

### General Description

These N-channel MOSFET are produced using advanced MagnaChip's MOSFET Technology, which provides low on-state resistance, high switching performance and excellent quality.

These devices are suitable device for SMPS, high Speed switching and general purpose applications.

### Features

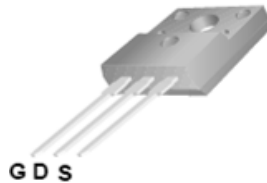
- $V_{DS} = 500V$
- $V_{DS} = 550V$  @  $T_{jmax}$
- $I_D = 13.0A$  @  $V_{GS} = 10V$
- $R_{DS(ON)} < 0.5\Omega$  @  $V_{GS} = 10V$

### Applications

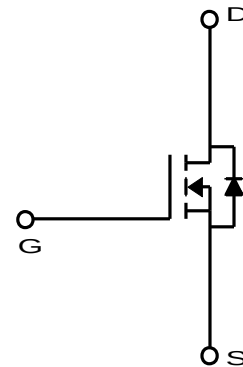
- Power Supply
- HID
- Lighting



TO-220  
MDP Series



TO-220F  
MDF Series



### Absolute Maximum Ratings ( $T_a = 25^\circ C$ )

| Characteristics                              |                           | Symbol               | MDP13N50G | MDF13N50G | Unit |
|----------------------------------------------|---------------------------|----------------------|-----------|-----------|------|
| Drain-Source Voltage                         |                           | $V_{DSS}$            | 500       |           | V    |
| Drain-Source Voltage @ $T_{jmax}$            |                           | $V_{DSS} @ T_{jmax}$ | 550       |           | V    |
| Gate-Source Voltage                          |                           | $V_{GSS}$            | $\pm 30$  |           | V    |
| Continuous Drain Current                     | $T_c = 25^\circ C$        | $I_D$                | 13        | 13*       | A    |
|                                              | $T_c = 100^\circ C$       |                      | 8.2       | 8.2*      | A    |
| Pulsed Drain Current <sup>(1)</sup>          |                           | $I_{DM}$             | 52        | 52*       | A    |
| Power Dissipation                            | $T_c = 25^\circ C$        | $P_D$                | 187       | 42        | W    |
|                                              | Derate above $25^\circ C$ |                      | 1.49      | 0.33      | W/°C |
| Repetitive Avalanche Energy <sup>(1)</sup>   |                           | $E_{AR}$             | 18.7      |           | mJ   |
| Peak Diode Recovery $dv/dt$ <sup>(3)</sup>   |                           | $dv/dt$              | 4.5       |           | V/ns |
| Single Pulse Avalanche Energy <sup>(4)</sup> |                           | $E_{AS}$             | 580       |           | mJ   |
| Junction and Storage Temperature Range       |                           | $T_J, T_{stg}$       | -55~150   |           | °C   |

\*  $I_D$  limited by maximum junction temperature

### Thermal Characteristics

| Characteristics                                        | Symbol          | MDP13N50G | MDF13N50G | Unit |
|--------------------------------------------------------|-----------------|-----------|-----------|------|
| Thermal Resistance, Junction-to-Ambient <sup>(1)</sup> | $R_{\theta JA}$ | 62.5      | 62.5      | °C/W |
| Thermal Resistance, Junction-to-Case <sup>(1)</sup>    | $R_{\theta JC}$ | 0.67      | 3.0       |      |

## Ordering Information

| Part Number | Temp. Range | Package | Packing | RoHS Status  |
|-------------|-------------|---------|---------|--------------|
| MDP13N50GTH | -55~150°C   | TO-220  | Tube    | Halogen Free |
| MDF13N50GTH | -55~150°C   | TO-220F | Tube    | Halogen Free |

## Electrical Characteristics (Ta =25°C)

| Characteristics                                          | Symbol              | Test Condition                                                                                           | Min | Typ  | Max | Unit |
|----------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| Static Characteristics                                   |                     |                                                                                                          |     |      |     |      |
| Drain-Source Breakdown Voltage                           | BV <sub>DSS</sub>   | I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V                                                             | 500 | -    | -   | V    |
| Gate Threshold Voltage                                   | V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                               | 3.0 | -    | 5.0 |      |
| Drain Cut-Off Current                                    | I <sub>DSS</sub>    | V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V                                                             | -   | -    | 1   | μA   |
| Gate Leakage Current                                     | I <sub>GSS</sub>    | V <sub>GS</sub> = ±30V, V <sub>DS</sub> = 0V                                                             | -   | -    | 100 | nA   |
| Drain-Source ON Resistance                               | R <sub>DS(ON)</sub> | V <sub>GS</sub> = 10V, I <sub>D</sub> = 6.5A                                                             |     | 0.39 | 0.5 | Ω    |
| Forward Transconductance                                 | g <sub>fs</sub>     | V <sub>DS</sub> = 40V, I <sub>D</sub> = 6.5A                                                             | -   | 13   | -   | S    |
| Dynamic Characteristics                                  |                     |                                                                                                          |     |      |     |      |
| Total Gate Charge                                        | Q <sub>g</sub>      | V <sub>DS</sub> = 400V, I <sub>D</sub> = 13A, V <sub>GS</sub> = 10V <sup>(3)</sup>                       | -   | 33   |     | nC   |
| Gate-Source Charge                                       | Q <sub>gs</sub>     |                                                                                                          | -   | 10.4 |     |      |
| Gate-Drain Charge                                        | Q <sub>gd</sub>     |                                                                                                          | -   | 13   |     |      |
| Input Capacitance                                        | C <sub>iss</sub>    | V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz                                                  | -   | 1390 |     | pF   |
| Reverse Transfer Capacitance                             | C <sub>rss</sub>    |                                                                                                          | -   | 6.3  |     |      |
| Output Capacitance                                       | C <sub>oss</sub>    |                                                                                                          | -   | 173  |     |      |
| Turn-On Delay Time                                       | t <sub>d(on)</sub>  | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 250V, I <sub>D</sub> = 13A, R <sub>G</sub> = 25Ω <sup>(3)</sup> | -   | 57   |     | ns   |
| Rise Time                                                | t <sub>r</sub>      |                                                                                                          | -   | 54   |     |      |
| Turn-Off Delay Time                                      | t <sub>d(off)</sub> |                                                                                                          | -   | 112  |     |      |
| Fall Time                                                | t <sub>f</sub>      |                                                                                                          | -   | 37   |     |      |
| Drain-Source Body Diode Characteristics                  |                     |                                                                                                          |     |      |     |      |
| Maximum Continuous Drain to Source Diode Forward Current | I <sub>S</sub>      | I <sub>S</sub> = 13A, V <sub>GS</sub> = 0V                                                               | -   | 13   | -   | A    |
| Source-Drain Diode Forward Voltage                       | V <sub>SD</sub>     |                                                                                                          | -   |      | 1.4 | V    |
| Body Diode Reverse Recovery Time                         | t <sub>rr</sub>     | I <sub>F</sub> = 13A, dI/dt = 100A/μs <sup>(3)</sup>                                                     | -   | 325  |     | ns   |
| Body Diode Reverse Recovery Charge                       | Q <sub>rr</sub>     |                                                                                                          | -   | 2.9  |     | μC   |

Note :

1. Pulse width is based on  $R_{\theta JC}$  &  $R_{\theta JA}$  and the maximum allowed junction temperature of 150°C.
2. Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ , pulse width limited by junction temperature  $T_{J(MAX)} = 150^\circ C$ .
3.  $I_{SD} \leq 9.0A$ ,  $di/dt \leq 200A/\mu s$ ,  $V_{DD} = 50V$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$
4.  $L = 6.2mH$ ,  $I_{AS} = 13.0A$ ,  $V_{DD} = 50V$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$

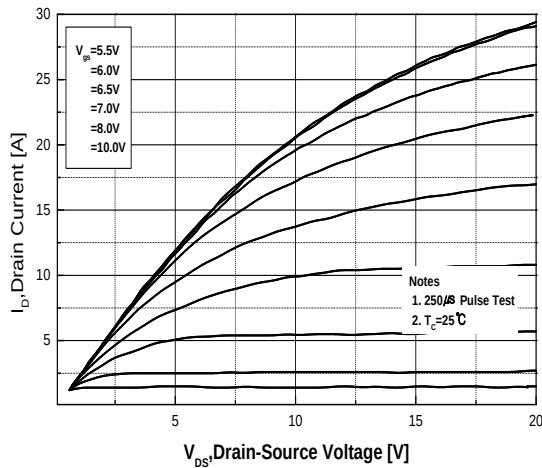


Fig.1 On-Region Characteristics

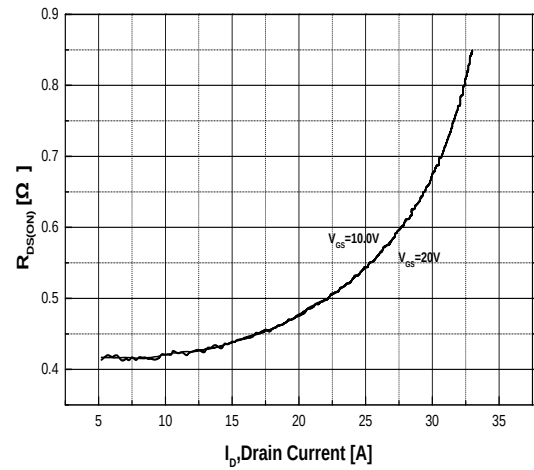


Fig.2 On-Resistance Variation with Drain Current and Gate Voltage

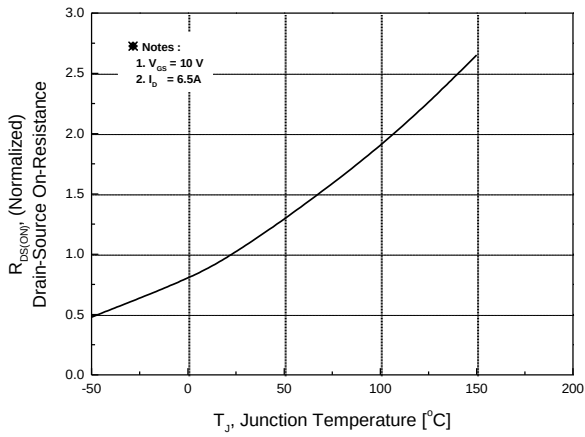


Fig.3 On-Resistance Variation with Temperature

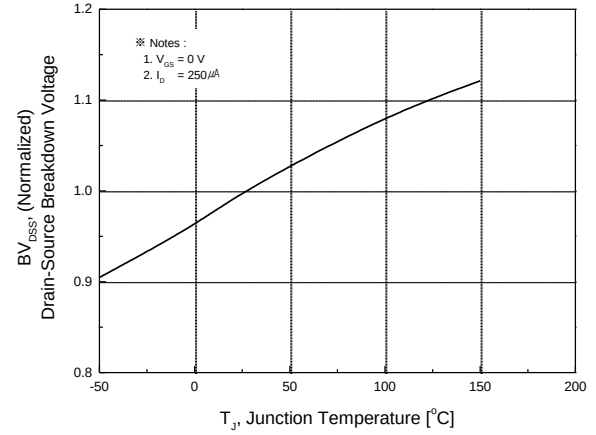


Fig.4 Breakdown Voltage Variation vs. Temperature

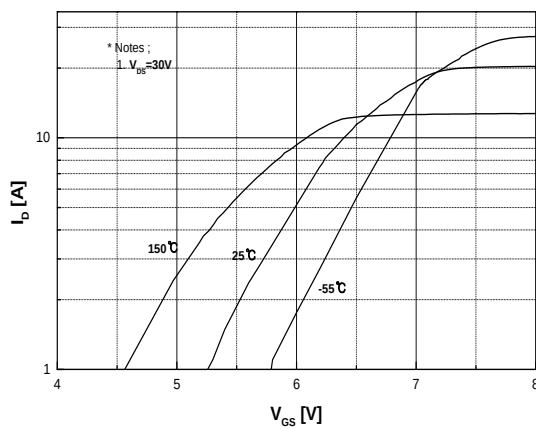


Fig.5 Transfer Characteristics

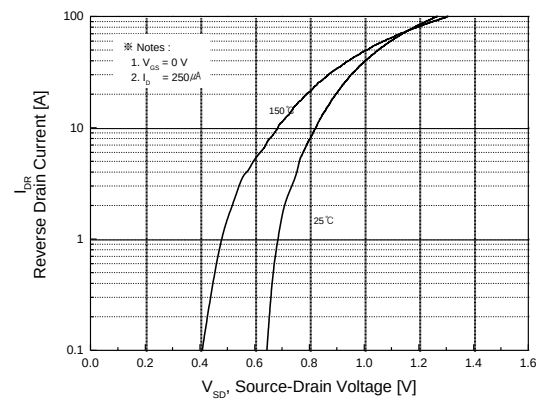


Fig.6 Body Diode Forward Voltage Variation with Source Current and Temperature

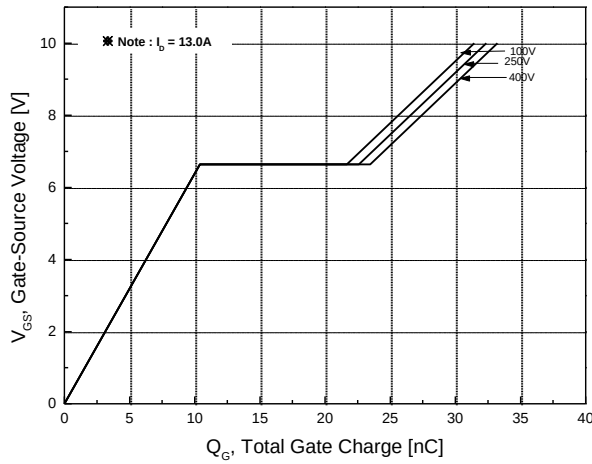


Fig.7 Gate Charge Characteristics

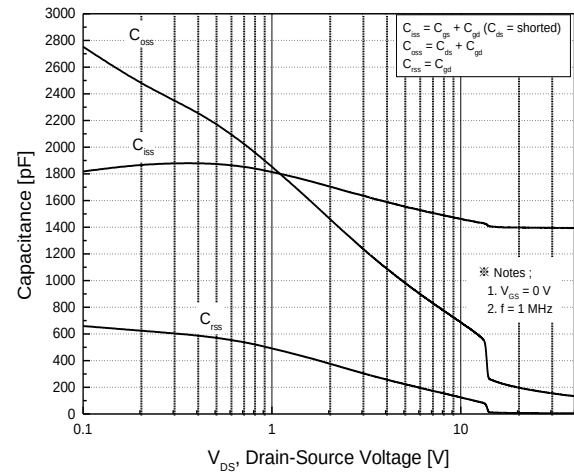
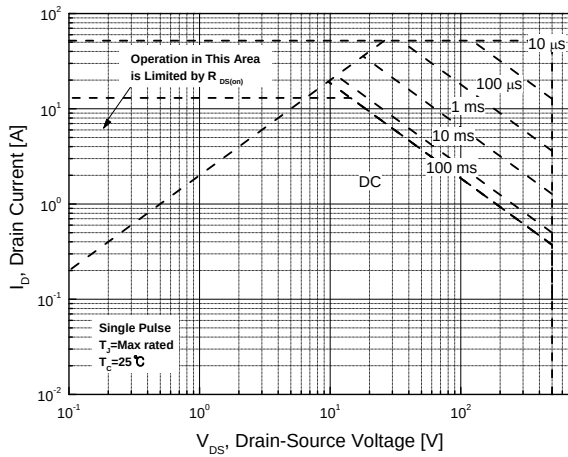
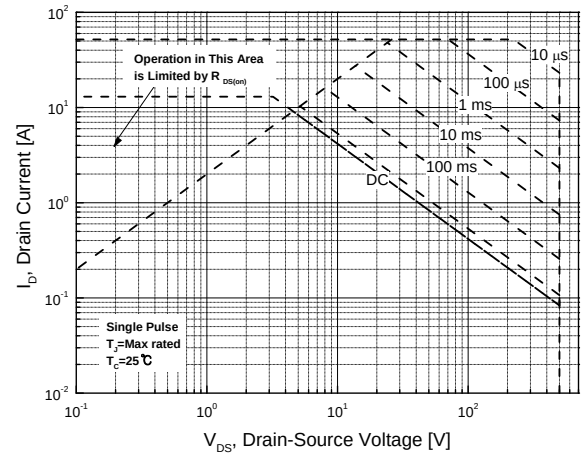
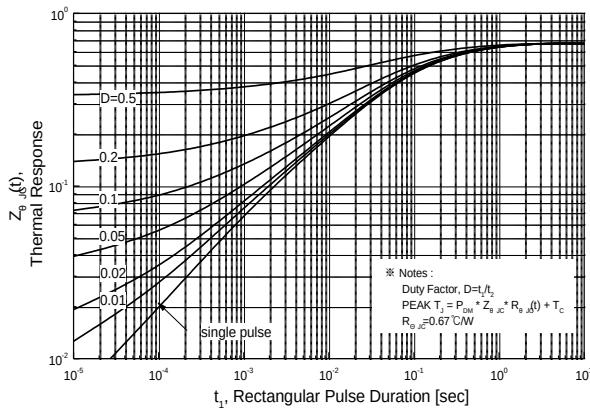
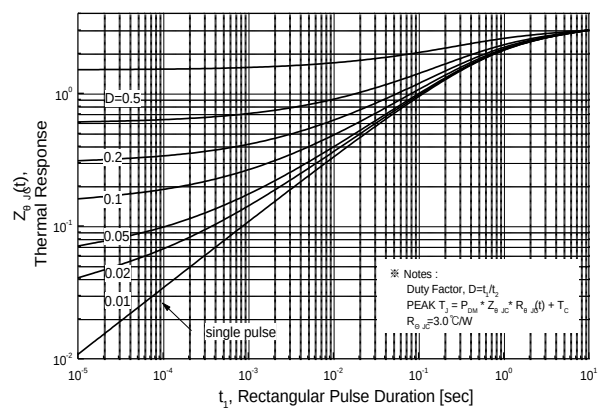
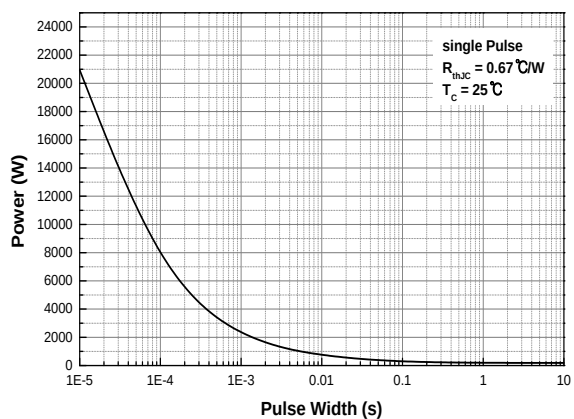
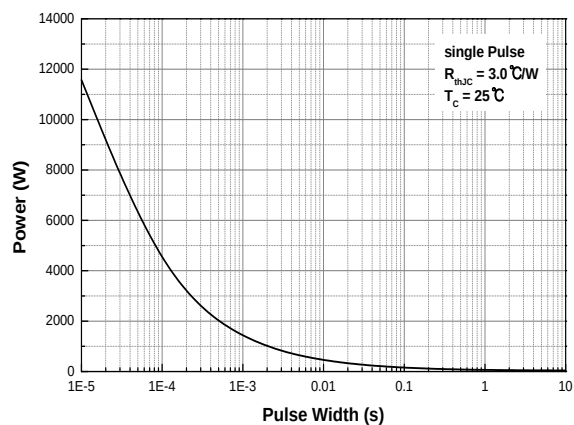


Fig.8 Capacitance Characteristics

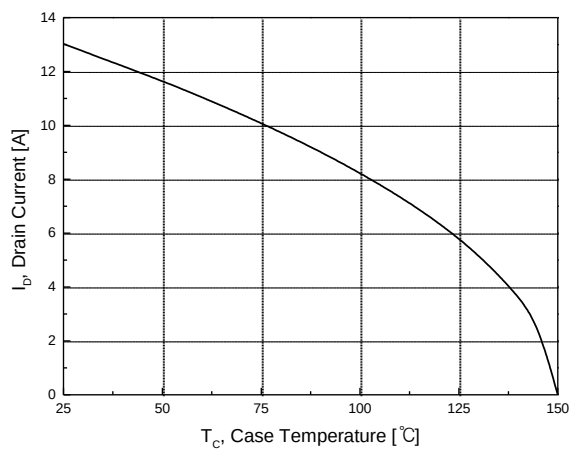
Fig.9 Maximum Safe Operating Area  
MDP13N50G(TO-220)Fig.10 Maximum Safe Operating Area  
MDF13N50G(TO-220F)Fig.11 Transient Thermal Response Curve  
MDP13N50G(TO-220)Fig.12 Transient Thermal Response Curve  
MDF13N50G(TO-220F)



**Fig.13 Single Pulse Maximum Power Dissipation MDP13N50G(TO-220)**



**Fig.14 Single Pulse Maximum Power DissipationMDF13N50G (TO-220F)**

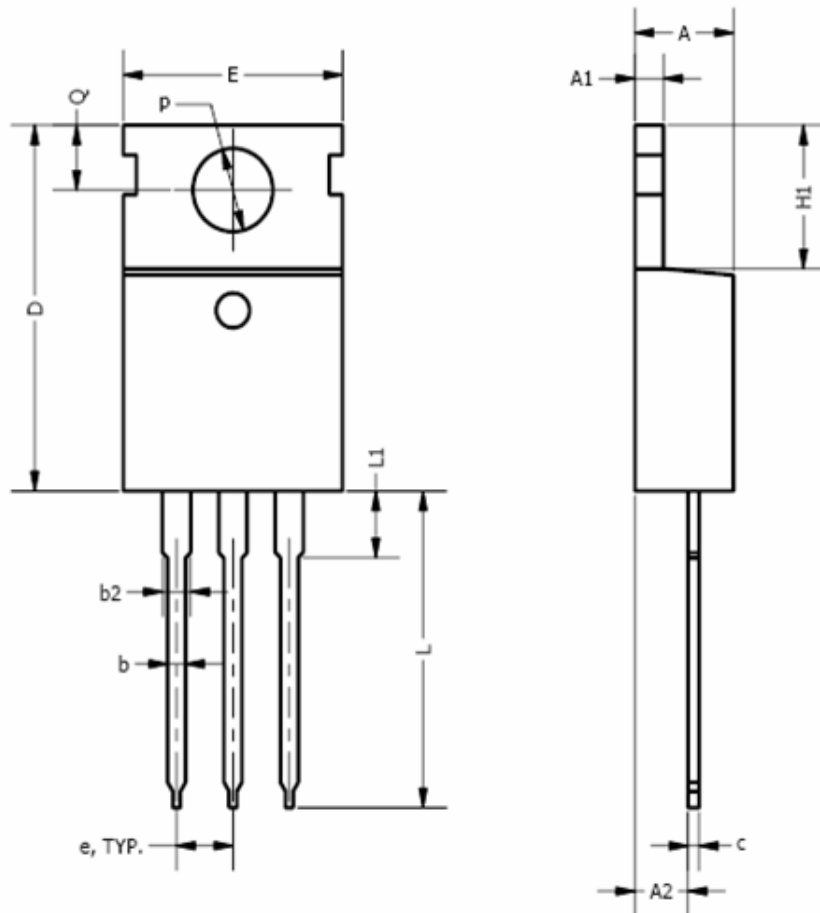


**Fig.15 Maximum Drain Current vs. Case Temperature**

## ■ Physical Dimension

### 3 Leads, TO-220

Dimensions are in millimeters unless otherwise specified

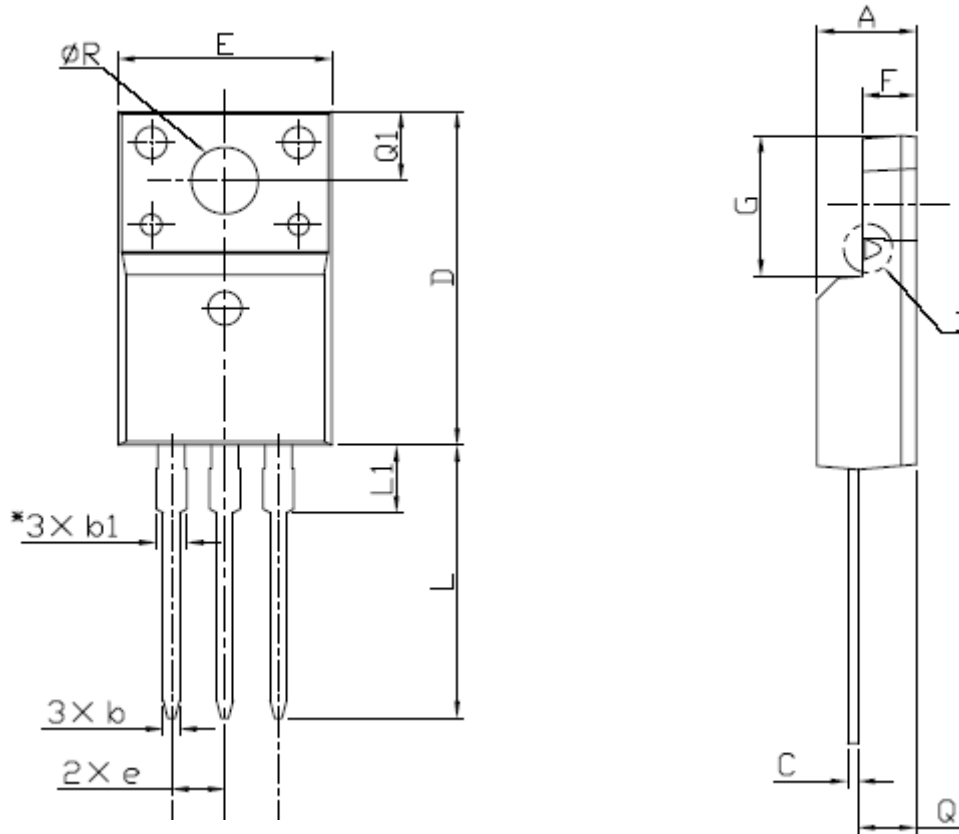


| Symbol   | Min      | Nom  | Max   |
|----------|----------|------|-------|
| A        | 3.56     |      | 4.83  |
| A1       | 0.50     |      | 1.40  |
| A2       | 2.03     |      | 2.92  |
| b        | 0.38     | 0.69 | 1.02  |
| b2       | 1.14     | 1.45 | 1.78  |
| c        | 0.36     |      | 0.61  |
| D        | 14.22    |      | 16.51 |
| e        | 2.54 TYP |      |       |
| E        | 9.65     |      | 10.67 |
| H1       | 5.84     |      | 6.86  |
| L        | 12.70    |      | 14.73 |
| L1       |          |      | 6.35  |
| $\phi P$ | 3.53     |      | 4.09  |
| Q        | 2.54     |      | 3.43  |

## ■ Physical Dimension

### 3 Leads, TO-220F

Dimensions are in millimeters unless otherwise specified



| Symbol | Min   | Nom  | Max   |
|--------|-------|------|-------|
| A      | 4.50  |      | 4.93  |
| b      | 0.63  |      | 0.91  |
| b1     | 1.15  |      | 1.47  |
| C      | 0.33  |      | 0.63  |
| D      | 15.47 |      | 16.13 |
| E      | 9.60  |      | 10.71 |
| e      |       | 2.54 |       |
| F      | 2.34  |      | 2.84  |
| G      | 6.48  |      | 6.90  |
| L      | 12.24 |      | 13.72 |
| L1     | 2.79  |      | 3.67  |
| Q      | 2.52  |      | 2.96  |
| Q1     | 3.10  |      | 3.50  |
| ØR     | 3.00  |      | 3.55  |

**DISCLAIMER:**

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