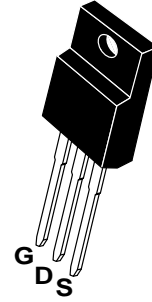




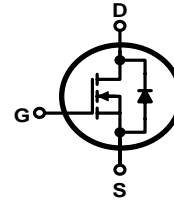
500V N-Channel MOSFET-T

Features

- Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Extended Safe Operating Area
- Unrivalled Gate Charge : 28 nC (Typ.)
- BVDSS=500V, ID=9A
- Lower $R_{DS(on)}$: 0.75 Ω (Max) @VG=10V
- 100% Avalanche Tested



Schematic diagram



Marking Diagram



- Y = Year
- A = Assembly Location
- WW = Work Week
- FIR9N50F = Specific Device Code

Absolute Maximum Ratings (Ta=25°C unless otherwise noted)

| Symbol | Parameter | Value | Unit |
|--------------|--|-------------------------|------------------|
| V_{DSS} | Drain-Source Voltage | 500 | V |
| I_D | Drain Current | $T_j=25^\circ\text{C}$ | 9.0 |
| | | $T_j=100^\circ\text{C}$ | 5.7 |
| $V_{GS(TH)}$ | Gate Threshold Voltage | ± 30 | V |
| E_{AS} | Single Pulse Avalanche Energy (note1) | 360 | mJ |
| I_{AR} | Avalanche Current (note2) | 9.0 | A |
| P_D | Power Dissipation ($T_j=25^\circ\text{C}$) | 50 | W |
| T_j | Junction Temperature(Max) | 150 | $^\circ\text{C}$ |
| T_{stg} | Storage Temperature | -55~+150 | $^\circ\text{C}$ |
| TL | Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | 300 | $^\circ\text{C}$ |

Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|-----------------|---|------|------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | - | 2.5 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | - | 120 | $^\circ\text{C}/\text{W}$ |

**Electrical Characteristics** (Ta=25°C unless otherwise noted)

| Symbol | Parameter | Test Condition | Min. | Typ. | Max | Units |
|---|---|--|------|------|------|-------|
| Off Characteristics | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | ID=250 μ A, VGS=0 | 500 | -- | -- | V |
| ΔBV _{DSS} / ΔT _J | Breakdown Voltage Temperature Conficient | ID=250 μ A ,Reference to 25°C | -- | 0.55 | -- | V/°C |
| IDSS | Zero Gate Voltage Drain Current | Vds=500V, Vgs=0V | -- | -- | 1 | μ A |
| | | Vds=400V, Tc=125°C | -- | -- | 10 | μ A |
| IGSSF | Gate-body leakage Current, Forward | Vgs=+30V, Vds=0V | -- | -- | 100 | nA |
| IGSSR | Gate-body leakage Current, Reverse | Vgs=-30V, Vds=0V | -- | -- | -100 | nA |
| On Characteristics | | | | | | |
| V _{GS(th)} | Date Threshold Voltage | Id=250uA,Vds=Vgs | 2 | -- | 4 | V |
| R _{DS(on)} | Static Drain-Source On-Resistance | Id=4.5A,Vgs=10V | -- | -- | 0.75 | Ω |
| Dynamic Characteristics | | | | | | |
| Ciss | Input Capacitance | VDS=25V, VGS=0, f=1.0MHz | -- | 1210 | -- | pF |
| Coss | Output Capacitance | | -- | 160 | -- | pF |
| Crss | Reverse Transfer Capacitance | | -- | 20 | -- | pF |
| Switching Characteristics | | | | | | |
| Td(on) | Turn-On Delay Time | VDD=250V, ID=9A, RG=25 Ω (Note 3,4) | -- | 25 | 60 | nS |
| Tr | Turn-On Rise Time | | -- | 95 | 200 | nS |
| Td(off) | Turn-Off Delay Time | | -- | 55 | 120 | nS |
| Tf | Turn-Off Fall Time | | -- | 60 | 130 | nS |
| Qg | Total Gate Charge | VDS=400,VGS=10V, ID=9A (Note 3,4) | -- | 28 | 36 | nC |
| Qgs | Gate-Source Charge | | -- | 7 | -- | nC |
| Qgd | Gate-Drain Charge | | -- | 12.5 | -- | nC |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I _S | Maximun Continuous Drain-Source Diode Forward Current | | -- | -- | 9 | A |
| I _{SM} | Maximun Plused Drain-Source DiodeForwad Current | | -- | -- | 36 | A |
| V _{SD} | Drain-Source Diode Forward Voltage | Id=9A | -- | -- | 1.45 | V |
| trr | Reverse Recovery Time | I _S =9.0A,V _{GS} =0V | -- | 300 | -- | nS |
| Qrr | Reverse Recovery Charge | di _F /dt=100A/ μ S (Note3) | -- | 2.2 | -- | μ C |

- *Notes
- 1, L=8mH, IAS=9A, VDD=50V, RG=25Ω, Starting T_J =25°C
 - 2, Repetitive Rating : Pulse width limited by maximum junction temperature
 - 3, Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
 - 4, Essentially Independent of Operating Temperature

Typical Characteristics

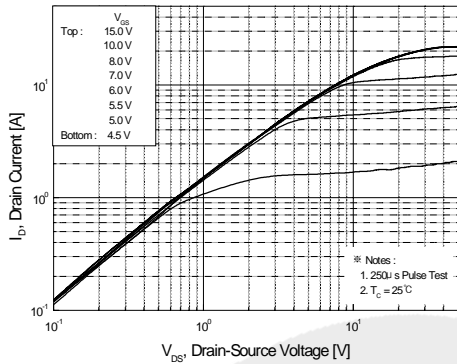


Figure 1. On-Region Characteristics

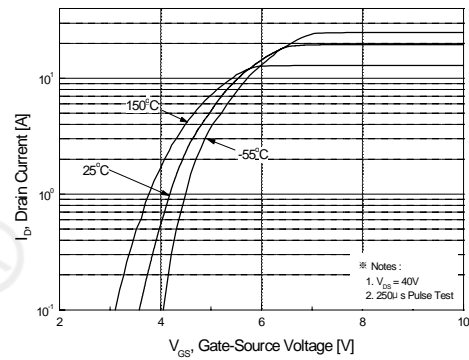


Figure 2. Transfer Characteristics

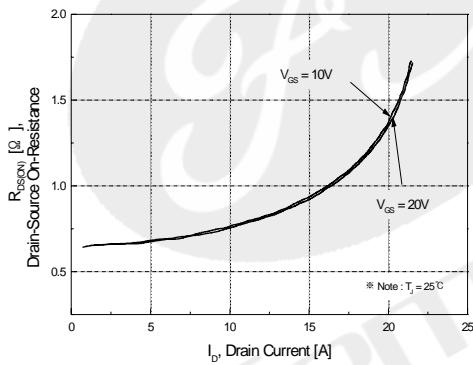


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

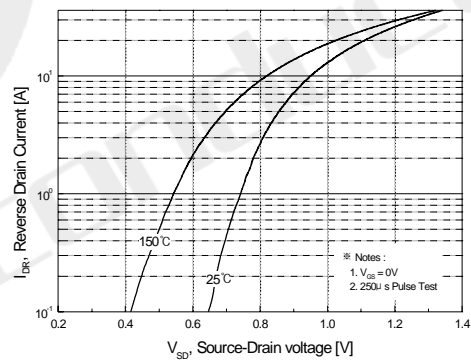


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

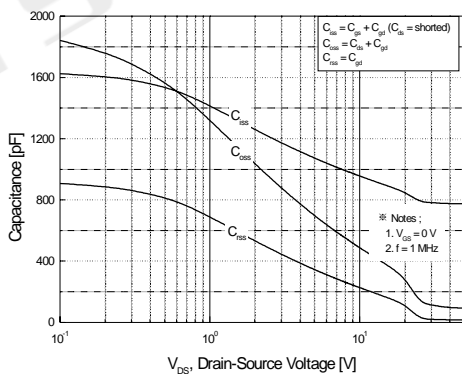


Figure 5. Capacitance Characteristics

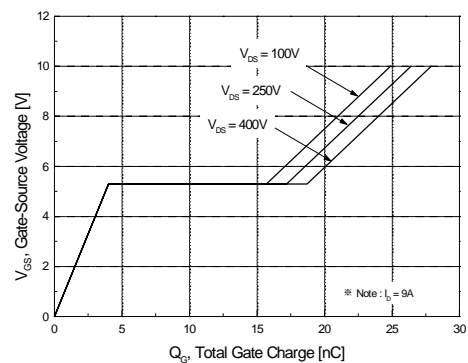


Figure 6. Gate Charge Characteristics



Typical Characteristics (Continued)

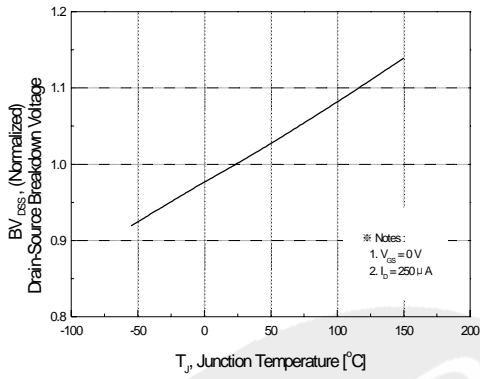


Figure 7. Breakdown Voltage Variation vs Temperature

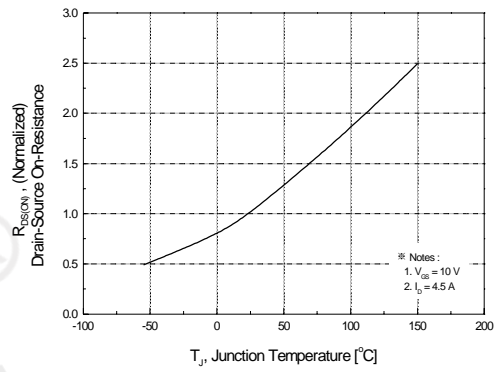


Figure 8. On-Resistance Variation vs Temperature

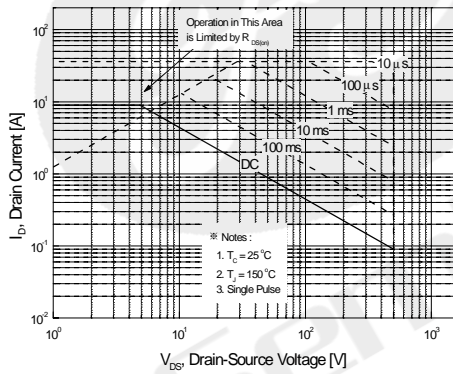


Figure 9-2. Maximum Safe Operating Area

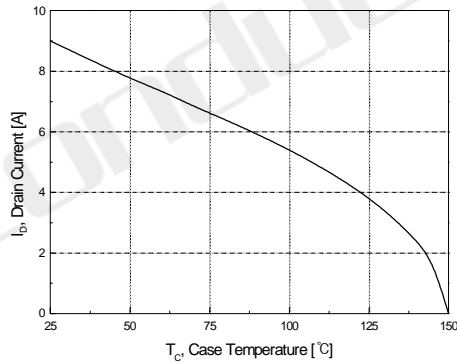


Figure 10. Maximum Drain Current vs Case Temperature

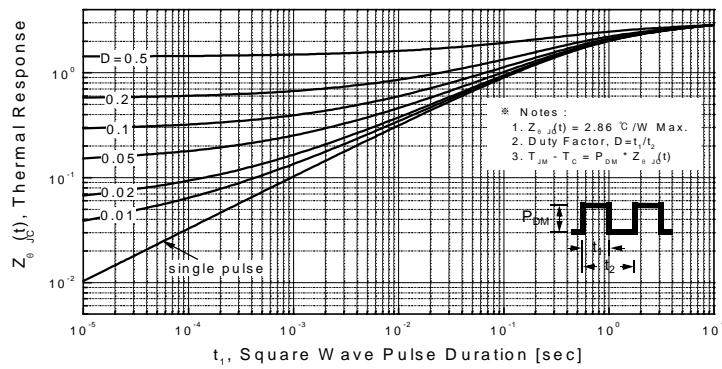
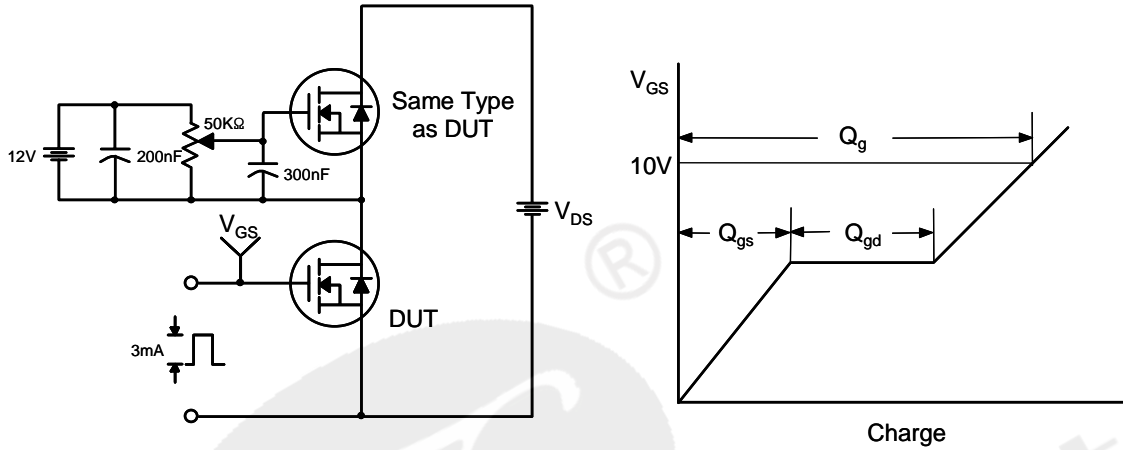
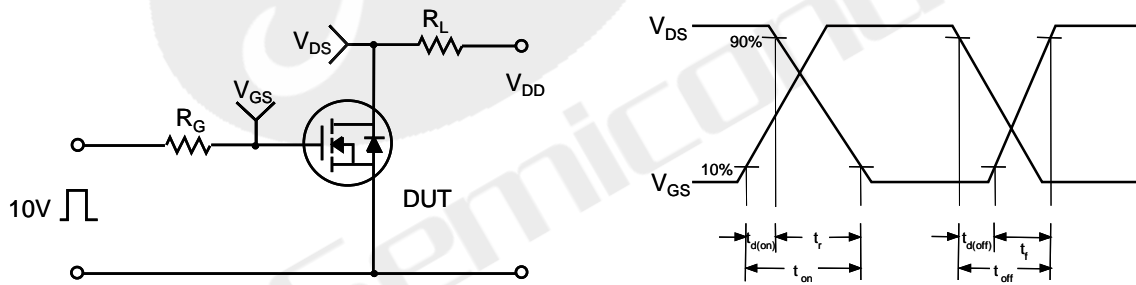


Figure 11-2. Transient Thermal Response Curve

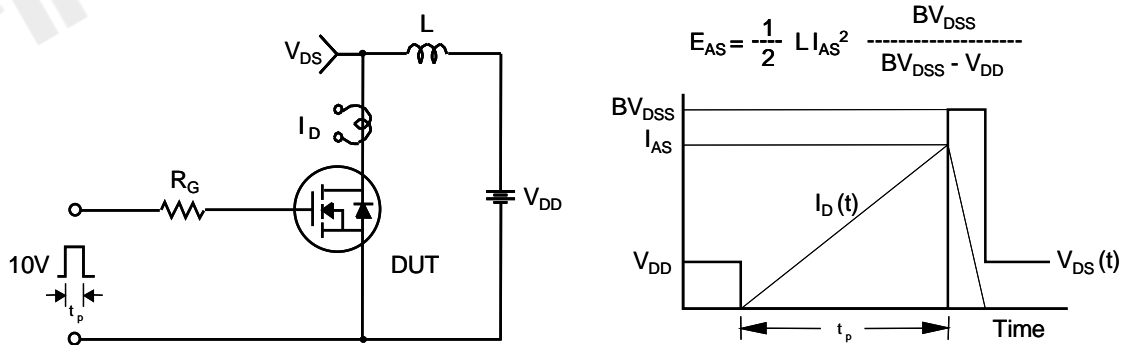
Gate Charge Test Circuit & Waveform



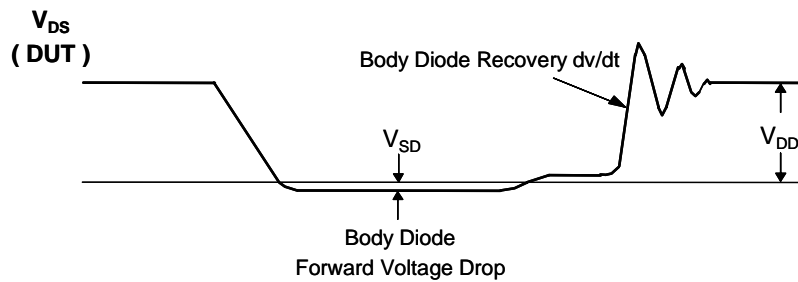
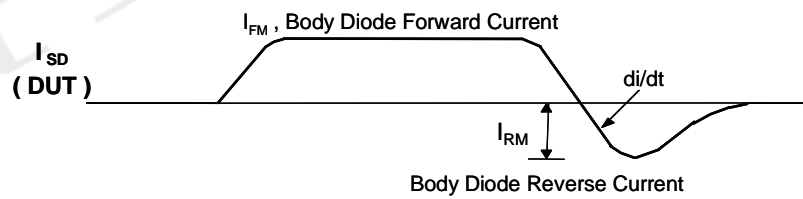
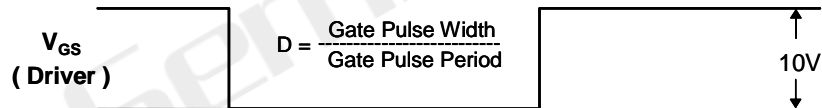
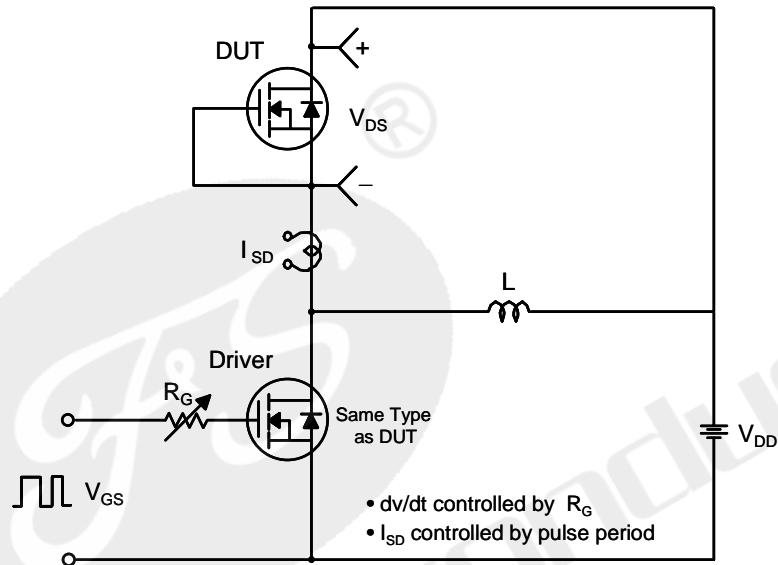
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



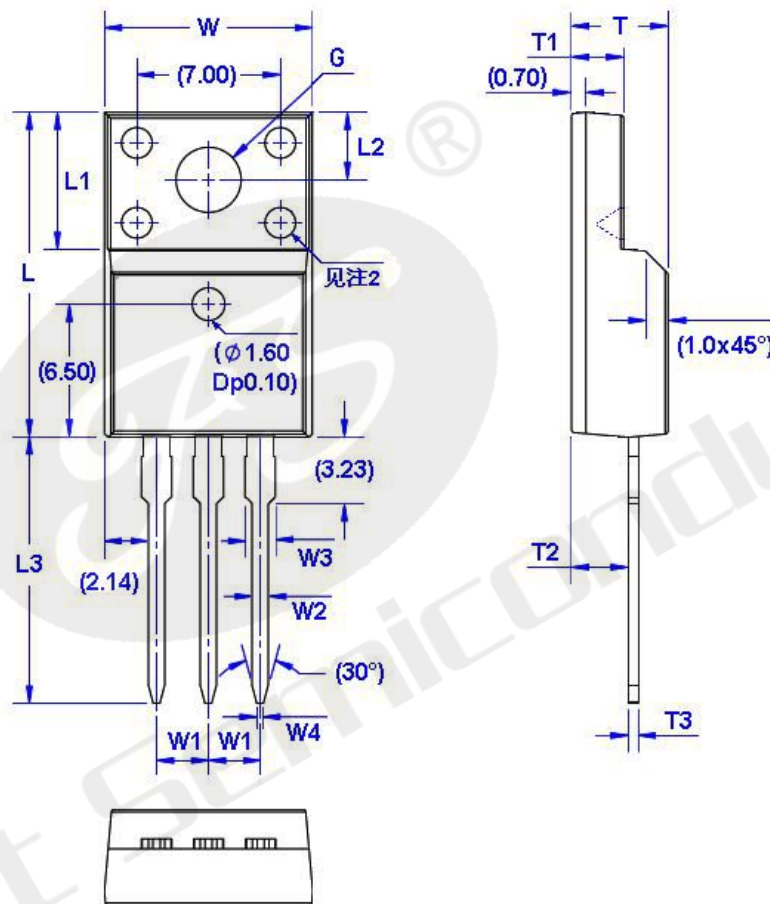
Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimension

TO-220F

Unit: mm



| Symbol | Size | | Symbol | Size | | Symbol | Size | | Symbol | Size | |
|--------|------|-------|--------|-------|-------|--------|-------|-------|-------------|------|------|
| | Min | Max | | Min | Max | | Min | Max | | Min | Max |
| W | 9.96 | 10.36 | W4 | 0.25 | 0.45 | L3 | 12.78 | 13.18 | T3 | 0.45 | 0.60 |
| W1 | 2.54 | (TYP) | L | 15.67 | 16.07 | T | 4.50 | 4.90 | G(Φ) | 3.08 | 3.28 |
| W2 | 0.70 | 0.90 | L1 | 6.48 | 6.88 | T1 | 2.34 | 2.74 | | | |
| W3 | 1.24 | 1.47 | L2 | 3.20 | 3.40 | T2 | 2.56 | 2.96 | | | |



Declaration

- FIRST reserves the right to change the specifications, the same specifications of products due to different packaging line mold, the size of the appearance will be slightly different, shipped in kind, without notice! Customers should obtain the latest version information before ordering, and verify whether the relevant information is complete and up-to-date.
- Any semiconductor product under certain conditions has the possibility of failure or failure, The buyer has the responsibility to comply with safety standards and take safety measures when using FIRST products for system design and manufacturing, To avoid To avoid potential failure risks, which may cause personal injury or property damage!
- Product promotion endless, our company will wholeheartedly provide customers with better products!

ATTACHMENT

Revision History

| Date | REV | Description | Page |
|------------|-----|-----------------|------|
| 2018.01.01 | 1.0 | Initial release | |