

Very High PSRR Low Noise 300mA LDO

General Description

The ET537XXYB 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), low noise, low dropout, low ground current, fast start-up and excellent output accuracy.

The ET537XXYB family are stable with a 1.0 μ F ceramic input and output capacitor, uses a precision voltage reference and feedback loop to achieve high excellent Regulation and transient response.

The ET537XXYB family are available in standard fixed output voltages of 1.1V (ET53711YB), 1.2V (ET53712YB), 1.8V (ET53718YB), 2.2V (ET53722YB), 2.8V (ET53728YB), 2.85V (ET537285YB), 3.0V (ET53730YB), 3.1V (ET53731YB), 3.3V (ET53733YB) and custom voltage options.

The ET537XXYB family are offered small DFN4 (1mm x 1mm) package, which is ideal for small form factor portable equipment.

Features

- Wide Input Voltage from 1.6V to 5.5V
- Up to 300mA Load Current
- Standard Fixed Output Voltage Options are 1.1V, 1.2V, 1.8V, 2.2V, 2.8V, 3.0V, 3.1V, and 3.3V etc.
- Other Output Voltage Options Available on Request
- Very Low IQ is 45 μ A Typical
- Low Dropout: 155mV at 300mA Load @V_{OUT} = 2.8V
- Very High PSRR up to 70dB at 1kHz
- Low Noise is 20 μ Vrms
- With Auto Discharge Function
- OTP, OCP, SCP
- Part No. and Package Information

Part No.	Package	MSL
ET537XXYB	DFN4 (1mm × 1mm)	1

Applications

- Smart Phones and Cellular Phones
- PDAs
- Digital Still Cameras
- Portable instrument
- Bluetooth, wireless handsets

ET537XXYB

Mark Specification

Part No.	Marking	V _{OUT}	Auto Discharge Function
ET53711YB	IX	1.1V	Y
ET53712YB	AX	1.2V	Y
ET53718YB	CX	1.8V	Y
ET53722YB	QX	2.2V	Y
ET53728YB	DX	2.8V	Y
ET537285YB	HX	2.85V	Y
ET53730YB	GX	3.0V	Y
ET53731YB	ZX	3.1V	Y
ET53733YB	EX	3.3V	Y

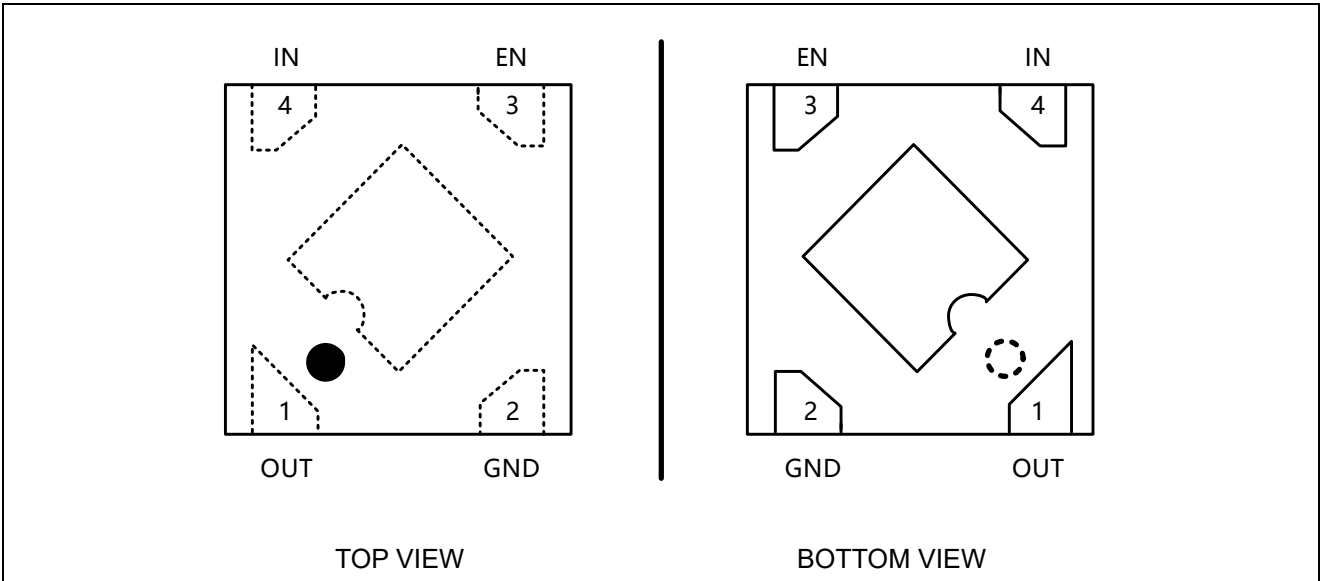
Device information

ET 537 XX Y B

<u>XX</u> Output Voltage		<u>X</u> Package		<u>B</u> Auto-discharge Function	
XX	V _{OUT} = X.XV	Y	DFN4 (1mm × 1mm)	B	Auto-discharge

ET537XXYB

Pin Configuration

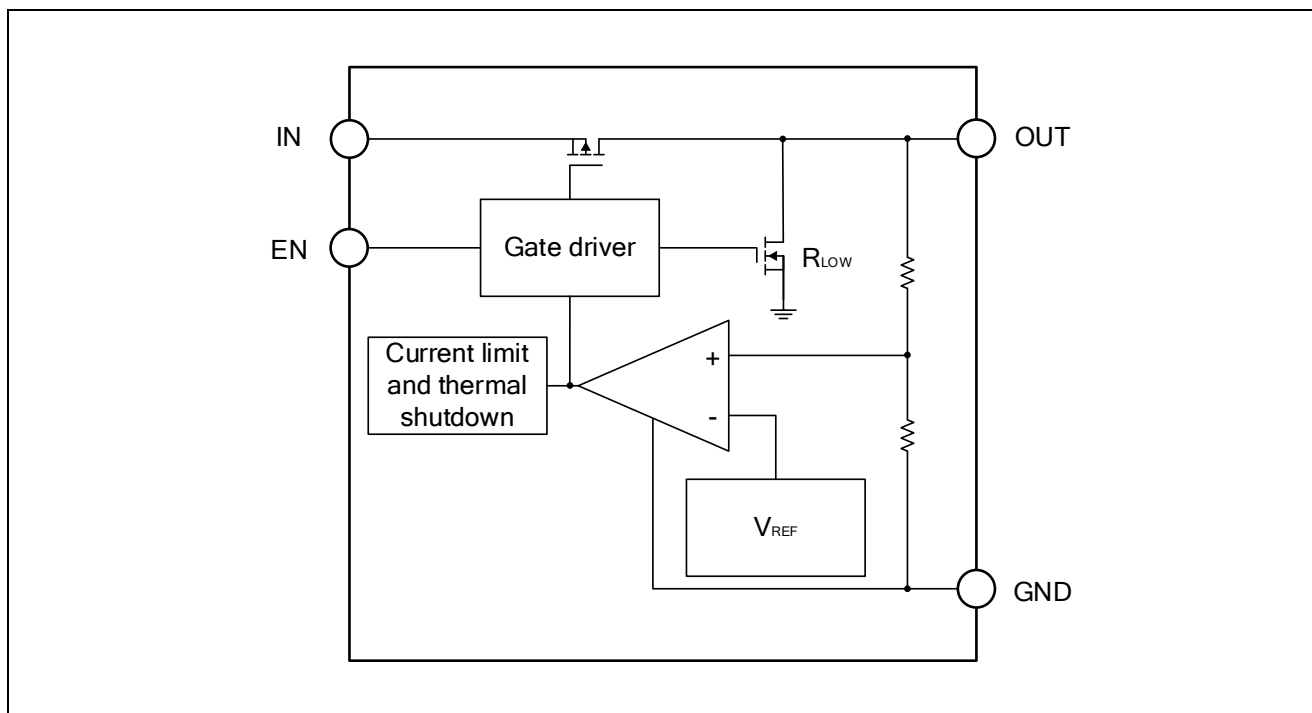


Pin Function

Pin No.	Pin Name	Pin Function
1	OUT	Output pin. Bypass a 1 μ F Ceramic Capacitor from This Pin to Ground.
2	GND	Ground Pin.
3	EN	Enable Control Input, Active High. Do not leave EN floating.
4	IN	Supply Input Pin. Must be closely decoupled to GND with a 1 μ F or greater ceramic capacitor.
-	Thermal Pad	Thermal Pad Connected to GND or Leave Floating. Do not connect to any potential other than GND.

ET537XXYB

Block Diagram



Functional Description

Input Capacitor

A 1 μ F ceramic capacitor is recommended to connect between V_{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 V_{IN} and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is 1 μ F or larger, Equivalent Series Resistance (ESR) is from 5m Ω to 100m Ω , 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 ET537XXYB 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 ET537XXYB, with PSRR of 70dB at 1KHz, is suitable for most of these applications that require high PSRR and low noise.

ET537XXYB

Fast Transient Response

Fast transient response LDOs can also extend battery life. TDMA-based cell phone protocols such as Global System for Mobile Communications (GSM) have a transmit/receive duty factor of only 12.5 percent, enabling power savings by putting much of the baseband circuitry into standby mode in between transmit cycles. In baseband circuits, the load often transitions virtually instantaneously from 100 μ A to 100mA. To meet this load requirement, the LDO must react very quickly without a large voltage drop or overshoot - a requirement that cannot be met with conventional, general-purpose LDOs.

The ET537XXYB's fast transient response from 1 to 300mA provides stable voltage supply for fast DSP and GSM chipset with fast changing load.

Low Quiescent Current

The ET537XXYB consuming only around 45 μ A 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.

ET537XXYB

Absolute Maximum Ratings

Symbol	Parameters (Items)	Value	Unit
V _{IN}	IN Voltage (IN Pin)	-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	300	mA
P _D	Maximum Power Consumption	400	mW
ESD	Human Body Model (JEDEC JS-001)	±4000	V
	Charged Device Model (JEDEC JS-002)	±1500	V
R _{θJA}	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

ET537XXYB

Electrical Characteristics ⁽¹⁾

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage Operation Range		1.6		5.5	V
V_{DROP}	Dropout Voltage ⁽²⁾	$V_{OUT} = 1.2V$, $I_{OUT} = 300mA$		320	400	mV
		$V_{OUT} = 1.8V$, $I_{OUT} = 300mA$		190	310	
		$V_{OUT} = 2.8V$, $I_{OUT} = 300mA$		155	280	
		$V_{OUT} = 3.0V$, $I_{OUT} = 300mA$		150	240	
		$V_{OUT} = 3.3V$, $I_{OUT} = 300mA$		140	220	
I_{Q_ON}	DC Supply Quiescent Current	Active mode: $V_{EN} = V_{IN}$		45	80	μA
I_{Q_OFF}	DC Supply Shutdown Current	$V_{EN} = 0V$		0.01	1	μA
V_{OUT}	Regulated Output Voltage	$V_{OUT} \geq 2.0V$, $V_{IN} = V_{OUT} + 1V$, $I_{OUT} = 1mA$, $T_A = 25^\circ C$	-1.5		1.5	%
		$V_{OUT} < 2.0V$, $V_{IN} = V_{OUT} + 1V$, $I_{OUT} = 1mA$, $T_A = 25^\circ C$	-30		30	mV
Reg_{LINE}	Output Voltage Line Regulation	$V_{IN} = V_{OUT} + 1V$ to $5.5V$, $I_{OUT} = 10mA$			0.2	%/V
Reg_{LOAD}	Output Voltage Load Regulation	I_{OUT} from 1mA to 300mA		20	60	mV
I_{LIMIT}	Current Limit		350	650	850	mA
I_{SHORT}	Short Circuit Current Limit	$V_{OUT} = 0V$		120		mA
PSRR	Power Supply Rejection Ratio	$V_{IN} = V_{IN-set} + 200mV_{pp}$, $C_{OUT} = 1\mu F$, $I_{OUT} = 10mA$	$f = 1kHz$	70		dB
			$f = 100kHz$	54		dB
			$f = 1MHz$	45		dB
e_n	Output Noise	10Hz to 100kHz, $I_{OUT} = 100mA$, $C_{OUT} = 1\mu F$		20		μV_{RMS}
V_{ENL}	EN Low Threshold				0.4	V
V_{ENH}	EN High Threshold		0.9			V
R_{LOW}	Output Discharge FET $R_{ds(on)}$	$V_{IN} = 4V$, $I_{OUT} = 10mA$		120		Ω
R_{EN}	EN pull-down Resistance			1		M Ω
t_s	Soft-start Time	From Enable to 90% V_{OUT_normal}		50		μs
T_{TSD}	Over-Temperature Shutdown Threshold	T_J rising		155		$^\circ C$
T_{HYS}	Over-Temperature Shutdown Hysteresis	T_J falling from shutdown		20		$^\circ C$

ET537XXYB

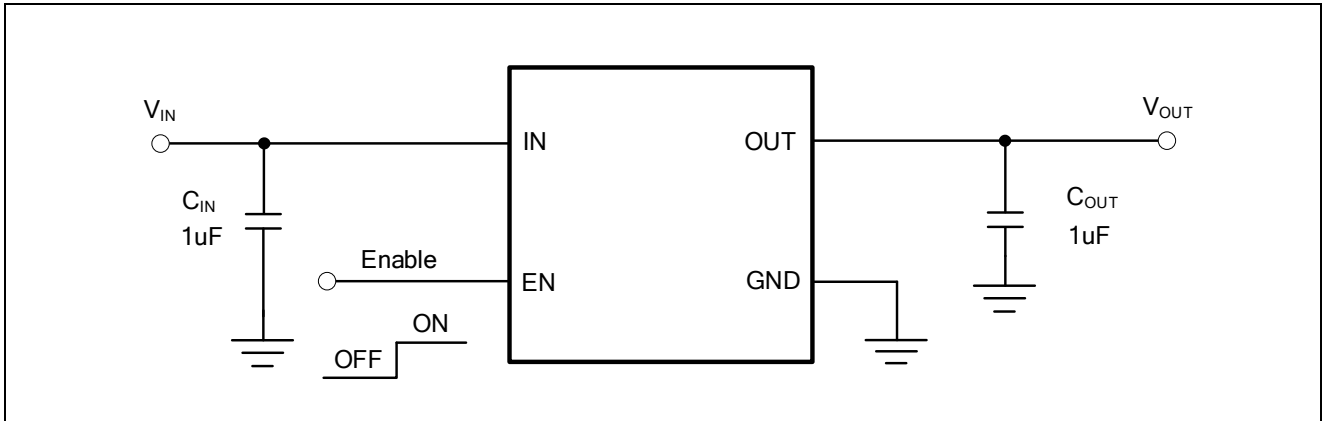
Notes:

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

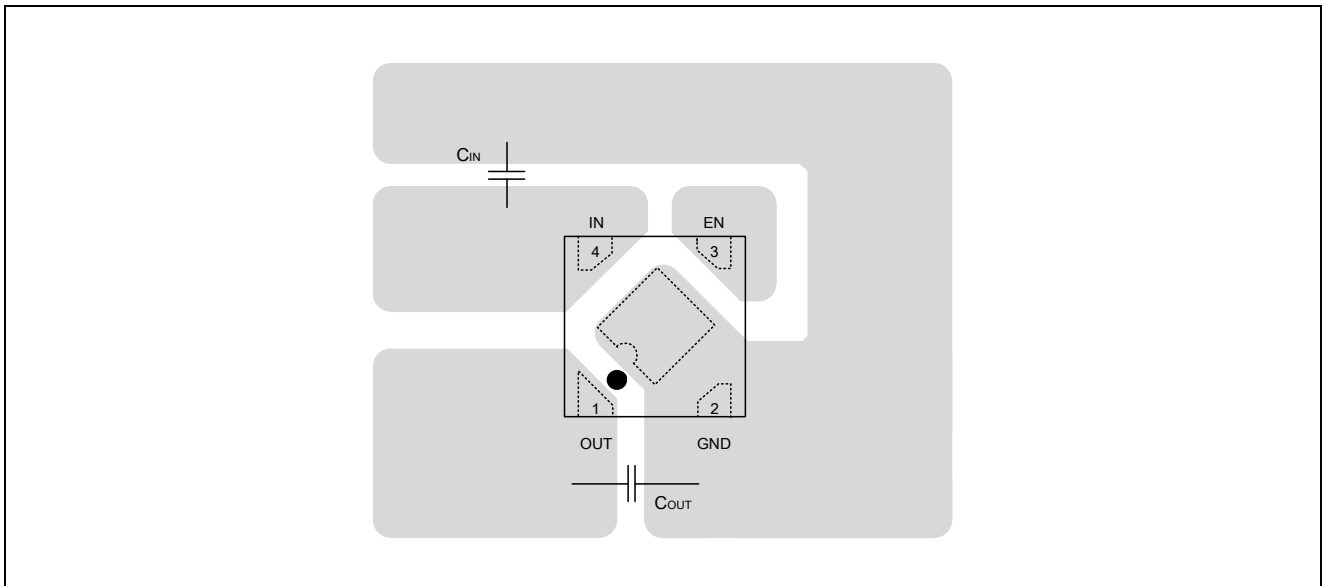
2: The minimum operating voltage is 1.6V. The calculation formula is as follows:

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

Application Circuits



PCB Layout Guide

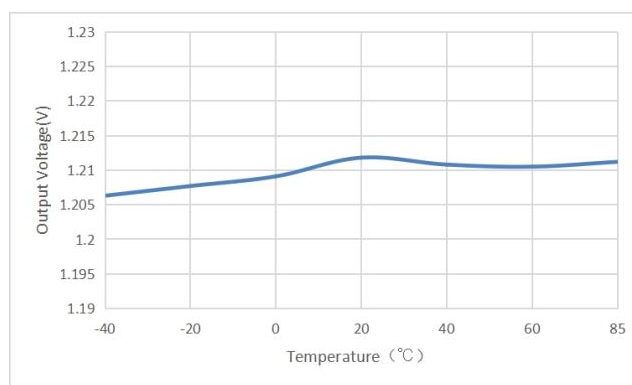


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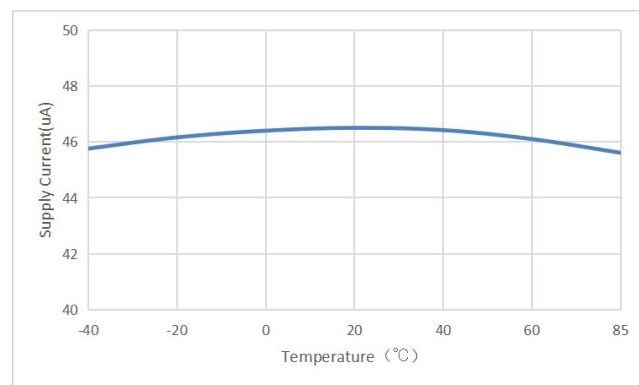
Typical Characteristics

(1) VOLTAGE VERSION 1.2 V

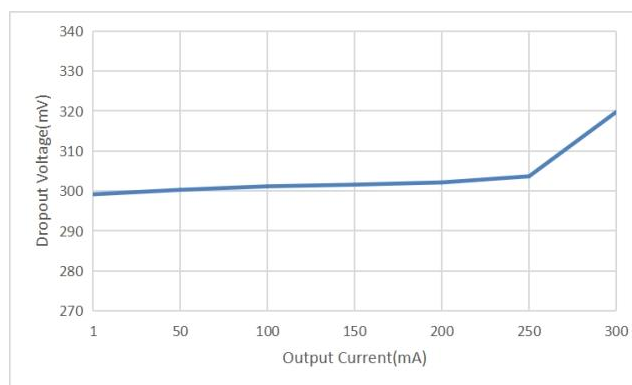
($V_{IN} = 2.2V$; $I_{OUT} = 1mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, unless otherwise noted. Typical values are at $T_A = 25^{\circ}C$.)



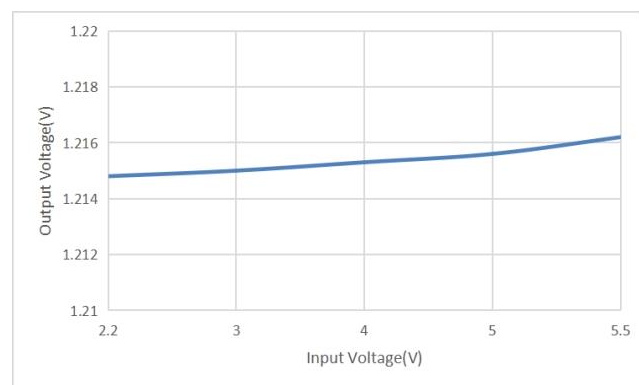
Output Voltage VS Temperature



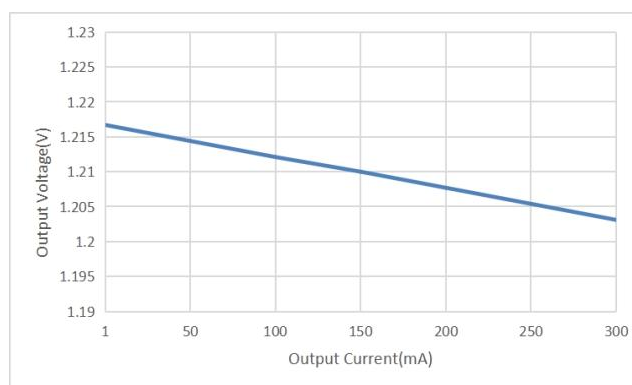
Supply Current VS Temperature



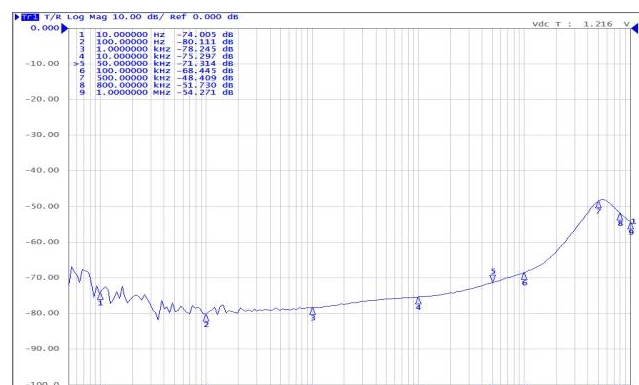
Dropout Voltage VS Output Current



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

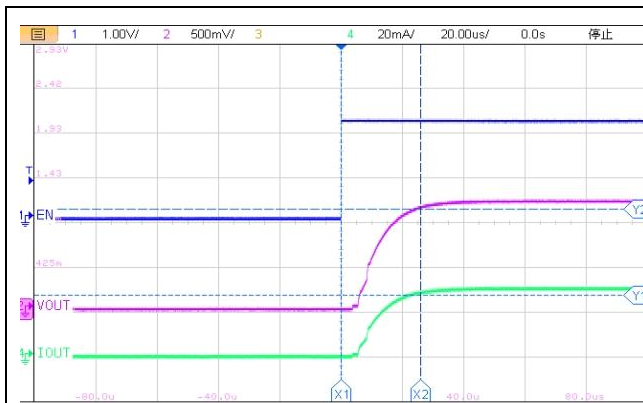


Output Voltage VS Output Current

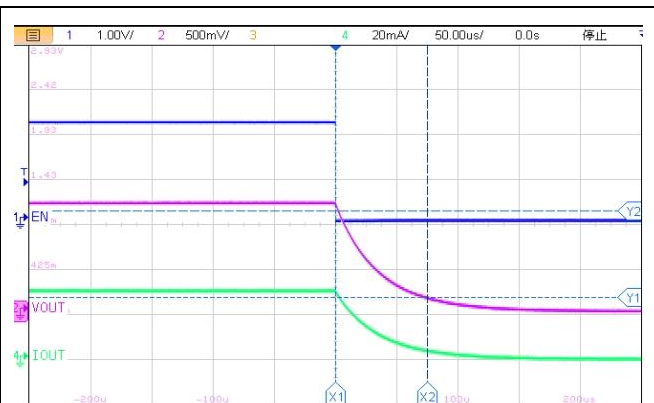


PSRR VS Output Current($I_{OUT} = 10mA$)

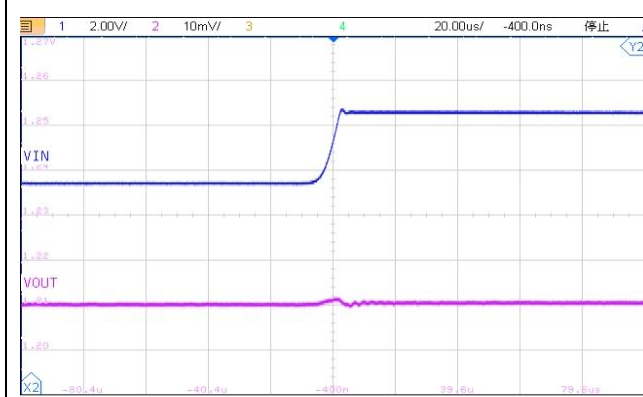
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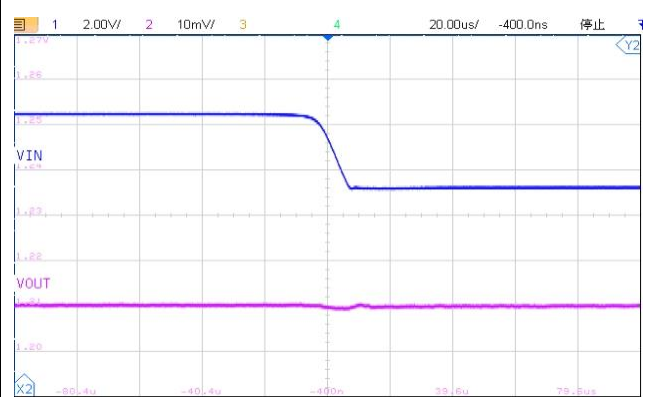
Turn On Speed VS EN Voltage ($I_{OUT} = 30mA$)



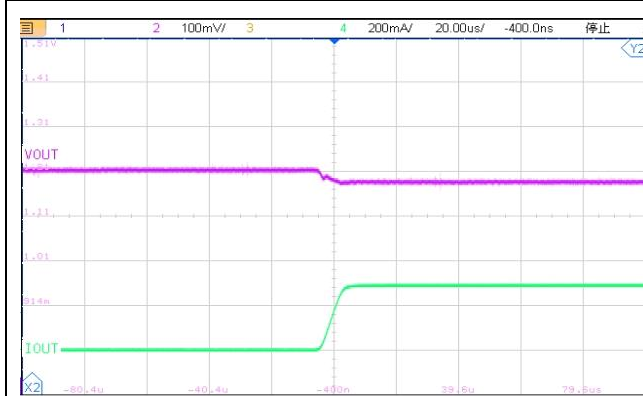
Turn Off Speed VS EN Voltage ($I_{OUT} = 30mA$)



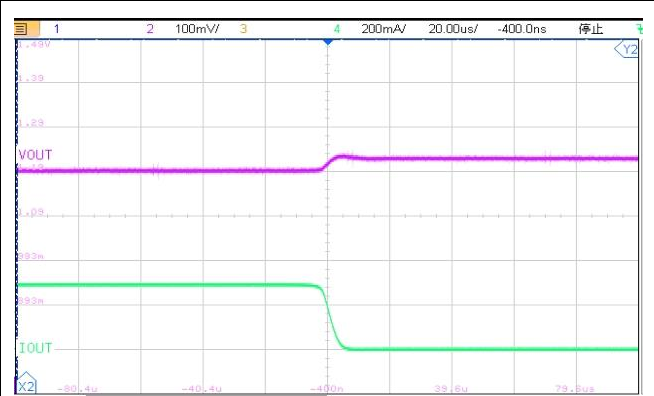
Line Transient Response
 $V_{IN} = 2.2V \sim 5.5V$, $V_{OUT} = 1.2V$, $I_{OUT} = 1mA$



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



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

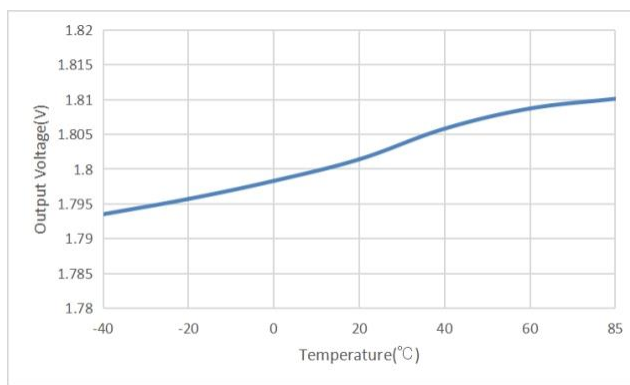


Load Transient Response
 $V_{IN} = 2.2V$, $V_{OUT} = 1.2V$, $I_{OUT} = 300mA \sim 1mA$

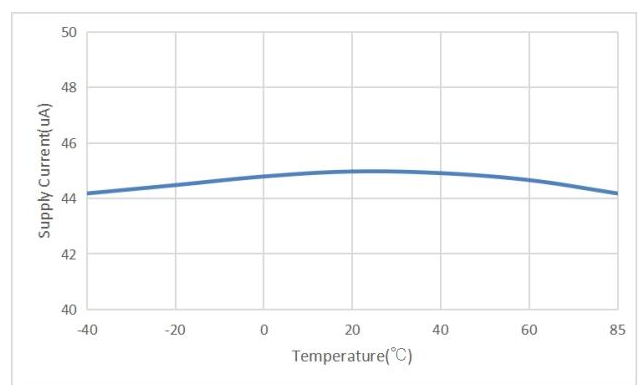
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(2) VOLTAGE VERSION 1.8 V

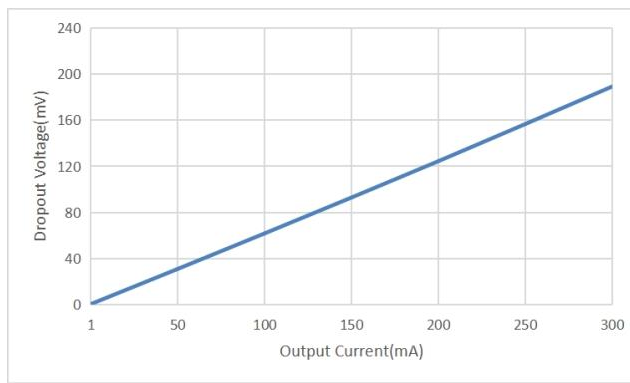
($V_{IN} = 2.8V$; $I_{OUT} = 1mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, unless otherwise noted. Typical values are at $T_A = 25^\circ C$.)



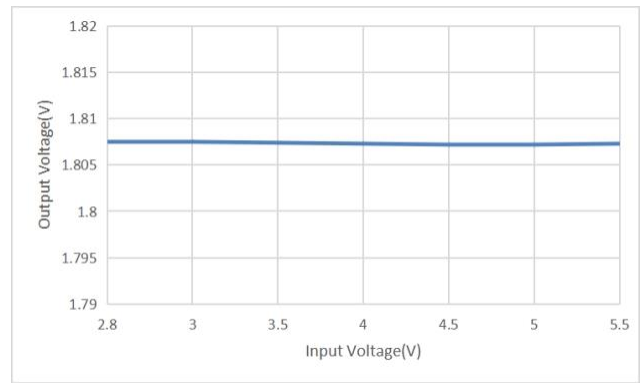
Output Voltage VS Temperature



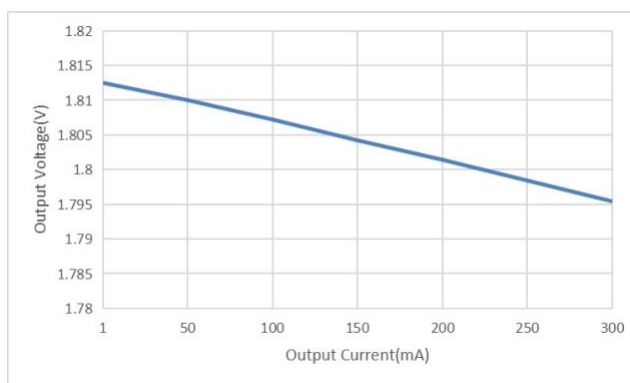
Supply Current VS Temperature



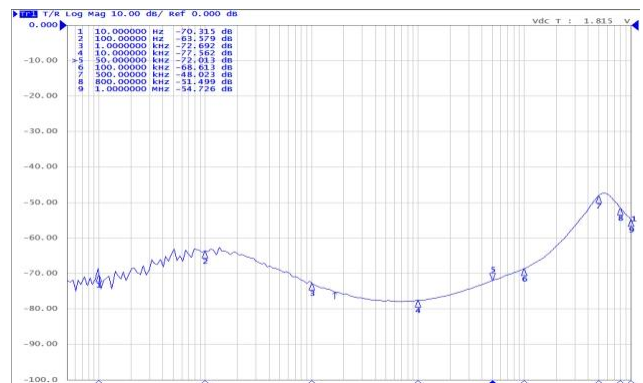
Dropout Voltage VS Output Current



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

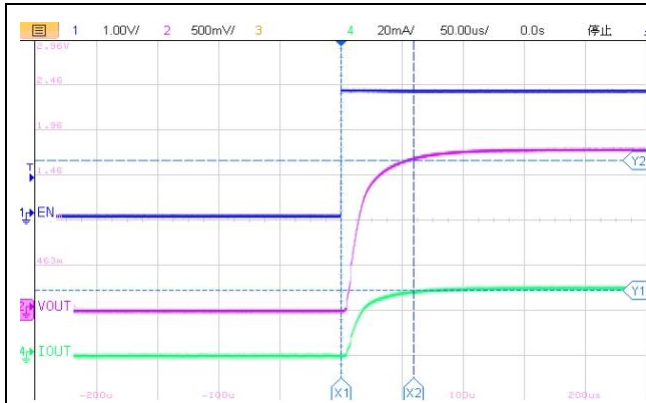


Output Voltage VS Output Current

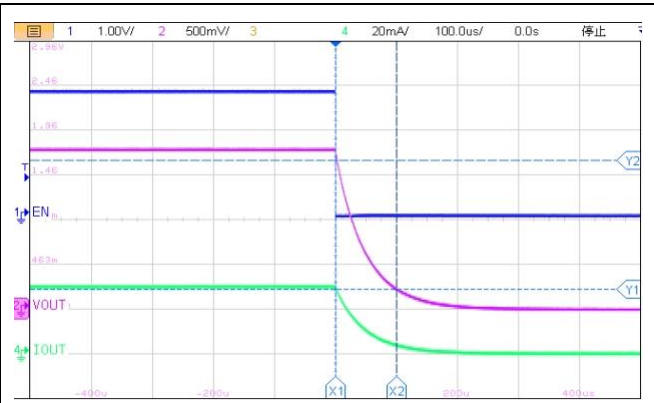


PSRR VS Output Current ($I_{OUT} = 10mA$)

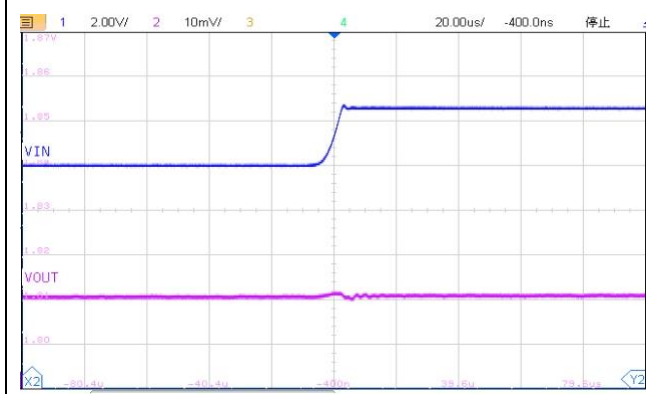
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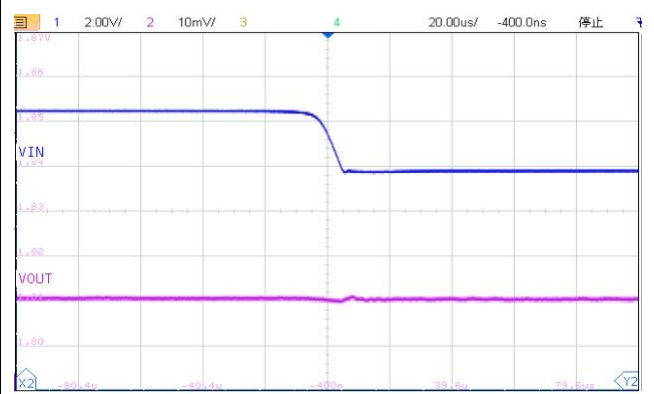
Turn On Speed VS EN Voltage ($I_{OUT} = 30mA$)



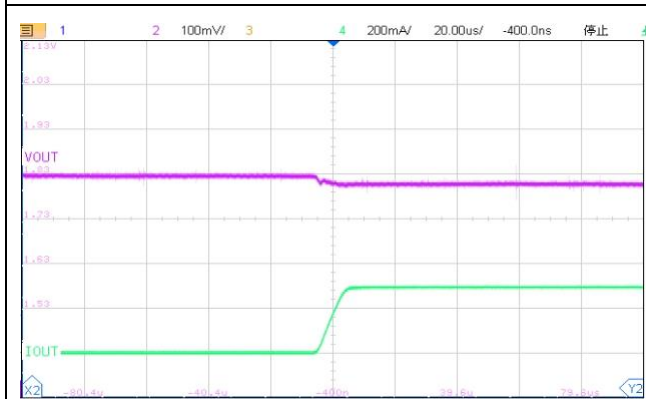
Turn Off Speed VS EN Voltage ($I_{OUT} = 30mA$)



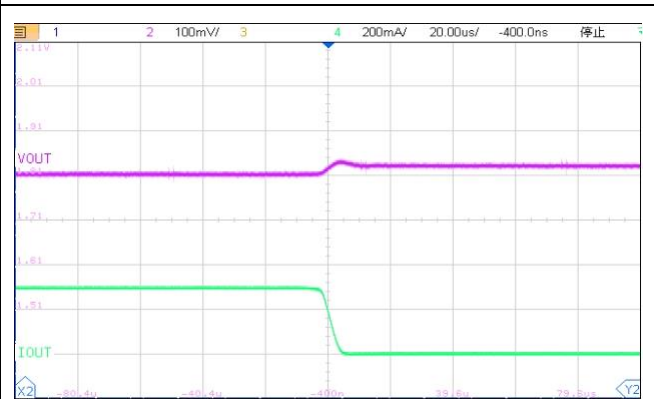
Line Transient Response
 $V_{IN} = 2.8V \sim 5.5V$, $V_{OUT} = 1.8V$, $I_{OUT} = 1mA$



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



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

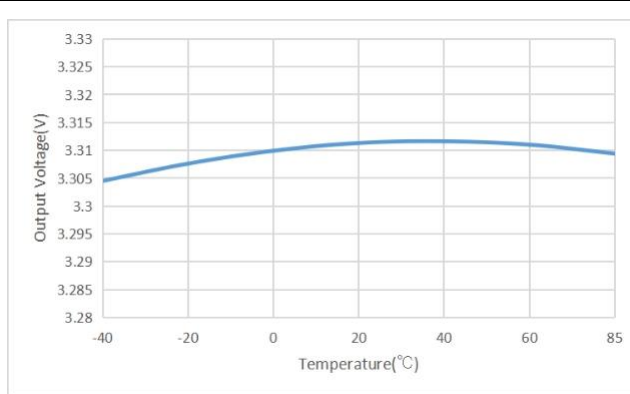


Load Transient Response
 $V_{IN} = 2.8V$, $V_{OUT} = 1.8V$, $I_{OUT} = 300mA \sim 1mA$

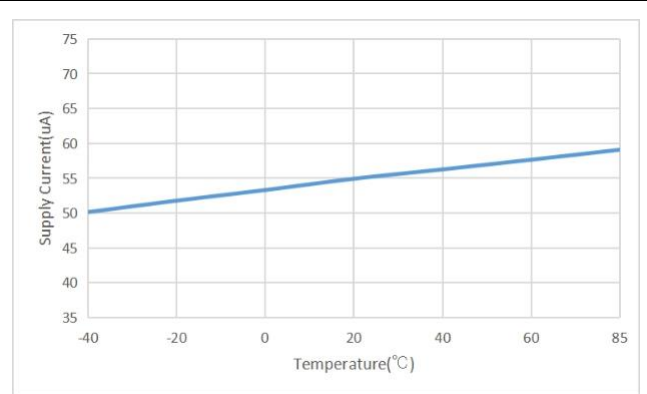
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(3) VOLTAGE VERSION 3.3 V

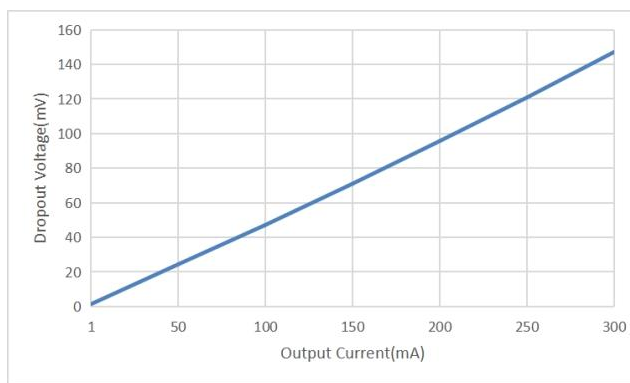
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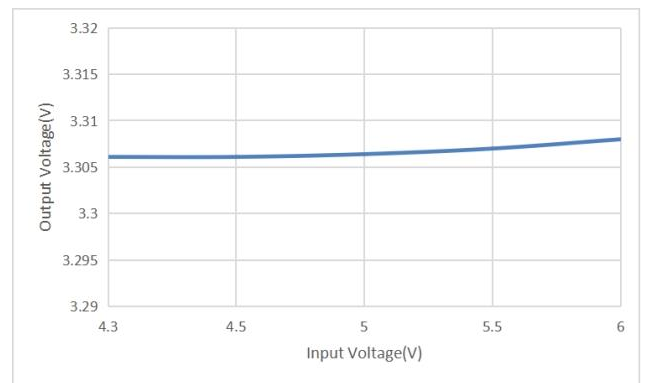
Output Voltage VS Temperature



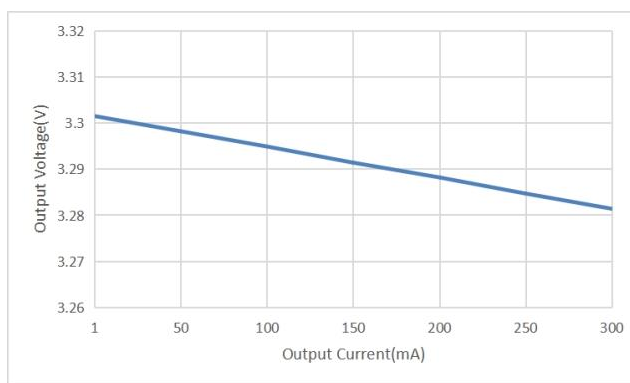
Supply Current VS Temperature



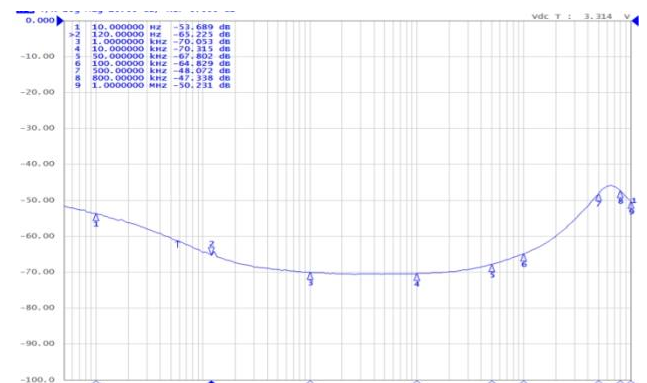
Dropout Voltage VS Output Current



Output Voltage VS Input Voltage

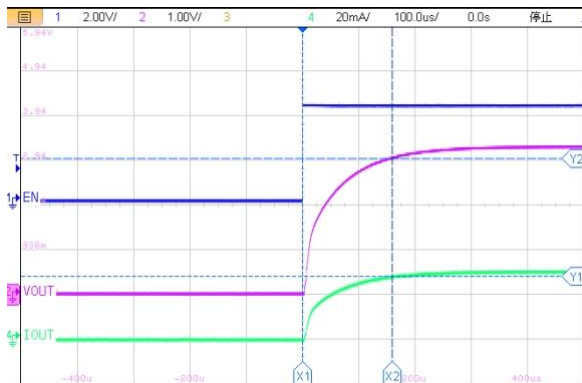


Output Voltage VS Output Current

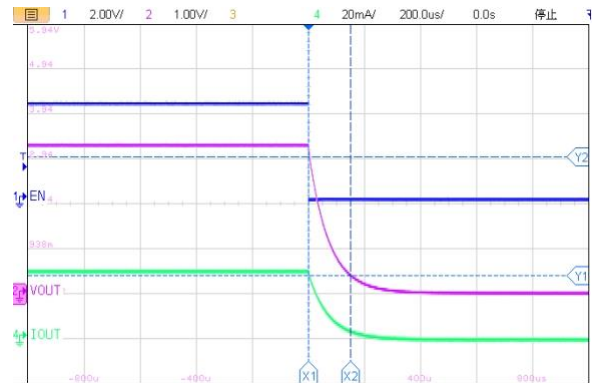


PSRR VS Output Current($I_{OUT} = 10mA$)

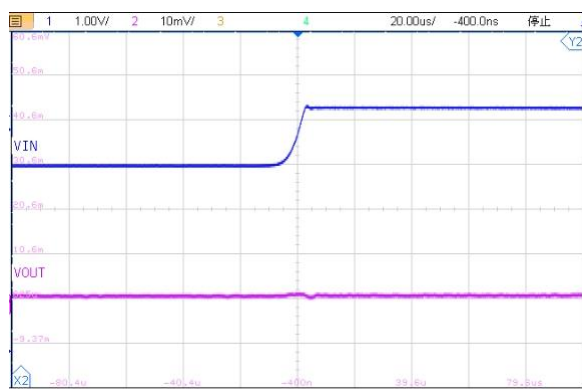
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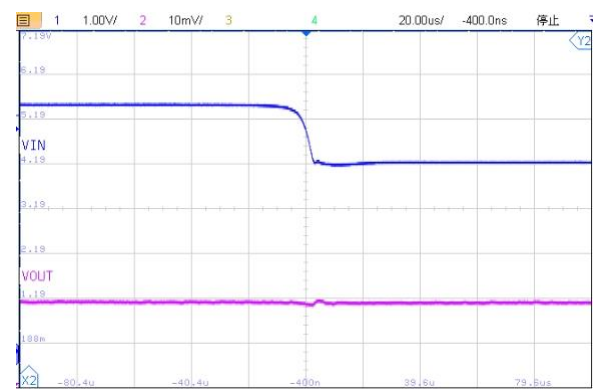
Turn On Speed VS EN Voltage ($I_{OUT} = 30mA$)



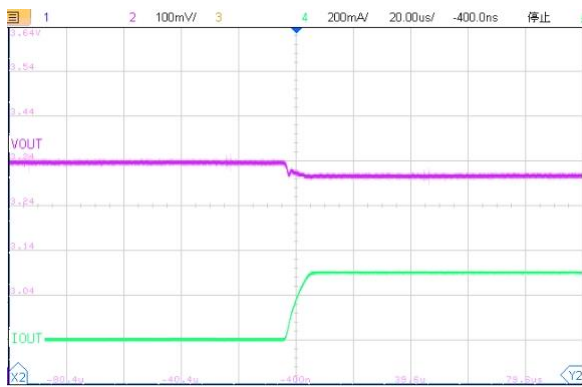
Turn Off Speed VS EN Voltage ($I_{OUT} = 30mA$)



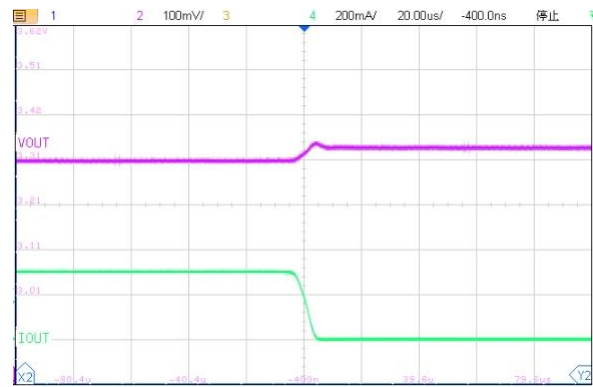
Line Transient Response
 $V_{IN} = 4.3V \sim 5.5V$, $V_{OUT} = 3.3V$, $I_{OUT} = 1mA$



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



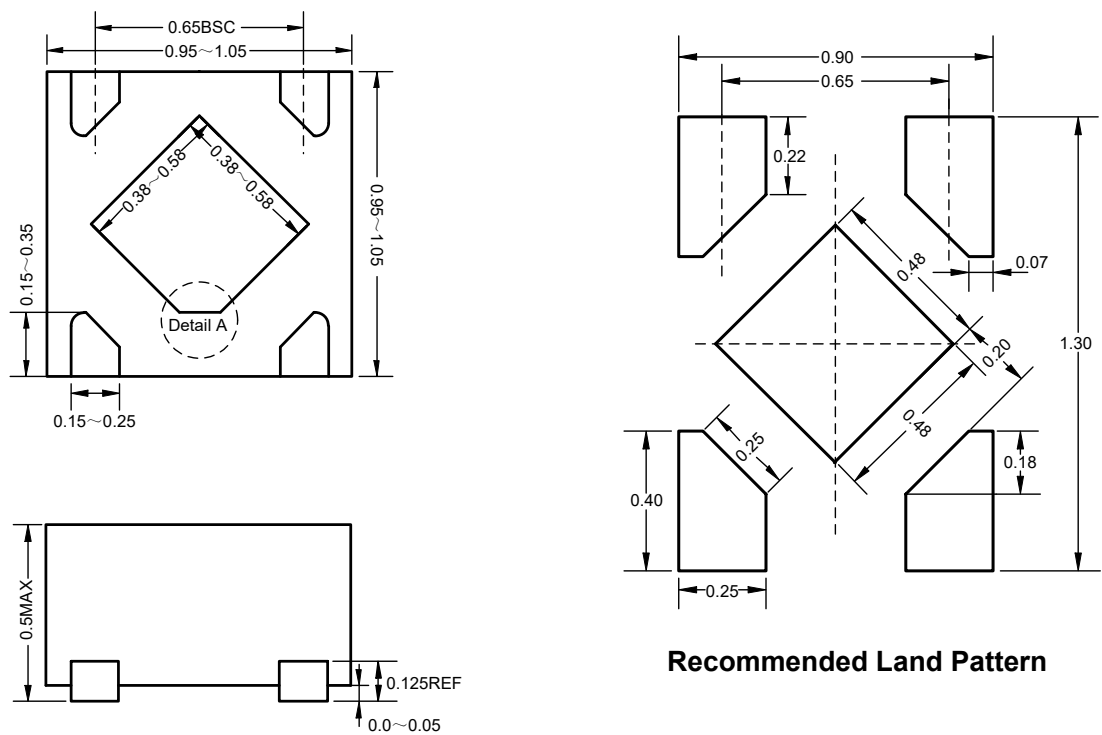
Load Transient Response
 $V_{IN} = 4.3V$, $V_{OUT} = 3.3V$, $I_{OUT} = 1mA \sim 300mA$



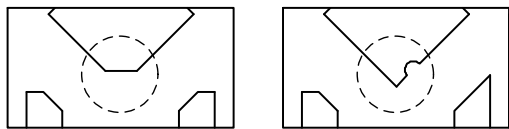
Load Transient Response
 $V_{IN} = 4.3V$, $V_{OUT} = 3.3V$, $I_{OUT} = 300mA \sim 1mA$

ET537XXYB

Package Dimension



Detail A: (PIN1 shape)



Unit: mm

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2023-12-24	First Version	Liuxm	Liuxm	Liujiy
1.1	2024-05-20	Add R_{LOW} , R_{EN}	Wangp	Wangp	Liujiy
1.2	2025-01-24	Update Current Limit Value	Yangxiaoxu	Liuxm	Liujiy
1.3	2025-02-18	Update Reg_{LOAD}	Yangxiaoxu	Liuxm	Liujiy