# ET553ADJ - 500mA Low Dropout LDO

## General Description

The ET553ADJ 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 ET553ADJ 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 ET553ADJ 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. ET553ADJ also possess the EN function to save more energy and extend the battery life.

## Features

- Wide Input Voltage Range: 1.9V to 5.5V
- Max Output Current: 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 |
|---|---|---|---|
| ET553ADJTB | SOT89-5 (4.5mm × 4.5mm) | Tape and Reel, 1K/Reel | 3 |
| ET553ADJB | SOT23-5 (1.6mm × 2.9mm) | Tape and Reel, 3K/Reel | 3 |
| ET553ADJYB | DFN4 (1.2mm × 1.2mm) | Tape and Reel, 3K/Reel | 3 |

## Applications

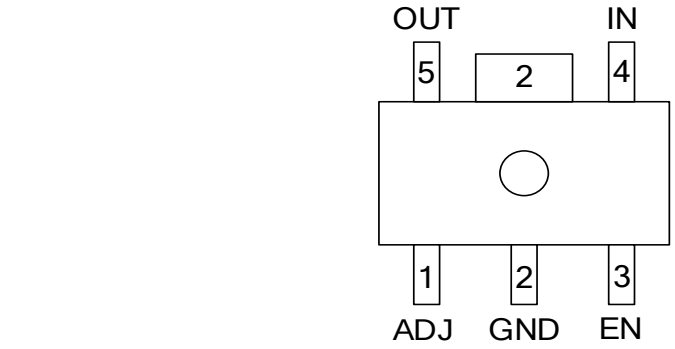
- Constant-voltage Power Supply for Battery-powered Device
- Constant-voltage Power Supply for TV, Notebook PC and Home Electric Appliance
- Constant-voltage Power Supply for Portable Equipment

## Device Information

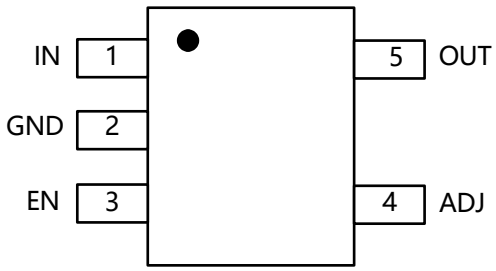
**ET 553 ADJ X B**

| **ADJ** Output Voltage | | **X** Package | | **B** Auto-Discharging Function | |
|---|---|---|---|---|---|
| ADJ | Adjustable by Resistive Divider 1.0V to 4.2V | T | SOT89-5 | B | Available |
| | | / | SOT23-5 | | |
| | | Y | DFN4 (1.2mm × 1.2mm) | | |

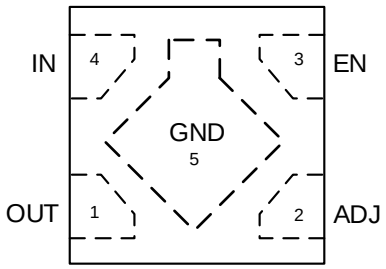
## Pin Configuration




ET553ADJTB (SOT89-5)




ET553ADJB (SOT23-5)




ET553ADJYB (DFN4)

Figure1 Pin Configuration

## Pin Function

| Pin No. | | | Pin Name | Pin Function |
|---|---|---|---|---|
| **DFN4** | **SOT23-5** | **SOT89-5** | | |
| 1 | 5 | 5 | OUT | Output Pin |
| 2 | 4 | 1 | ADJ(FB) | Set the Output Voltage |
| 3 | 3 | 3 | EN | Enable Control Input, Active High |
| 4 | 1 | 4 | IN | Supply Input Pin |
| 5 | 2 | 2 | GND | Ground |

## Block Diagram

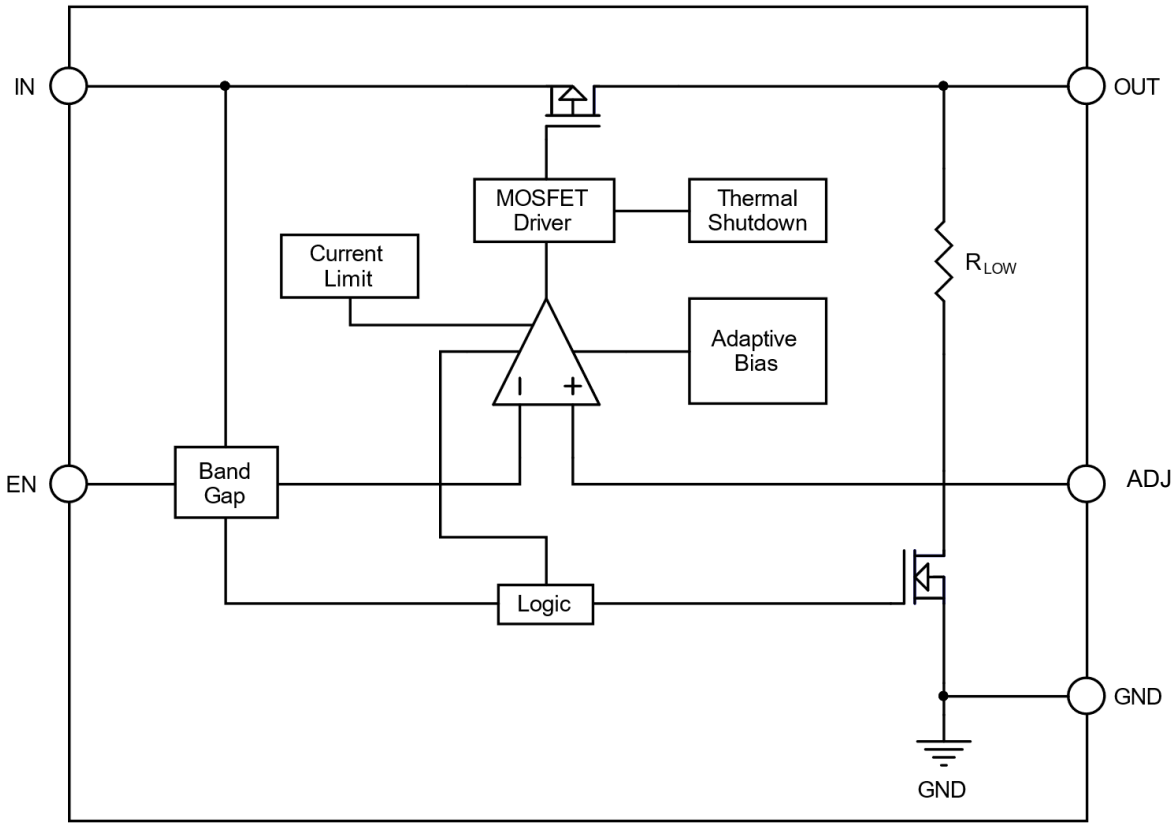



Figure2. Block Diagram

## 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 ET553ADJ is turned on by setting the EN pin to “H”. Since the EN pin is neither pulled down or float, The ET553ADJ OUT 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.

### 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 (1) | | 6.0 | V |
| $V_{EN}$ | DC Input Voltage (EN Pin) | | -0.3 to 6.0 | V |
| $V_{OUT}$ | DC Output Voltage | | -0.3 to 6.0 | V |
| $T_{JMAX}$ | Max Junction Temperature | | +150 | °C |
| $T_{STG}$ | Storage Temperature Range | | -65 to +150 | °C |
| $V_{ESD}$ | 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.

## Thermal Characteristics

| Symbol | Package | Ratings | Value | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | DFN4 | Thermal Characteristics, Thermal Resistance, Junction-to-Air | 180 | °C/W |
| | SOT23-5 | | 250 | °C/W |
| | SOT89-5 | | 80 | °C/W |

## 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

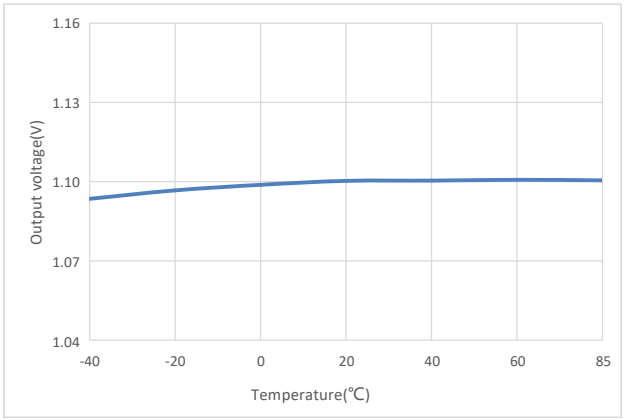
$V_{IN}$ = $V_{SET}$ + 1.0V, $I_{OUT}$ = 1mA, $C_{IN}$ = $C_{OUT}$ = 2.2μF, (unless otherwise noted). $T_A$ = 25°C.

| 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 |
| $REG_{LOAD}$ | Load Regulation | $V_{IN}$ = $V_{SET}$ + 1V, 1mA ≤ $I_{OUT}$ ≤ 0.5A | | 20 | 50 | mV |
| $V_{DIF}$ | 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 |
| $I_{QON}$ | Supply Current | $I_{OUT}$ = 0mA | | 50 | 85 | μA |
| $I_{QOFF}$ | Standby Current | $V_{EN}$ = 0V | | 0 | 1 | μA |
| $REG_{LINE}$ | Line Regulation | $V_{SET}$ + 0.5V ≤ $V_{IN}$ ≤ 5.5V ($V_{IN}$ ≥ 1.4V) | | 0.02 | | %/V |
| PSRR | Power Supply Rejection Ratio | f = 1kHz, Ripple 0.2Vp-p, $V_{IN}$ = $V_{SET}$ + 1.0V, $I_{OUT}$ = 30mA | | 80 | | dB |
| $e_N$ | Output Noise Voltage | $I_{OUT}$= 1mA, f=10Hz to 100KHz | | 20* $V_{OUT}$ | | $\mu V_{RMS}$ |
| $I_{LIM}$ | Output Current Limit | $V_{IN}$ = $V_{SET}$ + 1V | | 700 | 1200 | mA |
| $I_{SC}$ | 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 | | | | 0.40 | V |
| $R_{DIS}$ | Auto-discharge Resistance | $V_{IN}$ = 4V, $V_{EN}$ = 0V | | 80 | | Ω |
| $T_{TSD}$ | Thermal Shutdown Temperature | | | 155 | | °C |
| $T_{TSR}$ | Thermal Shutdown Released Temperature | | | 130 | | °C |

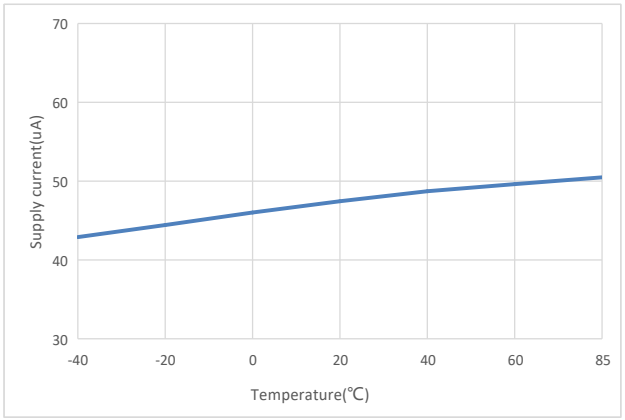
## Typical Characteristics

(1) VOLTAGE VERSION 1.1V

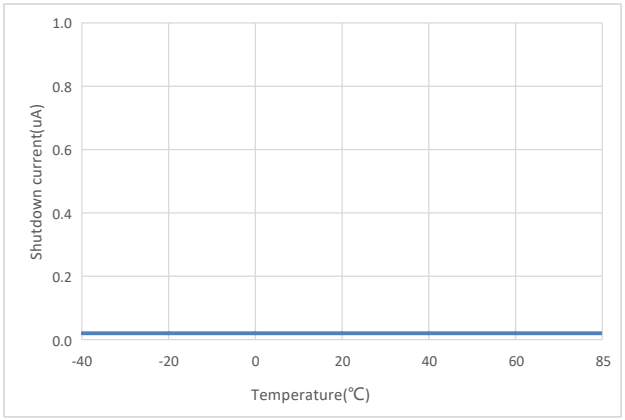
$V_{IN}$ = $V_{SET}$ + 1.0V, $I_{OUT}$ = 1mA, $C_{IN}$ = $C_{OUT}$ = 1μF, unless otherwise noted, $T_A$ = 25°C.



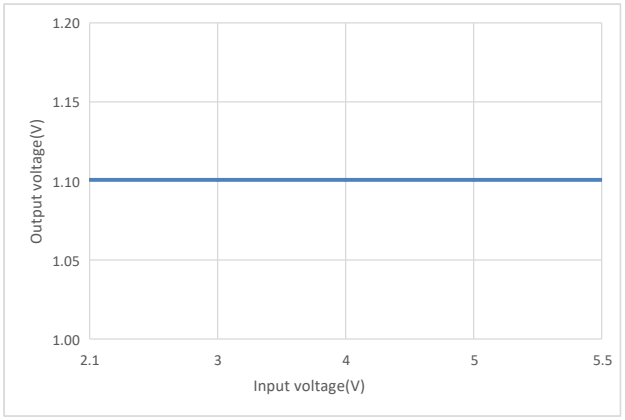

Output Voltage VS Temperature



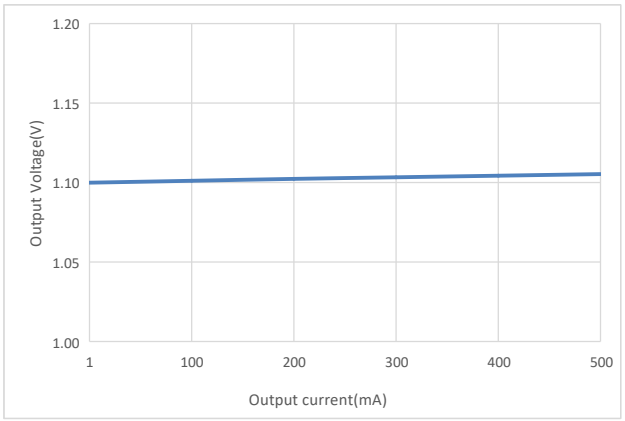

Supply Current VS Temperature



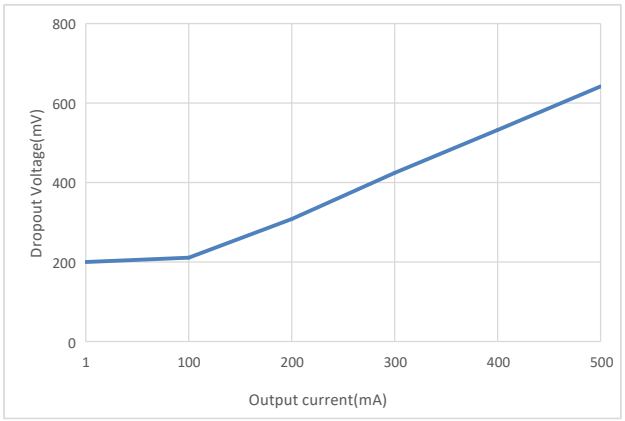

Shutdown Current VS Temperature



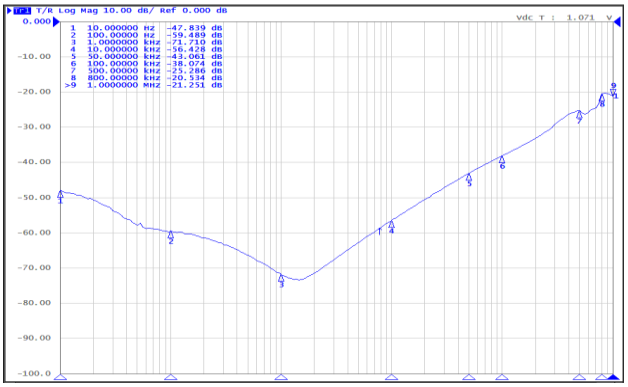

Output Voltage VS Input Voltage



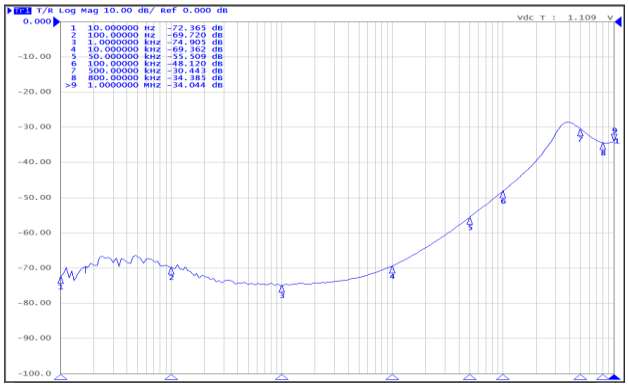

Output Voltage VS Output Current



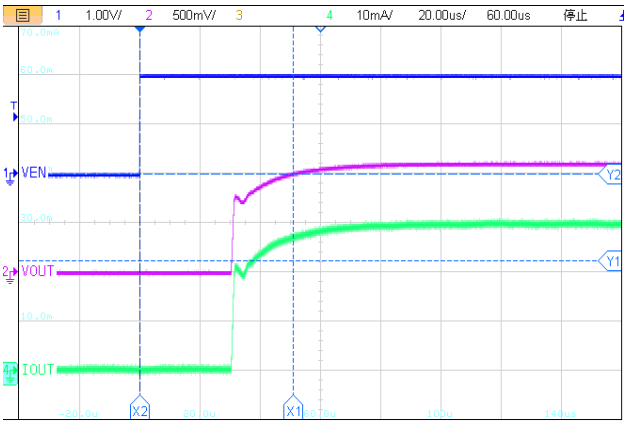

Dropout Voltage VS Output Current



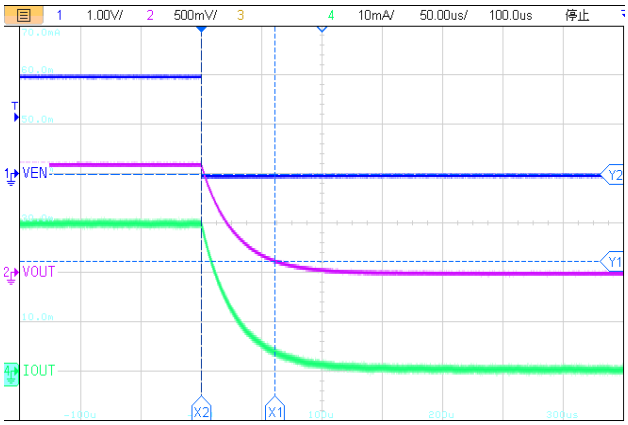
PSRR Test($I_{OUT}$ = 30mA)



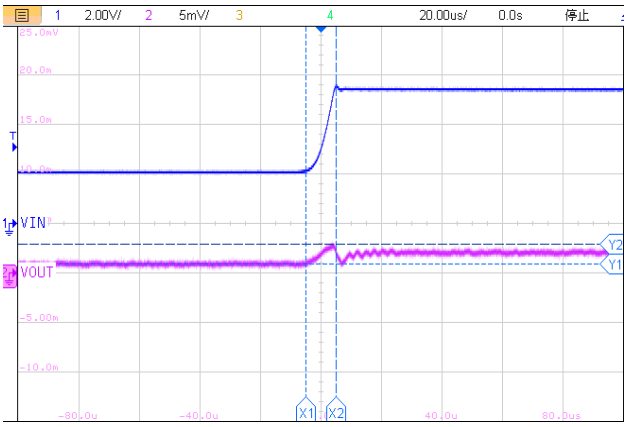
PSRR Test($I_{OUT}$ = 0.5A)



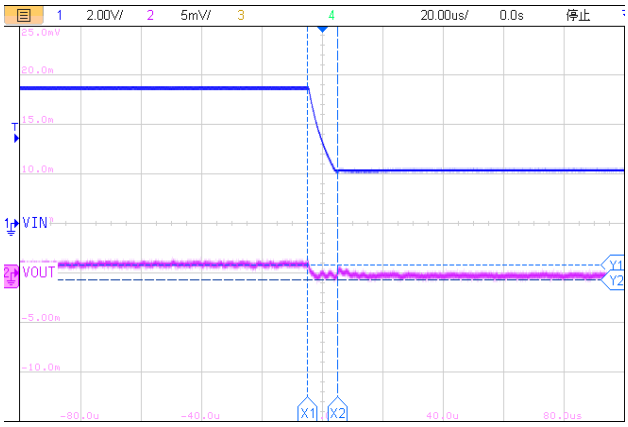

$t_{ON}$ = 51us($I_{OUT}$ = 30mA)



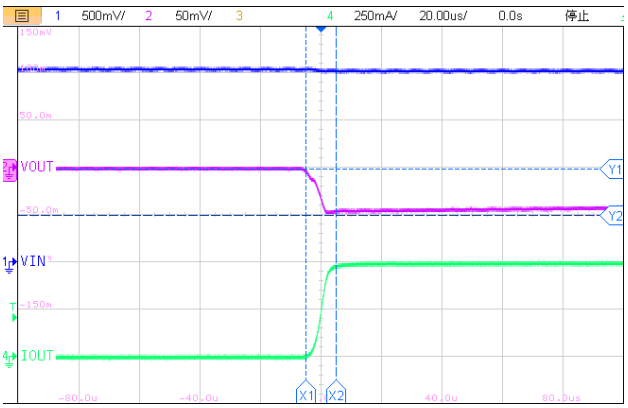

$t_{OFF}$ = 61us($I_{OUT}$ = 30mA)



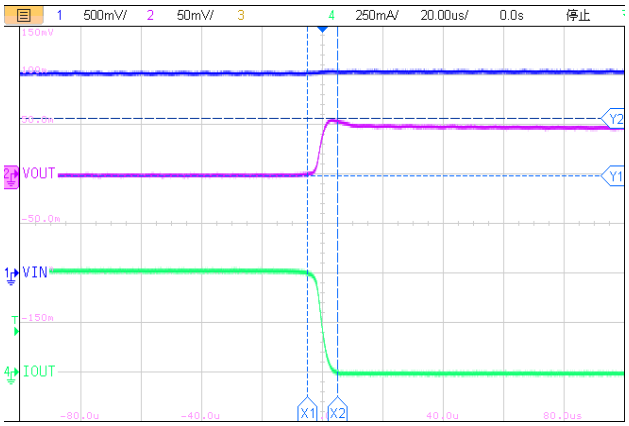

Line transient(2.1~5.5V t = 10us ΔV = 2mV)




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



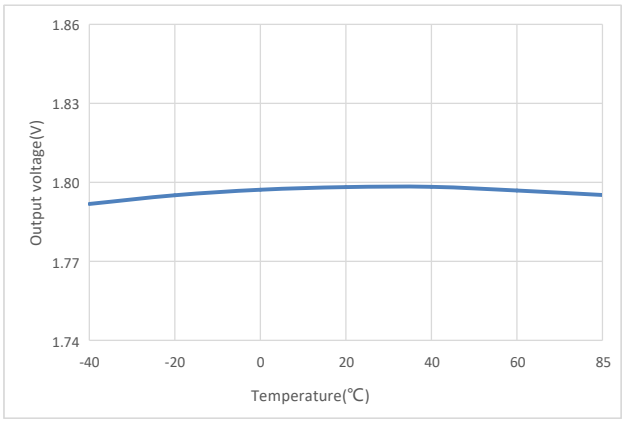

Load transient(1mA~0.5A t = 10us ΔV = 48.75mV)



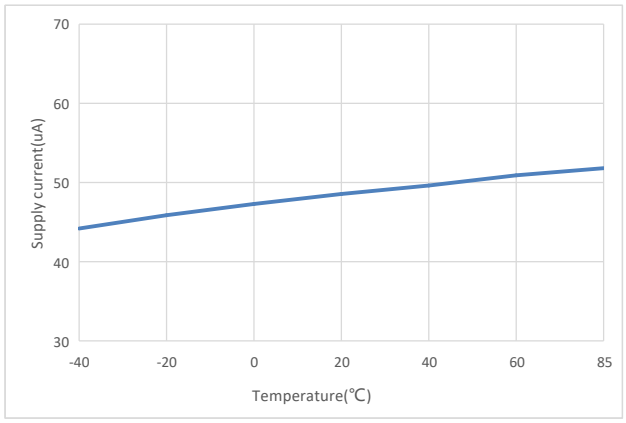

Load transient(0.5A~1mA t = 10us ΔV = 57.5mV)

(2) VOLTAGE VERSION 1.8V

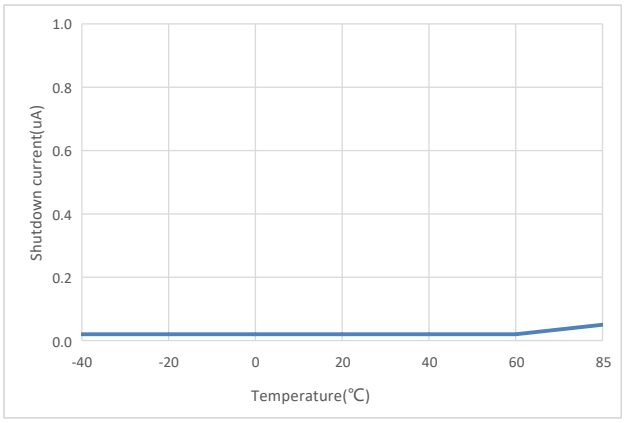
$V_{IN}$ = $V_{SET}$ + 1.0V, $I_{OUT}$ = 1mA, $C_{IN}$ = $C_{OUT}$ = 1μF, unless otherwise noted, $T_A$ = 25°C.



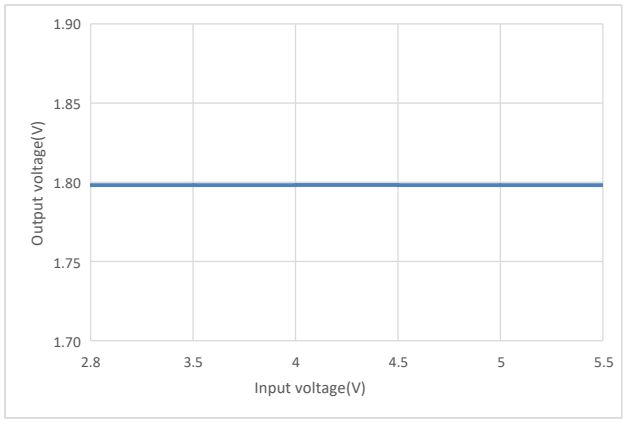

Output Voltage VS Temperature



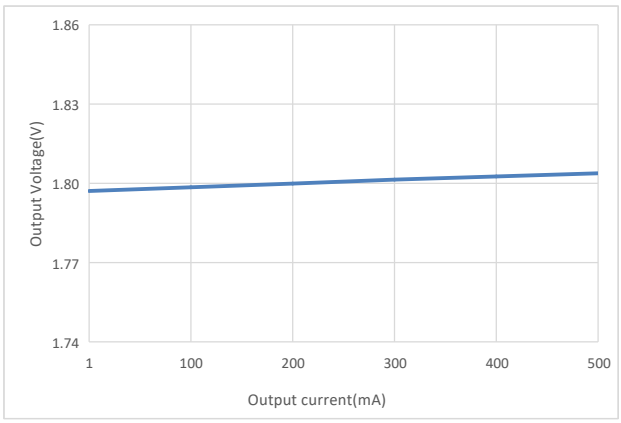

Supply Current VS Temperature



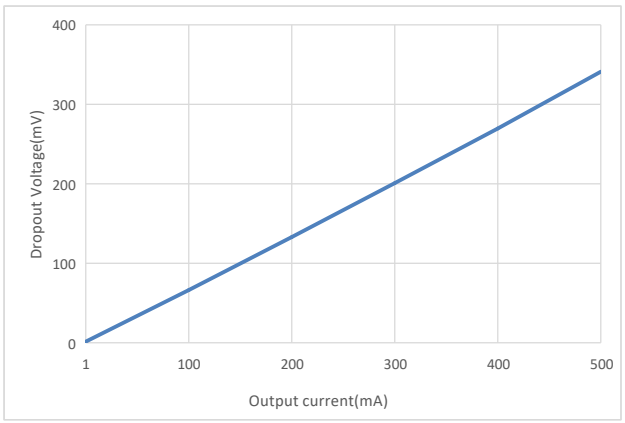

Shutdown Current VS Temperature



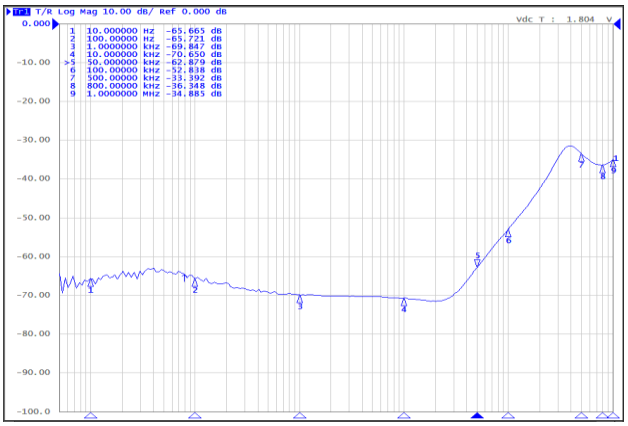

Output Voltage VS Input Voltage



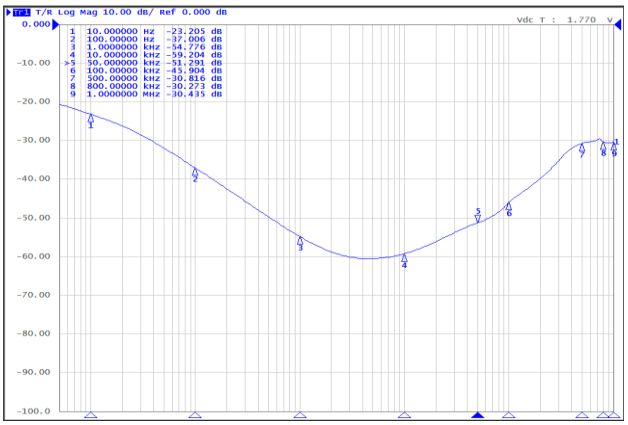

Output Voltage VS Output Current



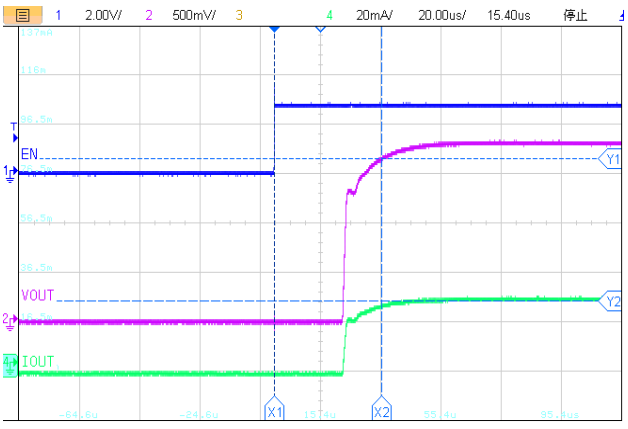

Dropout Voltage VS Output Current



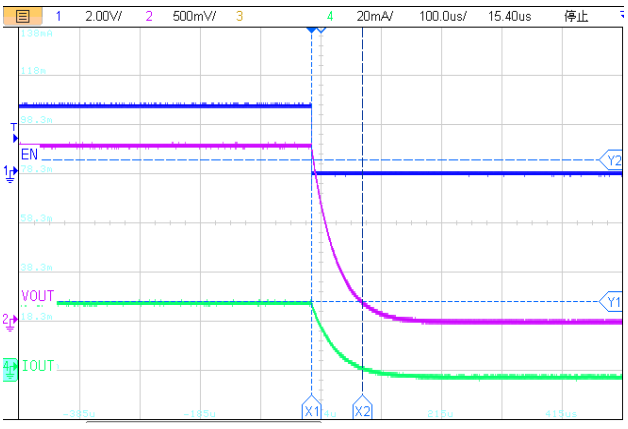
PSRR Test($I_{OUT}$ = 30mA)



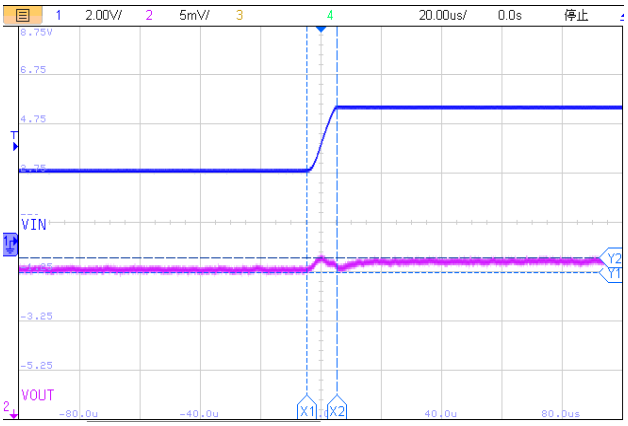
PSRR Test($I_{OUT}$ = 0.5A)



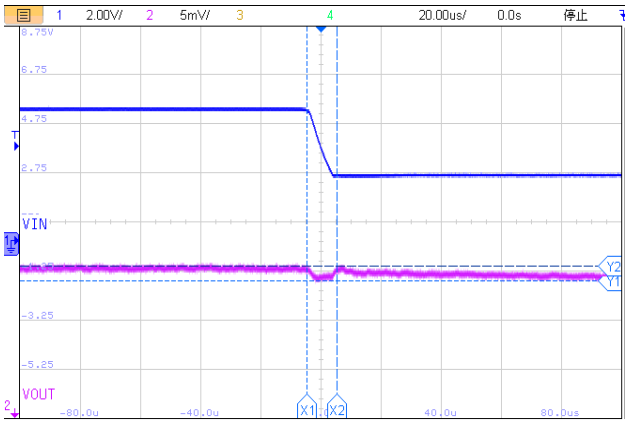

$t_{ON}$ = 35.8us($I_{OUT}$ = 30mA)



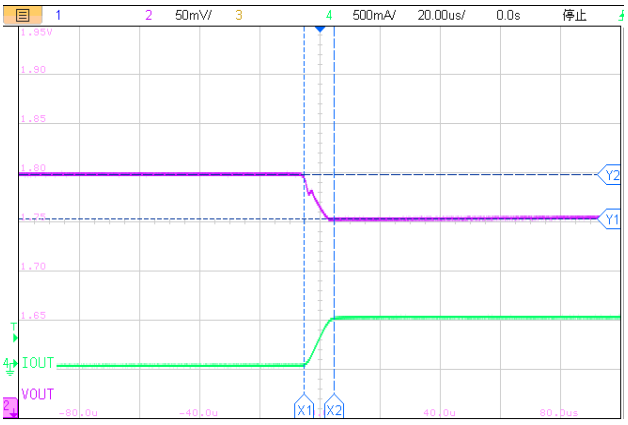

$t_{OFF}$ = 84us($I_{OUT}$ = 30mA)



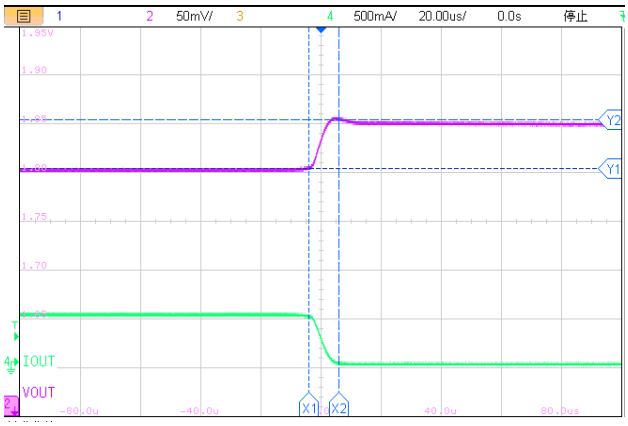

Line transient(2.8~5.5V t = 10us ΔV = 1.5mV)




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



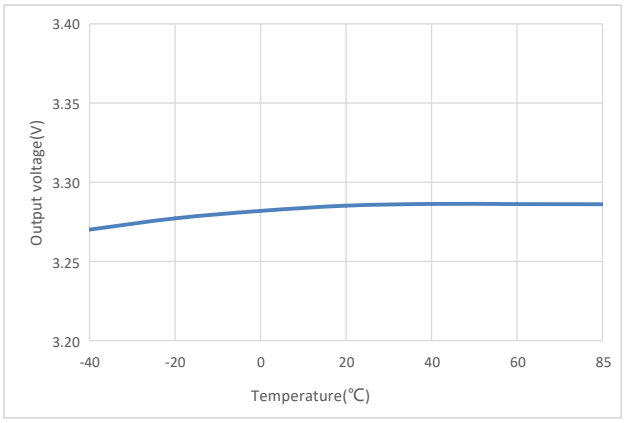

Load transient(1mA~0.5A t = 10us ΔV = 45mV)



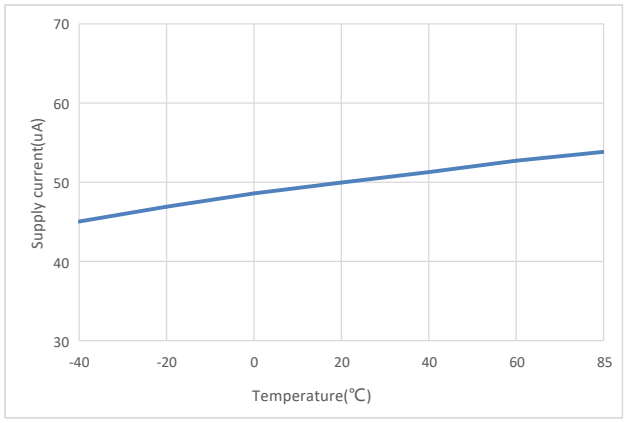

Load transient(0.5A~1mA t = 10us ΔV = 50mV)

(3) VOLTAGE VERSION 3.3V

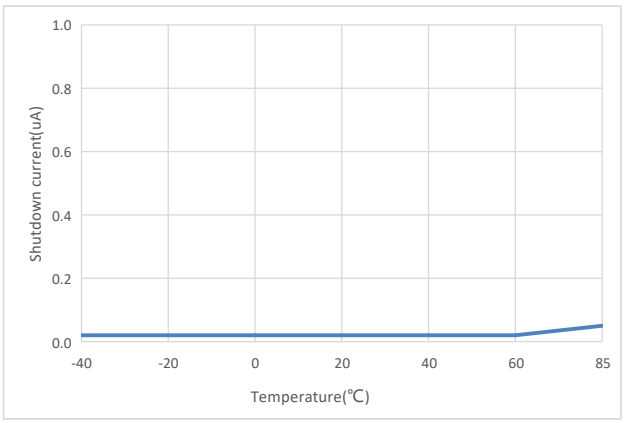
$V_{IN}$ = $V_{SET}$ + 1.0V, $I_{OUT}$ = 1mA, $C_{IN}$ = $C_{OUT}$ = 1μF, unless otherwise noted, $T_A$ = 25°C.



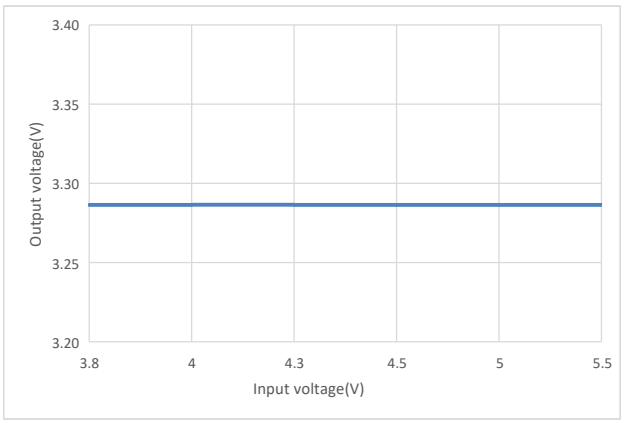

Output Voltage VS Temperature



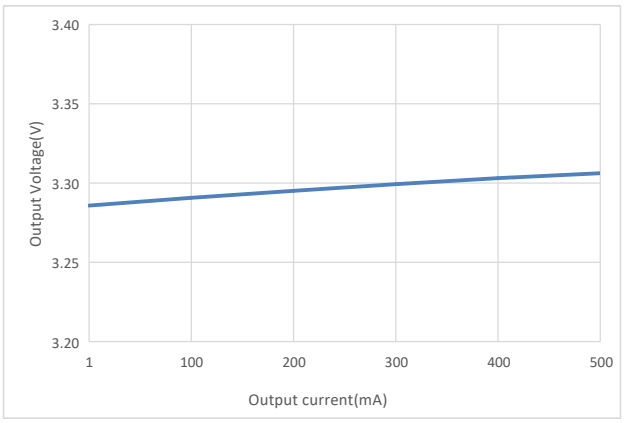

Supply Current VS Temperature



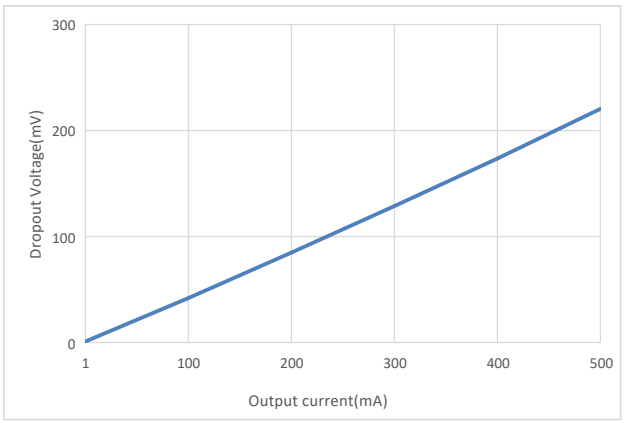

Shutdown Current VS Temperature



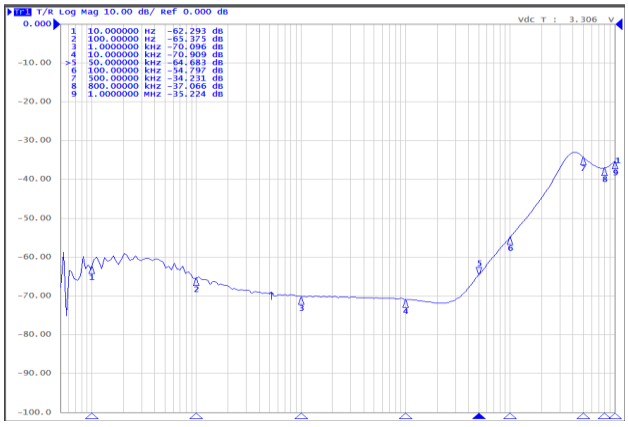

Output Voltage VS Input Voltage



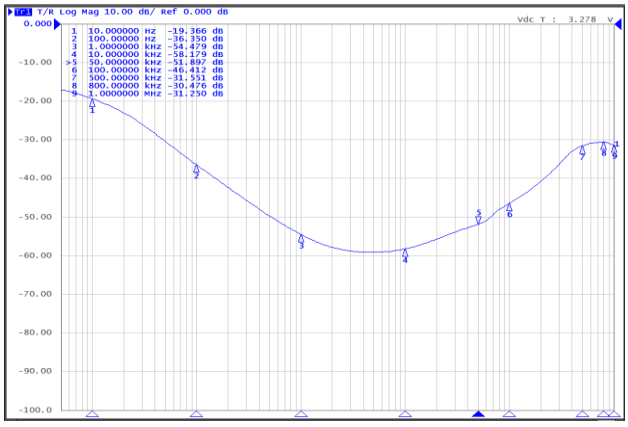

Output Voltage VS Output Current



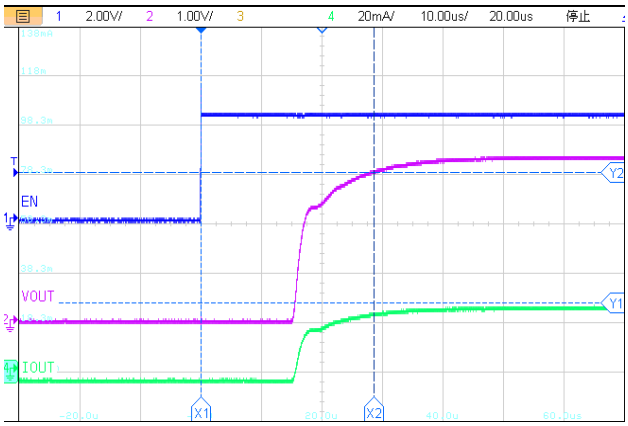

Dropout Voltage VS Output Current



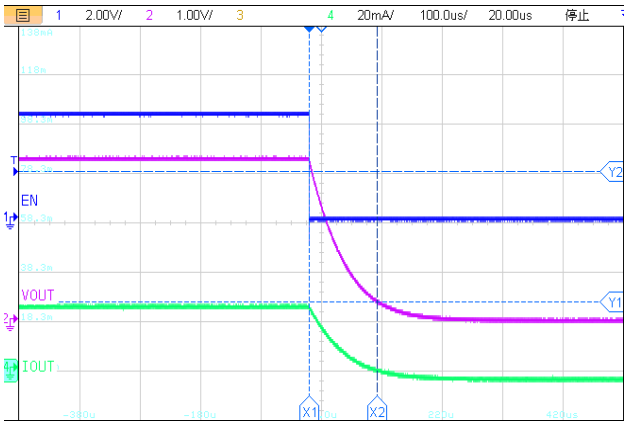

PSRR Test($I_{OUT}$ = 30mA)



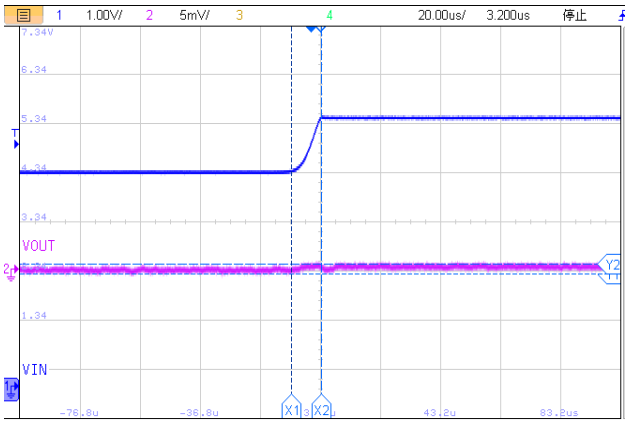

PSRR Test($I_{OUT}$ = 0.5A)



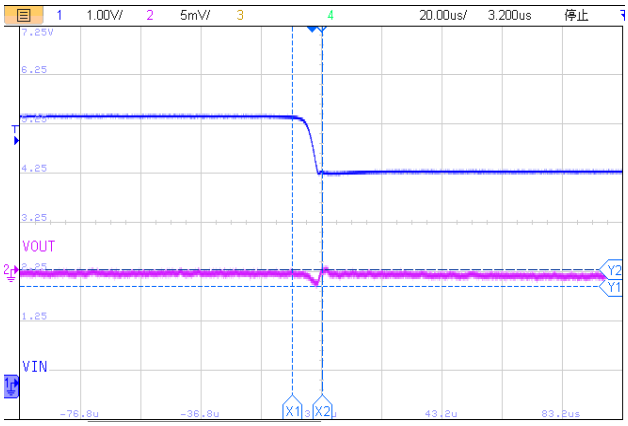

$t_{ON}$=28.6us($I_{OUT}$ = 30mA)



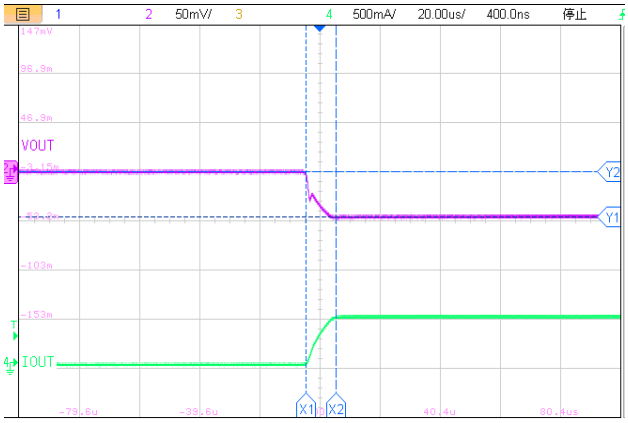

$t_{OFF}$ = 112us($I_{OUT}$ = 30mA)



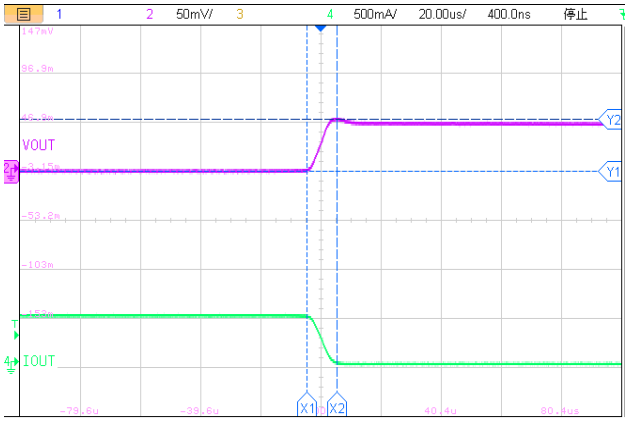

Line transient(4.3~5.5V t = 10us ΔV = 1.0mV)




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

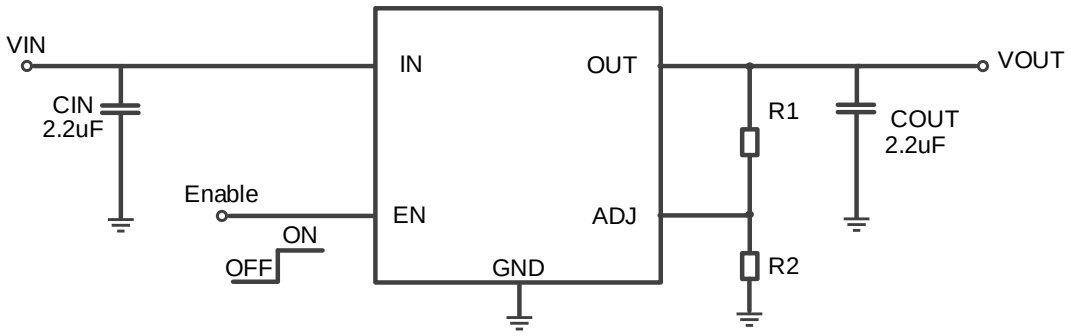



Load transient(1mA~0.5A t = 10us ΔV = 46.25mV)




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

## Application Circuits

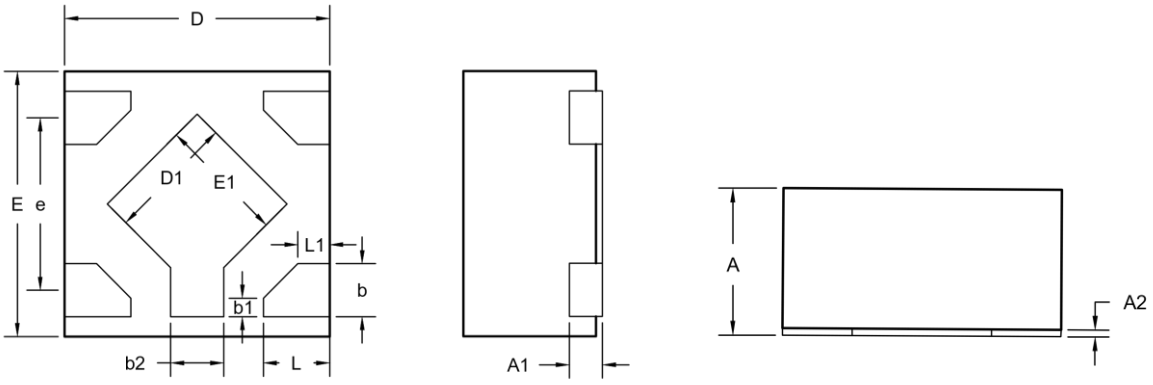



*: $V_{OUT}$ = (1 + R1 / R2) × 0.8V, R2 recommend 100KΩ ~ 1MΩ.

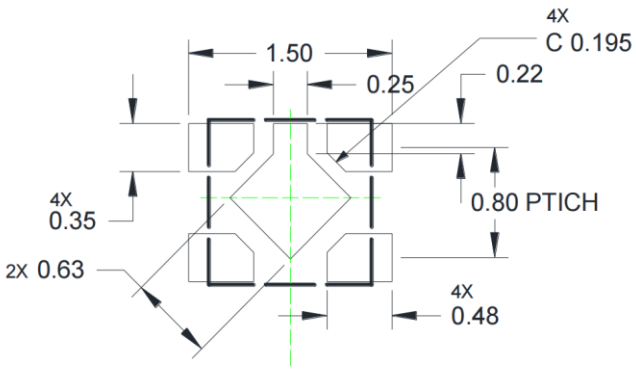
Figure3. Application Circuit

## Package Dimension

DFN4 (1.2mm × 1.2mm)



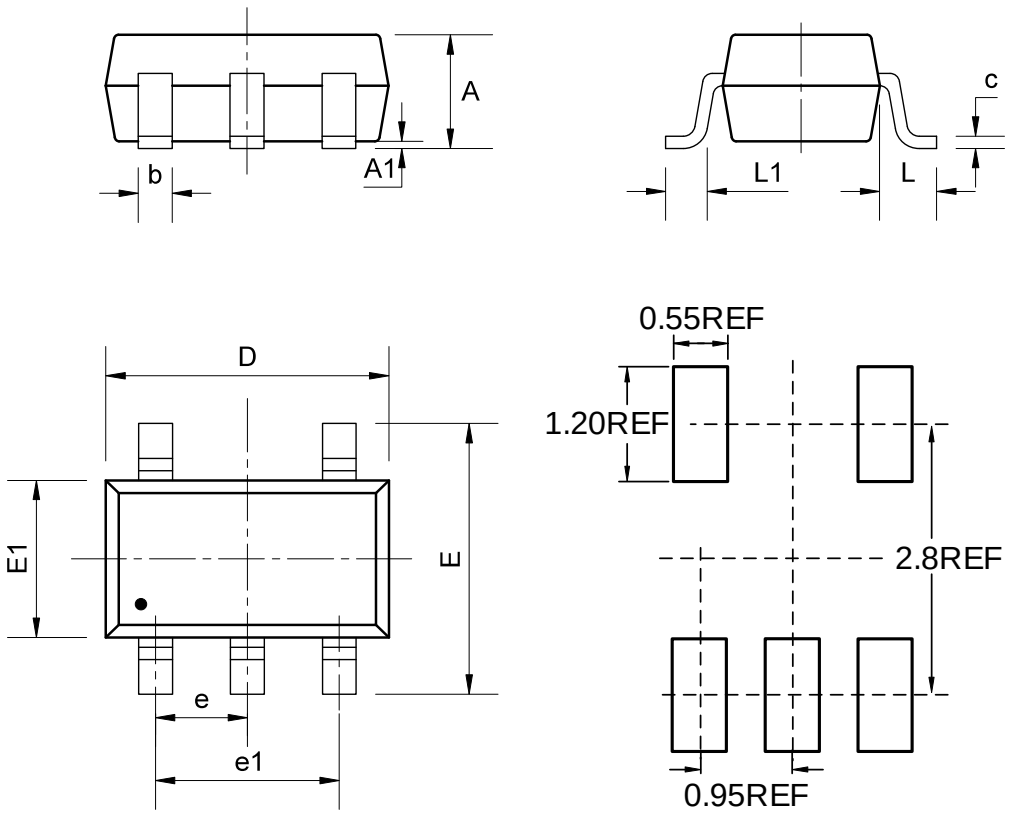

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 0.35 | 0.40 | 0.45 |
| A1 | | 0.13REF | |
| A2 | 0.00 | 0.02 | 0.05 |
| b | 0.25 | 0.30 | 0.35 |
| b1 | | 0.12REF | |
| b2 | 0.15 | 0.20 | 0.25 |
| D | 1.15 | 1.20 | 1.25 |
| D1 | 0.58 | 0.63 | 0.68 |
| E | 1.15 | 1.20 | 1.25 |
| E1 | 0.58 | 0.63 |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




DFN4 Recommended Land Pattern

Unit: mm

SOT23-5 (1.6mm × 2.9mm)

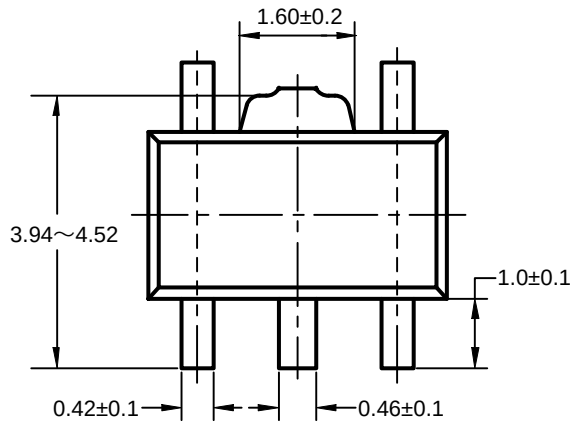



COMMON DIMENSIONS

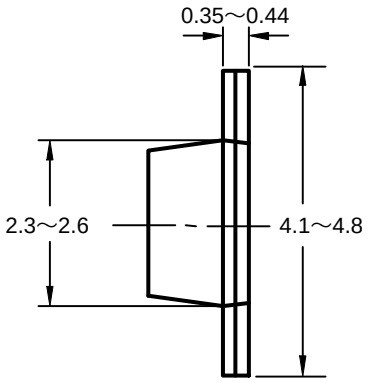
(Unit: mm)

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | - | - | 1.25 |
| A1 | 0 | - | 0.15 |
| b | 0.36 | - | 0.50 |
| c | 0.12 | - | 0.20 |
| D | 2.75 | 2.9 | 3.05 |
| e | 0.90 | 0.95 | 1.00 |
| e1 | 1.80 | 1.90 | 2.00 |
| E | 2.60 | 2.80 | 3.00 |
| E1 | 1.45 | 1.6 | 1.75 |
| L | 0.60REF | | |
| L1 | 0.30 | 0.45 | 0.60 |

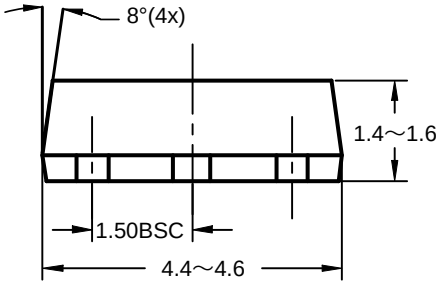
SOT89-5 (4.5mm × 4.5mm)



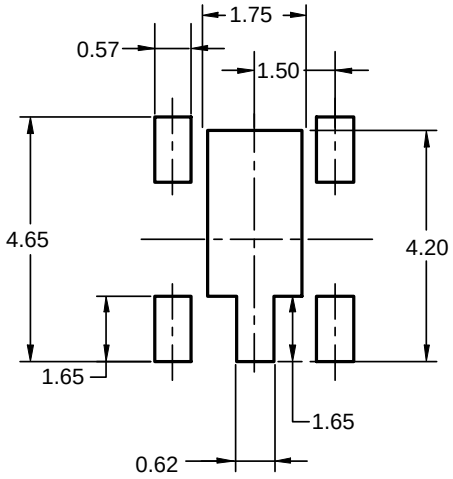

Top View




Side View




Side View




**Recommended Land Pattern**

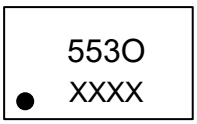
Unit: mm

## Marking

SOT89-5 (ET553ADJTB)

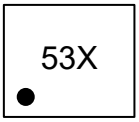

553 & T = Part Number
O = ADJ Version
XXXX = Tracking Number

SOT23-5 (ET553ADJB)




53 = Part Number
O = ADJ Version
XXXX = Tracking Number

DFN4 (ET553ADJYB)




53 = Part Number
X = Tracking Number

## Revision History and Checking Table

| Version | Date | Revision Item | Modifier | Function & Spec Checking | Package & Tape Checking |
|---|---|---|---|---|---|
| 0 | 2021-8-11 | Preliminary Version | Liuxm | Liuxm | Liujy |
| 1.0 | 2022-5-18 | Official Version | Shib | Liuxm | Liujy |
| 1.1 | 2022-11-18 | Add SOT89-5 | Shib | Liuxm | Liujy |
| 1.2 | 2022-12-22 | Y1 Changed Y<br>Add Marking | Shib | Liuxm | Liujy |
| 1.3 | 2024-6-11 | Update Package Picture | Shib | Liuxm | Liujy |
| 1.4 | 2026-3-12 | Update Output Voltage Range | Wangqf | Liuxm | Liujy |