

## N-Channel 120 V (D-S) 175 °C MOSFET

### PRODUCT SUMMARY

| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A)        |
|--------------|---------------------------|------------------|
| 120          | 0.0029 at $V_{GS} = 10$ V | 188 <sup>a</sup> |

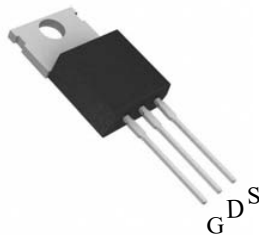
### FEATURES

- TrenchFET<sup>®</sup> Power MOSFET
- New Package with Low Thermal Resistance
- 100 %  $R_g$  Tested

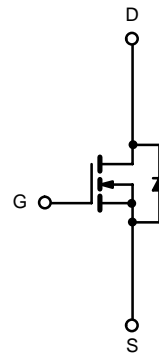


**RoHS**  
COMPLIANT

TO-220 Pin Configuration



Top View



N-Channel MOSFET

### ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted

| Parameter  | Symbol         | Limit          | Unit             |
|--|----------------|----------------|------------------|
| Drain-Source Voltage                             | $V_{DS}$       | 120            | V                |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$       |                  |
| Continuous Drain Current ( $T_J = 175$ °C)       | $I_D$          | $T_C = 25$ °C  | 188 <sup>a</sup> |
|  |                | $T_C = 125$ °C | 143 <sup>a</sup> |
| Pulsed Drain Current                             | $I_{DM}$       | 650            | A                |
| Avalanche Current                                | $I_{AR}$       | 180            |                  |
| Repetitive Avalanche Energy <sup>b</sup>         | $E_{AR}$       | 2200           | mJ               |
| Maximum Power Dissipation <sup>b</sup>           | $P_D$          | $T_C = 25$ °C  | 398 <sup>c</sup> |
|  |                | $T_A = 25$ °C  | 5.9              |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | - 55 to 175    | °C               |

### THERMAL RESISTANCE RATINGS

| Parameter                | Symbol     | Limit | Unit |
|--------------------------|------------|-------|------|
| Junction-to-Ambient      | $R_{thJA}$ | 38    | °C/W |
| Junction-to-Case (Drain) | $R_{thJC}$ | 0.4   |      |

Notes:

- Package limited.
- Duty cycle  $\leq 1$  %.
- See SOA curve for voltage derating.
- When mounted on 1" square PCB (FR-4 material).

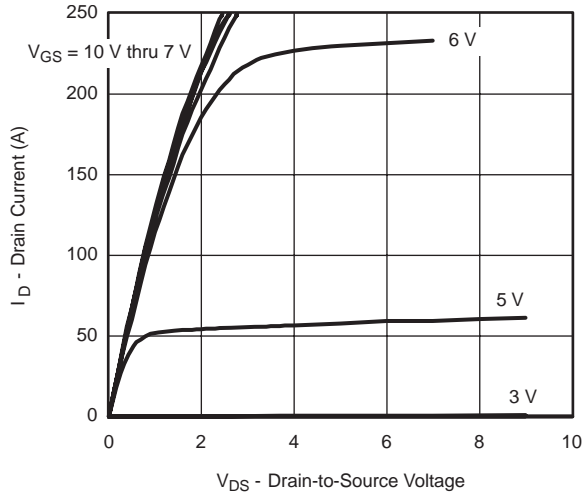
| <b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted                     |               |  |      |        |           |               |
|---|---------------|--|------|--------|-----------|---------------|
| Parameter   | Symbol        | Test Conditions  | Min. | Typ.   | Max.      | Unit          |
| <b>Static</b>   |               |  |      |        |           |               |
| Drain-Source Breakdown Voltage  | $V_{DS}$      | $V_{DS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$  | 120  |        |           | V             |
| Gate-Threshold Voltage  | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$  | 2    |        | 4         |               |
| Gate-Body Leakage   | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$  |      |        | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current   | $I_{DSS}$     | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$   |      |        | 1         | $\mu\text{A}$ |
|   |               | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$  |      |        | 50        |               |
|   |               | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$  |      |        | 250       |               |
| On-State Drain Current <sup>a</sup>   | $I_{D(on)}$   | $V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$   | 188  |        |           | A             |
| Drain-Source On-State Resistance <sup>a</sup>   | $R_{DS(on)}$  | $V_{GS} = 10\text{ V}, I_D = 20\text{ A}$  |      | 0.0029 | 0.0040    | $\Omega$      |
|   |               | $V_{GS} = 10\text{ V}, I_D = 15\text{ A}, T_J = 125\text{ }^\circ\text{C}$   |      |        | 0.0053    |               |
|   |               | $V_{GS} = 10\text{ V}, I_D = 15\text{ A}, T_J = 175\text{ }^\circ\text{C}$   |      |        | 0.0065    |               |
| Forward Transconductance <sup>a</sup>   | $g_{fs}$      | $V_{DS} = 15\text{ V}, I_D = 20\text{ A}$  | 68   |        |           | S             |
| <b>Dynamic<sup>b</sup></b>  |               |  |      |        |           |               |
| Input Capacitance   | $C_{iss}$     | $V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}, f = 1\text{ MHz}$  |      | 8150   |           | $\mu\text{F}$ |
| Output Capacitance  | $C_{oss}$     |  |      | 937    |           |               |
| Reverse Transfer Capacitance  | $C_{rss}$     |  |      | 110    |           |               |
| Total Gate Charge <sup>c</sup>  | $Q_g$         | $V_{DS} = 60\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$  |      | 110    | 150       | nC            |
| Gate-Source Charge <sup>c</sup>   | $Q_{gs}$      |  |      | 46     |           |               |
| Gate-Drain Charge <sup>c</sup>  | $Q_{gd}$      |  |      | 24     |           |               |
| Gate Resistance   | $R_g$         |  | 1.0  |        | 6.3       | $\Omega$      |
| Turn-On Delay Time <sup>c</sup>   | $t_{d(on)}$   | $V_{DD} = 60\text{ V}, R_L = 0.6\text{ }\Omega$<br>$I_D \cong 20\text{ A}, V_{GEN} = 10\text{ V}, R_g = 2.5\text{ }\Omega$ |      | 22     | 33        | ns            |
| Rise Time <sup>c</sup>  | $t_r$         |  |      | 102    | 180       |               |
| Turn-Off Delay Time <sup>c</sup>  | $t_{d(off)}$  |  |      | 53     | 85        |               |
| Fall Time <sup>c</sup>  | $t_f$         |  |      | 18     | 35        |               |
| <b>Source-Drain Diode Ratings and Characteristics</b> $T_C = 25\text{ }^\circ\text{C}$ <sup>b</sup> |               |  |      |        |           |               |
| Continuous Current  | $I_S$         |  |      |        | 188       | A             |
| Pulsed Current  | $I_{SM}$      |  |      |        | 650       |               |
| Forward Voltage <sup>a</sup>  | $V_{SD}$      | $I_F = 20\text{ A}, V_{GS} = 0\text{ V}$   |      | 1.0    | 1.5       | V             |
| Reverse Recovery Time   | $t_{rr}$      | $I_F = 20\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$  |      | 55     | 149       | ns            |
| Peak Reverse Recovery Charge  | $I_{RM(REC)}$ |  |      | 5.3    | 10        | A             |
| Reverse Recovery Charge   | $Q_{rr}$      |  |      | 0.15   | 0.37      | $\mu\text{C}$ |

**Notes:**

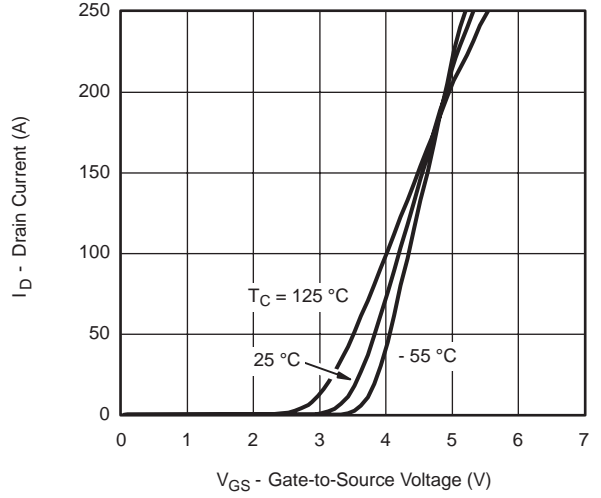
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

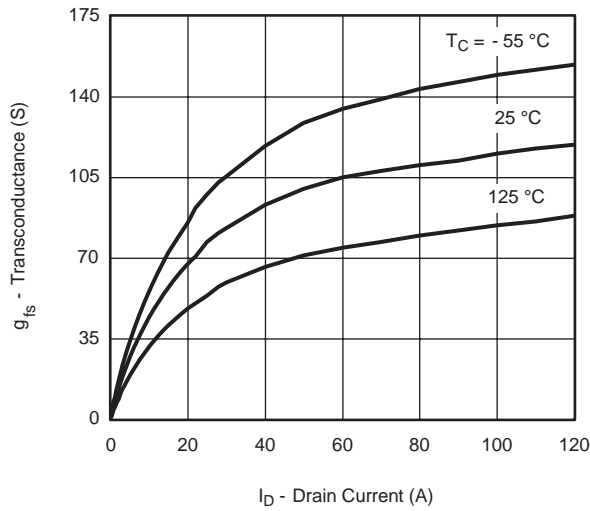
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



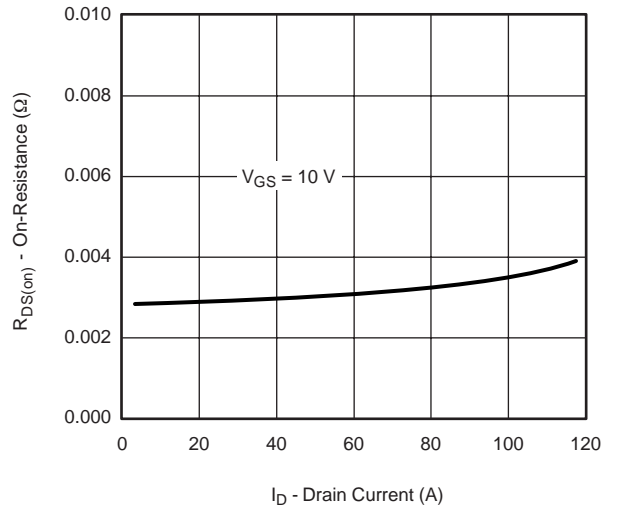
$V_{DS}$  - Drain-to-Source Voltage  
**Output Characteristics**



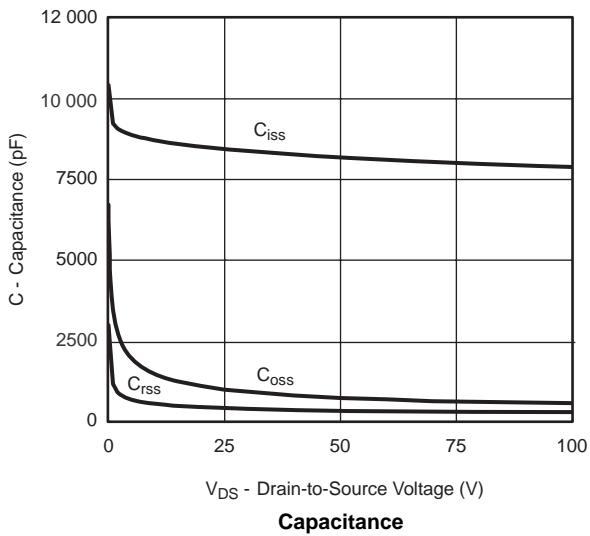
$V_{GS}$  - Gate-to-Source Voltage (V)  
**Transfer Characteristics**



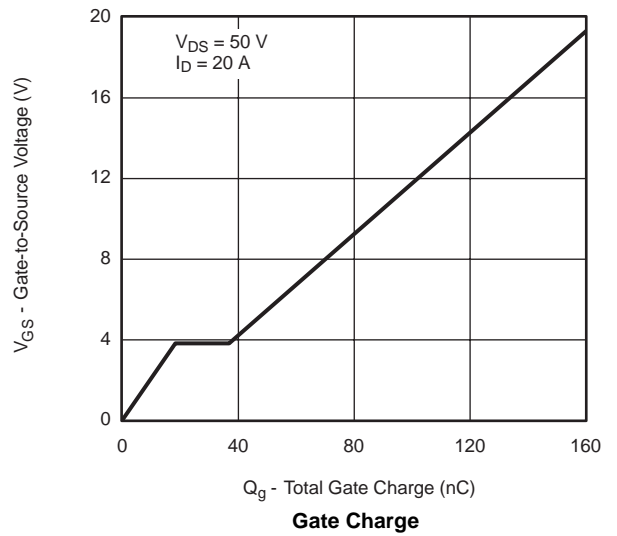
$I_D$  - Drain Current (A)  
**Transconductance**



$I_D$  - Drain Current (A)  
**On-Resistance vs. Drain Current**

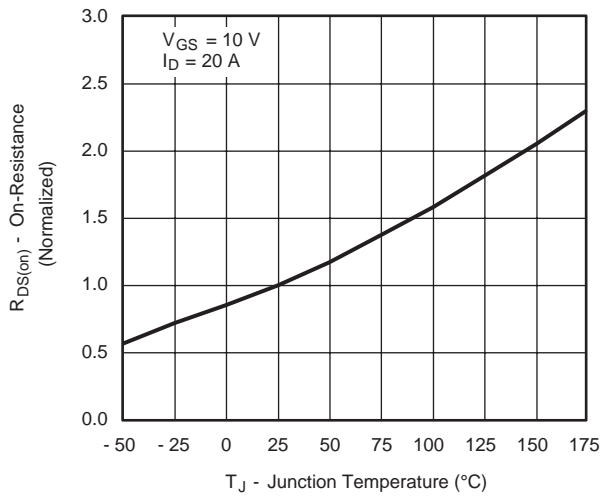


$V_{DS}$  - Drain-to-Source Voltage (V)  
**Capacitance**

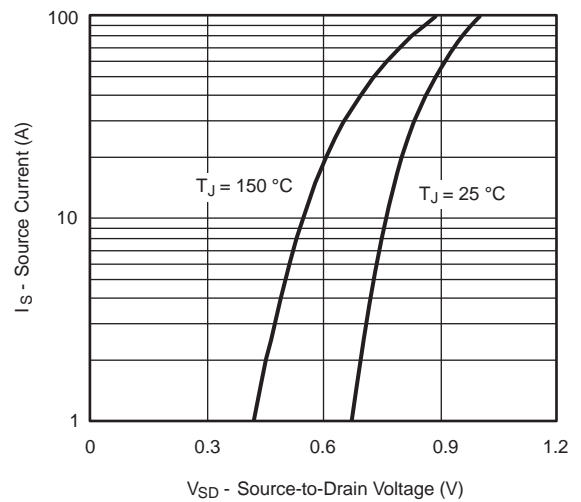


$Q_g$  - Total Gate Charge (nC)  
**Gate Charge**

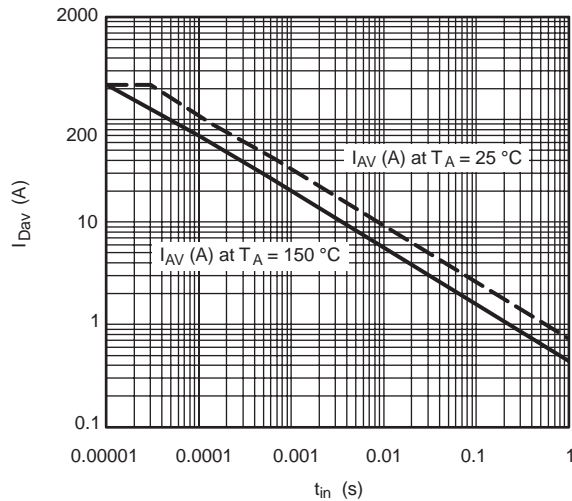
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



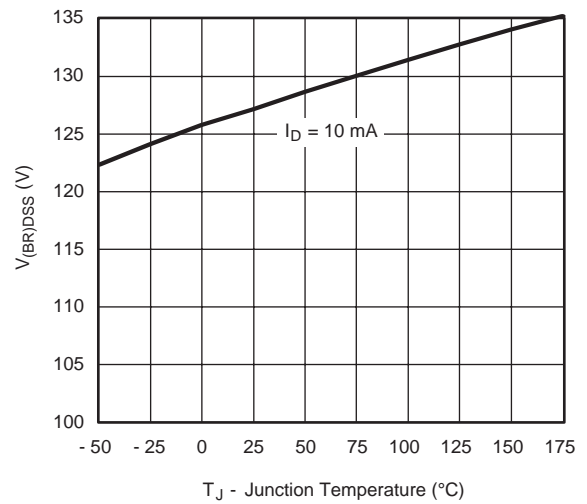
**On-Resistance vs. Junction Temperature**



**Source-Drain Diode Forward Voltage**

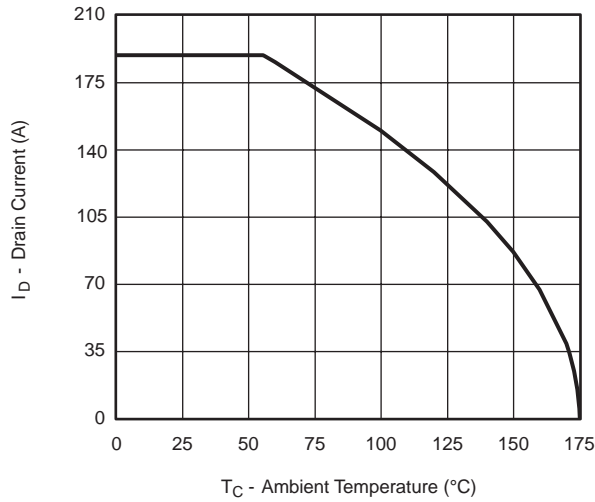


**Avalanche Current vs. Time**

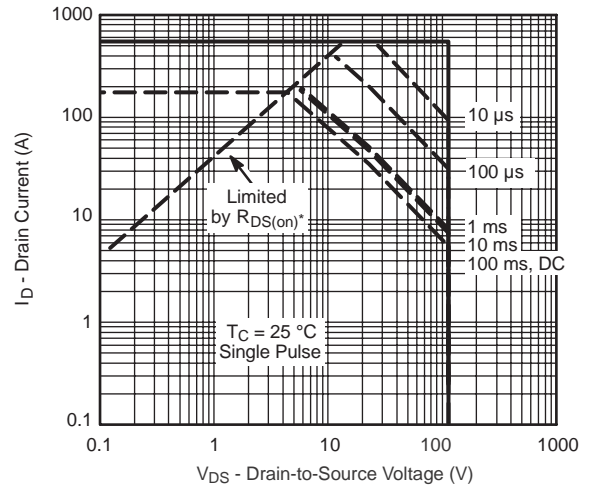


**Drain Source Breakdown vs. Junction Temperature**

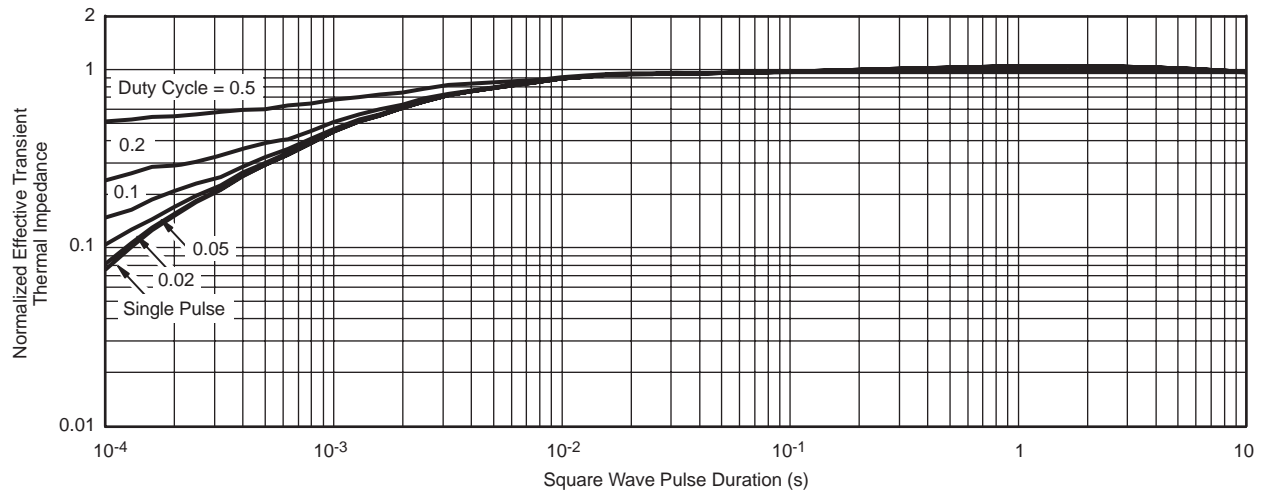
**THERMAL RATINGS**



**Maximum Avalanche and Drain Current vs. Case Temperature**

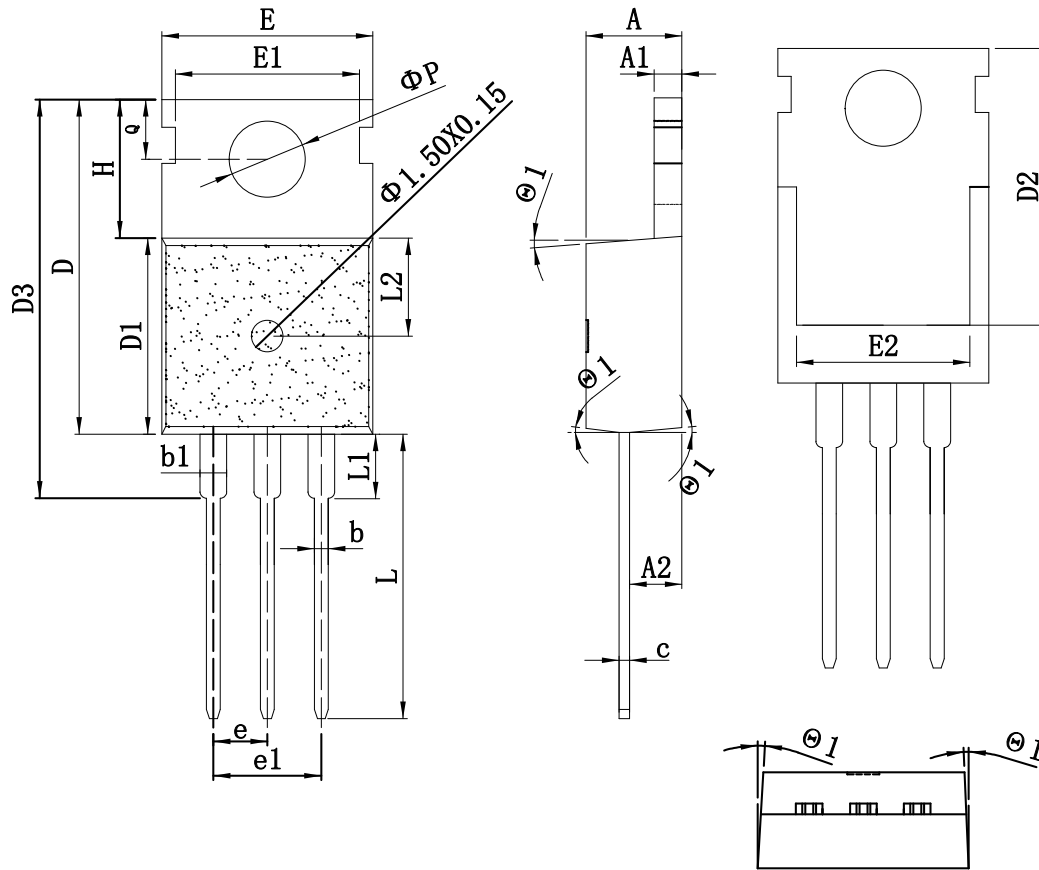


**Safe Operating Area**  
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified



**Normalized Thermal Transient Impedance, Junction-to-Case**

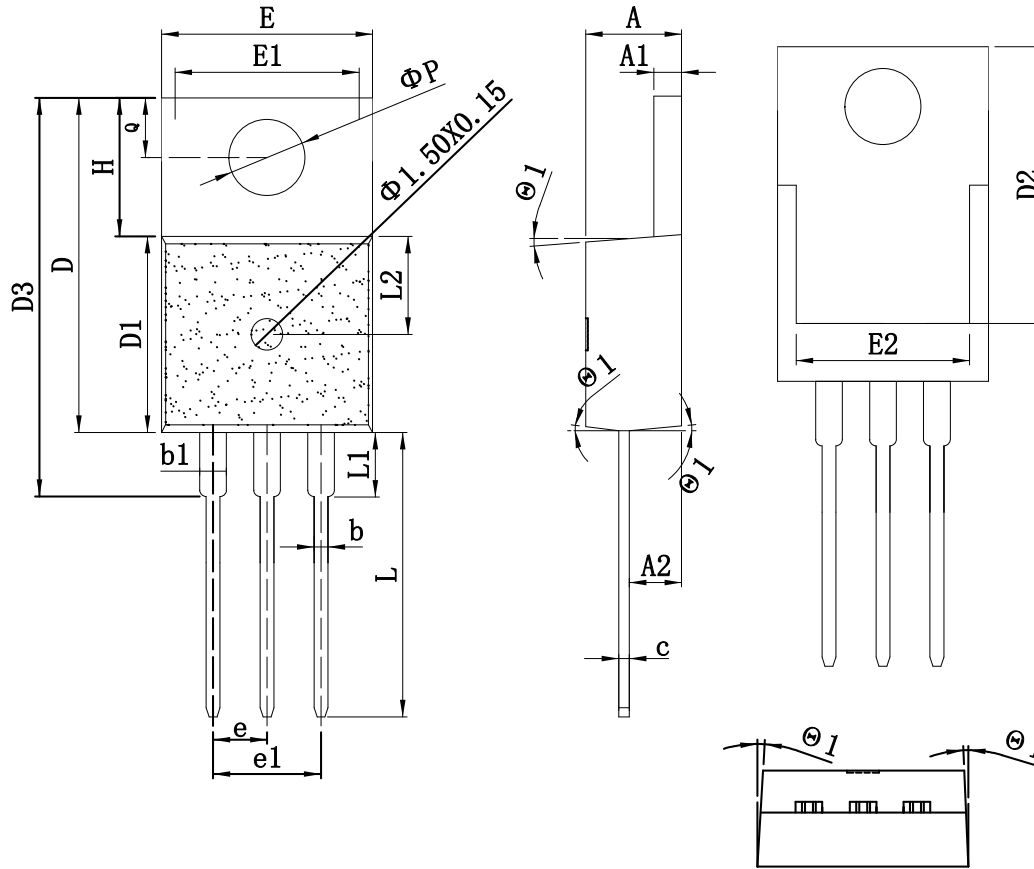
## TO-220\_3L-A PACKAGE OUTLINE



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | mm    |       |       | SYMBOL   | mm      |       |       |
|--------|-------|-------|-------|----------|---------|-------|-------|
|        | MIN   | TYP   | MAX   |          | MIN     | TYP   | MAX   |
| A      | 4.15  | 4.50  | 4.80  | E1       | 8.25    | 8.70  | 9.15  |
| A1     | 1.15  | 1.30  | 1.50  | E2       | 7.20    | 8.00  | 8.80  |
| A2     | 2.10  | 2.40  | 2.65  | e        | 2.38    | 2.54  | 2.74  |
| b      | 0.65  | 0.80  | 1.00  | e1       | 5.08REF |       |       |
| b1     | 1.10  | 1.33  | 1.80  | H        | 6.20    | 6.50  | 6.90  |
| c      | 0.35  | 0.50  | 0.65  | L        | 12.75   | 13.28 | 13.70 |
| D      | 14.25 | 15.75 | 16.15 | L1       | -       | -     | 3.50  |
| D1     | 8.70  | 9.20  | 9.60  | L2       | 2.30    | 4.65  | 7.00  |
| D2     | 12.30 | 13.10 | 13.85 | $\phi P$ | 3.40    | 3.65  | 3.85  |
| D3     | 16.20 | 18.80 | 20.60 | Q        | 2.50    | 2.80  | 3.00  |
| E      | 8.68  | 10.02 | 11.00 | $\theta$ | 2°      | -     | 7°    |

**TO-220\_3L-B PACKAGE OUTLINE**



**COMMON DIMENSIONS**  
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | mm    |       |       | SYMBOL   | mm      |       |       |
|--------|-------|-------|-------|----------|---------|-------|-------|
|        | MIN   | TYP   | MAX   |          | MIN     | TYP   | MAX   |
| A      | 4.15  | 4.50  | 4.80  | E1       | 8.25    | 8.70  | 9.15  |
| A1     | 1.15  | 1.30  | 1.50  | E2       | 7.20    | 8.00  | 8.80  |
| A2     | 2.10  | 2.40  | 2.65  | e        | 2.38    | 2.54  | 2.74  |
| b      | 0.65  | 0.80  | 1.00  | e1       | 5.08REF |       |       |
| b1     | 1.10  | 1.33  | 1.80  | H        | 6.20    | 6.50  | 6.90  |
| c      | 0.35  | 0.50  | 0.65  | L        | 12.75   | 13.28 | 13.70 |
| D      | 14.25 | 15.75 | 16.15 | L1       | -       | -     | 3.50  |
| D1     | 8.70  | 9.20  | 9.60  | L2       | 2.30    | 4.65  | 7.00  |
| D2     | 12.30 | 13.10 | 13.85 | $\phi P$ | 3.40    | 3.65  | 3.85  |
| D3     | 16.20 | 18.80 | 20.60 | Q        | 2.50    | 2.80  | 3.00  |
| E      | 8.68  | 10.02 | 11.00 | $\theta$ | 2°      | -     | 7°    |

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