



## 200mA Low-Dropout Linear voltage regulator

### CST9001 Features

- Low Power Consumption: 1.0uA (Typ)
- Maximum Output Current: 200mA
- Small Dropout Voltage  
150mV@100mA (Vout=3.3V)  
240mV@100mA (Vout=1.8V)
- Input Voltage Range: 1.5V~6.5V
- Output Voltage Range: 0.9V~5.0V  
(customized on command in 0.1V steps)
- RoHS Compliant and Lead (Pb) Free
- High Accurate:  $\pm 2\%$   
( $\pm 1\%$  customized)
- Output Current Limit
- Integrated Short-Circuit Protection
- Good Transient Response
- Stable with Ceramic Capacitor
- Available Package:  
SOT23、SOT23-3L  
(customized DFN1x1、SOT89-3L)

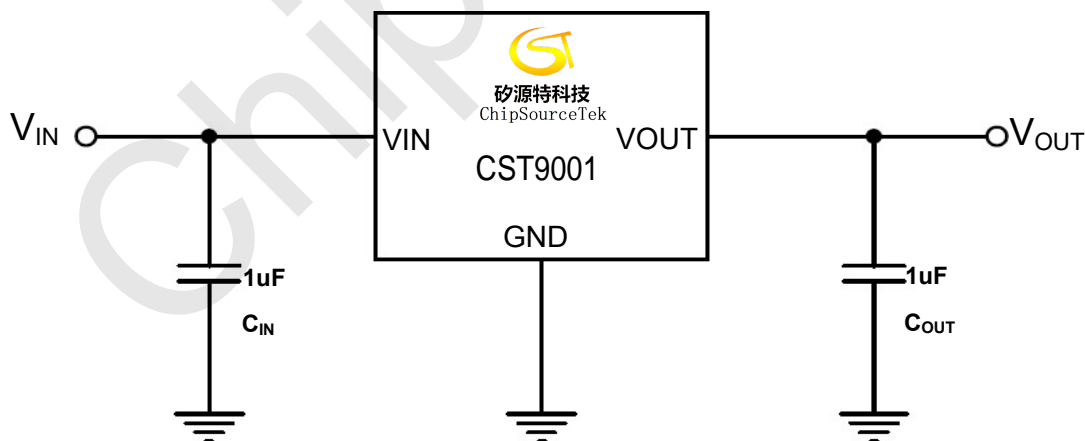
### CST9001 Application

- Battery Powered equipment
- Reference Voltage Source
- Power Management of MP3, PDA.....
- Weighting Scales

### CST9001 Description

CST9001 series is a group of positive voltage output, low power consumption, low dropout voltage, Linear voltage regulator. It can provide 100mA output current when input / output voltage differential dropsto 150mV (Vout=3.3V) , The very low power consumption of CST9001 (Iq=1.0uA) can greatly improve natural life of batteries.CST9001 can provide output value in the range of 0.9V~5.0V in 0.1V steps. It also can customized on command.CST9001 includes high accuracy voltage reference, error amplifier, current limit circuit and output driver module.CST9001 has well load transient response and good temperature characteristic, And it uses trimming technique to guarantee output voltage accuracy within $\pm 2\%$ .

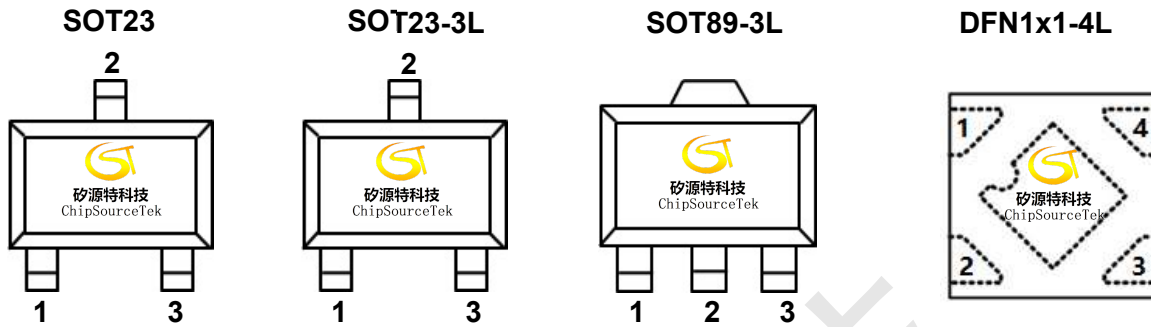
### CST9001 Application Circuits





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**CST9001 Pin Configuration**



**CST9001 Pin Description**

| Pin No. |          |          |           | Pin Name | Pin Function            |
|---------|----------|----------|-----------|----------|-------------------------|
| SOT23   | SOT23-3L | SOT89-3L | DFN1x1-4L |          |                         |
| 1       | 1        | 1        | 2         | GND      | Ground.                 |
| 2       | 2        | 2        | 4         | VIN      | Supply voltage input.   |
| 3       | 3        | 3        | 1         | VOUT     | Voltage Output.         |
| ----    | ----     | ----     | 3         | NC       | No Internal Connection. |

**CST9001 Order Information**

**CST9001①②-③④⑤**

| Designator | Symbol      | Description                                     |
|------------|-------------|-------------------------------------------------|
| ①②         | M3/S3/P3/D4 | SOT23 / SOT23-3L / SOT89-3L / DFN1x1-4L         |
| ③④         | Integer     | Output Voltage(09、10、12、15、18、25、28、30、33、36..) |
| ⑤          | A           | Accurate $\pm 1\%$                              |
|            | ----        | Accurate $\pm 2\%$                              |

| Model         | Marking** | Description                                           | Package   | T/R Qty    |
|---------------|-----------|-------------------------------------------------------|-----------|------------|
| CST9001M3-XX* | ①②③④      | CST9001 200mA Low-Dropout<br>Linear voltage regulator | SOT23     | 3,000 PCS  |
| CST9001S3-XX* | ①②③④      |                                                       | SOT23-3L  | 3,000 PCS  |
| CST9001P3-XX* | ①②③④      |                                                       | SOT89-3L  | 1,000 PCS  |
| CST9001D4-XX* | ⑤⑥        |                                                       | DFN1x1-4L | 10,000 PCS |

Note: (\*) XX Represents the Output Voltage

(\*\*) Please Page 3 .⑤⑥ Only Off DFN1x1-4L (customized)



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**CST9001 Marking Information**

①②Represents the product name

| Mark ①② | Product Series       |
|---------|----------------------|
| AL      | CST9001 M3 / S3 / P3 |

③Represents the range of output voltage

| Mark ③          |                 | Product Series       |
|-----------------|-----------------|----------------------|
| VOUT: 0.9V-3.0V | VOUT: 3.1V-5.0V | CST9001 M3 / S3 / P3 |
| V               | E               |                      |

④Represents the Output Voltage

| Mark④ | Output Voltage(V) |     |   |   | Mark④ | Output Voltage(V) |     |   |    |
|-------|-------------------|-----|---|---|-------|-------------------|-----|---|----|
| 0     | -                 | 3.1 | - | - | F     | 1.6               | 4.6 | - | -  |
| 1     | -                 | 3.2 | - | - | H     | 1.7               | 4.7 | - | -  |
| 2     | -                 | 3.3 | - | - | K     | 1.8               | 4.8 | - | -  |
| 3     | -                 | 3.4 | - | - | L     | 1.9               | 4.9 | - | -  |
| 4     | -                 | 3.5 | - | - | M     | 2.0               | 5.0 | - | -  |
| 5     | -                 | 3.6 | - | - | N     | 2.1               | -   | - | -  |
| 6     | -                 | 3.7 | - | - | P     | 2.2               | -   | - | -  |
| 7     | -                 | 3.8 | - | - | R     | 2.3               | -   | - | -- |
| 8     | 0.9               | 3.9 | - | - | S     | 2.4               | -   | - | -  |
| 9     | 1.0               | 4.0 | - | - | T     | 2.5               | -   | - | -  |
| A     | 1.1               | 4.1 | - | - | U     | 2.6               | -   | - | -  |
| B     | 1.2               | 4.2 | - | - | V     | 2.7               | -   | - | -  |
| C     | 1.3               | 4.3 | - | - | X     | 2.8               | -   | - | -  |
| D     | 1.4               | 4.4 | - | - | Y     | 2.9               | -   | - | -  |
| E     | 1.5               | 4.5 | - | - | Z     | 3.0               | -   | - | -  |

| Output Voltage(V) | Mark⑤⑥ | Output Voltage(V) | Mark⑤⑥ | Output Voltage(V) | Mark⑤⑥ |
|-------------------|--------|-------------------|--------|-------------------|--------|
| 0.9               | L0     | 2.3               | -      | 3.7               | -      |
| 1.0               | LK     | 2.4               | -      | 3.8               | -      |
| 1.1               | L1     | 2.5               | LD     | 3.9               | -      |
| 1.2               | LA     | 2.6               | -      | 4.0               | -      |
| 1.3               | L2     | 2.7               | -      | 4.1               | -      |
| 1.4               | -      | 2.8               | LE     | 4.2               | -      |
| 1.5               | LB     | 2.9               | -      | 4.3               | -      |
| 1.6               | -      | 3.0               | LF     | 4.4               | -      |
| 1.7               | -      | 3.1               | -      | 4.5               | -      |
| 1.8               | LC     | 3.2               | -      | 4.6               | -      |
| 1.9               | -      | 3.3               | LG     | 4.7               | -      |
| 2.0               | L3     | 3.4               | -      | 4.8               | -      |
| 2.1               | -      | 3.5               | -      | 4.9               | -      |
| 2.2               | -      | 3.6               | LH     | 5.0               | -      |



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**CST9001 Absolute Maximum Ratings** <sup>(1)(2)</sup>

| Parameter                    |          | Symbol                                                            | Maximum Rating                   | Unit          |
|------------------------------|----------|-------------------------------------------------------------------|----------------------------------|---------------|
| Input Voltage                |          | $V_{IN}$                                                          | $V_{SS} - 0.3 \sim V_{SS} + 7.0$ | V             |
| Output Current               |          | $I_{OUT}$                                                         | 300                              | mA            |
| Output Voltage               |          | $V_{OUT}$                                                         | $V_{SS} - 0.3 \sim V_{IN} + 0.3$ | V             |
| Power Dissipation            | SOT23    | $P_d$                                                             | 200                              | mW            |
|                              | SOT23-3  |                                                                   | 250                              |               |
|                              | SOT89-3  |                                                                   | 500                              |               |
|                              | DFN1*1-4 |                                                                   | 400                              |               |
| Thermal Resistance           | SOT23    | $R_{\theta JA}^{(3)}$<br>(Junction-to-ambient thermal resistance) | 500                              | $^{\circ}C/W$ |
|                              | SOT23-3  |                                                                   | 400                              | $^{\circ}C/W$ |
|                              | SOT89-3  |                                                                   | 200                              | $^{\circ}C/W$ |
|                              | DFN1*1-4 |                                                                   | 250                              | $^{\circ}C/W$ |
| Operating Temperature        |          | $T_{opr}$                                                         | -40~85                           | $^{\circ}C$   |
| Storage Temperature          |          | $T_{stg}$                                                         | -40~125                          | $^{\circ}C$   |
| Soldering Temperature & Time |          | $T_{solder}$                                                      | 260 $^{\circ}C$ , 10s            |               |

Note (1): Exceeding these ratings may damage the device.

Note (2): The device is not guaranteed to function outside of its operating conditions

Note (3): The package thermal impedance is calculated in accordance to JESD 51-7.

**CST9001 ESD Ratings**

| Item            | Description                                                                            | Value      | Unit |
|-----------------|----------------------------------------------------------------------------------------|------------|------|
| $V_{(ESD-HBM)}$ | Human Body Model (HBM)<br>ANSI/ESDA/JEDEC JS-001-2014<br>Classification, Class: 2      | $\pm 4000$ | V    |
| $V_{(ESD-CDM)}$ | Charged Device Mode (CDM)<br>ANSI/ESDA/JEDEC JS-002-2014<br>Classification, Class: C0b | $\pm 400$  | V    |
| $I_{LATCH-UP}$  | JEDEC STANDARD NO.78E APRIL 2016<br>Temperature Classification, Class: I               | $\pm 400$  | mA   |

ESD testing is performed according to the respective JESD22 JEDEC standard. The human body model is a 100 pF capacitor discharged through a 1.5k $\Omega$  resistor into each pin. The machine model is a 200pF capacitor discharged directly into each pin.

**Recommended Operating Conditions**

| Parameter                                   | MIN. | MAX. | Units       |
|---------------------------------------------|------|------|-------------|
| Supply voltage at $V_{IN}$                  | 1.5  | 6.5  | V           |
| Operating junction temperature range, $T_j$ | -40  | 125  | $^{\circ}C$ |
| Operating free air temperature range, $T_A$ | -40  | 85   | $^{\circ}C$ |

Note : All limits specified at room temperature ( $T_A = 25^{\circ}C$ ) unless otherwise specified. All room temperature limits are 100% production tested. All limits at temperature extremes are ensured through correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).



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**CST9001 Electrical Characteristics**

(Test Conditions:  $C_{IN}=1\mu F$ ,  $C_{OUT}=1\mu F$ ,  $T_A=25^\circ C$ , unless otherwise specified.)

| Parameter                              | Symbol                                               | Conditions                                                 | Min                  | Typ       | Max                  | Units           |    |
|----------------------------------------|------------------------------------------------------|------------------------------------------------------------|----------------------|-----------|----------------------|-----------------|----|
| Input Voltage                          | $V_{IN}$                                             |                                                            | -0.3                 |           | 6.5                  | V               |    |
| Quiescent Current                      | $I_Q$                                                | $V_{OUT} \leq V_{IN} \leq V_{set}^{(1)}$<br>$I_{LOAD}=0mA$ | —                    | 1.0       | —                    | $\mu A$         |    |
| Output Voltage                         | $V_{OUT}$                                            | $V_{IN}=V_{set}+1.0V$<br>$I_{OUT}=30mA$                    | $V_{set} \cdot 0.98$ | $V_{set}$ | $V_{set} \cdot 1.02$ | V               |    |
| Maximum Output Current                 | $I_{OUT(Max)}$                                       | $V_{IN}=V_{OUT}+1.0V$                                      | 200 <sup>(2)</sup>   | —         | —                    | mA              |    |
| Dropout Voltage                        | $V_{DROP}$                                           | $I_{OUT}=100mA$                                            | $V_{OUT}=0.9V$       | —         | 700                  | —               | mV |
|                                        |                                                      |                                                            | $V_{OUT}=1.2V$       | —         | 600                  | —               |    |
|                                        |                                                      |                                                            | $V_{OUT}=1.5V$       | —         | 380                  | —               |    |
|                                        |                                                      |                                                            | $V_{OUT}=1.8V$       | —         | 240                  | —               |    |
|                                        |                                                      |                                                            | $V_{OUT}=2.5V$       | —         | 240                  | —               |    |
|                                        |                                                      |                                                            | $V_{OUT}=2.8V$       | —         | 220                  | —               |    |
|                                        |                                                      |                                                            | $V_{OUT}=3.0V$       | —         | 200                  | —               |    |
|                                        |                                                      |                                                            | $V_{OUT}=3.3V$       | —         | 150                  | —               |    |
|                                        |                                                      |                                                            | $V_{OUT}=3.6V$       | —         | 130                  | —               |    |
|                                        |                                                      | $V_{OUT}=5.0V$                                             | —                    | 120       | —                    |                 |    |
| Line Regulation                        | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | $I_{OUT}=30mA$<br>$(V_{set}+1.0V) \leq V_{IN} \leq 7.0V$   | —                    | 0.05      | —                    | %/V             |    |
| Load Regulation                        | $\Delta V_{OUT}$                                     | $V_{IN}=V_{set}+1.0V$<br>$1mA \leq I_{OUT} \leq 100mA$     | —                    | 15        | —                    | mV              |    |
| Short Current                          | $I_{SHORT}$                                          | $V_{IN}=V_{set}+1.0V$<br>$V_{OUT}=GND$                     | —                    | 50        | —                    | mA              |    |
| Current Limit                          | $I_{LIMIT}$                                          |                                                            | —                    | 300       | —                    | mA              |    |
| Output Voltage Temperature Coefficient | $\frac{\Delta V_{OUT}}{\Delta T \cdot V_{OUT}}$      | $I_{OUT}=10mA$                                             | —                    | 100       | —                    | ppm/ $^\circ C$ |    |

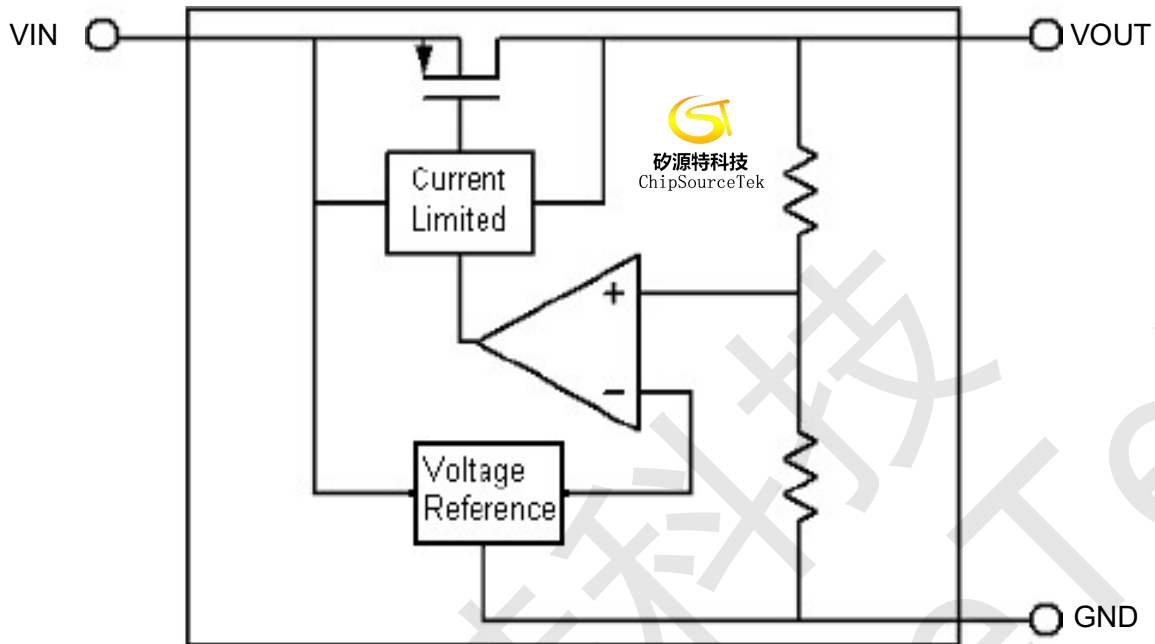
NOTE:(1) CST9001 keeps the chip low power when the input voltage is low

(2)  $I_{OUT}=P_d / (V_{IN}-V_{OUT})$



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**CST9001 Function Block Diagram**



**CST9001 Application Guideline**

**Input Capacitor**

A 1 $\mu$ F ceramic capacitor is recommended to connect between  $V_{DD}$  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 1 $\mu$ F, 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 VOUT and GND pins.

**Dropout Voltage**

The dropout voltage refers to the voltage difference between the VIN and VOUT pins while operating at specific output current. The dropout voltage  $V_{DROP}$  also can be expressed as the voltage drop on the pass-FET at specific output current ( $I_{RATED}$ ) while the pass-FET is fully operating at ohmic region and the pass-FET can be characterized as a resistance  $R_{DS(ON)}$ . Thus the dropout voltage





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can be defined as ( $V_{DROP} = V_{IN} - V_{OUT} = R_{DS(ON)} \times I_{RATED}$ ). For normal operation, the suggested LDO operating range is ( $V_{IN} > V_{OUT} + V_{DROP}$ ) for good transient response and PSRR ability. Vice versa, while operating at the ohmic region will degrade the performance severely.

#### Thermal Application

For continuous operation, do not exceed the 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 as below:  $T_A=25^{\circ}\text{C}$ , PCB,

The max  $P_D = (125^{\circ}\text{C} - 25^{\circ}\text{C}) / (\text{Thermal Resistance } ^{\circ}\text{C/W})$

Power dissipation ( $P_D$ ) is equal to the product of the output current and the voltage drop across the output pass element, as shown in the equation below:

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$$

#### Layout Consideration

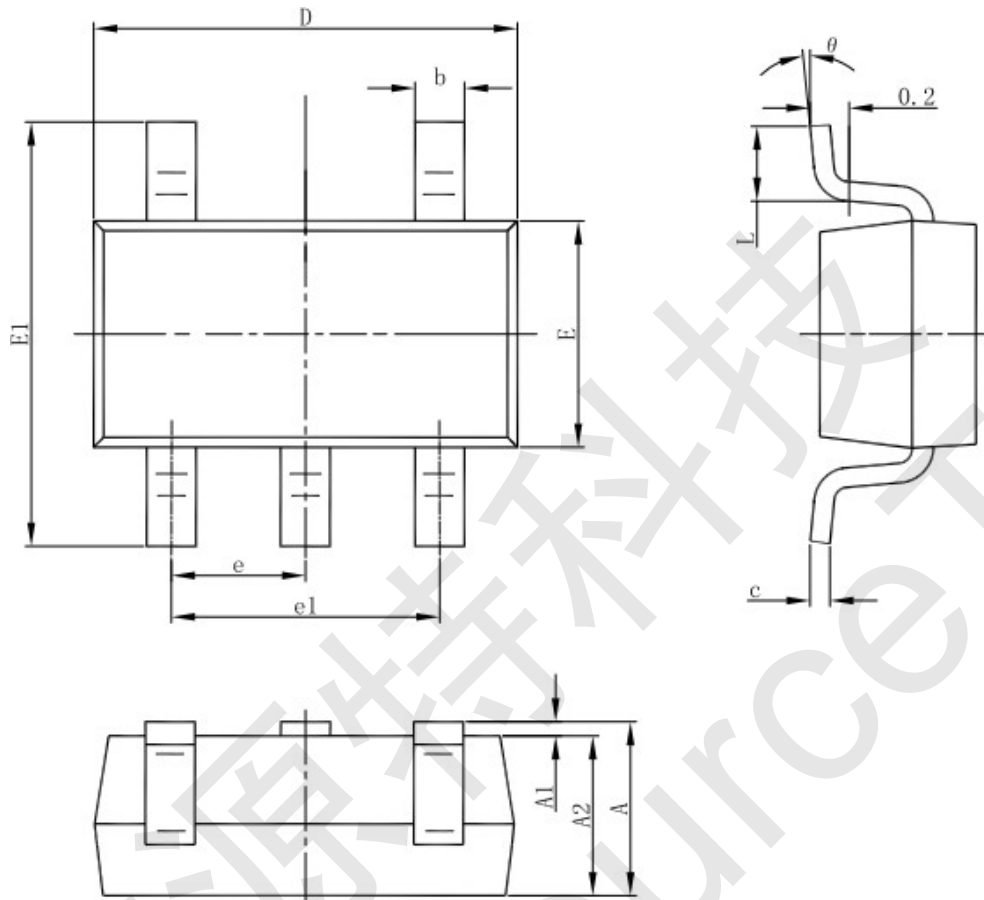
By placing input and output capacitors on the same side of the PCB as the LDO, and placing them as close as is practical to the package can achieve the best performance. The ground connections for input and output capacitors must be back to the CST9001 ground pin using as wide and as short of a copper trace as is practical. Connections using long trace lengths, narrow trace widths, and/or connections through via must be avoided. These add parasitic inductances and resistance that results in worse performance especially during transient conditions.



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CST9001 Packaging Information

SOT23



| Symbol | Dimensions In Millimeters |       | Dimensions 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     | 1.800                     | 2.000 | 0.071                | 0.079 |
| L      | 0.300                     | 0.600 | 0.012                | 0.024 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

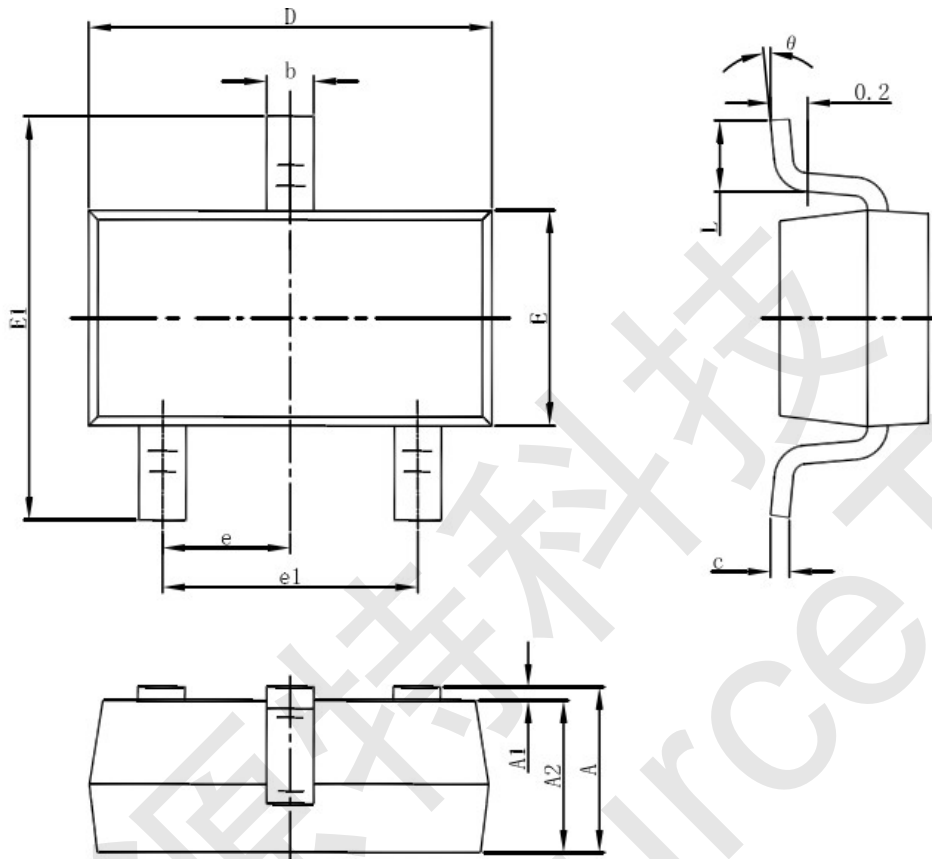




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CST9001 Packaging Information

SOT23-3L



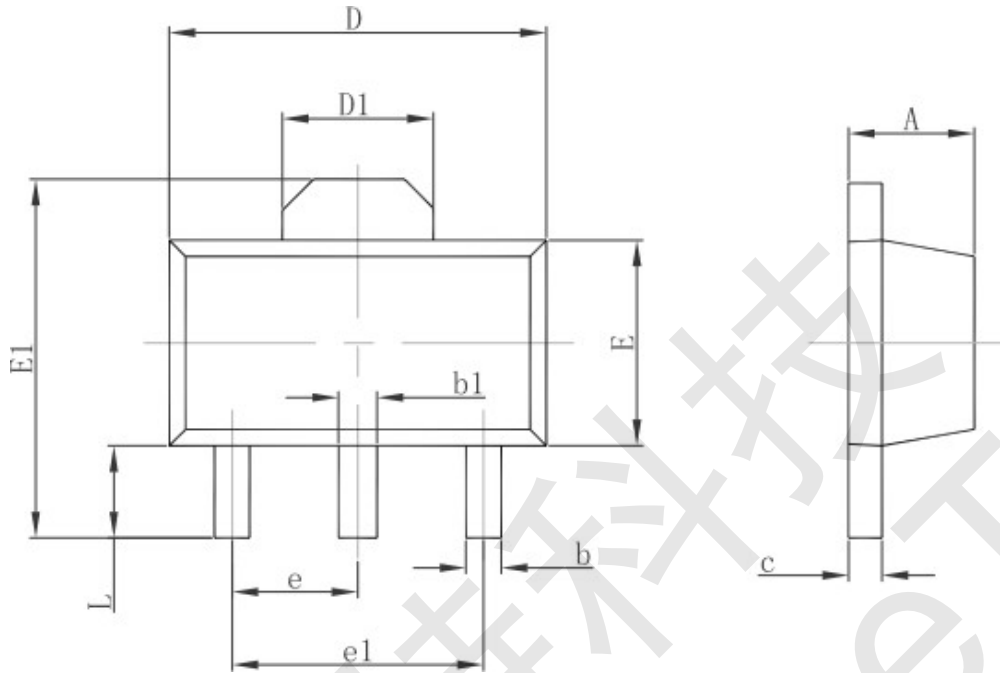
| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.050                     | 1.250 | 0.041                | 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     | 1.800                     | 2.000 | 0.071                | 0.079 |
| L      | 0.300                     | 0.600 | 0.012                | 0.024 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |



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CST9001 Packaging Information

SOT89-3L



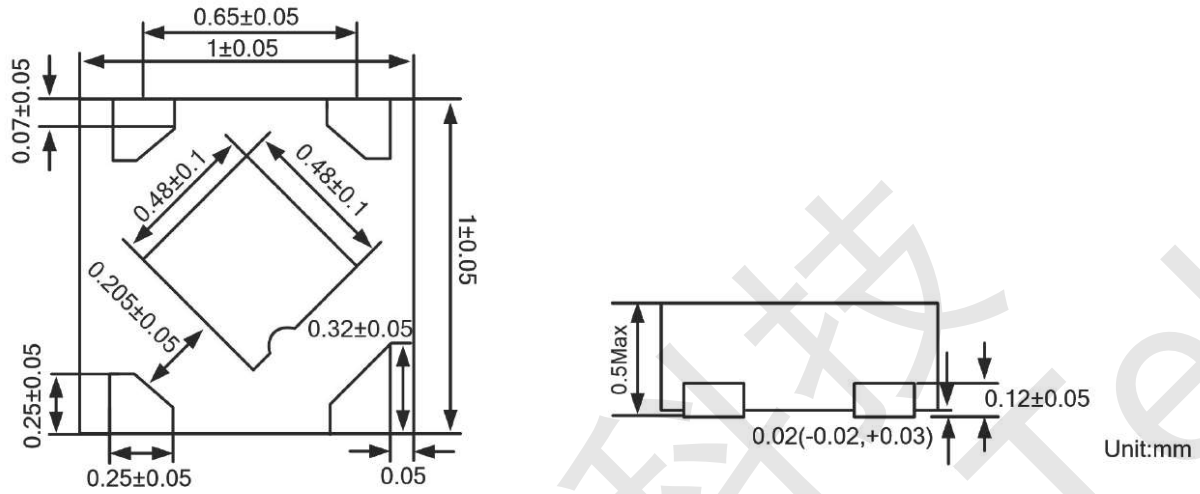
| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 1.400                     | 1.600 | 0.055                | 0.063 |
| b      | 0.320                     | 0.520 | 0.013                | 0.020 |
| b1     | 0.400                     | 0.580 | 0.016                | 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.           |       |
| E      | 2.300                     | 2.600 | 0.091                | 0.102 |
| E1     | 3.940                     | 4.250 | 0.155                | 0.167 |
| e      | 1.500 TYP.                |       | 0.060 TYP.           |       |
| e1     | 3.000 TYP.                |       | 0.118 TYP.           |       |
| L      | 0.900                     | 1.200 | 0.035                | 0.047 |



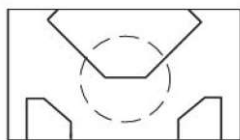
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CST9001 Packaging Information

DFN1x1-4L



Detail A: (PIN1 shape)



Unit:mm