

## GENERAL DESCRIPTION

The LW82XX Series is a group of voltage regulators with high accuracy, high speed, low drop-out, reverse current protection, high ripple rejection and fast discharge function.

The series consists of a voltage reference, an error amplifier, a driver transistor, a current limiter, a thermal protection circuit, a reverse current protection circuit and a phase compensation circuit.

Output voltage is selectable from 0.8V to 5.0V which fixed by laser trimming technologies, Step=100mV.

The LW82XX Series is available in SOT23-5, DFN2x2-6L and SOT89-5L packages.

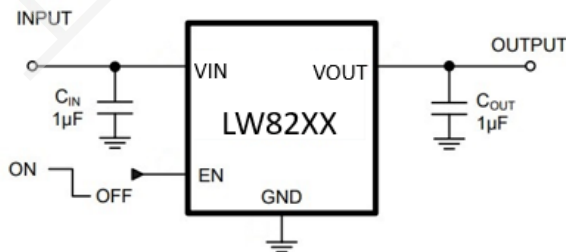
## FEATURES

- Output Accuracy:  $\pm 1.0\%$
- Low Quiescent Current: 28uA
- Low Dropout Voltage: 310mV@1000mA/3.3V
- High PSRR: 78dB@1KHz, 10mA
- Output Current: 1000mA
- Excellent Line and Load Transient Response
- Operating Voltage Range: from 1.8V to 7.0V
- Output Voltage Range: from 0.8V to 5.0V
- Over-Temperature Protection
- Current Limiting Protection
- Output Short-Circuit Protection
- Reverse Current Protection Function
- Available in SOT23-5, DFN2x2-6L and SOT89-5L Packages

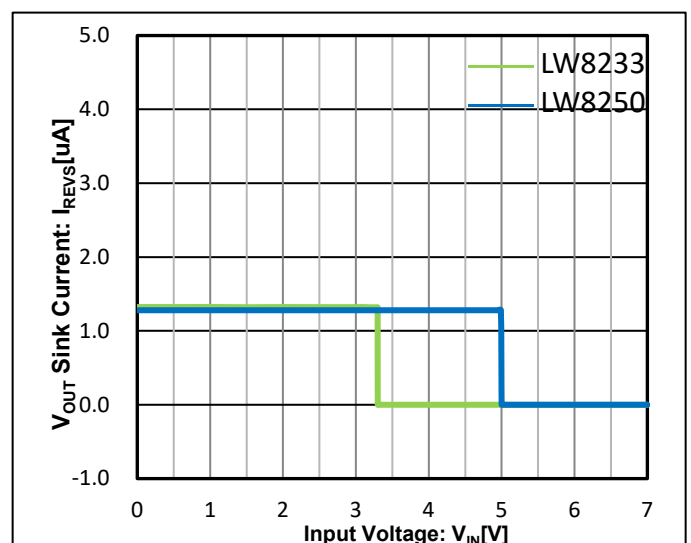
## APPLICATIONS

- Battery-Powered Devices
- Reference Voltage Sources
- USB products and HDMI Equipments
- Other Low Voltage Power Suppliers

## TYPICAL APPLICATION CIRCUIT



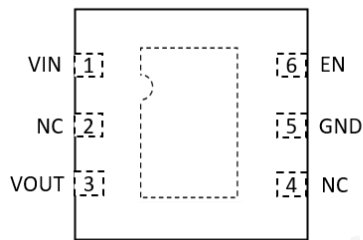
## TYPICAL PERFORMANCE CHARACTERISTICS



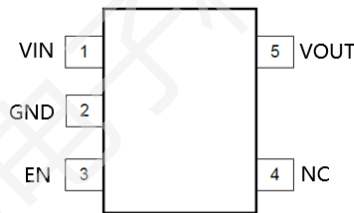
#### PIN DESCRIPTION:

| PIN No      |          |          | SYMBOL | DESCRIPTION                                       |
|-------------|----------|----------|--------|---------------------------------------------------|
| DFN2x2-6L   | SOT23-5L | SOT89-5L |        |                                                   |
| 1           | 1        | 4        | VIN    | Power Supply Input                                |
| 5           | 2        | 2        | GND    | Ground                                            |
| 6           | 3        | 1        | EN     | Chip Enable                                       |
| 2,4         | 4        | 3        | NC     | Not Connected                                     |
| 3           | 5        | 5        | VOUT   | Output                                            |
| Thermal pad | --       | --       | Pad    | Connect the thermal pad to a large area GND plane |

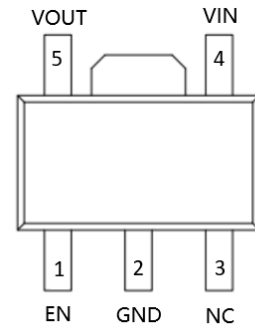
#### PIN ASSIGNMENT



DFN2x2-6L



SOT23-5L



SOT89-5L

#### MARK INFORMATION:

##### DFN2X2-6L

**XX: VOLTAGE**

**YY: DATE CODE**

LW82XX  
YYYY

##### SOT23-5L

**XX: VOLTAGE**

**YY: DATE CODE**

LW82XX  
YYYY

##### SOT89-5L

**X: VOLTAGE**

**YY: DATE CODE**

LW82XX  
YYYY

**ABSOLUTE MAXIMUM RATINGS** <sup>(1)</sup>:(T<sub>A</sub> =25℃, unless otherwise specified.)

| SYMBOL              | ITEM                                                      |           | RATING                       | UNIT |
|---------------------|-----------------------------------------------------------|-----------|------------------------------|------|
| V <sub>IN</sub>     | Supply Voltage                                            |           | -0.3~8.0                     | V    |
| V <sub>EN</sub>     | EN Pin Voltage                                            |           | -0.3~8.0                     | V    |
| V <sub>OUT</sub>    | VOUT pin Voltage                                          |           | -0.3~ (V <sub>IN</sub> +0.3) | V    |
| V <sub>(ESD)</sub>  | ESD Susceptibility, HBM <sup>(2)</sup>                    |           | ± 4000                       | V    |
| P <sub>D</sub>      | Maximum Power Dissipation <sup>(3)</sup>                  | DFN2x2-6L | 1.56                         | W    |
|                     |                                                           | SOT23-5L  | 0.59                         |      |
|                     |                                                           | SOT89-5L  | 1.64                         |      |
| R <sub>θJA</sub>    | Package Thermal Resistance Θ <sub>JA</sub> <sup>(3)</sup> | DFN2x2-6L | 80                           | ℃/W  |
|                     |                                                           | SOT23-5L  | 210                          |      |
|                     |                                                           | SOT89-5L  | 76                           |      |
| T <sub>J</sub>      | Junction Temperature Range                                |           | -40~150                      | ℃    |
| T <sub>STG</sub>    | Storage Temperature Range                                 |           | -40~150                      | ℃    |
| T <sub>SOLDER</sub> | Lead Temperature (Soldering)                              |           | 260℃, 10s                    |      |

**Note:**

1. 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 conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability
2. per ANSI/ESDA/JEDEC JS-001
3. Device mounted on FR-4 PCB

**RECOMMENDED OPERATING RANGE:**

| SYMBOL           | ITEM                       | VALUE   | UNIT |
|------------------|----------------------------|---------|------|
| V <sub>IN</sub>  | VIN Supply Voltage         | 1.8~7.0 | V    |
| V <sub>EN</sub>  | EN Pin Voltage             | 0~7.0   | V    |
| V <sub>OUT</sub> | VOUT Pin Voltage           | 0.8~5.0 | V    |
| I <sub>OUT</sub> | Output Current             | 0~1.0   | A    |
| T <sub>J</sub>   | Junction Temperature Range | -40~125 | ℃    |

**ELECTRICAL CHARACTERISTICS:**

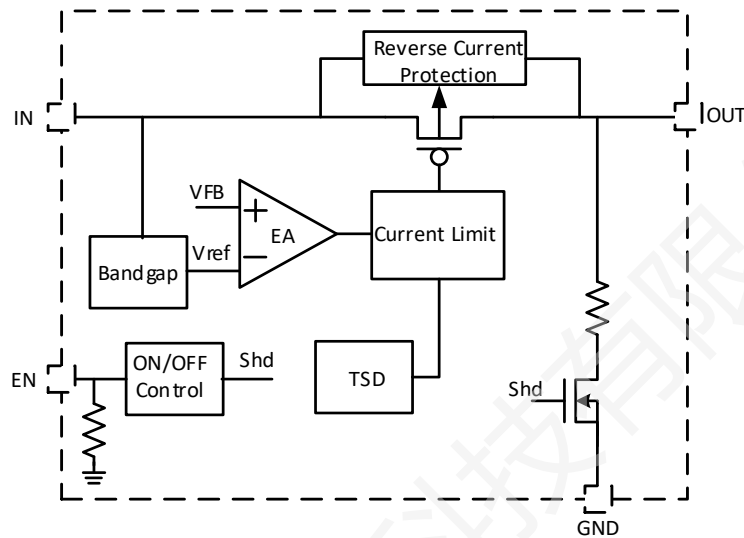
( $V_{IN}=V_{OUT}+1V$ ,  $V_{OUT}=3.3V$ ,  $C_{IN}=C_{OUT}=1\mu F$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.)

| Symbol          | Parameter                                 | Conditions                                                                                  | MIN       | TYP   | MAX  | Units       |
|-----------------|-------------------------------------------|---------------------------------------------------------------------------------------------|-----------|-------|------|-------------|
| $V_{IN}$        | Input Voltage                             |                                                                                             | 1.8       |       | 7.0  | V           |
| $V_{OUT}$       | Output Accuracy                           | $I_{OUT}=1mA$                                                                               | -1.0      |       | +1.0 | %           |
| $I_{LIM}$       | Current Limit <sup>(1)</sup>              | $V_{IN}=4.3V$ , $V_{OUT}=3.3V$                                                              | 1.1       | 1.45  |      | A           |
| $I_Q$           | Quiescent Current                         | $V_{IN}=V_{EN}=V_{OUT}+1V$ , No Load                                                        |           | 28    | 45   | $\mu A$     |
| $I_{SHD}$       | Shutdown Current                          | $V_{IN}=7.0V$ , $V_{EN}=0V$                                                                 |           |       | 0.1  | $\mu A$     |
| $V_{DROP}$      | Dropout Voltage <sup>(2)</sup>            | $I_{OUT}=300mA$                                                                             |           | 84    |      | mV          |
|                 |                                           | $I_{OUT}=500mA$                                                                             |           | 143   |      |             |
|                 |                                           | $I_{OUT}=1000mA$                                                                            |           | 310   |      |             |
| $S_{LINE}$      | Line Regulation                           | $V_{IN}=V_{OUT}+1V$ to $7.0V$ , $I_{OUT}=1mA$                                               |           | 0.05  | 0.1  | %/V         |
| $S_{LOAD}$      | Load Regulation                           | $1mA \leq I_{OUT} \leq 1000mA$                                                              |           | 0.001 | 0.01 | %/mA        |
| $I_{SHORT}$     | Short Current                             | $V_{OUT}=0V$                                                                                |           | 70    |      | mA          |
| $V_{ENH}$       | EN High Voltage                           | $V_{IN}=1.8V$ to $7.0V$ , $I_{OUT}=1mA$                                                     | 1.5       |       |      | V           |
| $V_{ENL}$       | EN Low Voltage                            |                                                                                             |           |       | 0.5  | V           |
| $T_{STR}$       | Startup Time                              | From $V_{EN}$ 'L' $\rightarrow$ 'H' to $95\% \cdot V_{OUT}$ ,<br>$C_{OUT}=1\mu F$ , No Load |           | 50    |      | $\mu s$     |
| PSRR            | Power Supply Rejection Ratio              | $C_{IN}=None$ ,<br>$V_{OUT}=3.3V$ ,<br>$I_{OUT}=10mA$                                       | $f=217Hz$ | 79    |      | dB          |
|                 |                                           |                                                                                             | $f=1KHz$  | 78    |      |             |
|                 |                                           |                                                                                             | $f=10KHz$ | 72    |      |             |
| $I_{REV}$       | Reverse Current <sup>(3)</sup>            | $V_{IN}=0V$ , $V_{OUT}=7.0V$                                                                |           | 0.01  | 0.5  | $\mu A$     |
| $I_{REVS}$      | $V_{OUT}$ Pin Sink Current <sup>(4)</sup> | $V_{IN}=6.0V$ , $V_{OUT}=7.0V$                                                              |           | 1.5   | 2.5  | $\mu A$     |
| $T_{SD}$        | Thermal Shut Down                         | Temperature rising                                                                          |           | 160   |      | $^{\circ}C$ |
| $\Delta T_{SD}$ | TSD Hysteresis                            | Temperature falling                                                                         |           | 20    |      | $^{\circ}C$ |
| $R_{DISCHRG}$   | $R_{ON}$ of Discharge MOSFET              | $V_{EN}=0V$                                                                                 |           | 80    |      | $\Omega$    |

**NOTES:**

1. Guaranteed by design
2. The dropout voltage is defined as  $V_{IN} - V_{OUT}$ , when  $V_{OUT}=95\% \cdot V_{OUT(NOM)}$
3. Reverse Current ( $I_{REV}$ ) flows from  $V_{OUT}$  to  $V_{IN}$
4.  $V_{OUT}$  Pin Sink Current ( $I_{REVS}$ ) flows from  $V_{OUT}$  to GND

#### SIMPLIFIED BLOCK DIAGRAM:



#### DETAIL OPERATION DESCRIPTION:

The LW82XX Series is a low noise, high PSRR, low drop-out voltage regulator. It consists of a current limiter circuit, a driver transistor, a precision voltage reference, a thermal protection circuit, a reverse current protection circuit and an error correction circuit, and is compatible with low ESR ceramic capacitors. The current limiter's fold-back circuit operates as a short circuit protection as well as the output current limiter.

##### Reverse Current Protection

The LW82XX series includes reverse current protection to prevent the damage as a result of current flow from VOUT pin to the VIN pin when the power supply is connected to the VOUT pin. When VIN is smaller than VOUT, the reverse current protection works and suppress the reverse current to 0.5μA (MAX.). When VIN is smaller than VOUT, the VOUT pin sink current flowing from the VOUT pin to the GND pin is 1.5μA (TYP.) as the IC operation current. Please also note when an external power supply is connected to the VOUT pin, please use it within 7.0V.

##### Current Limiting and Short-Circuit Protection

The current limit circuitry prevents damage to the MOSFET switch and the hub downstream port but can deliver load current up to the current limit

threshold through the switch. When a heavy load or short circuit is applied to an enabled switch, a large transient current may flow until the current limit circuitry responds. Once this current limit threshold is exceeded the device enters constant current mode until the thermal shutdown occurs or the fault is removed.

##### Thermal Shutdown

When the junction temperature of the built-in driver transistor reaches the temperature limit level (160°C TYP.), the thermal shutdown circuit operates and the driver transistor will be turned OFF. The IC resumes its operation when the thermal shutdown function is released and the IC's operation is automatically restored because the junction temperature drops to the level of 140°C (TYP.) as the thermal shutdown release threshold.

##### Chip Enable

The LW82XX series can be turned off via the EN pin signal. In shutdown mode, output at the VOUT pin will be pulled down to the GND.

The LW82XX series has a pull-down resistor in order to operate normally even the EN pin is floating.

If the EN pin voltage is set with the specified voltage range, the logic is fixed and the IC will operate normally.

#### TYPICAL OPERATING CHARACTERISTICS:

(Tested under  $T_A = 25^\circ\text{C}$ , unless otherwise specified)

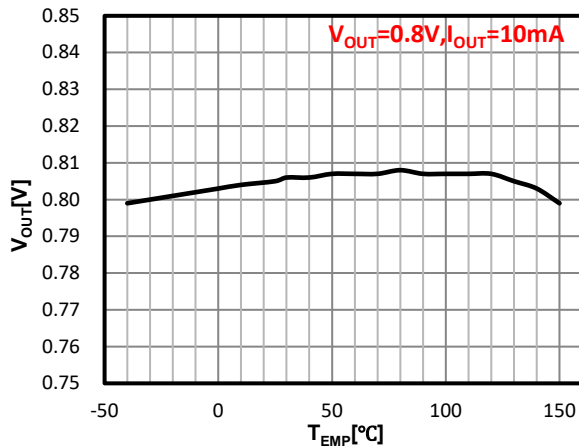


Figure 1.  $V_{OUT}$  vs Temperature

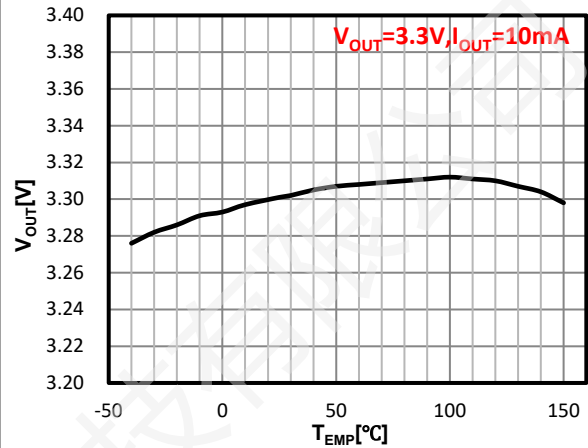


Figure 2.  $V_{OUT}$  vs Temperature

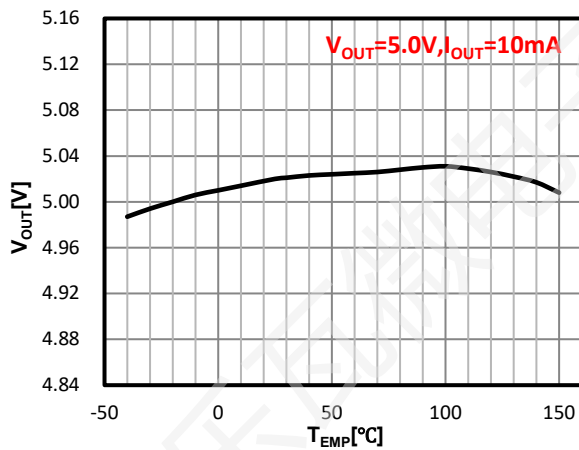


Figure 3.  $V_{OUT}$  vs Temperature

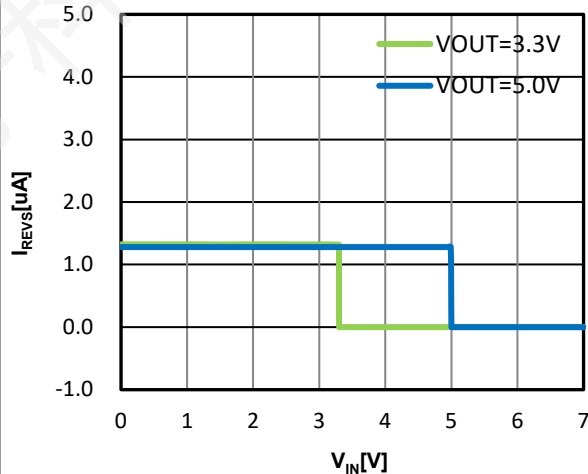


Figure 4.  $V_{OUT}$  Sink Current VS Input Voltage

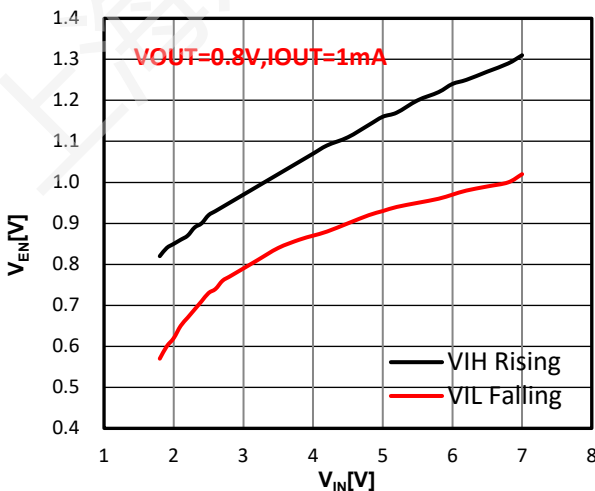


Figure 5.  $V_{EN}$  vs  $V_{IN}$

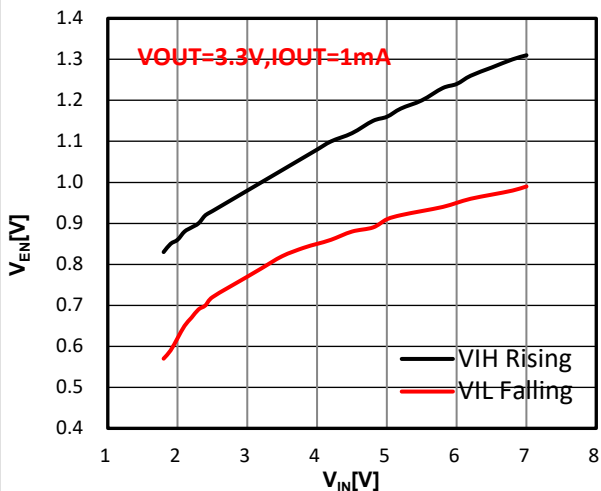


Figure 6.  $V_{EN}$  vs  $V_{IN}$

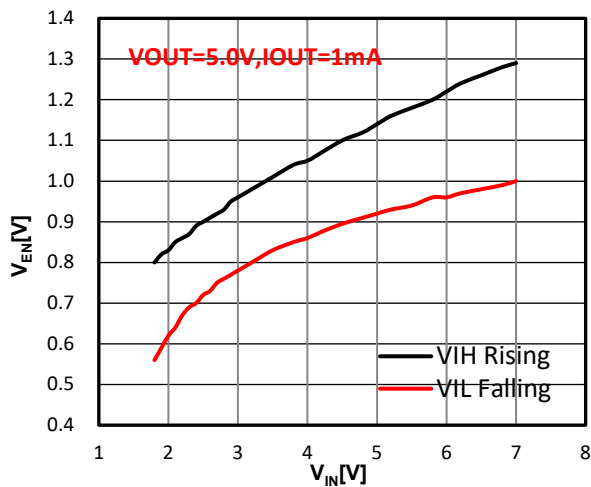


Figure 7.  $V_{EN}$  vs  $V_{IN}$

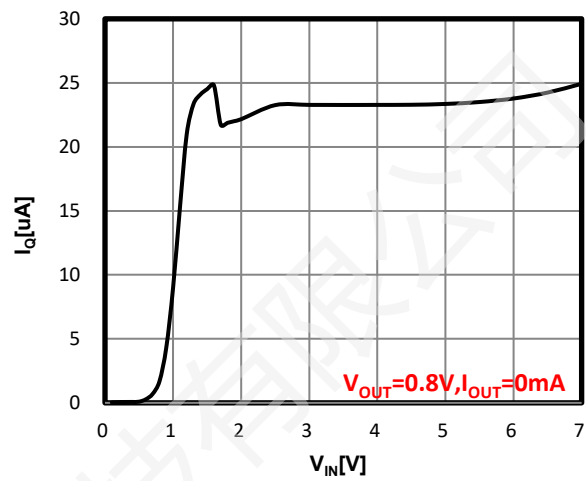


Figure 8.  $I_Q$  vs  $V_{IN}$

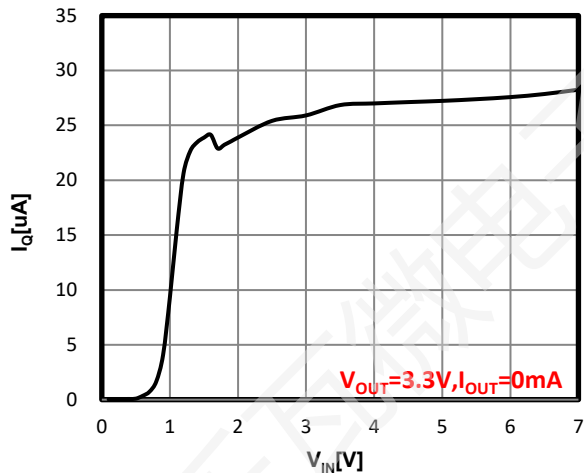


Figure 9.  $I_Q$  vs  $V_{IN}$

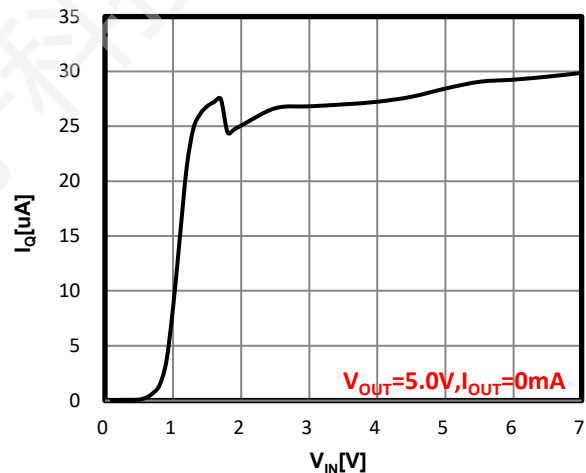


Figure 10.  $I_Q$  vs  $V_{IN}$

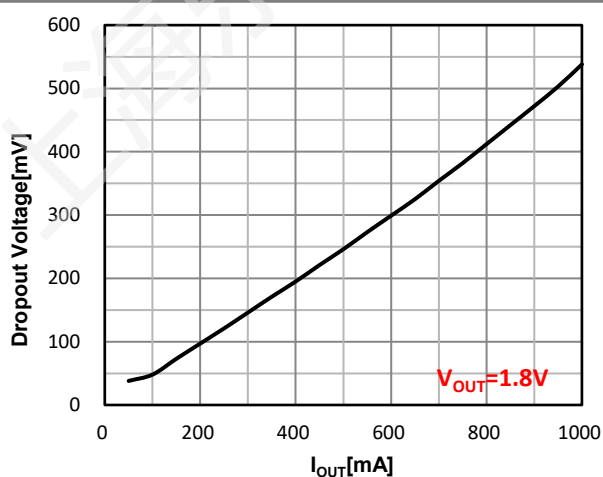


Figure 11. Dropout Voltage vs  $I_{OUT}$

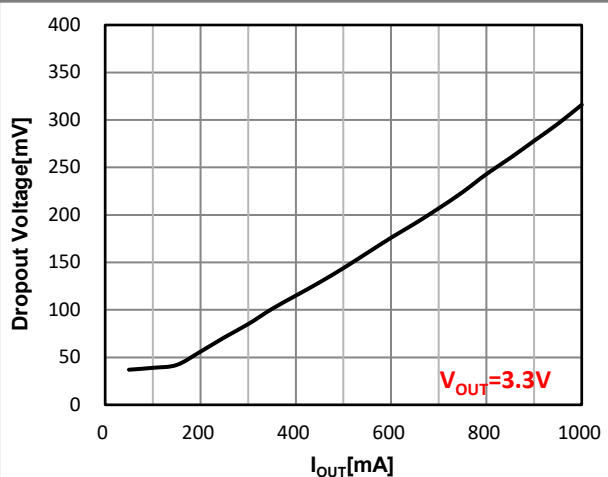


Figure 12. Dropout Voltage vs  $I_{OUT}$

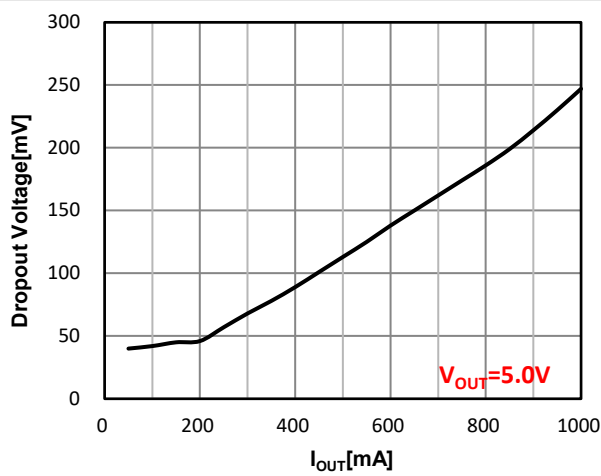


Figure 13. Dropout Voltage VS  $I_{OUT}$

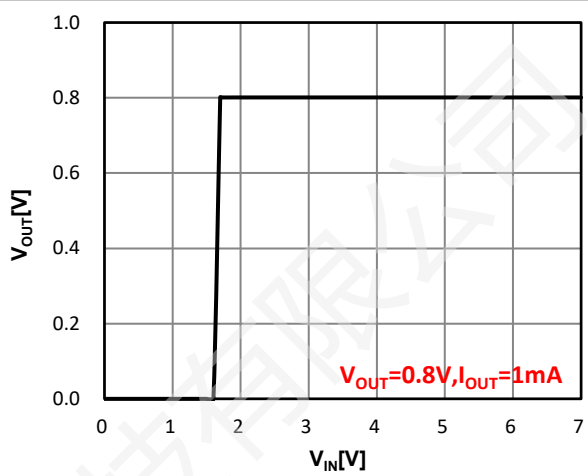


Figure 14.  $V_{OUT}$  VS  $V_{IN}$

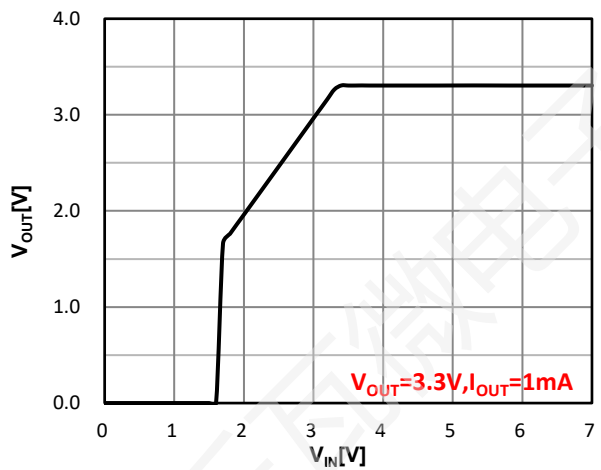


Figure 15.  $V_{OUT}$  VS  $V_{IN}$

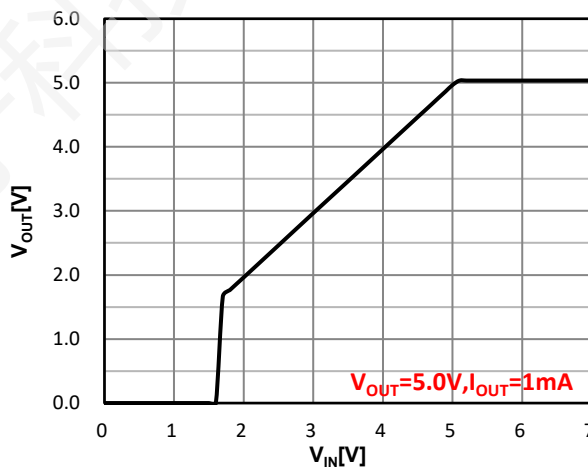
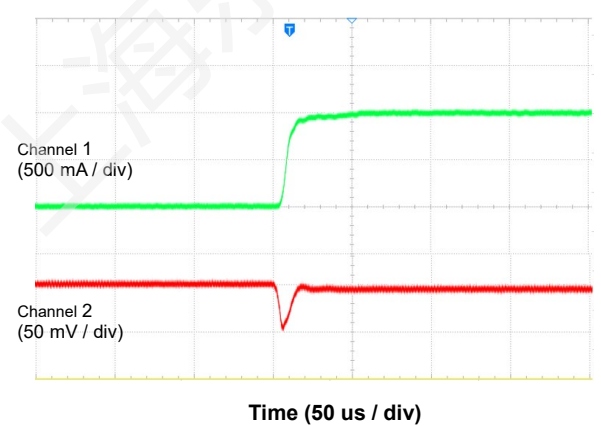
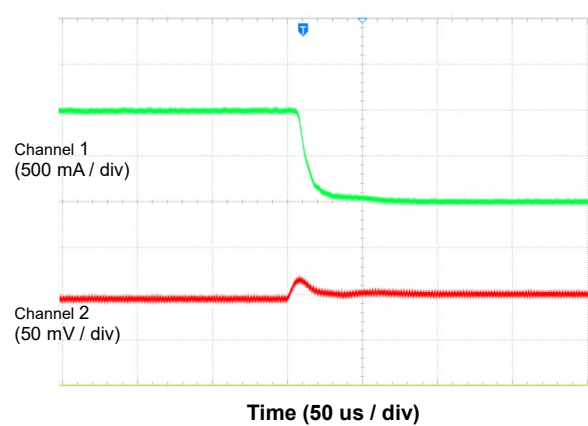


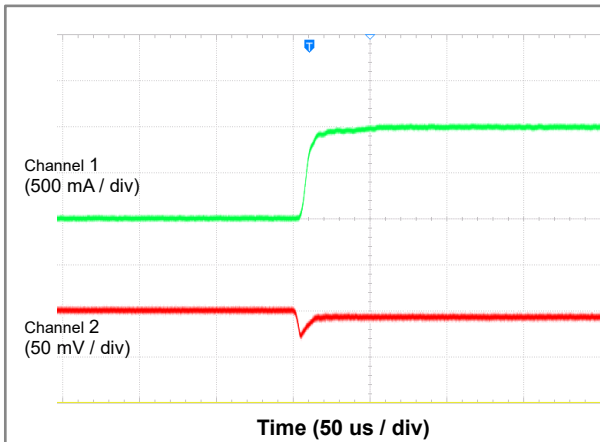
Figure 16.  $V_{OUT}$  VS  $V_{IN}$



Channel 1 =  $I_{OUT}$ , channel 2 =  $V_{OUT}$ ,  $V_{IN} = 1.8V$ ,  $V_{OUT} = 0.8V$   
Figure 17. Load Transient (1 mA to 1000 mA)

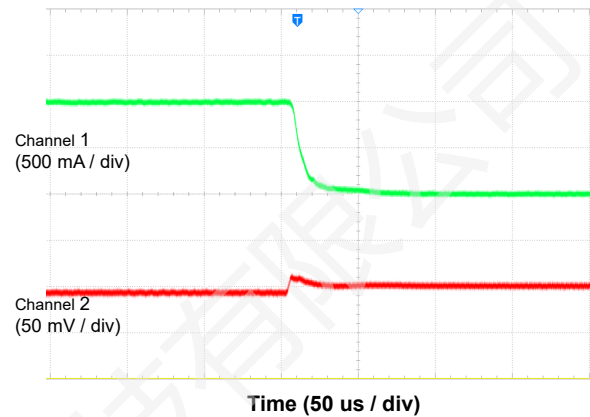


Channel 1 =  $I_{OUT}$ , channel 2 =  $V_{OUT}$ ,  $V_{IN} = 1.8V$ ,  $V_{OUT} = 0.8V$   
Figure 18. Load Transient (1000 mA to 1 mA)



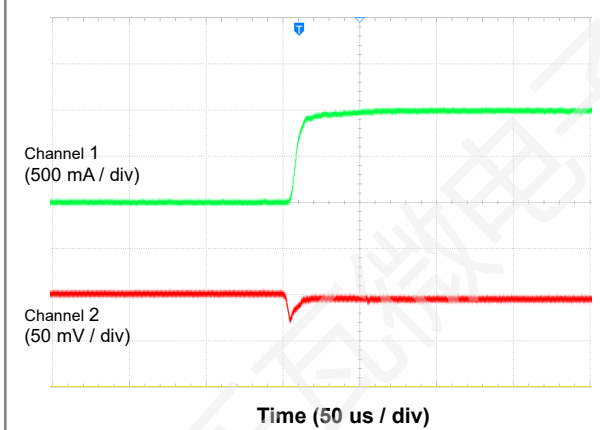
Channel 1 =  $I_{OUT}$ , channel 2 =  $V_{OUT}$ ,  $V_{IN}=4.3V$ ,  $V_{OUT}=3.3V$

**Figure 19. Load Transient (1 mA to 1000 mA)**



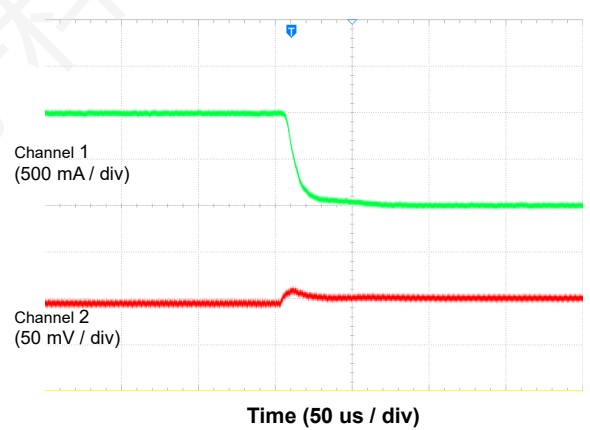
Channel 1 =  $I_{OUT}$ , channel 2 =  $V_{OUT}$ ,  $V_{IN}=4.3V$ ,  $V_{OUT}=3.3V$

**Figure 20. Load Transient (1000 mA to 1 mA)**



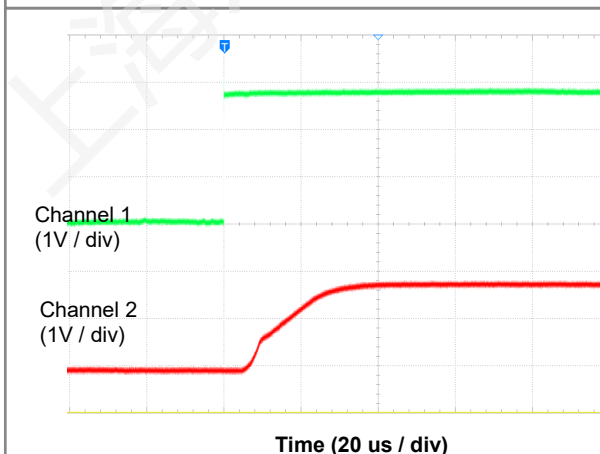
Channel 1 =  $I_{OUT}$ , channel 2 =  $V_{OUT}$ ,  $V_{IN}=6.0V$ ,  $V_{OUT}=5.0V$

**Figure 21. Load Transient (1 mA to 1000 mA)**



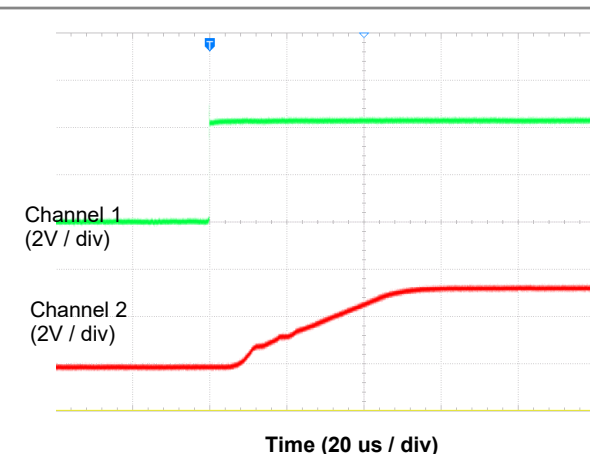
Channel 1 =  $I_{OUT}$ , channel 2 =  $V_{OUT}$ ,  $V_{IN}=6.0V$ ,  $V_{OUT}=5.0V$

**Figure 22. Load Transient (1000 mA to 1 mA)**



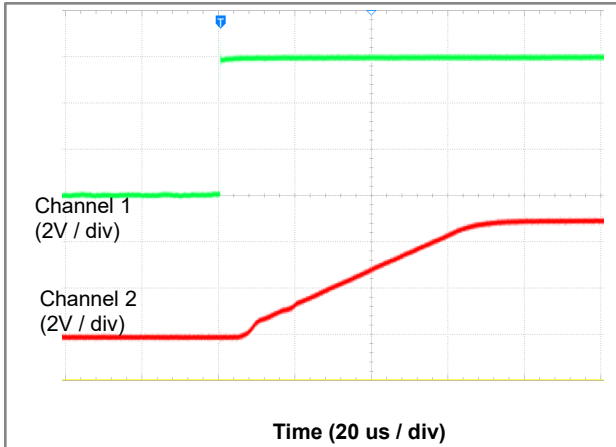
Channel 1 = En, channel 2 =  $V_{OUT}$ ,  $V_{OUT}=1.8V$ , No Load

**Figure 23. Power-Up with Enable**



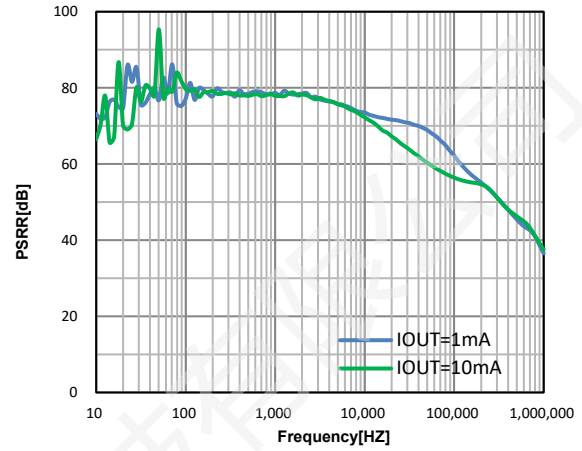
Channel 1 = En, channel 2 =  $V_{OUT}$ ,  $V_{OUT}=3.3V$ , No Load

**Figure 24. Power-Up with Enable**



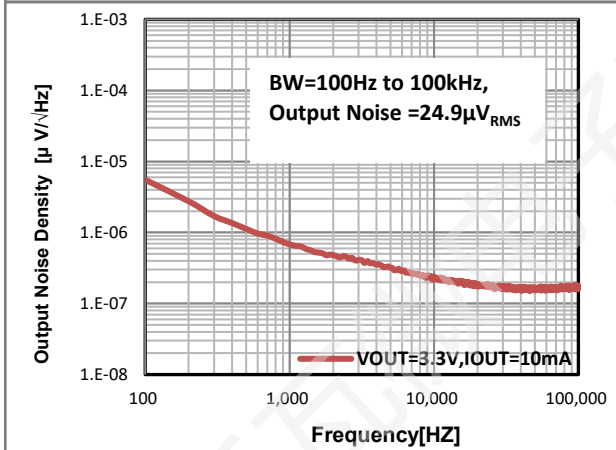
Channel 1 = En, channel 2 =  $V_{OUT}$ ,  $V_{OUT}=5.0V$ , No Load

**Figure 25. Power-Up with Enable**



$V_{OUT}=3.3V$ ,  $V_{IN}=4.3V$ ,  $V_{PP}=0.2V$ ,  $C_{IN}=non$ ,  $C_{OUT}=1\mu F$

**Figure 26. PSRR vs Frequency**



**Figure 27. Output Noise Density vs Frequency**

## APPLICATION INFORMATION:

### ● Input Capacitor Selection

Like any low-dropout regulator, the external capacitors used with the LW82XX Series must be carefully selected for regulator stability and performance. Using a capacitor whose value is  $\geq 1\mu\text{F}$  on the LW82XX Series input and the amount of capacitance can be increased without limit. An at least  $10\mu\text{F}$  input capacitor is needed if input ripple voltage  $V_{pp} > 1\text{V}$ . The input capacitor must be located a distance less than 0.5 inch from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line-transient response.

### ● Layout considerations

To improve ac performance such as PSRR, output noise, and transient response, it is recommended that the PCB be designed with separate ground planes for VIN and VOUT, with each ground plane connected only at the GND pin of the device.

### ● Output Capacitor Selection

The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application. The LW82XX Series is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is at least  $1\mu\text{F}$  on the LW82XX Series output ensures stability. An appropriate output capacitor can reduce noise and improve load transient response and PSRR. The output capacitor should be located not more than 0.5 inch from the VOUT pin of the LW82XX Series and returned to a clean analog ground.

#### ORDER INFORMATION:

LW82①②③④⑤⑥

| Designator | Item           | Symbol | Description          |
|------------|----------------|--------|----------------------|
| ①②         | Output Voltage | 08~50  | e.g. 1.2V → ①=1, ②=2 |
| ③④⑤⑥       | Packages       | A22G   | DFN2X2-6L(Type-A)    |
|            |                | A23E   | SOT23-5L             |
|            |                | A89E   | SOT89-5L             |

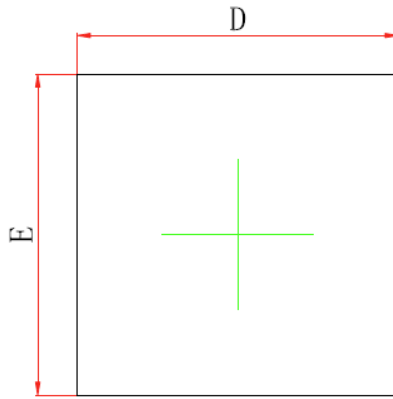
| Part #     | Output Voltage | Package   | Shipping               |
|------------|----------------|-----------|------------------------|
| LW8208A22G | 0.8V           | DFN2X2-6L | 3000 Pcs/ Tape & Reel  |
| LW8212A22G | 1.2V           |           |                        |
| LW8215A22G | 1.5V           |           |                        |
| LW8218A22G | 1.8V           |           |                        |
| LW8228A22G | 2.8V           |           |                        |
| LW8230A22G | 3.0V           |           |                        |
| LW8233A22G | 3.3V           |           |                        |
| LW8236A22G | 3.6V           |           |                        |
| LW8242A22G | 4.2V           |           |                        |
| LW8250A22G | 5.0V           |           |                        |
| LW8208A23E | 0.8V           | SOT23-5L  | 3000 Pcs / Tape & Reel |
| LW8212A23E | 1.2V           |           |                        |
| LW8215A23E | 1.5V           |           |                        |
| LW8218A23E | 1.8V           |           |                        |
| LW8228A23E | 2.8V           |           |                        |
| LW8230A23E | 3.0V           |           |                        |
| LW8233A23E | 3.3V           |           |                        |
| LW8236A23E | 3.6V           |           |                        |
| LW8242A23E | 4.2V           |           |                        |
| LW8250A23E | 5.0V           |           |                        |

| Part #     | Output Voltage | Package  | Shipping              |
|------------|----------------|----------|-----------------------|
| LW8208A89E | 0.8V           | SOT89-5L | 3000 Pcs/ Tape & Reel |
| LW8212A89E | 1.2V           |          |                       |
| LW8215A89E | 1.5V           |          |                       |
| LW8218A89E | 1.8V           |          |                       |
| LW8228A89E | 2.8V           |          |                       |
| LW8230A89E | 3.0V           |          |                       |
| LW8233A89E | 3.3V           |          |                       |
| LW8236A89E | 3.6V           |          |                       |
| LW8242A89E | 4.2V           |          |                       |
| LW8250A89E | 5.0V           |          |                       |

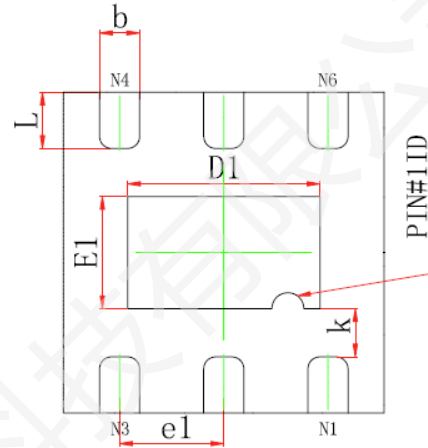
If customers have special output voltage requirements, please contact us.

#### PACKAGE OUTLINE:

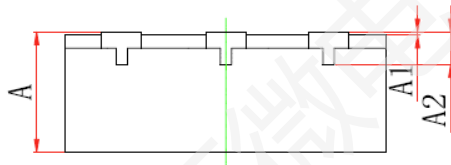
#### DFN2x2-6L Package



TOP VIEW  
[顶视图]



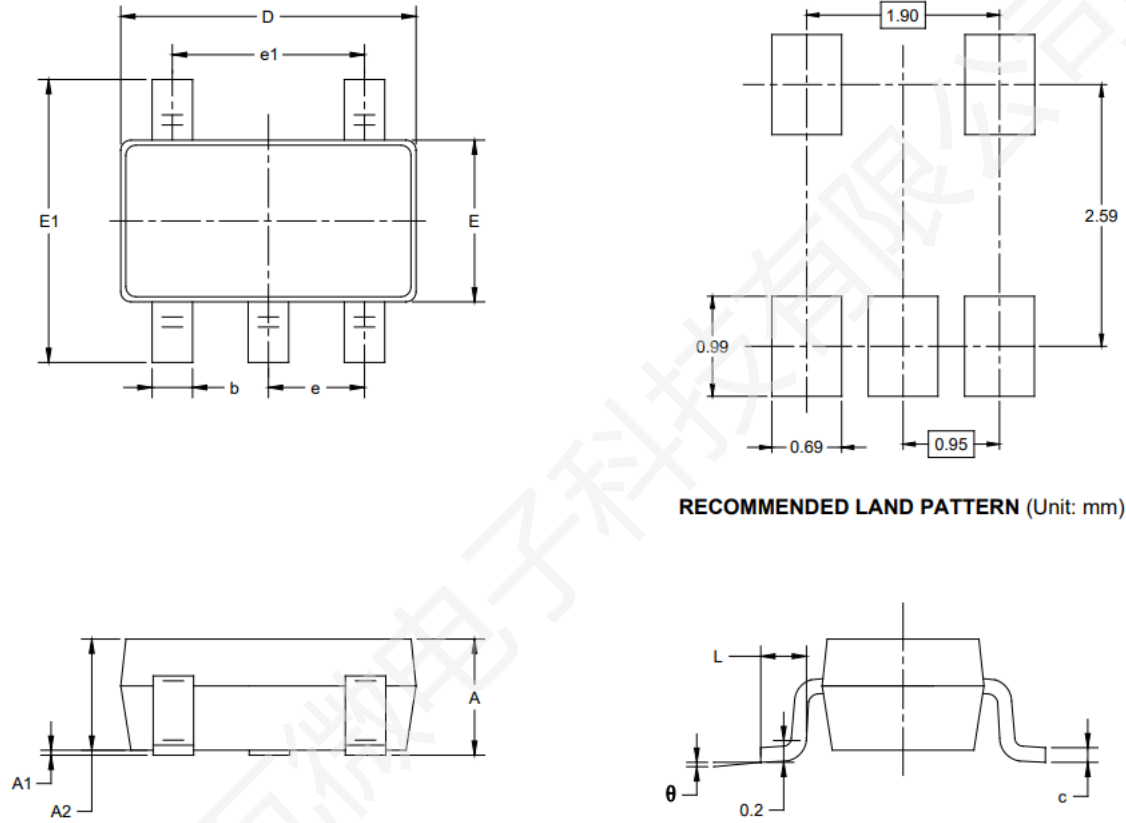
BOTTOM VIEW  
[背视图]



SIDE VIEW  
[侧视图]

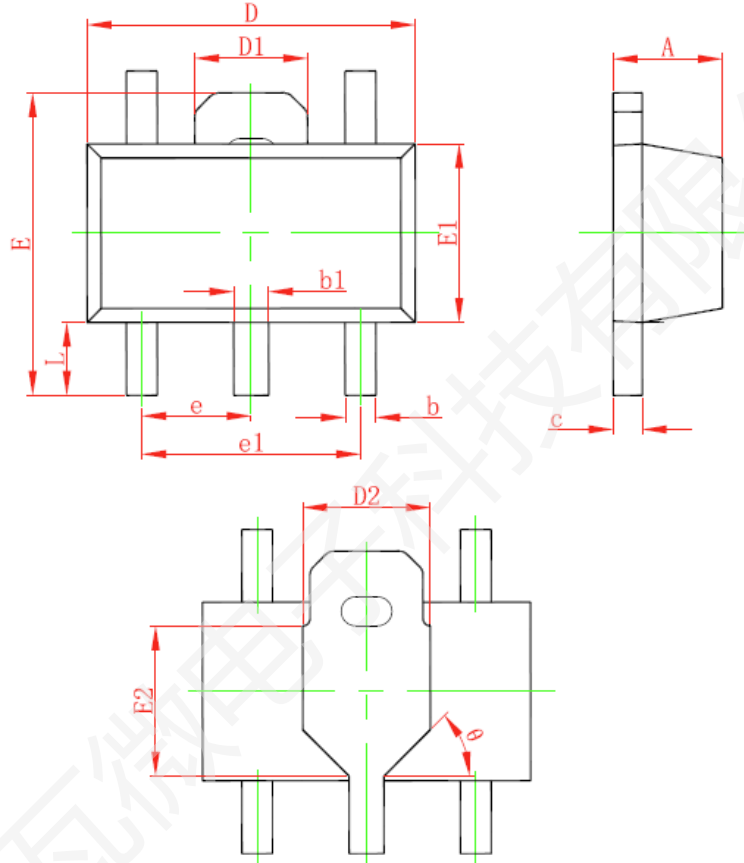
| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 0.700                     | 0.800 | 0.028                | 0.031 |
| A1     | 0.000                     | 0.050 | 0.000                | 0.002 |
| A2     | 0.203REF.                 |       | 0.008REF.            |       |
| D      | 1.924                     | 2.076 | 0.076                | 0.082 |
| E      | 1.924                     | 2.076 | 0.076                | 0.082 |
| D1     | 1.150                     | 1.250 | 0.045                | 0.049 |
| E1     | 0.650                     | 0.750 | 0.026                | 0.030 |
| b      | 0.200                     | 0.300 | 0.008                | 0.012 |
| e1     | 0.650TYP.                 |       | 0.026TYP.            |       |
| k      | 0.200MIN.                 |       | 0.008MIN.            |       |
| L      | 0.300                     | 0.400 | 0.012                | 0.016 |

#### SOT23-5L Package



| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 1.050                        | 1.250 | 0.041                   | 0.049 |
| A1     | 0.000                        | 0.100 | 0.000                   | 0.004 |
| A2     | 1.050                        | 1.150 | 0.041                   | 0.045 |
| b      | 0.300                        | 0.500 | 0.012                   | 0.020 |
| c      | 0.100                        | 0.200 | 0.004                   | 0.008 |
| D      | 2.820                        | 3.020 | 0.111                   | 0.119 |
| E      | 1.500                        | 1.700 | 0.059                   | 0.067 |
| E1     | 2.650                        | 2.950 | 0.104                   | 0.116 |
| e      | 0.950 BSC                    |       | 0.037 BSC               |       |
| e1     | 1.900 BSC                    |       | 0.075 BSC               |       |
| L      | 0.300                        | 0.600 | 0.012                   | 0.024 |
| θ      | 0°                           | 8°    | 0°                      | 8°    |

#### SOT89-5L Package



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 1.400                     | 1.600 | 0.055                | 0.063 |
| b      | 0.320                     | 0.520 | 0.013                | 0.020 |
| b1     | 0.380                     | 0.580 | 0.015                | 0.023 |
| c      | 0.350                     | 0.440 | 0.014                | 0.017 |
| D      | 4.400                     | 4.600 | 0.173                | 0.181 |
| D1     | 1.550 REF.                |       | 0.061 REF.           |       |
| D2     | 1.750 REF.                |       | 0.069 REF.           |       |
| E      | 3.940                     | 4.250 | 0.155                | 0.167 |
| E1     | 2.300                     | 2.600 | 0.091                | 0.102 |
| E2     | 1.900 REF.                |       | 0.075 REF.           |       |
| e      | 1.500 TYP.                |       | 0.060 TYP.           |       |
| e1     | 3.000 TYP.                |       | 0.118 TYP.           |       |
| L      | 0.900                     | 1.200 | 0.035                | 0.047 |
| θ      | 45°                       |       | 45°                  |       |

**Revision History:**

| Revision | Date     | Descriptions    |
|----------|----------|-----------------|
| Rev 0.1  | Sep.2023 | Initial Version |
| Rev 1.0  | Nov.2023 | Formal Version  |

**DISCLAIMER:**

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