

N-Channel MOSFET

Lead Free Package and Finish

Applications:

- Adaptor
- Charger
- SMPS

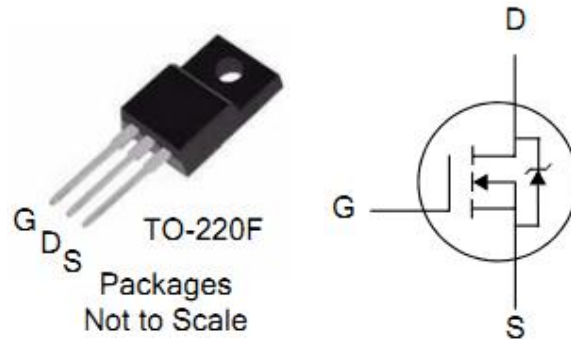
| | | |
|-----------|--------------------|-------|
| V_{DSS} | $R_{DS(ON)}(Typ.)$ | I_D |
| 500V | 0.24 Ω | 20A |

Features:

- RoHS Compliant
- Low ON Resistance
- Low Gate Charge
- Peak Current vs Pulse Width Curve
- Inductive Switching Curves

Ordering Information

| PART NUMBER | PACKAGE | BRAND |
|-------------|---------|------------|
| ITA20N50R | TO-220F | IPS |



Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | ITA20N50R | Units |
|---------------------|--|-----------------|---------------------|
| V_{DSS} | Drain-to-Source Voltage | 500 | V |
| I_D | Continuous Drain Current | 20 | A |
| | Continuous Drain Current $T_C = 100^\circ\text{C}$ | 12.5 | A |
| I_{DM} | Pulsed Drain Current (NOTE *1) | 80 | A |
| P_D | Power Dissipation | 45 | W |
| | Derating Factor above 25°C | 0.36 | W/ $^\circ\text{C}$ |
| V_{GS} | Gate-to-Source Voltage | ± 30 | V |
| E_{AS} | Single Pulse Avalanche Energy(NOTE *2) | 1200 | mJ |
| dv/dt | Peak Diode Recovery dv/dt(NOTE *3) | 5 | V/ns |
| T_L | Maximum Temperature for Soldering | 300 | $^\circ\text{C}$ |
| T_J and T_{STG} | Operating Junction and Storage Temperature Range | 150, -55 to 150 | |

Thermal Resistance

| Symbol | Parameter | Typ. | Units | Test Conditions |
|-----------------|---------------------|------|--------------------|---|
| $R_{\theta JC}$ | Junction-to-Case | 2.78 | $^\circ\text{C/W}$ | Water cooled heatsink, P_D adjusted for a peak junction temperature of $+150^\circ\text{C}$. |
| $R_{\theta JA}$ | Junction-to-Ambient | 62.5 | | 1 cubic foot chamber, free air. |



ITA20N50R

OFF Characteristics $T_C=25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|------------|-----------------------------------|------|------|------|---------|---|
| BV_{DSS} | Drain-to-Source Breakdown Voltage | 500 | -- | -- | V | $V_{GS}=0V, I_D=250\mu A$ |
| I_{DSS} | Drain-to-Source Leakage Current | -- | -- | 1 | μA | $V_{DS}=500V, V_{GS}=0V$ $T_J=25^\circ\text{C}$ |
| | | -- | -- | 100 | | $V_{DS}=400V, V_{GS}=0V$ $T_J=125^\circ\text{C}$ |
| I_{GSS} | Gate-to-Source Forward Leakage | -- | -- | +100 | nA | $V_{GS}=+30V$ |
| | Gate-to-Source Reverse Leakage | -- | -- | -100 | | $V_{GS}=-30V$ |

ON Characteristics $T_J=25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|--------------------------------------|------|------|------|----------|-------------------------------|
| $R_{DS(ON)}$ | Static Drain-to-Source On-Resistance | -- | 0.24 | 0.3 | Ω | $V_{GS}=10V, I_D=10A$ |
| $V_{GS(TH)}$ | Gate Threshold Voltage | 2 | -- | 4 | V | $V_{DS}=V_{GS}, I_D=250\mu A$ |
| g_{fs} | Forward Transconductance | -- | 18 | -- | S | $V_{DS}=15V, I_D=10A$ |
| Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$ | | | | | | |

Dynamic Characteristics Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|-----------|---------------------------------|------|------|------|---------|--|
| C_{iss} | Input Capacitance | -- | 2919 | -- | μF | $V_{GS}=0V, V_{DS}=25V$ $f=1.0\text{MHz}$ |
| C_{oss} | Output Capacitance | -- | 277 | -- | | |
| C_{rss} | Reverse Transfer Capacitance | -- | 16 | -- | | |
| Q_g | Total Gate Charge | -- | 52 | -- | nC | $I_D=20A, V_{DD}=400V$ $V_{GS}=10V$ |
| Q_{gs} | Gate-to-Source Charge | -- | 12.6 | -- | | |
| Q_{gd} | Gate-to-Drain ("Miller") Charge | -- | 18.6 | -- | | |

Resistive Switching Characteristics Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|--------------|---------------------|------|------|------|-------|--|
| $t_{d(ON)}$ | Turn-on Delay Time | -- | 34 | -- | ns | $V_{DD}=250V, I_D=20A,$ $V_G=10V, R_G=10\Omega$ |
| t_{rise} | Rise Time | -- | 65 | -- | | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | -- | 82 | -- | | |
| t_{fall} | Fall Time | -- | 45 | -- | | |



Source-Drain Diode Characteristics $T_c=25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|------|------|------|-------|--|
| I_S | Continuous Source Current (Body Diode) | -- | -- | 20 | A | $T_C=25^\circ\text{C}$ |
| I_{SM} | Maximum Pulsed Current (Body Diode) | -- | -- | 80 | A | |
| V_{SD} | Diode Forward Voltage | -- | -- | 1.5 | V | $I_{SD}=20\text{A}, V_{GS}=0\text{V}$ |
| t_{rr} | Reverse Recovery Time | -- | 535 | -- | ns | $I_F=I_S$ $di/dt=100\text{A}/\mu\text{s}$ |
| Q_{rr} | Reverse Recovery Charge | -- | 5671 | -- | nC | |
| Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$ | | | | | | |

Notes:

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

*2. $L=10\text{mH}$, $I_D=15.5\text{A}$, Start $T_J=25^\circ\text{C}$

*3. $I_{SD}=20\text{A}$, $di/dt \leq 100\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DS}$, Start $T_J=25^\circ\text{C}$

Characteristics Curve:

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

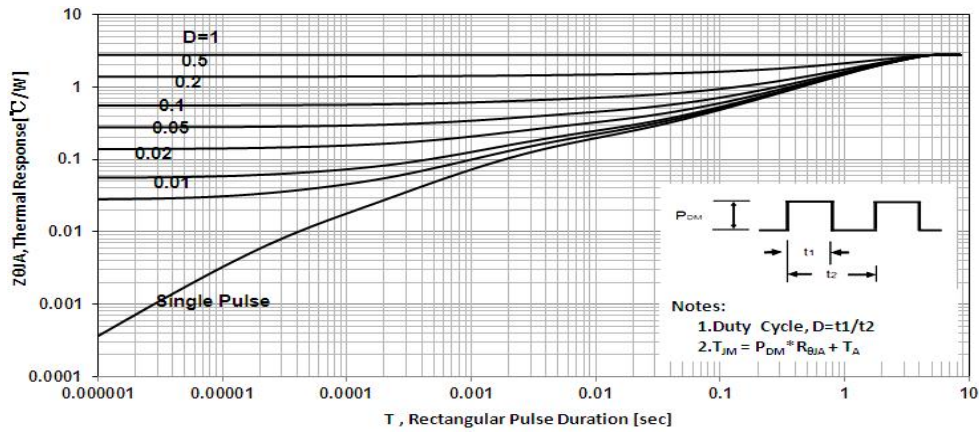


Figure 2. Max. Power Dissipation vs Case Temperature

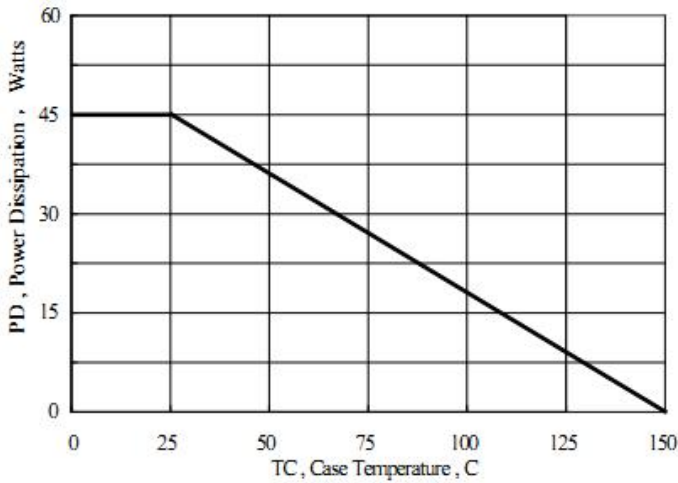


Figure 3. Max. Drain Current vs Case Temperature

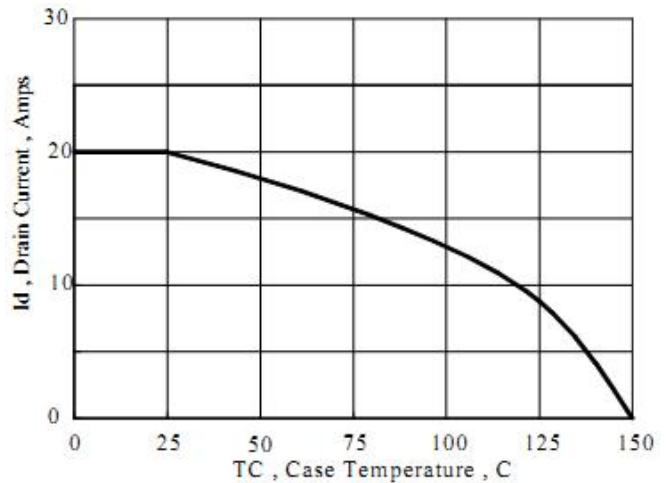


Figure 4. Typical Output Characteristics

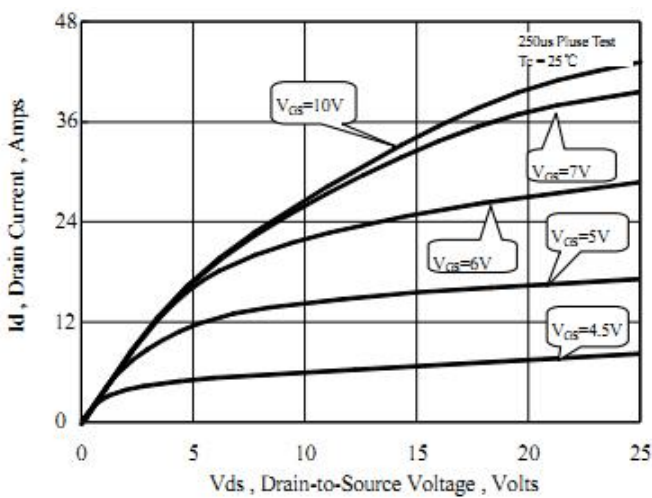


Figure 5. Typical Transfer Characteristics

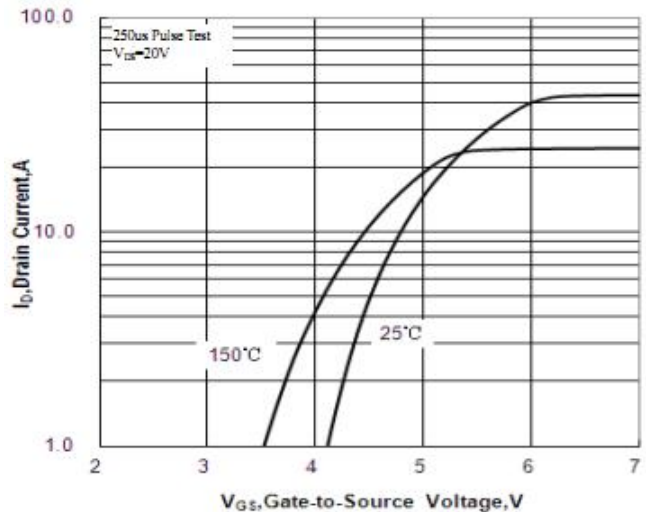


Figure 6. Typical Body Diode Transfer Characteristics

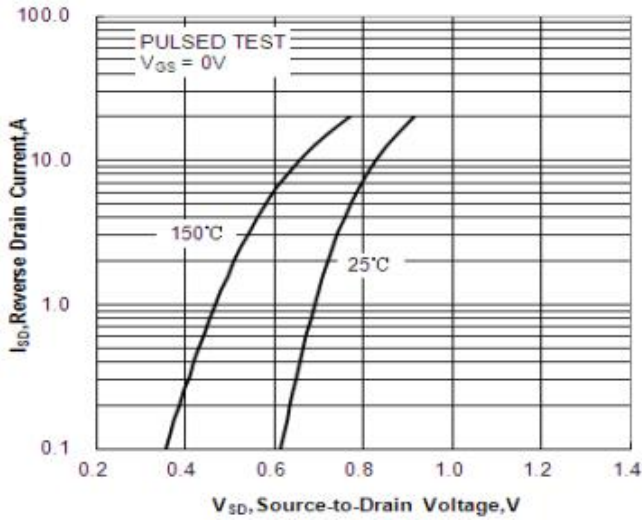


Figure 7. Typical on Resistance VS Drain Current

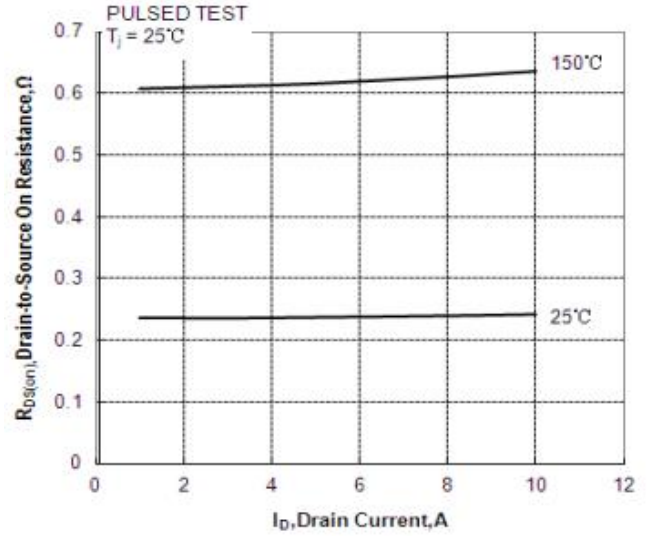


Figure 8. Capacitance VS Drain-to-Source Voltage

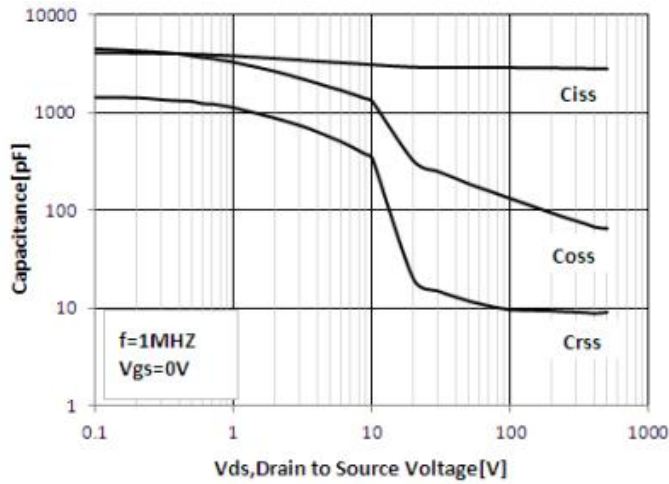


Figure 9. Gate Charge VS Gate-to-Source Voltage

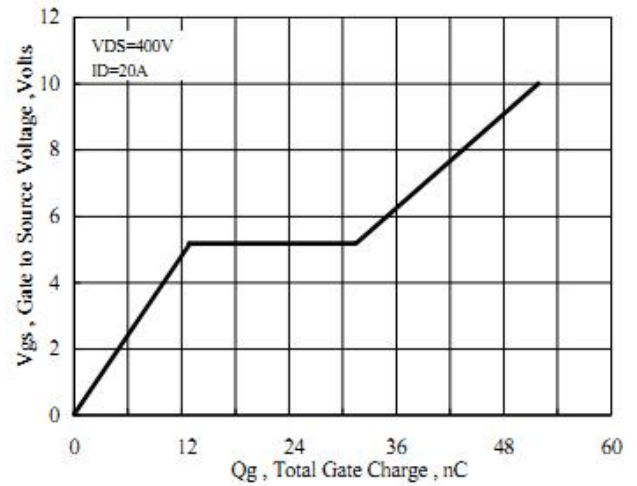


Figure 10. Breakdown Voltage VS Temperature

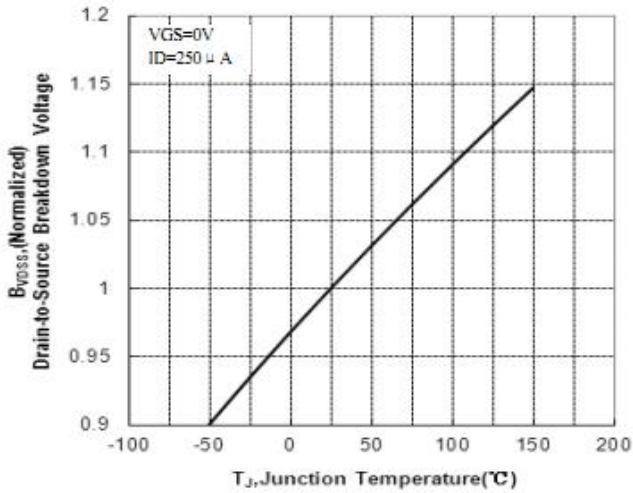


Figure 11. on-Resistance VS Temperature

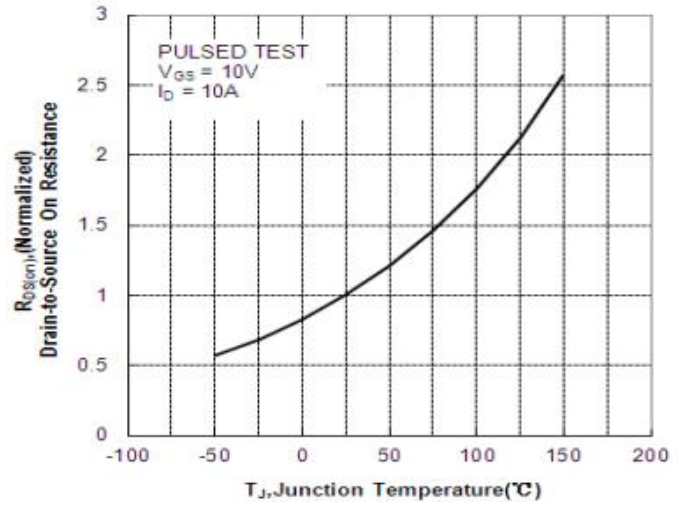


Figure 12 Theshold Voltage vs Junction Temperature

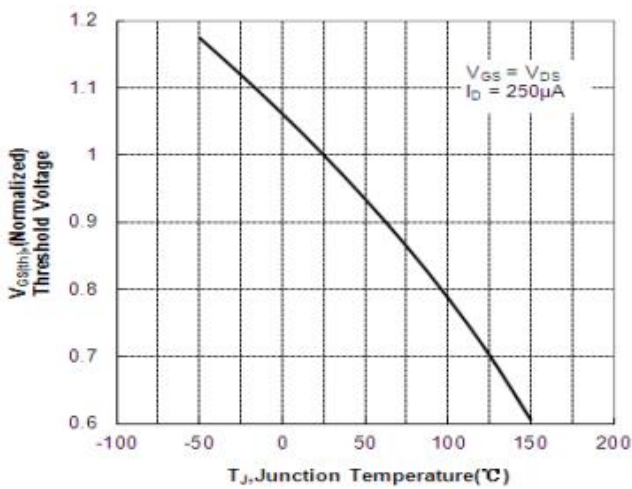
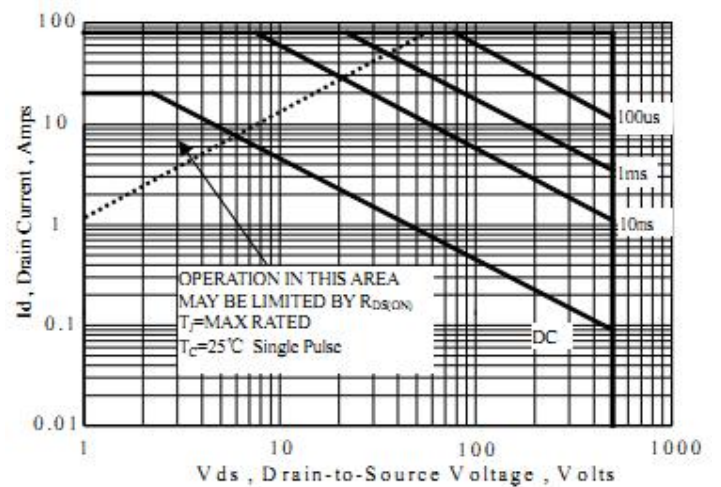


Figure 13. Safe Operating Area



Test Circuits and Waveforms

Figure 14. Gate Charge Test Circuit

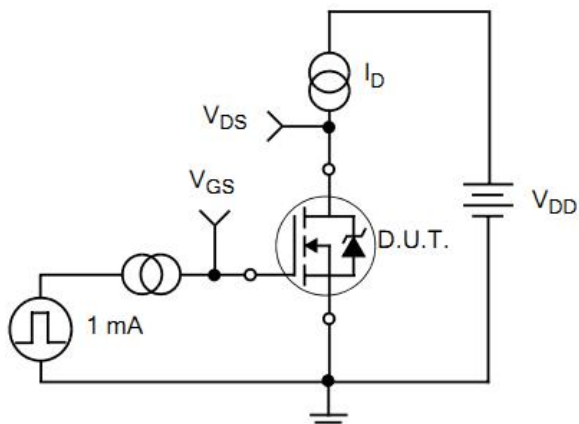


Figure 15. Gate Charge Waveforms

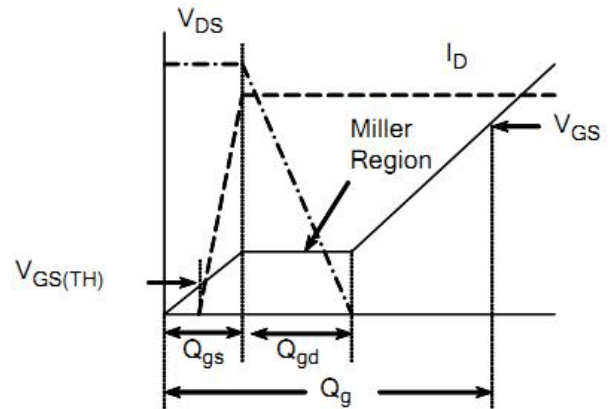


Figure 16. Resistive Switching Test Circuit

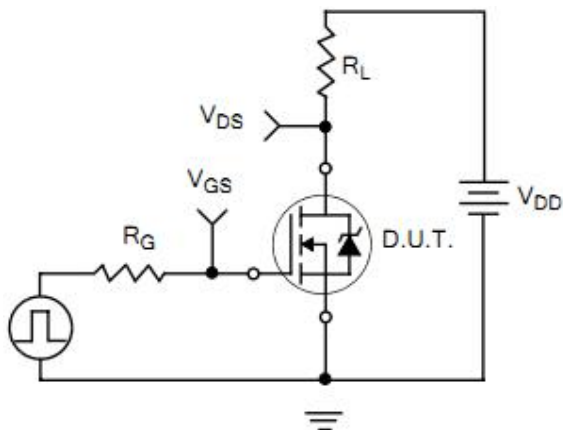


Figure 17. Resistive Switching Waveforms

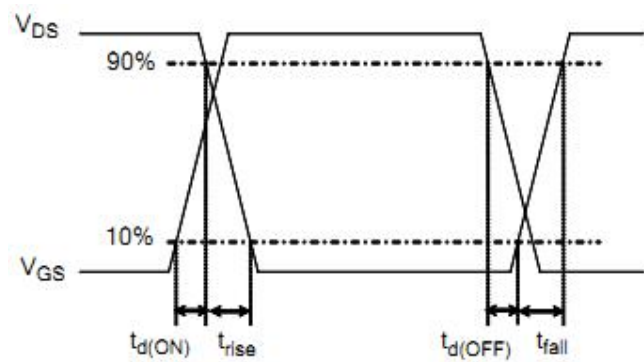


Figure 18. Diode Reverse Recovery Test Circuit

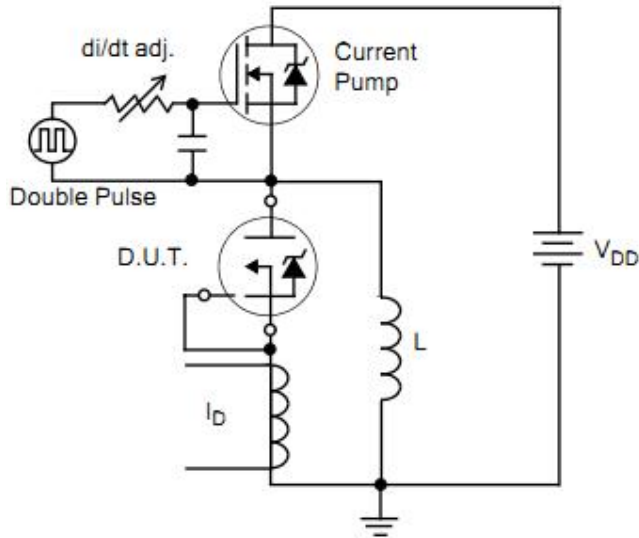


Figure 19. Diode Reverse Recovery Waveform

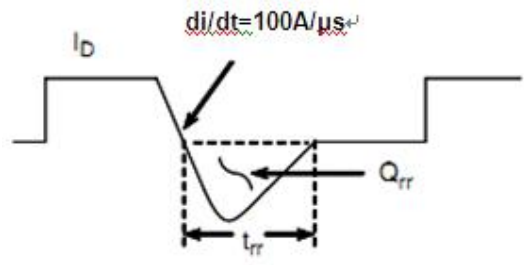


Figure20.Unclamped Inductive Switching Test Circuit

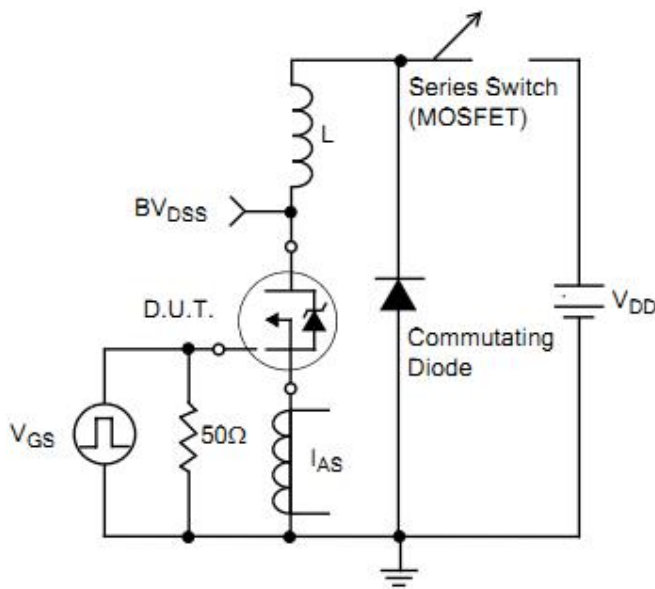
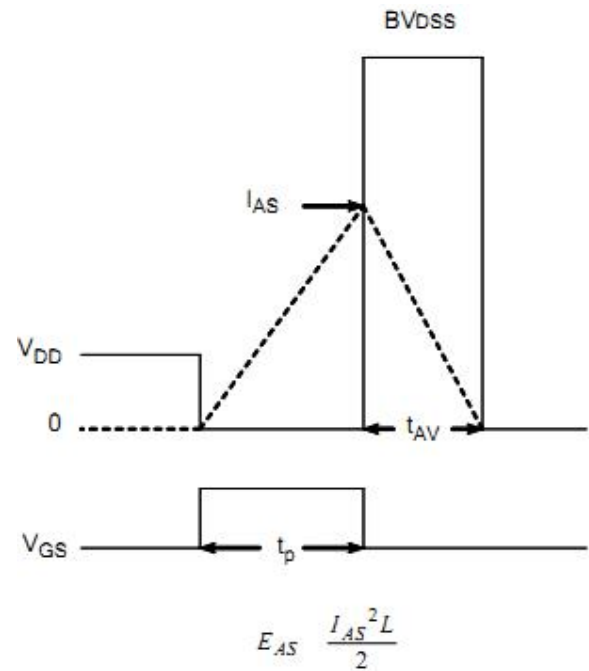


Figure21.Unclamped Inductive Switching Waveform





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