
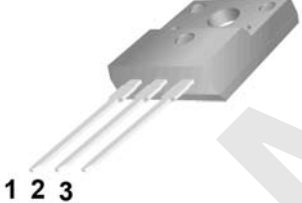
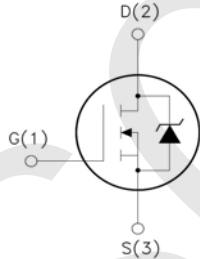


SM13N50S

Features:

- Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Extended Safe Operating Area
- Unrivalled Gate Charge :Qg= 50nC (Typ.)
- BVDSS=500V, ID=13A
- R_{DS(on)} :0.50Ω (Max) @VG=10V
- 100% Avalanche Tested

TO-220F

- 1.Gate (G)
- 2.Drain (D)
- 3.Source (S)

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°C | 13 |
| | | T _j =100°C | 7.9 |
| V _{GS(TH)} | Gate Threshold Voltage | ±30 | V |
| E _{AS} | Single Pulse Avalanche Energy (note1) | 500 | mJ |
| I _{AR} | Avalanche Current (note2) | 13 | A |
| P _D | Power Dissipation (T _j =25°C) | 50 | W |
| T _j | Junction Temperature(Max) | 150 | °C |
| T _{stg} | Storage Temperature | -55~+150 | °C |
| TL | Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | 300 | °C |

Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|------------------|---|------|------|------|
| R _{θJC} | Thermal Resistance, Junction to Case | - | 2.50 | °C/W |
| R _{θJA} | Thermal Resistance, Junction to Ambient | - | 62.5 | °C/W |

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

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|--|------|------|------|------|
| Off Characteristics | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | I _D =250μA, V _{GS} =0 | 500 | - | - | V |
| ΔBV _{DSS} /ΔT _J | Breakdown Voltage Temperature Coefficient | I _D =250μA, Reference to 25°C | - | 0.65 | - | V/°C |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} =500V, V _{GS} =0V | - | - | 1 | μA |
| | | V _{DS} =400V, T _J =125°C | - | - | 100 | |
| I _{GSSF} | Gate-body leakage Current, Forward | V _{GS} =+30V, V _{DS} =0V | - | - | 100 | nA |
| I _{GSSR} | Gate-body leakage Current, Reverse | V _{GS} =-30V, V _{DS} =0V | - | - | -100 | |
| On Characteristics | | | | | | |
| V _{GS(TH)} | Date Threshold Voltage | I _D =250μA, V _{DS} =V _{GS} | 2 | - | 4 | V |
| R _{DS(ON)} | Static Drain-Source On-Resistance | I _D =6.5A, V _{GS} =10V | - | 0.45 | 0.50 | Ω |
| Dynamic Characteristics | | | | | | |
| C _{iss} | Input Capacitance | V _{DS} =25V, V _{GS} =0, f=1.0MHz | - | 1680 | - | pF |
| C _{oss} | Output Capacitance | | - | 120 | - | |
| C _{rss} | Reverse Transfer Capacitance | | - | 12 | - | |
| Switching Characteristics | | | | | | |
| T _{d(on)} | Turn-On Delay Time | V _{DD} =250V, I _D =13A R _G =25Ω (Note 3,4) | - | 40 | - | nS |
| T _r | Turn-On Rise Time | | - | 140 | - | |
| T _{d(off)} | Turn-Off Delay Time | | - | 125 | - | |
| T _f | Turn-Off Rise Time | | - | 85 | - | |
| Q _g | Total Gate Charge | V _{DS} =400V, V _{GS} =10V, I _D =13A (Note 3,4) | - | 50 | - | nC |
| Q _{gs} | Gate-Source Charge | | - | 9.8 | - | |
| Q _{gd} | Gate-Drain Charge | | - | 18.5 | - | |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I _S | Max. Diode Forward Current | - | - | - | 13 | A |
| I _{SM} | Max. Pulsed Forward Current | - | - | - | 52 | |
| V _{SD} | Diode Forward Voltage | I _D =13A | - | - | 1.4 | V |
| T _{rr} | Reverse Recovery Time | I _S =13A, V _{GS} =0V diF/dt=100A/μs | - | 420 | - | nS |
| Q _{rr} | Reverse Recovery Charge | (Note3) | - | 4.2 | - | μC |

- Notes : 1, L=17.1mH, I_{AS}=13A, V_{DD}=50V, R_G=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

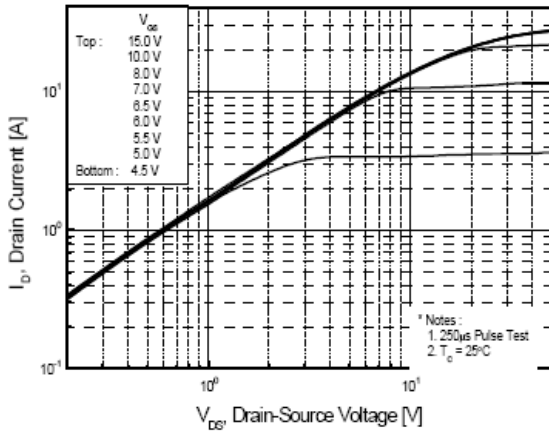


Fig1 Typical Output Characteristics, $T_c = 25^\circ\text{C}$

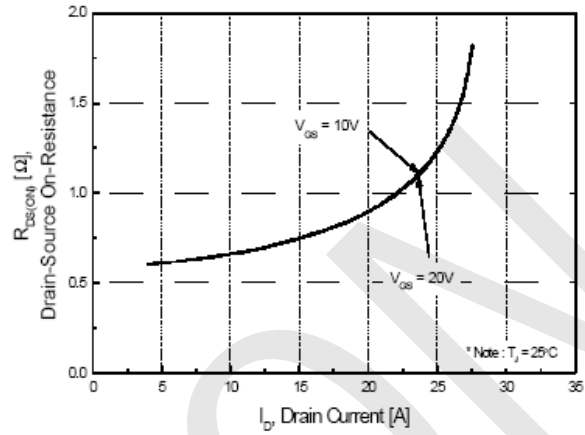


Fig2 On-Resistance Vs. Drain Current and Gate Voltage

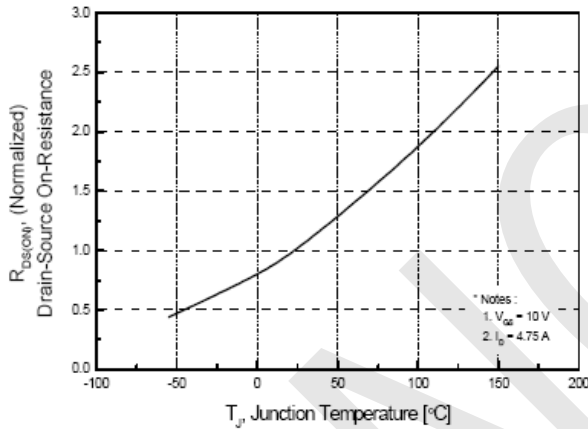


Fig3 Normalized On-Resistance Vs. Temperature

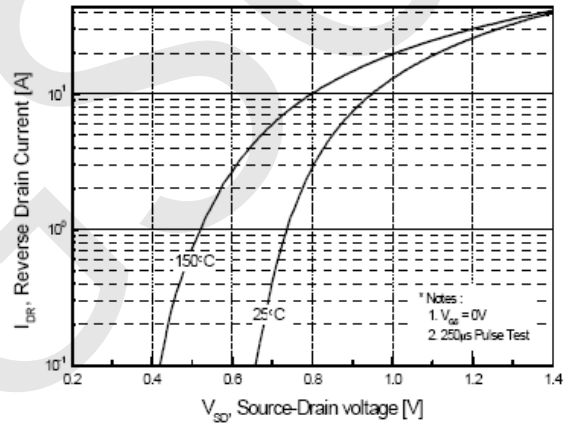


Fig4 Typical Source-Drain Diode Forward Voltage

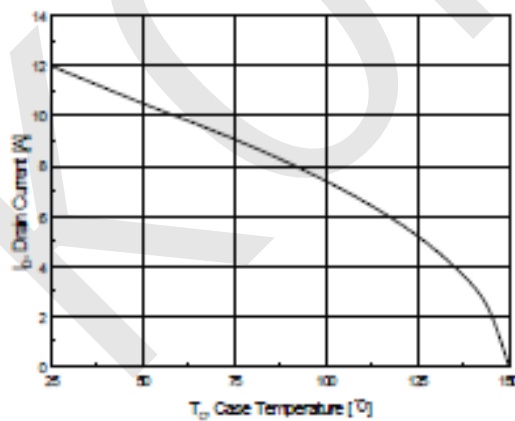


Fig5 Maximum Drain Current Vs. Case Temperature

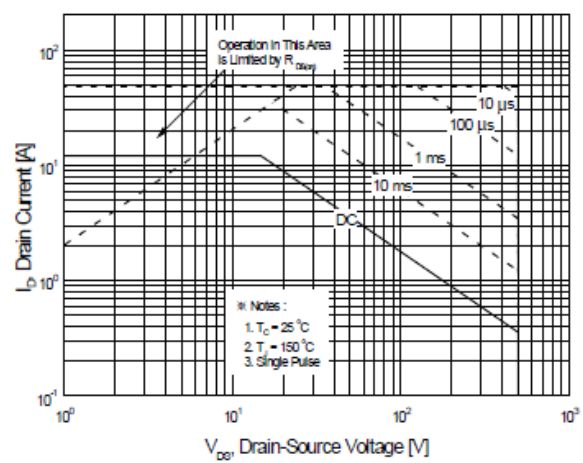
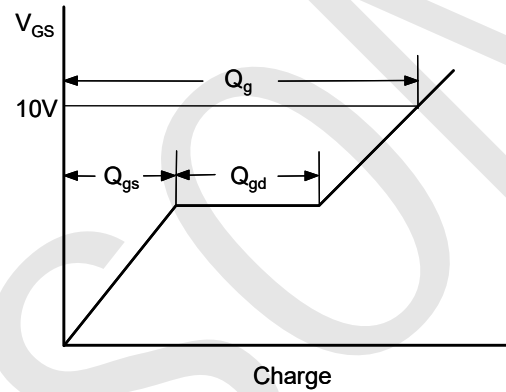
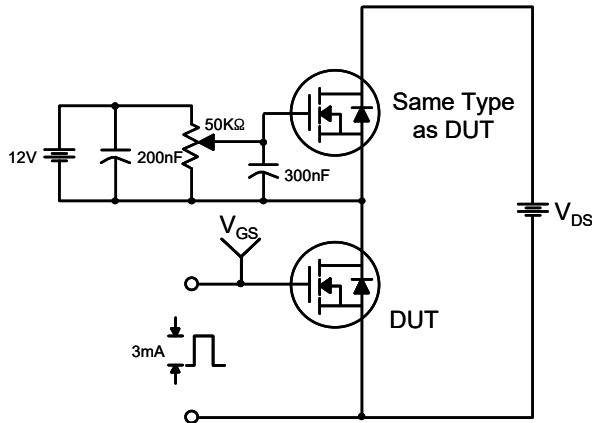
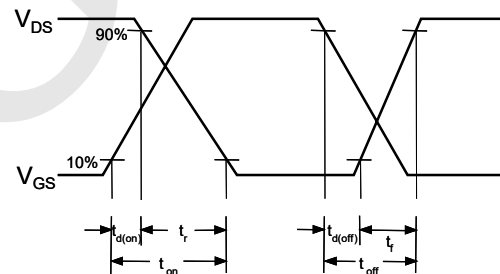
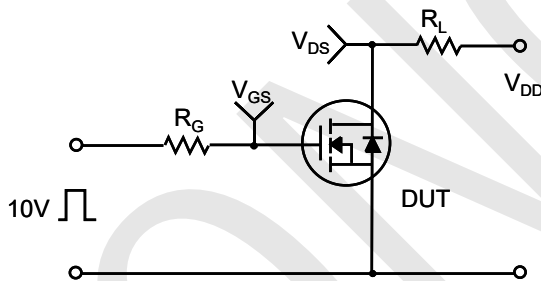


Fig6 Maximum Safe Operating Area

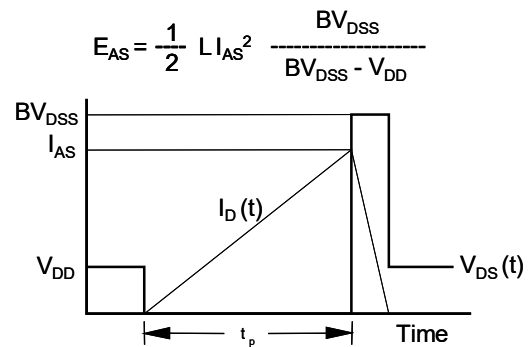
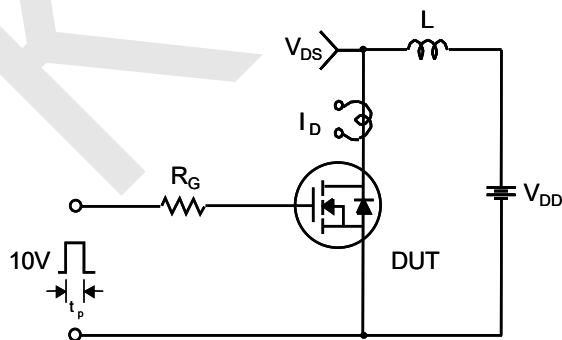
Gate Charge Test Circuit & Waveform



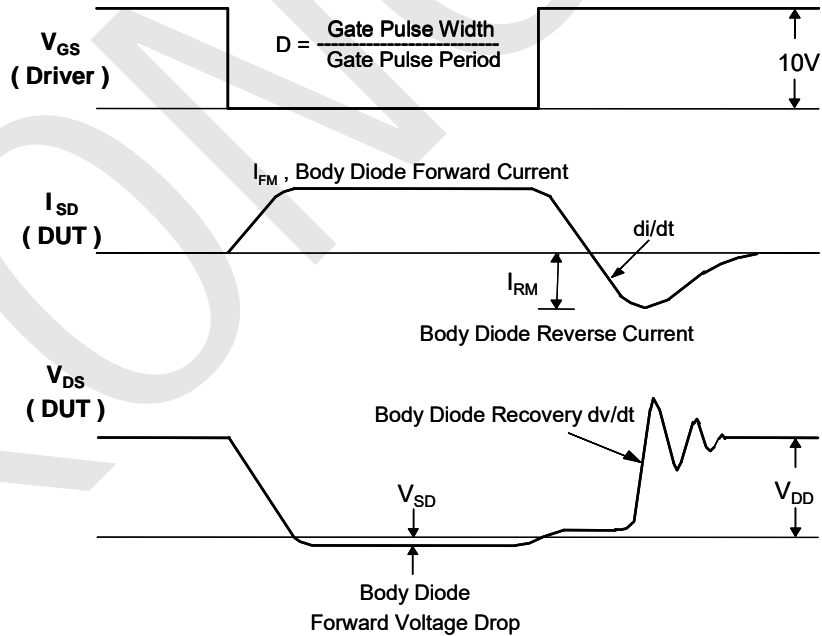
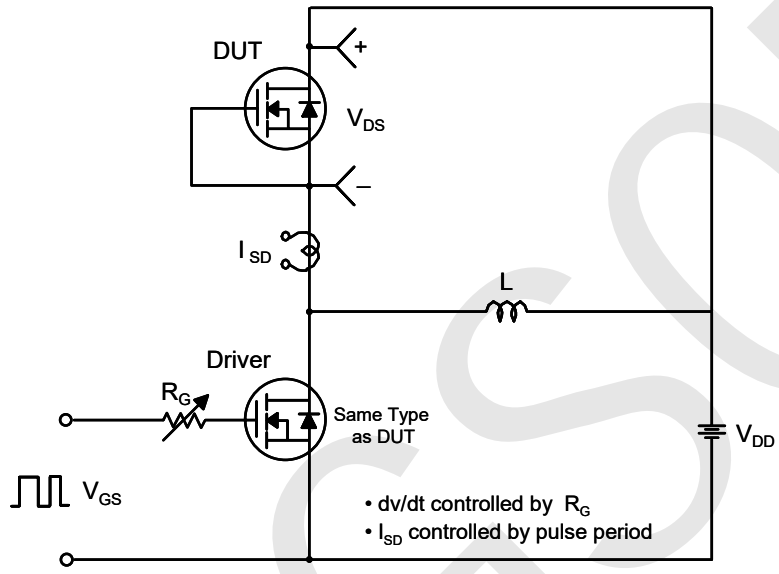
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



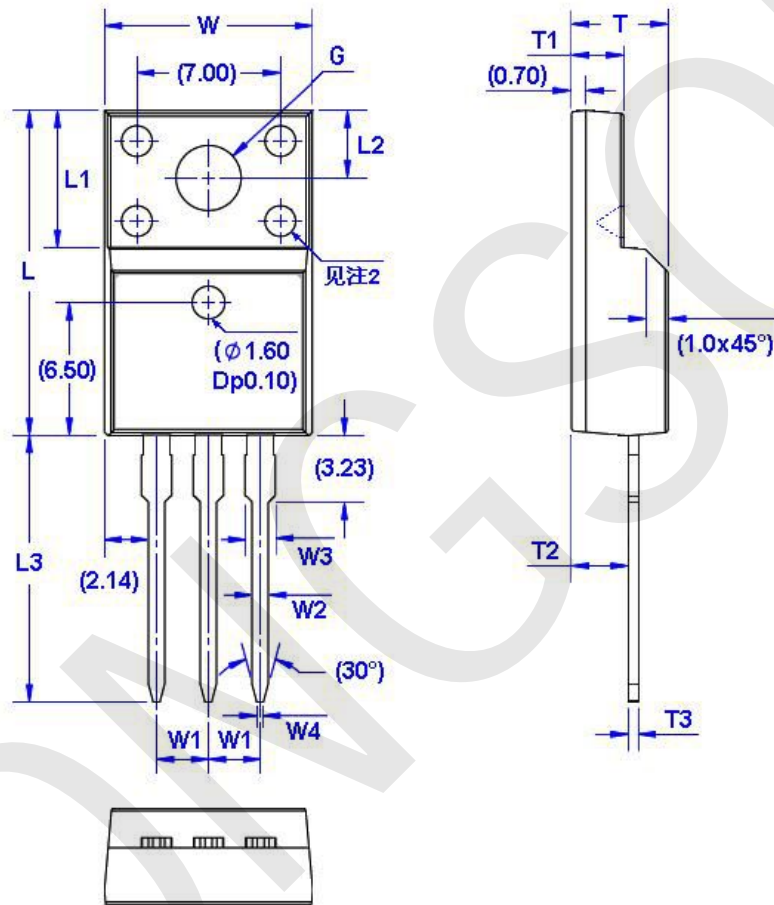
Peak Diode Recovery dv/dt Test Circuit & Waveforms



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 | | | |