# ET5H6ADJY - High Input Ultra-high PSRR 300mA LDO

## General Description

ET5H6ADJY is a high input voltage and ultra-high PSRR 300mA LDO with enable function that output adjustable from 1.0V~5.0V, which is designed specifically for portable battery-powered applications which require low quiescent current. The consumption of type 50μA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

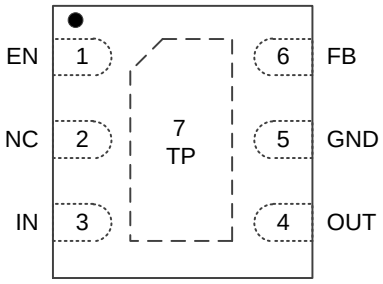
ET5H6ADJY offered DFN6 package.

## Features

- Wide Input Voltage Range from 2.5V to 24V
- Up to 300mA Load Current
- Low $I_Q$ is 50μA Typical
- ADJ Output Voltage Range 1.0V~5.0V
- Very Low Dropout is 270mV at 150mA Load @$V_{OUT}$ = 3.3V
- Excellent Load/Line Transient Response
- Ultra-high Ripple Rejection is 90dB at 1kHz
- Part No. and Package Information

| Part No. | Package | MSL |
|---|---|---|
| ET5H6ADJY | DFN6 (2mm × 2mm) | 1 |

## Pin Configuration

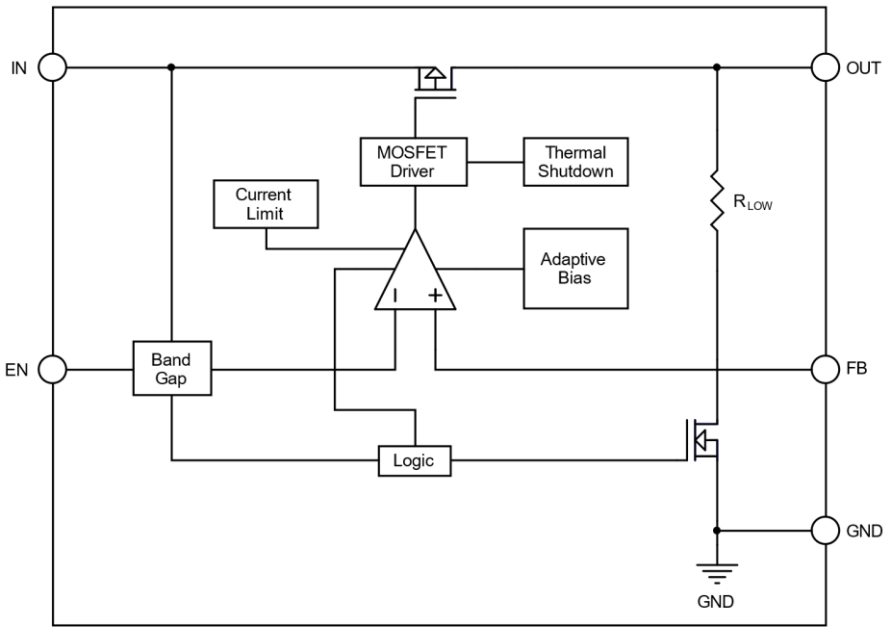



Top View

## Pin Function

| Pin Name | Pin Function |
|---|---|
| EN | ON/OFF Control, Active “H” |
| NC | No Connect |
| IN | Supply Input Pin. |
| OUT | Output Pin. |
| GND | Ground. |
| FB | Set the Output Voltage by Using Divider Resistors |
| TP | Thermal Pad. Only be connect to GND or floating, can’t be connected to other pins |

## Block Diagram



## Functional Description

### Input Capacitor

A 1μF~10μF ceramic capacitor is recommended to connect between VIN 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 VIN and GND.

### Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1μF to 10μF, 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.

### Enable

The ET5H6ADJY delivers the output power when it is set to enable state. When it works in disable state, there is no output power and the operation quiescent current is almost zero. The enable pin (EN) is active high.

### Dropout Voltage

The ET5H6ADJY uses a PMOS pass transistor to achieve low dropout. When ($V_{IN}$ - $V_{OUT}$) is less than the dropout voltage ($V_{DROP}$), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(ON)}$ of the PMOS pass element. $V_{DROP}$ scales approximately with output current because the PMOS device behaves like a resistor in dropout mode. As with any linear regulator, PSRR and transient response degrade as ($V_{IN}$ - $V_{OUT}$) approaches dropout operation.

### Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 155°C.Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 130°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the LDO from damage as a result of overheating. Activating the thermal shutdown feature usually indicates excessive power dissipation as a result of the product of the ($V_{IN}$ - $V_{OUT}$) voltage and the load current. For reliable operation, limit junction temperature to 150°C maximum.

### Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula:

$$\mathbf{P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}}$$

where $T_{J(MAX)}$ is the maximum junction temperature, $T_A$ is the ambient temperature, and $\theta_{JA}$ is the junction to ambient thermal resistance.

For recommended operating condition specifications the maximum junction temperature is 150°C and $T_A$ is

the ambient temperature. The junction to ambient thermal resistance, $\theta_{JA}$, is layout dependent.

The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance $\theta_{JA}$.

**Current-Limit Protection**

The ET5H6ADJY provides current limit function to prevent the device from damages during over-load or shorted-circuit condition. This current is detected by an internal sensing transistor.

**Layout Guidelines**

- Place input and output capacitors as close to the device as possible.
- Use copper planes for device connections in order to optimize thermal performance.
- Place thermal vias around the device to distribute heat.
- Do not place a thermal via directly beneath the thermal pad. A via can wick solder or solder paste away from the thermal pad joint during the soldering process, leading to a compromised solder joint on the thermal pad.
- Thermal pad only be connected to GND or floating, can't be connected to other pins.

## Absolute Maximum Ratings

| Symbol | Rating | Value | Unit |
|---|---|---|---|
| $V_{IN}$ (1) | Input Voltage | -0.3~30 | V |
| $V_{OUT}$ | Output Voltage | -0.3~6 | V |
| $V_{EN}$ | Chip Enable Input | -0.3~30 | V |
| $T_{J(MAX)}$ | Maximum Junction Temperature | 150 | °C |
| $T_{STG}$ | Storage Temperature | -65~150 | °C |
| $V_{ESD}$ (2) | HBM Capability | ±2000 | V |
| | CDM Capability | ±1500 | V |
| $I_{LU}$ (2) | Latch up Current Maximum Rating | 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:*** Refer to Electrical Characteristics and Application Information for Safe Operating Area.

***Note2:*** This device series incorporates ESD protection and is tested by the following methods:

ESD HBM tested per JEDEC JS-001;

ESD CDM tested per JEDEC JS-002;

Latch up Current Maximum Rating tested per JEDEC JESD78F.

## Thermal Characteristics

| Symbol | Package | Ratings | Value | Unit |
|---|---|---|---|---|
| $\theta_{JA}$ | DNF6 (2mm × 2mm) | Thermal Characteristics, Thermal Resistance, Junction-to-Air | 125 | °C/W |

## Recommended Operating Conditions

| Symbol | Item | Rating | Unit |
|---|---|---|---|
| $V_{IN}$ | Input Voltage | 2.5 to 24 | V |
| $I_{OUT}$ | Output Current | 0 to 300;<br>0 to 100 @$V_{IN}$ = 2.5V, $V_{OUT}$ = 1.95V | mA |
| $T_J$ | Operating Junction Temperature | -40 to 125 | °C |
| $C_{IN}$ | Effective Input Ceramic Capacitor Value | 1 to 10 | μF |
| $C_{OUT}$ | Effective Output Ceramic Capacitor Value | 1 to 10 | μF |
| ESR | Input and Output Capacitor Equivalent Series Resistance (ESR) | 5 to 100 | mΩ |

## Electrical Characteristics

($V_{IN}$ = $V_{OUT}$ + 2V; $I_{OUT}$ = 1mA, $C_{IN}$ = $C_{OUT}$ = 2.2μF, unless otherwise noted. Typical values are at $T_A$ = +25°C.) (3)

| Symbol | Parameter | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{IN}$ | Operating Input Voltage (4) | | | 2.5 | | 24 | V |
| $V_{FB}$ | FB Voltage | $I_{OUT}$ = 1mA, 25°C | | 0.591 | 0.600 | 0.609 | V |
| | | $I_{OUT}$ = 1mA, -40~125°C | | 0.588 | | 0.612 | V |
| $Line_{REG}$ | Line Regulation (7) | $V_{OUT}$ + 2 ≤ $V_{IN}$ ≤ 24V<br>$I_{OUT}$ = 10mA | | | 0.05 | 0.20 | %/V |
| | | 2.5V ≤ $V_{IN}$ ≤ 24V<br>$I_{OUT}$ = 10mA@$V_{OUT}$ = 1.95V | | | | | |
| $Load_{REG}$ | Load Regulation<br>$T_A$ = +25°C (7) | 1mA ≤ $I_{OUT}$ ≤ 300mA,<br>$V_{IN}$ = $V_{OUT}$ + 2V | | | 20 | 40 | mV |
| | | 1mA ≤ $I_{OUT}$ ≤ 100mA,<br>$V_{IN}$ = 2.5V, $V_{OUT}$ = 1.95V | | | | | |
| $V_{DROP}$ | Dropout Voltage<br>$T_A$ = +25°C (5) (7) | $I_{OUT}$ = 300mA | $V_{OUT}$ = 3.3V | | 600 | 950 | mV |
| | | $I_{OUT}$ = 150mA | $V_{OUT}$ = 3.3V | | 270 | 450 | mV |
| | | $I_{OUT}$ = 100mA | $V_{OUT}$ = 1.95V | | | 550 | mV |
| $I_{_LMT}$ | Current Limit | $V_{IN}$ = $V_{OUT}$ + 2V, $T_A$ = +25°C | | 350 | 600 | 900 | mA |
| $I_{_SHORT}$ | Short Current Limit | $V_{IN}$ = $V_{OUT}$ + 2V, $T_A$ = +25°C | | 80 | 150 | 220 | mA |
| $I_{Q_ON}$ | Quiescent Current | $I_{OUT}$ = 0mA, $T_A$ = +25°C | | | 50 | 80 | μA |
| | | $I_{OUT}$ = 0mA, $T_A$ = +25°C<br>$V_{IN}$ = 2.5V@$V_{OUT}$ = 1.95V | | | 60 | 90 | μA |
| $I_{Q_OFF}$ | Standby Current | $V_{EN}$ = 0V, $T_A$ = +25°C<br>$V_{IN}$ = 2.5V, $V_{IN}$ = $V_{OUT}$ + 2V | | | 0.1 | 1 | μA |
| $V_{ENH}$ | EN Pin Threshold Voltage | EN Input Voltage “H” | | 1.0 | | | V |
| $V_{ENL}$ | EN Pin Threshold Voltage | EN Input Voltage “L” | | | | 0.4 | V |
| $I_{EN}$ | EN Pin Current | $V_{EN}$ = 0-24V | | | 1 | 2 | μA |
| PSRR | Power Supply Rejection Ratio<br>$V_{IN}$ = $V_{OUT}$ + 2V, $I_{OUT}$ = 20mA | f = 1kHz | | 70 | 90 | | dB |
| $e_N$ | Output Noise Voltage (6) | $V_{IN}$ = $V_{OUT}$ + 2V, $I_{OUT}$ = 1mA,<br>f = 10Hz to 100KHz,<br>($V_{OUT}$ = 3.3V) $C_{OUT}$ = 1μF | | | 70 | 95 | μVrms |
| $R_{DIS}$ | Output Discharge FET Rdson | $V_{EN}$ < $V_{IL}$ (Output Disable) | | 40 | 100 | 160 | Ω |
| $T_{TSD}$ | Thermal Shutdown<br>Temperature (6) | Temperature Increasing<br>from $T_A$ = +25°C | | 130 | 155 | 180 | °C |
| $T_{HYS}$ | Thermal Shutdown<br>Hysteresis (6) | Temperature Falling<br>from $T_{TSD}$ | | 15 | 25 | 35 | °C |

***Note3:*** 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.

***Note4:*** The minimum operating voltage is 2.5V. $V_{DROP} = V_{IN(min)} - V_{OUT}$.

***Note5:*** $V_{DROP}$ FT test method: test the $V_{OUT}$ voltage at $V_{SET} + V_{DROPMAX}$ with 300mA output current.

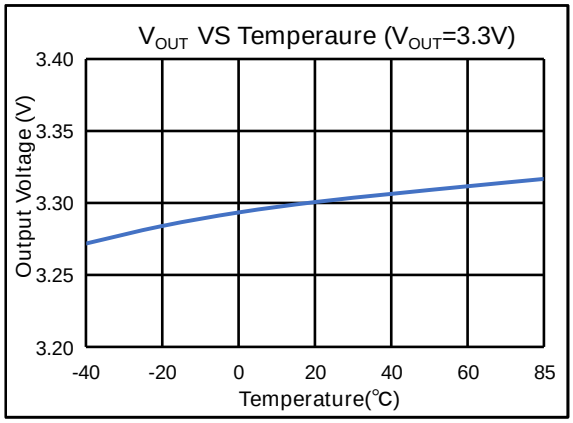
***Note6:*** Guaranteed by design and characterization. not a FT item.

***Note7:*** At high temperatures, the maximum load current can be calculated according to the following formula：

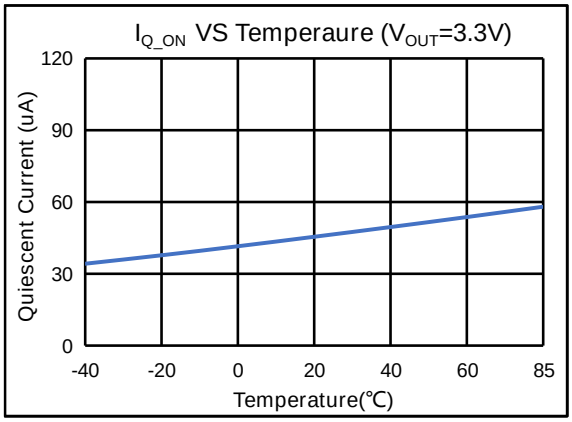
$$\mathbf{I_{OUT_MAX} = (T_J - T_A) / R_{\theta JA} / (V_{IN} - V_{OUT})}$$

## Typical Characteristics

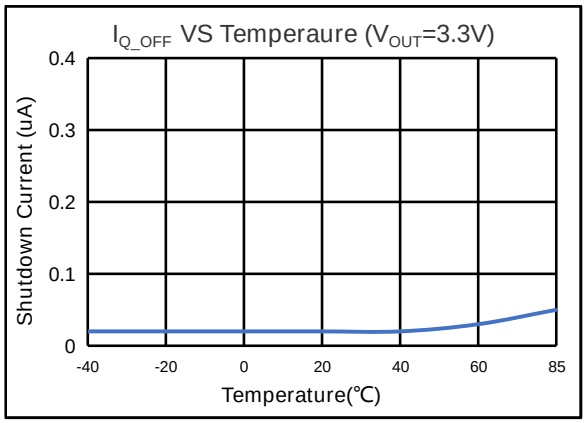
Voltage set 3.3V ($V_{IN}$ = $V_{OUT}$ + 2V, $I_{OUT}$ = 10mA, R1 = 200kΩ, R2 = 900kΩ, $C_{IN}$ = $C_{OUT}$ = 1.0μF, unless otherwise noted. Typical values are at $T_A$ = +25°C).



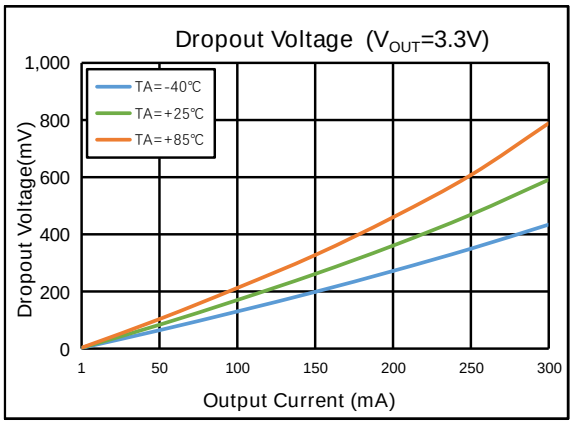

Output Voltage VS Temperature



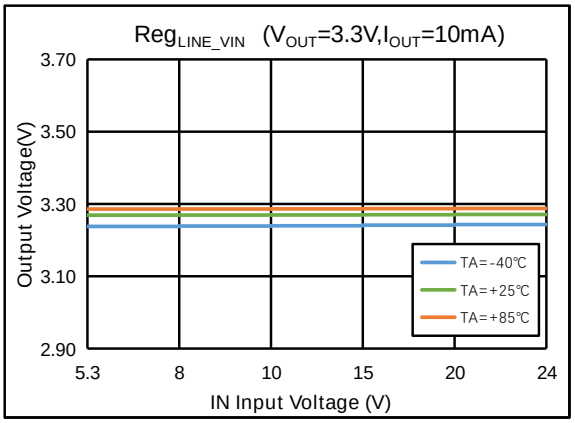

Quiescent Current VS Temperature



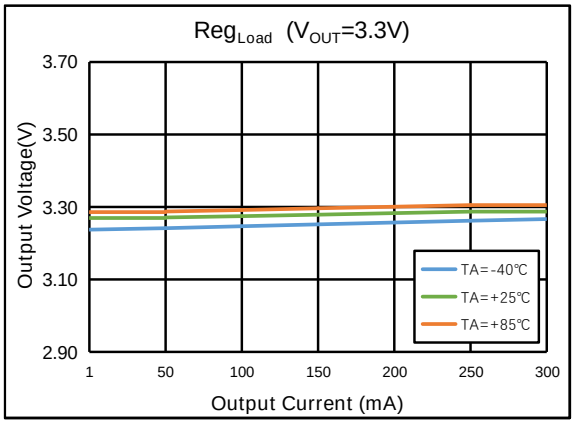

Standby Current VS Temperature




Dropout Voltage VS Output Current



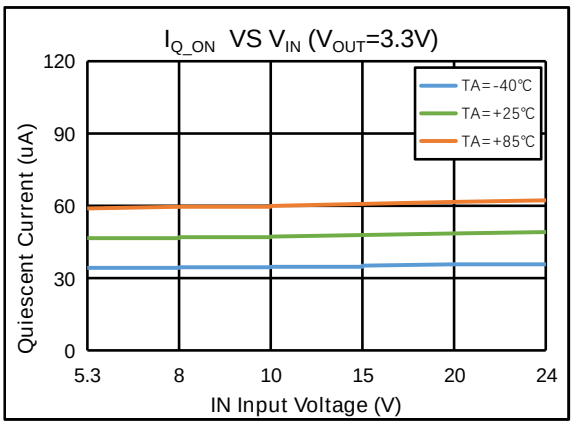

Output Voltage VS Input Voltage



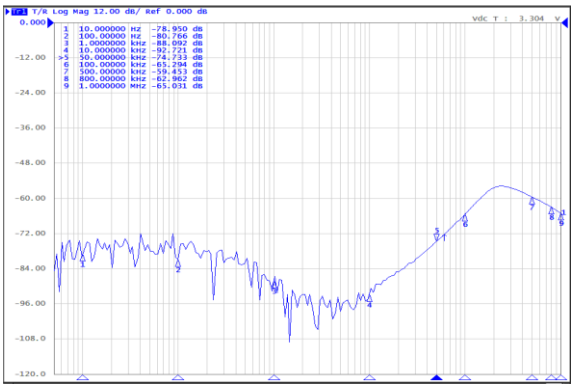

Output Voltage VS Output Current

## Typical Characteristics (Continued)

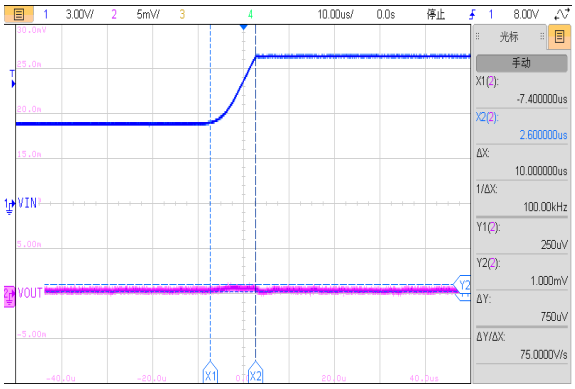
Voltage set 3.3V ($V_{IN}$ = $V_{OUT}$ + 2V, $I_{OUT}$ = 10mA, R1 = 200kΩ, R2 = 900kΩ, $C_{IN}$ = $C_{OUT}$ = 1.0μF, unless otherwise noted. Typical values are at $T_A$ = +25°C.)



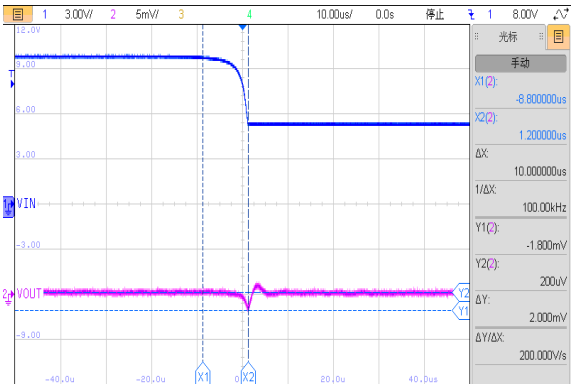

Quiescent Current VS Input Voltage



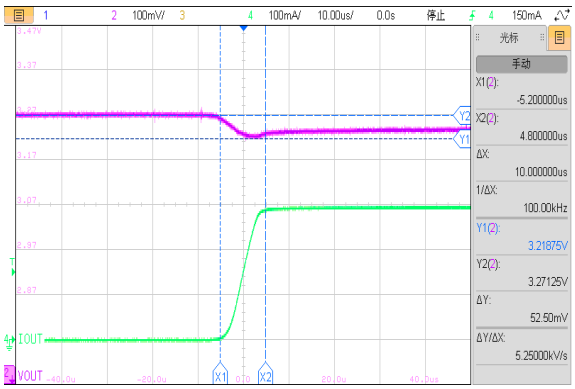
PSRR



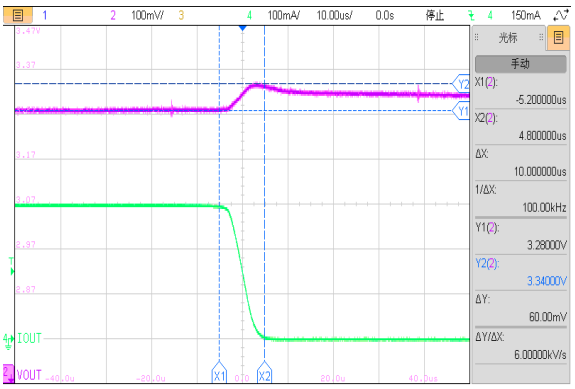

Input-Transient (5.3~10V tr = 10μs $I_{OUT}$ = 1mA)




Input-Transient (10~5.3V tf = 10μs, $I_{OUT}$ = 1mA)



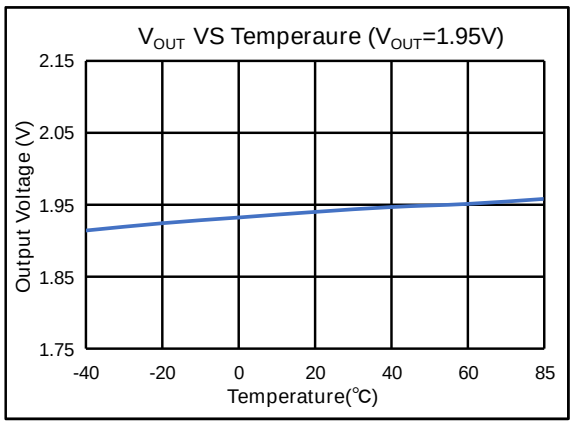

Load-Transient ($V_{IN}$ = 5.3V, $I_{OUT}$ = 1~300mA tr = 10μs)



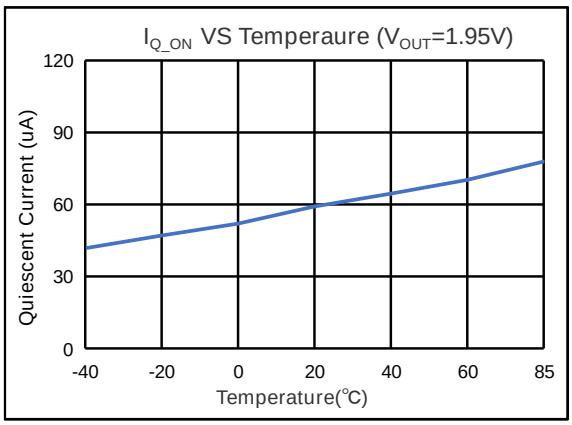

Load-Transient ($V_{IN}$ = 5.3V, $I_{OUT}$ = 300~1mA tf = 10μs)

## Typical Characteristics (Continued)

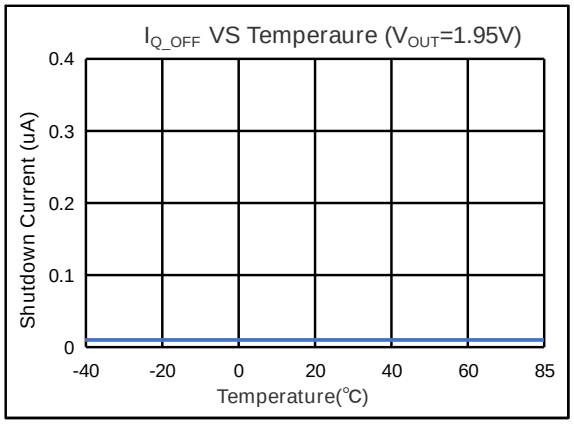
Voltage set 1.95V ($V_{IN}$ = 2.5V, $I_{OUT}$ = 10mA, R1 = 200kΩ, R2 = 450kΩ, $C_{IN}$ = $C_{OUT}$ = 1.0μF, unless otherwise noted. Typical values are at $T_A$ = +25°C.)



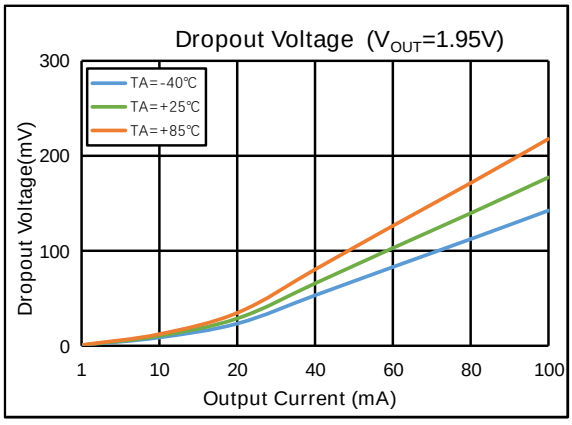

Output Voltage VS Temperature



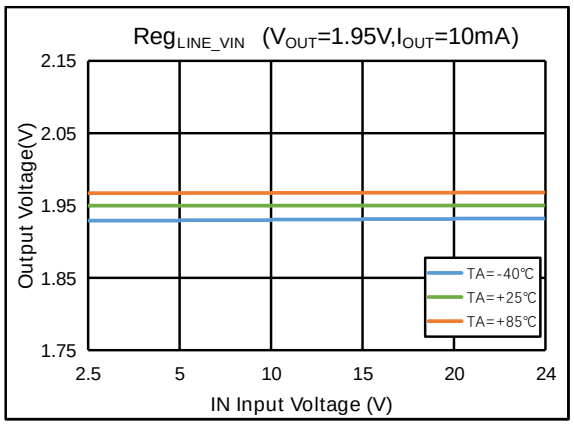

Quiescent Current VS Temperature



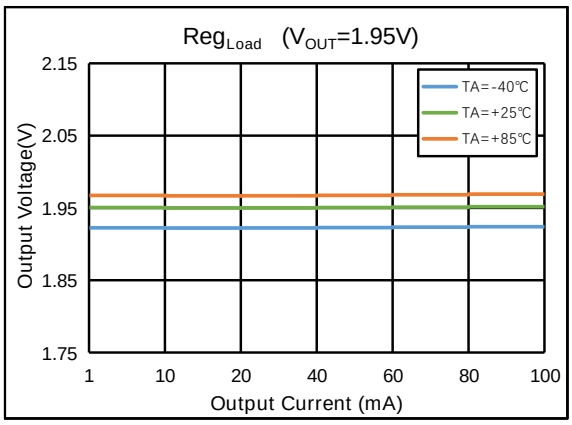

Standby Current VS Temperature




Dropout Voltage VS Output Current



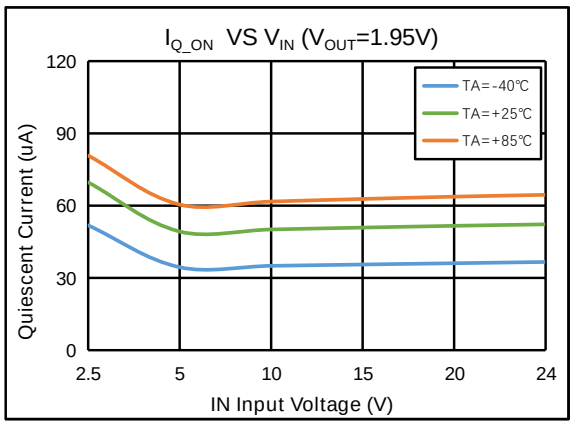

Output Voltage VS Input Voltage



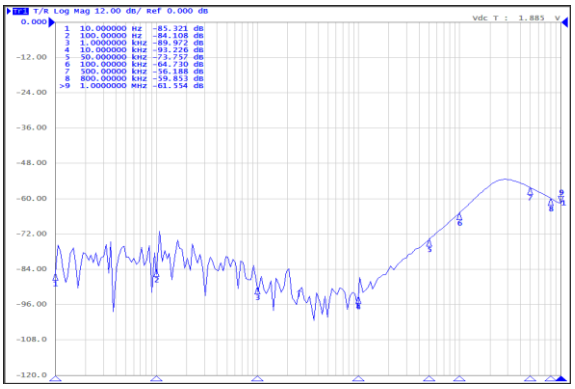

Output Voltage VS Output Current

## Typical Characteristics (Continued)

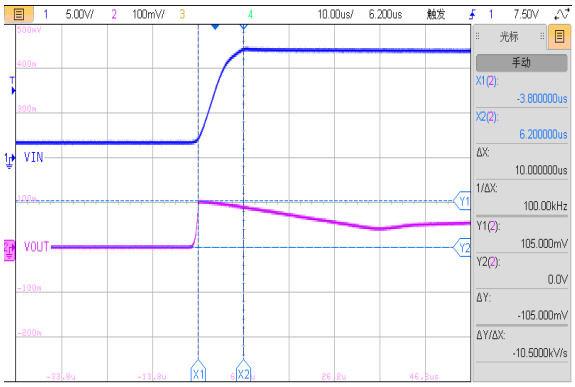
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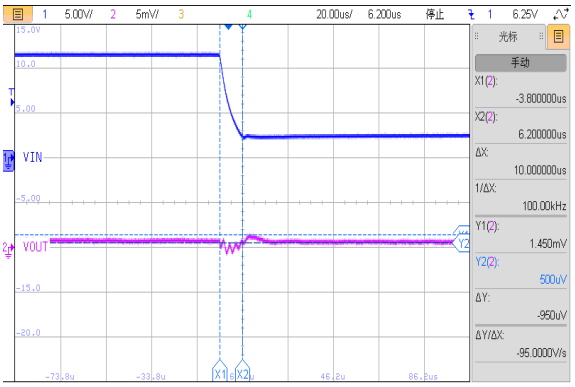

Quiescent Current VS Input Voltage



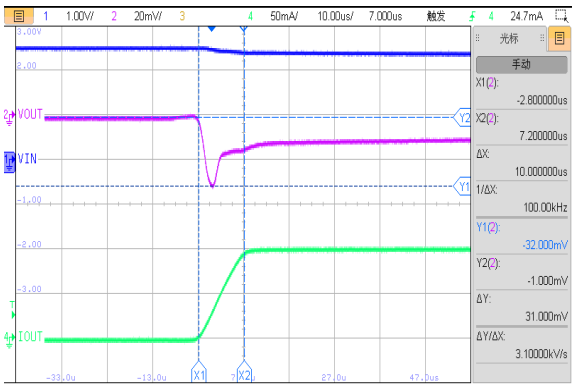
PSRR



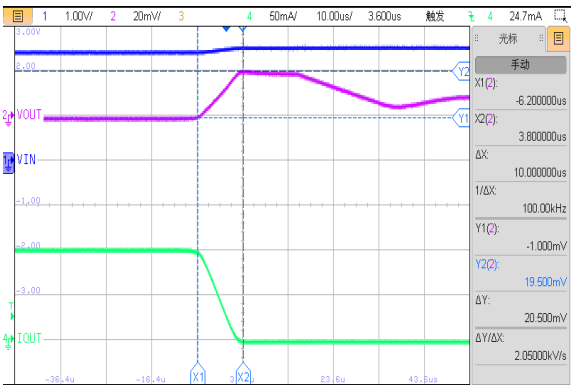

Input-Transient (2.5~12V tr = 10μs $I_{OUT}$ = 1mA)




Input-Transient (12~2.5V tf = 10μs, $I_{OUT}$ = 1mA)

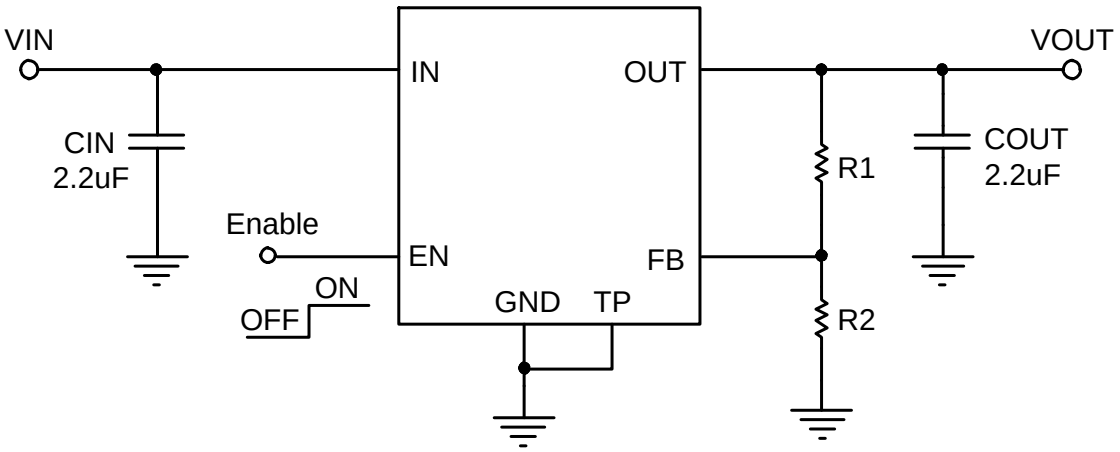



Load-Transient ($V_{IN}$ = 2.5V, $I_{OUT}$ = 1~100mA tr = 10μs)




Load-Transient ($V_{IN}$ = 2.5V, $I_{OUT}$ = 100~1mA tf = 10μs)

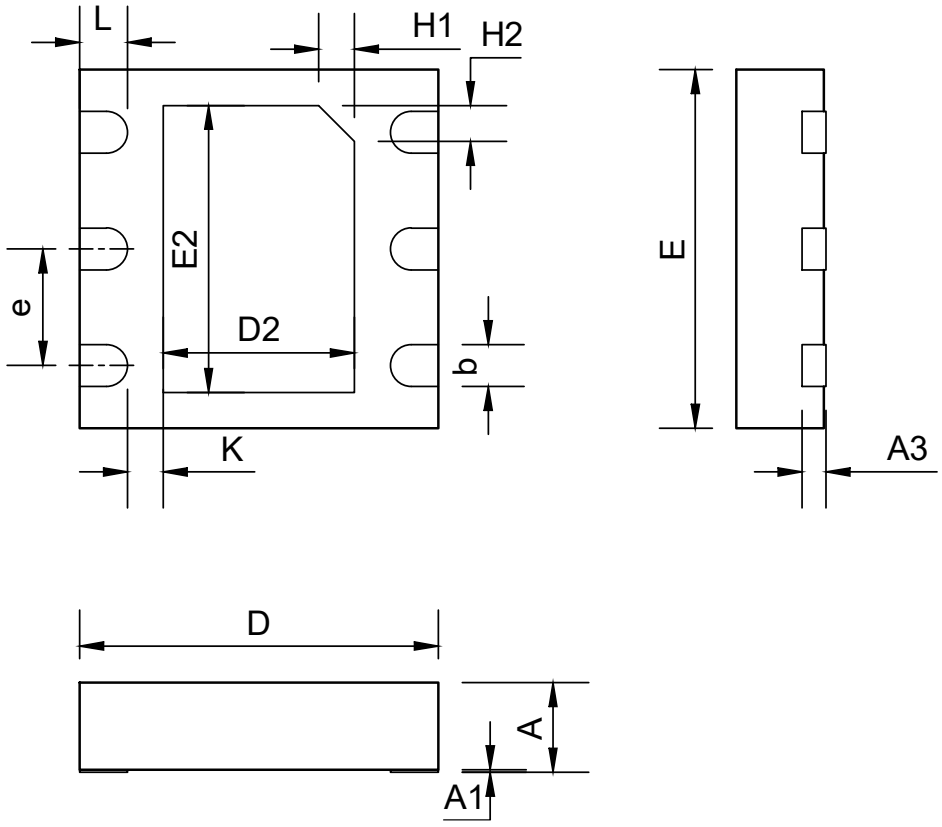
## Application Circuits




***Note **:*** $V_{OUT}$ = 0.6V × (R1 + R2) / R2； Recommended R2 = 100K~1M
Thermal pad only be connected to GND or floating, can't be connected to other pins.

## Package Dimension

DFN6

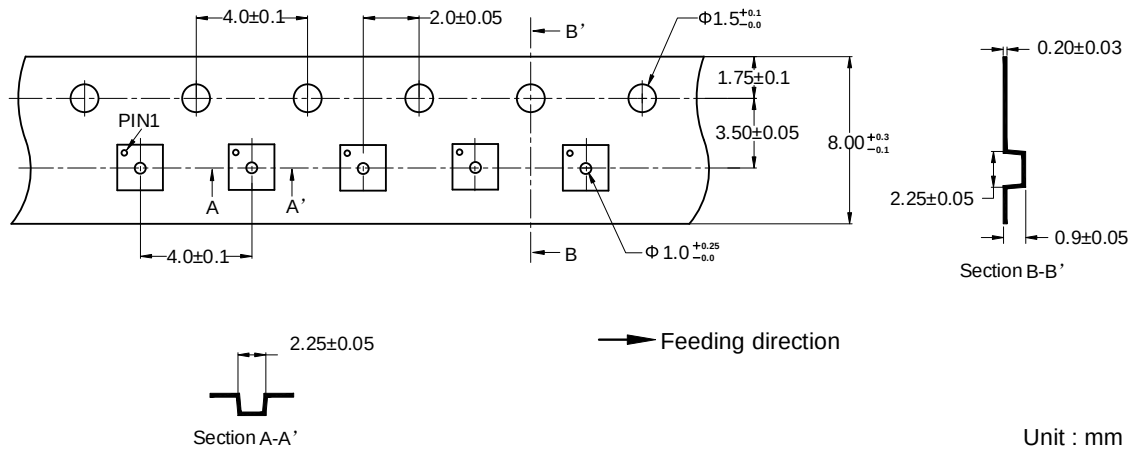



COMMON DIMENSIONS

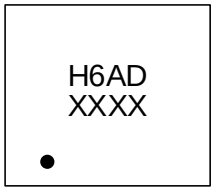
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0 | -- | 0.05 |
| A3 | 0.18 | -- | 0.25 |
| b | 0.25 | 0.30 | 0.35 |
| D | 1.90 | 2.00 | 2.10 |
| E | 1.90 | 2.00 | 2.10 |
| D2 | 0.90 | 1.00 | 1.10 |
| E2 | 1.50 | 1.60 | 1.70 |
| e | 0.65BSC | | |
| H1 | 0.25 | 0.30 | 0.35 |
| H2 | 0.20 | 0.25 | 0.30 |
| L | 0.20 | 0.25 | 0.30 |
| k | 0.20 | -- | -- |

## Tape Information




## Marking




H= Part Number (ET5A0ADJAY2B)

O = ADJ Version

XX = Tracking Number

## Revision History and Checking Table

| Version | Date | Revision Item | Modifier | Function & Spec Checking | Package & Tape Checking |
|---|---|---|---|---|---|
| 0.0 | 2020-04-28 | Preliminary Version | Liuxm | Shibo | Zhujl |
| 0.1 | 2020-06-01 | Preliminary Version | Liuxm | Shibo | Zhujl |
| 0.2 | 2020-07-17 | Preliminary Version | Liuxm | Shibo | Zhujl |
| 1.0 | 2020-12-17 | Initial version | Liuxm | Shibo | Zhujl |
| 1.1 | 2022-08-08 | Update Typeset | Shibo | Shibo | Zhujl |
| 1.2 | 2024-11-05 | Add thermal pad suggest | Shibo | Shibo | Zhujl |
| 1.3 | 2025-02-17 | Add Electrical Characteristics & Typical Characteristics of $V_{OUT}$=1.95V | Pengjj | Pengjj | Zhujl |
| 1.3.a | 2026-07-20 | Add Tape & Marking Information | Yangxx | Yangxx | Liujy |