# MOSFET

88A,40V,7mΩ N-CHANNEL MOSFET

## Features

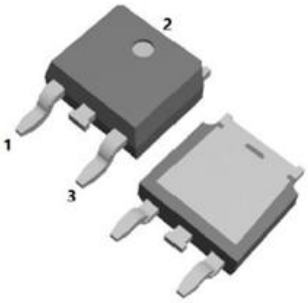
- Advanced Trench Technology
- Excellent $R_{DS(ON)}$ and Low Gate Charge
- LeadFree

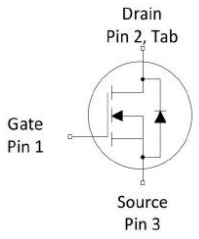
## Applications

- LoadSwitch
- PWMApplication
- PowerManagement

**View and Internal Schematic Diagram**

**TO-252-2L**




| Parameter | Values | Unit |
|---|---|---|
| $BV_{DSS}$ | 40 | V |
| $I_D$ | 88 | A |
| $R_{Dson}$(max) | 7 | mΩ |
| $V_{GS(th)}$(Typ) | 1.5 | V |

| Ordering Code | Marking | Package | Packaging |
|---|---|---|---|
| X7N040TLE2 | X7N040TLE2 | TO-252-2L | Tape & Reel |

## Absolute Maximum Ratings($T_C$=25℃,unless otherwise noted)

| Parameter | Symbol | Values | | | Unit | Note/Test Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Drain-Source Voltage | $V_{DSS}$ | - | - | 40 | V | - |
| Gate-Source Voltage | $V_{GS}$ | -20 | - | 20 | V | - |
| Continuous Drain Current(Note 1) | $I_D$ | - | - | 88 | A | $T_C$=25℃ |
| | | - | - | 55 | A | $T_C$=100 |
| Pulsed Drain Current(Note 2) | $I_{DM}$ | - | - | 352 | A | - |
| Single Pulse Avalanche Energy | $E_{AS}$ | - | - | 90 | mJ | L=0.5mH,$V_D$=24V, $T_C$=25℃ |
| Maximum Power Dissipation | $P_D$ | - | - | 98 | W | $T_C$=25℃ |
| | | - | - | 3 | W | $T_A$=25℃ |
| Operating Junction and Storage Temperature Range | $T_j$,$T_{STG}$ | -50 | - | 150 | ℃ | - |

## Thermal Characteristics

| Parameter | Symbol | Values | | | Unit | Note/Test Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Thermal resistance , Junction to Case | $R_{th(J-c)}$ | - | 1.27 | | ℃/W | - |
| Thermal resistance , Junction to Ambient | $R_{th(J-a)}$ | - | 41 | | ℃/W | |

## Electrical Characteristics ($T_j$=25℃,unless otherwise noted)

### Static characteristics

| Parameter | Symbol | Values | | | Unit | Note/Test Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 40 | - | - | V | $V_{GS}$=0V,$I_D$=250μA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | - | - | 1 | μA | $V_{DS}$=40V,$V_{GS}$=0V |
| Gate-Body Leakage Current | $I_{GSS}$ | - | - | ±100 | nA | $V_{GS}$=±20V,$V_{DS}$=0V |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | 1 | - | 2.4 | V | $V_{DS}$=$V_{GS}$,$I_D$=250μA |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | - | 5.7 | 7 | mΩ | $V_{GS}$=10V,$I_D$=20A |
| | | - | 7.6 | 12 | | $V_{GS}$=4.5V,$I_D$=10A |
| Gate Resistance | $R_g$ | - | 2.8 | - | Ω | $V_{GS}$=0V, $V_{DS}$ =0V, f=1MHz |
| Forward Transconductance | $g_{fs}$ | - | 17 | - | S | $V_{DS}$=5V,$I_D$=20A |

### Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note/Test Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Input Capacitance | $C_{iss}$ | - | 1887 | - | pF | $V_{DS}$=25V,$V_{GS}$=0V,f=1.0MHZ |
| Output Capacitance | $C_{oss}$ | - | 163 | - | | |
| Reverse Transfer Capacitance | $C_{rss}$ | - | 148 | - | | |
| Turn-On Delay Time | $t_{d(on)}$ | - | 8 | - | ns | $V_{DD}$=20V,$I_D$=20A,$V_{GS}$=10V,$R_G$=10Ω |
| Turn-On Rise Time | $t_r$ | - | 63 | - | | |
| Turn-Off Delay Time | $t_{d(off)}$ | - | 79 | - | | |
| Turn-Off Fall Time | $t_f$ | - | 54 | - | | |

### Gate charge characteristics

| Parameter | Symbol | Values | | | Unit | Note/Test Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Total Gate Charge | $Q_g$ | - | 42 | - | nC | $V_{DS}$=32V,$I_D$=20A,$V_{GS}$=10V |
| Gate-Source Charge | $Q_{gs}$ | - | 7 | - | | |
| Gate-Drain Charge | $Q_{gd}$ | - | 10 | - | | |

### Diode Characteristic

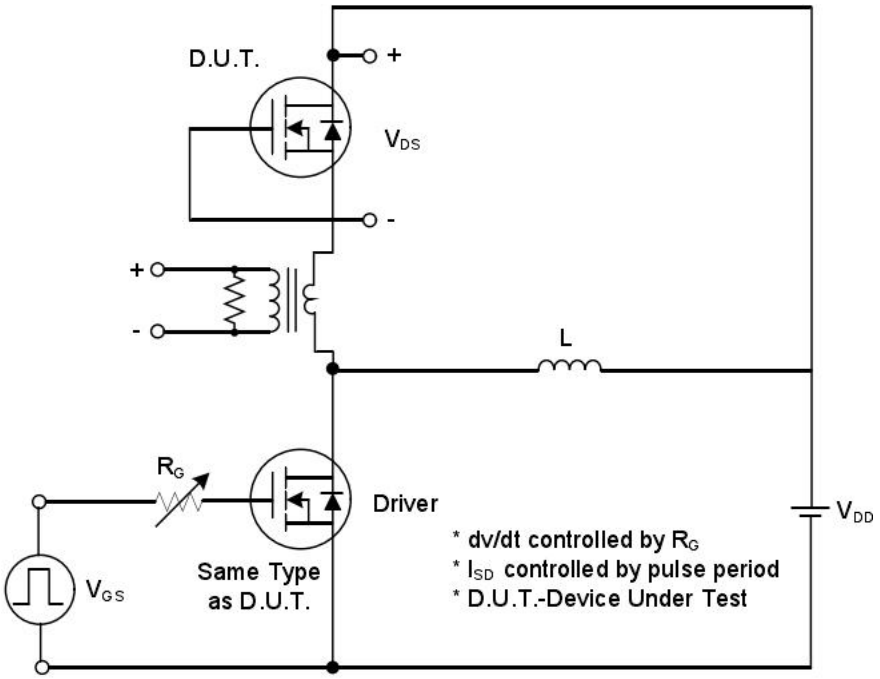
| Parameter | Symbol | Values | | | Unit | Note/Test Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Continuous Diode Forward Current | $I_S$ | - | - | 88 | A | - |
| Pulsed Diode Forward Current | $I_{SM}$ | - | - | 352 | A | - |
| Diode Forward Voltage | $V_{SD}$ | - | - | 1 | V | $I_S$=20A,$V_{GS}$=0V |
| Reverse Recovery Time | $t_{rr}$ | - | 22 | - | ns | $V_{DS}$=20V,$V_{GS}$=0V, $I_S$=30A , |
| Reverse Recovery Charge | $Q_{rr}$ | - | 19 | - | nC | di/dt=100A/μs |

**Notes**

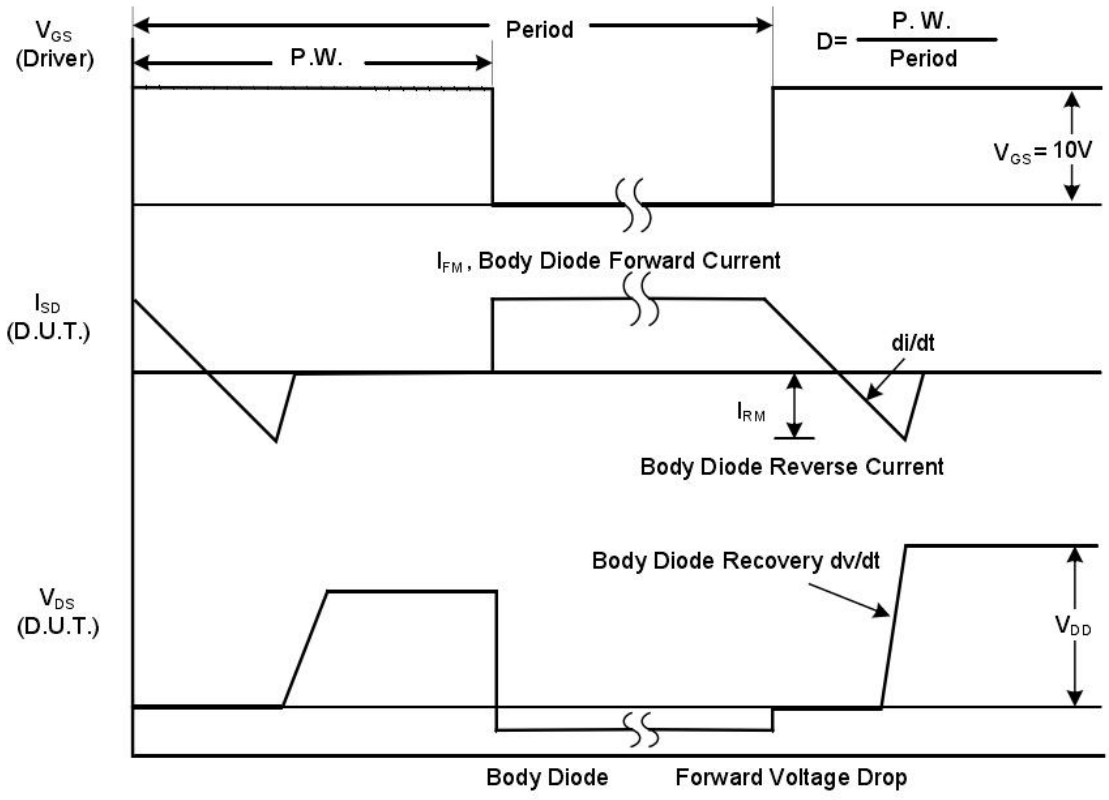
1. Computed continuous current assumes the condition of $T_{j_Max}$ while the actual continuous current depends on the thermal & electro-mechanical application board design.

2.This single-pulse measurement was taken under $T_{j_Max}$ = 150°C.

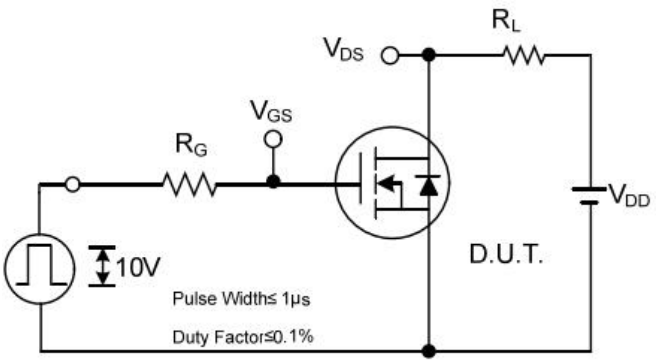
## RATING AND CHARACTERISTIC CURVES



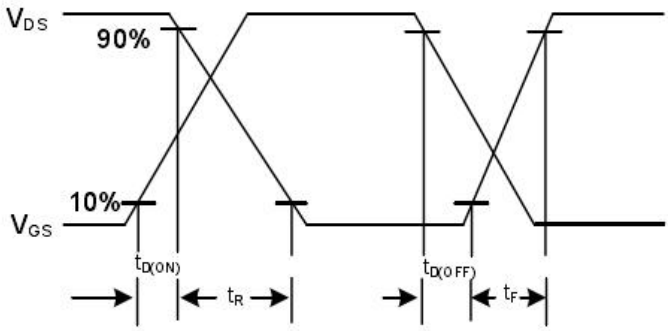

**Peak Diode Recovery dv/dt Test Circuit**



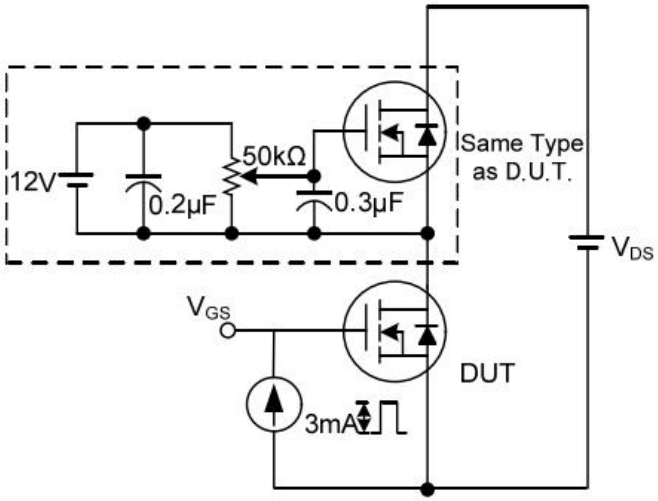

**Peak Diode Recovery dv/dt Waveforms**



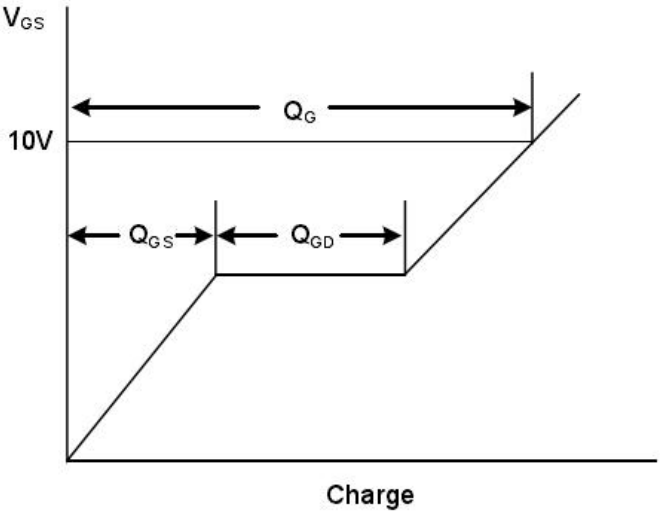

**Switching Test Circuit**



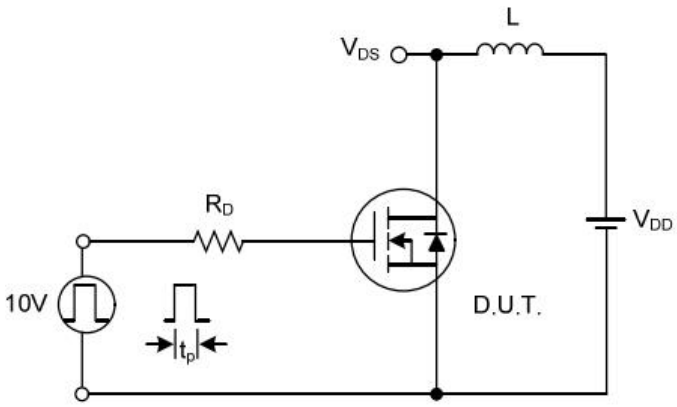

**Switching Waveforms**



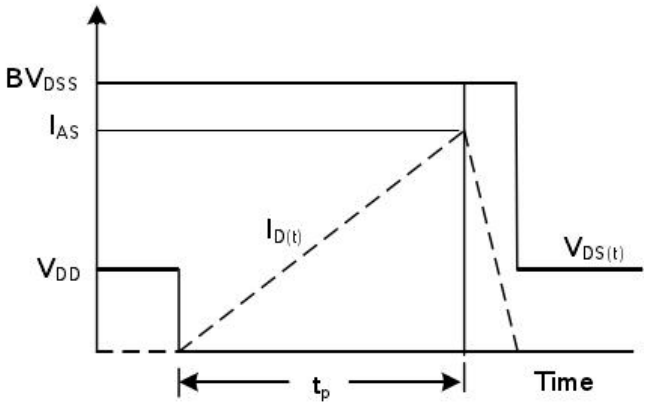

**Gate Charge Test Circuit**




**Gate Charge Waveform**




**Unclamped Inductive Switching Test Circuit**




**Unclamped Inductive Switching Waveforms**

## RATING AND CHARACTERISTIC CURVES

Figure.1 Output Characteristics $T_j$=25℃

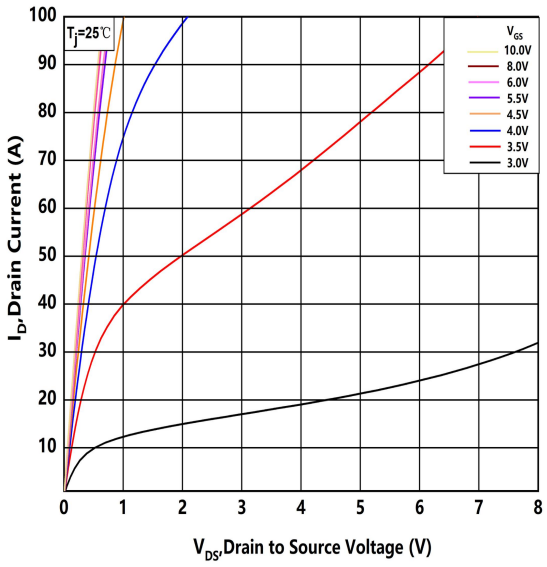



Figure.2 Transfer Characteristic for Various Junction Temperatures

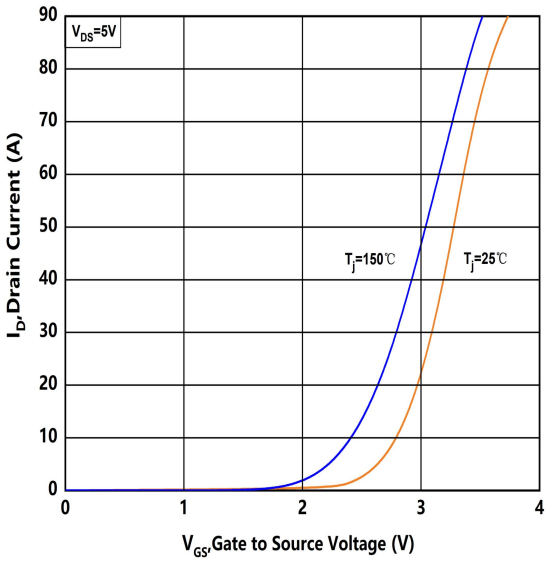



Figure.3 On-Resistance vs Drain Current For Various Gate Voltage

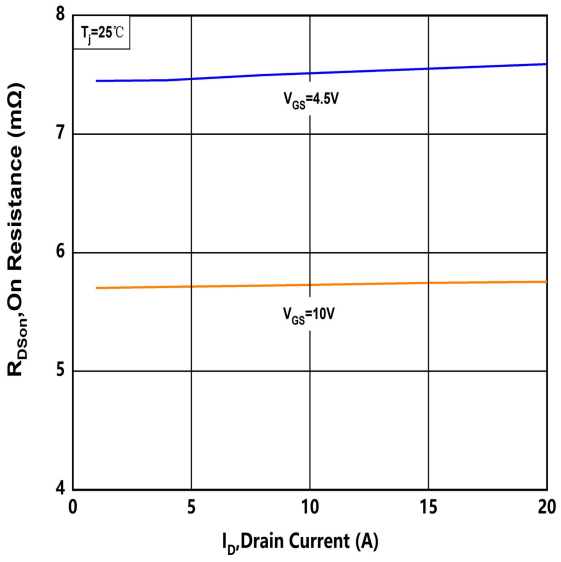



Figure.4 Typical On-Resistance vs Junction Temperature

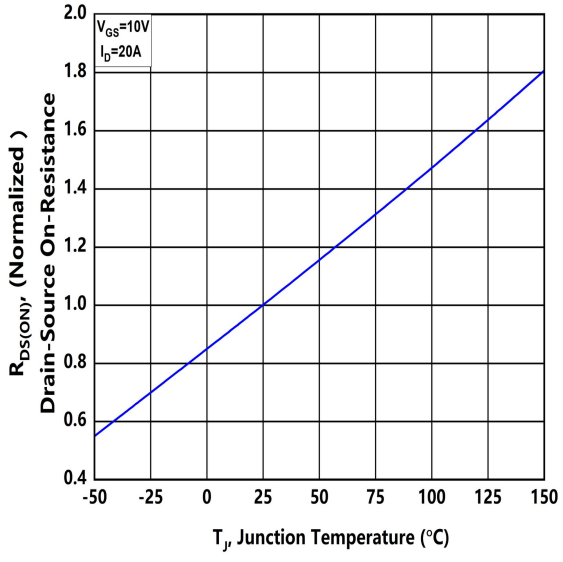


Figure.5 Typical Threshold Voltage vs Junction Temperature

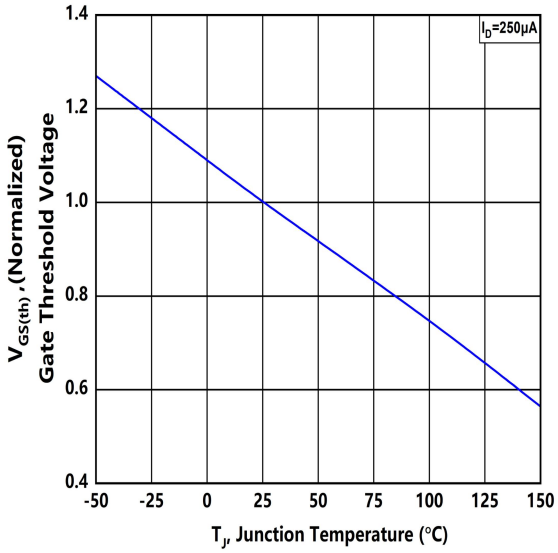



Figure.6 Typical Breakdown Voltage vs Junction Temperature

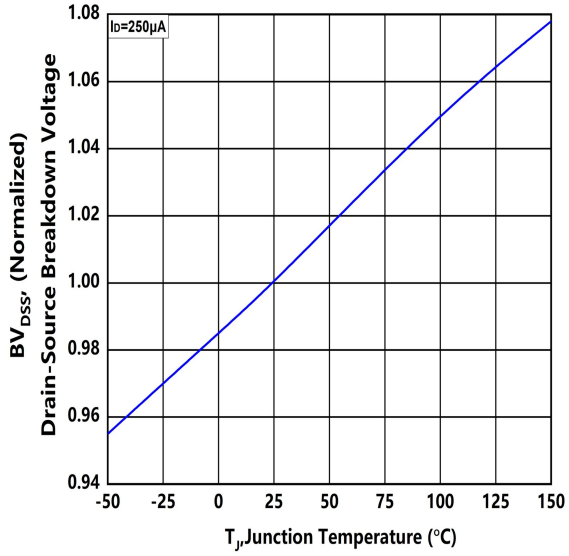



Figure.7 Typical Capacitance vs Drain to Source Voltage

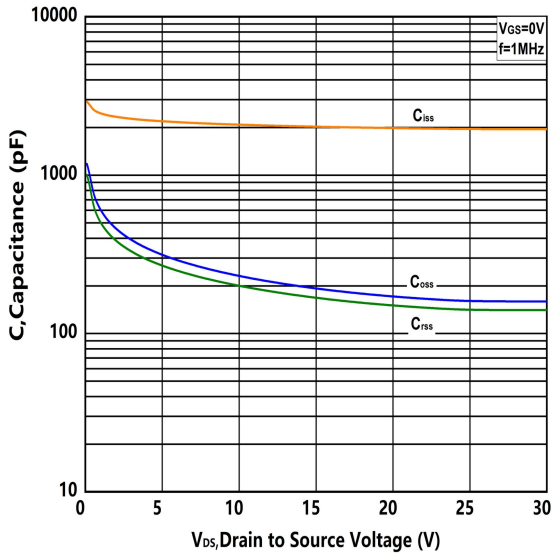



Figure.8 Typical Gate Charge vs Gate to Source Voltage

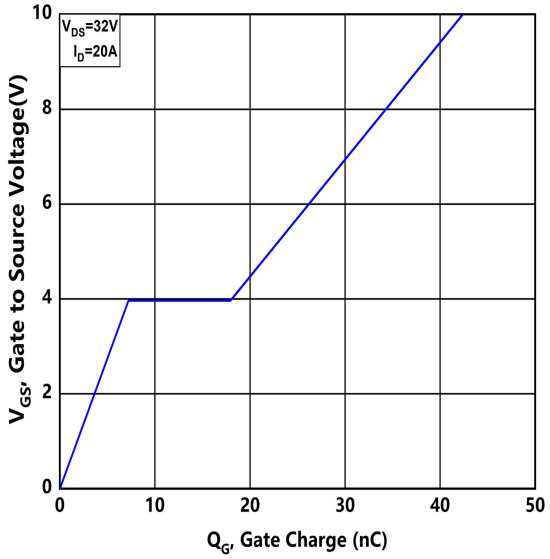


Figure.9 Typical Body Diode Characteristics

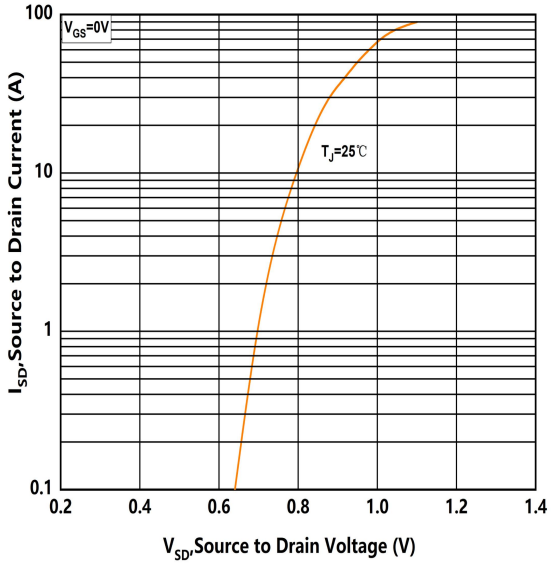



Figure.10 Maximum power Dissipation Derating vs Case Temperature

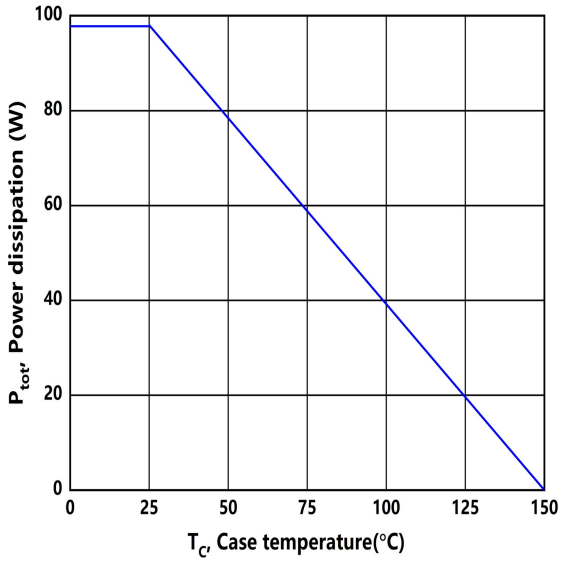



Figure.11 Continuous Drain Current Derating vs Case Temperature

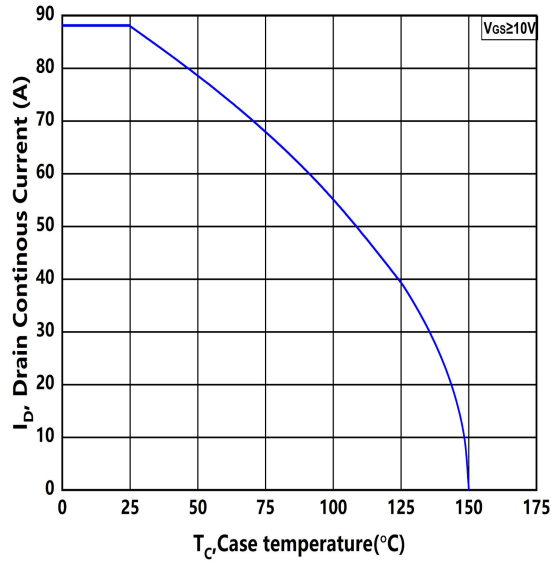



Figure.12 Safe Operating Area

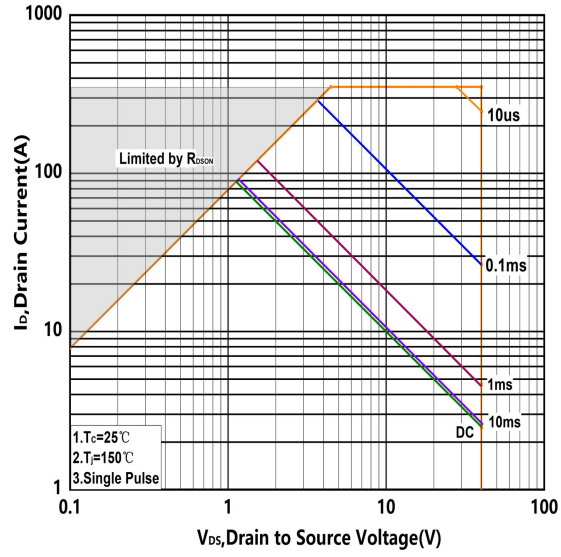
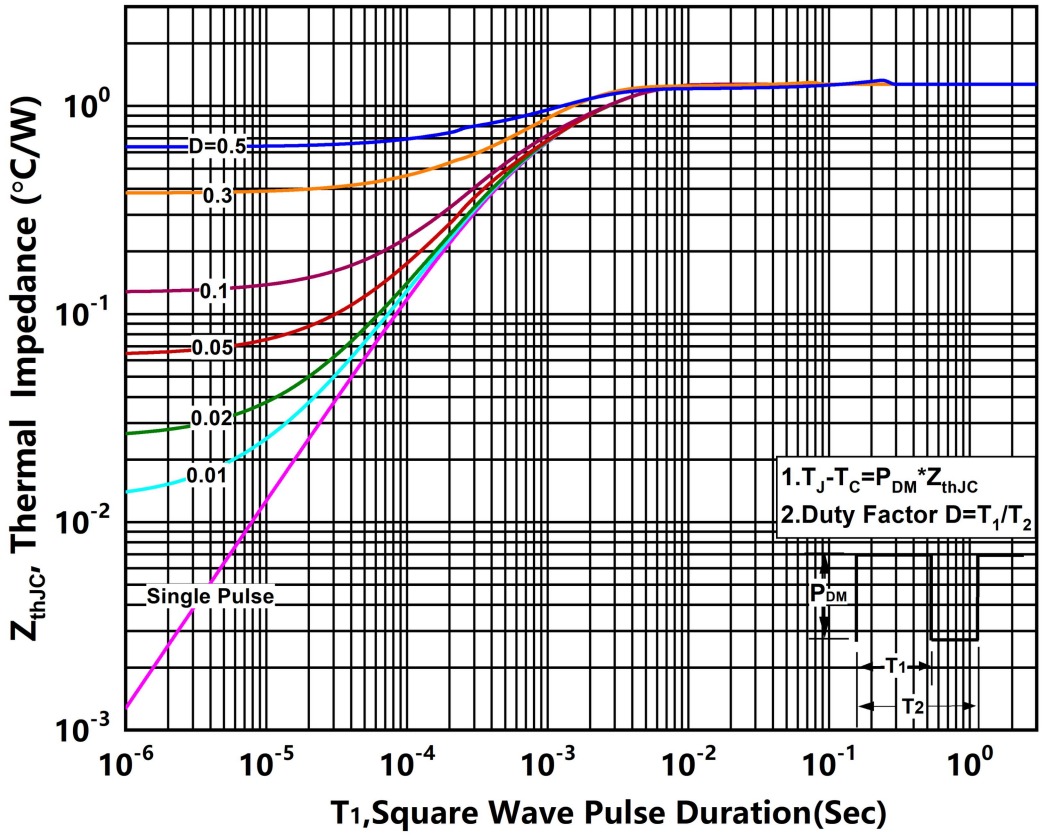
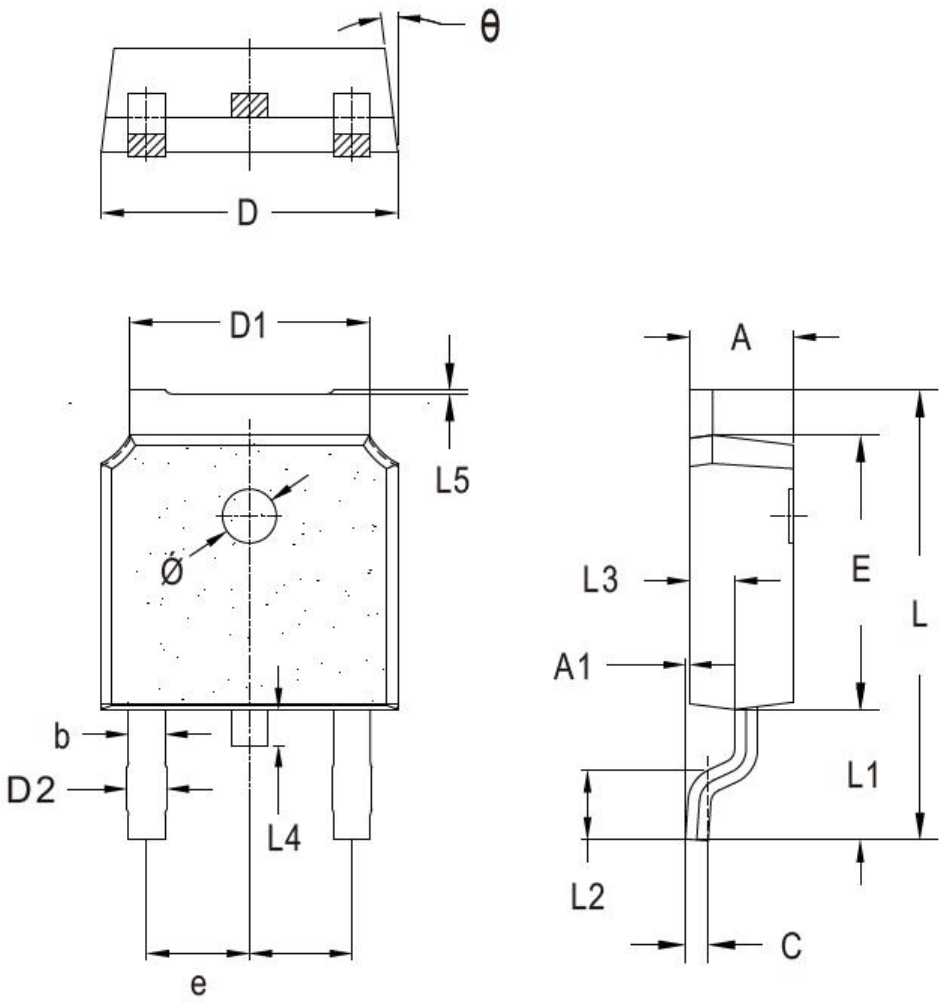


Figure.13 Transient Thermal Impedance (Junction - Case)



**Package Outline:TO-252-2L**




| Symbol | Millimeters | | Symbol | Millimeters | |
|---|---|---|---|---|---|
| | Min | Max | | Min | Max |
| A | 2.20 | 2.40 | L | 9.80 | 10.40 |
| A1 | 0.00 | 0.13 | L1 | 2.80 | 3.00 |
| b | 0.60 | 0.86 | L2 | 1.40 | 1.70 |
| C | 0.48 | 0.52 | L3 | 0.95 | 1.05 |
| D | 6.50 | 6.70 | L4 | 0.70 | 0.90 |
| D1 | 5.10 | 5.46 | L5 | 0.095 | 0.105 |
| E | 6.00 | 6.30 | Φ | 1.10 | 1.30 |
| e | 2.19 | 2.39 | θ | 0.0° | 7.0° |