ET553ADJYB - 500mA Low Dropout LDO

General Description

The ET553ADJYB are CMOS-based low-dropout, low-power linear regulators, offering 500mA with low dropout voltage, high ripple rejection, high output accuracy and low supply current. The ET553ADJYB consist of an accurate voltage-reference block, an error amplifier, a voltage-setting resistor net, a PMOSFET pass device, a thermal-shutdown circuit, and a current limit circuit with short protection.

The ET553ADJYB use a type of outstanding CMOS process to minimize the supply current. A low on-resistance PMOS pass device is equipped for lower dropout voltage. ET553ADJYB also possess the EN function to save more energy and extend the battery life.

Features

- Wide Input Voltage Range: 1.9V to 5.5V
- Output Current up to 500mA
- Output Voltage Range: 1.0V to 4.2V (Externally Resistance Set)
- Very Low I_Q: 50μA
- Excellent Load / Line Transient Response
- Built-in Over Current Protection and Thermal Shutdown Circuit
- Built-in Inrush Current Suppression Circuit and Current Limit
- Built-in Auto-discharging Circuit
- ESD Protection Complies with JESD22 Standard
  -- HBM: ±4000V Pass (JEDEC JS-001)
  -- CDM: ±1500V Pass (JEDEC JS-002)
- Latch-up Performance Exceeds ±200mA per JEDEC JESD78F
- Part No. and Package Information

Part No.	Package	Packing Option	MSL
ET553ADJYB	DFN4 (1.2mm × 1.2mm)	Tape and Reel, 3K/Reel	1

Applications

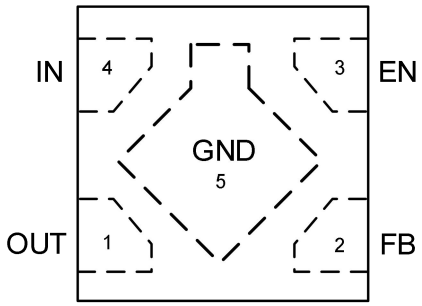
- Constant-voltage Power Supply for Battery-powered Device
- Constant-voltage Power Supply for TV, Notebook PC and Home Electric Appliance
- Constant-voltage Power Supply for Portable Equipment

Device Information

ET553 ADJ Y B

ADJ	Y Package	B Auto-Discharging Function
ADJ – VOUT Adjustable by Resistive Divider	DFN4 (1.2mm × 1.2mm)	**B** - Available

Pin Configuration



TOP VIEW

Figure1 Pin Configuration

Pin Function

Pin No.	Pin Name	Pin Function
4	IN	Supply Input Pin Ground
5	GND	Ground
3	EN	Output Pin Enable Control Input, Active High
2	FB	Set the Output Voltage
1	OUT	Output Pin

Block Diagram

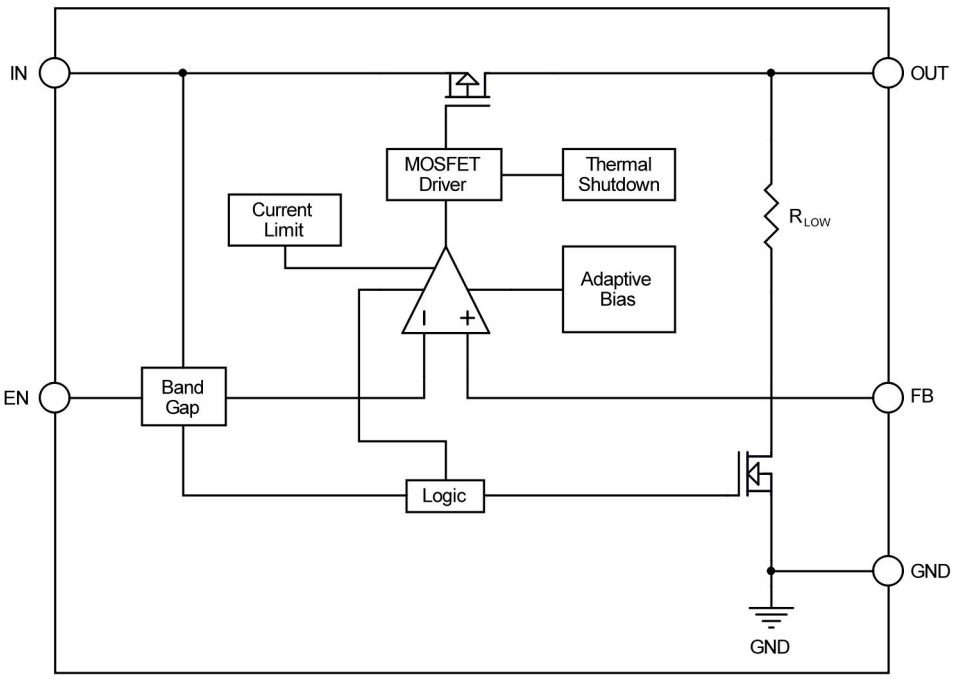


Figure2. Block Diagram

Functional Description

Input Capacitor

A 2.2μF 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 2.2μF, 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 OUT and GND pins.

EN Pin Operation

The ET553ADJYB is turned on by setting the EN pin to “H”. Since the EN pin is neither pulled down or float, The ET553ADJYB is closed.

Current Limit Protection

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

Thermal Shutdown Protection

Thermal protection disables the output when the junction temperature rises to approximately +155°C, allowing to cool down. When the junction temperature reduce to approximately +130°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.

Auto Discharging

When the EN 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. The Auto-Discharging function is optional.

Output Voltage

The output voltage is adjustable using external 2-resistors. For better performance of the circuit, the R2 value need to be between 100kΩ and 1MΩ. The output voltage is calculated by:

$$\mathbf{V_{OUT} = (1 + R1 / R2) \times 0.8\ (V)}$$

Absolute Maximum Ratings

Symbol	Parameter		Value	Unit
V_{IN}	DC Input Voltage (IN Pin) (1)		-0.3 to 6.0	V
V_{EN}	DC Input Voltage (EN Pin) (1)		-0.3 to 6.0	V
V_{FB}	DC Input Voltage (FB Pin) (1)		-0.3 to 6.0	V
V_{OUT}	DC Output Voltage (OUT Pin) (1)		-0.3 to 6.0	V
T_J	Max Junction Temperature		+150	°C
T_{STG}	Storage Temperature Range		-65 to +150	°C
$R_{\theta JA}$	Thermal Characteristics, Thermal Resistance, Junction-to-Air		210	°C/W
V_{ESD}	ESD Classification	Human Body Model (2)	±4000	V
		Charged Device Model (3)	±1500	
I_{LU}	Latch Up Current Maximum Rating (4)		± 200	mA

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.

Note1: I_O absolute maximum rating must be observed.

Note2: HBM tested per JEDEC JS-001;

Note3: CDM tested per JEDEC JS-002;

Note4: Latch up Current Maximum Rating tested per JEDEC JESD78F.

Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_{IN}	DC Input Voltage	1.9 to 5.5	V
I_{OUT}	Output Current	0 to 500	mA
T_A	Operating Ambient Temperature	-40 to 85	°C
C_{IN}	Effective Input Ceramic Capacitor Value	1 to 10	uF
C_{OUT}	Effective Output Ceramic Capacitor Value	1 to 10	uF

Electrical Characteristics

V_{IN} = V_{SET} + 1.0V, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 2.2μF, (unless otherwise noted). T_A = 25°C.

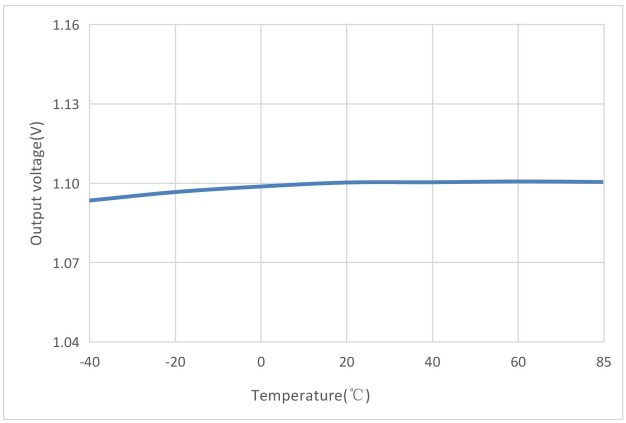
Symbol	Parameter	Condition	Min	Typ	Max	Unit
V_{IN}	Input Voltage		1.9		5.5	V
V_{FB}	FB Voltage	T_A = 25°C	0.784	0.800	0.818	V
		T_A = -40°C ~ 85°C	0.776	0.800	0.824	V
ΔV_{OUT} /ΔI_{OUT}	Load Regulation	V_{IN} = V_{SET} + 1V, 1mA ≤ I_{OUT} ≤ 0.5A		20	50	mV
V_{DROP}	Dropout Voltage	1.0V ≤ V_{SET} < 1.6V, I_{OUT} = 0.5A, V_{OUT} Dropping to 0.98 × V_{SET}			900	mV
		1.7V ≤ V_{SET} < 2.6V, I_{OUT} = 0.5A, V_{OUT} Dropping to 0.98 × V_{SET}		350	500	mV
		2.6 ≤ V_{SET} < 3.6V, I_{OUT} = 0.5A, V_{OUT} Dropping to 0.98 × V_{SET}		260	400	mV
		3.6 ≤ V_{SET} ≤ 4.2V, I_{OUT} = 0.5A, V_{OUT} Dropping to 0.98 × V_{SET}		210	350	mV
I_Q	Supply Current	I_{OUT} = 0mA		50	85	μA
I_{Q_OFF}	Standby Current	V_{EN} = 0V		0	1	μA
ΔV_{OUT} /ΔV_{IN}	Line Regulation	V_{SET} + 0.5V ≤ V_{IN} ≤ 5.5V (V_{IN} ≥ 1.4V)		0.02		%/V
PSRR	Power Supply Rejection Ratio[5]	f = 1kHz, Ripple 0.2Vp-p, V_{IN} = V_{SET} + 1.0V, I_{OUT} = 30mA		80	--	dB
I_{LIM}	Output Current Limit	V_{IN} = V_{SET} + 1V		700	1200	mA
I_{SHORT}	Short Current Limit	V_{OUT} = 0V		150	240	mA
R_{PD}	EN Pull-down Resistance			1M		Ω
V_{IH}	EN Input Voltage High		0.9			V
V_{IL}	EN Input Voltage Low				0.4	V
R_{DIS}	Auto-discharge Resistance	V_{IN} = 4V, V_{EN} = 0V		80		Ω
T_{SD}	Thermal Shutdown Temperature[5]			155		°C
T_{SR}	Thermal Shutdown Released Temperature[5]			130		°C

Note5. Guaranteed by design and characterization. not a FT item.

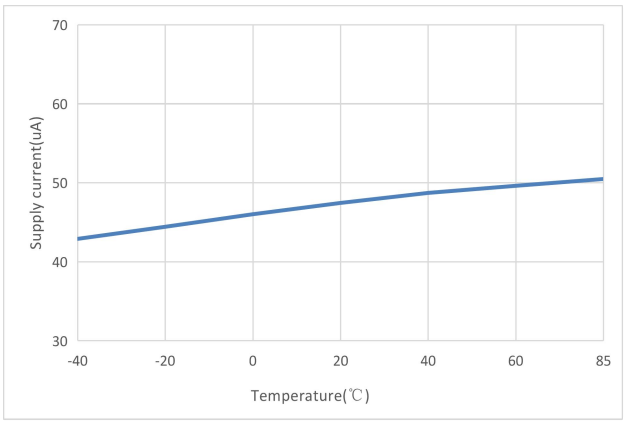
Typical Characteristics

(1) VOUT set 1.1V

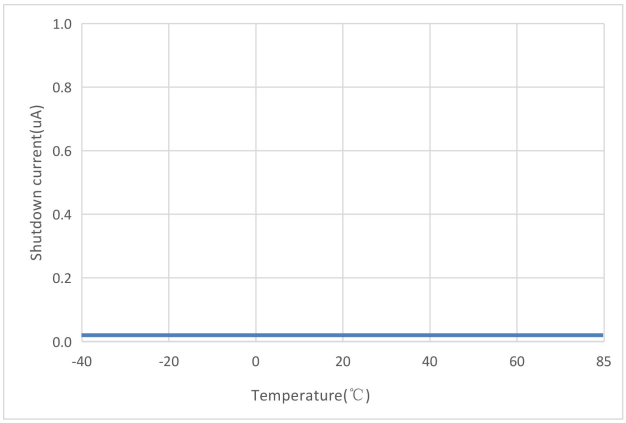
V_{IN} = V_{SET} + 1.0V, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 2.2μF, (unless otherwise noted). T_A = 25°C.



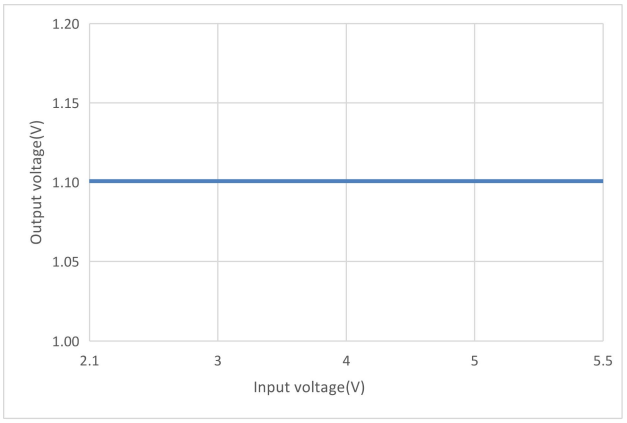
Output Voltage VS Temperature



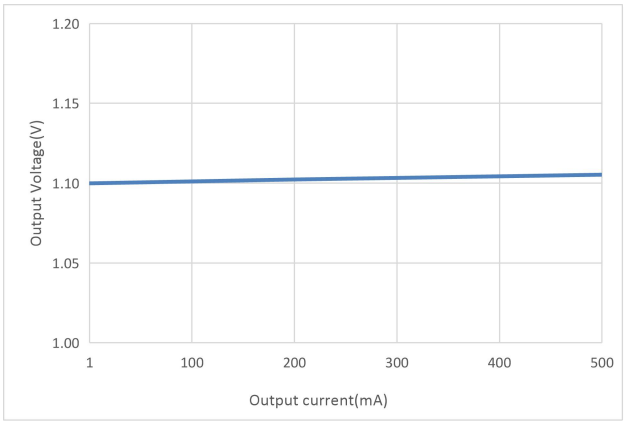
Supply Current VS Temperature



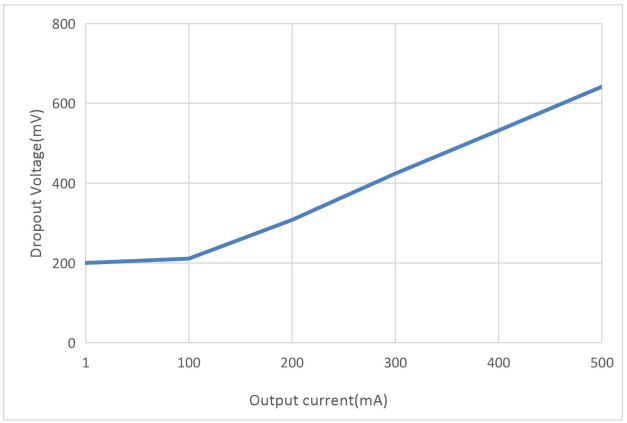
Shutdown Current VS Temperature



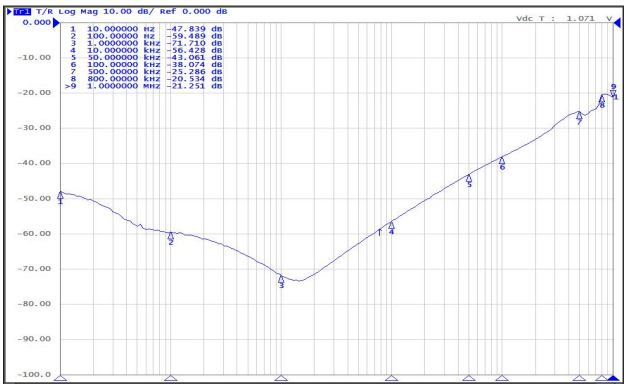
Output Voltage VS Input Voltage



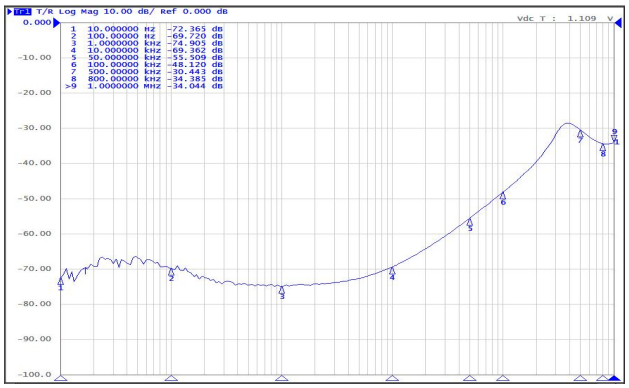
Output Voltage VS Output Current



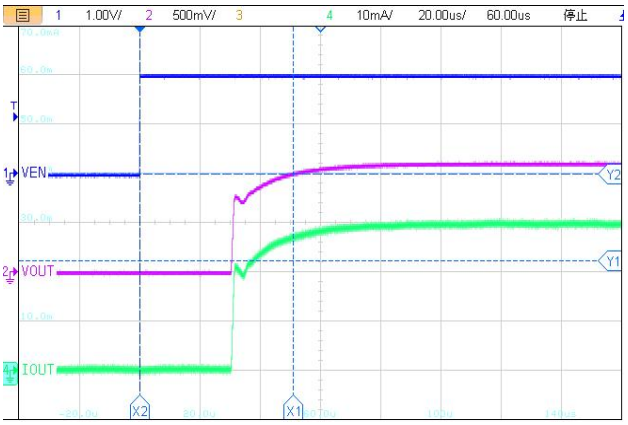
Dropout Voltage VS Output Current



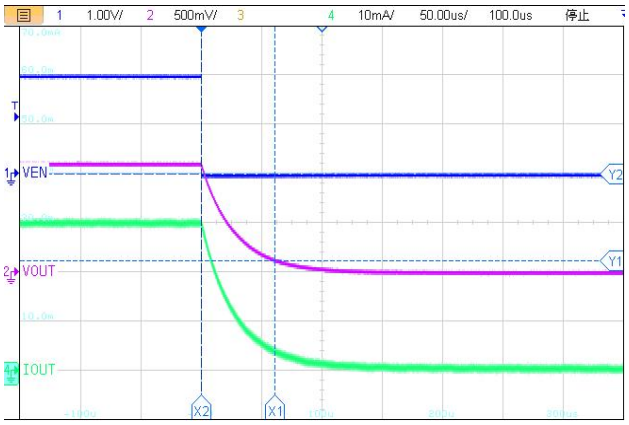
PSRR Test(I_{OUT} = 30mA)



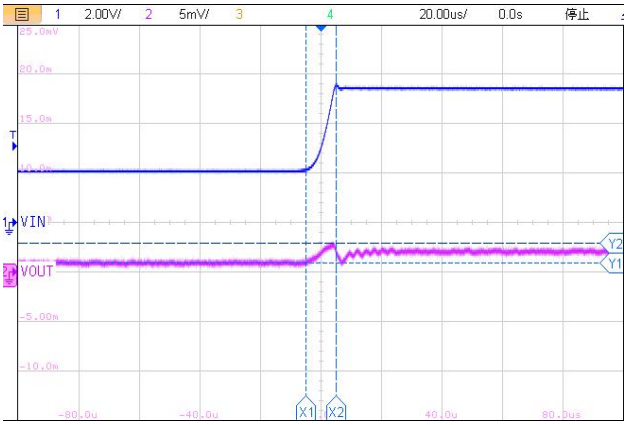
PSRR Test(I_{OUT} = 0.5A)



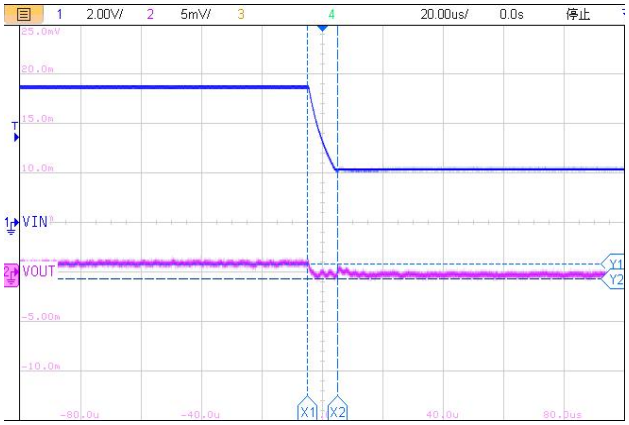
t_{ON} = 51us(I_{OUT} = 30mA)



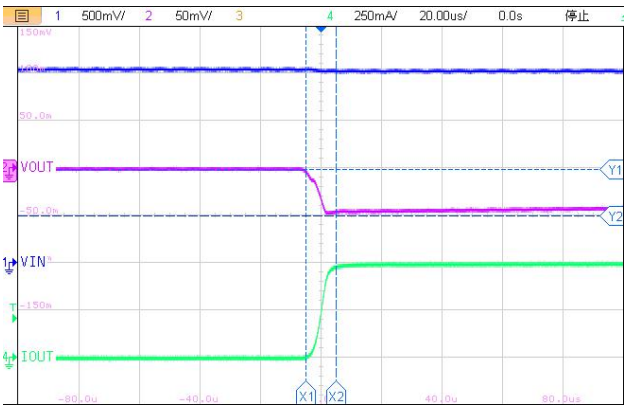
t_{OFF} = 61us(I_{OUT} = 30mA)



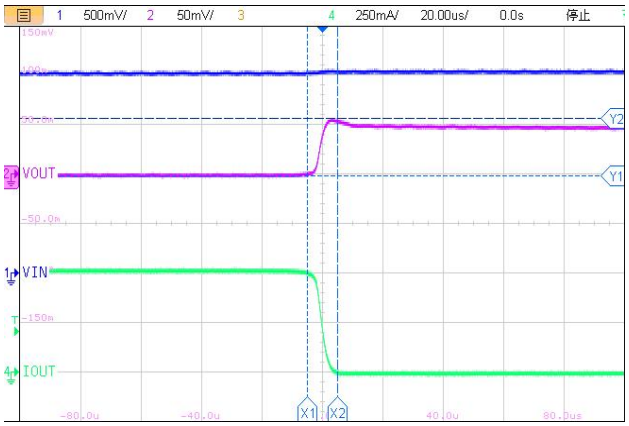
Line transient(2.1~5.5V t = 10us ΔV = 2mV)



Line transient(5.5~2.1V t = 10us ΔV = 1.5mV)



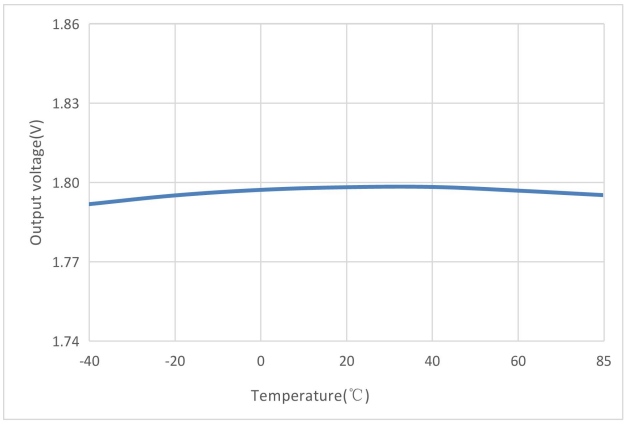
Load transient(1mA~0.5A t = 10us ΔV = 48.75mV)



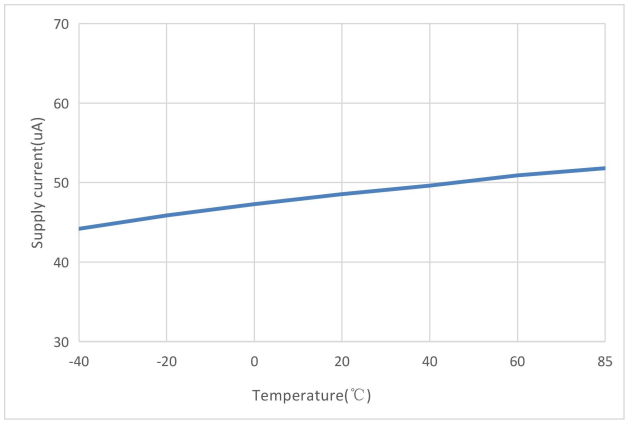
Load transient(0.5A~1mA t = 10us ΔV = 57.5mV)

(1) VOUT set 1.8V

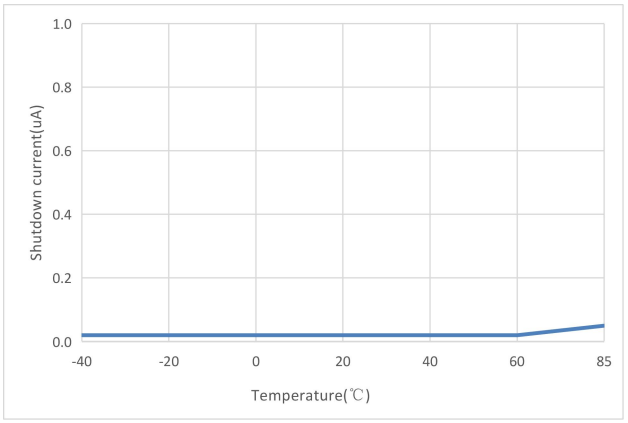
V_{IN} = V_{SET} + 1.0V, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, unless otherwise noted, T_A = 25°C.



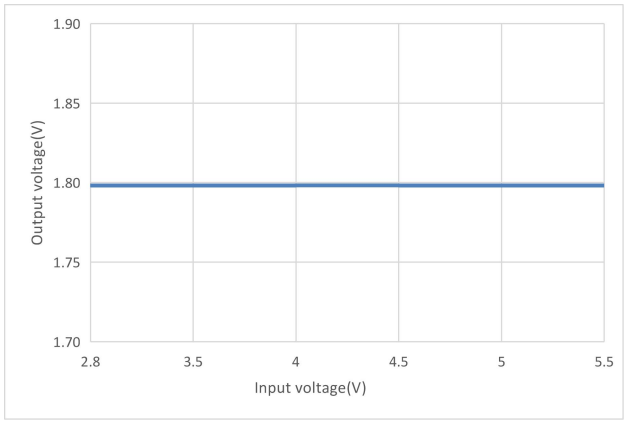
Output Voltage VS Temperature



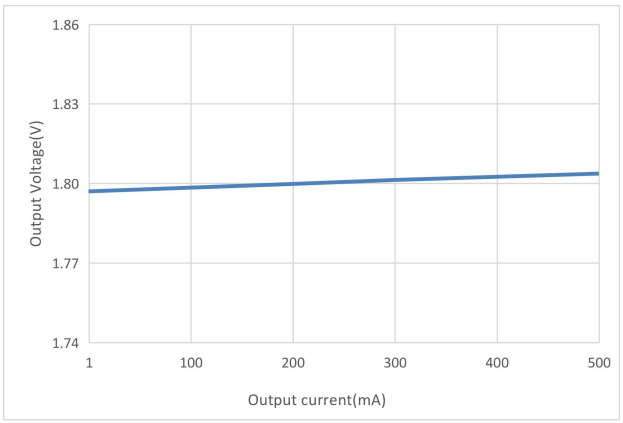
Supply Current VS Temperature



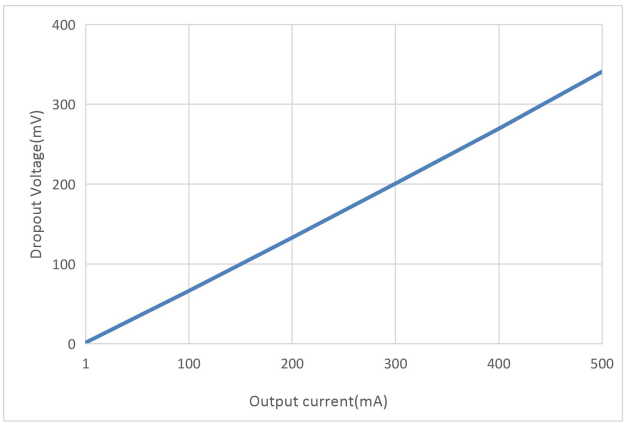
Shutdown Current VS Temperature



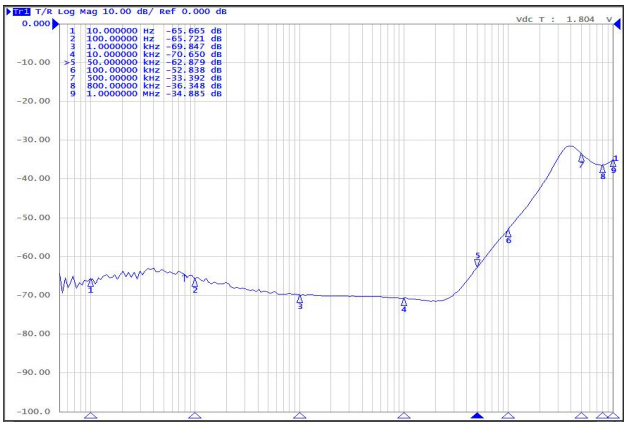
Output Voltage VS Input Voltage



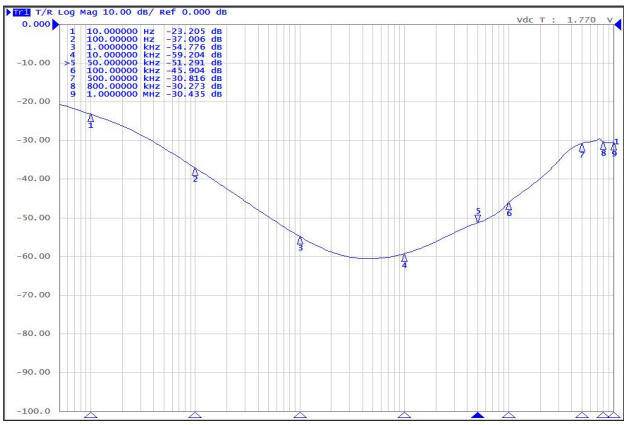
Output Voltage VS Output Current



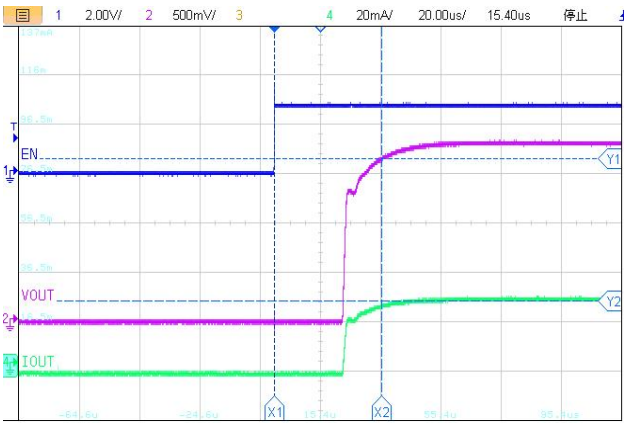
Dropout Voltage VS Output Current



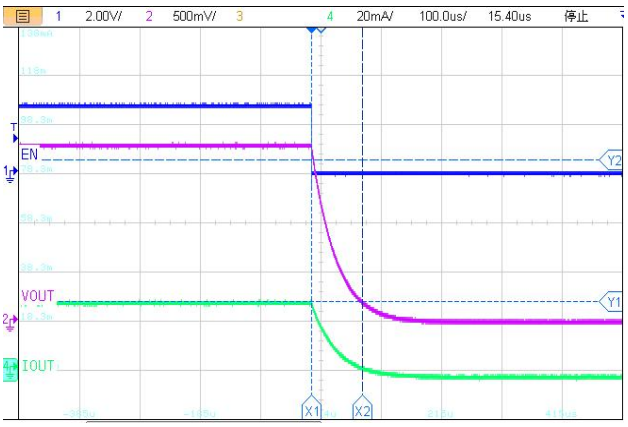
PSRR Test(I_{OUT} = 30mA)



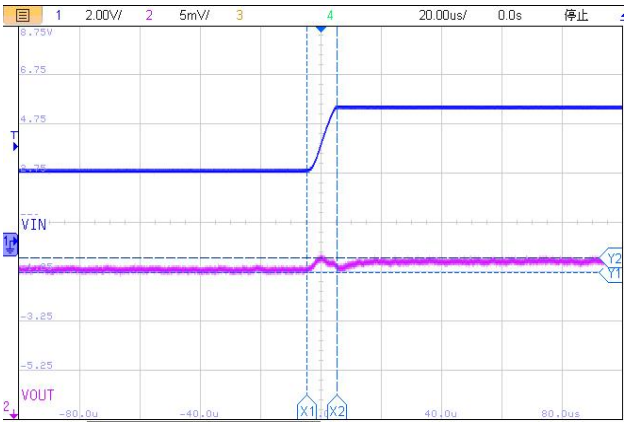
PSRR Test(I_{OUT} = 0.5A)



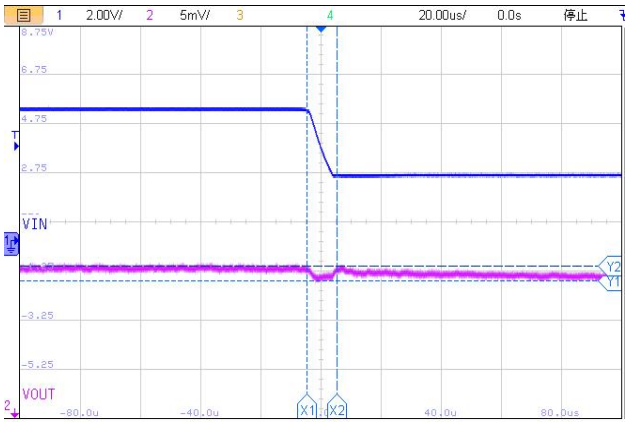
t_{ON} = 35.8us(I_{OUT} = 30mA)



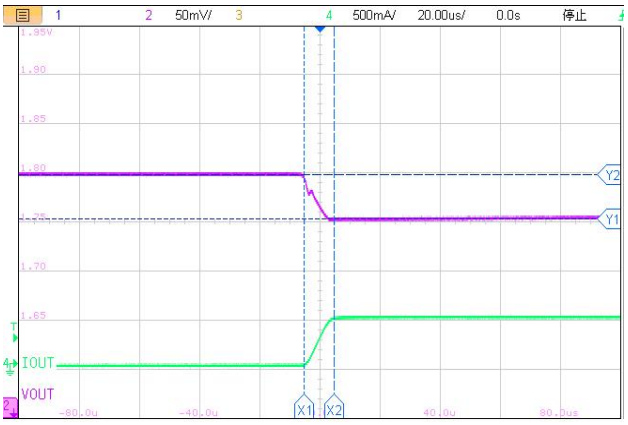
t_{OFF} = 84us(I_{OUT} = 30mA)



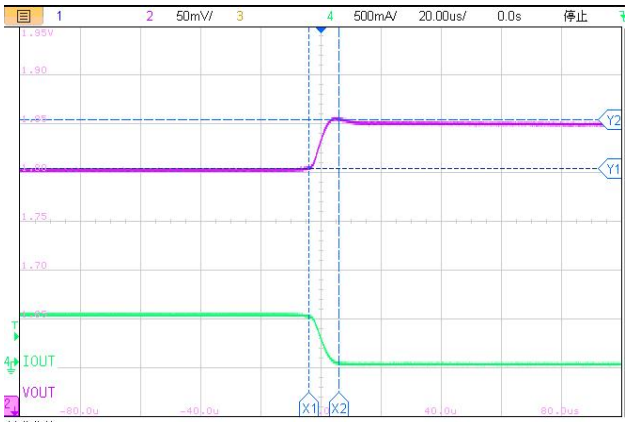
Line transient(2.8~5.5V t = 10us ΔV = 1.5mV)



Line transient(5.5~2.8V t = 10us ΔV = 1.5mV)



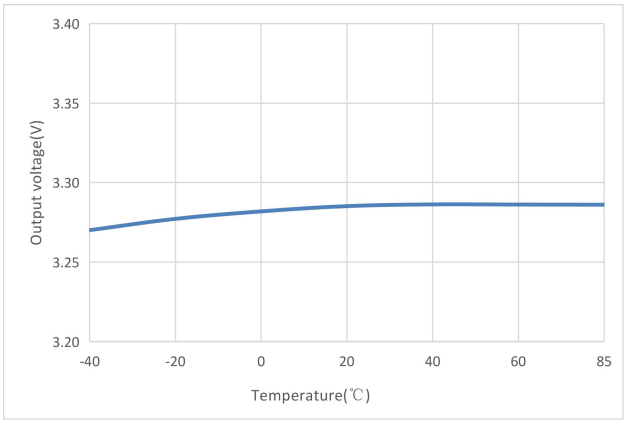
Load transient(1mA~0.5A t = 10us ΔV = 45mV)



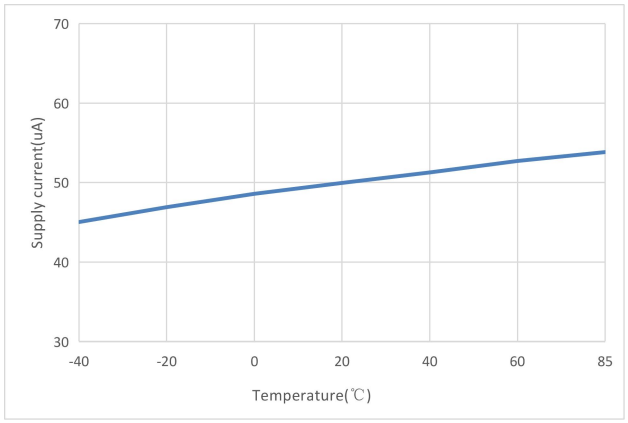
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(2) VOUT set 3.3V

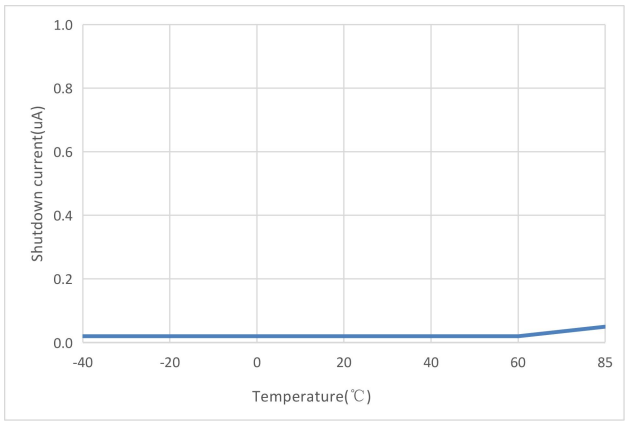
V_{IN} = V_{SET} + 1.0V, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, unless otherwise noted, T_A = 25°C.



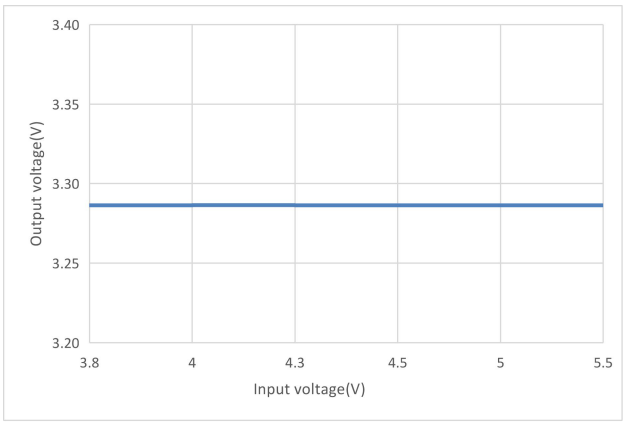
Output Voltage VS Temperature



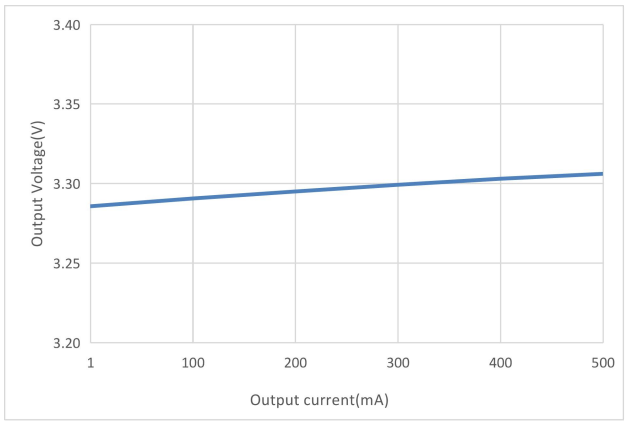
Supply Current VS Temperature



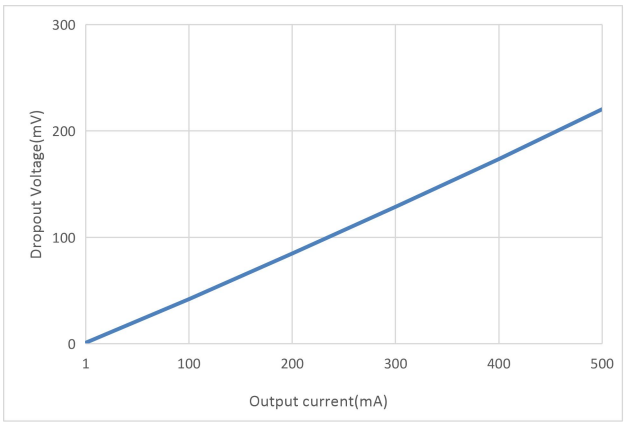
Shutdown Current VS Temperature



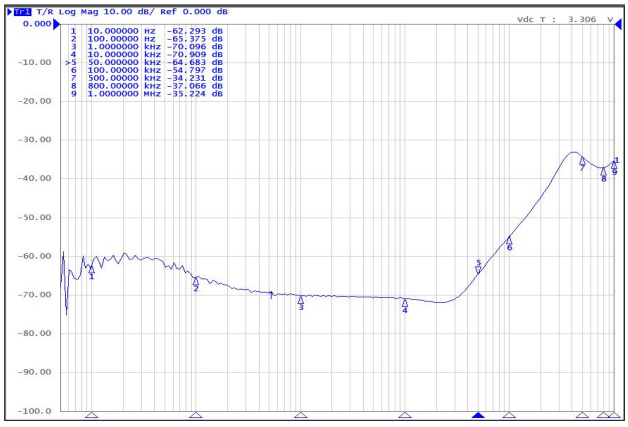
Output Voltage VS Input Voltage



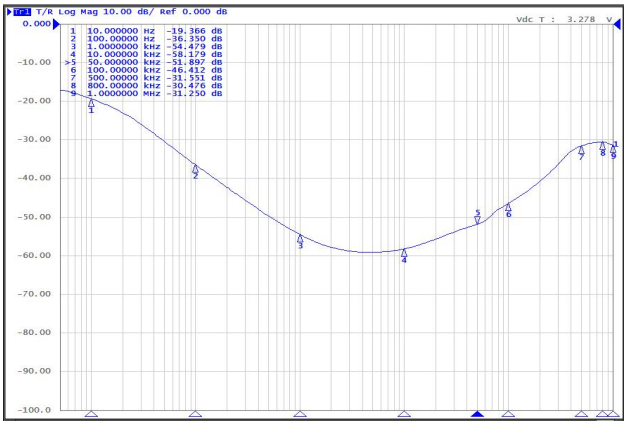
Output Voltage VS Output Current



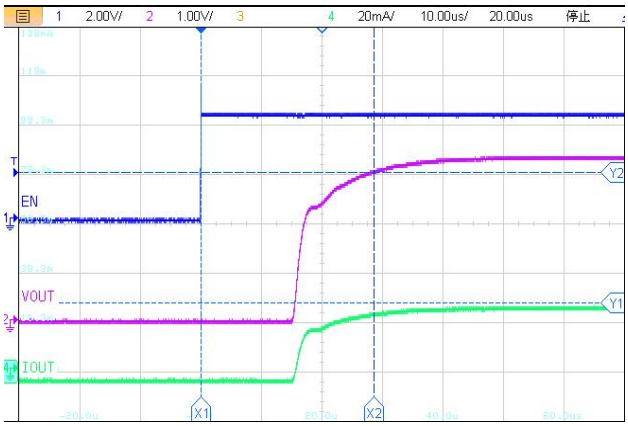
Dropout Voltage VS Output Current



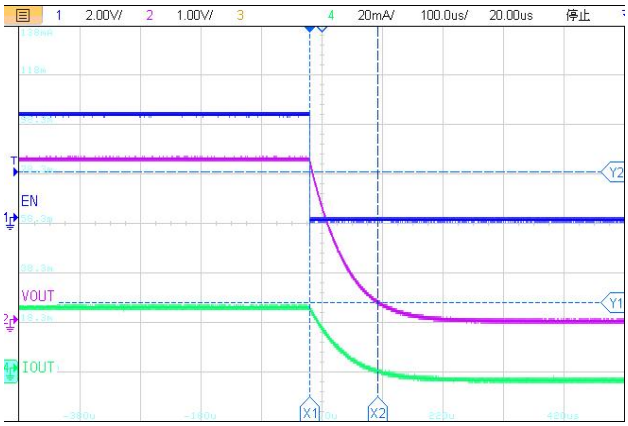
PSRR Test(I_{OUT} = 30mA)



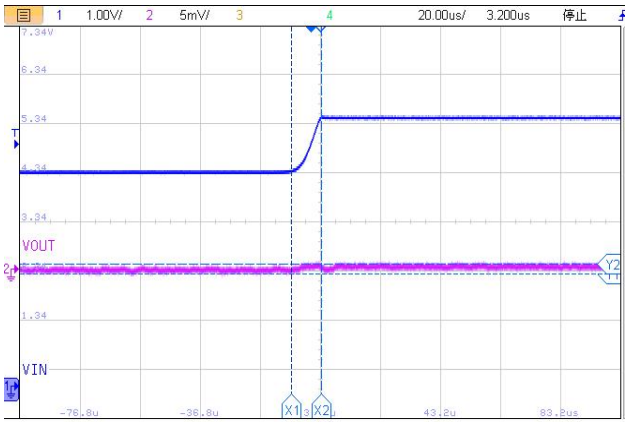
PSRR Test(I_{OUT} = 0.5A)



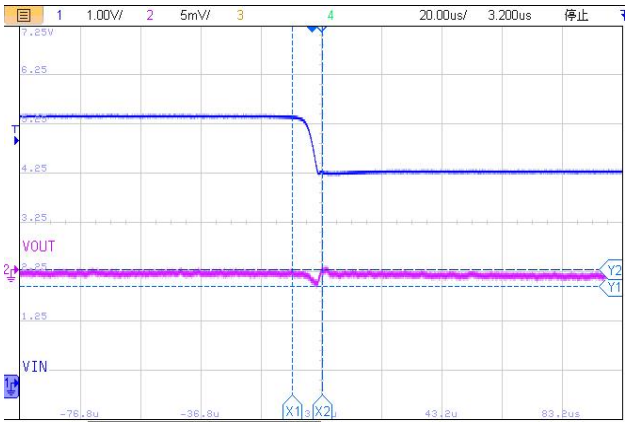
t_{ON}=28.6us(I_{OUT} = 30mA)



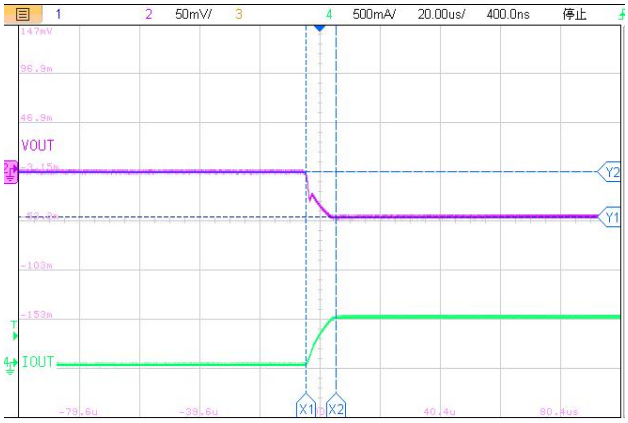
t_{OFF} = 112us(I_{OUT} = 30mA)



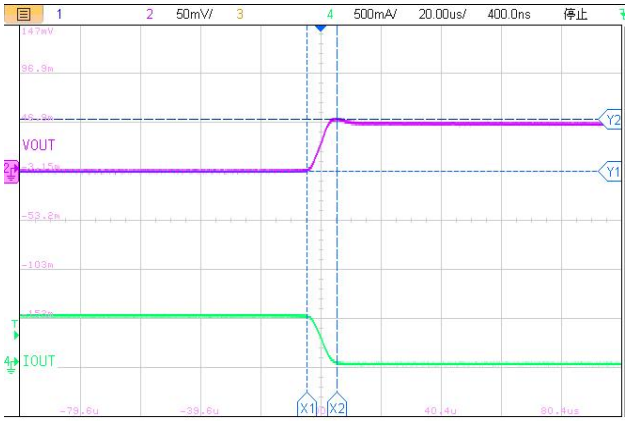
Line transient(4.3~5.5V t = 10us ΔV = 1.0mV)



Line transient(5.5~4.3V t = 10us ΔV = 1.7mV)

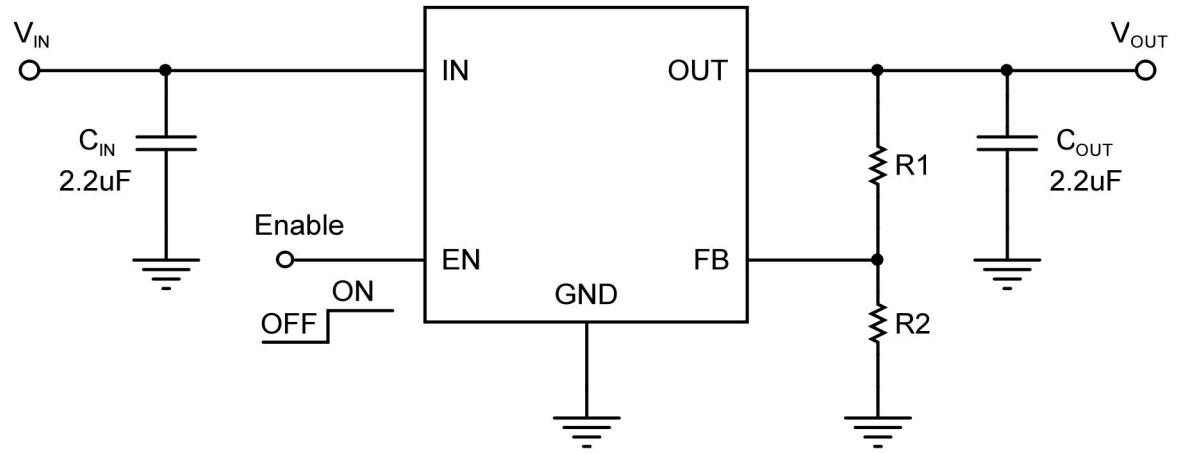


Load transient(1mA~0.5A t = 10us ΔV = 46.25mV)



Load transient(0.5A~1mA t = 10us ΔV = 52.5mV)

Application Circuits

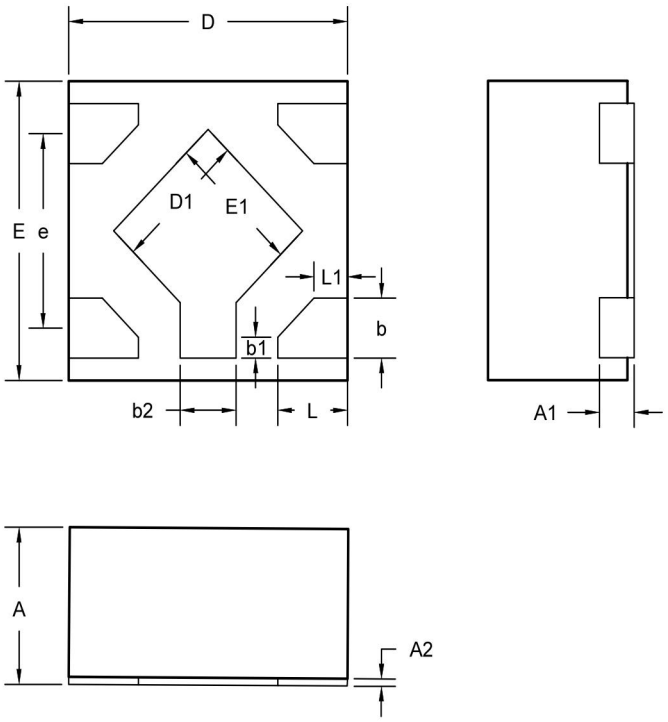


*: V_{OUT} = (1 + R1 / R2) × 0.8V, R2 recommend 100KΩ ~ 1MΩ.

Figure3. Reference Application Circuit

Package Dimension

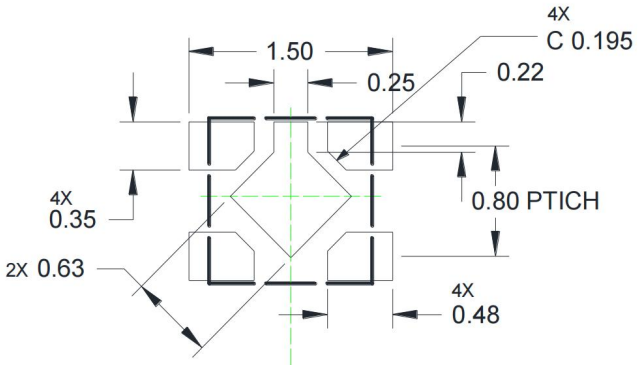
DFN4 (1.2mm × 1.2mm)



COMMON DIMENSIONS

(Unit: mm)

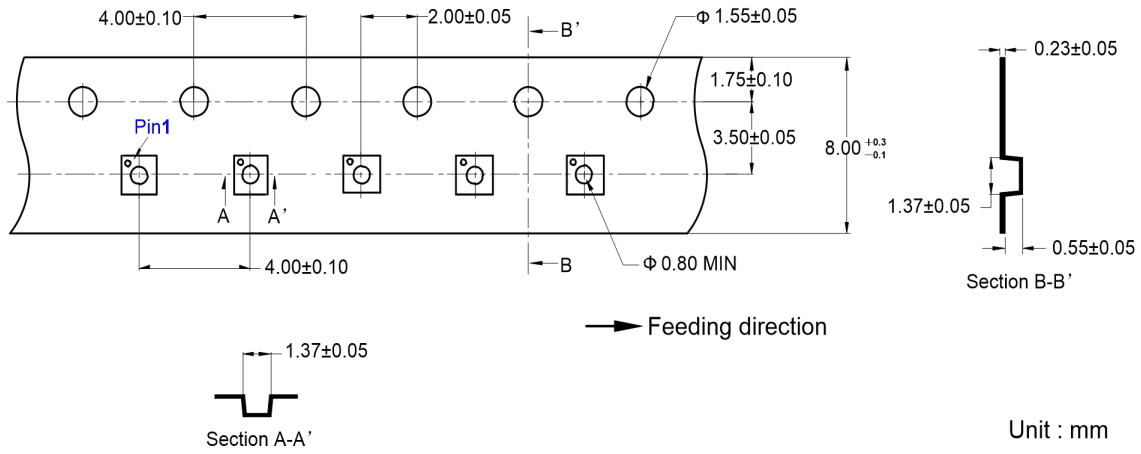
SYMBOL	MIN	NOM	MAX
A	0.35	0.40	0.45
A1		0.13REF	
A2	0.00	0.02	0.05
b	0.25	0.30	0.35
b1		0.12REF	
b2	0.15	0.20	0.25
D	1.15	1.20	1.25
D1	0.58	0.63	0.68
E	1.15	1.20	1.25
E1	0.58	0.63	0.68
e		0.8BSC	
L	0.25	0.30	0.35
L1		0.12REF	



Recommended Land Pattern

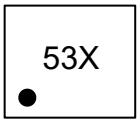
Unit: mm

Tape Information



Unit : mm

Marking



53 – Part Number

X – Tracking Number

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2021-08-11	Preliminary Version	Liuxm	Liuxm	Liujy
1.0	2022-05-18	Official Version	Shib	Liuxm	Liujy
1.1	2023-03-13	Add MSL, ESD, L_U Information	Wangp	Liuxm	Liujy
1.2	2023-10-06	Add Tape Information	Wangp	Liuxm	Liujy
1.3	2026-03-18	Update Format	Wangqf	Liuxm	Liujy
1.4	2026-10-18	Update some format error	Shibo	Liuxm	Liujy