

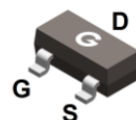
### Features

- Low on-resistance
- High-speed switching
- HBM: AEC-Q101-001: H2 (JESD22-A114-B: 2)
- RoHS compliant with Halogen-free
- Qualified to AEC-Q101 Standards

HF

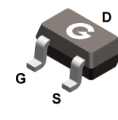
### Mechanical Data

- Case: SOT-23, SOT-323, SOT-23-3L
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte Tin-Plated Leads, Solderability-per MIL-STD-202, Method 208



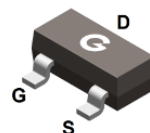
TBSS123

SOT-23



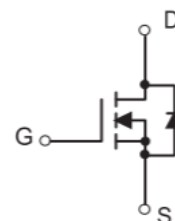
TBSS123W

SOT-323



TBSS123-3L

SOT-23-3L



### Ordering Information

| Part Number | Package   | Shipping Quantity      | Marking Code |
|-------------|-----------|------------------------|--------------|
| TBSS123     | SOT-23    | 3000 pcs / Tape & Reel | B123         |
| TBSS123W    | SOT-323   | 3000 pcs / Tape & Reel | B123         |
| TBSS123-3L  | SOT-23-3L | 3000 pcs / Tape & Reel | B123         |

### Maximum Ratings (@ T<sub>A</sub> = 25°C unless otherwise specified)

| Parameter                                                           | Symbol           | Value      | Unit |
|---------------------------------------------------------------------|------------------|------------|------|
| Drain-to-Source Voltage                                             | V <sub>DSS</sub> | 100        | V    |
| Gate-to-Source Voltage                                              | V <sub>GSS</sub> | ±20        | V    |
| Continuous Drain Current (T <sub>A</sub> = 25°C) *1                 | I <sub>D</sub>   | 170        | mA   |
| Continuous Drain Current (T <sub>A</sub> = 70°C) *1                 |                  | 135        | mA   |
| Pulsed Drain Current (t <sub>p</sub> = 10μs, T <sub>A</sub> = 25°C) | I <sub>DM</sub>  | 680        | mA   |
| Single Pulse Avalanche Energy *3                                    | E <sub>AS</sub>  | 0.1        | mJ   |
| Power Dissipation (T <sub>A</sub> = 25°C, SOT-23, SOT-23-3L) *1     | P <sub>D</sub>   | 0.35       | W    |
| Power Dissipation (T <sub>A</sub> = 25°C, SOT-323) *1               |                  | 0.2        | W    |
| Operating Junction Temperature Range                                | T <sub>J</sub>   | -55 ~ +150 | °C   |
| Storage Temperature Range                                           | T <sub>STG</sub> | -55 ~ +150 | °C   |

### Thermal Characteristics

| Parameter                                                 | Symbol           | Min. | Typ. | Max. | Unit |
|-----------------------------------------------------------|------------------|------|------|------|------|
| Thermal Resistance Junction-to-Case (SOT-23, SOT-23-3L)   | R <sub>θJC</sub> | -    | 190  | 200  | °C/W |
| Thermal Resistance Junction-to-Case (SOT-323)             |                  | -    | -    | 300  | °C/W |
| Thermal Resistance Junction-to-Air (SOT-23, SOT-23-3L) *1 | R <sub>θJA</sub> | -    | 330  | 357  | °C/W |
| Thermal Resistance Junction-to-Air (SOT-323) *1           |                  | -    | -    | 625  | °C/W |

### Electrical Characteristics (@ $T_A = 25^\circ\text{C}$ unless otherwise specified)

| Symbol                             | Parameter                                 | Test Condition                                                                                   | Min. | Typ. | Max. | Unit |
|------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------------------|------|------|------|------|
| Static Characteristics             |                                           |                                                                                                  |      |      |      |      |
| V <sub>DSS</sub>                   | Drain-Source Breakdown Voltage            | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                                                     | 100  | -    | -    | V    |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 100V, V <sub>GS</sub> = 0V                                                     | -    | -    | 1    | μA   |
|                                    |                                           | V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V                                                      | -    | -    | 10   | nA   |
| I <sub>GSS</sub>                   | Gate-Body Leakage Current                 | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V                                                     | -    | -    | ±1   | μA   |
| On Characteristics                 |                                           |                                                                                                  |      |      |      |      |
| R <sub>DS(ON)</sub>                | Drain-Source On-resistance *2             | V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.17A                                                    | -    | 3.5  | 6    | Ω    |
|                                    |                                           | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 0.17A                                                   | -    | 4.3  | 10   |      |
| V <sub>GS(TH)</sub>                | Gate Threshold Voltage                    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                       | 1    | 1.9  | 2.8  | V    |
| R <sub>G</sub>                     | Gate Resistance                           | V <sub>GS</sub> = 0V, f = 1MHz                                                                   | -    | 41   | -    | Ω    |
| Dynamic Characteristics            |                                           |                                                                                                  |      |      |      |      |
| C <sub>ISS</sub>                   | Input Capacitance                         | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 20V<br>f = 1.0MHz                                      | -    | 37   | -    | pF   |
| C <sub>OSS</sub>                   | Output Capacitance                        |                                                                                                  | -    | 5    | -    |      |
| C <sub>RSS</sub>                   | Reverse Transfer Capacitance              |                                                                                                  | -    | 2    | -    |      |
| Switching Characteristics          |                                           |                                                                                                  |      |      |      |      |
| t <sub>d(on)</sub>                 | Turn-on Delay Time *4                     | V <sub>DD</sub> = 30V<br>V <sub>GS</sub> = 10V<br>I <sub>D</sub> = 0.28A<br>R <sub>G</sub> = 50Ω | -    | 8    | -    | ns   |
| t <sub>r</sub>                     | Turn-on Rise Time *4                      |                                                                                                  | -    | 8    | -    |      |
| t <sub>d(off)</sub>                | Turn-Off Delay Time *4                    |                                                                                                  | -    | 13   | -    |      |
| t <sub>f</sub>                     | Turn-Off Fall Time *4                     |                                                                                                  | -    | 16   | -    |      |
| Q <sub>G</sub>                     | Total Gate-Charge(V <sub>GS</sub> = 10V)  | V <sub>DD</sub> = 80V<br>V <sub>GS</sub> = 4.5V<br>I <sub>D</sub> = 0.2A                         | -    | 4    | -    | nC   |
|                                    | Total Gate-Charge(V <sub>GS</sub> = 4.5V) |                                                                                                  | -    | 2    | -    |      |
| Q <sub>GS</sub>                    | Gate to Source Charge                     |                                                                                                  | -    | 1.2  | -    |      |
| Q <sub>GD</sub>                    | Gate to Drain (Miller) Charge             |                                                                                                  | -    | 0.45 | -    |      |
| Source-Drain Diode Characteristics |                                           |                                                                                                  |      |      |      |      |
| V <sub>SD</sub>                    | Diode Forward Voltage *2                  | I <sub>S</sub> = 0.3A, V <sub>GS</sub> = 0V                                                      | -    | 0.88 | 1.3  | V    |

Notes:

- The data tested by surface mounted on a minimum recommended FR-4 board
- The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
- The  $E_{AS}$  data shows Max. rating. The test condition is  $V_{DD} = 50V, V_{GS} = 10V, L = 0.1mH$
- Guaranteed by design, not subject to production

Ratings and Characteristic Curves (@  $T_A = 25^\circ\text{C}$  unless otherwise specified)

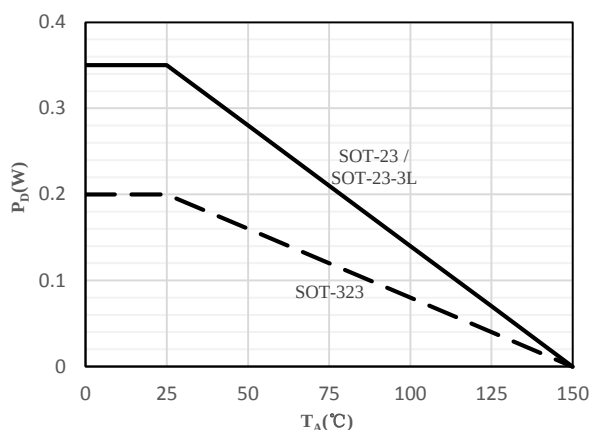


Fig 1 Power Dissipation

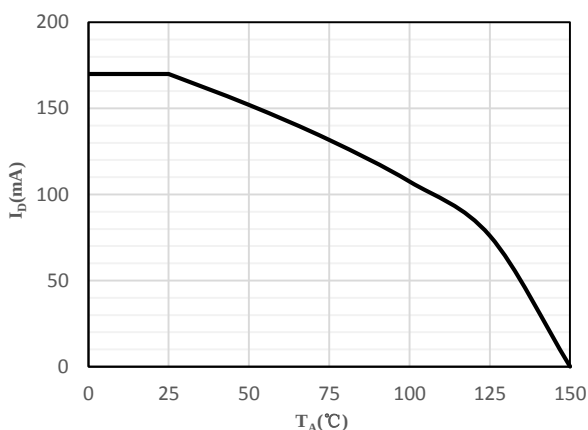


Fig 2 Drain Current

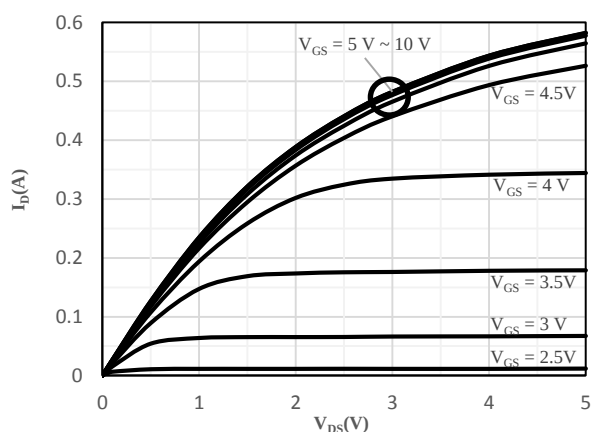


Fig 3 Typical Output Characteristics

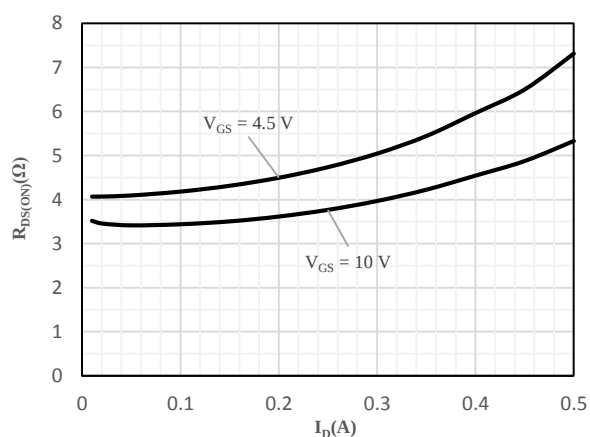


Fig 4 On-Resistance vs. Drain Current  
and Gate Voltage

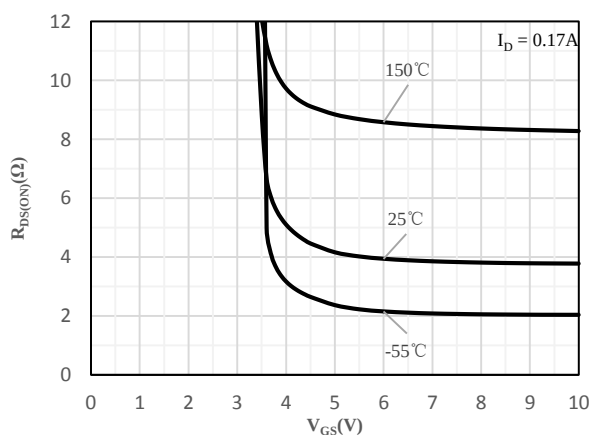


Fig 5 On-Resistance vs. Gate-Source Voltage

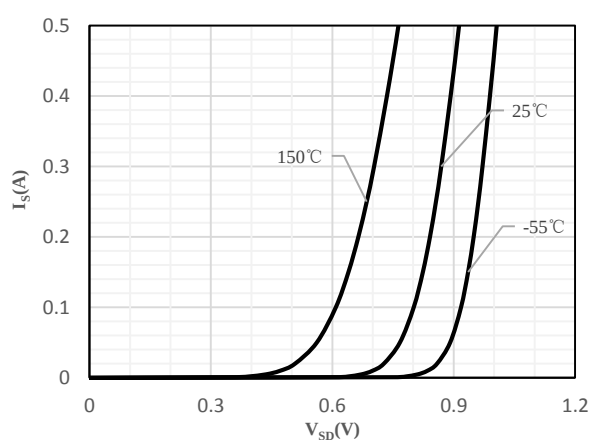


Fig 6 Body-Diode Characteristics

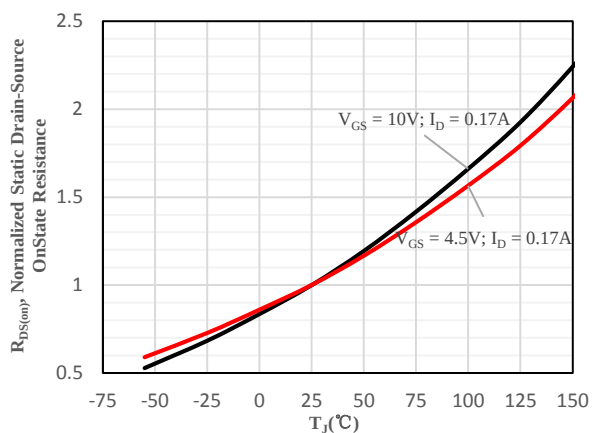


Fig 7 Normalized On-Resistance vs. Junction Temperature

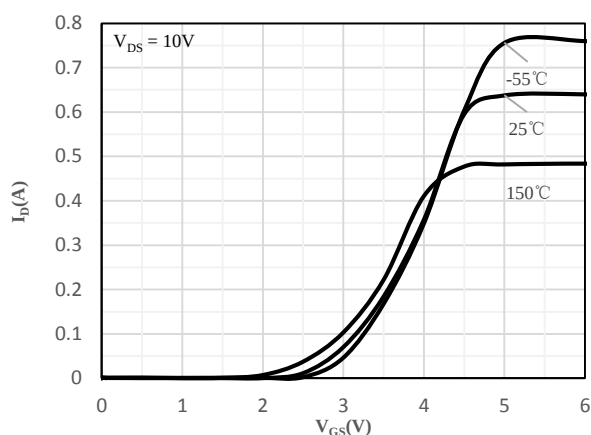


Fig 8 Transfer Characteristics

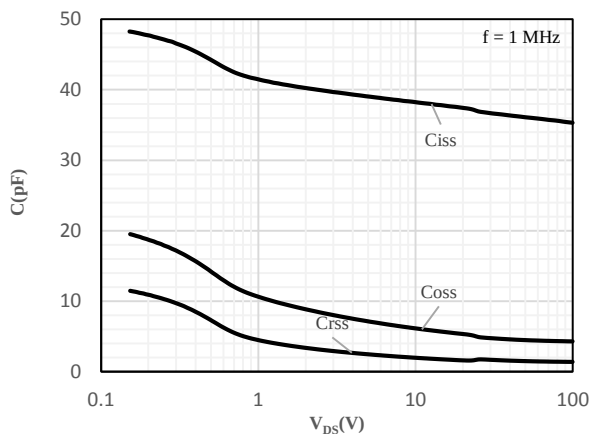


Fig 9 Capacitance Characteristics

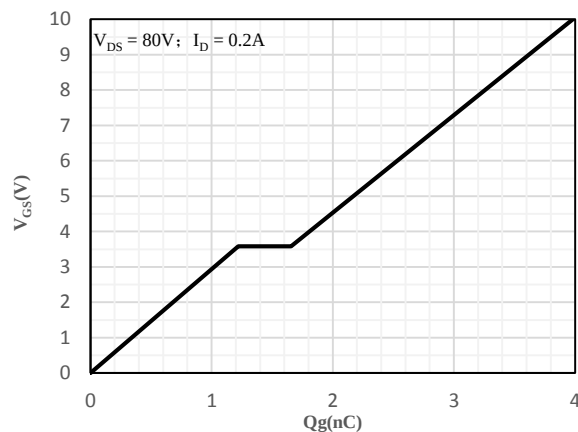


Fig 10 Gate-Charge Characteristics

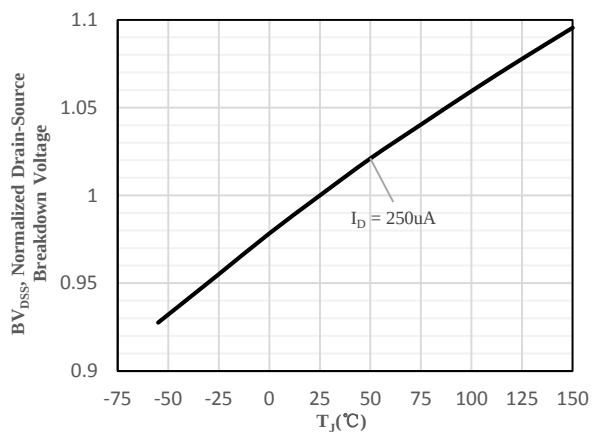


Fig 11 Normalized Breakdown Voltage vs. Junction Temperature

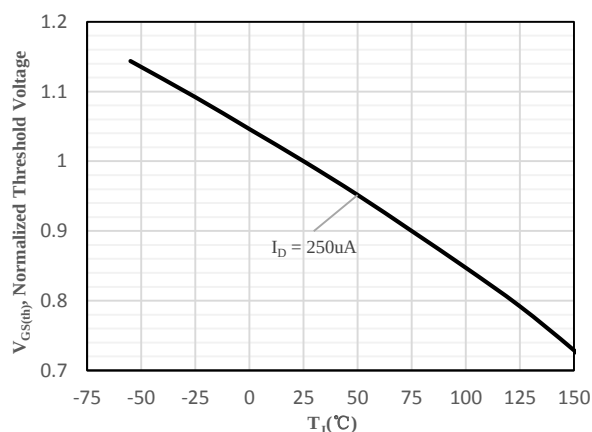
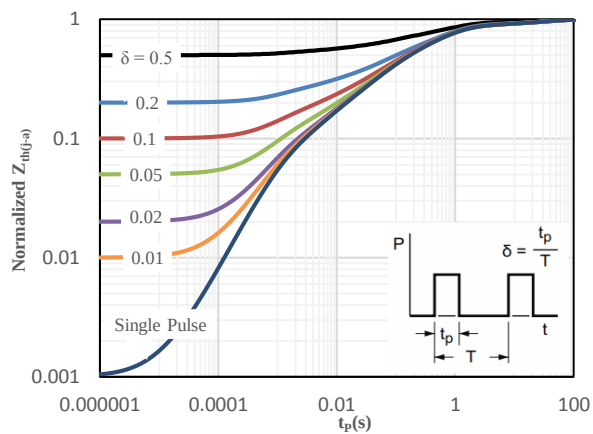
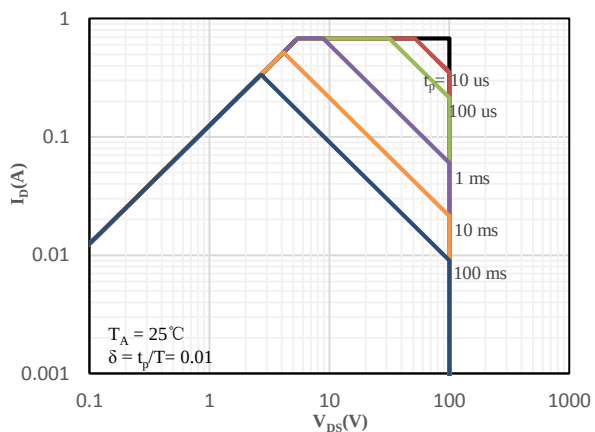
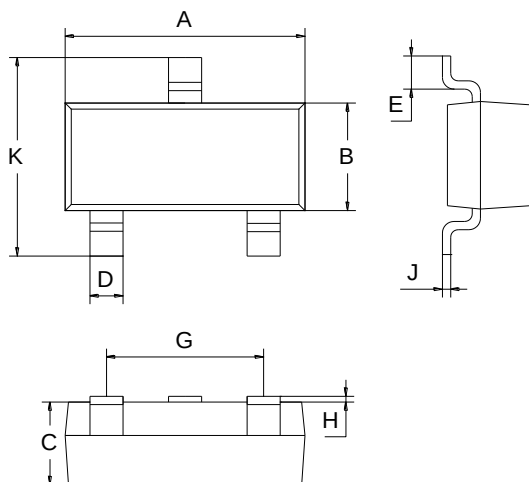


Fig 12 Normalized  $V_{GS(th)}$  vs. Junction Temperature



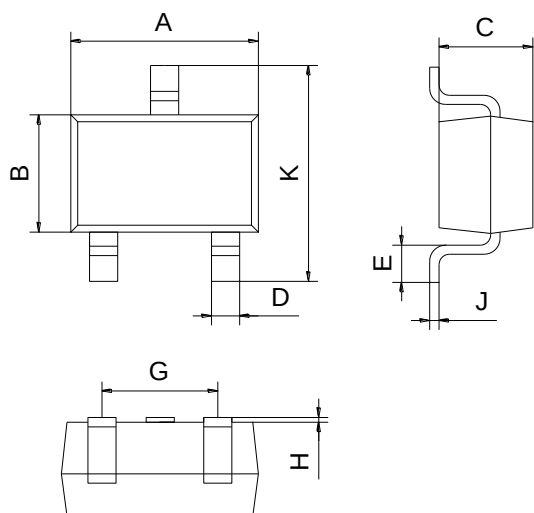
Package Outline Dimensions (Unit: mm)

SOT-23



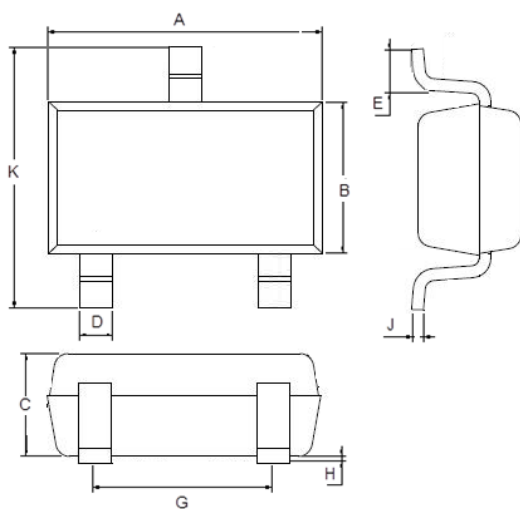
| SOT-23    |      |      |
|-----------|------|------|
| Dimension | Min. | Max. |
| A         | 2.70 | 3.10 |
| B         | 1.10 | 1.50 |
| C         | 0.90 | 1.10 |
| D         | 0.30 | 0.50 |
| E         | 0.35 | 0.48 |
| G         | 1.80 | 2.00 |
| H         | 0.02 | 0.10 |
| J         | 0.05 | 0.15 |
| K         | 2.20 | 2.60 |

SOT-323



| SOT-323   |      |      |
|-----------|------|------|
| Dimension | Min. | Max. |
| A         | 2.00 | 2.20 |
| B         | 1.15 | 1.35 |
| C         | 0.90 | 1.10 |
| D         | 0.15 | 0.35 |
| E         | 0.25 | 0.40 |
| G         | 1.20 | 1.40 |
| H         | 0.02 | 0.10 |
| J         | 0.05 | 0.15 |
| K         | 2.20 | 2.40 |

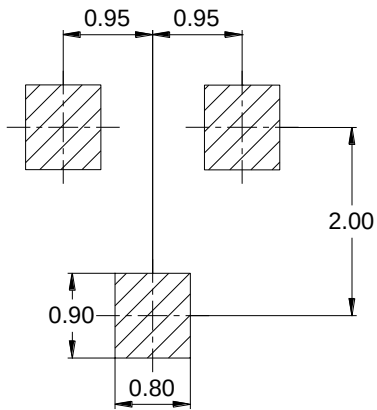
SOT-23-3L



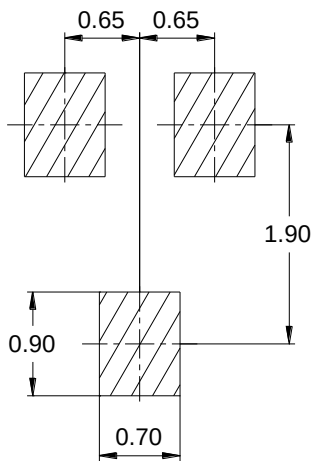
| SOT-23-3L |      |      |
|-----------|------|------|
| Dimension | Min. | Max. |
| A         | 2.80 | 3.00 |
| B         | 1.50 | 1.70 |
| C         | 1.00 | 1.20 |
| D         | 0.35 | 0.45 |
| E         | 0.35 | 0.55 |
| G         | 1.80 | 2.00 |
| H         | 0.02 | 0.10 |
| J         | 0.10 | 0.20 |
| K         | 2.60 | 3.00 |

**Mounting Pad Layout** (Unit: mm)

**SOT-23**



**SOT-323**



**SOT-23-3L**

