# ISA09N90A

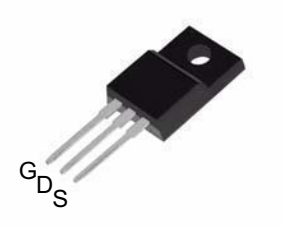
## N-Channel MOSFET

**Lead Free Package and Finish**

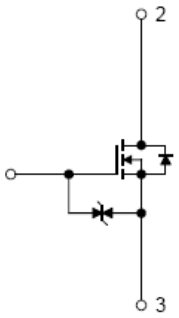
### Applications:
- ATX Power
- LCD Panel Power

| $V_{DSS}$ | $R_{DS(on)}$(Typ) | $I_D$ (Max) |
|---|---|---|
| 900V | 1.2Ω | 9.0A |

### Features:
- RoHS Compliant & Halogen Free
- Low ON Resistance
- Low Gate Charge
- ESD Capability Improved




TO-220F
Not to Scale




1. GATE
2. DRAIN (HEATSINK)
3. SOURCE

### Ordering Information

| Part Number | Package Type | Brand |
|---|---|---|
| ISA09N90A | TO-220F | ***IPS*** |

### Absolute Maximum Ratings Tc= 25℃ unless otherwise specified

| Symbol | Parameter | Maximum | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage (NOTE *1) | 900 | V |
| $I_D$ | Continuous Drain Current | 9.0 | A |
| $I_D$@ 100 ℃ | Continuous Drain Current | Figure3 | |
| $I_{DM}$ | Pulsed Drain Current, $V_{GS}$@ 10V (NOTE *2) | Figure6 | |
| $P_D$ | Power Dissipation | 60 | W |
| | Derating Factor above 25℃ | 0.48 | W/℃ |
| $V_{GS}$ | Gate-to-Source Voltage | ±20 | V |
| EAS | Single Pulse Avalanche Engergy(L=20mH); | 500 | mJ |
| $V_{ESD(GS)}$ | Gate Source ESD Voltage(HBM,c=100pF,R=1.5K Ω ) | 6000 | V |
| dv/dt | Peak Diode Recovery dv/dt (NOTE *3) | 5.0 | V/ns |
| $T_L$<br>$T_{PKG}$ | Maximum Temperature for Soldering<br>Leads at 0.063in(1.6mm) from Case for 10 seconds<br>Package Body for 10 seconds | 300<br>260 | ℃ |
| $T_J$ and $T_{STG}$ | Operation Junction and Storage Temperature Range | 150, -55 to 150 | ℃ |

***Caution:*** *Stresses greater than those listed in "Absolute Maximum Ratings" Table may cause permanent damage to the device.*

### Thermal Resistance

| Symbol | Parameter | Maximum | Units | Test Condition |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | 2.08 | ℃/W | Drain lead soldered to water cooled heatsink, PD ad-justed for a peak junction temperature of +150oC.<br>1 cubic foot chamber, free air. |
| $R_{\theta JA}$ | Junction-to-Ambient | 100 | | |

**Electrical Characteristics** TJ= 25℃ unless otherwise specified:

| **OFF Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Rating | | | Units | Test Conditions |
| | | Min. | Typ. | Max. | | |
| $V_{DSS}$ | Drain-to-Source Breakdown Voltage | 900 | -- | -- | V | $V_{GS}$=0V, $I_D$=250μA |
| $\Delta BV_{DSS}/\Delta T_J$ | Bvdss Temperature Coefficient | -- | 0.5 | -- | V/℃ | Reference to 25℃, ID=250uA |
| $I_{DS(off)}$ | Off-State Drain-to-Source Current | -- | -- | 1.0 | uA | $V_{DS}$ = 900V, $V_{GS}$=0V, $T_a$ = 25℃ |
| | | -- | -- | 250 | | $V_{DS}$ =720V, $V_{GS}$= 0 V, $T_a$ = 125℃ |
| $I_{GSS(F)}$ | Gate-to-Source Forward Leakage | -- | -- | 1.0 | uA | $V_{GS}$ =+20V |
| $I_{GSS(R)}$ | Gate-to-Source Reverse Leakage | -- | -- | -1.0 | | $V_{GS}$ =-20V |

| **ON Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Rating | | | Units | Test Conditions |
| | | Min. | Typ. | Max. | | |
| $R_{DS(ON)}$ | Drain-to-Source On-Resistance | -- | 1.20 | 1.4 | Ω | $V_{GS}$=10V,$I_D$=4.5A (NOTE*4) |
| $g_{fs}$ | Forward Transconductance | -- | 10 | -- | S | \|$V_{DS}$\|>2$I_D$*$R_{DS(on)max}$ $I_D$ =9A (NOTE*4) |
| $V_{GS(TH)}$ | Gate Threshold Voltage | 2.0 | -- | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |

| **Dynamic Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Rating | | | Units | Test Conditions |
| | | Min. | Typ. | Max. | | |
| $C_{iss}$ | Input Capacitance | -- | 2100 | -- | pF | $V_{GS}$ =0V $V_{DS}$ = 25V f = 1.0MHz |
| $C_{oss}$ | Output Capacitance | -- | 152 | -- | | |
| $C_{rss}$ | Reverse Transfer Capacitance | -- | 12 | -- | | |
| $Q_g$ | Total Gate Charge | -- | 47 | -- | nC | $V_{DD}$ =450V $I_D$ =9.0A Vgs=10V |
| $Q_{gs}$ | Gate-to-Source Charge | -- | 10 | -- | | |
| $Q_{gd}$ | Gate-to-Drain (“Miller”)Charge | -- | 17 | -- | | |

| **Resistive Switching Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Rating | | | Units | Test Conditions |
| | | Min. | Typ. | Max. | | |
| $t_{d(ON)}$ | Turn-on Delay Time | -- | 16 | -- | ns | $V_{DD}$ = 450V $I_D$ =4.0A $V_{GS}$ = 10V $R_G$ =4.7Ω |
| trise | Rise Time | -- | 10 | -- | | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | -- | 50 | -- | | |
| $t_{fall}$ | Fall Time | -- | 23 | -- | | |

| **Source-Drain Diode Characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Rating | | | Units | Test Conditions |
| | | Min. | Typ. | Max. | | |
| $I_S$ | Continuous Source Current (Body Diode) | -- | -- | 9.0 | A | Integral pn-diode in MOSFET |
| $I_{SM}$ | Maximum Pulsed Current (Body Diode) | -- | -- | 36 | A | |
| $V_{SD}$ | Diode Forward Voltage | -- | -- | 1.5 | V | $I_S$=9.0A,$V_{GS}$=0V |
| trr | Reverse Recovery Time | -- | 305 | -- | nS | $I_F$=9.0A, $T_j$ = 25°C di/dt=100A/us |
| Qrr | Reverse Recovery Charge | -- | 2.2 | -- | uC | |

**Notes:**

***1.** $T_J$=+25℃ to +150℃.

***2.** Repetitive rating; pulse width limited by maximum junction temperature.

***3.** $I_{SD}$=9.0A di/dt≤100A/us, $V_{DD}$≤$BV_{DSS}$, $T_{Jmax}$=+150℃.

***4.** Pulse width≤380us; duty cycle≤2%.

## Characteristics Curve:

**Figure 1. Maximum Effective Thermal Impedance, Junction-to-Case**

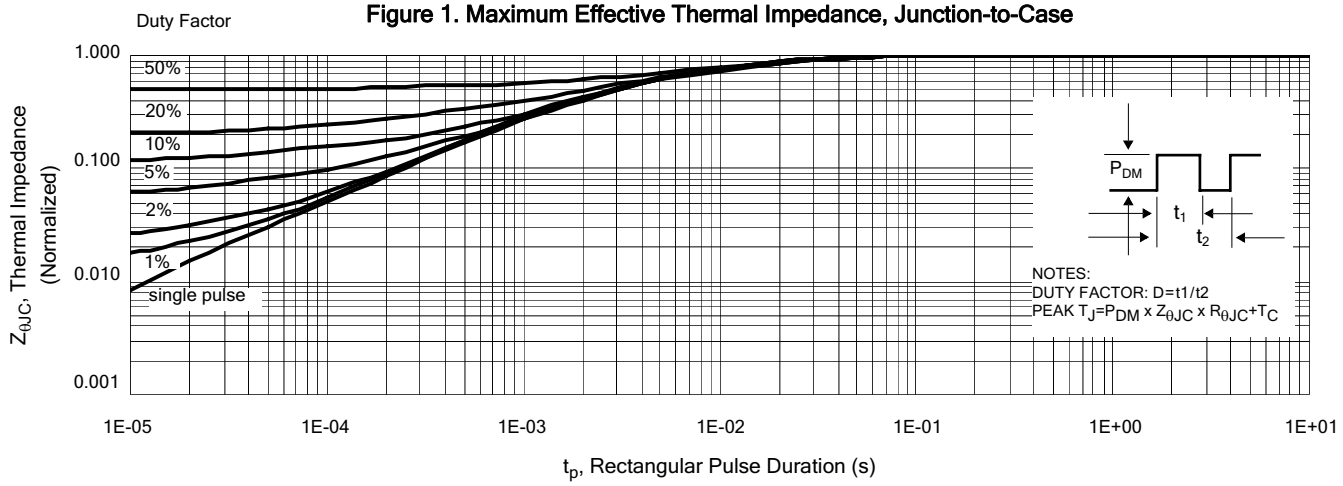



**Figure 2. Maximum Power Dissipation vs Case Temperature**

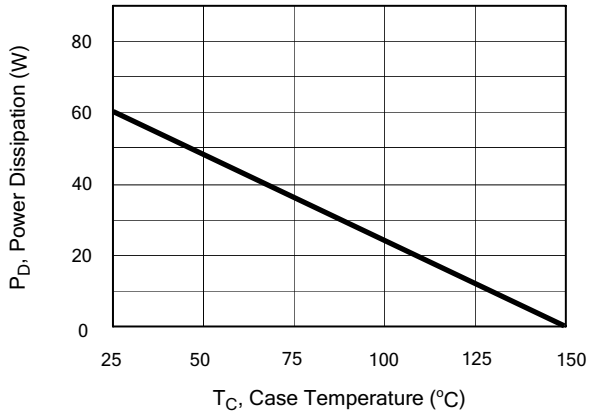



**Figure3. Maximum Continuous Drain Current vs Case Temperature**

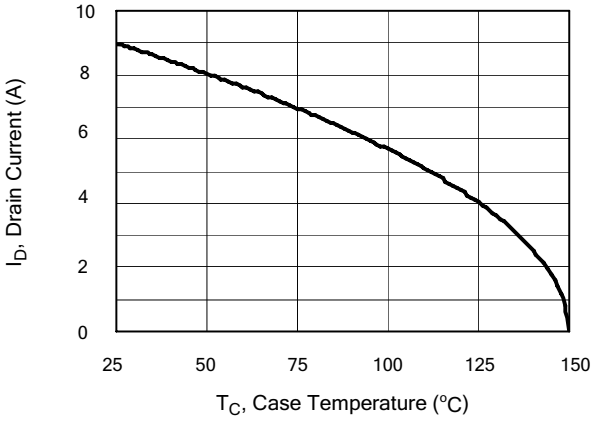



**Figure 4. Typical Output Characteristics**

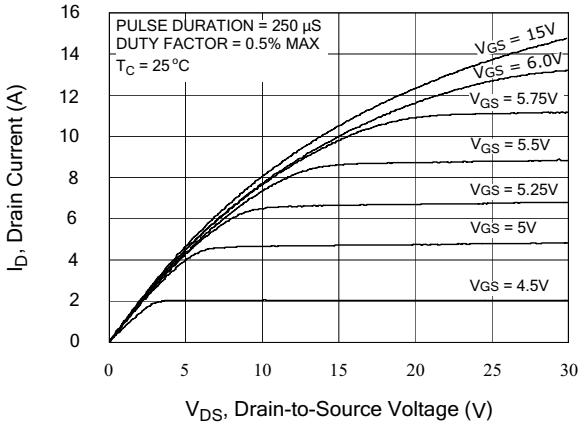



**Figure5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current**

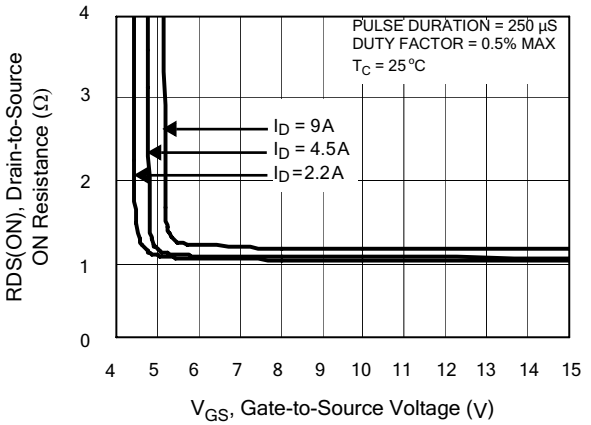


**Figure 6. Maximum Peak Current Capability**

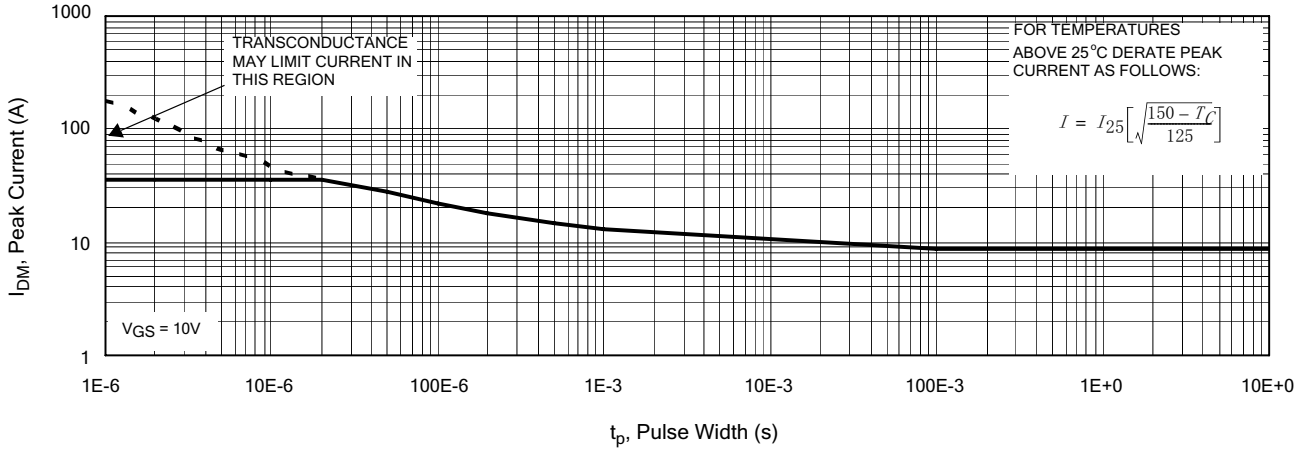



**Figure 7. Typical Transfer Characteristics**

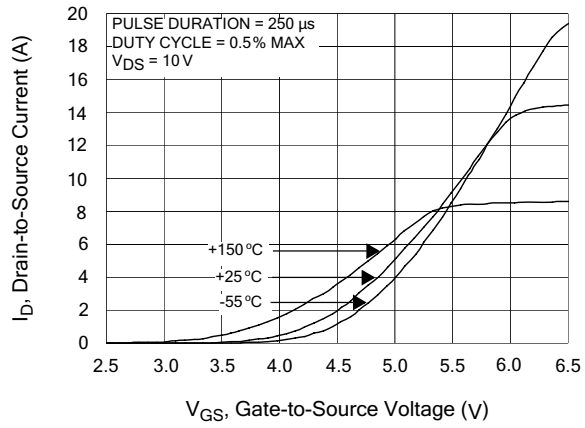



**Figure8. Unclamped Inductive Switching Capability**

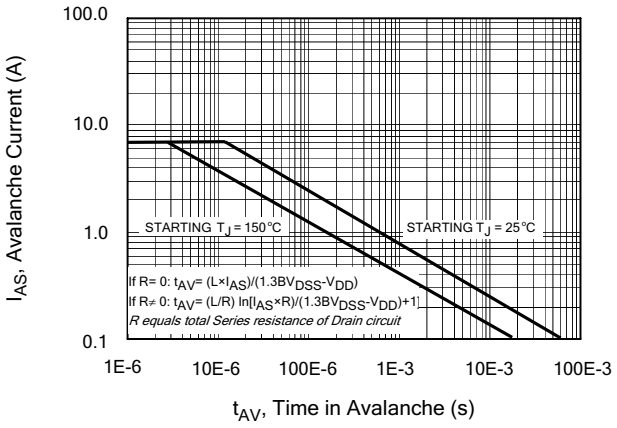



**Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current**

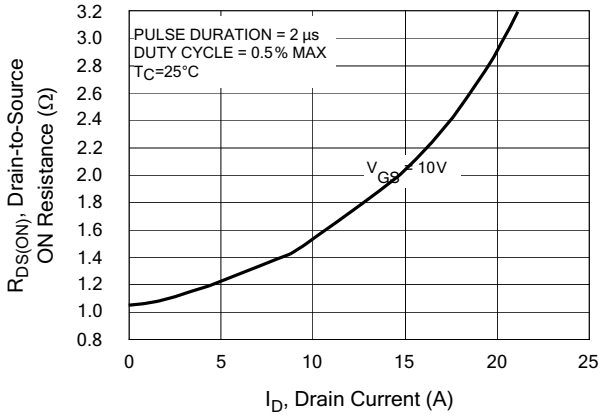



**Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature**

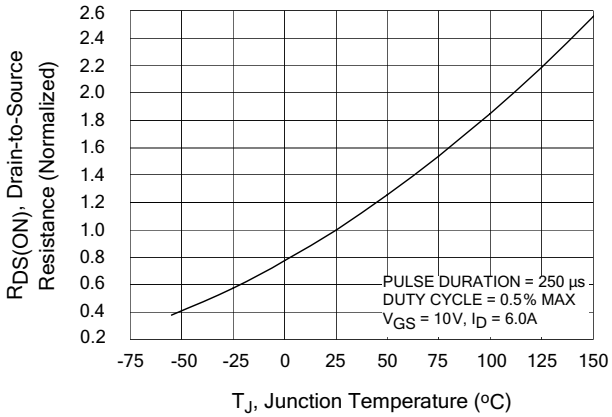


**Figure 11. Typical Breakdown Voltage vs Junction Temperature**

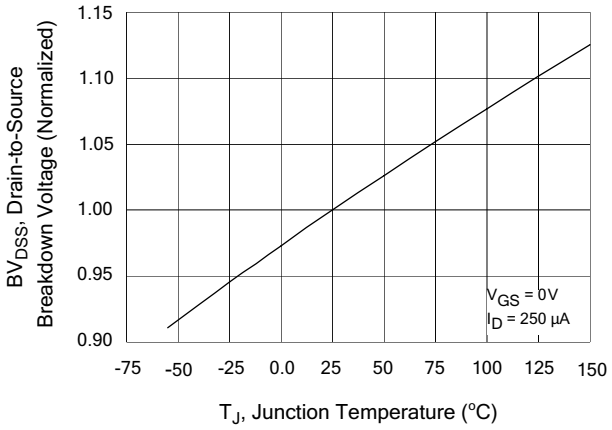



**Figure 12. Typical Threshold Voltage vs Junction Temperature**

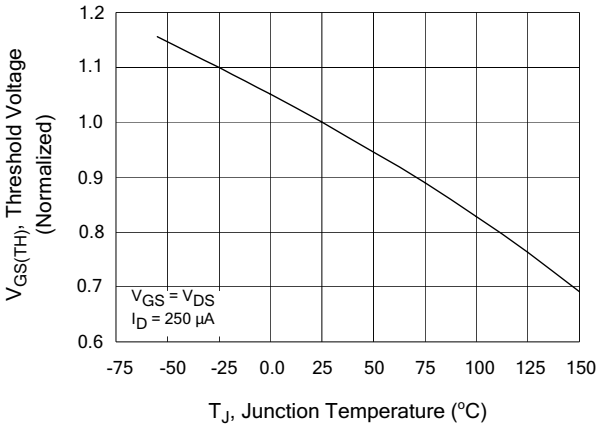



**Figure 13. Maximum Forward Bias Safe Operating Area**

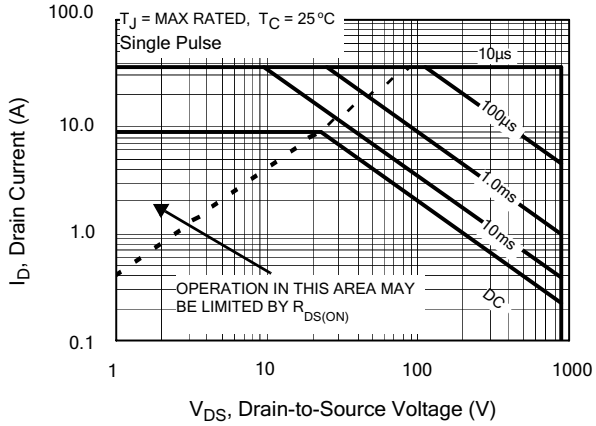



**Figure 14. Typical Capacitance vs Drain-to-SourceVoltage**

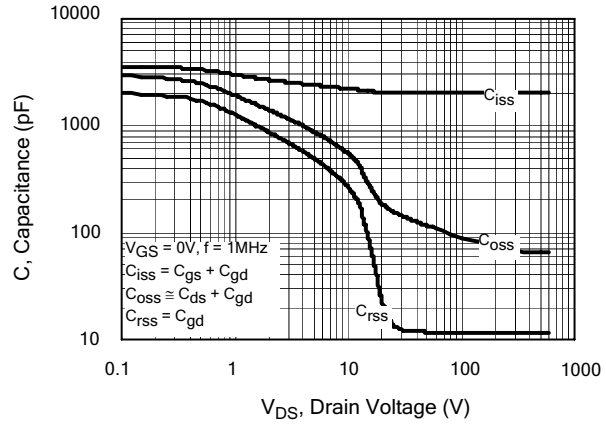



**Figure 15. Typical Gate Charge vs Gate-to-Source Voltage**

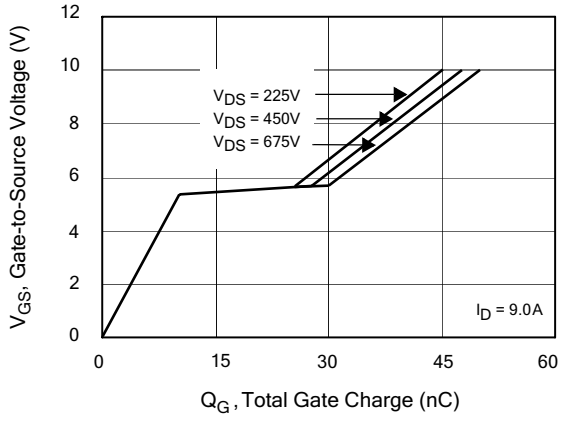
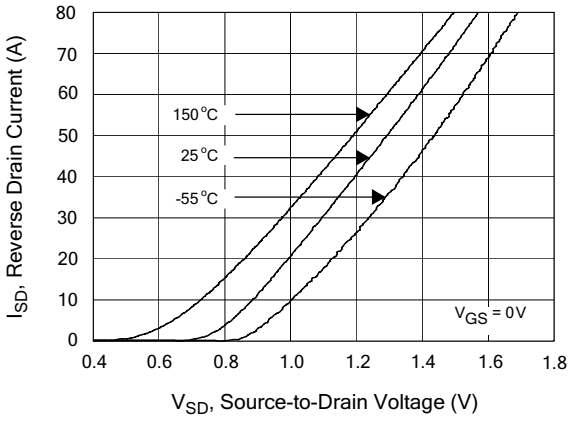



**Figure 16. Typical Body Diode Transfer Characteristics**



## Test Circuits and Waveforms

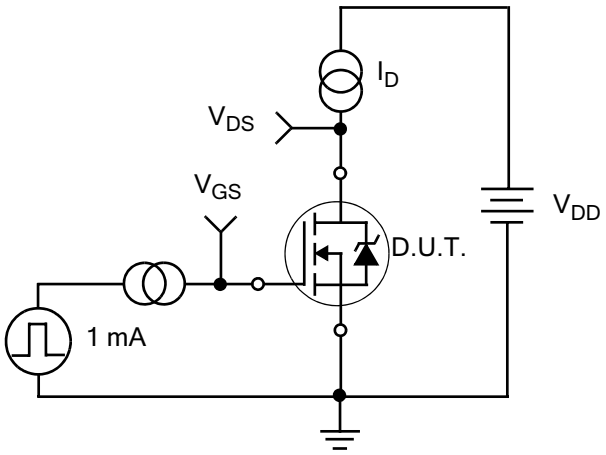



Figure 17. Gate Charge Test Circuit

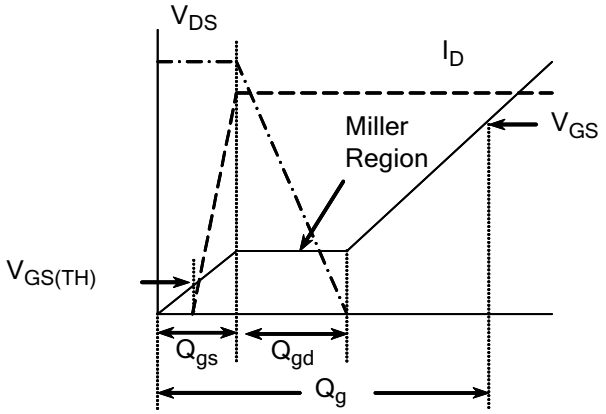



Figure 18. Gate Charge Waveform

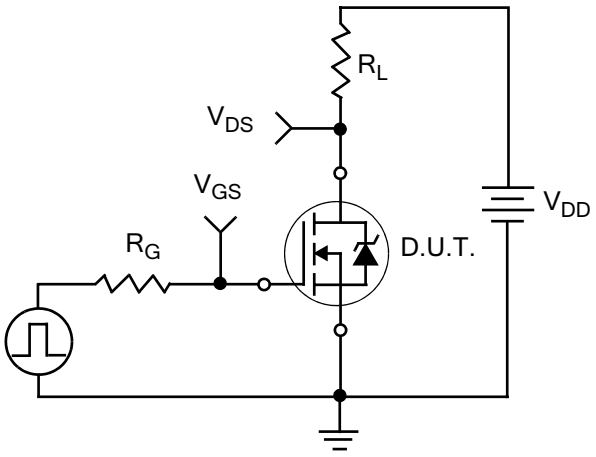



Figure 19. Resistive Switching Test Circuit

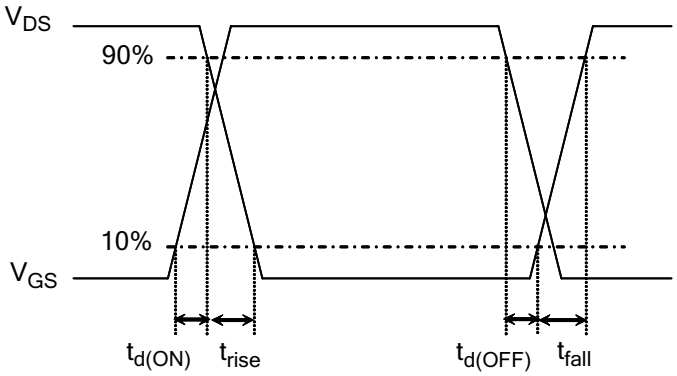



Figure 20. Resistive Switching Waveforms

## Test Circuits and Waveforms

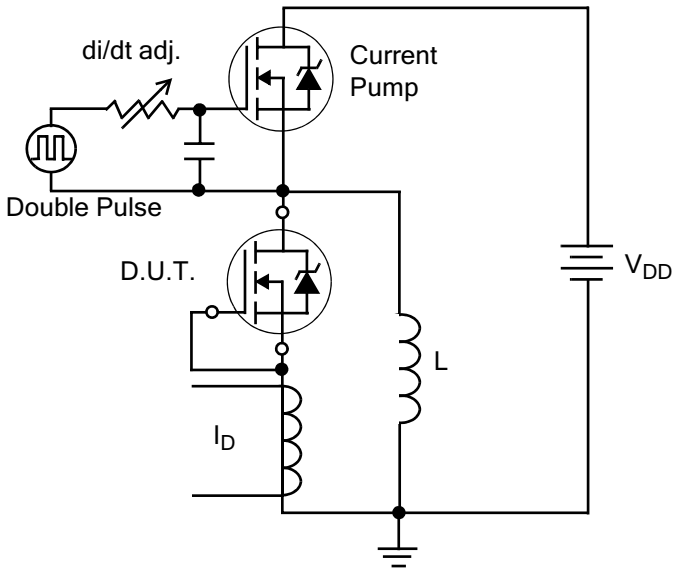



Figure 21. Diode Reverse Recovery Test Circuit

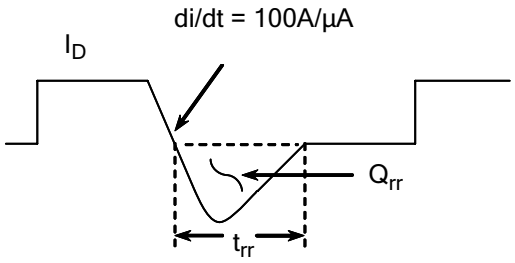



Figure 22. Diode Reverse Recovery Waveform

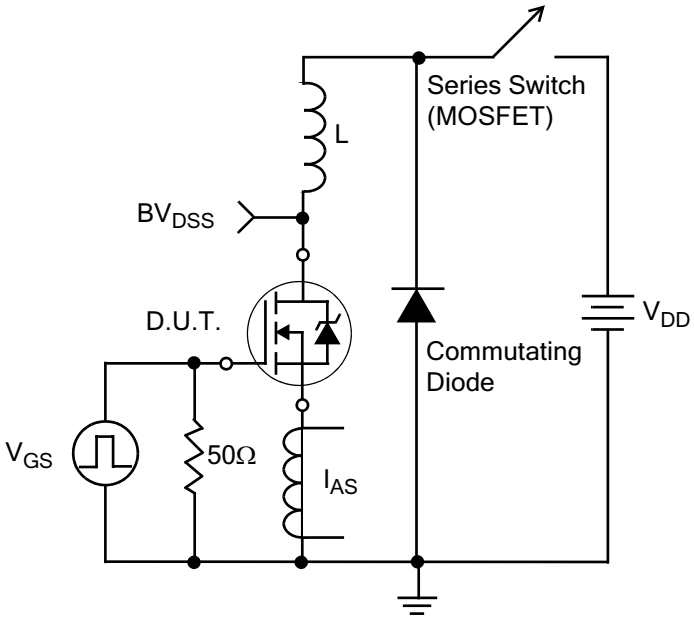
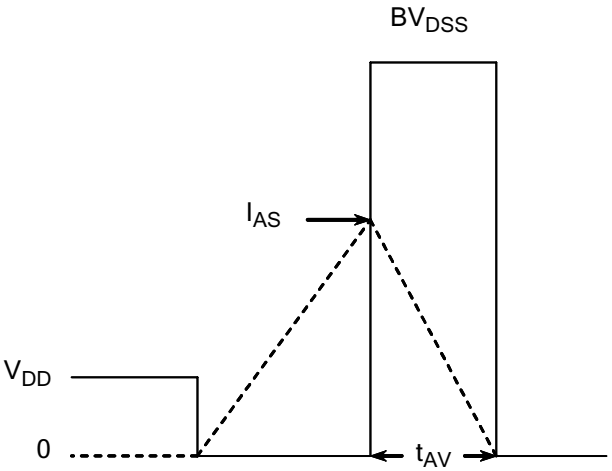



Figure 23. Unclamped Inductive Switching Test Circuit




$$E_{AS} = \frac{I_{AS}{}^2 L}{2}$$

Figure 24. Unclamped Inductive Switching Waveforms

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