} = 300mA	200	220	260	
		V_{OUT} = 1.8V, I_{OUT} = 300mA		200	300	
		V_{OUT} = 2.2V, I_{OUT} = 300mA		180	270	
		V_{OUT} = 2.8V, I_{OUT} = 300mA		160	250	
		V_{OUT} = 3.0V, I_{OUT} = 300mA		140	230	
		V_{OUT} = 3.1V, I_{OUT} = 300mA		135	220	
		V_{OUT} = 3.3V, I_{OUT} = 300mA		130	200	
I_{Q_ON}	DC Supply Quiescent Current	Active mode: V_{EN}=V_{IN}		45	70	μA
I_{Q_OFF}	DC Supply Shutdown Current	V_{EN}=0V		0.01	1	μA
V_{OUT}	Regulated Output Voltage	I_{OUT}=1mA to 300mA, T_A=25 °C	-2		2	%
Reg_{LINE}	Output Voltage Line Regulation	V_{IN} = V_{OUT} + 1V to 5.5V, I_{OUT} = 10mA		0.03	0.2	%/V
Reg_{LOAD}	Output Voltage Load Regulation	I_{OUT} from 1mA to 300mA		20	40	mV
I_{LIMIT}	Current Limit		300			mA
I_{SHORT}	Short Circuit Current Limit	V_{OUT} = 0V		100		mA
PSRR[2]	Power Supply Rejection Ratio	V_{IN} = V_{OUT} + 1V + 200mVpp , f = 1kHz, C_{OUT} = 1μF, I_{OUT} = 30mA		78		dB
		V_{IN} = V_{OUT} + 1V + 200mVpp , f = 10kHz, C_{OUT} = 1μF, I_{OUT} = 30mA		65		dB
e_N[2]	Output Noise	10Hz to 100kHz, I_{OUT} = 200mA, C_{OUT} = 1μF		20		μVRMS
V_{ENL}	EN Low Threshold	V_{IN}=1.9V to 5.5V, V_{EN} falling until the output is disabled			0.3	V
V_{ENH}	EN High Threshold	V_{IN}=1.9V to 5.5V, V_{EN} rising until the output is enabled	1.5			V

Electrical Characteristics(Continued)

(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
I_{EN}	EN Pin Input Current	V_{EN}=5.5V		0	0.1	μA
R_{PD}	EN pull-down resistance		0.8	1	1.3	MΩ
R_{LOW}	Output resistance of auto discharge at off state	EN=0V, V_{IN}=4V		130		Ω
T_{TSD}(2)	Over-temperature Shutdown Threshold	T_J rising		155		°C
T_{HYS}(2)	Over-temperature Shutdown Hysteresis	T_J falling from shutdown		20		°C

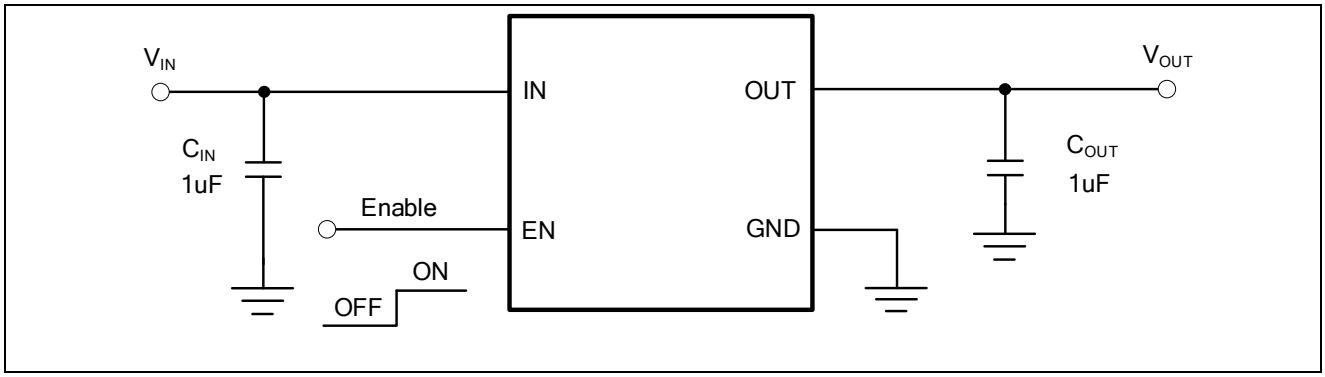
Notes:

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

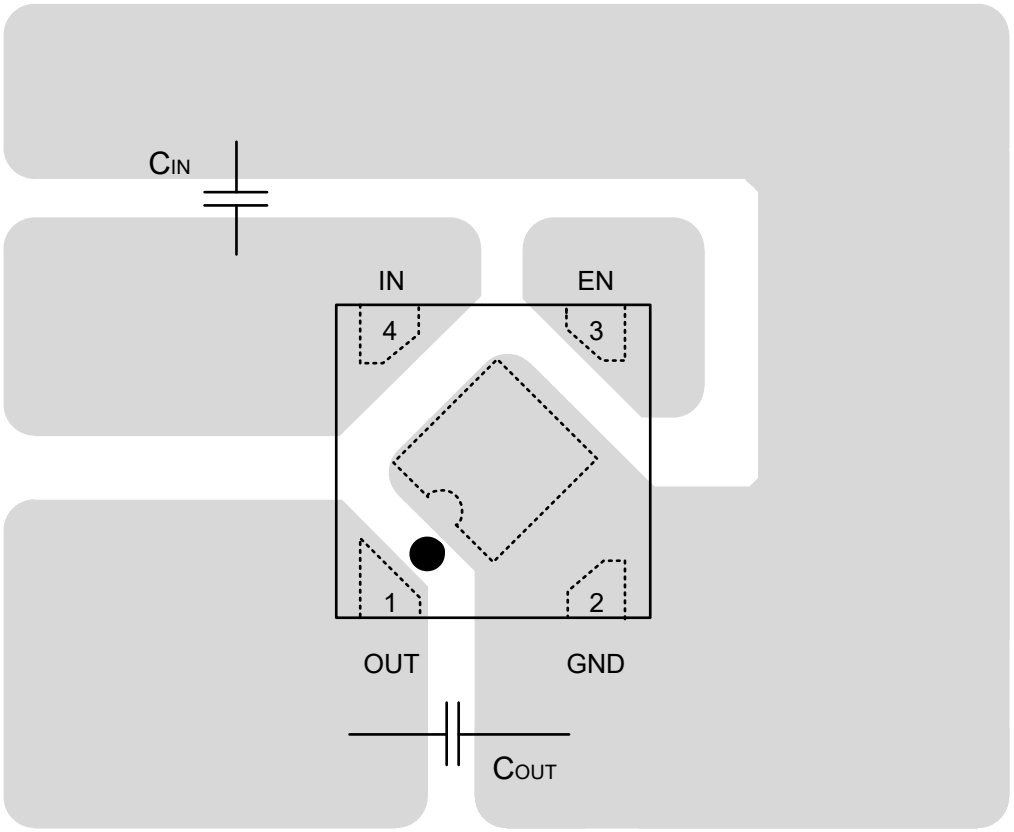
2: The minimum operating voltage is 1.6V.The calculation formula is as follows:

$$V_{DROP}=V_{IN(min)}-V_{OUT}$$

Application Circuits



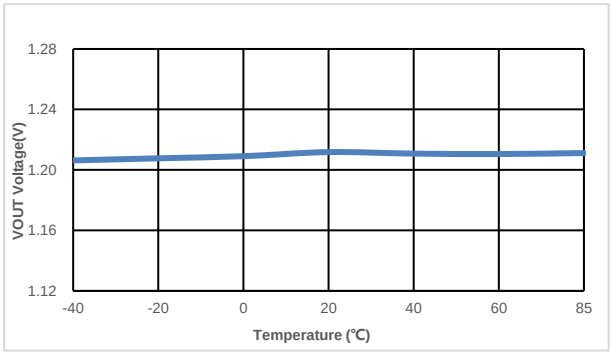
PCB Layout Guide



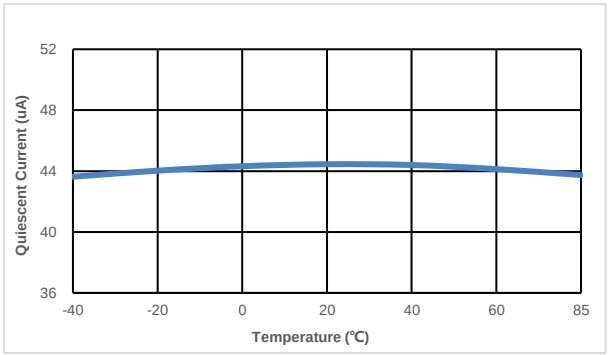
Typical Characteristics

(1)VOLTAGE VERSION 1.2 V

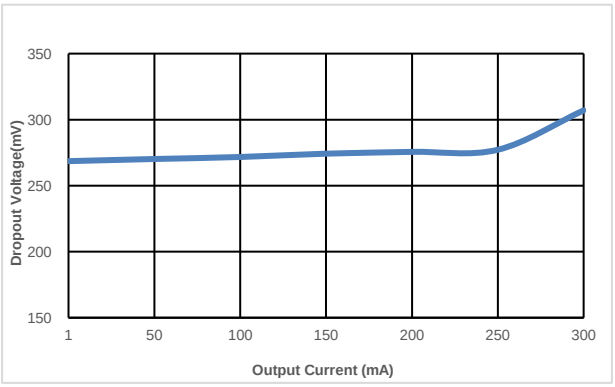
(V_{IN}=V_{EN}=2.2V; I_{OUT}= 1mA, C_{IN}=C_{OUT} =1.0μF, unless otherwise noted. Typical values are at T_A=25°C.)



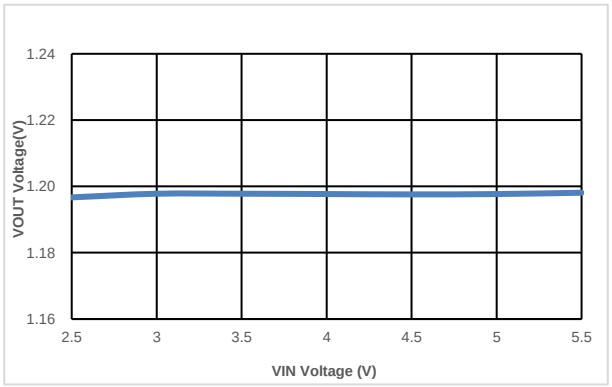
Output Voltage VS Temperature



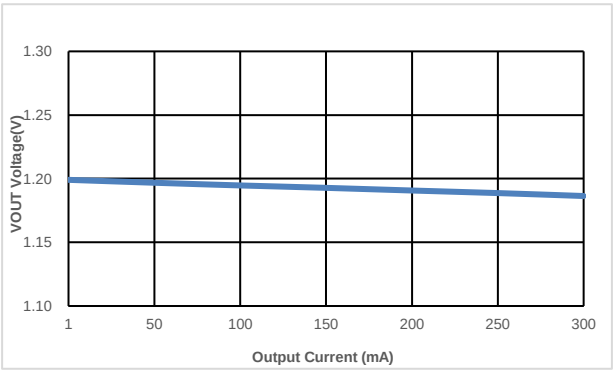
Supply Current VS Temperature



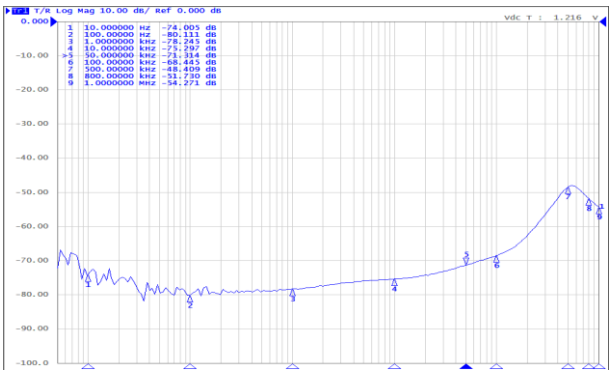
Dropout Voltage VS Output Current



Output Voltage VS Input Voltage (I_{OUT}=10mA)



Output Voltage VS Output Current

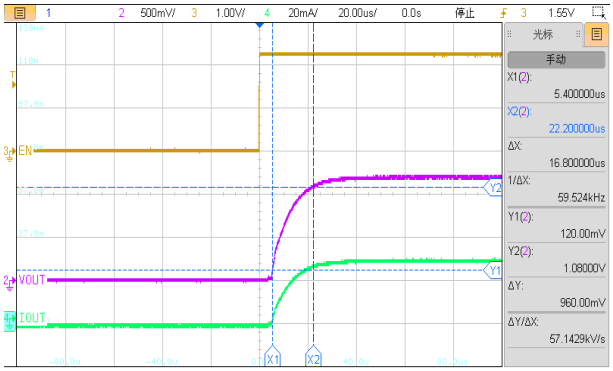


PSRR VS Output Current (I_{OUT}=30mA)

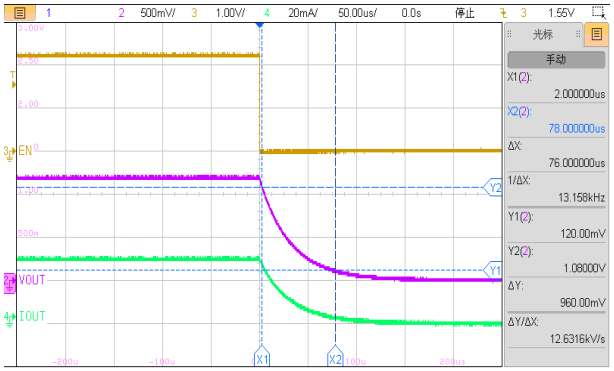
Typical Characteristics(Continued)

(1)VOLTAGE VERSION 1.2 V

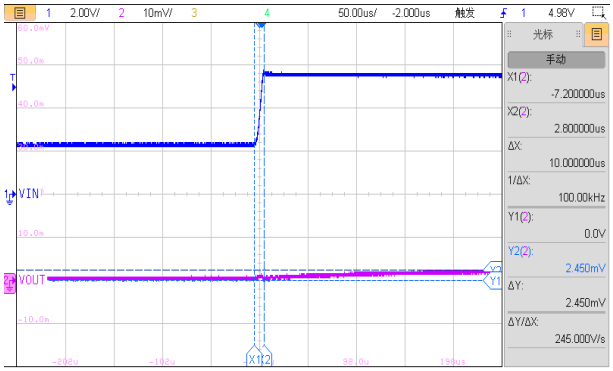
(V_{IN}=V_{EN}=2.2V; I_{OUT}= 1mA, C_{IN}=C_{OUT} =1.0μF, unless otherwise noted. Typical values are at T_A=25°C.)



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

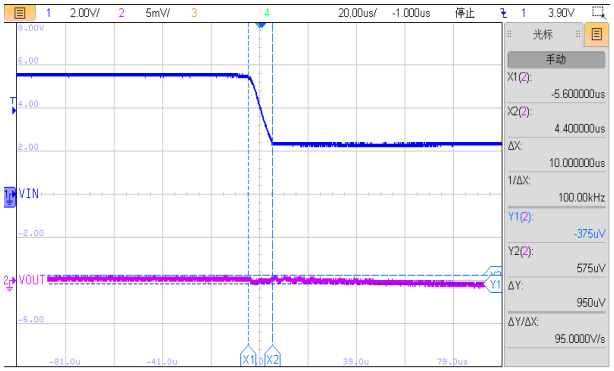


Turn Off Speed VS EN Voltage (I_{OUT}=30mA)



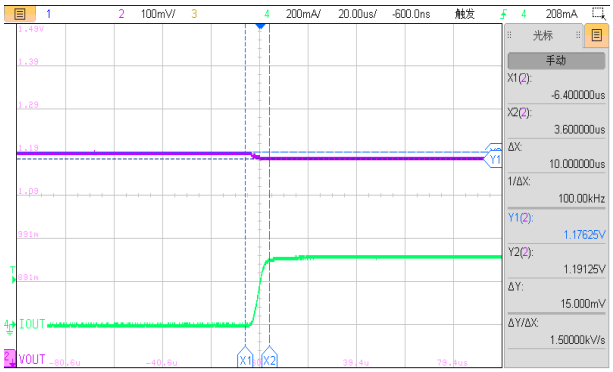
Line Transient Response

V_{IN}=2.2V~5.5V, V_{OUT}=1.2V, I_{OUT}=1mA



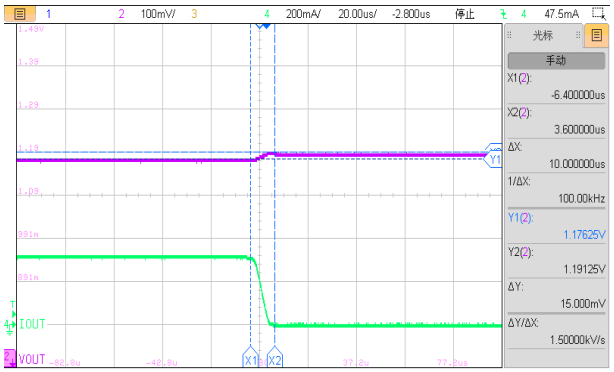
Line Transient Response

VIN=5.5V~2.2V, V_{OUT}=1.2V, I_{OUT}=1mA



Load Transient Response

V_{IN}=2.2V, V_{OUT}=1.2V, I_{OUT}=1mA~300mA



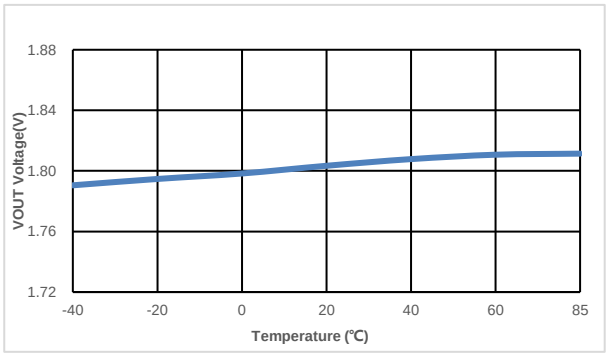
Load Transient Response

V_{IN}=2.2V, V_{OUT}=1.2V, I_{OUT}=300mA~1mA

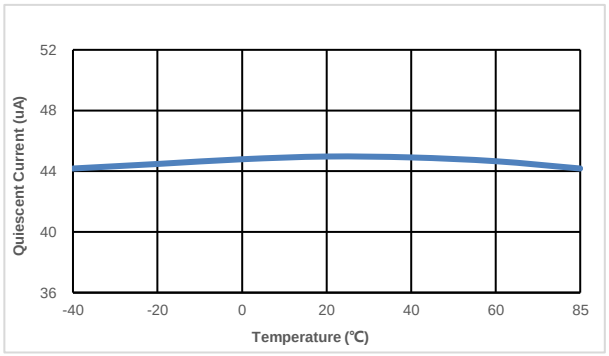
Typical Characteristics(Continued)

(2)VOLTAGE VERSION 1.8 V

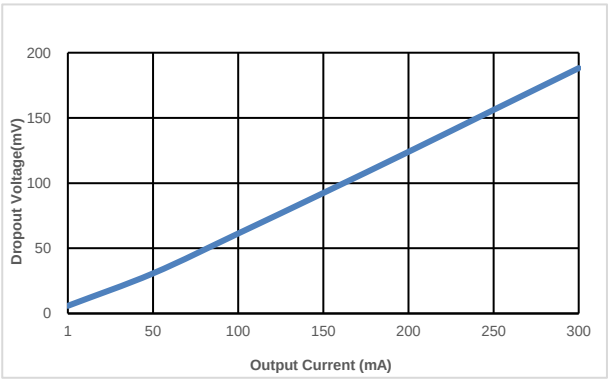
(V_{IN}=V_{EN}=2.8V; I_{OUT}= 1mA, C_{IN}=C_{OUT} =1.0μF, unless otherwise noted. Typical values are at T_A=25°C.)



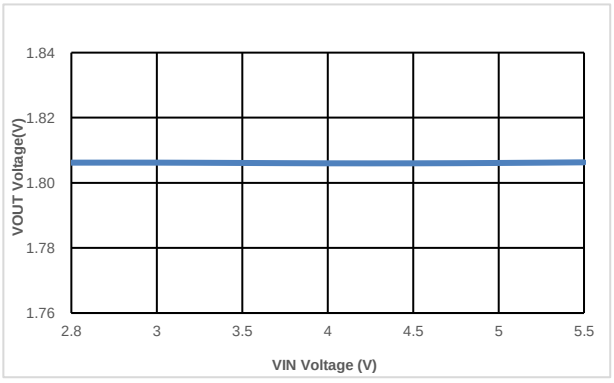
Output Voltage VS Temperature



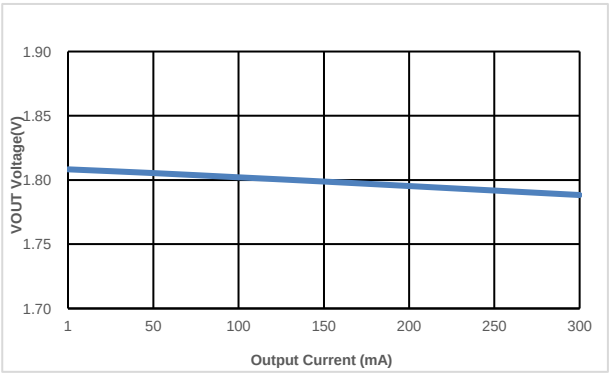
Supply Current VS Temperature



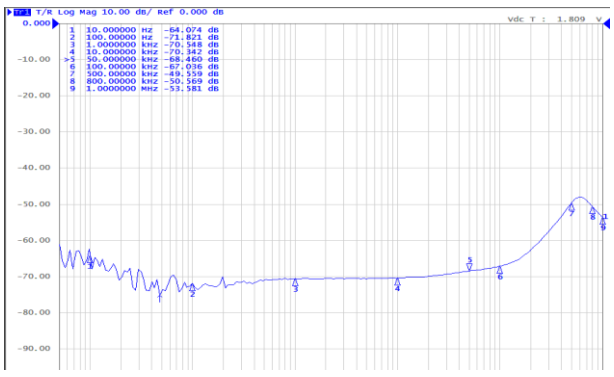
Dropout Voltage VS Output Current



Output Voltage VS Input Voltage (I_{OUT}=10mA)



Output Voltage VS Output Current

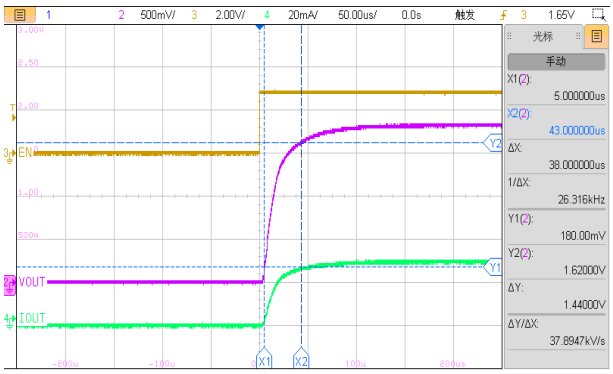


PSRR VS Output Current (I_{OUT}=30mA)

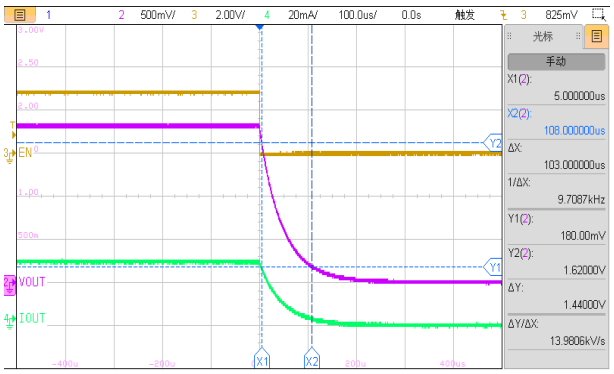
Typical Characteristics(Continued)

(2)VOLTAGE VERSION 1.8 V

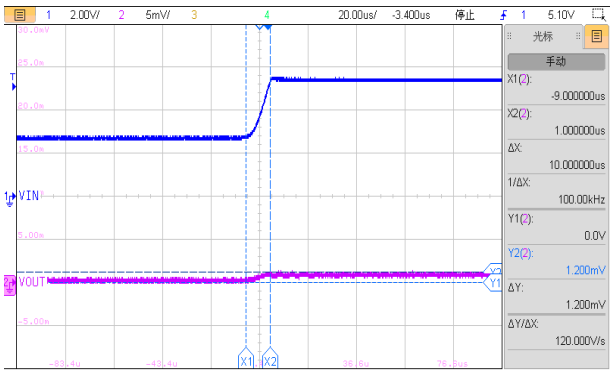
(V_{IN}=V_{EN}=2.8V; I_{OUT}= 1mA, C_{IN}=C_{OUT} =1.0μF, unless otherwise noted. Typical values are at T_A=25°C.)



Turn On Speed VS EN Voltage (I_{OUT}=300mA)

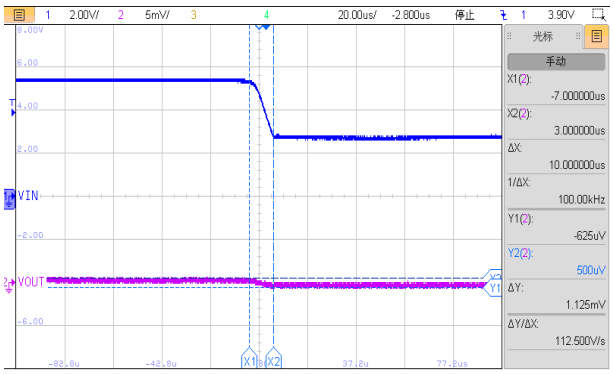


Turn Off Speed VS EN Voltage (I_{OUT}=300mA)



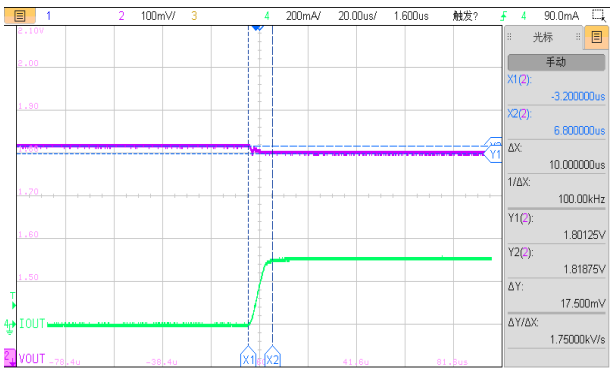
Line Transient Response

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



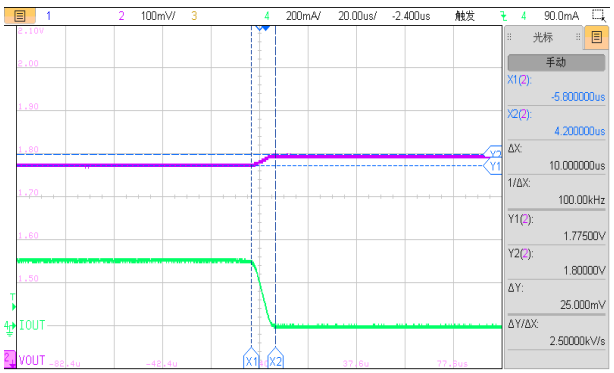
Line Transient Response

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



Load Transient Response

V_{IN}=2.8V, V_{OUT}=1.8V, I_{OUT}=1mA~300mA, t=10us



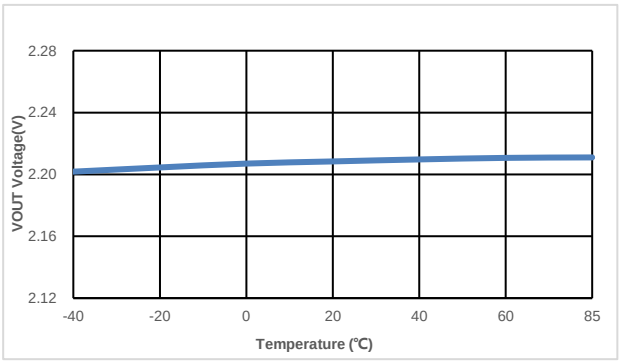
Load Transient Response

V_{IN}=2.8V, V_{OUT}=1.8V, I_{OUT}=300mA~1mA, t=10us

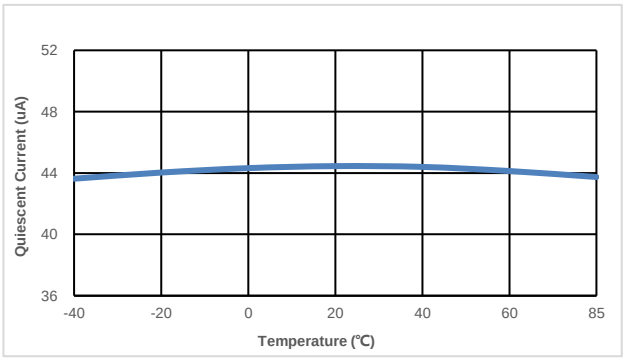
Typical Characteristics(Continued)

(3)VOLTAGE VERSION 2.2 V

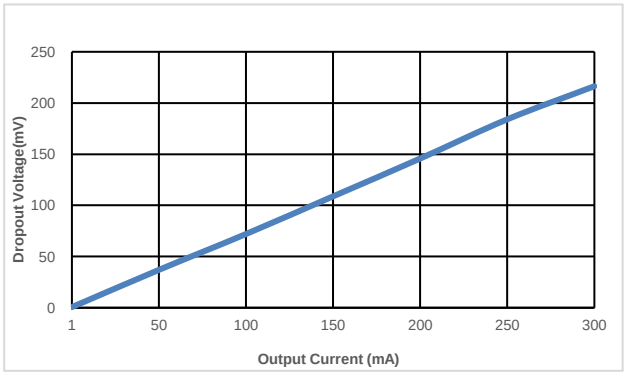
(V_{IN}=V_{EN}=3.2V; I_{OUT}= 1mA, C_{IN}=C_{OUT} =1.0μF, unless otherwise noted. Typical values are at T_A=25°C.)



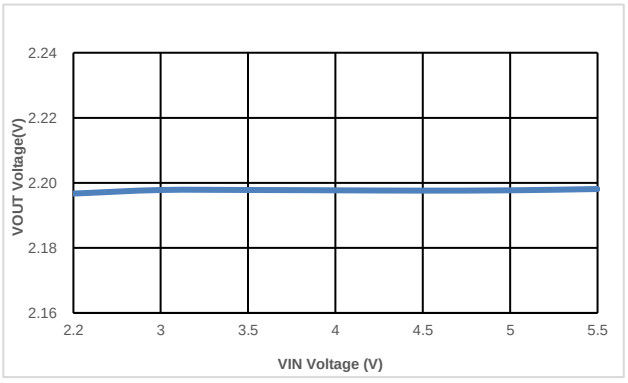
Output Voltage VS Temperature



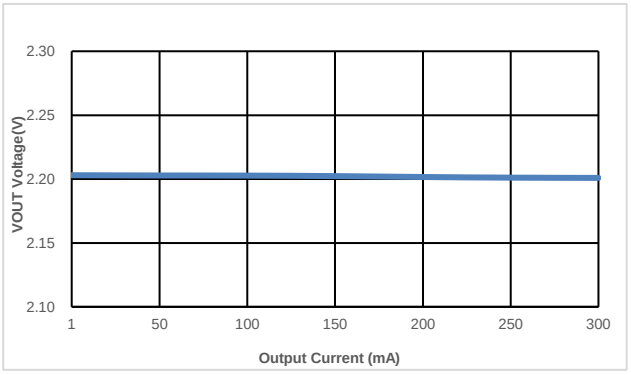
Supply Current VS Temperature



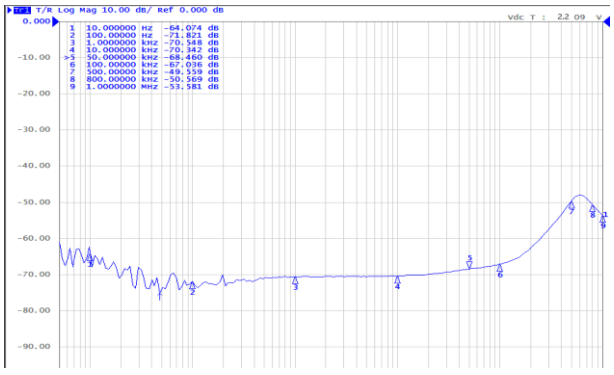
Dropout Voltage VS Output Current



Output Voltage VS Input Voltage (I_{OUT}=10mA)



Output Voltage VS Output Current

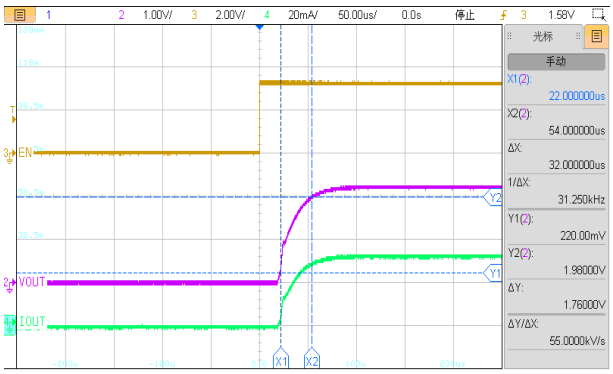


PSRR VS Output Current (I_{OUT}=30mA)

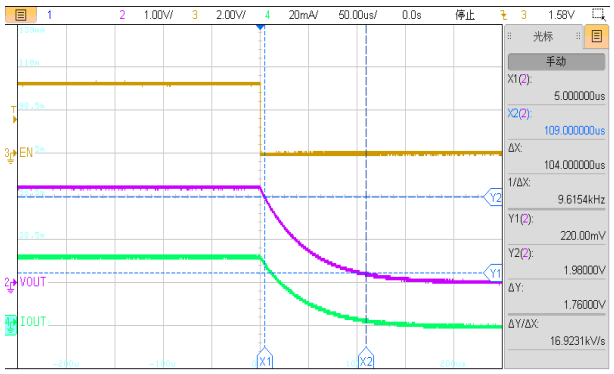
Typical Characteristics(Continued)

(3)VOLTAGE VERSION 2.2 V

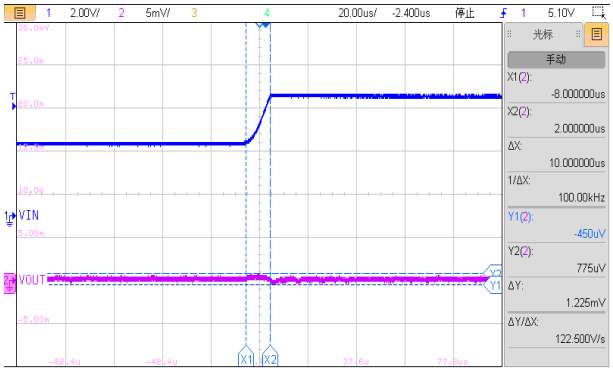
(V_{IN}=V_{EN}=3.2V; I_{OUT}= 1mA, C_{IN}=C_{OUT} =1.0μF, unless otherwise noted. Typical values are at T_A=25°C.)



Turn On Speed VS EN Voltage (IOUT=30mA)

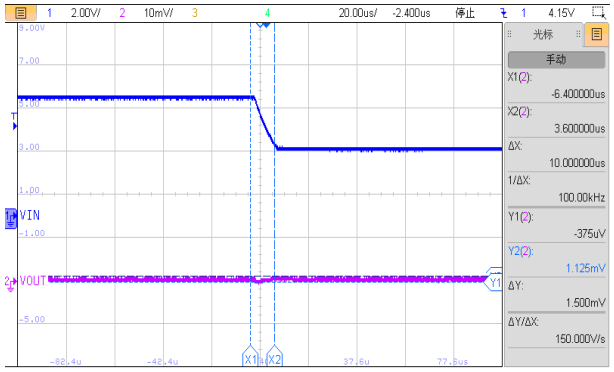


Turn Off Speed VS EN Voltage (IOUT=30mA)



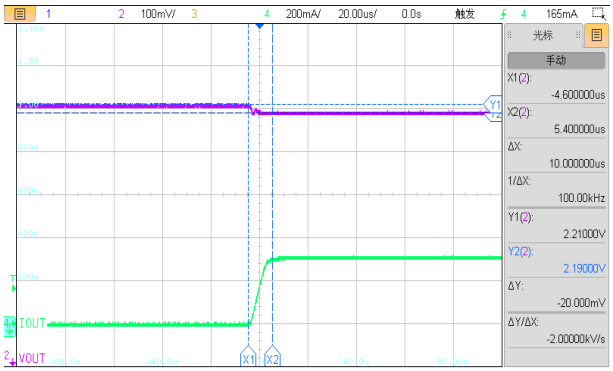
Line Transient Response

V_{IN}=3.2V~5.5V, V_{OUT}=2.2V, I_{OUT}=1mA



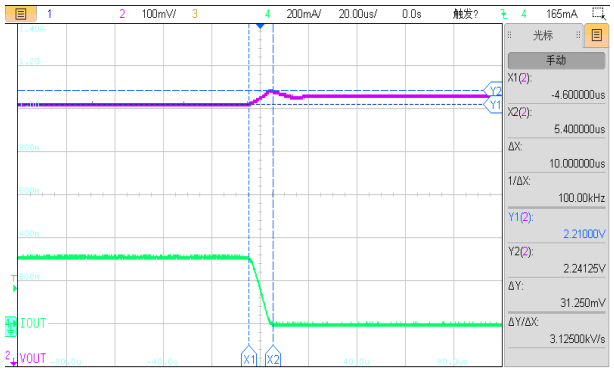
Line Transient Response

VIN=5.5V~3.2V, V_{OUT}=2.2V, I_{OUT}=1mA



Load Transient Response

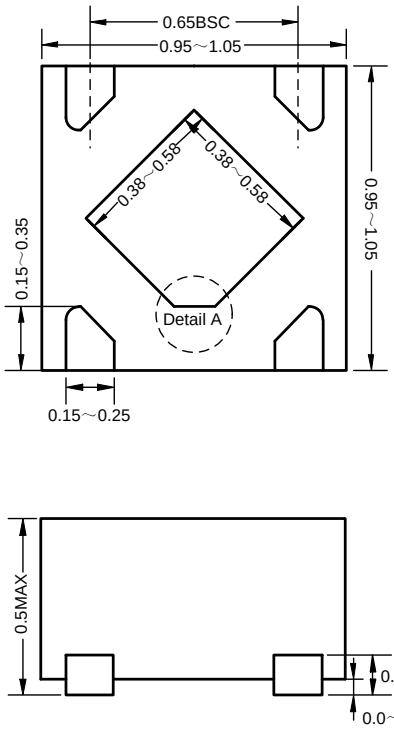
V_{IN}=3.2V, V_{OUT}=2.2V, I_{OUT}=1mA~300mA

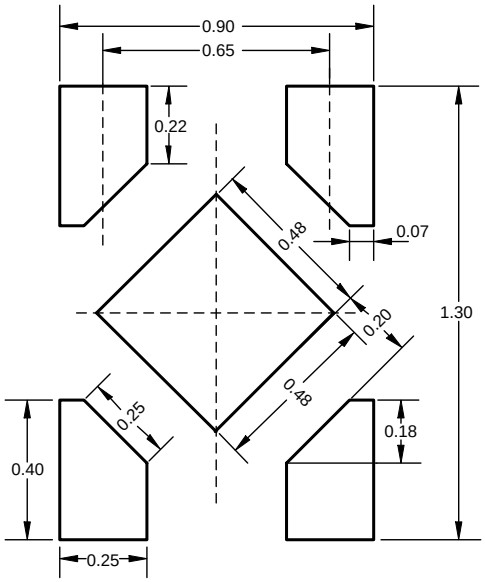


Load Transient Response

V_{IN}=3.2V, V_{OUT}=2.2V, I_{OUT}=300mA~1mA

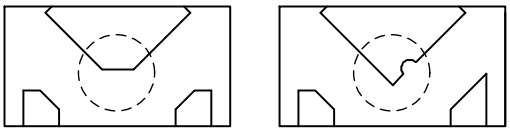
Package Dimension





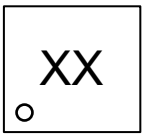
Recommended Land Pattern

Detail A: (PIN1 shape)



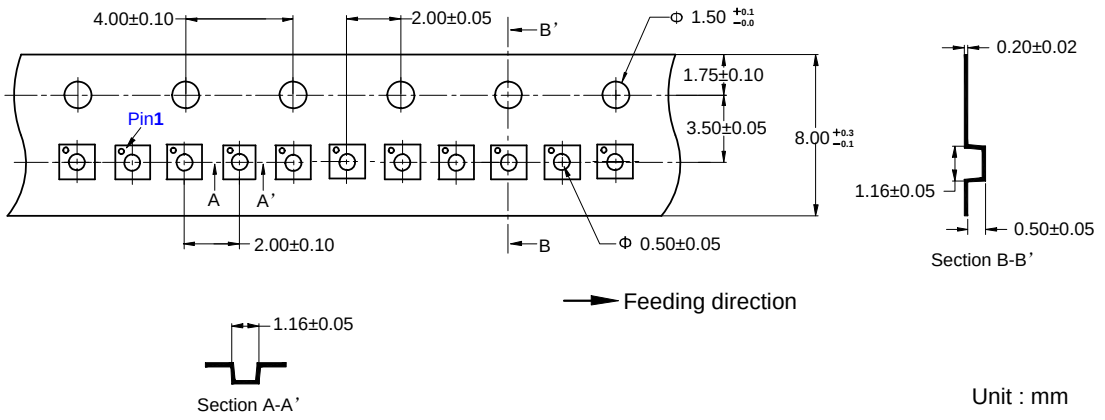
Unit: mm

Marking Information



X=V_{OUT} Version
X=Tracking Number

Tape Information



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function &	Package &
1.0	2019-06-10	First Version	Liuxm	Zhujl	Zhujl
1.1	2023-10-07	Update Typeset	Pengjj	Liuyg	Liujy
1.2	2024-02-18	Update Typeset, Add Typical Characteristics	Pengjj	Pengjj	Liujy