

1. Description

MS33N25, the silicon N-channel Enhanced MOSFETs, is obtained by advanced MOSFET technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. The transistor is suitable device for SMPS, high speed switching and general purpose applications.

KEY CHARACTERISTICS

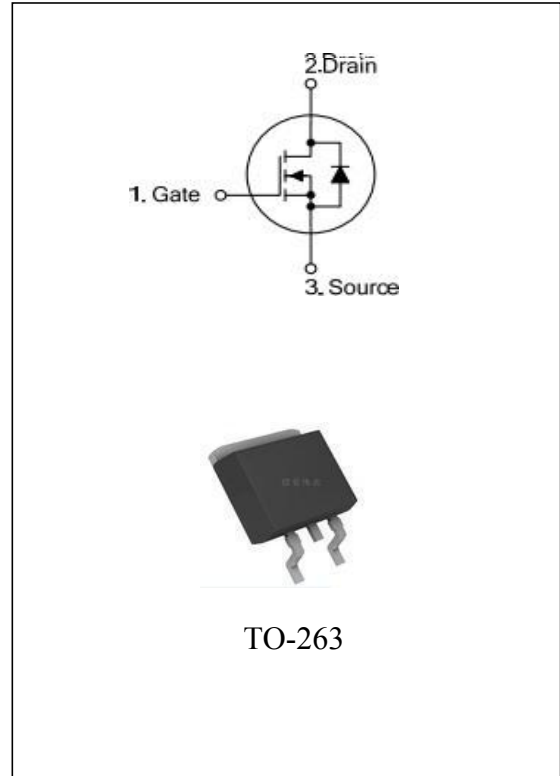
| Parameter | Value | Unit |
|------------------|-------|----------|
| V_{DS} | 250 | V |
| I_D | 33 | A |
| $R_{DS(ON).Typ}$ | 0.1 | Ω |

FEATURES

- Fast Switching
- Low C_{rss}
- 100% avalanche tested
- Improved dv/dt capability
- RoHS product

APPLICATIONS

- High frequency switching mode power supply



ORDERING INFORMATION

| Ordering Codes | Package | Product Code | Packing |
|----------------|---------|--------------|---------|
| MS33N25 | TO-263 | 33N25 | Tube |
| | | | Tube |

| | | | |
|---------|-----------|--|---|
| MS33N25 | Chip name | | XXXX: Product Code YYWW: Year&Week ZZ: Assembly Code SSSSS: Lot Code |
|---------|-----------|--|---|

2. ABSOLUTE RATINGS

 at $T_C = 25^\circ\text{C}$, unless otherwise specified

| Symbol | Parameter | Rating | Units |
|----------------|--|---------------------|---------------------|
| V_{DSS} | Drain-to-Source Voltage | 250 | V |
| I_D | Continuous Drain Current | 33 | A |
| | Continuous Drain Current $T_C = 100^\circ\text{C}$ | 20.8 | A |
| I_{DM} | Pulsed Drain Current(Note1) | 132 | A |
| V_{GS} | Gate-to-Source Voltage | ± 30 | V |
| E_{AS} | Single Pulse Avalanche Energy(Note2) | 1170 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note3) | 5.0 | V/ns |
| P_D | Power Dissipation TO-220 | 198 | W |
| | Derating Factor above 25°C | 1.6 | W/ $^\circ\text{C}$ |
| P_D | Power Dissipation TO-220F | 62 | W |
| | Derating Factor above 25°C | 0.5 | W/ $^\circ\text{C}$ |
| T_J, T_{stg} | Operating Junction and Storage Temperature Range | 150, -55 to 150 | $^\circ\text{C}$ |
| T_L | Maximum Temperature for Soldering | 300 | $^\circ\text{C}$ |

3. Thermal characteristics

Thermal characteristics TO-263

| Symbol | Parameter | RATINGS | Units |
|-----------------|---------------------|---------|---------------------------|
| $R_{\theta JC}$ | Junction-to-Case | 0.63 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Junction-to-Ambient | 62.5 | $^\circ\text{C}/\text{W}$ |

Thermal characteristics TO-263

| Symbol | Parameter | RATINGS | Units |
|-----------------|---------------------|---------|---------------------------|
| $R_{\theta JC}$ | Junction-to-Case | 2 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Junction-to-Ambient | 62.5 | $^\circ\text{C}/\text{W}$ |

4. Electrical Characteristics

 at $T_C = 25^\circ\text{C}$, unless otherwise specified

| OFF Characteristics | | | | | | |
|--------------------------------------|-----------------------------------|---|--------|------|------|--------------------|
| Symbol | Parameter | Test Conditions | Values | | | Units |
| | | | Min. | Typ. | Max. | |
| V_{DSS} | Drain to Source Breakdown Voltage | $V_{GS}=0V$, $I_D=250\mu A$ | 250 | -- | -- | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Bvdss Temperature Coefficient | $I_D=250\mu A$, Reference 25°C | -- | 0.5 | -- | $V/^\circ\text{C}$ |
| I_{DSS} | Drain to Source Leakage Current | $V_{DS} = 250V$, $V_{GS} = 0V$, $T_J = 25^\circ\text{C}$ | -- | -- | 1 | μA |
| | | $V_{DS} = 200V$, $V_{GS} = 0V$, $T_J = 125^\circ\text{C}$ | -- | -- | 10 | μA |
| $I_{GSS(F)}$ | Gate to Source Forward Leakage | $V_{GS} = +30V$ | -- | -- | 100 | nA |
| $I_{GSS(R)}$ | Gate to Source Reverse Leakage | $V_{GS} = -30V$ | -- | -- | -100 | nA |

| ON Characteristics | | | | | | |
|--------------------|-------------------------------|---|--------|------|------|----------|
| Symbol | Parameter | Test Conditions | Values | | | Units |
| | | | Min. | Typ. | Max. | |
| $R_{DS(ON)}$ | Drain-to-Source On-Resistance | $V_{GS}=10V$, $I_D=16.5A$ (Note4) | -- | 0.11 | 0.15 | Ω |
| $V_{GS(TH)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$, $I_D = 250\mu A$ (Note4) | 2.0 | -- | 4.0 | V |
| g_{fs} | Forward Transconductance | $V_{DS}=20V$, $I_D = 2A$ (Note4) | -- | 5.1 | -- | S |

| Dynamic Characteristics | | | | | | |
|-------------------------|------------------------------|--|--------|------|------|----------|
| Symbol | Parameter | Test Conditions | Values | | | Units |
| | | | Min. | Typ. | Max. | |
| R_g | Gate resistance | $f = 1.0\text{MHz}$ | -- | 1.5 | -- | Ω |
| C_{iss} | Input Capacitance | $V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1.0\text{MHz}$ | -- | 5600 | -- | PF |
| C_{oss} | Output Capacitance | | -- | 465 | -- | |
| C_{rss} | Reverse Transfer Capacitance | | -- | 21 | -- | |

| Switching Characteristics | | | | | | |
|---------------------------|---------------------------------|--|--------|------|------|-------|
| Symbol | Parameter | Test Conditions | Values | | | Units |
| | | | Min. | Typ. | Max. | |
| $t_{d(ON)}$ | Turn-on Delay Time | ID =33A VDD = 50V VGS = 10V RG =15Ω | -- | 230 | -- | ns |
| t_r | Rise Time | | -- | 75 | -- | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | | -- | 120 | -- | |
| t_f | Fall Time | | -- | 36 | -- | |
| Q_g | Total Gate Charge | ID =33A VDD =200V VGS = 10V | -- | 40 | -- | nC |
| Q_{gs} | Gate to Source Charge | | -- | 14 | -- | |
| Q_{gd} | Gate to Drain ("Miller") Charge | | -- | 11 | -- | |

| Source-Drain Diode Characteristics | | | | | | |
|------------------------------------|--|---|--------|------|------|-------|
| Symbol | Parameter | Test Conditions | Values | | | Units |
| | | | Min. | Typ. | Max. | |
| I_S | Continuous Source Current (Body Diode) | TC=25 °C | -- | -- | 33 | A |
| I_{SM} | Maximum Pulsed Current (Body Diode) | | -- | -- | 132 | A |
| V_{SD} | Diode Forward Voltage | IS=33A, VGS=0V(Note4) | -- | -- | 1.2 | V |
| T_{rr} | Reverse Recovery Time | IS=33A, Tj = 25°C dIF/dt=100A/us, VGS=0V | -- | 240 | -- | ns |
| Q_{rr} | Reverse Recovery Charge | | -- | 2000 | -- | nC |
| I_{rrm} | Reverse Recovery Current | | -- | 35.3 | -- | A |

Note1: Pulse width limited by maximum junction temperature

Note2: L=10mH, VD_s=50V, Start T_J=25°C

Note3: ISD =30A, di/dt ≤100A/us, VDD≤BVDS, Start T_J=25°C

Note4: Pulse width tp≤300μs, δ≤2%

5. Characteristics Curves

Figure 1a Safe Operating Area (TO-263)

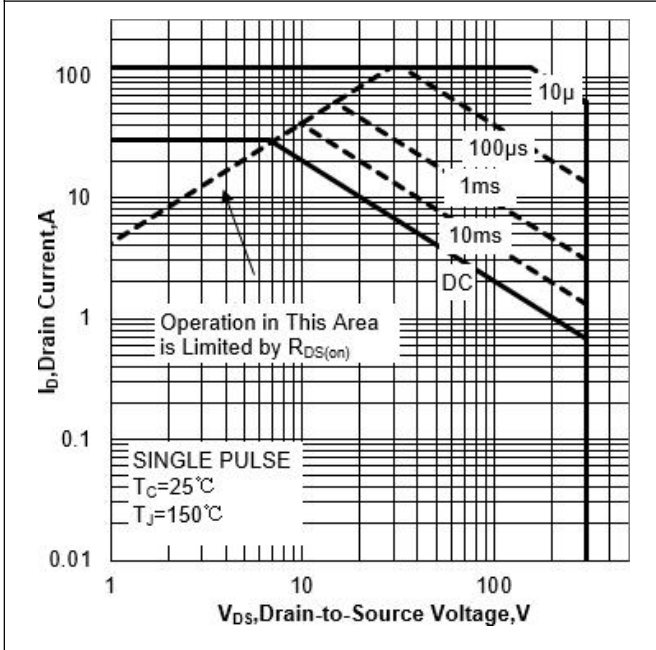


Figure 1b Safe Operating Area (TO-263)

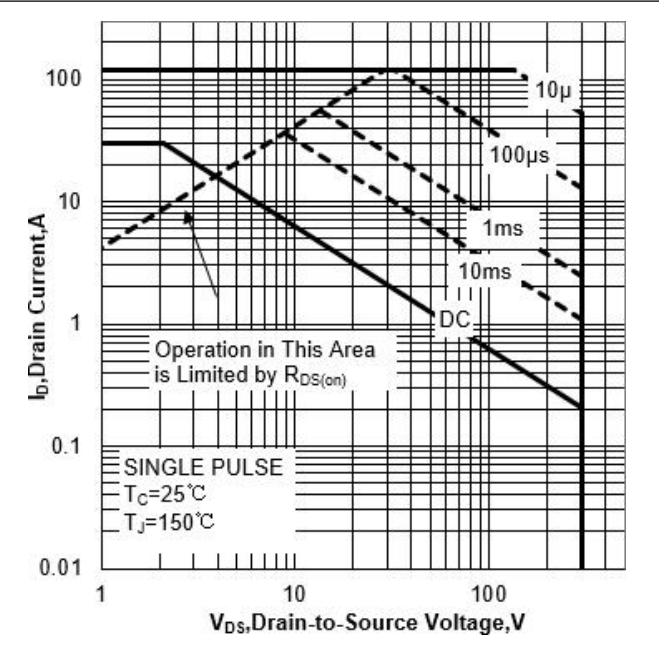


Figure 2a Power Dissipation (TO-263)

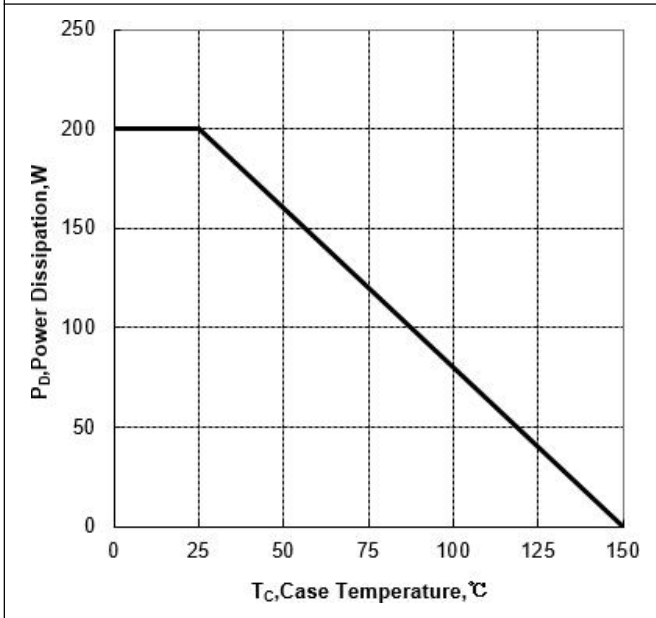


Figure 2b Power Dissipation (TO-263)

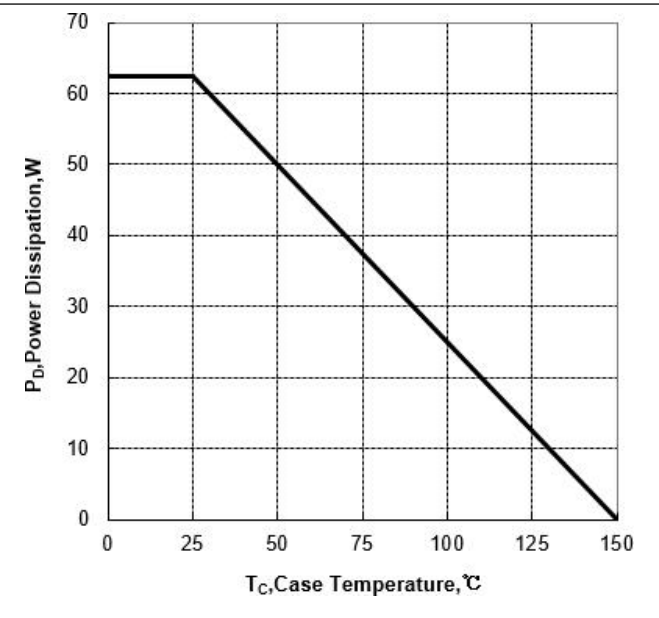


Figure 3a Max Thermal Impedance (TO-263)

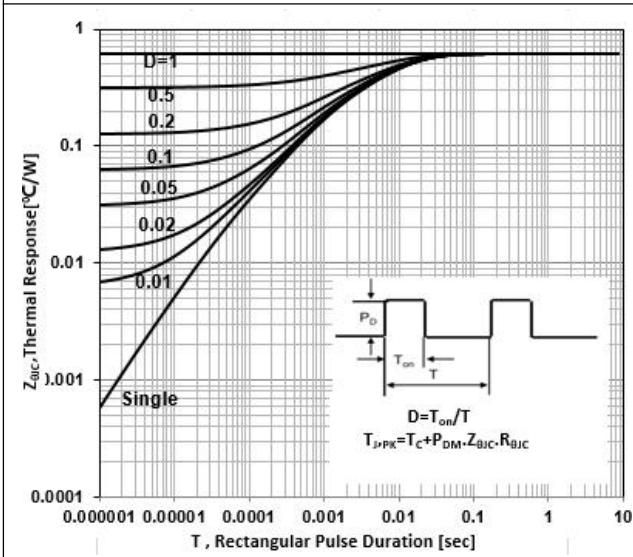


Figure 3b Max Thermal Impedance (TO-263)

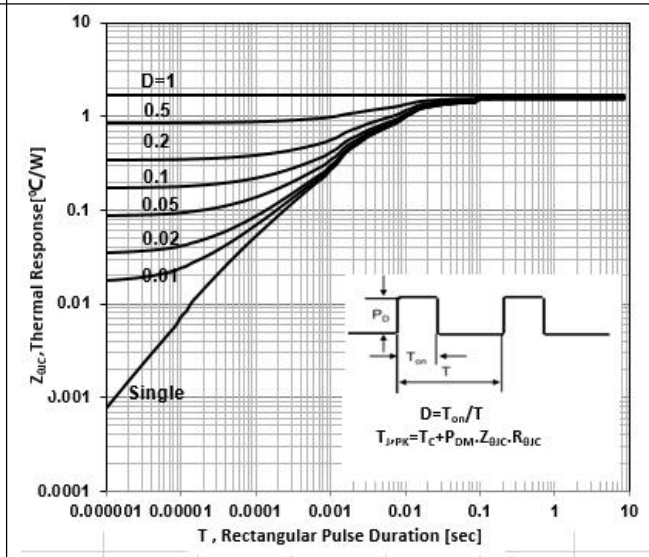


Figure 4 Typical Output Characteristics

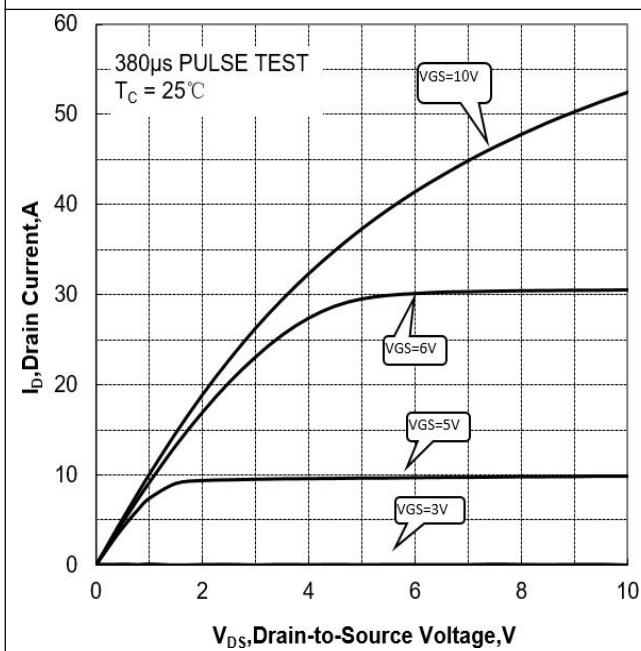


Figure 5 Typical Transfer Characteristics

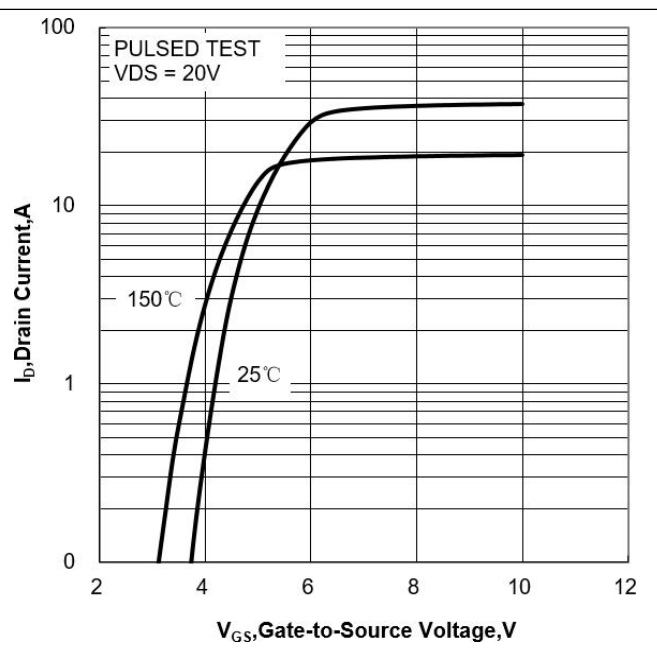


Figure 6 Typical Drain to Source ON Resistance vs Drain Current

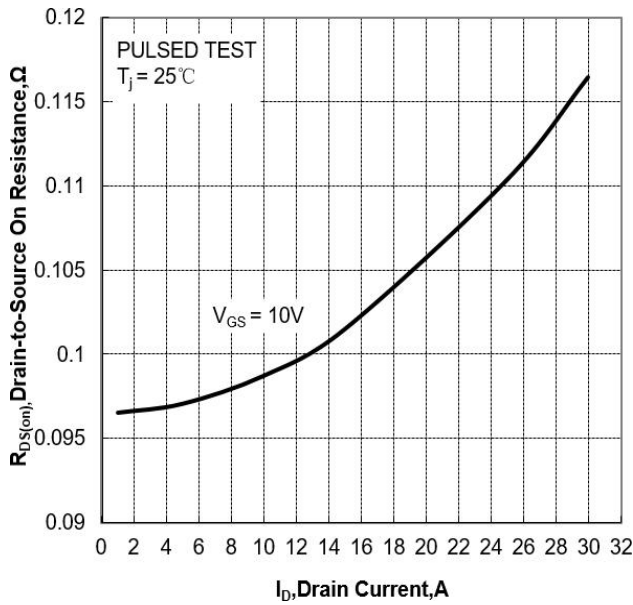


Figure 7 Typical Drain to Source on Resistance vs Junction Temperature

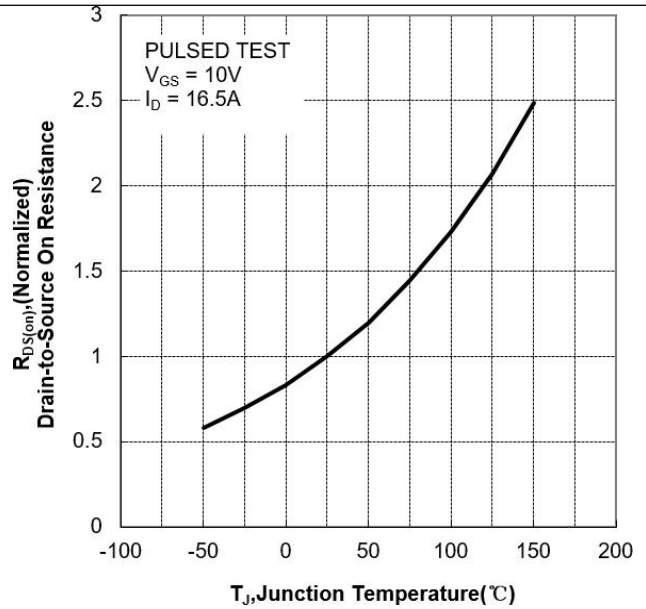


Figure 8 Typical Threshold Voltage vs Junction Temperature

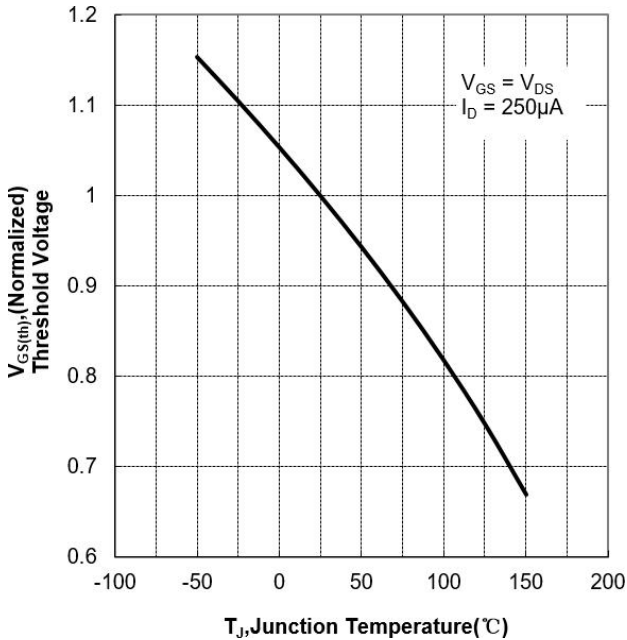


Figure 9 Typical Breakdown Voltage vs Junction Temperature

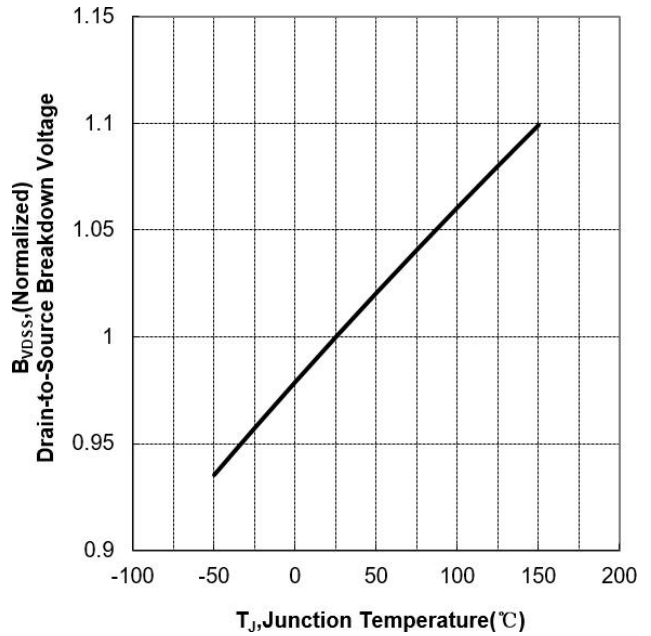


Figure 10 Typical Capacitance vs Drain to Source Voltage

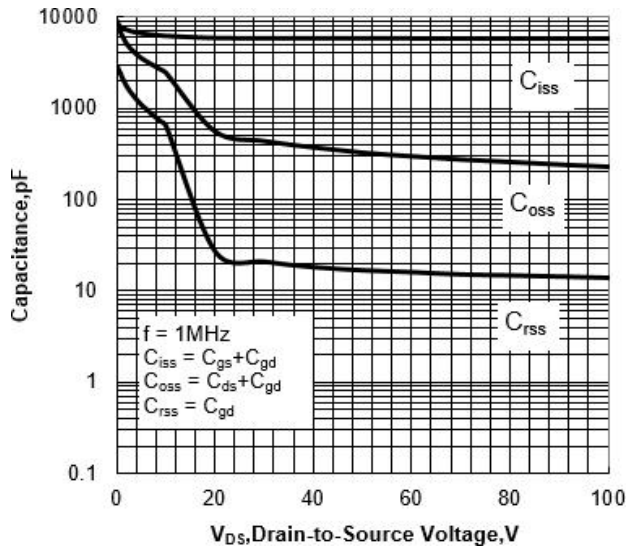
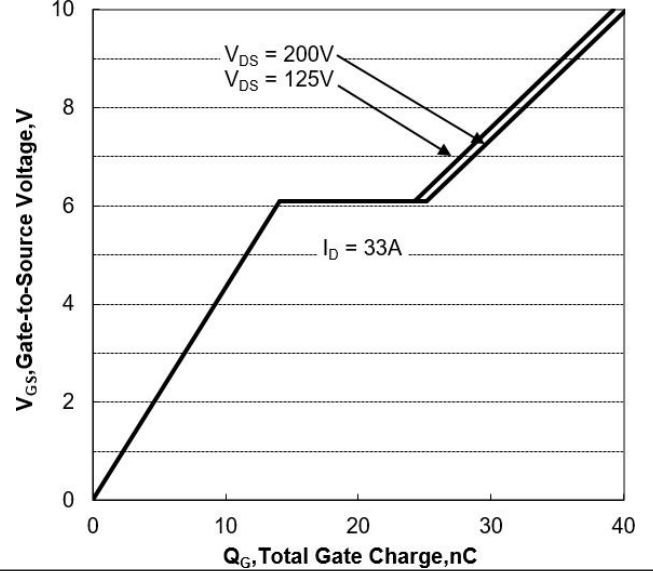


Figure 11 Typical Gate Charge vs Gate to Source Voltage



6. Test Circuit and Waveform

Figure 12 Gate Charge Test Circuit

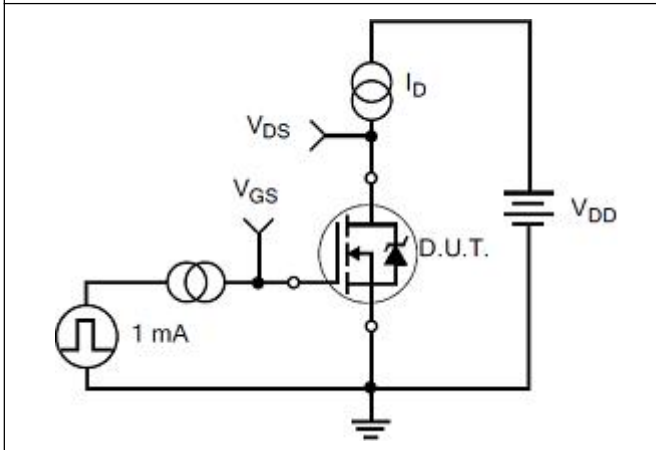


Figure 13 Gate Charge Waveforms

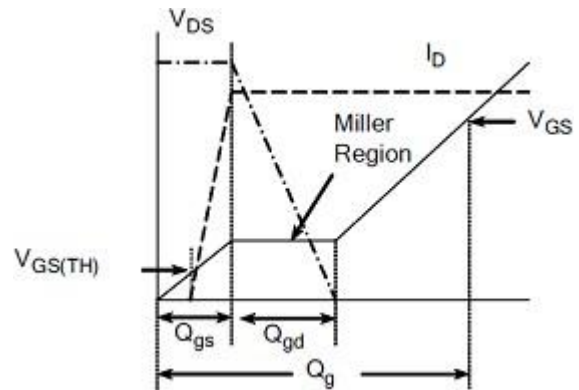


Figure 14 Resistive Switching Test Circuit

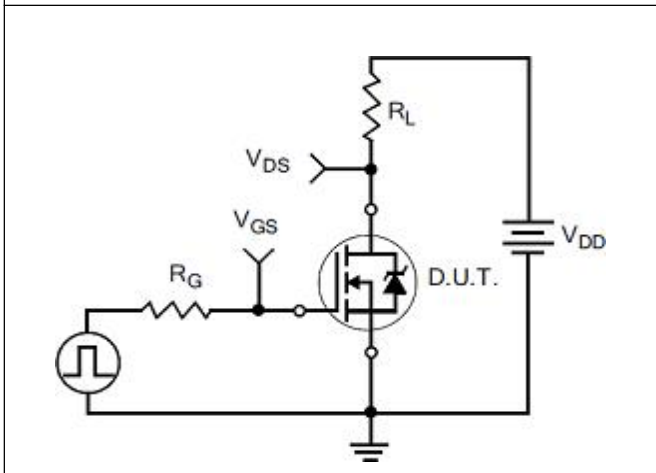


Figure 15 Resistive Switching Waveforms

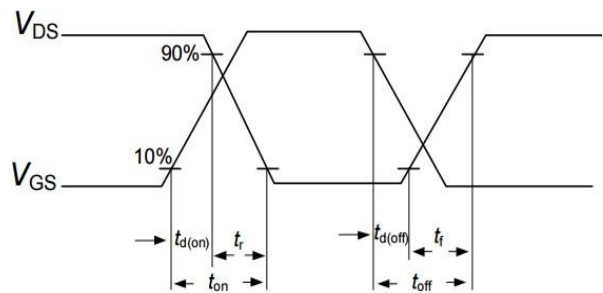


Figure 16 Diode Reverse Recovery Test Circuit

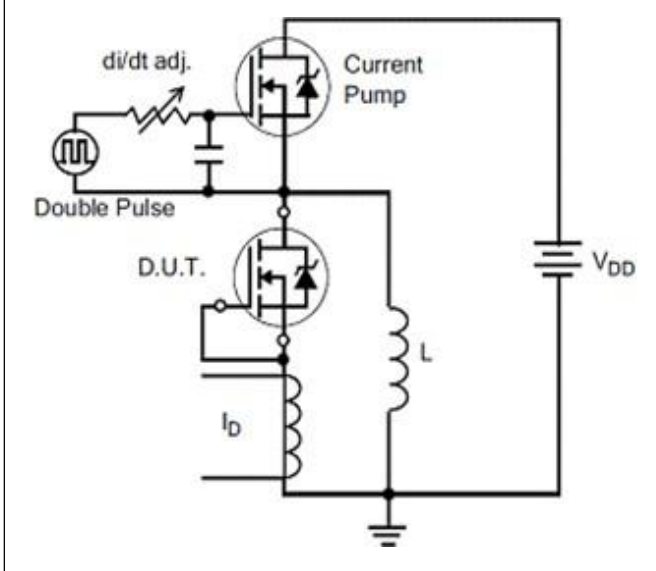


Figure 17 Diode Reverse Recovery Waveform

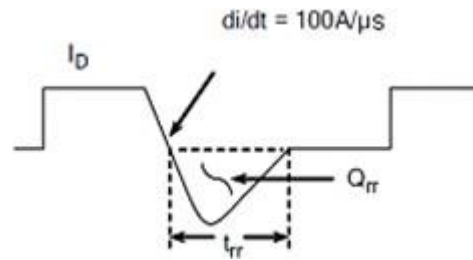


Figure 18 Unclamped Inductive Switching Test Circuit

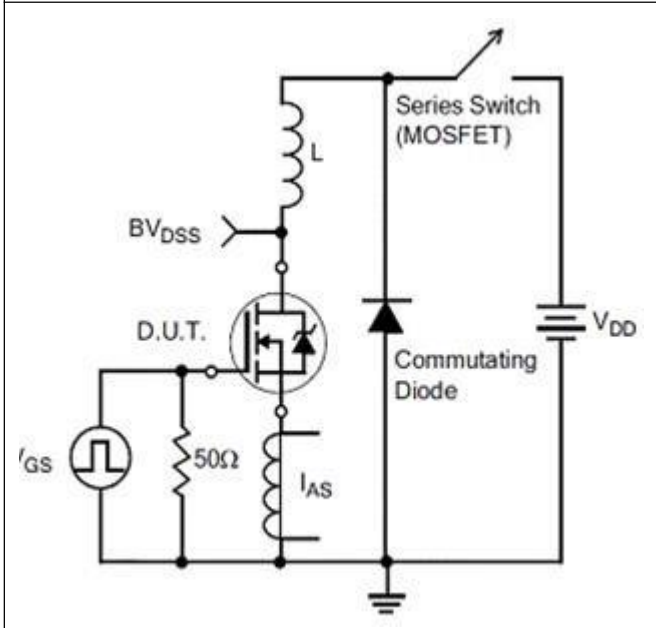


Figure 19 Unclamped Inductive Switching Waveform

