

## Product Summary

|                                |         |
|--------------------------------|---------|
| $V_R$                          | 1200V   |
| $I_{F(135/151^\circ\text{C})}$ | 17A/12A |
| $Q_C$                          | 72nC    |

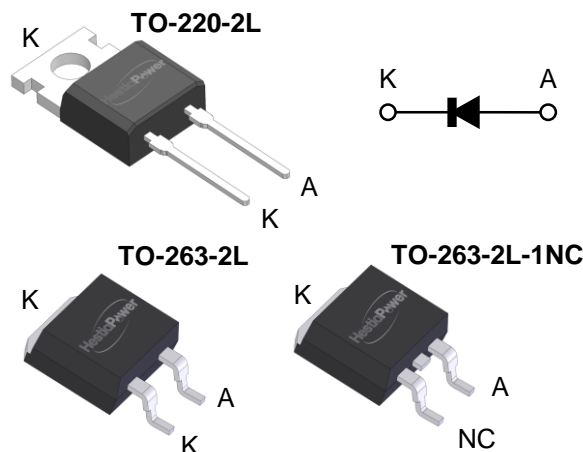


# H3S120A012, H3S120T012, H3S120U012

## Features

- Low Conduction and Switching Loss
- Zero Reverse Recovery
- Temperature Independent Switching Behavior
- Positive Temperature Coefficient Device
- High Surge Current Capability
- RoHS Compliant and Halogen Free
- Optimized for High Power Application

## Circuit Diagram



## Benefits

- Higher System Efficiency
- Increase Parallel Device Convenience
- Enable High Temperature Application
- Allow High Frequency Operation
- Realize Compact and Lightweight Systems
- High Reliability

## Applications

- Switching Mode Power Supply
- PFC
- UPS
- Motor Drives
- Flywheel diode in Power Inverters
- Solar/Wind Renewable Energy

| Part Number | Package       | Marking    |
|-------------|---------------|------------|
| H3S120A012  | TO-220-2L     | H3S120A012 |
| H3S120T012  | TO-263-2L     | H3S120T012 |
| H3S120U012  | TO-263-2L-1NC | H3S120U012 |

## Absolute Maximum Ratings ( $T_C = 25^\circ\text{C}$ unless otherwise specified)

| Parameter                                 | Symbol         | Test Conditions   | Value      | Unit                 |
|---|----------------|---|------------|----------------------|
| Peak Repetitive Reverse Voltage           | $V_{RRM}$      | $I_R = 100 \mu\text{A}$   | 1200       | V                    |
| Peak Reverse Surge Voltage                | $V_{RSM}$      | $T_J = 25^\circ\text{C}$  | 1200       | V                    |
| DC Blocking Voltage                       | $V_R$          | $T_J = 25^\circ\text{C}$  | 1200       | V                    |
| Continuous Forward Current                | $I_F$          | $T_C = 25^\circ\text{C}$  | 35         | A                    |
|   |                | $T_C = 135^\circ\text{C}$   | 17         |                      |
|   |                | $T_C = 151^\circ\text{C}$   | 12         |                      |
| Non-Repetitive Peak Forward Surge Current | $I_{FSM}$      | $T_C = 25^\circ\text{C}, T_p = 10 \text{ ms}, \text{Half Sine Wave}$        | 127        | A                    |
|   |                | $T_C = 125^\circ\text{C}, T_p = 10 \text{ ms}, \text{Half Sine Wave}$       | 118        |                      |
|   |                | $T_C = 25^\circ\text{C}, T_p = 10 \mu\text{s}, \text{Pulse}$                | 1136       |                      |
| Repetitive Peak Forward Surge Current     | $I_{FRM}$      | $T_C = 25^\circ\text{C}, T_p = 10 \text{ ms}$<br>Half Sine Wave, $D = 0.1$  | 94         | A                    |
|   |                | $T_C = 125^\circ\text{C}, T_p = 10 \text{ ms}$<br>Half Sine Wave, $D = 0.1$ | 81         |                      |
| Power Dissipation                         | $P_D$          | $T_C = 25^\circ\text{C}$  | 150        | W                    |
|   |                | $T_C = 125^\circ\text{C}$   | 50         |                      |
| $I^2t$ value                              | $\int i^2 dt$  | $T_C = 25^\circ\text{C}, T_p = 10 \text{ ms}$                               | 81         | $\text{A}^2\text{s}$ |
| Junction & Storage Temperature            | $T_J, T_{stg}$ |   | -55 to 175 | $^\circ\text{C}$     |
| Soldering Temperature                     | $T_L$          |   | 260        |                      |
| Mounting Torque                           | $M_D$          | M3 or 6-32 screw  | 1.0        | Nm                   |

## Electrical Characteristics (T<sub>c</sub> = 25°C unless otherwise specified)

| Parameter                 | Symbol          | Test Conditions   | Min.   | Typ. | Max. | Unit |
|---------------------------|-----------------|---|--------|------|------|------|
| DC Blocking Voltage       | V <sub>DC</sub> | I <sub>R</sub> = 100 μA, T <sub>J</sub> = 25°C          | > 1200 |      |      | V    |
| Forward Voltage           | V <sub>F</sub>  | I <sub>F</sub> = 12A, T <sub>J</sub> = 25°C             |        | 1.42 | 1.7  | V    |
|                           |                 | I <sub>F</sub> = 12A, T <sub>J</sub> = 175°C            |        | 1.9  | 2.2  | V    |
| Reverse Current           | I <sub>R</sub>  | V <sub>R</sub> = 1200V, T <sub>J</sub> = 25°C           |        | 6    | 240  | μA   |
|                           |                 | V <sub>R</sub> = 1200V, T <sub>J</sub> = 175°C          |        | 36   | 1000 | μA   |
| Total Capacitive Charge   | Q <sub>C</sub>  | V <sub>R</sub> = 800V, T <sub>J</sub> = 25°C            |        | 72   |      | nC   |
| Total Capacitance         | C <sub>J</sub>  | V <sub>R</sub> = 0.1V, T <sub>J</sub> = 25°C, f = 1 MHz |        | 1016 |      |      |
|                           |                 | V <sub>R</sub> = 400V, T <sub>J</sub> = 25°C, f = 1 MHz |        | 71   |      | pF   |
|                           |                 | V <sub>R</sub> = 800V, T <sub>J</sub> = 25°C, f = 1 MHz |        | 53   |      |      |
| Capacitance Stored Energy | E <sub>C</sub>  | V <sub>R</sub> = 800V                                   |        | 27   |      | μJ   |

## Thermal Resistance

| Parameter                               | Symbol           | Min. | Typ. | Max. | Unit |
|---|------------------|------|------|------|------|
| Thermal Resistance, Junction to Case    | R <sub>θJC</sub> |      | 1.0  |      | °C/W |
| Thermal Resistance, Junction to Ambient | R <sub>θJA</sub> |      |      |      | °C/W |

## Naming Rule

**H3 S 120 A 012**

### Generation

H3 = 3<sup>rd</sup> Gen Discrete

### Device Type

S = JBS diode (High Power)     D = JBS diode (High Speed)

### Breakdown Voltage

065 = 650V     120 = 1200V     170 = 1700V

### Package

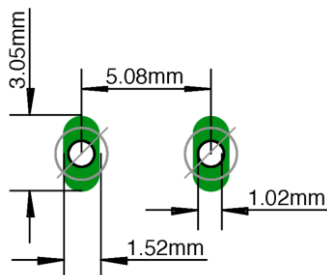
A = TO-220-2L     T = TO-263-2L     U = TO-263-2L-1NC

### Typical Current Rating

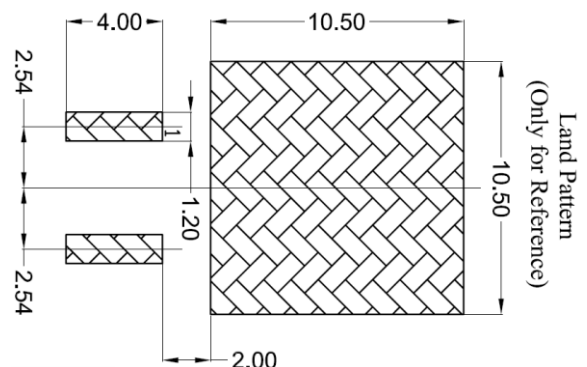
002 = 2A     005 = 5A     008 = 8A     010 = 10A     012 = 12A     020 = 20A

## Recommended Solder Pad Layout

### TO-220-2L



### TO-263-2L, TO-263-2L-1NC



Land Pattern  
(Only for Reference)

## Typical Device Performance

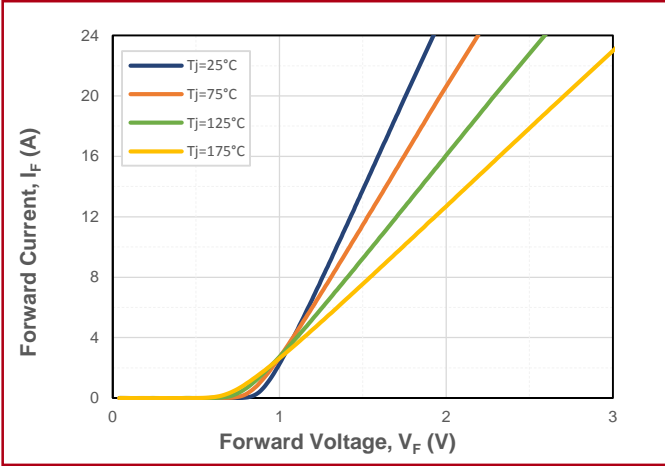


Fig.1 Forward Characteristics

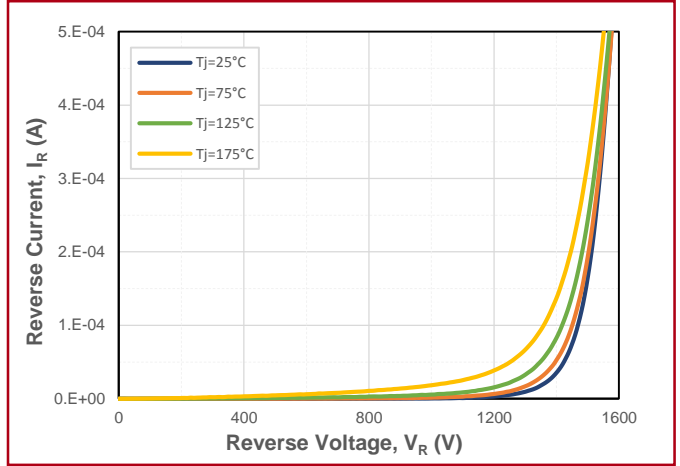


Fig.2 Reverse Characteristics

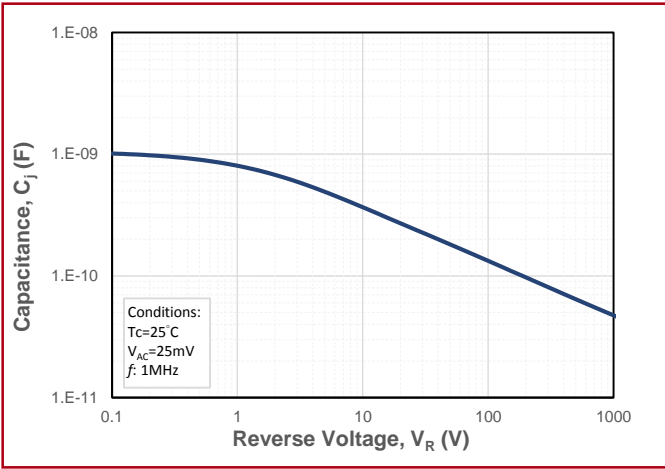


Fig.3 Junction Capacitance vs. Reverse Voltage

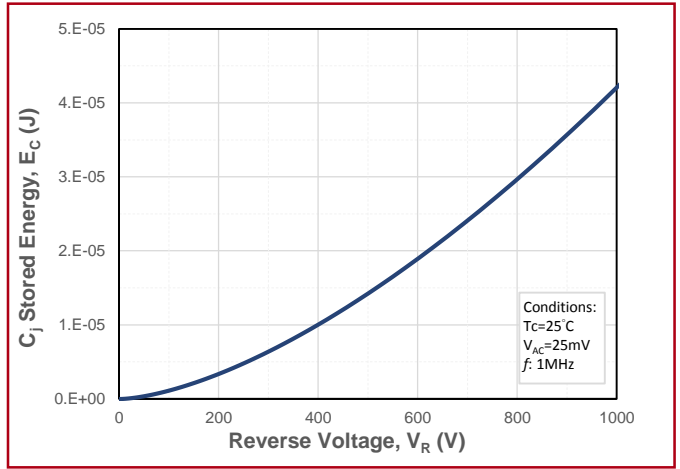


Fig.4 Capacitance Stored Energy

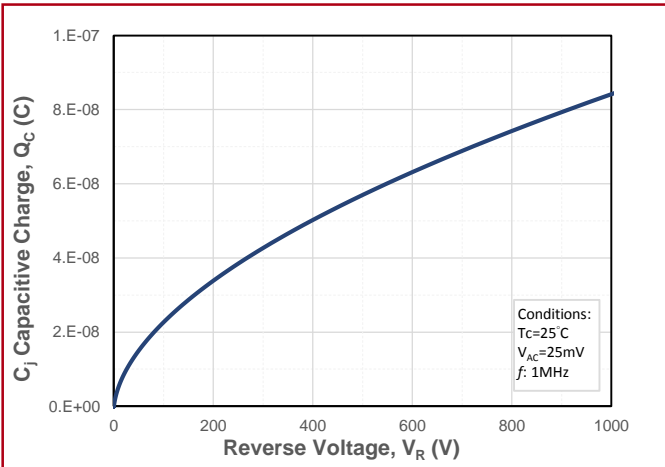


Fig.5 Recovery Charge vs. Reverse Voltage

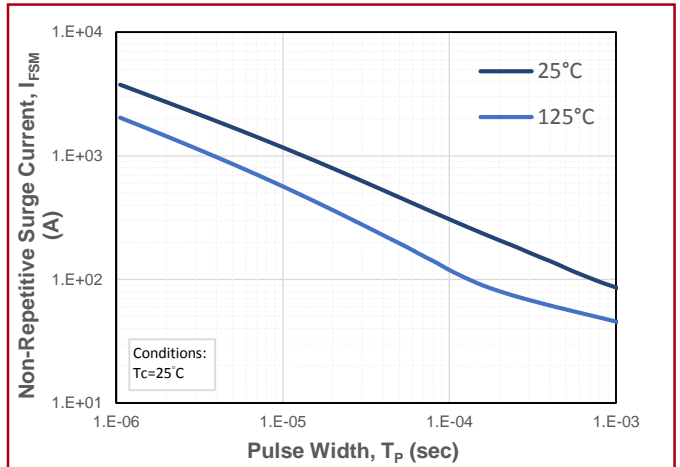
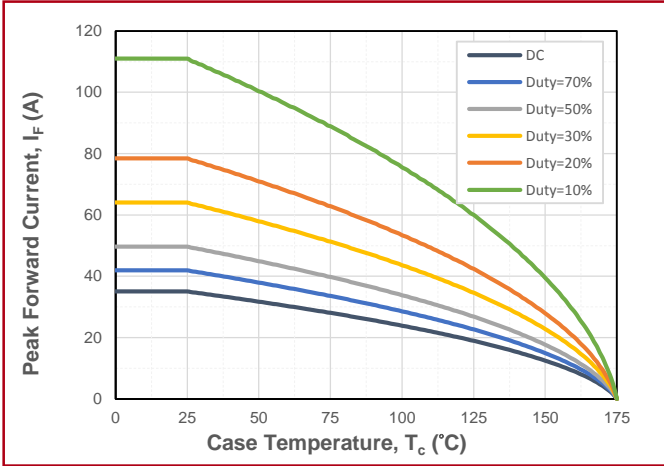
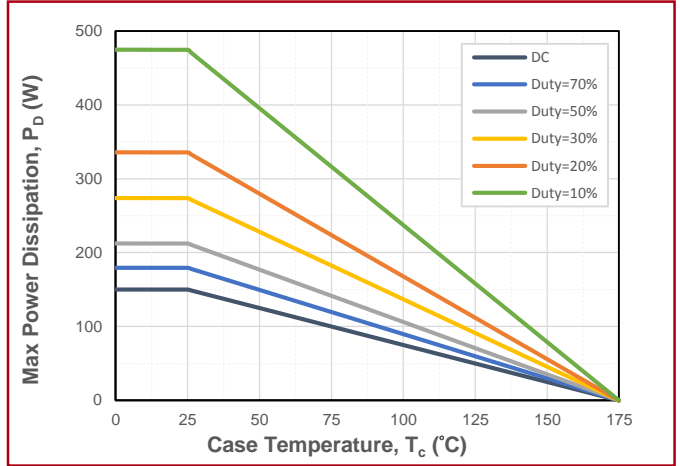


Fig.6 Non-Repetitive Peak Forward Surge Current (Pulse Mode)

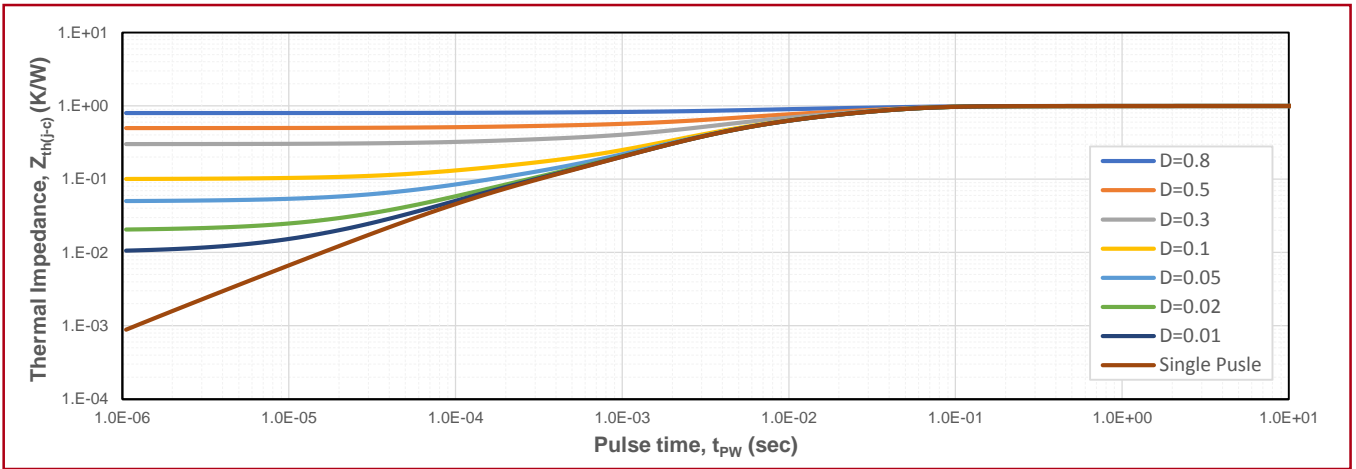
### Typical Device Performance



**Fig.7 Maximum Forward Current Derating vs. Case Temperature**



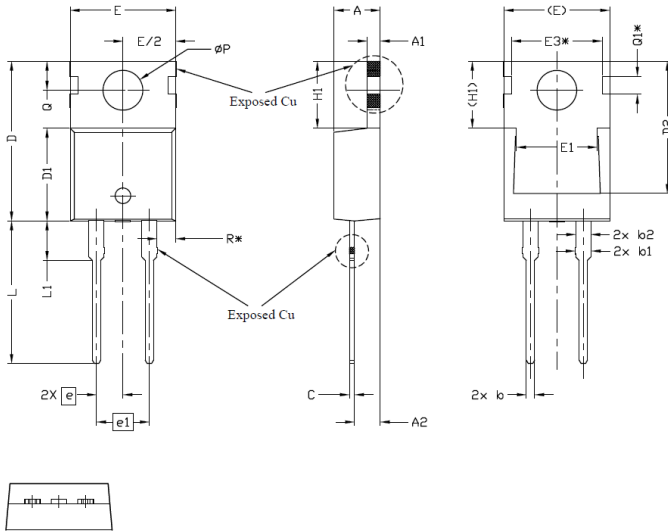
**Fig.8 Maximum Power Dissipation Derating vs. Case Temperature**



**Fig.9 Transient Junction to Case Thermal Impedance**

The information provided herein is subject to change without notice.

## Package Dimensions (TO-220-2L)

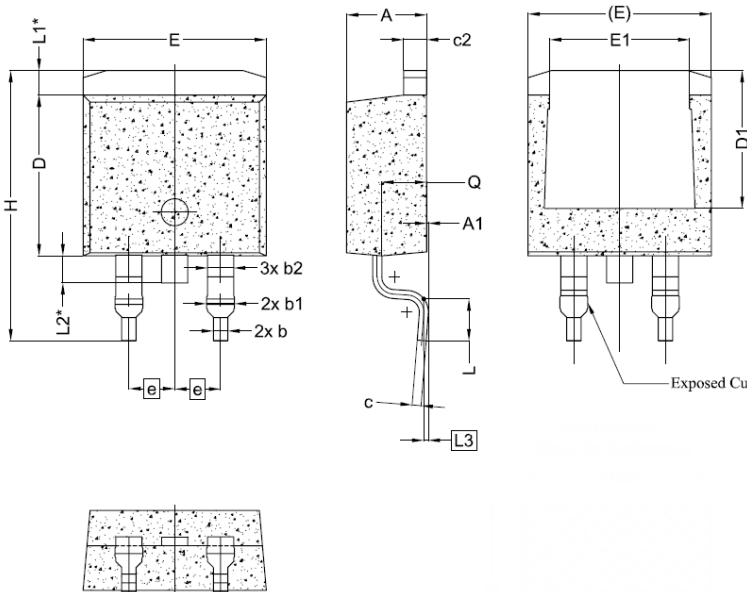


**Note:**

1. Package Reference: JEDEC TO220, Variation AB.
2. All Dimensions Are In mm.
3. Slot Required. Notch May Be Rounded
4. Dimension D & E Do Not Include Mold Flash. Mold Flash Shall Not Exceed 0.127mm Pre Side. These Dimensions Are Measured At The Outermost Extreme Of The Plastic Body.
5. Thermal Pad Contour Optional Within Dimensions E, H1, D2 & E1.
6. Dimension E2 & H1 Define A Zone Where Stamping And Singulation Irregularities Are Allowed.
7. "\*" is reference.

| Symbol | mm        |       |       |
|--------|-----------|-------|-------|
|        | Min.      | Typ.  | Max.  |
| A      | 4.24      | 4.44  | 4.64  |
| A1     | 1.15      | 1.27  | 1.40  |
| A2     | 2.30      | 2.48  | 2.70  |
| b      | 0.70      | 0.80  | 0.90  |
| b1     | 1.20      | 1.55  | 1.75  |
| b2     | 1.20      | 1.45  | 1.70  |
| c      | 0.40      | 0.50  | 0.60  |
| D      | 14.70     | 15.37 | 16.00 |
| D1     | 8.82      | 8.92  | 9.02  |
| D2     | 12.63     | 12.73 | 12.83 |
| E      | 9.96      | 10.16 | 10.36 |
| E1     | 6.86      | 7.77  | 8.89  |
| E3*    | 8.70 REF. |       |       |
| e      | 2.54 BSC  |       |       |
| e1     | 5.08 BSC  |       |       |
| H1     | 6.30      | 6.45  | 6.60  |
| L      | 13.47     | 13.72 | 13.97 |
| L1     | 3.60      | 3.80  | 4.00  |
| phi P  | 3.75      | 3.84  | 3.93  |
| Q      | 2.60      | 2.80  | 3.00  |
| Q1*    | 1.73 REF. |       |       |
| R*     | 1.82 REF. |       |       |

## Package Dimensions (TO-263-2L, TO-263-2L-1NC)



| Symbol | mm   |       |       |
|--------|--|-------|-------|
|        | Min.   | Typ.  | Max.  |
| A      | 4.24   | 4.44  | 4.64  |
| A1     | 0.00   | 0.10  | 0.25  |
| b      | 0.70   | 0.80  | 0.90  |
| b1     | 1.20   | 1.55  | 1.75  |
| b2     | 1.20   | 1.45  | 1.70  |
| c      | 0.40   | 0.50  | 0.60  |
| c2     | 1.15   | 1.27  | 1.40  |
| D      | 8.82   | 8.92  | 9.02  |
| D1     | 6.86   | 7.65  | ---   |
| E      | 9.96   | 10.16 | 10.36 |
| E1     | 6.89   | 7.77  | 7.89  |
| e      | 2.54 BSC   |       |       |
| e1     | 5.08 BSC   |       |       |
| H      | 14.61  | 15.00 | 15.88 |
| L      | 1.78   | 2.32  | 2.79  |
| L1     | 1.36 REF.  |       |       |
| L2     | 0.00 REF. (TO-263-2L)<br>1.50 REF. (TO-263-2L-1NC) |       |       |
| L3     | 0.25 BSC   |       |       |
| Q      | 2.30   | 2.48  | 2.70  |

**Note:**

1. All Dimensions Are In mm.
2. Dimension D & E Do Not Include Mold Flash. Mold Flash Shall Not Exceed 0.127mm Pre Side. These Dimensions Are Measured At The Outermost Extreme Of The Plastic Body.
3. Thermal Pad Contour Optional Within Dimensions E, L1, D1 & E1.
4. Dimension D1 & E1 Establish A Minmum Mounting Surface for The Thermal Pad.
5. "\*" is reference.