Low Input Voltage 500mA LDO

General Description

The ET552XXY1B is a low input voltage 500mA LDO. The input voltage is as low as Min. 1.2V. The output voltage accuracy has been improved to ±2% and due to a built-in transistor with low on-resistance. It consists of a voltage reference unit, an error amplifier, a resistor-net for voltage setting, and a current limit circuits for over-current prevention.

The ET552XXY1B uses a type of outstanding CMOS process to minimize the supply current. A low on-resistance PMOS pass device is equipped for lower dropout voltage. ET552XXY1B also possess the CE function to save more energy and extend the battery life. The CE pin can switch the regulator to standby mode.

Features

- Wide Input Voltage Range: 1.2V to 5V
- Output Voltage Range: 0.6V~3.6V(Fixed V_{OUT})
- Very Low IQ: 55μA
- Up to 500mA Load Current
- Output Voltage Accuracy: ±2%
- Dropout Voltage: Typ. 0.43V(500mA) @1.05V Output
- Excellent Load/Line Transient Response
- Line Regulation: 0.1%/V (typical)
- Built-in Fold Back Protection Circuit
- Built-in Constant Slope Circuit
- Built-in Auto-discharging Circuit
- Built-in Thermal Protection Circuit
- Package No. and MSL Level:

Part No.	Package	MSL
ET552XXY1B	DFN4(1×1)	Level 1

Applications

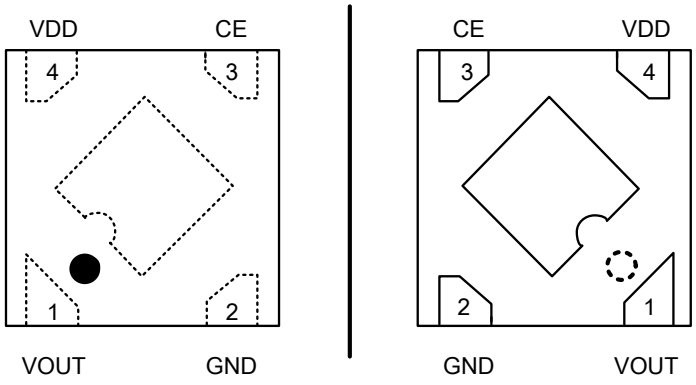
- Constant-Voltage Power Supply for Battery-powered Device
- Constant-Voltage Power Supply for TV, Notebook PC and Home Electric Appliance
- Constant-Voltage Power Supply for Portable Equipment

Device Information

ET 552 XX Y1 B

XX Output Voltage		**Y1** Package		**B** Auto-Discharging Function	
XX	Fixed Output Voltage， For example, 12 is 1.2V	Y1	DFN4(1×1)	B	Available

Pin Configuration

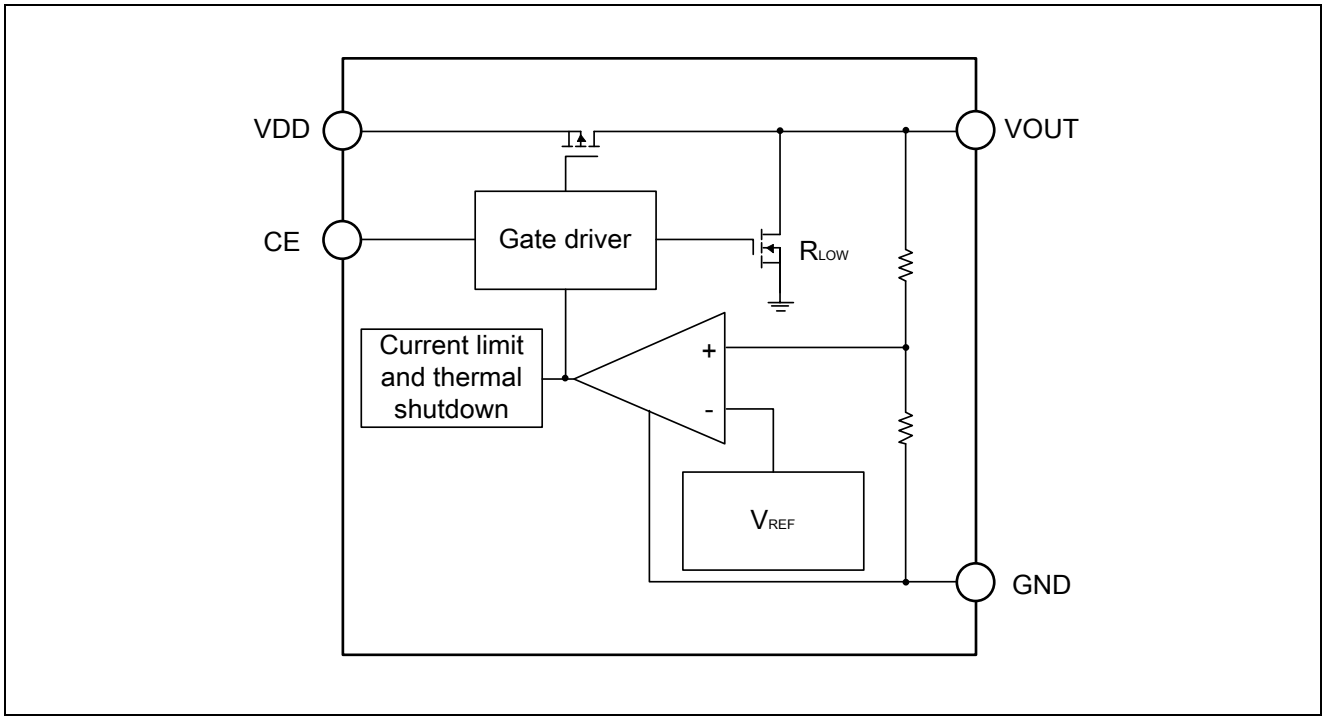


TOP VIEW BOTTOM VIEW

Pin Function

Pin No.	Pin Name	Pin Function
1	VOUT	Output Pin
2	GND	Ground Pin
3	CE	Chip Enable Pin, “H” Enable
4	VDD	Input Pin
-	Thermal Pad	Thermal pad for DFN4(1×1) package, connect to GND.

Block Diagram



Functional Description

Input Capacitor

A 1μF ceramic capacitor is recommended to connect between V_{DD} 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_{DD} and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is 0.47μF to 10μF(usually 1μF), Equivalent Series Resistance (ESR) is from 5mΩ to 100mΩ. Ceramic capacitor is recommended, 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 V_{OUT} and GND pins.

CE Pin Operation

The ET552XXY1B is turned on by setting the CE pin to “H”. The CE pin do not set it in floating status. When the CE pin is not used, connect the CE pin with V_{DD} to keep the LDO in operating mode.

Current Limit Protection

When output current of V_{OUT} pin is higher than current limit threshold, the current limit protection will be triggered and clamp the output current at a predesigned level to prevent over-current and thermal damage.

Auto Discharging

When the CE pin set to “L”, the output circuit will be disable immediately, and the Auto-Discharging circuit will be turned on to discharge the electric charge on output capacitor, and decrease the voltage of V_{OUT} in very

short time.

Thermal Shutdown Protection

Thermal protection disables the output when the junction temperature rises to approximately +160°C, allowing the device to cool down. When the junction temperature reduces to approximately +140°C the output circuit 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

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Parameters	Rating	Unit
Input Voltage	-0.3 to 6.0	V
Input Voltage (CE Pin)	-0.3 to 6.0	V
Output Voltage	-0.3 to V_{DD}+0.3	V
Maximum Load Current	500	mA
Maximum Power Consumption	600	mW
Operating Junction Temperature	-40 to 150	ºC
Storage Temperature	-65 to 150	ºC
Lead Temperature (Soldering, 10 sec)	300	ºC

Recommended Operating Conditions

Symbol	Items	Rating	Unit
V_{IN}	Input Voltage	1.2 to 5.0	V
I_{OUT}	Output Current	0 to 500	mA
T_A	Operating Ambient Temperature	-40 to 85	ºC
C_{IN}	Effective Input Ceramic Capacitor Value	0.47 to 10	µF
C_{OUT}	Effective Output Ceramic Capacitor Value	0.47 to 10	µF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

Electrical Characteristics

(Unless otherwise noted, $V_{IN}=V_{OUT}+1V$, $T_A=25ºC$, unless otherwise stated, $C_{IN}=C_{OUT}=1\mu F$)

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
V_{IN}[(1)]	Operating Input Voltage Range		1.2		5.0	V
V_{DROP}[(2)]	Dropout Voltage	V_{OUT} = 0.6V, I_{OUT} = 500mA		700	900	mV
		V_{OUT} = 0.6V, I_{OUT} = 300mA		400	600	mV
		V_{OUT} = 0.85V, I_{OUT} = 500mA		600	825	mV
		V_{OUT} = 0.85V, I_{OUT} = 300mA		360	495	mV
		V_{OUT} = 0.9V, I_{OUT} = 500mA		600	825	mV
		V_{OUT} = 0.9V, I_{OUT} = 300mA		360	495	mV
		V_{OUT} = 1.05V, I_{OUT} = 500mA		430	575	mV
		V_{OUT} = 1.05V, I_{OUT} = 300mA		255	345	mV
		V_{OUT} = 1.1V, I_{OUT} = 500mA		430	575	mV
		V_{OUT} = 1.1V, I_{OUT} = 300mA		255	345	mV
		V_{OUT} = 1.8V, I_{OUT} = 500mA		240	375	mV
		V_{OUT} = 1.8V, I_{OUT} = 300mA		140	245	mV
I_{Q_ON}	DC Supply Quiescent Current	Active mode: V_{CE} = V_{IN}	30	55	70	μA
$I_{Q\ OFF}$	DC Supply Shutdown Current	V_{CE} = 0V		0.1	2	μA
V_{OUT}	Output Voltage	I_{OUT} = 1mA~500mA, T_A = 25°C	-2		2	%
		I_{OUT} = 1mA, T_A = -40°C~85°C	-2.5		2.5	
Reg_{LINE}	Output Voltage Line Regulation	$V_{OUT}+1V \le V_{IN} \le 5V$, I_{OUT} = 10mA ($\Delta V_{OUT}/\Delta V_{IN}/V_{OUT}$)		0.10	0.25	%/V
Reg_{LOAD}	Output Voltage Load Regulation	I_{OUT} from 1mA to 500mA (ΔV_{OUT})		25	45	mV
V_{TRLN}[(3)]	Line Transient (The absolute value of the output change)	I_{OUT} = 1mA, V_{IN} =V_{OUT}+1V to 5V in 10us, T_A=25°C		15	30	mV
		I_{OUT} = 1mA, V_{IN} =5V to V_{OUT}+1V in 10us, T_A=25°C		15	30	
V_{TRLD}[(3)]	Load Transient (The absolute value of the output change)	V_{IN} = V_{OUT}+1V, I_{OUT} from 1mA to 500mA in 10us, T_A = 25°C		85	120	mV
		V_{IN} = V_{OUT}+1V, I_{OUT} from 500mA to 1mA in 10us, T_A = 25°C		50	120	
I_{OUT}	Output Current		500			mA
I_{LMT}	Over Current Limit	V_{IN} = V_{OUT}+1V, T_A = 25°C	600	700	900	mA

Electrical Characteristics(continues)

(Unless otherwise noted, V_{IN}=V_{OUT}+1V, T_A=25°C, unless otherwise stated, C_{IN}=C_{OUT}=1μF)

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
I_{SHORT}	Short Current Limit	V_{OUT} = 0V, T_A = 25°C	70	110	180	mA
PSRR[3]	Power Supply Rejection Ratio	f =1kHz, C_{OUT} = 1μF, I_{OUT} = 20mA, V_{IN} = V_{OUT}+1V, T_A = 25°C	50	80		dB
e_N[3]	Output Noise	10Hz to 100kHz, I_{OUT} = 30mA, C_{OUT} = 1μF, T_A = 25°C		40	70	μV_{RMS}
V_{ENL}	EN Low Threshold	V_{IN}=1.2 to 5V			0.4	V
V_{ENH}	EN High Threshold	V_{IN}=1.2 to 5V	0.9			V
I_{CE}	CE Pull-down Current	V_{IN} = V_{CE} =V_{OUT}+1V, T_A = 25°C	0.2	0.7	1	μA
R_{LOW}	Output resistance of auto discharge at off state	V_{EN} = 0V, V_{IN} = 2V, I_{OUT} = 10mA	20	40	80	Ω
T_{TSD}[4]	Thermal Shutdown Temperature	Junction Temperature		160		°C
T_{TSR}[4]	Thermal Shutdown Temperature, released	Junction Temperature		140		°C
HBM	ESD	Reference: ESDA/JEDEC JS-001-2017	±4000			V
CDM		Reference: ESDA/JEDEC JS-002-2014	±1500			V

Note1: 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. The maximum input voltage should take into account the maximum power consumption (PD(max)). The calculation formula is as follows:

$$\mathbf{PD_{(MAX)} = (V_{IN(MAX)} - V_{OUT}) * I_{OUT}}$$

The maximum power consumption of the circuit is 600mW.

$$\mathbf{V_{IN(MAX)} = 600mW / I_{OUT} + V_{OUT}}$$

For example:

If I_{OUT}=500mA, V_{OUT}=1.05V, the maximum input voltage is V_{IN}(max)=600mW/500mA+1.05=2.25V.

Note2: V_{DROP} list I_{OUT} = 300mA&500mA here.

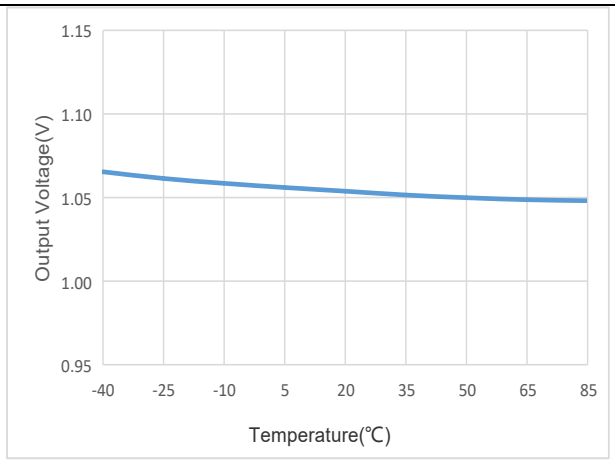
Note3: Guaranteed by design and characterization. not a FT item.

Note4: Guaranteed by design and CP test. Not a FT item.

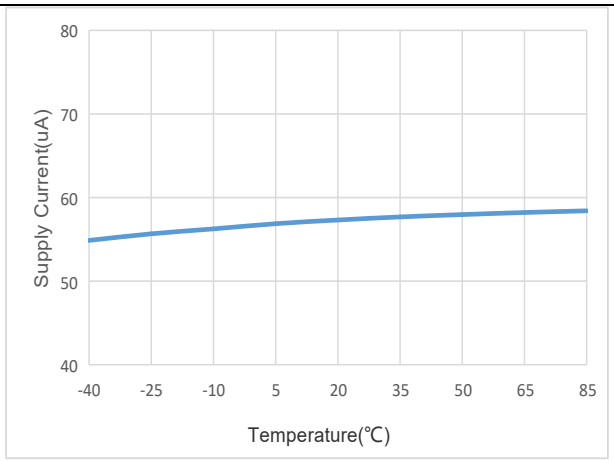
Typical Characteristics

(1) VOLTAGE VERSION 1.05 V

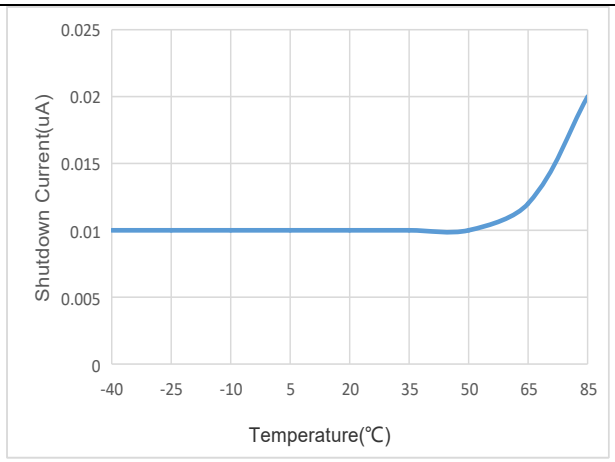
(V_{OUT}=1.05V, V_{IN}=2.05V, C_{IN}=C_{OUT}=1μF, T_A=25°C, unless otherwise stated)



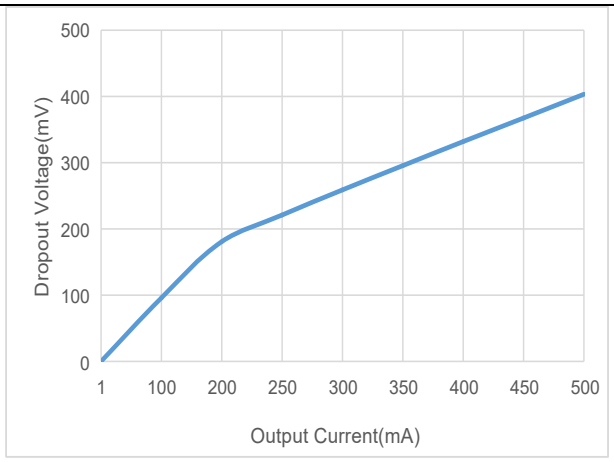
Output Voltage VS Temperature



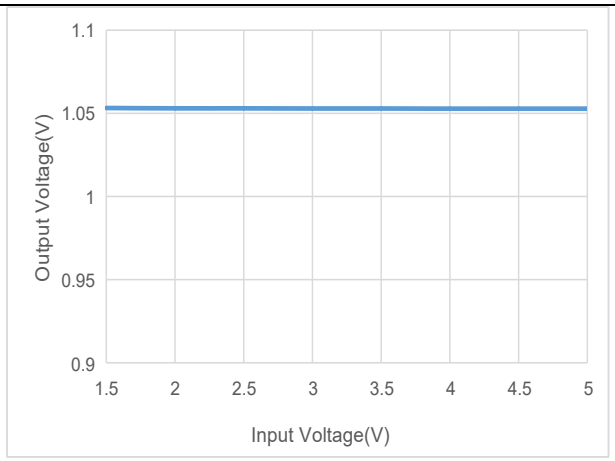
Supply Current VS Temperature



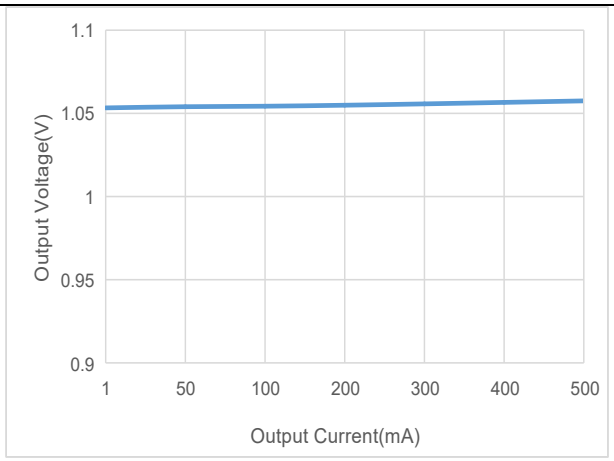
Shutdown Current VS Temperature



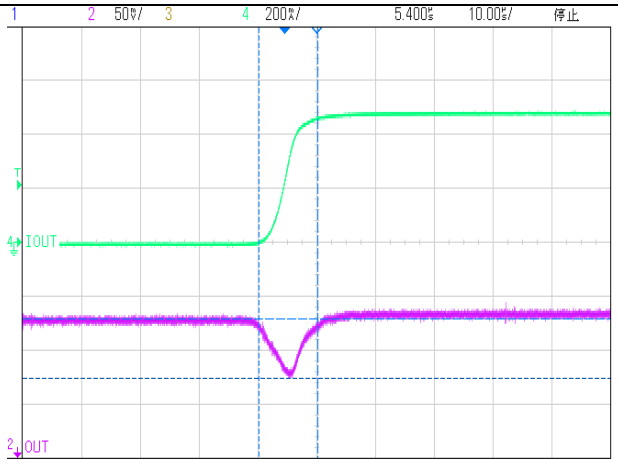
Dropout Voltage VS Output Current



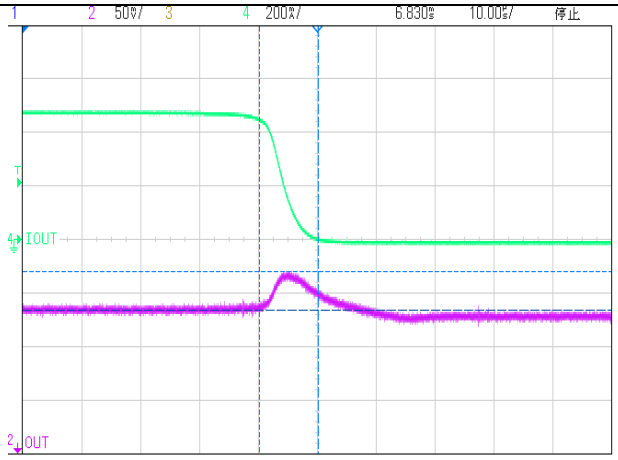
Output Voltage VS Input Voltage



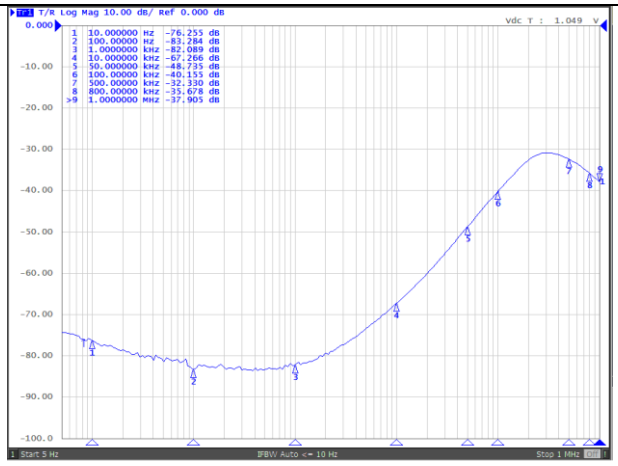
Output Voltage VS Output Current



Load Transient(1mA to 500mA t=10us)



Load Transient(500mA to 1mA t=10us)

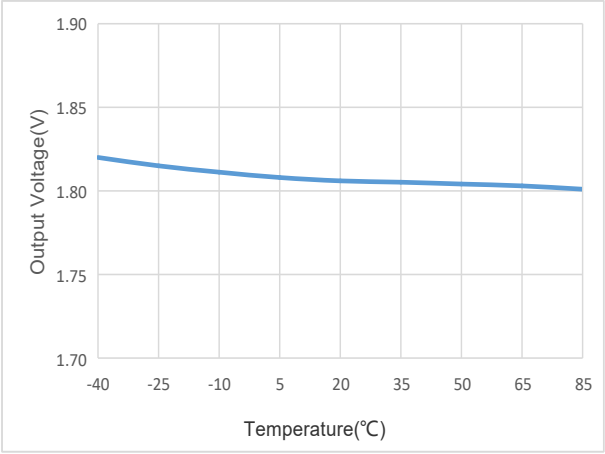


PSRR

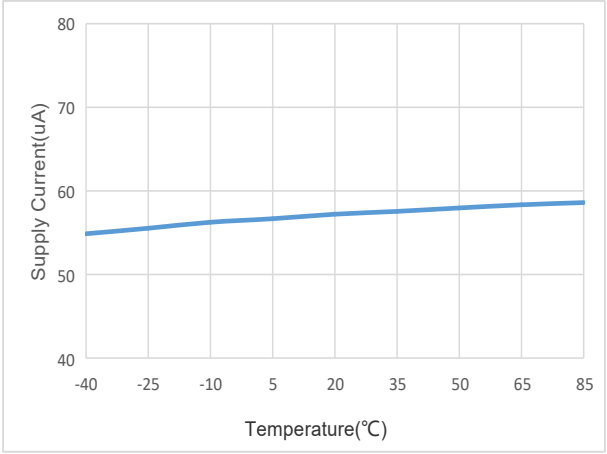
Typical Characteristics

(2) VOLTAGE VERSION 1.8 V

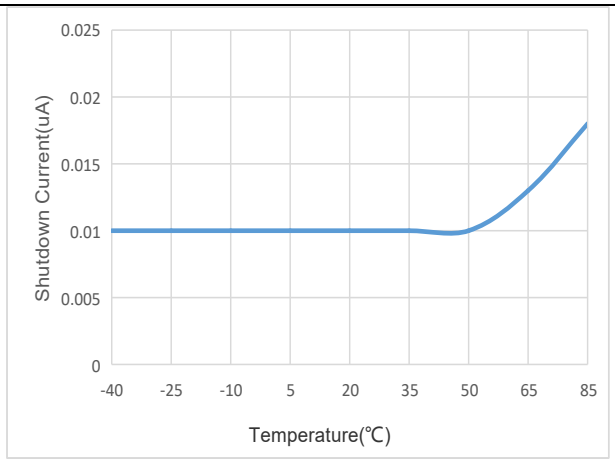
(V_{OUT}=1.8V, V_{IN}=2.8V, C_{IN}=C_{OUT}=1μF, T_A=25°C, unless otherwise stated)



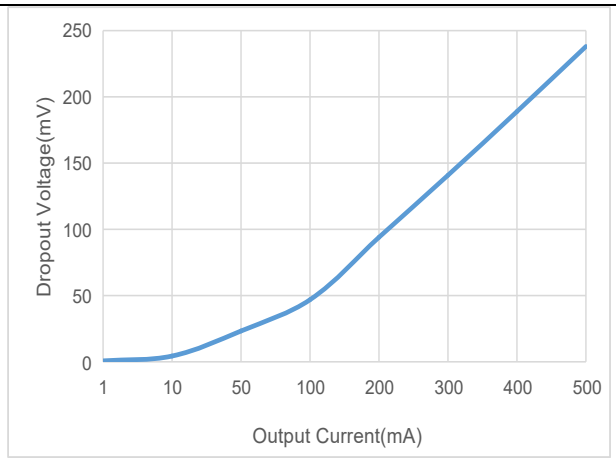
Output Voltage VS Temperature



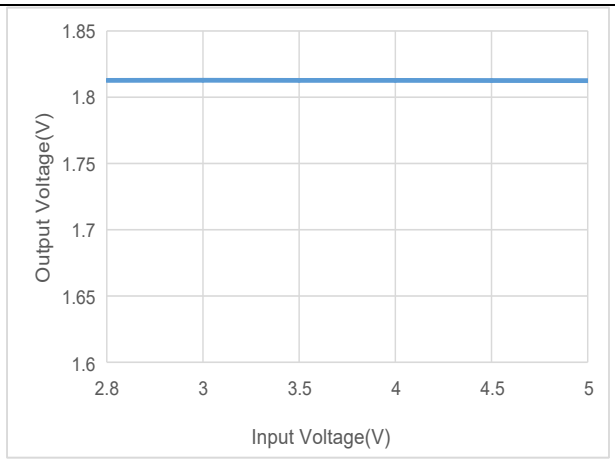
Supply Current VS Temperature



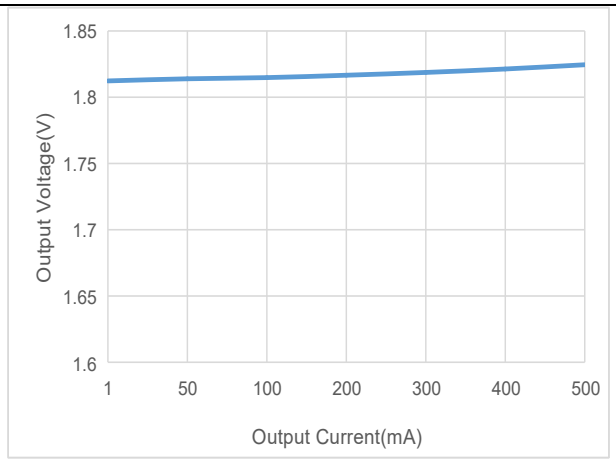
Shutdown Current VS Temperature



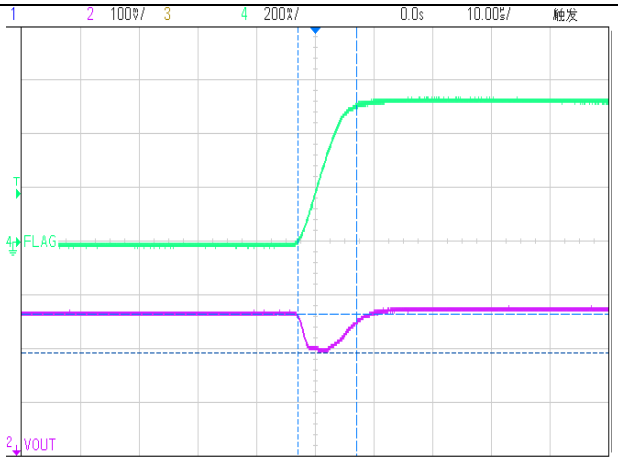
Dropout Voltage VS Output Current



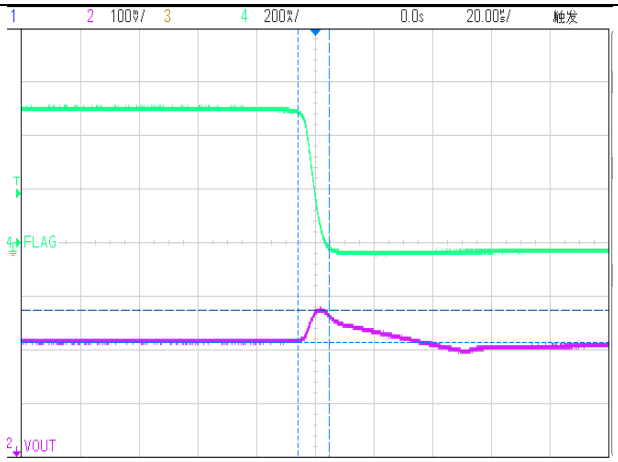
Output Voltage VS Input Voltage



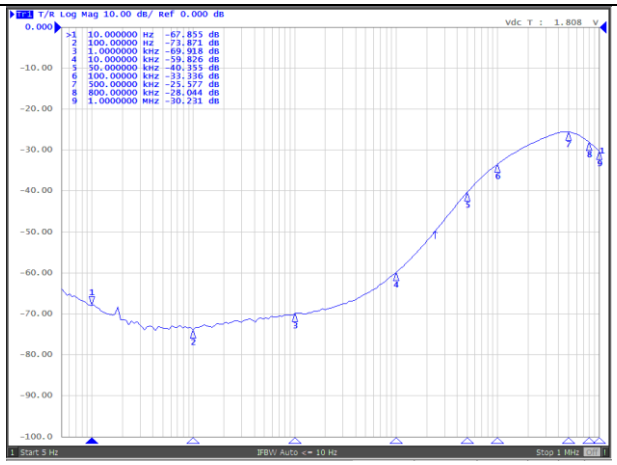
Output Voltage VS Output Current



Load Transient(1mA to 500mA t=10us)

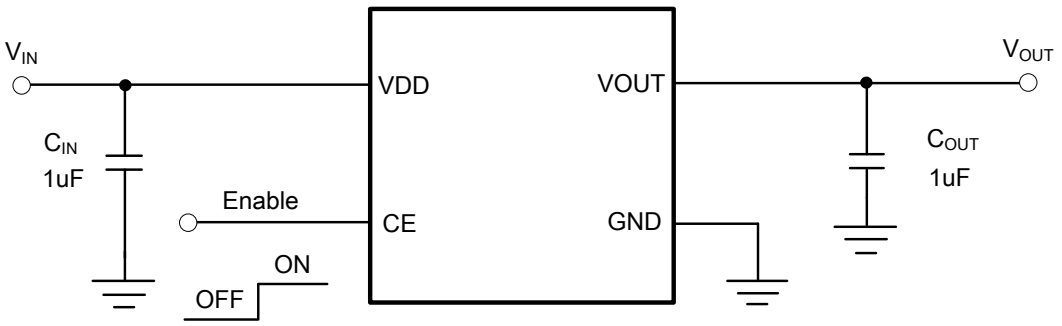


Load Transient(500mA to 1mA t=10us)

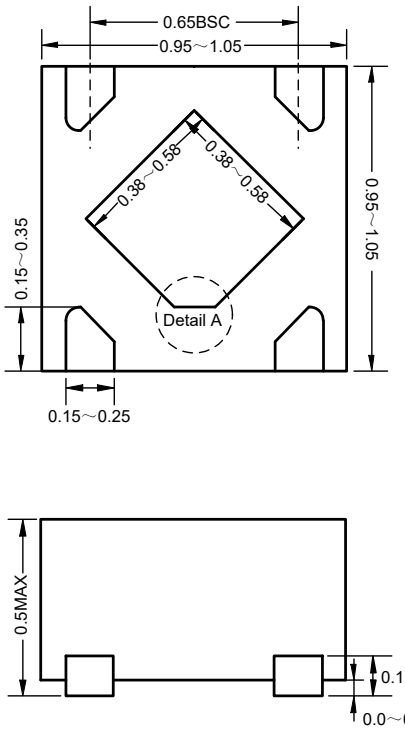


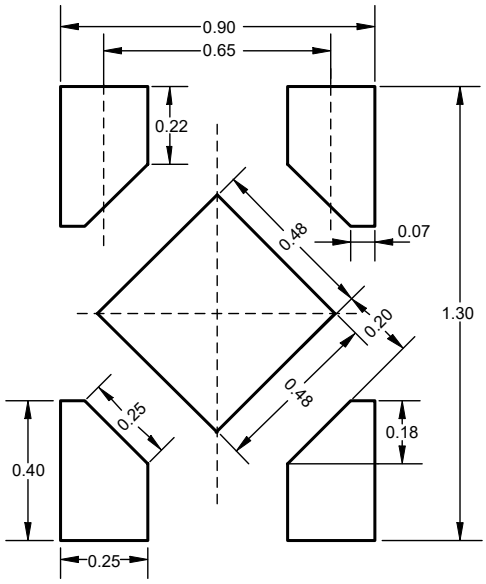
PSRR

Application Circuits



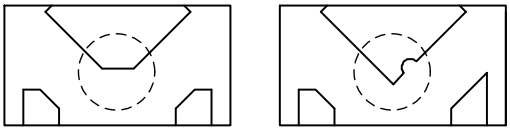
Package Dimension





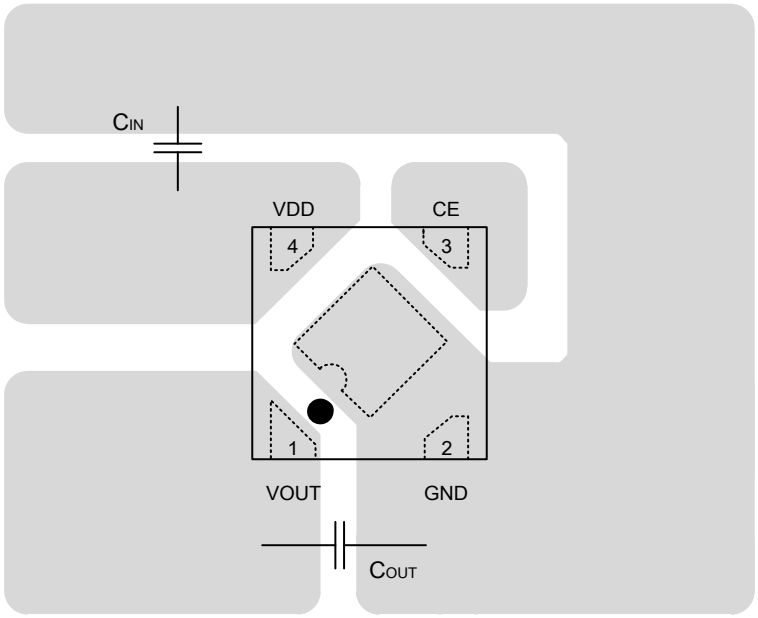
Recommended Land Pattern

Detail A: (PIN1 shape)

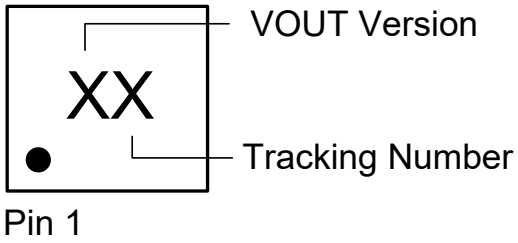


Unit: mm

PCB Layout Guide



Marking



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2019-1-31	Preliminary Version	Liu Yi Guo	Liu Yi Guo	Zhujl
1.1	2019-5-10	Update recommend layout	Shibo	Shibo	Liujy
1.2	2022-11-9	Update recommend layout	Yangzhi	Liu Yi Guo	Zhujl
1.3	2023-10-10	Update package picture	Shibo	Shibo	Liujy