# FTU36N06N

N-Channel MOSFET

Lead Free Package and Finish

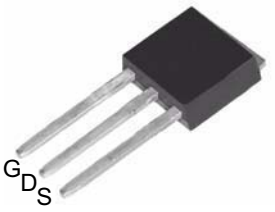
## Applications:

•Automotive
•DC Motor Control
•DC-DC Converters and Off-Line UPS

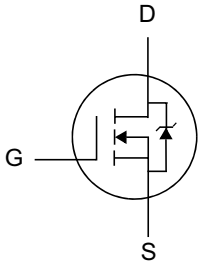
| $V_{DSS}$ | $R_{DS(ON)}$ (Max.) | $I_D$ |
|---|---|---|
| 60V | 36 mΩ | 25A |

## Features:

• RoHS Compliant
• Low ON Resistance
• Low Gate Charge
• Peak Current vs Pulse Width Curve




Package
Not to Scale




## Ordering Information

| PART NUMBER | PACKAGE | BRAND |
|---|---|---|
| FTU36N06N | TO-251 | FTU36N06N |

## Absolute Maximum Ratings $T_C$=25 °C unless otherwise specified

| Symbol | Parameter | Maximum | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage (NOTE *1) | 60 | V |
| $I_D$ | Continuous Drain Current | 25 | A |
| $I_D$@ 100 °C | Continuous Drain Current | Fig-3 | |
| $I_{DM}$ | Pulsed Drain Current, $V_{GS}$@ 10V (NOTE *2) | 80 | |
| $P_D$ | Power Dissipation | 50 | W |
| | Derating Factor above 25 °C | 0.33 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | 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 | <br>300<br>260 | °C |
| $T_J$ and $T_{STG}$ | Operating Junction and Storage Temperature Range | -55 to 175 | |

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

## Thermal Resistance

| Symbol | Parameter | Maximum | Units | Test Conditions |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | 3.0 | °C/W | Drain Lead soldered to water cooled heatsink, $P_D$ adjusted for a peak junction temperature of +175 °C. |
| $R_{\theta JA}$ | Junction-to-Ambient | 110 | | 1 cubic foot chamber, free air. |

**OFF Characteristics** $T_J$=25°C unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | 60 | -- | -- | V | $V_{GS}$=0V, $I_D$=250μA |
| $\Delta BV_{DSS}/\Delta T_J$ | BreakdownVoltage Temperature Coefficient, Figure 11. | -- | 0.05 | -- | V/°C | Reference to 25°C, $I_D$=250μA |
| $I_{DSS}$ | Drain-to-Source Leakage Current | -- | -- | 1.0 | μA | $V_{DS}$=60V, $V_{GS}$=0V |
| | | -- | -- | 25 | | $V_{DS}$=48V, $V_{GS}$=0V $T_J$=150°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | -- | -- | 100 | nA | $V_{GS}$=+20V |
| | Gate-to-Source Reverse Leakage | -- | -- | -100 | | $V_{GS}$= -20V |

**ON Characteristics** $T_J$=25°C unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-to-Source On-Resistance | -- | -- | 36 | mΩ | $V_{GS}$=10V, $I_D$=18A (NOTE *4) |
| | | -- | -- | 50 | | $V_{GS}$=4.5V, $I_D$=12A (NOTE *4) |
| $V_{GS(TH)}$ | Gate Threshold Voltage, Figure 12. | 1.0 | -- | 3.0 | V | $V_{DS}$=$V_{GS}$, $I_D$=250uA |
| gfs | Forward Transconductance | -- | 17 | -- | S | $V_{DS}$=30V, $I_D$=18A (NOTE *4) |

**Dynamic Characteristics** Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | -- | 1296 | -- | pF | $V_{GS}$=0V $V_{DS}$=25V f=1.0MHz Figure 14 |
| $C_{oss}$ | Output Capacitance | -- | 117 | -- | | |
| $C_{rss}$ | Reverse Transfer Capacitance | -- | 87 | -- | | |
| $Q_g$ | Total Gate Charge | -- | 13.0 | -- | nC | $V_{DD}$=30V $I_D$=18A,$V_{GS}$=4.5V Figure 15 |
| $Q_{gs}$ | Gate-to-Source Charge | -- | 6.8 | -- | | |
| $Q_{gd}$ | Gate-to-Drain (“Miller”) Charge | -- | 4.0 | -- | | |

**Resistive Switching Characteristics** Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $t_{d(ON)}$ | Turn-on Delay Time | -- | 8.0 | -- | ns | $V_{DD}$=30V $I_D$=18A $V_{GS}$=10V $R_G$=3.3Ω |
| $t_{rise}$ | Rise Time | -- | 19.0 | -- | | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | -- | 34.0 | -- | | |
| $t_{fall}$ | Fall Time | -- | 7.0 | -- | | |

**Source-Drain Diode Characteristics** $T_C$=25°C unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | -- | -- | 25 | A | Integral pn-diode in MOSFET |
| $I_{SM}$ | Maximum Pulsed Current (Body Diode) | -- | -- | 80 | A | |
| $V_{SD}$ | Diode Forward Voltage | -- | -- | 1.2 | V | $I_S$=25A, $V_{GS}$=0V |
| $t_{rr}$ | Reverse Recovery Time | -- | 53 | -- | ns | $V_{GS}$=0V, $V_{DD}$=-30V |
| $Q_{rr}$ | Reverse Recovery Charge | -- | 86 | -- | nC | $I_F$=18A, di/dt=100 A/μs |

Notes:

*1. $T_J$ = +25°C to +175°C.

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

*3. $I_{SD}$= 18A di/dt ≤ 100 A/μs, $V_{DD}$ ≤ $BV_{DSS}$, $T_J$=+175°C.

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

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

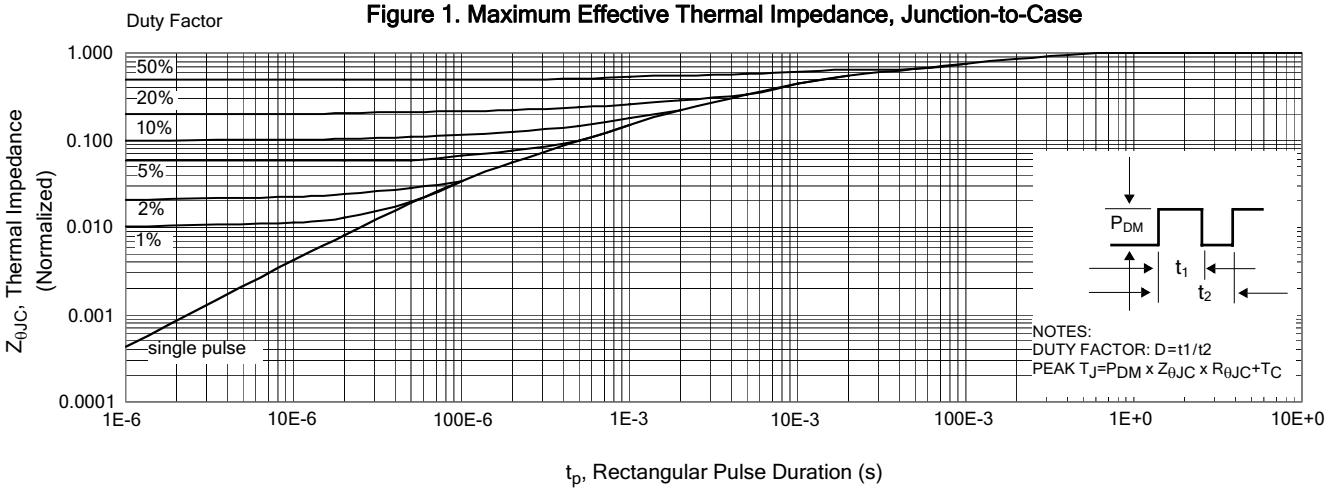



Figure 2. Maximum Power Dissipation vs Case Temperature

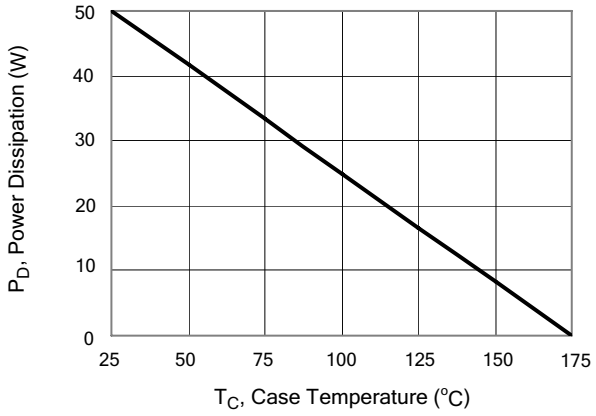



Figure3. Maximum Continuous Drain Current vs Case Temperature

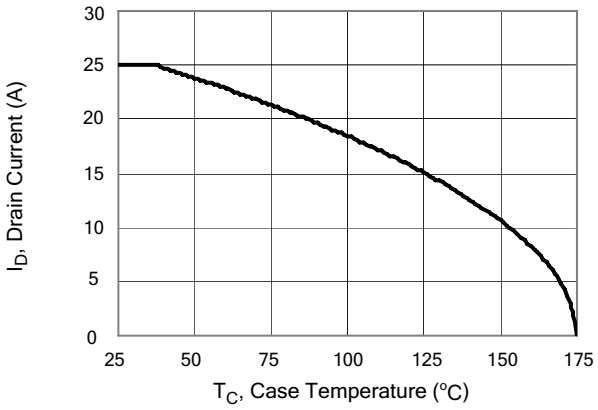



Figure 4. Typical Output Characteristics

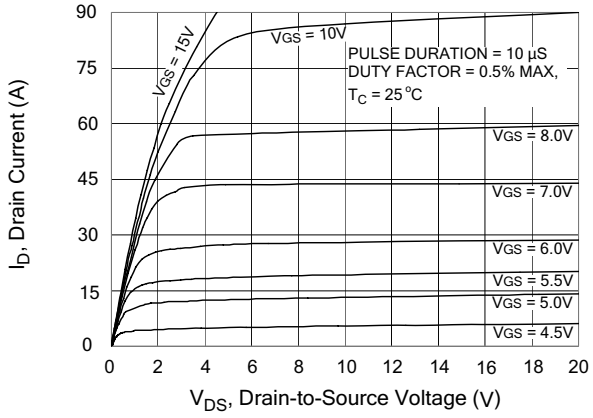



Figure5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current

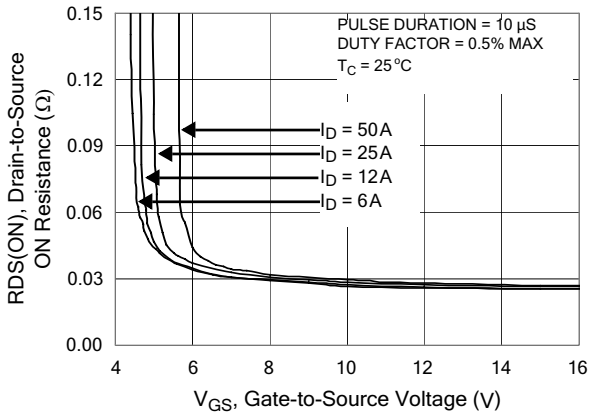


**Figure 6. Maximum Peak Current Capability**

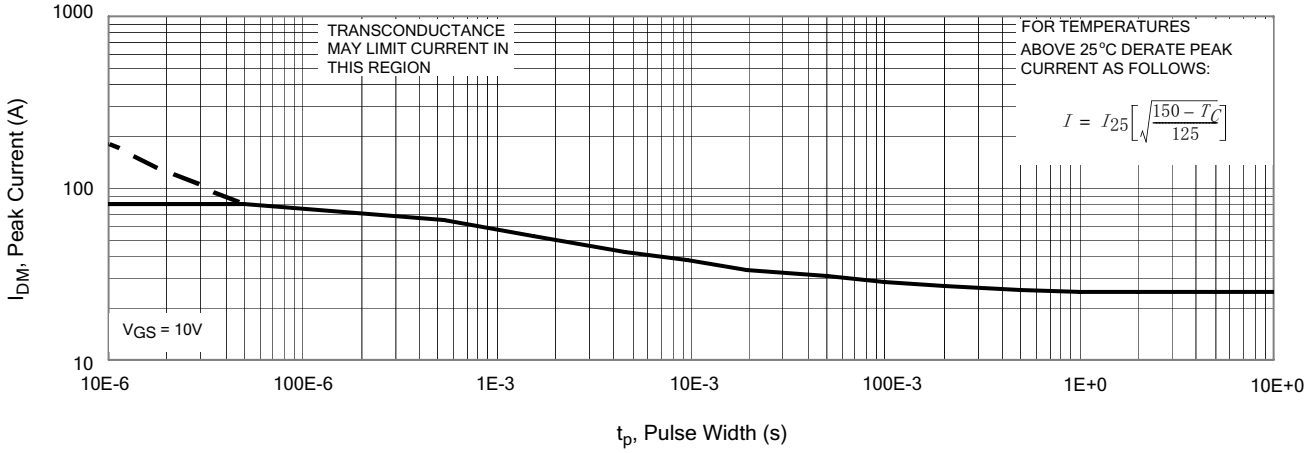



**Figure 7. Typical Transfer Characteristics**

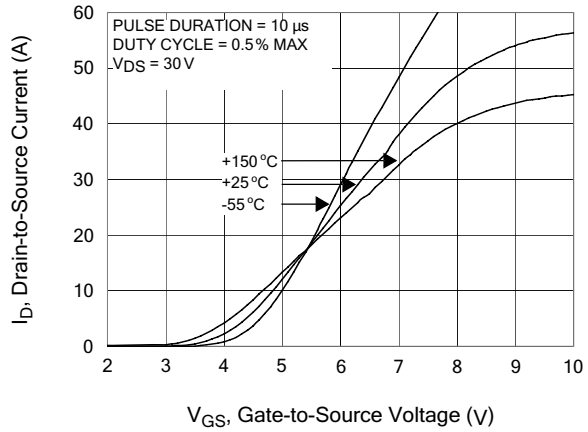



**Figure8. Unclamped Inductive Switching Capability**

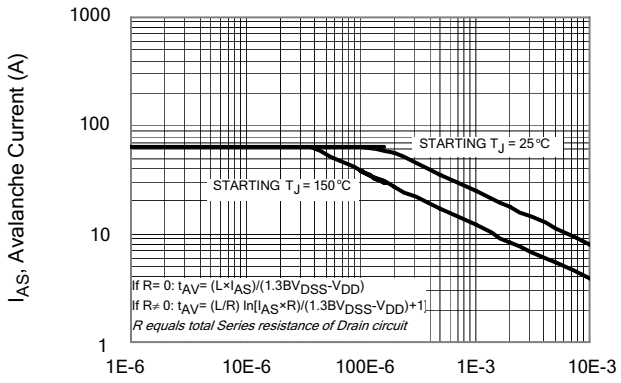



**Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current**

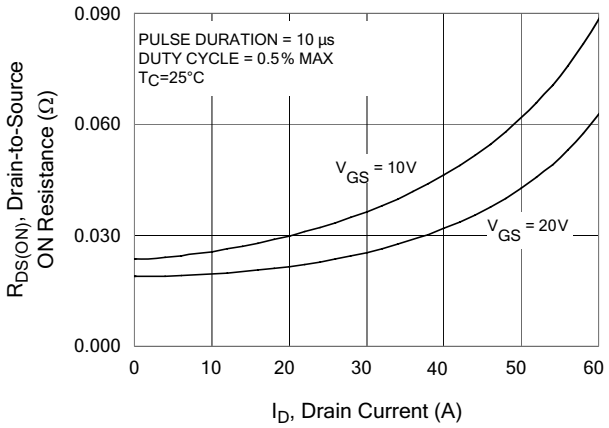



**Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature**

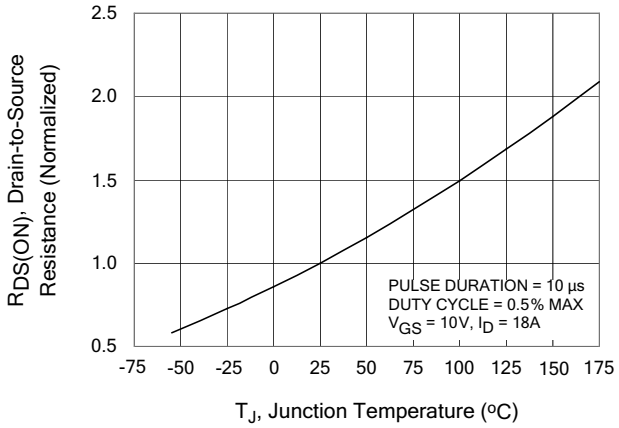


**Figure 11. Typical Breakdown Voltage vs Junction Temperature**

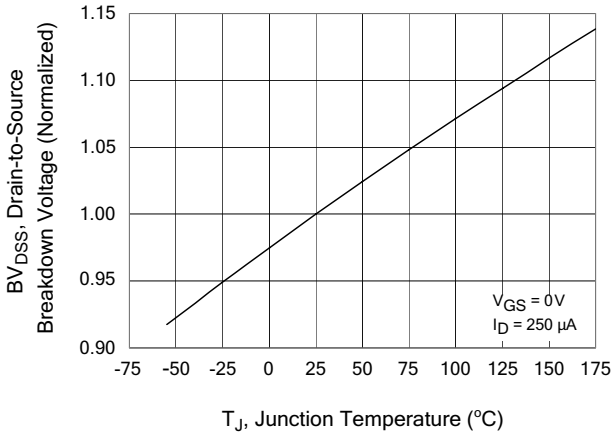



**Figure 12. Typical Threshold Voltage vs Junction Temperature**

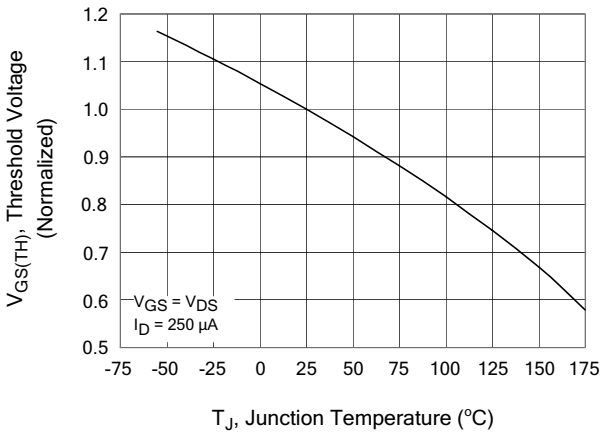



**Figure 13. Maximum Forward Bias Safe Operating Area**

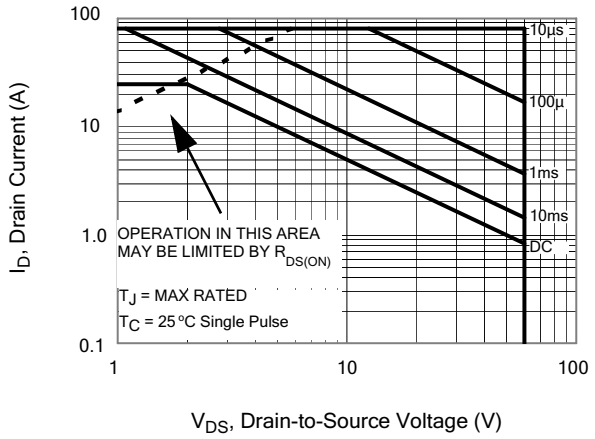



**Figure 14. Typical Capacitance vs Drain-to-Source Voltage**

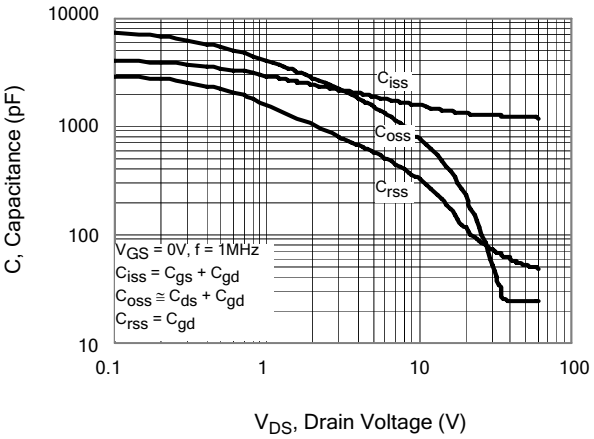



**Figure 15. Typical Gate Charge vs Gate-to-Source Voltage**

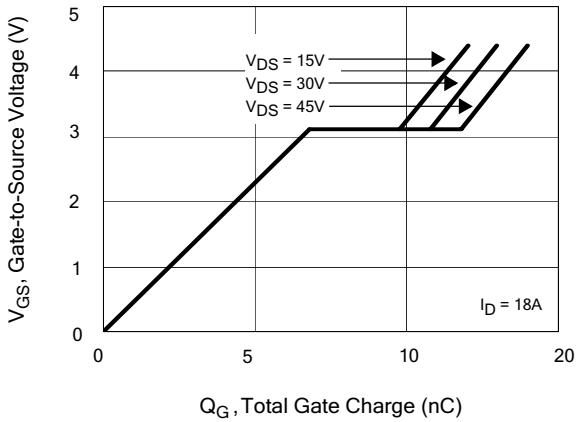
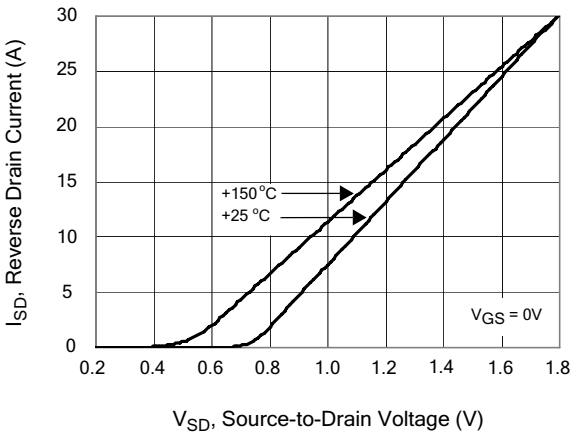



**Figure 16. Typical Body Diode Transfer Characteristics**



## Test Circuits and Waveforms

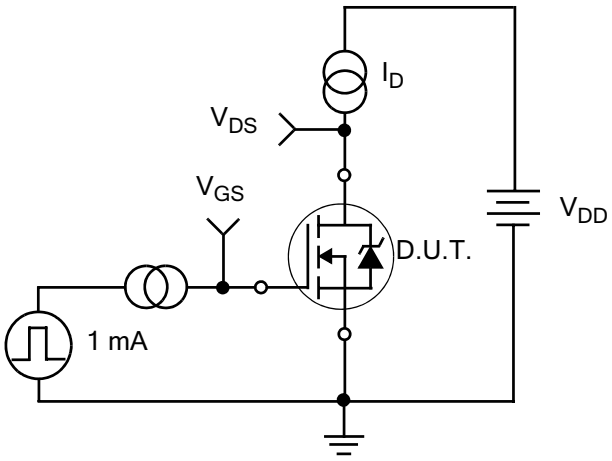



Figure 17. Gate Charge Test Circuit

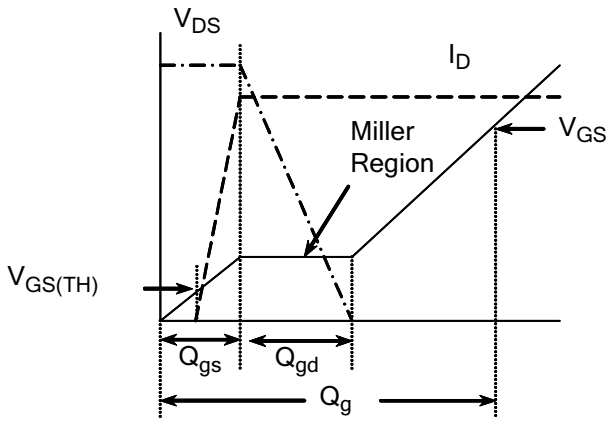



Figure 18. Gate Charge Waveform

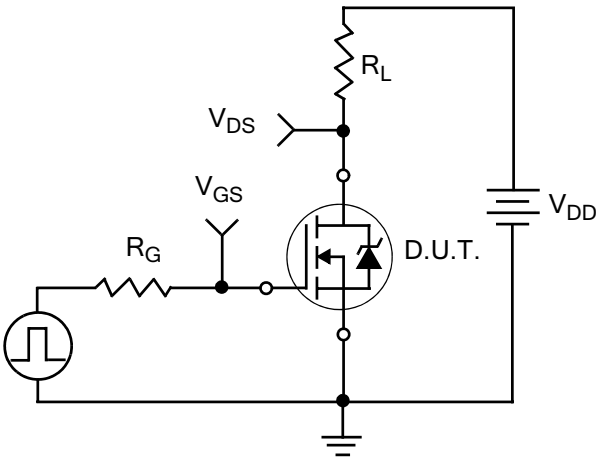



Figure 19. Resistive Switching Test Circuit

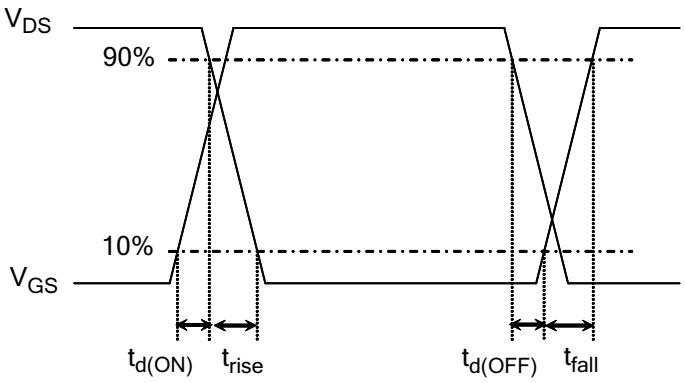



Figure 20. Resistive Switching Waveforms

## Test Circuits and Waveforms

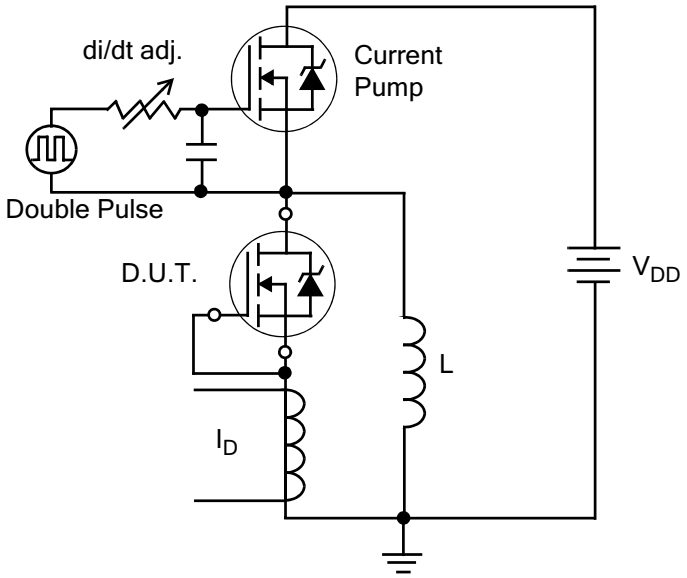



Figure 21. Diode Reverse Recovery Test Circuit

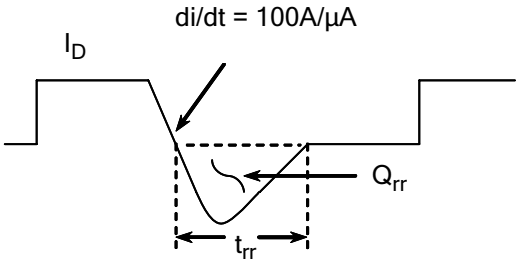



Figure 22. Diode Reverse Recovery Waveform

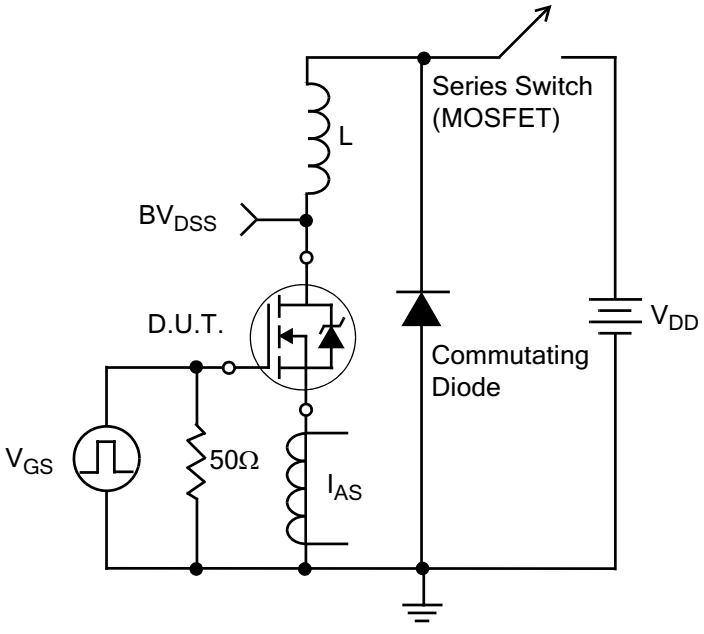
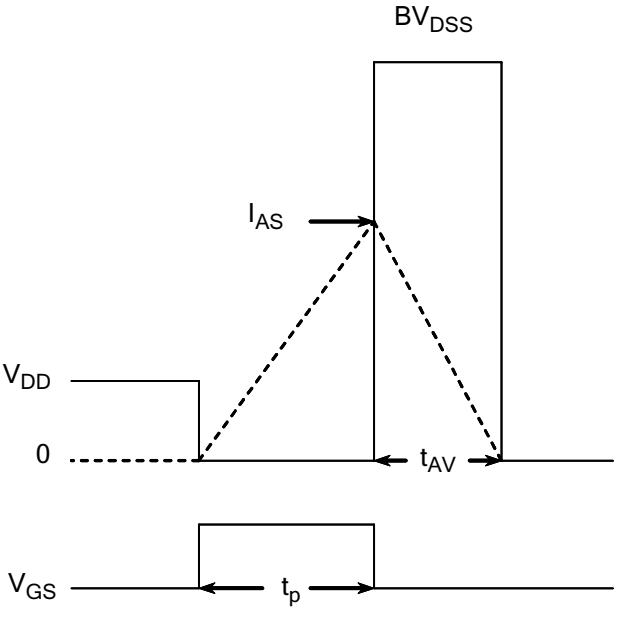



Figure 23. Unclamped Inductive Switching Test Circuit




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

Figure 24. Unclamped Inductive Switching Waveforms

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