

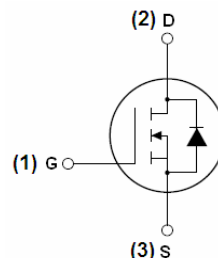
## N-Channel Power MOSFET

### General Features

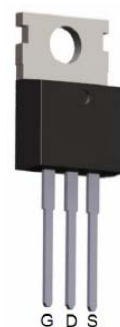
- $V_{DS} = 80V, I_D = 100A$   
 $R_{DS(ON)} < 12m\Omega @ V_{GS} = 10V$
- Special process technology for high ESD capability
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation

### Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply



Schematic diagram



TO-220-3L top view

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

| Symbol              | Parameter                                         | Limit      | Unit          |
|---------------------|---------------------------------------------------|------------|---------------|
| $V_{DS}$            | Drain-Source Voltage                              | 80         | V             |
| $V_{GS}$            | Gate-Source Voltage                               | $\pm 20$   | V             |
| $I_D$               | Drain Current-Continuous                          | 100        | A             |
| $I_D (100^\circ C)$ | Drain Current-Continuous( $T_C = 100^\circ C$ )   | 70         | A             |
| $I_{DM}$            | Pulsed Drain Current                              | 200        | A             |
| $P_D$               | Maximum Power Dissipation                         | 89         | W             |
|                     | Derating factor                                   | 1.33       | W/ $^\circ C$ |
| $E_{AS}$            | Single pulse avalanche energy <sup>(Note 5)</sup> | 80         | mJ            |
| $T_J, T_{STG}$      | Operating Junction and Storage Temperature Range  | -55 To 175 | $^\circ C$    |

## Thermal Characteristic

|                 |                                                          |      |               |
|-----------------|----------------------------------------------------------|------|---------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | 0.65 | $^{\circ}C/W$ |
|-----------------|----------------------------------------------------------|------|---------------|

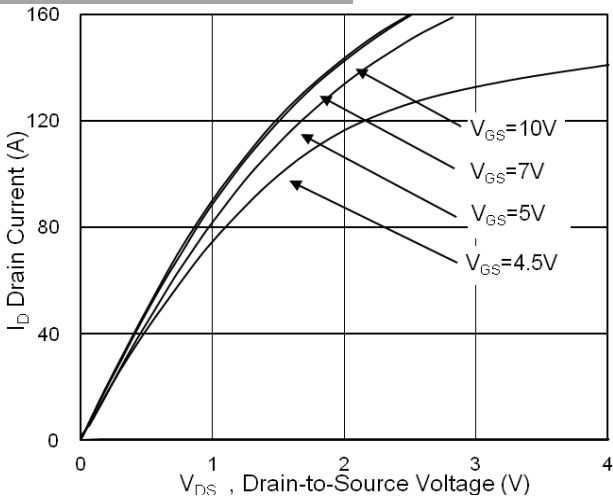
## Electrical Characteristics ( $T_C=25^{\circ}C$ unless otherwise noted)

| Symbol                                               | Parameter                                 | Condition                                                            | Min | Typ  | Max       | Unit       |
|------------------------------------------------------|-------------------------------------------|----------------------------------------------------------------------|-----|------|-----------|------------|
| <b>Off Characteristics</b>                           |                                           |                                                                      |     |      |           |            |
| $BV_{DSS}$                                           | Drain-Source Breakdown Voltage            | $V_{GS}=0V, I_D=250\mu A$                                            | 80  | -    | -         | V          |
| $I_{DSS}$                                            | Zero Gate Voltage Drain Current           | $V_{DS}=100V, V_{GS}=0V$                                             | -   | -    | 1         | $\mu A$    |
| $I_{GSS}$                                            | Gate-Body Leakage Current                 | $V_{GS}=\pm 20V, V_{DS}=0V$                                          | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics</b> <sup>(Note 3)</sup>        |                                           |                                                                      |     |      |           |            |
| $V_{GS(th)}$                                         | Gate Threshold Voltage                    | $V_{DS}=V_{GS}, I_D=250\mu A$                                        | 1.2 | -    | 2.5       | V          |
| $R_{DS(ON)}$                                         | Drain-Source On-State Resistance          | $V_{GS}=10V, I_D=13.5A$                                              | -   | 9.6  | 12        | m $\Omega$ |
| $g_{FS}$                                             | Forward Transconductance                  | $V_{DS}=50V, I_D=40A$                                                | -   | 32   | -         | S          |
| <b>Dynamic Characteristics</b> <sup>(Note 4)</sup>   |                                           |                                                                      |     |      |           |            |
| $C_{iss}$                                            | Input Capacitance                         | $V_{DS}=50V, V_{GS}=0V,$<br>$F=1.0MHz$                               | -   | 3120 | -         | PF         |
| $C_{oss}$                                            | Output Capacitance                        |                                                                      | -   | 140  | -         | PF         |
| $C_{rss}$                                            | Reverse Transfer Capacitance              |                                                                      | -   | 110  | -         | PF         |
| <b>Switching Characteristics</b> <sup>(Note 4)</sup> |                                           |                                                                      |     |      |           |            |
| $t_{d(on)}$                                          | Turn-on Delay Time                        | $V_{DD}=50V, I_D=40A$<br>$V_{GS}=10V, R_{GEN}=2.5\Omega$             | -   | 12.2 | -         | nS         |
| $t_r$                                                | Turn-on Rise Time                         |                                                                      | -   | 24.5 | -         | nS         |
| $t_{d(off)}$                                         | Turn-Off Delay Time                       |                                                                      | -   | 50.5 | -         | nS         |
| $t_f$                                                | Turn-Off Fall Time                        |                                                                      | -   | 17.6 | -         | nS         |
| $Q_g$                                                | Total Gate Charge                         | $V_{DS}=80V, I_D=40A,$<br>$V_{GS}=10V$                               | -   | 60.9 | -         | nC         |
| $Q_{gs}$                                             | Gate-Source Charge                        |                                                                      | -   | 8.1  | -         | nC         |
| $Q_{gd}$                                             | Gate-Drain Charge                         |                                                                      | -   | 17.9 | -         | nC         |
| <b>Drain-Source Diode Characteristics</b>            |                                           |                                                                      |     |      |           |            |
| $V_{SD}$                                             | Diode Forward Voltage <sup>(Note 3)</sup> | $V_{GS}=0V, I_S=40A$                                                 | -   | -    | 1.2       | V          |
| $I_S$                                                | Diode Forward Current <sup>(Note 2)</sup> | -                                                                    | -   | -    | 57        | A          |
| $t_{rr}$                                             | Reverse Recovery Time                     | $T_J = 25^{\circ}C, I_F = 40A$<br>$di/dt = 100A/\mu s$ (Note 3)      | -   | 18.6 | -         | nS         |
| $Q_{rr}$                                             | Reverse Recovery Charge                   |                                                                      | -   | 65   | -         | nC         |
| $t_{on}$                                             | Forward Turn-On Time                      | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) |     |      |           |            |

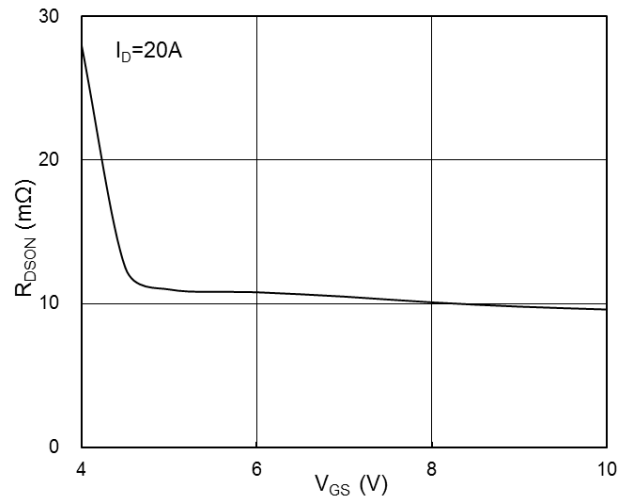
**Note :**

1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
2. The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$
3. The EAS data shows Max. rating . The test condition is  $V_{DD}=50V, V_{GS}=10V, L=0.1mH, I_{AS}=40A$
4. The power dissipation is limited by 175 $^{\circ}C$  junction temperature
5. The data is theoretically the same as  $I_D$  and  $I_{DM}$  , in real applications , should be limited by total power dissipation.

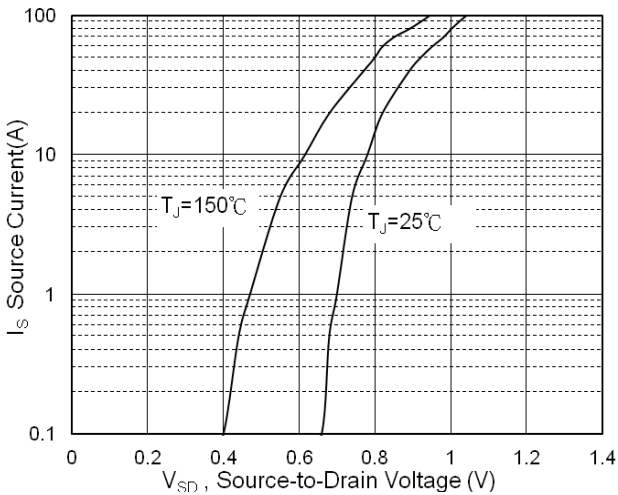
## Typical Characteristics



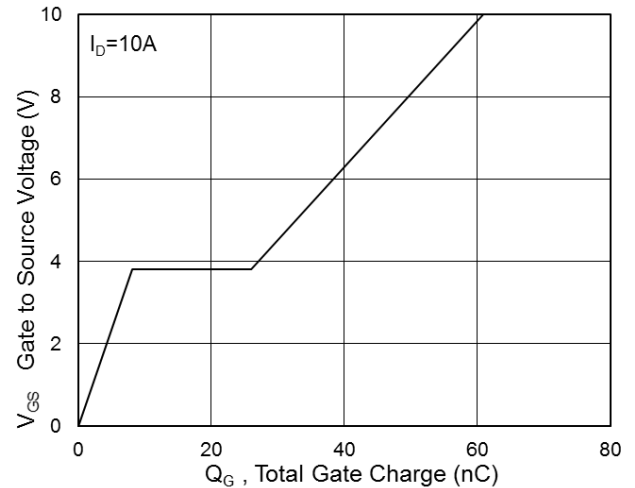
**Fig.1 Typical Output Characteristics**



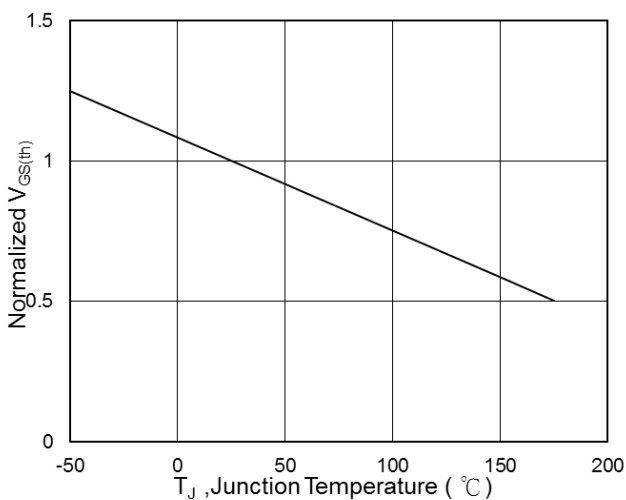
**Fig.2 On-Resistance v.s Gate-Source**



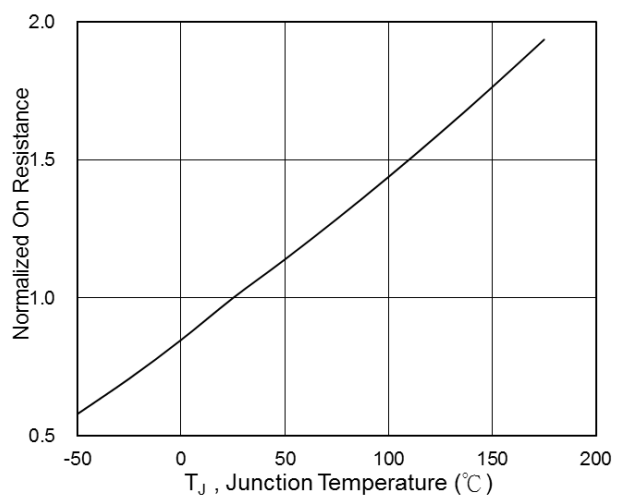
**Fig.3 Forward Characteristics of Reverse**



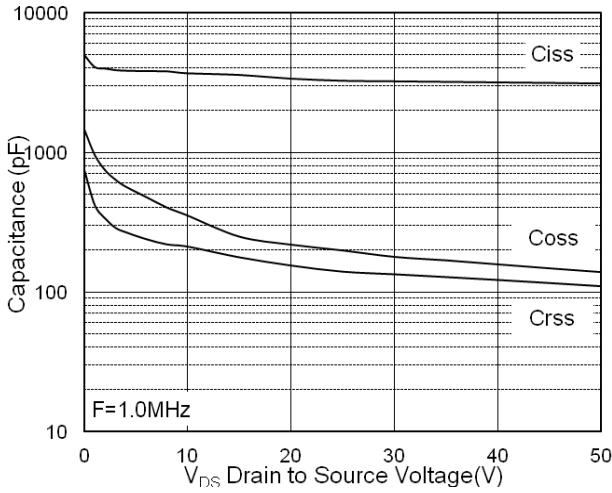
**Fig.4 Gate-Charge Characteristics**



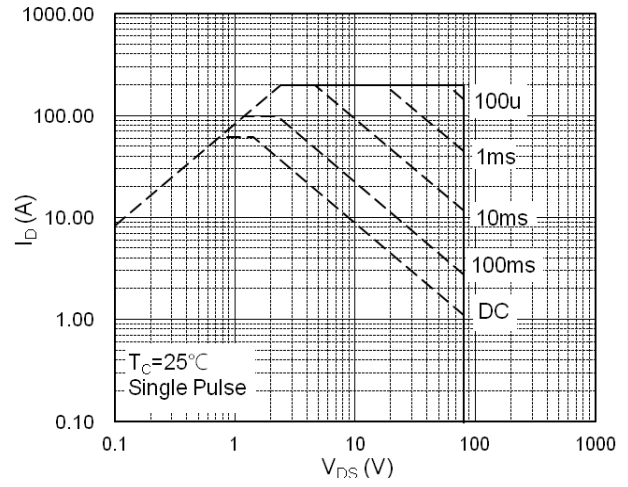
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



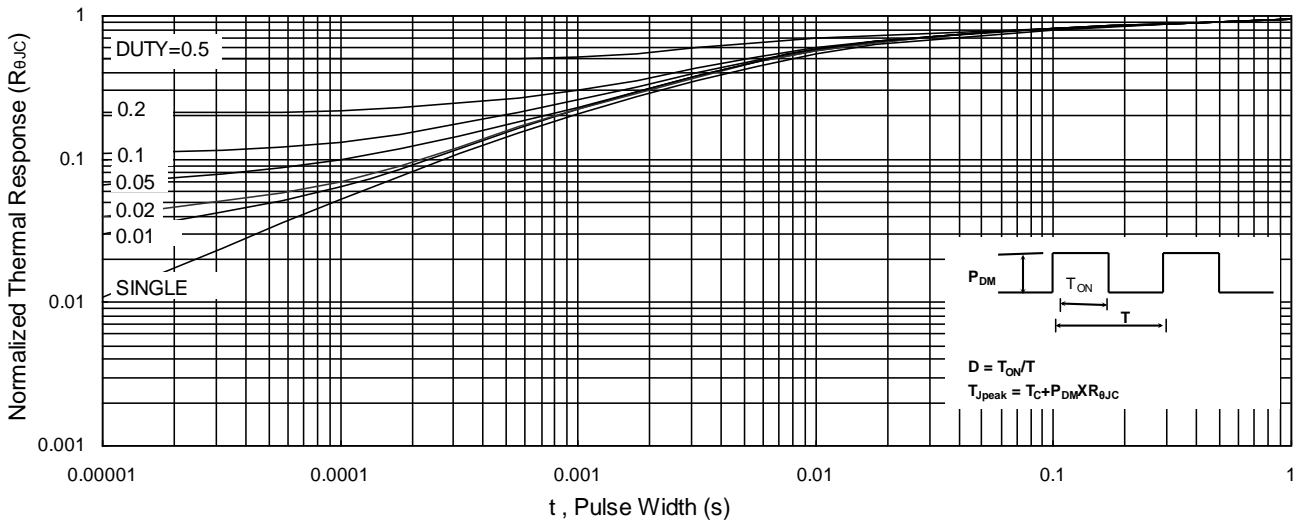
**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**



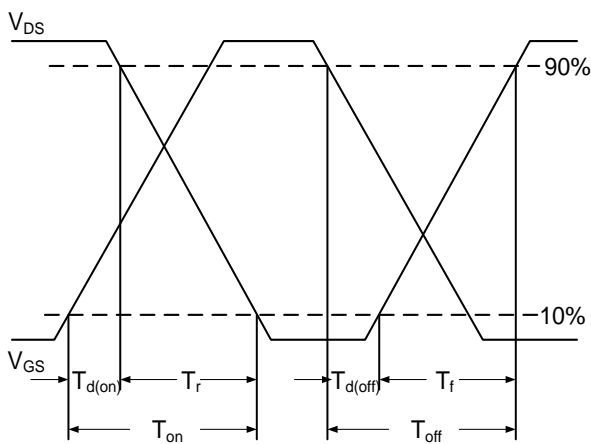
**Fig.7 Capacitance**



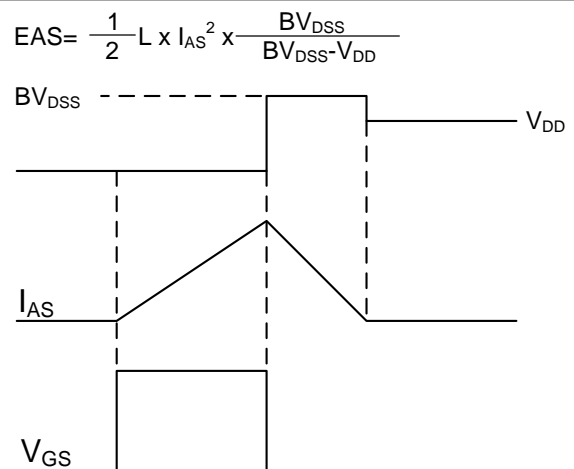
**Fig.8 Safe Operating Area**



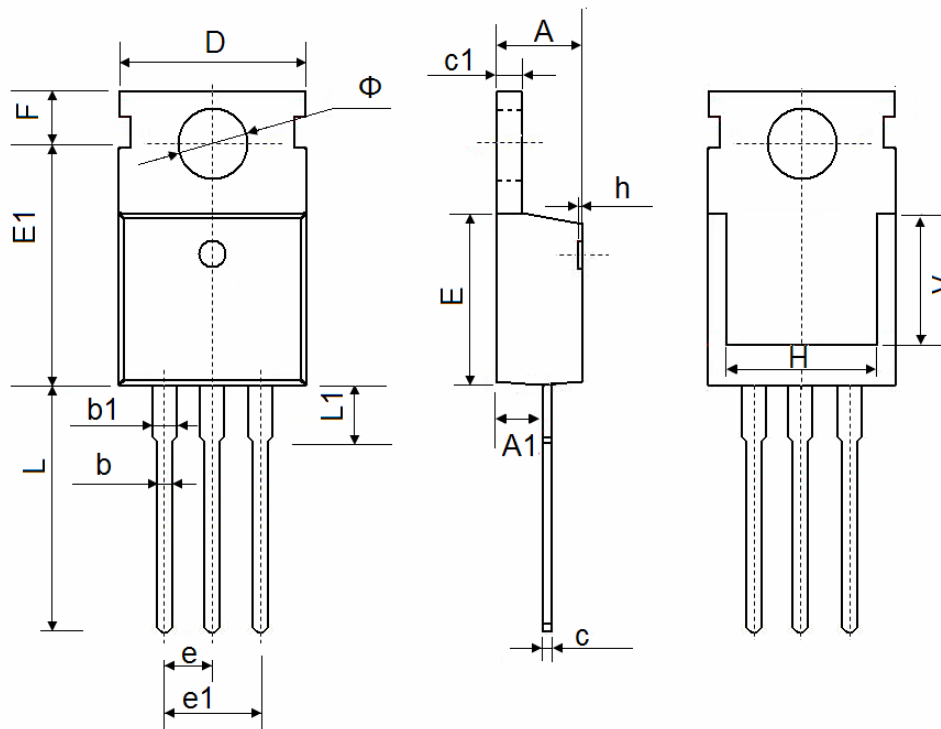
**Fig.9 Normalized Maximum Transient Thermal Impedance**



**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**

**TO-220-3L Package Information**


| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.400                     | 4.600  | 0.173                | 0.181 |
| A1     | 2.250                     | 2.550  | 0.089                | 0.100 |
| b      | 0.710                     | 0.910  | 0.028                | 0.036 |
| b1     | 1.170                     | 1.370  | 0.046                | 0.054 |
| c      | 0.330                     | 0.650  | 0.013                | 0.026 |
| c1     | 1.200                     | 1.400  | 0.047                | 0.055 |
| D      | 9.910                     | 10.250 | 0.390                | 0.404 |
| E      | 8.9500                    | 9.750  | 0.352                | 0.384 |
| E1     | 12.650                    | 12.950 | 0.498                | 0.510 |
| e      | 2.540 TYP.                |        | 0.100 TYP.           |       |
| e1     | 4.980                     | 5.180  | 0.196                | 0.204 |
| F      | 2.650                     | 2.950  | 0.104                | 0.116 |
| H      | 7.900                     | 8.100  | 0.311                | 0.319 |
| h      | 0.000                     | 0.300  | 0.000                | 0.012 |
| L      | 12.900                    | 13.400 | 0.508                | 0.528 |
| L1     | 2.850                     | 3.250  | 0.112                | 0.128 |
| V      | 7.500 REF.                |        | 0.295 REF.           |       |
| $\Phi$ | 3.400                     | 3.800  | 0.134                | 0.150 |

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