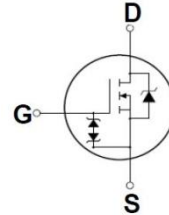
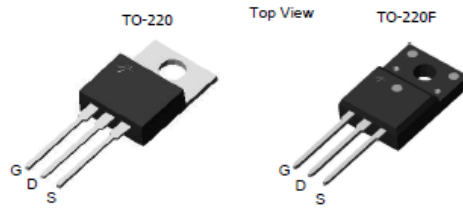


N-channel MOSFET

## Features

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

| $BV_{DSS}$ | $I_D$ | $R_{DS(on)MAX}$ |
|------------|-------|-----------------|
| 600V       | 2A    | <4.0Ω           |



| Device                 | Package          | Marking                | Remark       |
|------------------------|------------------|------------------------|--------------|
| TMP2N60Z / TMPF2N60Z   | TO-220 / TO-220F | TMP2N60Z / TMPF2N60Z   | RoHS         |
| TMP2N60ZG / TMPF2N60ZG | TO-220 / TO-220F | TMP2N60ZG / TMPF2N60ZG | Halogen Free |

## Absolute Maximum Ratings

| Parameter                                                                     |                                     | Symbol         | TMP2N60Z(G) | TMPF2N60Z(G) | Unit                  |
|-------------------------------------------------------------------------------|-------------------------------------|----------------|-------------|--------------|-----------------------|
| Drain-Source Voltage                                                          |                                     | $V_{DSS}$      | 600         |              | V                     |
| Gate-Source Voltage                                                           |                                     | $V_{GS}$       | ±30         |              | V                     |
| Continuous Drain Current                                                      | $T_C = 25\text{ }^{\circ}\text{C}$  | $I_D$          | 2           | 2 *          | A                     |
|                                                                               | $T_C = 100\text{ }^{\circ}\text{C}$ |                | 1.4         | 1.4 *        | A                     |
| Pulsed Drain Current (Note 1)                                                 |                                     | $I_{DM}$       | 8           | 8 *          | A                     |
| Single Pulse Avalanche Energy (Note 2)                                        |                                     | $E_{AS}$       | 128         |              | mJ                    |
| Repetitive Avalanche Current (Note 1)                                         |                                     | $I_{AR}$       | 2           |              | A                     |
| Repetitive Avalanche Energy (Note 1)                                          |                                     | $E_{AR}$       | 5.2         |              | mJ                    |
| Power Dissipation                                                             | $T_C = 25\text{ }^{\circ}\text{C}$  | $P_D$          | 52          | 17.3         | W                     |
|                                                                               | Derate above 25 $^{\circ}\text{C}$  |                | 0.416       | 0.138        | W/ $^{\circ}\text{C}$ |
| 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          | TMP2N60Z(G) | TMPF2N60Z(G) | Unit                 |
|-------------------------------------------------|-----------------|-------------|--------------|----------------------|
| Maximum Thermal resistance, Junction-to-Case    | $R_{\theta JC}$ | 2.4         | 7.2          | $^{\circ}\text{C/W}$ |
| Maximum Thermal resistance, Junction-to-Ambient | $R_{\theta JA}$ | 62.5        | 62.5         | $^{\circ}\text{C/W}$ |

**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      | $BV_{DSS}$ | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 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 | $I_{GSSF}$ | $V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$         | --  | --  | 70  | $\mu\text{A}$ |
| Reverse Gate-Source Leakage Current | $I_{GSSR}$ | $V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$        | --  | --  | -70 | $\mu\text{A}$ |

**ON**

|                                   |              |                                                 |    |     |     |          |
|-----------------------------------|--------------|-------------------------------------------------|----|-----|-----|----------|
| Gate Threshold Voltage            | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 2  | --  | 4   | V        |
| Drain-Source On-Resistance        | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 1.0\text{ A}$      | -- | 3.2 | 4.0 | $\Omega$ |
| Forward Transconductance (Note 4) | $g_{FS}$     | $V_{DS} = 30\text{ V}, I_D = 1.0\text{ A}$      | -- | 5   | --  | S        |

**DYNAMIC**

|                              |           |                                                                      |    |     |    |    |
|------------------------------|-----------|----------------------------------------------------------------------|----|-----|----|----|
| Input Capacitance            | $C_{iss}$ | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ | -- | 400 | -- | pF |
| Output Capacitance           | $C_{oss}$ |                                                                      | -- | 41  | -- | pF |
| Reverse Transfer Capacitance | $C_{rss}$ |                                                                      | -- | 7.5 | -- | pF |

**SWITCHING**

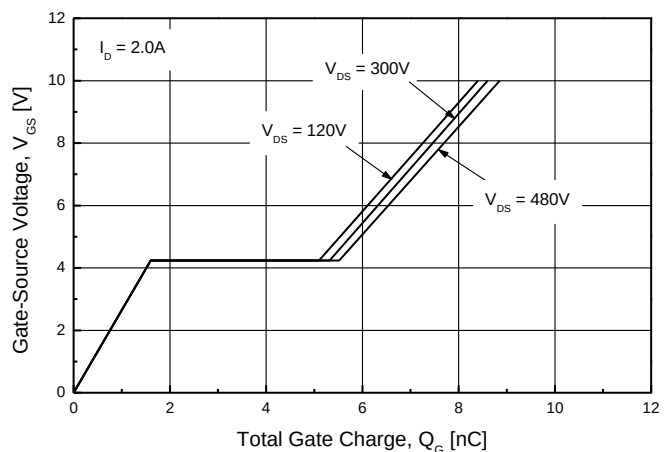
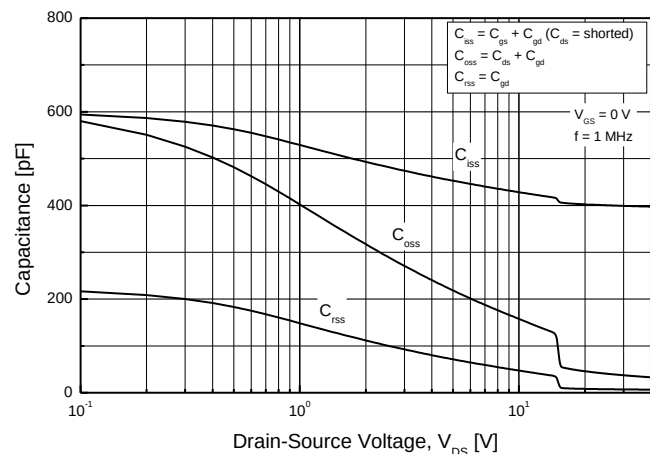
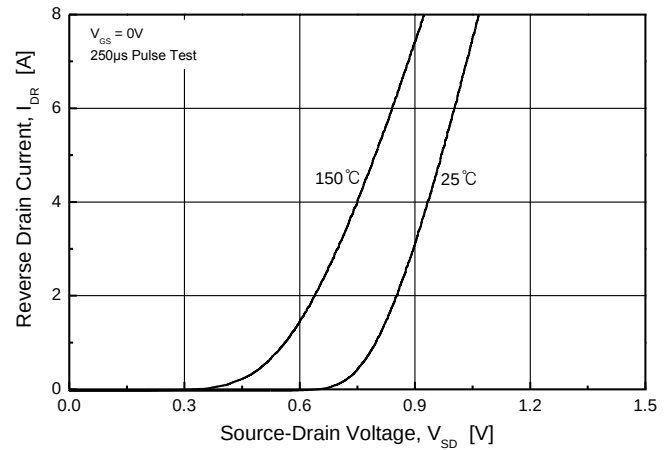
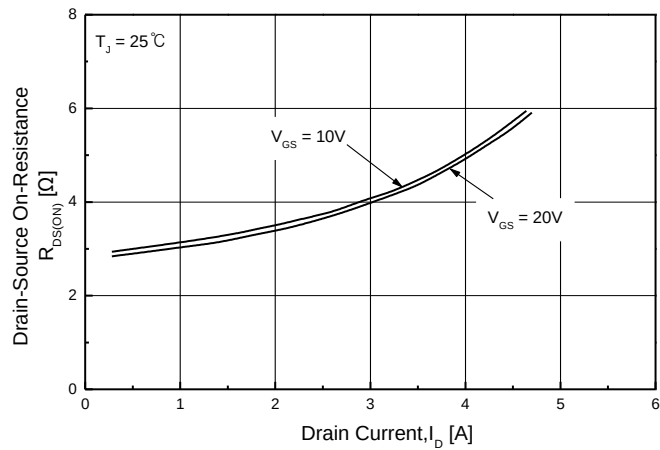
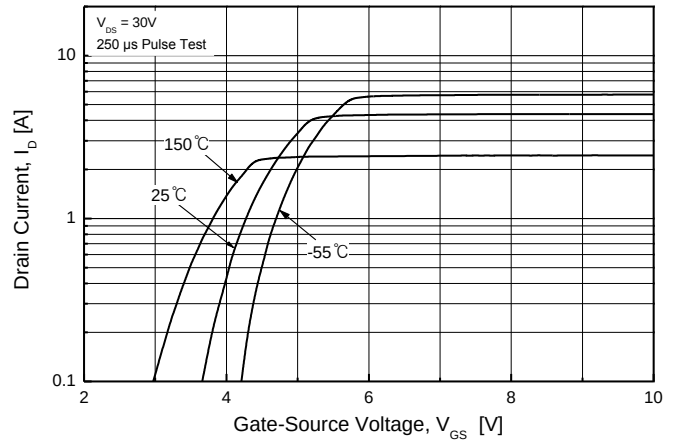
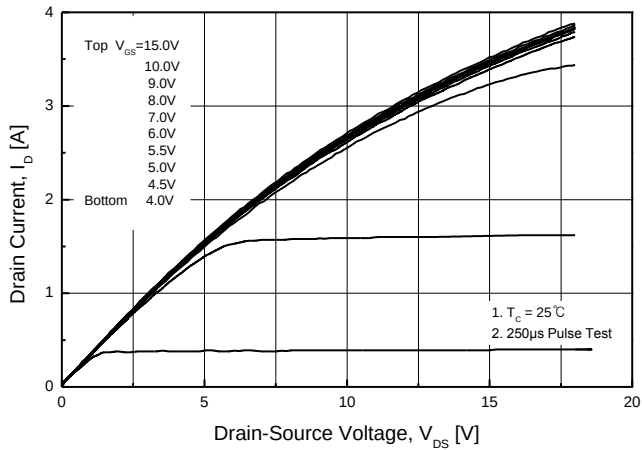
|                                |              |                                                                          |    |     |    |    |
|--------------------------------|--------------|--------------------------------------------------------------------------|----|-----|----|----|
| Turn-On Delay Time (Note 4,5)  | $t_{d(on)}$  | $V_{DD} = 300\text{ V}, I_D = 2.0\text{ A},$<br>$R_G = 25\text{ }\Omega$ | -- | 13  | -- | ns |
| Turn-On Rise Time (Note 4,5)   | $t_r$        |                                                                          | -- | 18  | -- | ns |
| Turn-Off Delay Time (Note 4,5) | $t_{d(off)}$ |                                                                          | -- | 46  | -- | ns |
| Turn-Off Fall Time (Note 4,5)  | $t_f$        |                                                                          | -- | 20  | -- | ns |
| Total Gate Charge (Note 4,5)   | $Q_g$        | $V_{DS} = 480\text{ V}, I_D = 2.0\text{ A},$<br>$V_{GS} = 10\text{ V}$   | -- | 9.6 | -- | nC |
| Gate-Source Charge (Note 4,5)  | $Q_{gs}$     |                                                                          | -- | 1.6 | -- | nC |
| Gate-Drain Charge (Note 4,5)   | $Q_{gd}$     |                                                                          | -- | 4.3 | -- | nC |

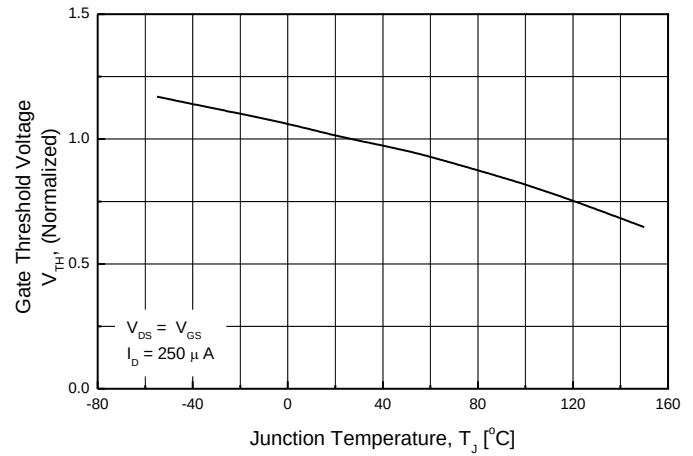
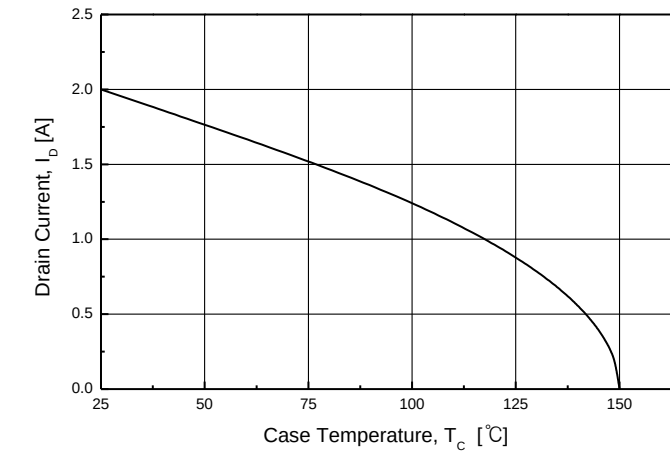
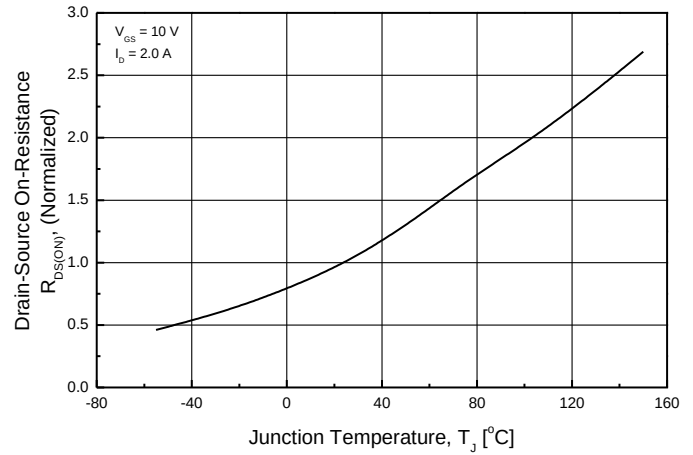
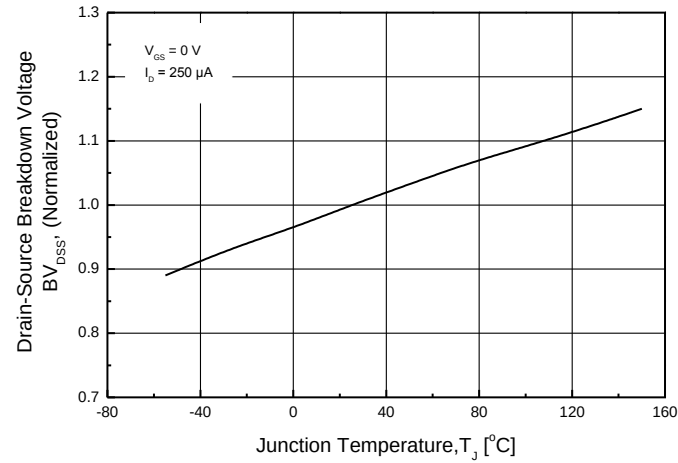
**SOURCE DRAIN DIODE**

|                                                       |          |                                                                                     |    |     |     |               |
|-------------------------------------------------------|----------|-------------------------------------------------------------------------------------|----|-----|-----|---------------|
| Maximum Continuous Drain-Source Diode Forward Current | $I_S$    | ----                                                                                | -- | --  | 2   | A             |
| Maximum Pulsed Drain-Source Diode Forward Current     | $I_{SM}$ | ----                                                                                | -- | --  | 8   | A             |
| Drain-Source Diode Forward Voltage                    | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = 2.0\text{ A}$                                           | -- | --  | 1.5 | V             |
| Reverse Recovery Time (Note 4)                        | $t_{rr}$ | $V_{GS} = 0\text{ V}, I_S = 2.0\text{ A}$<br>$dI_F / dt = 100\text{ A}/\mu\text{s}$ | -- | 241 | --  | ns            |
| Reverse Recovery Charge (Note 4)                      | $Q_{rr}$ |                                                                                     | -- | 0.8 | --  | $\mu\text{C}$ |

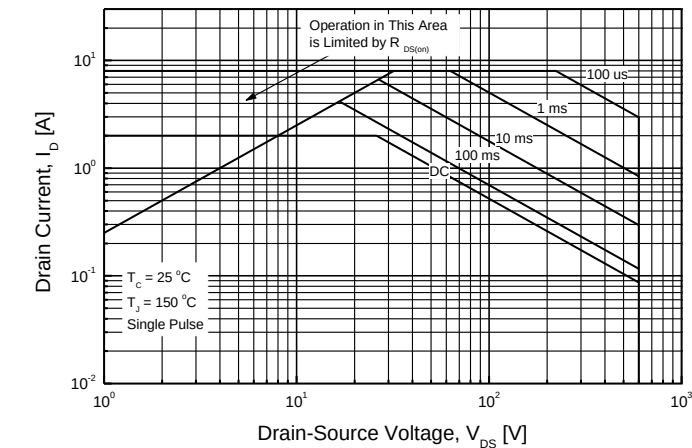
Note :

1. Repetitive rating : Pulse width limited by maximum junction temperature
2.  $L=59\text{ mH}, I_{AS} = 2\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\text{ }\Omega$ , Starting  $T_J = 25^{\circ}\text{C}$
3.  $I_{SD} \leq 2\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DS}$ , Starting  $T_J = 25^{\circ}\text{C}$
4. Pulse Test : Pulse width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

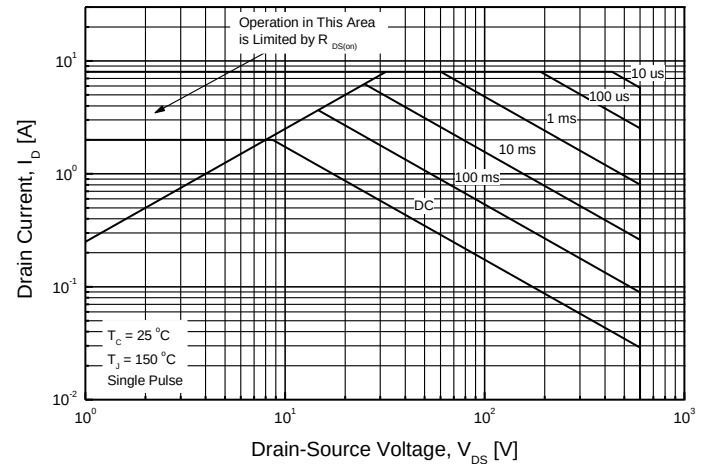


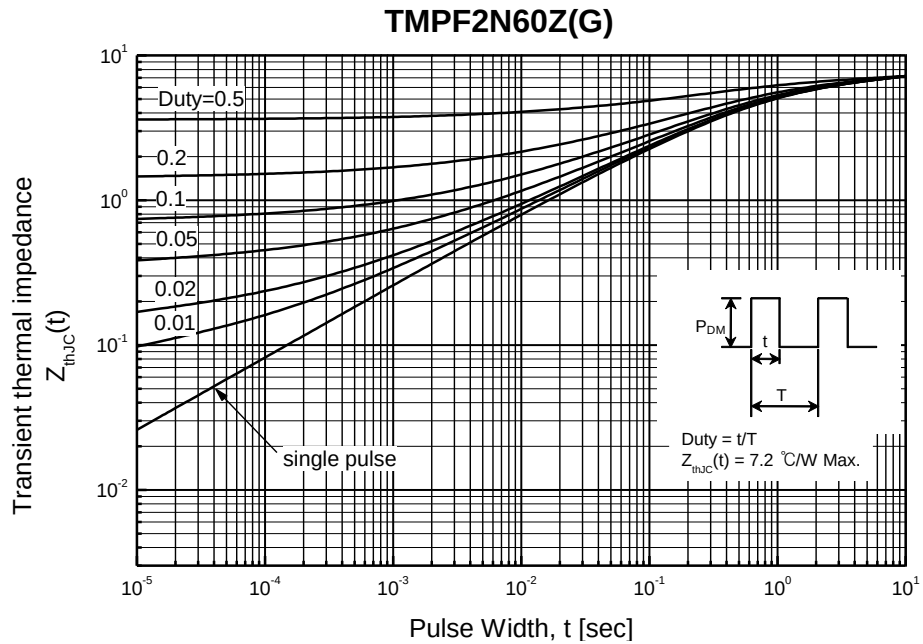
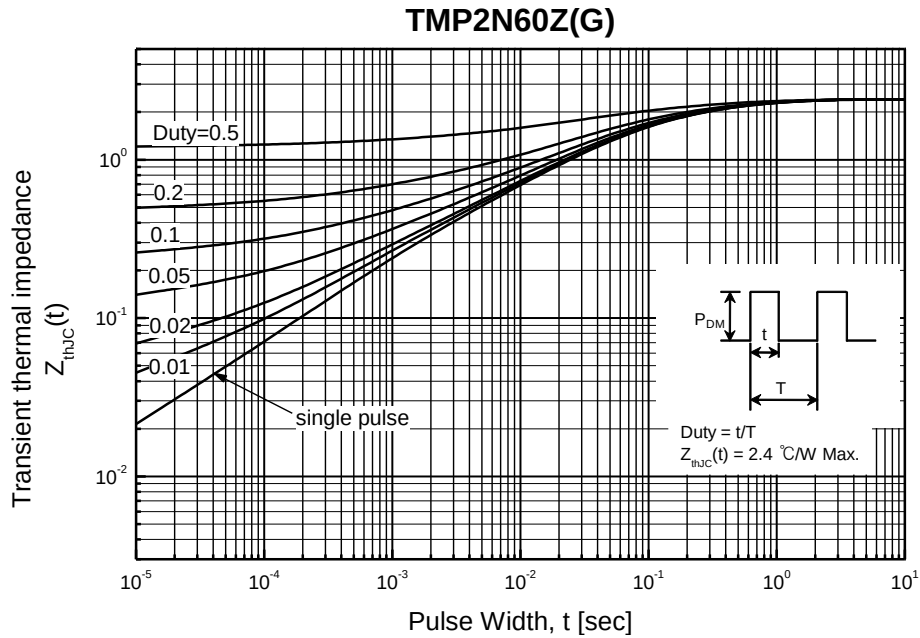


**TMP2N60Z(G)**

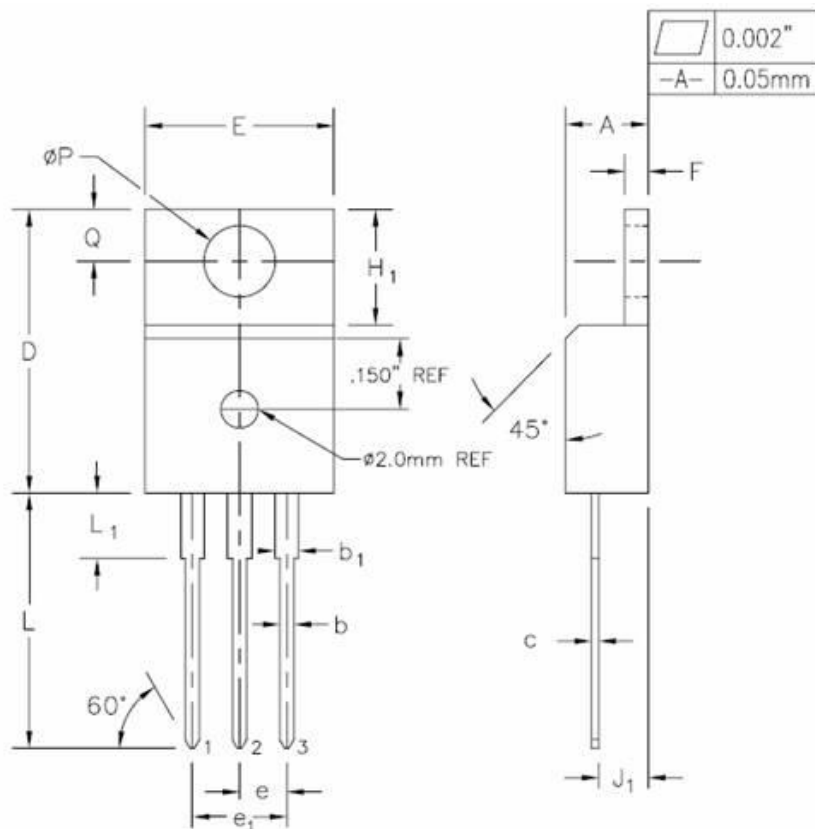


**TMPF2N60Z(G)**

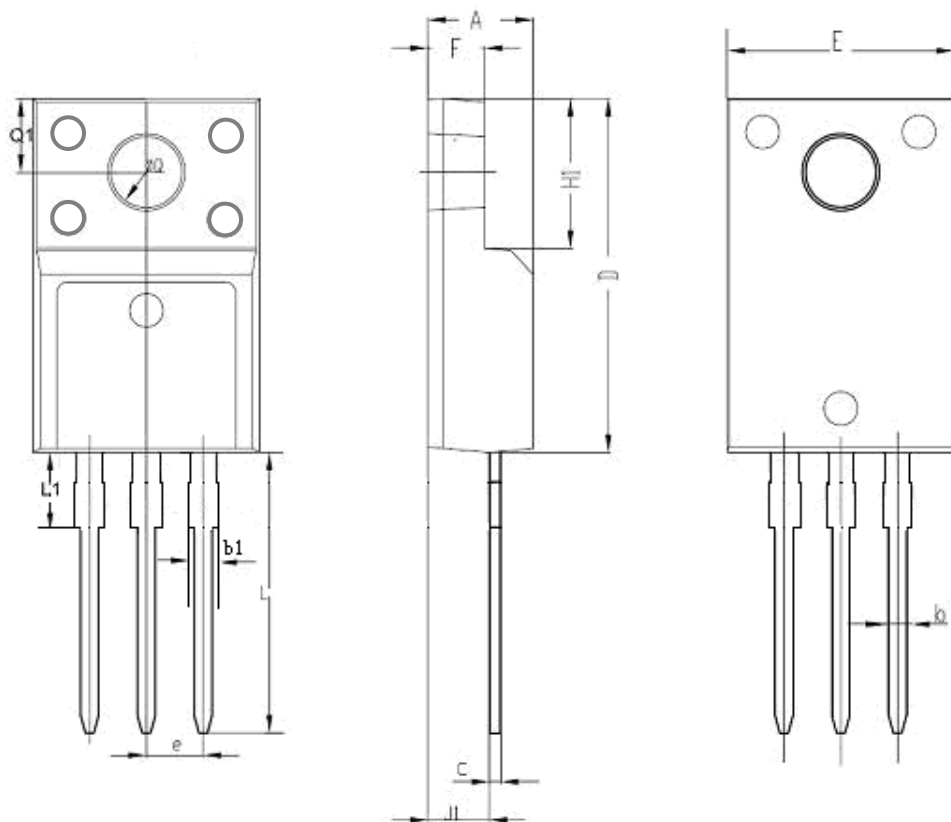




## TO-220AB-3L MECHANICAL DATA



| SYMBOL         | INCHES     |       | MILLIMETERS |       | NOTES |
|----------------|------------|-------|-------------|-------|-------|
|                | MIN.       | MAX.  | MIN.        | MAX.  |       |
| A              | 0.170      | 0.180 | 4.32        | 4.57  |       |
| b              | 0.028      | 0.036 | 0.71        | 0.91  |       |
| b <sub>1</sub> | 0.045      | 0.055 | 1.15        | 1.39  |       |
| c              | 0.014      | 0.021 | 0.36        | 0.53  |       |
| D              | 0.590      | 0.610 | 14.99       | 15.49 |       |
| E              | 0.395      | 0.410 | 10.04       | 10.41 |       |
| e              | 0.100 TYP. |       | 2.54 TYP.   |       |       |
| e <sub>1</sub> | 0.200 BSC  |       | 5.08 BSC    |       |       |
| F              | 0.048      | 0.054 | 1.22        | 1.37  |       |
| H <sub>1</sub> | 0.235      | 0.255 | 5.97        | 6.47  |       |
| J <sub>1</sub> | 0.100      | 0.110 | 2.54        | 2.79  |       |
| L              | 0.530      | 0.550 | 13.47       | 13.97 |       |
| L <sub>1</sub> | 0.130      | 0.150 | 3.31        | 3.81  | 2     |
| $\phi P$       | 0.149      | 0.153 | 3.79        | 3.88  |       |
| Q              | 0.102      | 0.112 | 2.60        | 2.84  |       |

**TO-220F-3L MECHANICAL DATA**


| SYMBOL | INCHES     |       | MILLIMETERS |       | NOTES |
|--------|------------|-------|-------------|-------|-------|
|        | MIN        | MAX   | MIN         | MAX   |       |
| A      | 0.178      | 0.194 | 4.53        | 4.93  |       |
| b      | 0.028      | 0.036 | 0.71        | 0.91  |       |
| C      | 0.018      | 0.024 | 0.45        | 0.60  |       |
| D      | 0.617      | 0.633 | 15.67       | 16.07 |       |
| E      | 0.392      | 0.408 | 9.96        | 10.36 |       |
| e      | 0.100 TYP. |       | 2.54TYP.    |       |       |
| H1     | 0.256      | 0.272 | 6.50        | 6.90  |       |
| J1     | 0.101      | 0.117 | 2.56        | 2.96  |       |
| L      | 0.503      | 0.519 | 12.78       | 13.18 |       |
| φQ     | 0.117      | 0.133 | 2.98        | 3.38  |       |
| b1     | 0.045      | 0.055 | 1.15        | 1.39  |       |
| L1     | 0.114      | 0.130 | 2.9         | 3.3   |       |
| Q1     | 0.122      | 0.138 | 3.10        | 3.50  |       |
| F      | 0.092      | 0.108 | 2.34        | 2.74  |       |