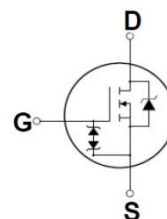
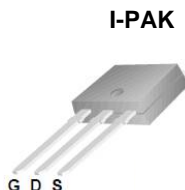


## Features

- Low gate charge
- 100% avalanche tested
- Improved dv/dt capability
- RoHS compliant
- Halogen free package
- JEDEC Qualification
- Improved ESD performance

N-channel MOSFET

|            |       |                |
|------------|-------|----------------|
| $BV_{DSS}$ | $I_D$ | $R_{DS(on)}$   |
| 600V       | 4.0A  | < 2.5 $\Omega$ |



| Device                  | Package     | Marking                 | Remark       |
|-------------------------|-------------|-------------------------|--------------|
| TMD4N60AZ / TMU4N60AZ   | D-PAK/I-PAK | TMD4N60AZ / TMU4N60AZ   | RoHS         |
| TMD4N60AZG / TMU4N60AZG | D-PAK/I-PAK | TMD4N60AZG / TMU4N60AZG | Halogen Free |

## Absolute Maximum Ratings

| Parameter   | Symbol         | TMD4N60AZ(G)/TMU4N60AZ(G)         | Unit             |
|---|----------------|-----------------------------------|------------------|
| Drain-Source Voltage  | $V_{DSS}$      | 600                               | V                |
| Gate-Source Voltage   | $V_{GS}$       | $\pm 30$                          | V                |
| Continuous Drain Current  | $I_D$          | $T_C = 25\text{ }^\circ\text{C}$  | 4                |
|   |                | $T_C = 100\text{ }^\circ\text{C}$ | 2.34             |
| Pulsed Drain Current (Note 1)   | $I_{DM}$       | 16                                | A                |
| Single Pulse Avalanche Energy (Note 2)  | $E_{AS}$       | 192                               | mJ               |
| Repetitive Avalanche Current (Note 1)   | $I_{AR}$       | 4                                 | A                |
| Repetitive Avalanche Energy (Note 1)  | $E_{AR}$       | 8.62                              | mJ               |
| Power Dissipation   | $P_D$          | $T_C = 25\text{ }^\circ\text{C}$  | 86.2             |
|   |                | Derate above 25 $^\circ\text{C}$  | 0.68             |
| Peak Diode Recovery dv/dt (Note 3)  | dv/dt          | 4.5                               | V/ns             |
| Operating Junction and Storage Temperature Range                              | $T_J, T_{STG}$ | -55~150                           | $^\circ\text{C}$ |
| Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | $T_L$          | 300                               | $^\circ\text{C}$ |

\* Limited only by maximum junction temperature

## Thermal Characteristics

| Parameter                                       | Symbol          | TMD4N60AZ(G)/TMU4N60AZ(G) | Unit                      |
|---|-----------------|---------------------------|---------------------------|
| Maximum Thermal resistance, Junction-to-Case    | $R_{\theta JC}$ | 1.45                      | $^\circ\text{C}/\text{W}$ |
| Maximum Thermal resistance, Junction-to-Ambient | $R_{\theta JA}$ | 110                       | $^\circ\text{C}/\text{W}$ |

**Electrical Characteristics :  $T_C=25^\circ\text{C}$ , unless otherwise noted**

| Parameter                           | Symbol     | Test condition                                   | Min | Typ | Max  | Units         |
|-------------------------------------|------------|--|-----|-----|------|---------------|
| <b>OFF</b>                          |            |  |     |     |      |               |
| Drain-Source Breakdown Voltage      | $BV_{DSS}$ | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$    | 600 | --  | --   | V             |
| Zero Gate Voltage Drain Current     | $I_{DSS}$  | $V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$     | --  | --  | 1    | $\mu\text{A}$ |
|                                     |            | $V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$ | --  | --  | 10   | $\mu\text{A}$ |
| Forward Gate-Source Leakage Current | $I_{GSSF}$ | $V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$      | --  | --  | 100  | $\mu\text{A}$ |
| Reverse Gate-Source Leakage Current | $I_{GSSR}$ | $V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$     | --  | --  | -100 | $\mu\text{A}$ |

**ON**

|  |              |  |    |     |     |          |
|--|--------------|--|----|-----|-----|----------|
| Gate Threshold Voltage                       | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$  | 3  | --  | 5   | V        |
| Drain-Source On-Resistance                   | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 2.0\text{ A}$ | -- | 2.0 | 2.5 | $\Omega$ |
| Forward Transconductance <sup>(Note 4)</sup> | $g_{FS}$     | $V_{DS} = 30\text{ V}, I_D = 2.0\text{ A}$ | -- | 6   | --  | S        |

**DYNAMIC**

|                              |           |  |    |     |    |    |
|------------------------------|-----------|--|----|-----|----|----|
| Input Capacitance            | $C_{ISS}$ | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ | -- | 545 | -- | pF |
| Output Capacitance           | $C_{OSS}$ |  | -- | 61  | -- | pF |
| Reverse Transfer Capacitance | $C_{RSS}$ |  | -- | 10  | -- | pF |

**SWITCHING**

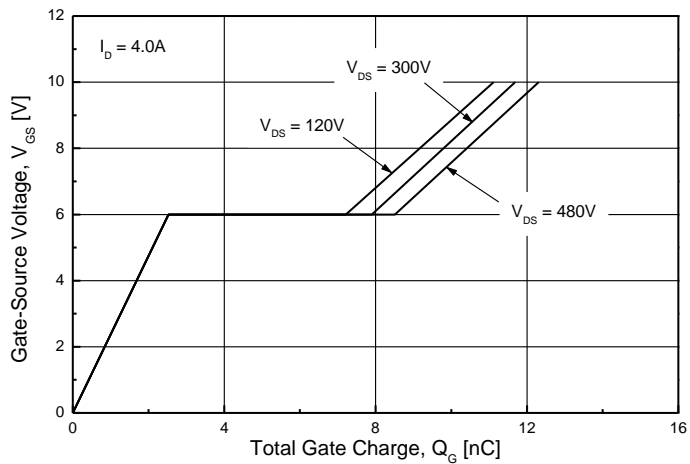
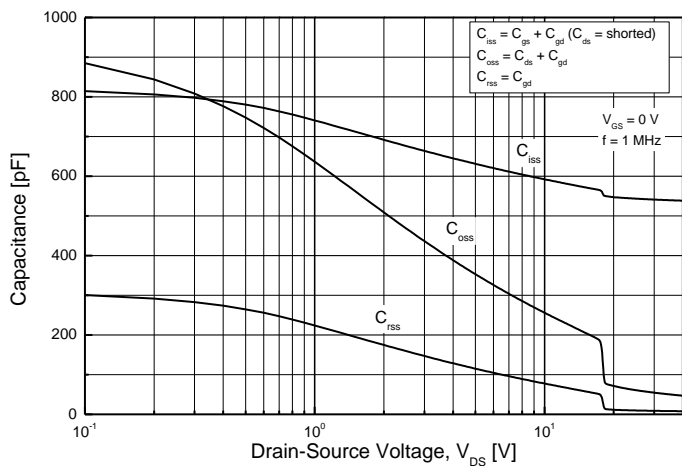
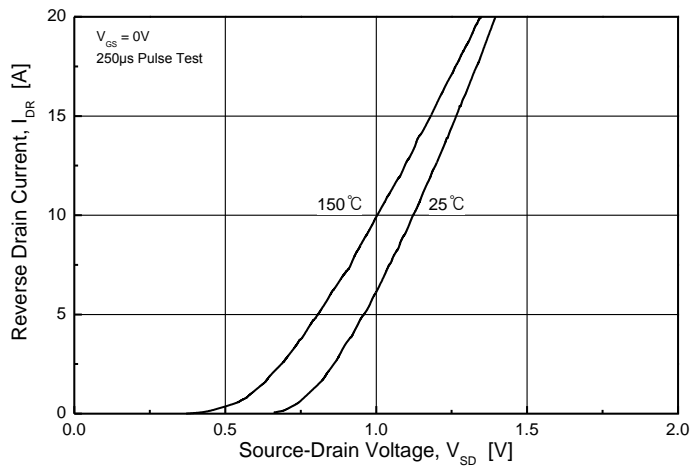
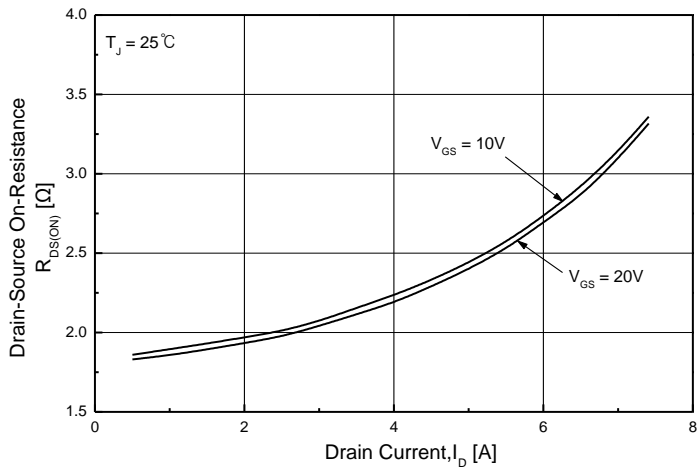
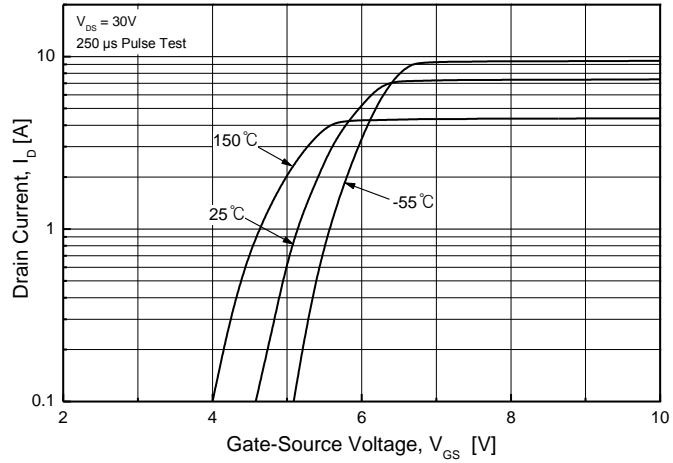
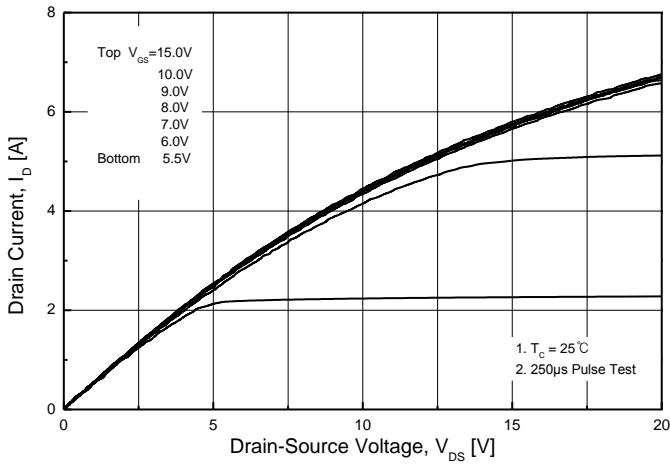
|   |              |  |    |    |    |    |
|---|--------------|--|----|----|----|----|
| Turn-On Delay Time <sup>(Note 4,5)</sup>  | $t_{d(on)}$  | $V_{DD} = 300\text{ V}, I_D = 4.0\text{ A},$<br>$R_G = 25\ \Omega, V_{GS} = 10\text{ V}$ | -- | 18 | -- | ns |
| Turn-On Rise Time <sup>(Note 4,5)</sup>   | $t_r$        |  | -- | 27 | -- | ns |
| Turn-Off Delay Time <sup>(Note 4,5)</sup> | $t_{d(off)}$ |  | -- | 47 | -- | ns |
| Turn-Off Fall Time <sup>(Note 4,5)</sup>  | $t_f$        |  | -- | 21 | -- | ns |
| Total Gate Charge <sup>(Note 4,5)</sup>   | $Q_g$        | $V_{DS} = 480\text{ V}, I_D = 4.0\text{ A},$<br>$V_{GS} = 10\text{ V}$                   | -- | 12 | -- | nC |
| Gate-Source Charge <sup>(Note 4,5)</sup>  | $Q_{gs}$     |  | -- | 3  | -- | nC |
| Gate-Drain Charge <sup>(Note 4,5)</sup>   | $Q_{gd}$     |  | -- | 6  | -- | nC |

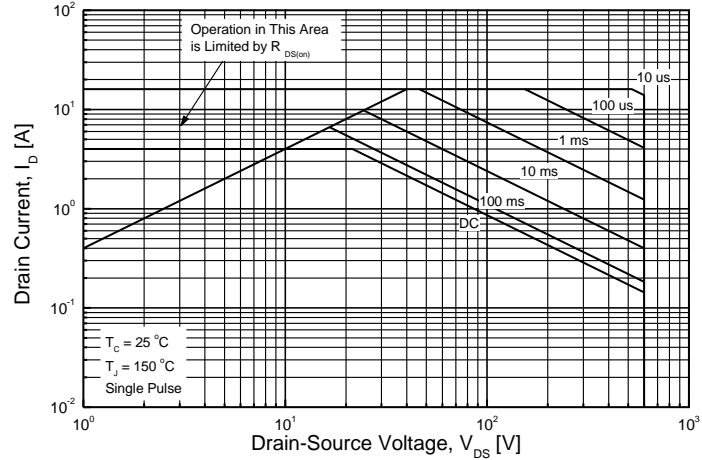
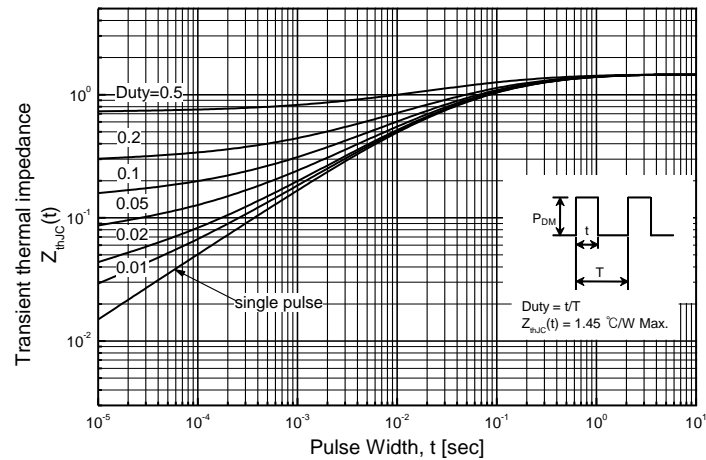
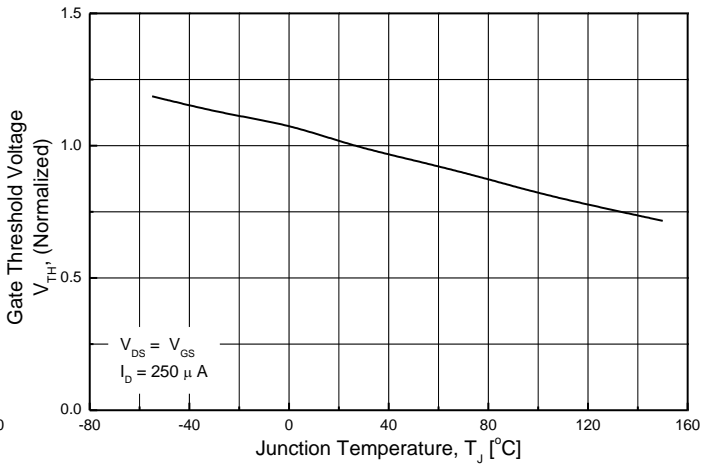
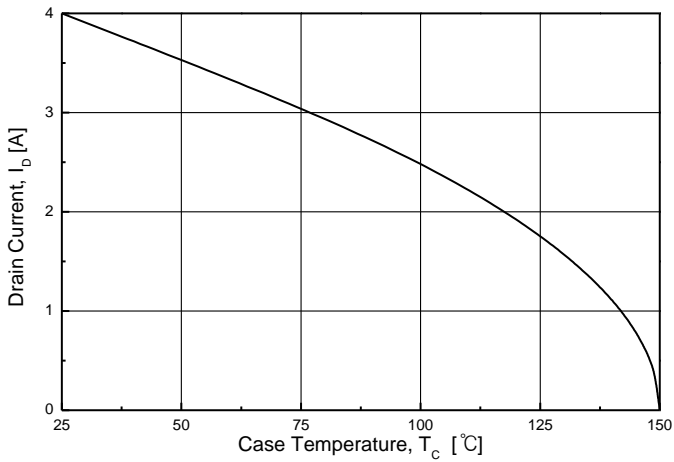
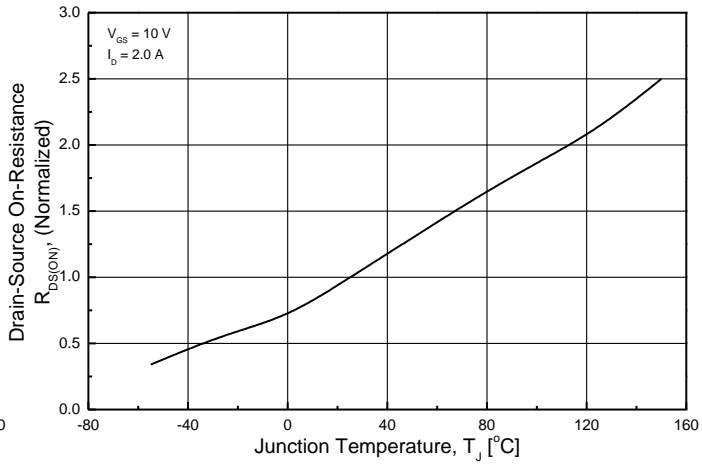
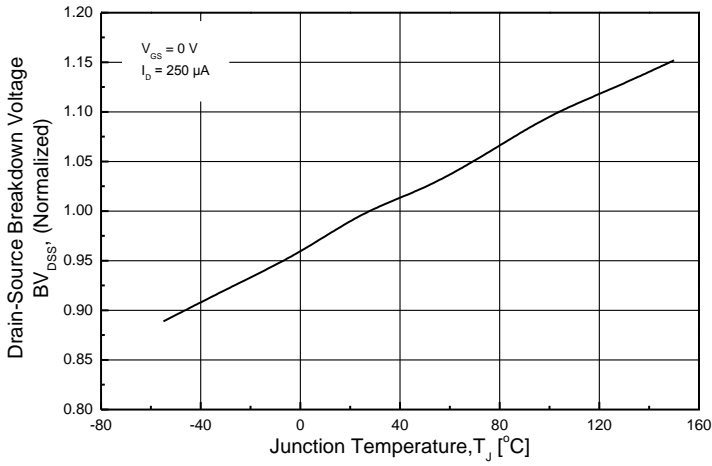
**SOURCE DRAIN DIODE**

|   |          |   |    |     |     |               |
|---|----------|---|----|-----|-----|---------------|
| Maximum Continuous Drain-Source Diode Forward Current | $I_S$    | ----  | -- | --  | 4   | A             |
| Maximum Pulsed Drain-Source Diode Forward Current     | $I_{SM}$ | ----  | -- | --  | 16  | A             |
| Drain-Source Diode Forward Voltage                    | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = 4.0\text{ A}$   | -- | --  | 1.5 | V             |
| Reverse Recovery Time <sup>(Note 4)</sup>             | $t_{rr}$ | $V_{GS} = 0\text{ V}, I_S = 4.0\text{ A}$<br>$di_F / dt = 100\text{ A}/\mu\text{s}$ | -- | 316 | --  | ns            |
| Reverse Recovery Charge <sup>(Note 4)</sup>           | $Q_{rr}$ |   | -- | 1.2 | --  | $\mu\text{C}$ |

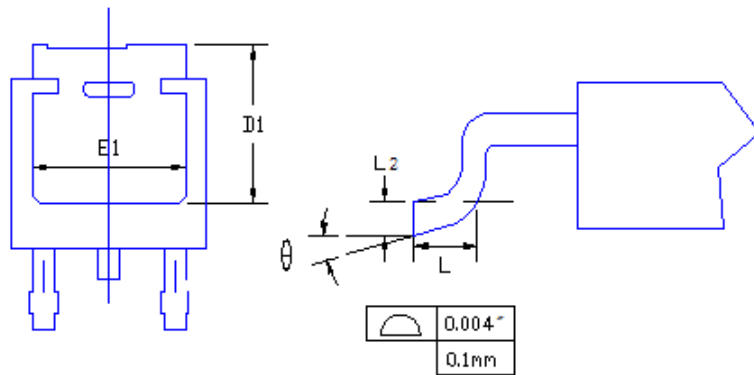
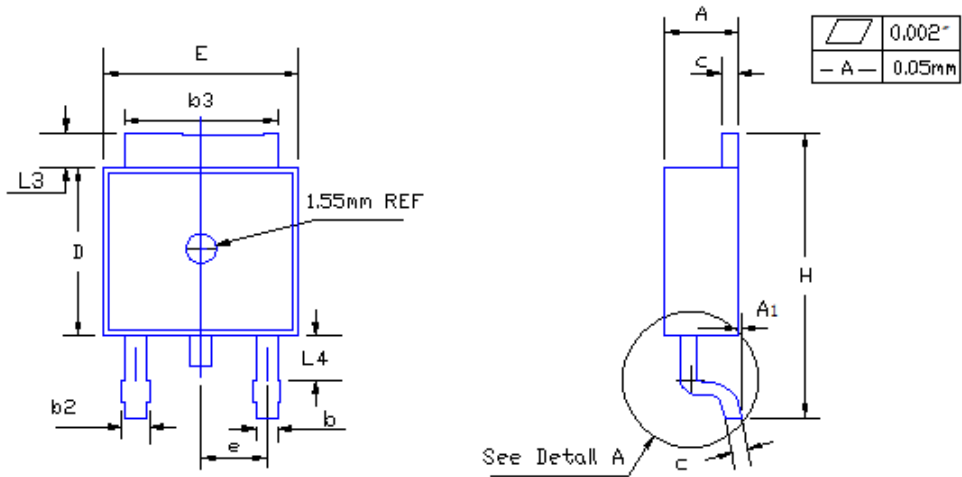
Note :

1. Repeated rating : Pulse width limited by safe operating area
2.  $L=22\text{mH}, I_{AS} = 4.0\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega,$  Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 4.0\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DS},$  Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\mu\text{s},$  Duty Cycle  $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics



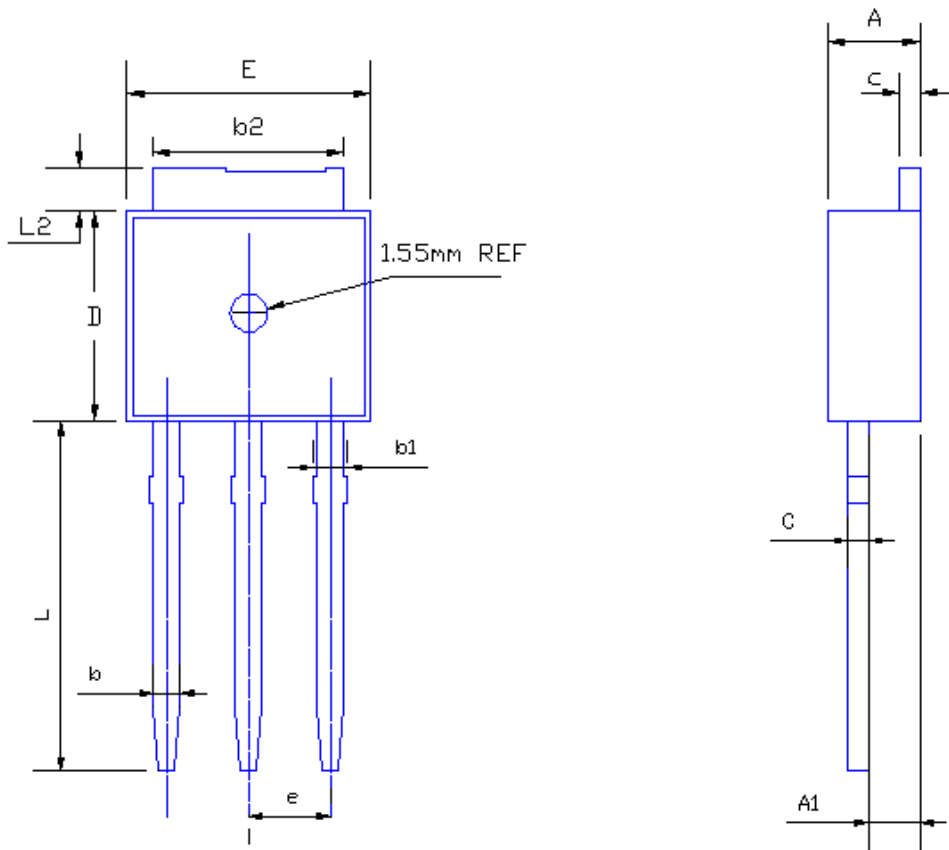


**TO-252 (D-PAK) MECHANICAL DATA**



| SYMBOL | MILLIMETERS |       |
|--------|-------------|-------|
|        | MIN         | MAX   |
| A      | 2.19        | 2.38  |
| A1     | —           | 0.13  |
| b      | 0.64        | 0.89  |
| b2     | 0.84        | 1.14  |
| b3     | 5.21        | 5.46  |
| c      | 0.46        | 0.61  |
| D      | 5.97        | 6.22  |
| D1     | 5.21        | —     |
| E      | 6.35        | 6.73  |
| E1     | 4.83        | —     |
| e      | 2.29BSC     |       |
| H      | 9.65        | 10.41 |
| L      | 1.40        | 1.78  |
| L2     | 0.51BSC     |       |
| L3     | 0.89        | 1.27  |
| L4     | 0.64        | 1.01  |
| ⌀      | 0           | 8     |

**TO-251 (I-PAK) MECHANICAL DATA**



| SYMBOL | MILLIMETERS |      |
|--------|-------------|------|
|        | MIN         | MAX  |
| A      | 2.19        | 2.38 |
| A1     | 1.04        | 1.23 |
| b      | 0.64        | 0.89 |
| b1     | 0.84        | 1.14 |
| b2     | 5.23        | 5.48 |
| c      | 0.46        | 0.61 |
| D      | 5.91        | 6.28 |
| E      | 6.21        | 6.59 |
| e      | 2.28 TYP    |      |
| L      | 8.89        | 9.65 |
| L2     | 0.89        | 1.27 |