# Low Power Linear Regulator with Current Limiting Function

## 1 Description

CN88LXXX is a wide voltage input high precision low voltage differential linear regulator with high PSRR and 150mA output current. With short circuit protection, overcurrent protection and overheat protection, there are SOT89-3, DFN2X2-6, SOT23-5, SOT23-3 and other packaging forms.

## 2 Features

- Low static current: 6μA
- High accuracy: ±2%
- Differential pressure：500mV @ $I_{OUT}$ = 100mA @ $V_{OUT}$ =5V
- Maximum output current: 150mA
- Input voltage range: Max. 35V
- Output short circuit protection
- Internal Thermal Overload Protection
- Internal Short-Circuit Limiting
- Recommend Capacitor: 1μF~10μF

## 3 Applications

- Smart Electric Meter
- Switch Power

## 4 Ordering information

| Product Number | Package | Quantity/Tape |
|---|---|---|
| CN88LXXXDSR | DFN2x2-6 | 4000/Tape |
| CN88LXXXTCR | SOT23-5 | 3000/Tape |
| CN88LXXXATCR | SOT23-5 | 3000/Tape |
| CN88LXXXOGR | SOT89-3 | 1000/Tape |
| CN88LXXXAOGR | SOT89-3 | 1000/Tape |
| CN88LXXXTGR | SOT23-3 | 3000/Tape |

| Product Number | Output voltage |
|---|---|
| CN88L025 | Vout=2.5V |
| CN88L033 | Vout=3.3V |
| CN88L040 | Vout=4.0V |
| CN88L050 | Vout=5.0V |
| CN88L056 | Vout=5.6V |

## 5 Marking

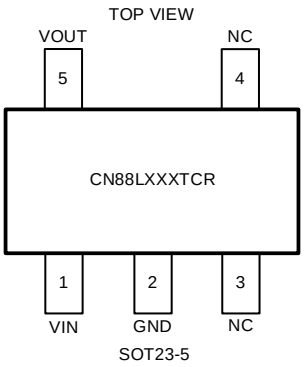
| Product Number | Marking |
|---|---|
| CN88LXXXDSR | CN88XX<br>YYWW |
| CN88LXXXTCR | 88LXXX<br>YYWW |
| CN88LXXXATCR | 88LXXXA<br>YYWW |
| CN88LXXXOGR | CN88LXXX<br>YYWW |
| CN88LXXXAOGR | CN88LXXXA<br>YYWW |
| CN88LXXXTGR | 88XXXT<br>YYWW |

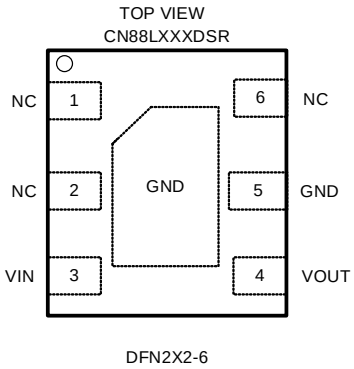
Note: YY=Year WW=Week.

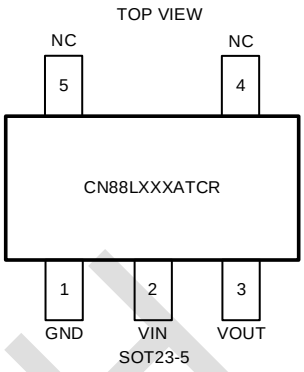
Green (RoHS & HF): CHIPNORTH defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your CHIPNORTH representative directly.

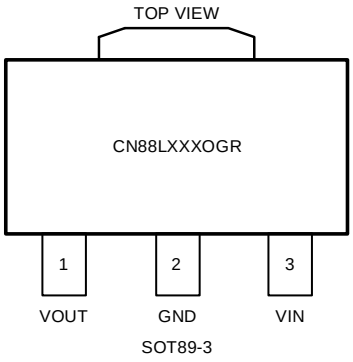
Moisture sensitivity level(MSL):3

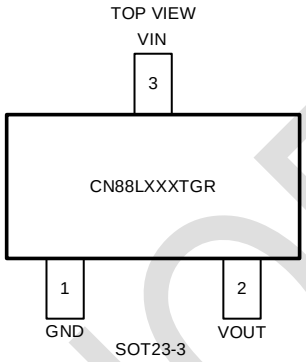
## 6 Pinout

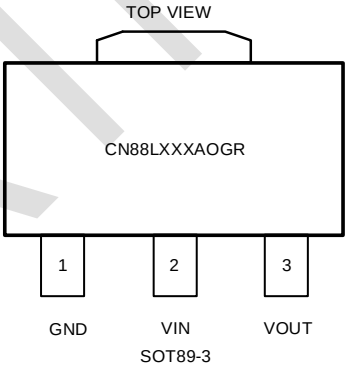


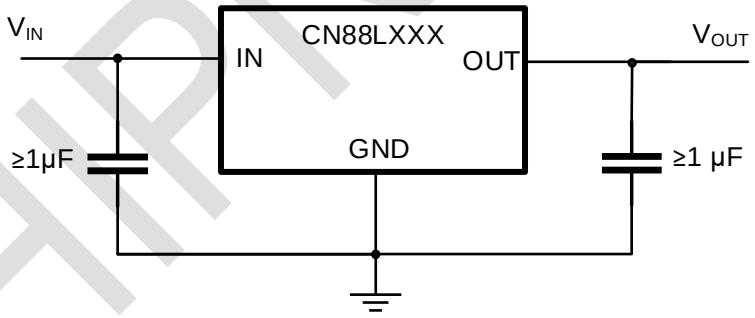



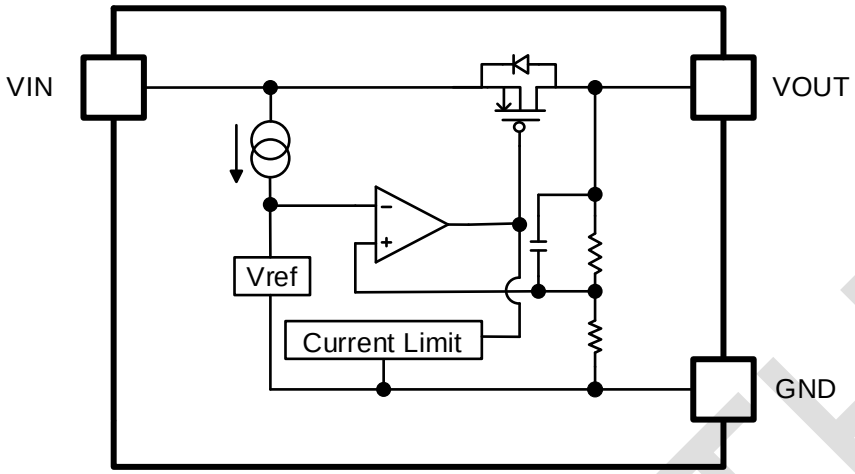




## 7 Typical Application




Note: Input capacitance CIN≥1μF is recommended for general application circuits, close to the chip input end; Output capacitance COUT≥1μF, close to the chip output end.

## 8 Block Diagram




## 9 Pin Descriptions

| Pin Number | | | | | | | Description |
|---|---|---|---|---|---|---|---|
| Pin Name | CN88L XXXAOGR | CN88L XXXOGR | CN88L XXXDSR | CN88L XXXTCR | CN88L XXATCR | CN88L XXTGR | |
| GND | 1 | 2 | 5 | 2 | 1 | 1 | GND |
| VIN | 2 | 3 | 3 | 1 | 2 | 3 | Input |
| VOUT | 3 | 1 | 4 | 5 | 3 | 2 | Output |
| NC | | | 1、2、6 | 3、4 | 4、5 | | No Connect |

## 10 Specifications

### 10.1 Absolute Maximum Ratings

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Maximum input voltage | $V_{IN}$ | -0.3 ~ 40 | V |
| Maximum output voltage | $V_{SS}$ | -0.3 ~ 12 | V |
| Storage temperature range | $T_{STG}$ | -55 ~ 150 | °C |
| Soldering temperature | $T_{LEAD}$ | 260(Soldering 10s) | °C |

(1) Stress exceeding the values listed under the absolute maximum rating may cause permanent damage to the device. These listed values are stress levels only and do not indicate that the device will operate properly under these conditions and under any other conditions other than the recommended operating conditions. Prolonged operation under maximum absolute rated conditions will affect device reliability.

(2) All voltage values are based on the ground terminal.

### 10.2 ESD Ratings

| Discharge mode | Norm | Value | Units |
|---|---|---|---|
| HBM | ESDA/JEDEC JS-001-2017 | ±4000 | V |
| CDM | ESDA/JEDEC JS-002-2018 | ±2000 | V |

## 10.3 Recommended Operating Range

| Parameter | Symbol | Min. | Max. | Units |
|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | $V_{OUT}$+1 | 35 | V |
| Operating Temperature | $T_A$ | -40 | 105 | °C |

## 10.4 Thermal Information

| Parameter | Package | Value | Unit |
|---|---|---|---|
| Junction to ambient thermal resistance ($R_{\theta JA}$) | SOT23-3 | 220 | °C/W |
| | SOT23-5 | 188 | °C/W |
| | DFN2x2-6 | 140 | °C/W |
| | SOT89-3（OGR） | 100 | °C/W |
| | SOT89-3（AOGR） | 165 | °C/W |

(1) Thermal resistance is not a fixed constant; its value is influenced by the following factors: PCB heat dissipation capacity, number and thickness of copper layers, ambient temperature, airflow velocity, etc.

(2) The thermal resistance values listed in the datasheet are provided solely for customers to compare the thermal performance of different packages. Since the heat dissipation conditions of the PCB in actual customer applications differ from those of our test boards, the actual measured thermal resistance values may vary from the nominal values in the datasheet. Customers should conduct verification on their own system boards to ensure that the thermal design meets the requirements of the product application.

## 10.5 Electrical Characteristics

Test Condition：$V_{IN}$=$V_{OUT}$+1V, $C_{IN}$=1μF, $C_{OUT}$=1μF, $T_A$=25°C, unless otherwise specified.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Input voltage range | $V_{IN}$ | $I_{OUT}$=10mA | $V_{OUT}$+1V | | 35 | V |
| Output voltage | $V_{OUT}$ | $V_{IN}$=$V_{OUT}$+2V, $I_{OUT}$=1mA | $V_{OUT}$ x0.98 | $V_{OUT}$ | $V_{OUT}$ x1.02 | V |
| Output voltage accuracy | $V_{OUT}$% | $V_{IN}$=$V_{OUT}$+2V, $I_{OUT}$=10mA | 98% | | 102% | |
| Linear adjustment rate | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | $V_{IN}$=$V_{SET}$+1V~19V<br>$I_{OUT}$=1mA@$V_{OUT}$=5V | | 0.04 | | %/V |
| Load adjustment rate | $\Delta V_{OUT}$ | $V_{IN}$=$V_{OUT}$+2V<br>$I_{OUT}$=1~150mA@$V_{OUT}$=5V | | | 40 | mV |
| Static current | $I_Q$ | $V_{IN}$=12V, $I_{OUT}$ =0mA | | 5.5 | 12 | μA |
| Pressure drop | $V_{DROP}$ | $I_{OUT}$=100mA@$V_{OUT}$=5V | | 500 | | mV |
| Maximum output current | $I_{OUT\_MAX}$ | | | 150 | | mA |
| Current limitation | $I_{LIMIT}$ | $V_{IN}$=$V_{OUT}$+1.0V | | 230 | | mA |
| Temperature protection point | | | | 150 | | °C |
| Temperature protection point hysteresis | | | | 30 | | °C |
| PSRR | | $V_{IN}$=8-16V, F=120HZ<br>$I_{OUT}$=50mA, $T_J$=25°C | | 60 | | dB |

Note:

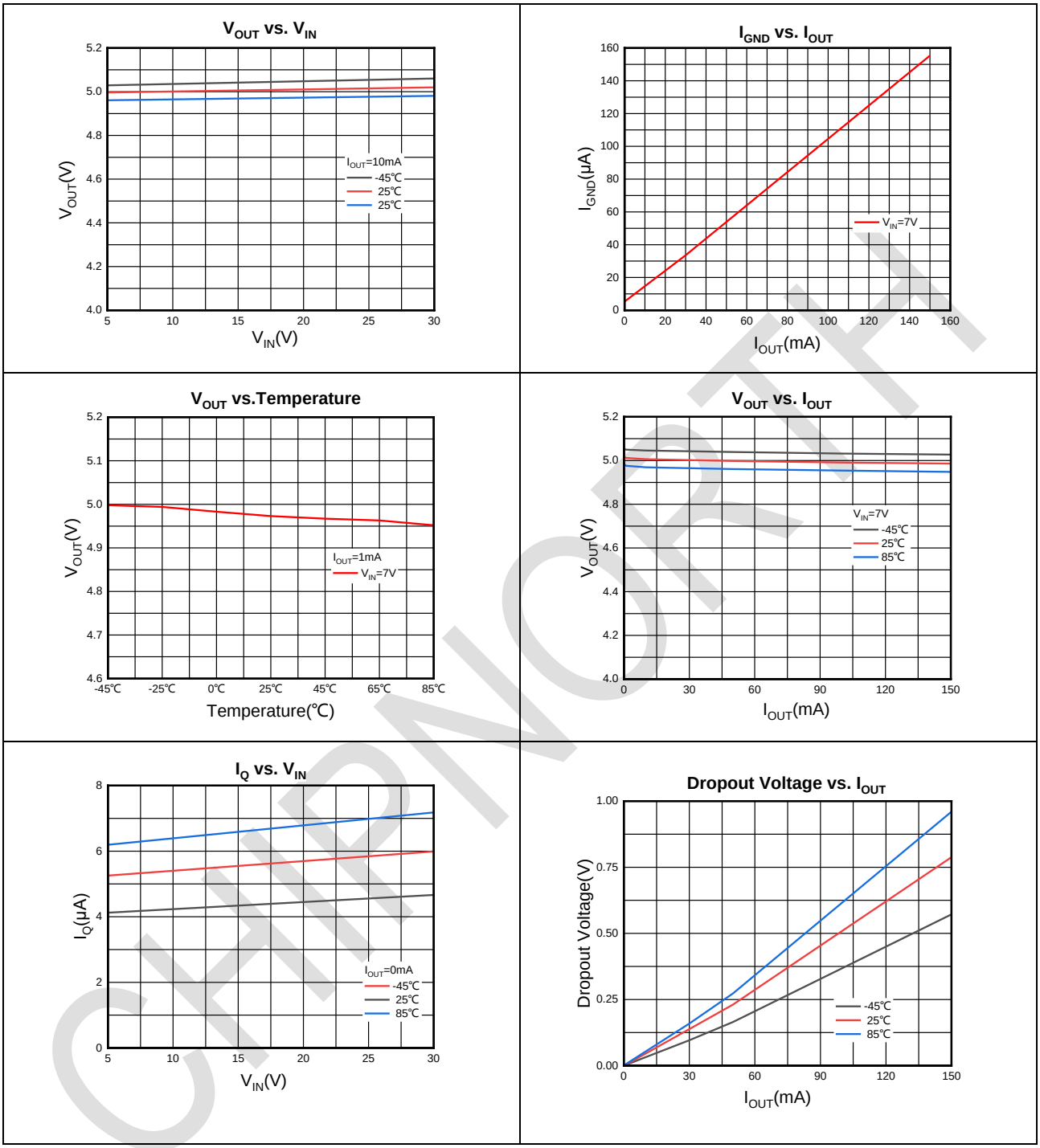
$V_{OUT(S)}$: Output voltage when $V_{IN}$ = $V_{OUT}$ + 1V, $I_{OUT}$ = 1mA.

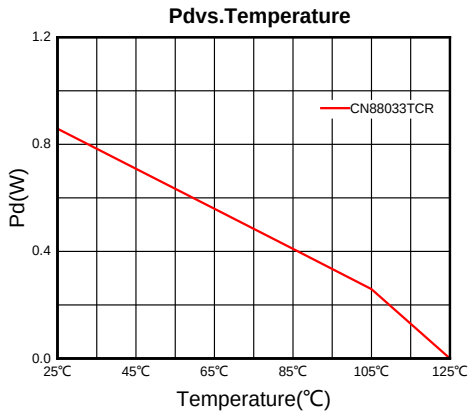
$V_{DROP}$=$V_{IN}$-($V_{OUT\_REG}$*0.98), where $V_{OUT\_REG}$ is the output voltage when $V_{IN}$=$V_{OUT}$+1.0V and $I_{OUT}$=100mA. $V_{IN}$ is the input voltage, when the input voltage gradually decreases, the output voltage becomes 98% of $V_{OUT\_REG}$.

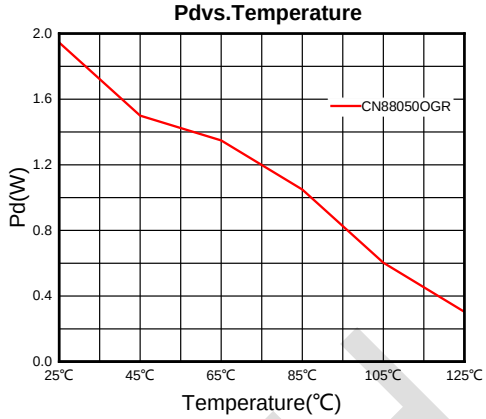
$I_{LIMIT}$: Output current when $V_{IN}$ = $V_{OUT}$ + 1V and $V_{OUT}$ = 0.95 x $V_{OUT(S)}$.

## 10.6 Characteristics Curve（CN88L050AOGR）

Test condition: $V_{IN}$=$V_{OUT}$+1V, $C_{IN}$=1μF, $C_{OUT}$=1μF, TA=25°C, unless otherwise noted.





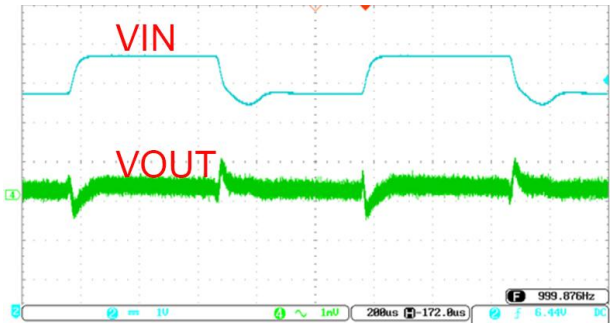




Figure 1 Line Transient

(VIN=from 5.6V to 12V to 5.6V IOUT=0mA)

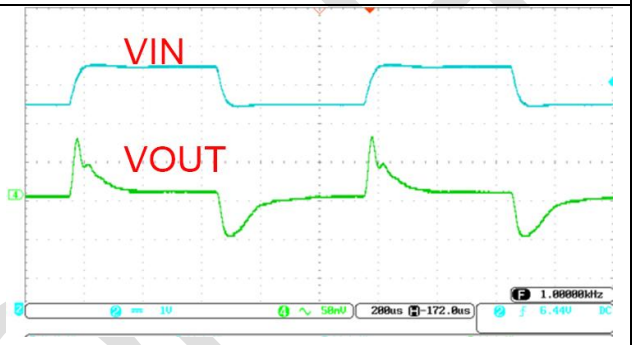



Figure 2 Line Transient

(VIN=from 5.6V to 7V to 5.6V IOUT=150mA)

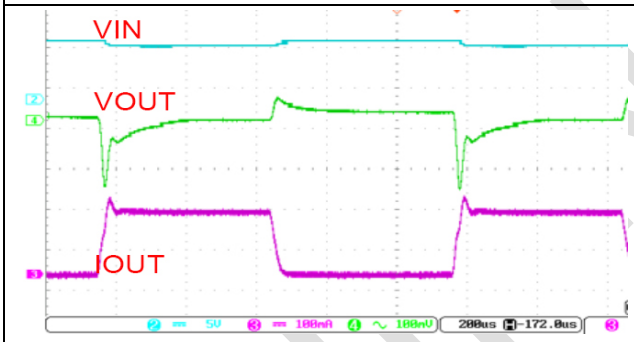



Figure 3 Load Transient

(VIN=7V, IOUT=0mA-150mA-0mA)

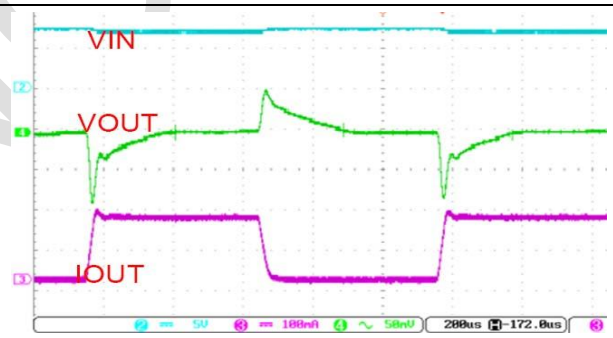
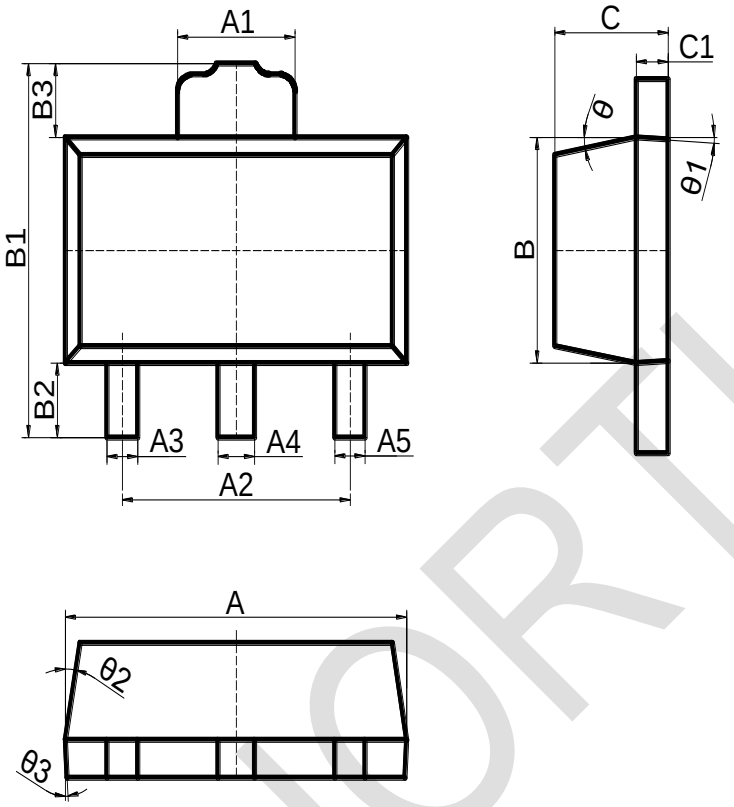



Figure 4 Load Transient

(VIN=7V, IOUT=1mA-150mA-1mA)

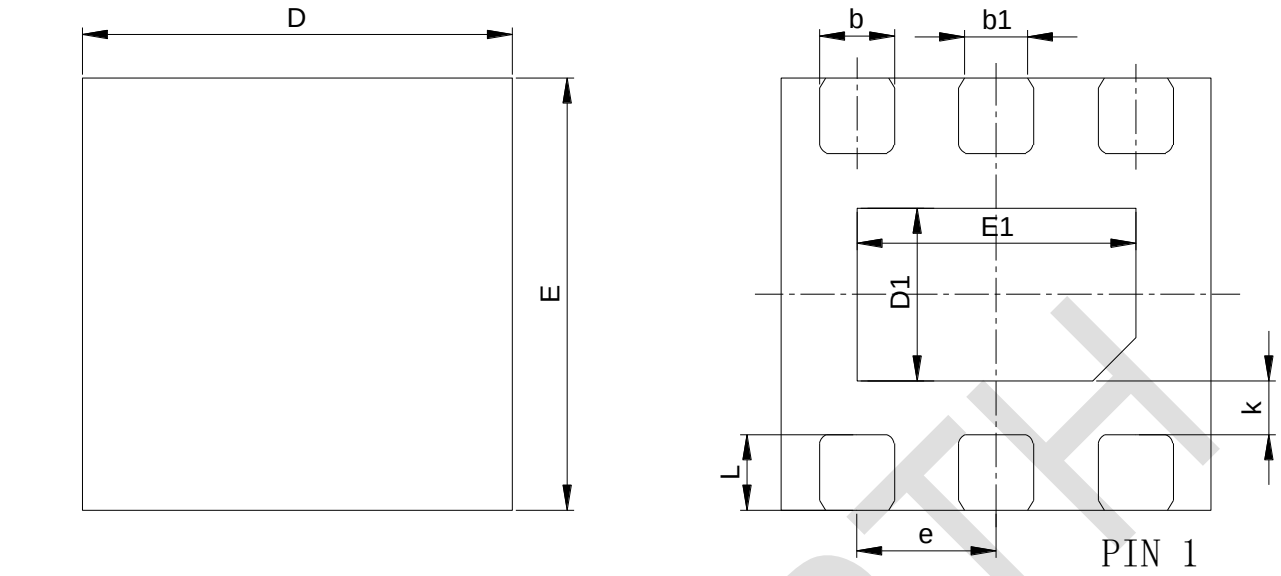
## 11 Package Information

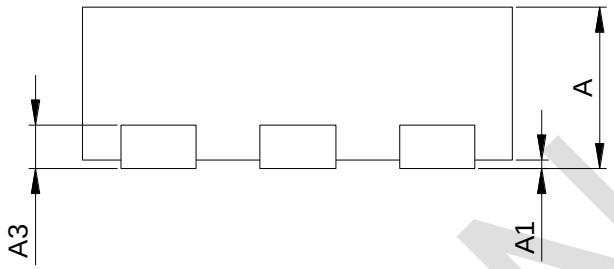
### SOT89-3




| Dimension / Symbol | Min (mm) | Nom (mm) | Max (mm) |
|---|---|---|---|
| A | 4.4 | 4.5 | 4.6 |
| A1 | 1.4 | 1.6 | 1.8 |
| A2 | 2.8 | 3.0 | 3.2 |
| A4 | 0.37 | 0.47 | 0.57 |
| A5 | 0.22 | 0.42 | 0.62 |
| B | 2.4 | 2.5 | 2.6 |
| B1 | - | - | 4.25 |
| B2 | 0.8 | - | - |
| C | 1.4 | 1.5 | 1.6 |
| C1 | 0.3 | 0.4 | 0.5 |

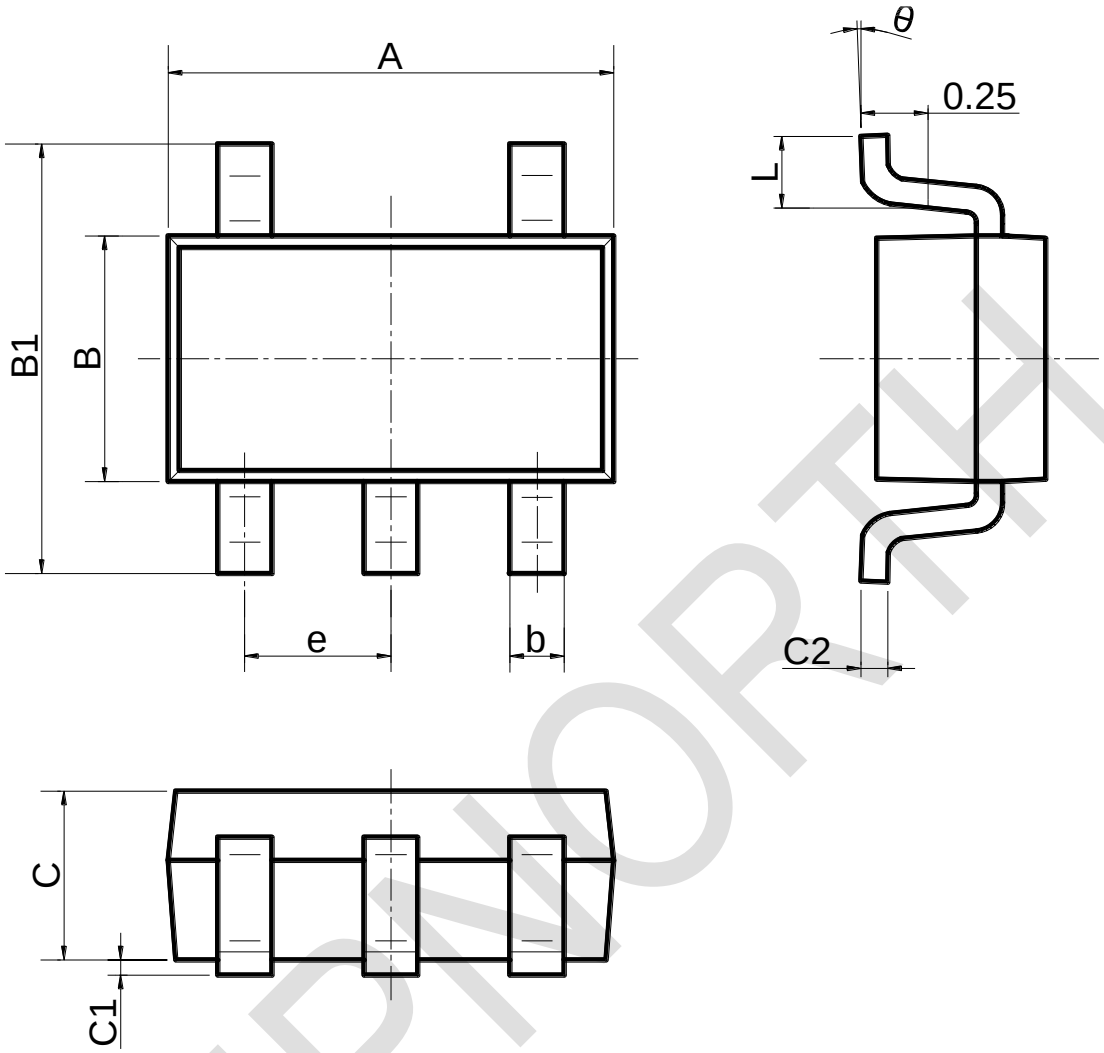
**DFN2x2-6**



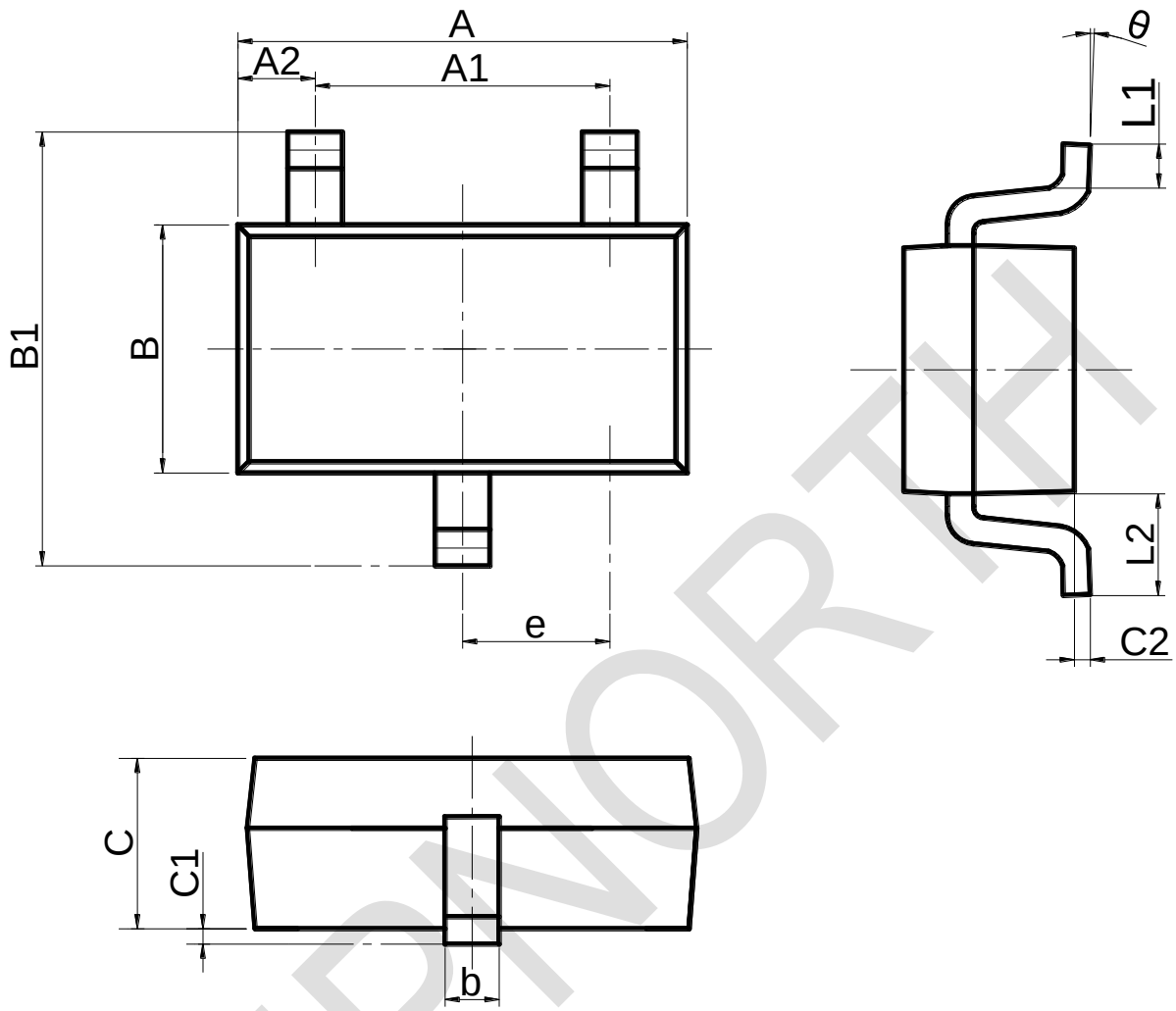

| Dimension / Symbol | Min (mm) | Nom (mm) | Max (mm) | Dimension / Symbol | Min (mm) | Nom (mm) | Max (mm) |
|---|---|---|---|---|---|---|---|
| A | 0.7 | 0.75 | 0.8 | E1 | 1.5 | 1.6 | 1.7 |
| A1 | 0 | 0.025 | 0.05 | k | | 0.25REF | |
| A3 | | 0.203REF | | b | 0.25 | 0.3 | 0.35 |
| D | 1.9 | 2.0 | 2.1 | b1 | | 0.22REF | |
| E | 1.9 | 2.0 | 2.1 | e | | 0.65REF | |
| D1 | 0.9 | 1.0 | 1.1 | L | 0.2 | 0.25 | 0.3 |

**SOT23-5**




| Dimension / Symbol | Min (mm) | Max (mm) | Dimension / Symbol | Min (mm) | Max (mm) |
|---|---|---|---|---|---|
| A | 2.82 | 3.02 | C | 1.05 | 1.15 |
| e | 0.95(BSC) | | C1 | 0.03 | 0.15 |
| b | 0.28 | 0.45 | C2 | 0.12 | 0.23 |
| B | 1.50 | 1.70 | L | 0.35 | 0.55 |
| B1 | 2.75 | 3.05 | θ | 0° | 8° |

**SOT23-3**




| Dimension / Symbol | Min (mm) | Nom (mm) | Max (mm) |
|---|---|---|---|
| A | 2.70 | 2.90 | 3.10 |
| A1 | 1.70 | 1.90 | 2.10 |
| A2 | - | - | 0.6 |
| e | 0.85 | 0.95 | 1.05 |
| b | 0.30 | 0.40 | 0.50 |
| B | 1.50 | 1.60 | 1.80 |
| B1 | 2.60 | 2.80 | 3.00 |
| C | 1.00 | 1.10 | 1.20 |
| C1 | - | - | 0.10 |
| C2 | 0.02 | - | 0.08 |
| L1 | 0.20 | - | 0.55 |
| L2 | - | 0.60 | - |
| θ | 0° | - | 15° |

## 12 Important Statement

Chipnorth Electronic Technology (Nanjing) Co., Ltd. and its subsidiaries reserve the right to make modifications, improvements, corrections, or other changes to this document and to any of the products described herein at any time without notice. Chipnorth Electronic Technology (Nanjing) Co., Ltd. disclaims any liability arising out of the use of this document or any of the products described herein; Chipnorth Electronic Technology (Nanjing) Co., Ltd. does not transfer any license to its patents or trademarks or other rights. Any customer or user using this document or any of the products described herein assumes all risk and agrees to hold harmless Chipnorth Electronic Technology (Nanjing) Co., Ltd. and all companies whose products are displayed on Chipnorth Electronic Technology (Nanjing) Co., Ltd.

Chipnorth Electronic Technology (Nanjing) Co., Ltd. makes no warranty and assumes no responsibility for any products purchased through unauthorized sales channels. In the event that a customer purchases or uses a product from Chipnorth Electronic Technology (Nanjing) Co., Ltd. for any unintended or unauthorized use, the customer shall indemnify and hold harmless Chipnorth Electronic Technology (Nanjing) Co., Ltd. and its representatives from and against all claims, damages, and attorney's fees arising from any personal injury or death, directly or indirectly, arising out of or in connection with such purchase or use.