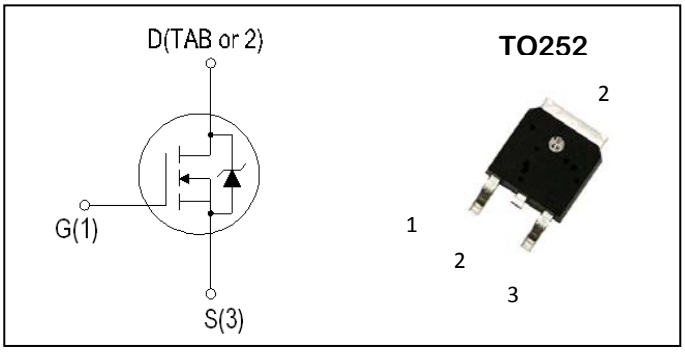
# *N-Channel Enhancement Mode Field Effect Transistor*




## PRODUCT SUMMARY

| $V_{DSS}$ | $I_D$ | $R_{DS(ON)}$ (mΩ) |
|---|---|---|
| 60V | 18A | 40mΩ |

## Absolute Maximum Ratings ( $T_A$ = 25°C unless otherwise specifed )

| Symbol | Parameter | | Ratings | Unit |
|---|---|---|---|---|
| **Common Ratings** | | | | |
| $V_{DSS}$ | Drain-Source Voltage | | 60 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ±20 | |
| $T_J$ | Maximum Junction Temperature | | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | | -55 to 150 | °C |
| $I_S$ | Diode Continuous Forward Current | $T_C$=25°C | 18 | A |
| **Mounted on Large Heat Sink** | | | | |
| $I_{DM}$ | 300μs Pulse Drain Current Tested(1) | $T_C$=25°C | 40 | A |
| $I_D$ | Continuous Drain Current | $T_C$=25°C | 18 | A |
| | | $T_C$=70°C | 13 | A |
| $P_D$ | Maximum Power Dissipation | $T_C$=25°C | 31.3 | W |

1. Pulse width limited by maximum junction temperature.

## Thermal Characteristics

| Symbol | Parameter | Ratings | Unit |
|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case max | 4 | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient max | 62 | °C/W |

## Electrical Characteristics (TA=25°C Unless Otherwise Noted)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **On/off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_{DS}$=250uA | 60 | -- | -- | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$= 48V, $V_{GS}$=0V | -- | -- | 1 | uA |
| | | $V_{DS}$=48V, $V_{GS}$=0V $T_J$=55°C | -- | -- | 5 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_{DS}$=250uA | 1 | 1.5 | 2.5 | V |
| $I_{GSS}$ | Gate Leakage Current | $V_{GS}$=±20V, $V_{DS}$=0V | -- | -- | ±100 | nA |
| $R_{DS(ON)}$ | Drain-SourceOn-stateResistance(2) | $V_{GS}$= 10V, $I_{DS}$=10A | -- | 42 | 55 | mΩ |
| $g_{FS}$ | Forward transconductance(2) | $V_{DS}$= 5V, $I_{DS}$=15A | -- | 25.3 | -- | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, | -- | 1027 | -- | pF |
| $C_{oss}$ | Output Capacitance | $V_{DS}$= 15V, | -- | 65 | -- | |
| $C_{rss}$ | Reverse Transfer Capacitance | Frequency=1.0MHz | -- | 46 | -- | |
| **Switching Characteristics** | | | | | | |
| $t_{d(ON)}$ | Turn-on Delay Time(1) | $V_{DD}$=30V, | -- | 2.8 | -- | ns |
| $t_r$ | Turn-on Rise Time(1) | $I_D$= 15A, $V_{GS}$= 10V, | -- | 16.6 | -- | |
| $t_{d(OFF)}$ | Turn-off Delay Time(1) | $R_{GEN}$=3.3Ω | -- | 21.2 | -- | |
| $t_f$ | Turn-off Fall Time(1) | | -- | 5.6 | -- | |
| $Q_g$ | Total Gate Charge(1) | $V_{DS}$=48V, $V_{GS}$= 10V, | -- | 19 | -- | nC |
| $Q_{gs}$ | Gate-Source Charge(1) | $I_{DS}$=15A | -- | 2.5 | -- | |
| $Q_{gd}$ | Gate-Drain Charge(1) | | -- | 5 | -- | |
| **Diode Characteristics** | | | | | | |
| $V_{SD}$ | Diode Forward Voltage(2) | $I_{SD}$ = 1A, $V_{GS}$ = 0 | -- | -- | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$=15A, $dI_{SD}/dt$=100A/μs | -- | 12.2 | -- | ns |
| $q_{rr}$ | Reverse Recovery Charge | | -- | 7.3 | -- | nC |

NOTES:

1. Independent of operating temperature.
2. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%

## Typical Performance Characteristics

**Figure 1: On-Region Characteristics**

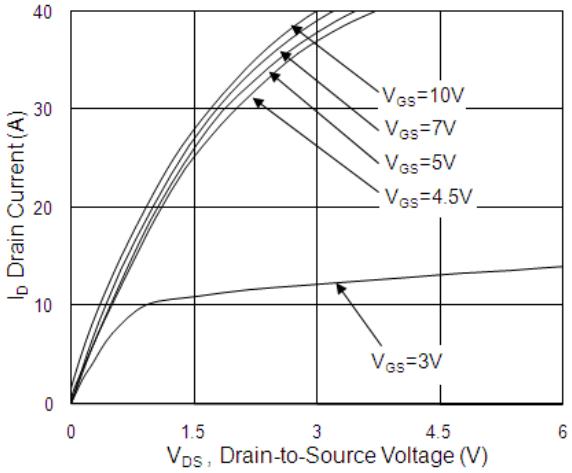



**Figure 2: On-Resistance vs. Gate-Source**

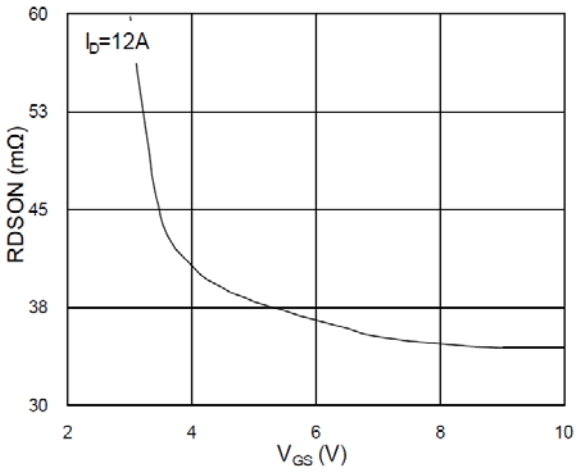



**Figure 3: Forward Characteristics Of Reverse**

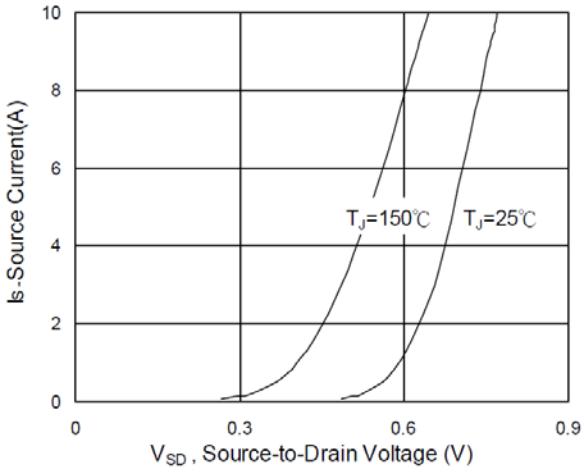



**Figure 4: Normalized RDSON vs. TJ**

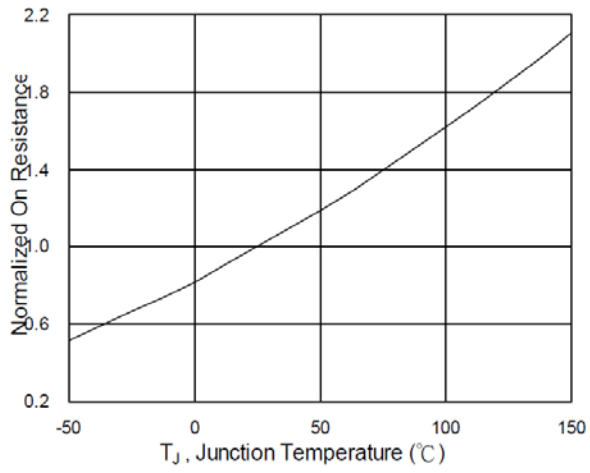



**Figure 5: Capacitance Characteristics**

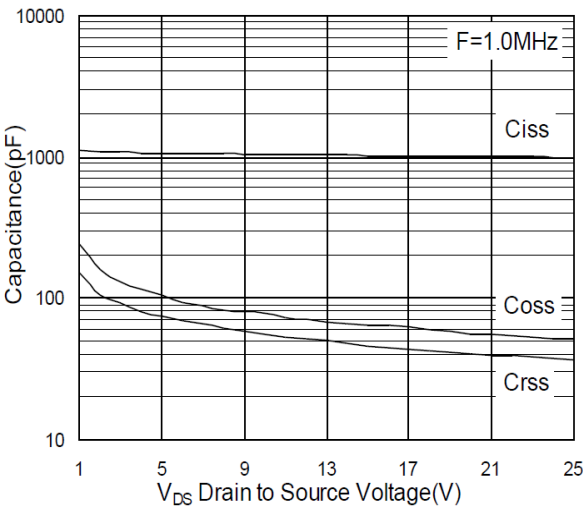



**Figure 6: Gate Charge Characteristics**

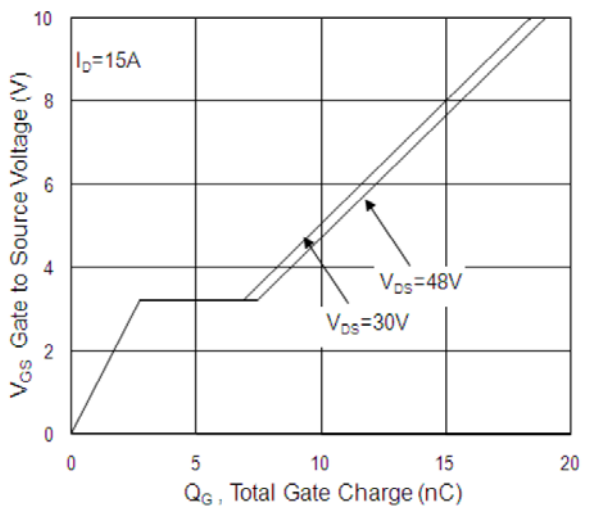


**Figure 7: Normalized VGS(th) vs. TJ**

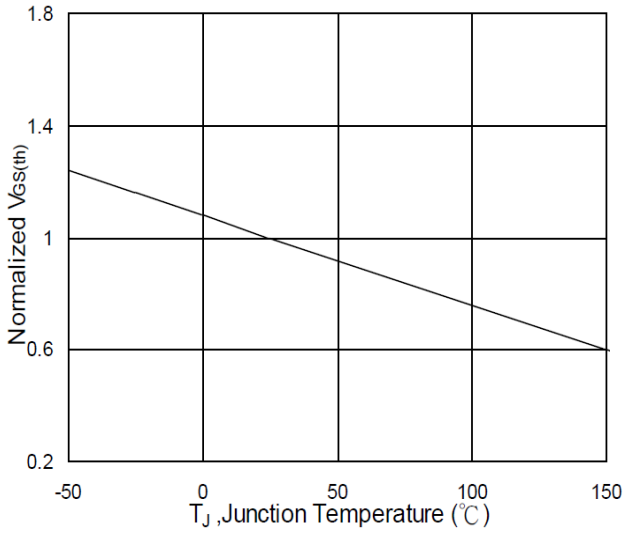



**Figure 8: Maximum Safe Operating Area**

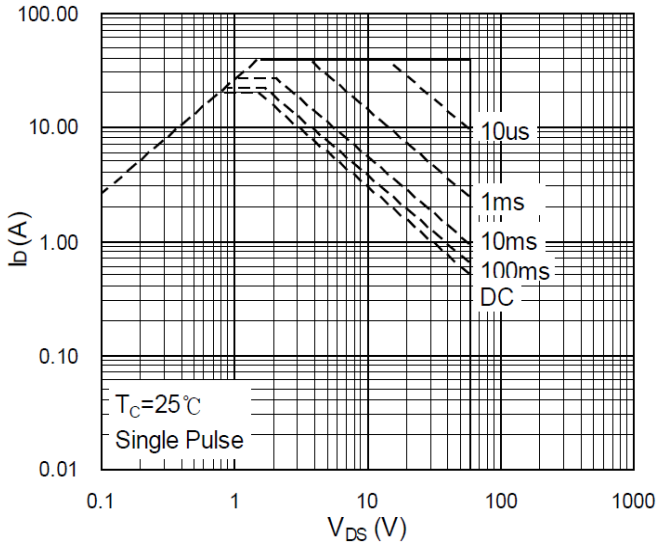
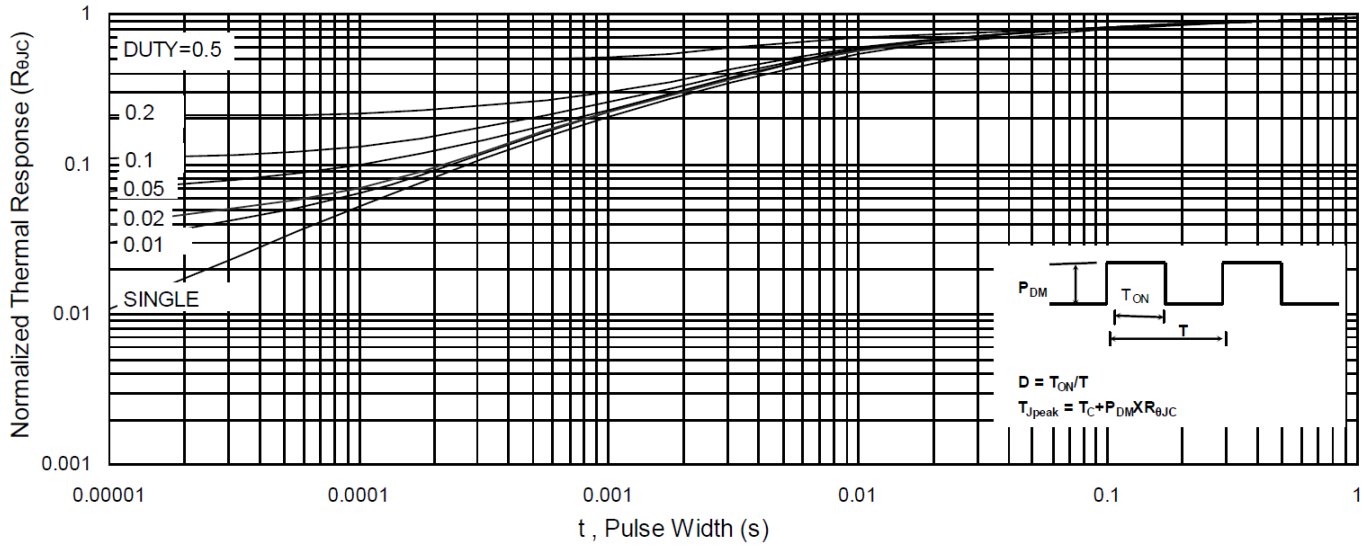
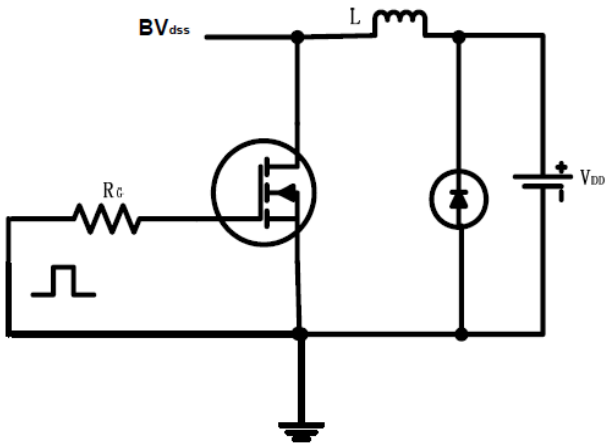



**Figure 11. Normalized Maximum Transient Thermal Impedance**

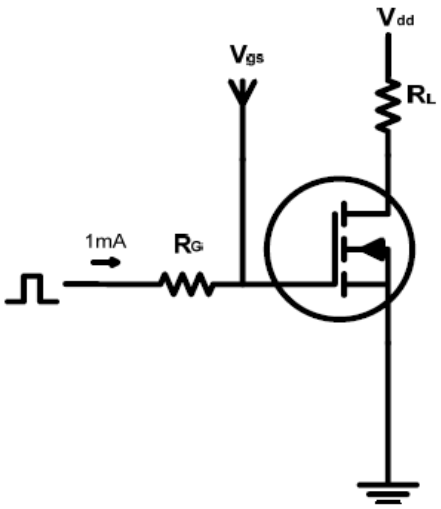


## Test circuits and Waveforms

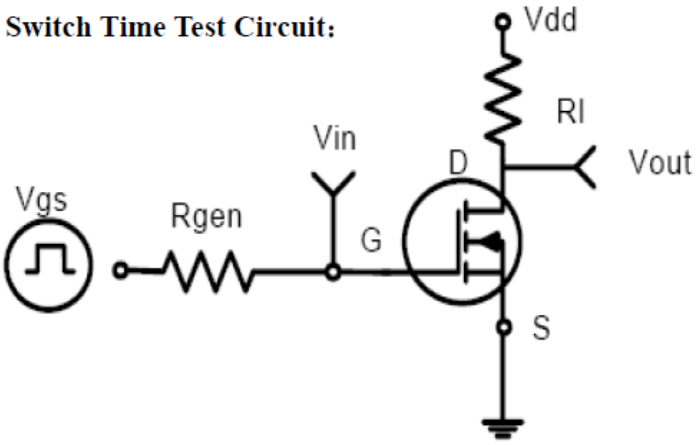
**EAS test circuits:**



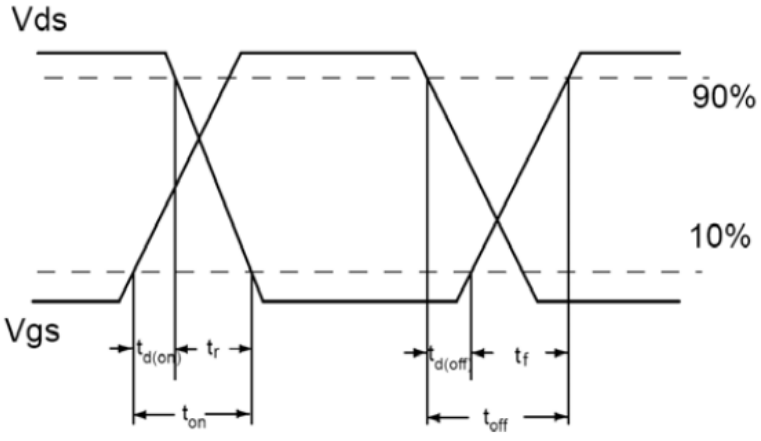

**Gate charge test circuit:**




**Switch Time Test Circuit:**

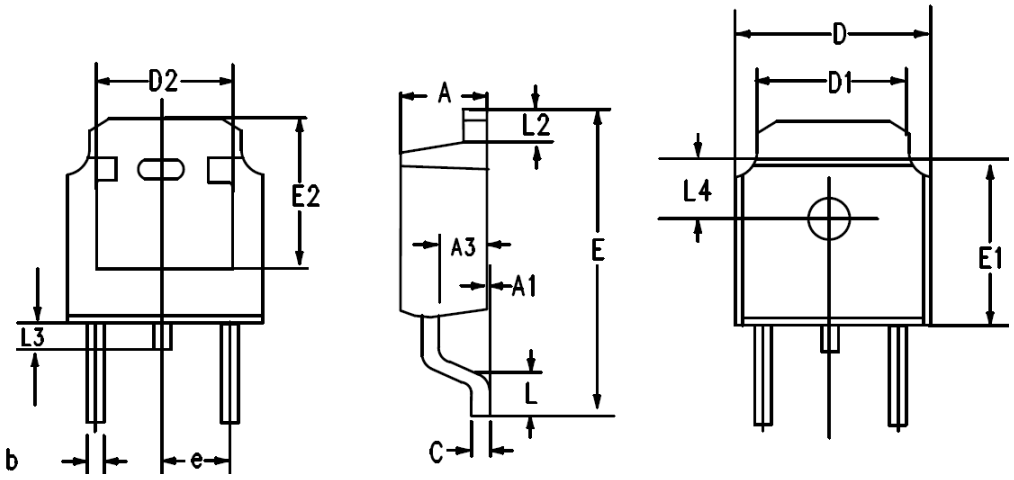



**Switch Waveforms:**



**PACKAGE MECHANICAL DATA**

**TO-252 Package Dimension**




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 2.200 | 2.400 | 0.087 | 0.094 |
| A1 | 0.000 | 0.127 | 0.000 | 0.005 |
| A3 | 1.020 | 1.120 | 0.040 | 0.044 |
| b | 0.740 | 0.820 | 0.029 | 0.032 |
| c | 0.510 | 0.580 | 0.020 | 0.023 |
| D | 6.500 | 6.700 | 0.256 | 0.263 |
| D1 | 5.200 | 5.400 | 0.205 | 0.213 |
| D2 | 4.830REF. | | 0.190REF. | |
| E | 9.900 | 10.300 | 0.390 | 0.405 |
| E1 | 6.000 | 6.200 | 0.236 | 0.244 |
| E2 | 5.300 REF. | | 0.208 REF. | |
| e | 2.286TYP. | | 0.090 TYP. | |
| L | 1.400 | 1.600 | 0.055 | 0.063 |
| L2 | 0.900 | 1.250 | 0.035 | 0.049 |
| L3 | 0.600 | 1.000 | 0.024 | 0.039 |
| L4 | 1.700 | 1.900 | 0.066 | 0.075 |