

N-Channel MOSFET

Lead Free Package and Finish

Applications:

- Adaptor
- Charger
- SMPS

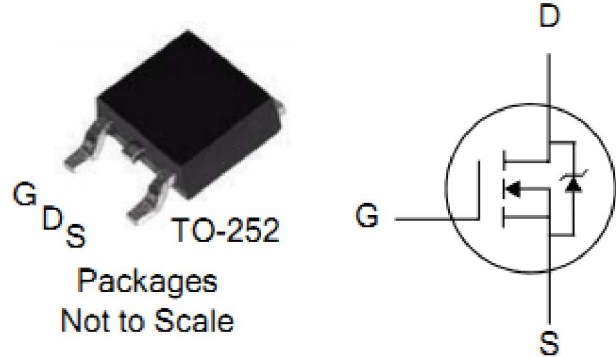
| | | |
|-----------|--------------------|-------|
| V_{DSS} | $R_{DS(ON)}(Typ.)$ | I_D |
| 650V | 2.4Ω | 4A |

Features:

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

Ordering Information

| PART NUMBER | PACKAGE | BRAND |
|-------------|---------|------------|
| ITD04N65R | TO-252 | IPS |



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

| Symbol | Parameter | ITD04N65R | Units |
|---------------------|---|-----------------|---------------------|
| V_{DSS} | Drain-to-Source Voltage | 650 | V |
| I_D | Continuous Drain Current | 4 | A |
| I_{DM} | Pulsed Drain Current, $V_{GS}@10\text{V}$ (NOTE *1) | 16 | A |
| P_D | Power Dissipation | 75 | W |
| | Derating Factor above 25°C | 0.6 | W/ $^\circ\text{C}$ |
| V_{GS} | Gate-to-Source Voltage | ± 30 | V |
| E_{AS} | Single Pulse Avalanche Energy (NOTE *2) | 200 | mJ |
| 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 | Max. | Units | Test Conditions |
|-----------------|---------------------|------|---------------------------|---|
| $R_{\theta JC}$ | Junction-to-Case | 1.67 | $^\circ\text{C}/\text{W}$ | Water cooled heatsink, P_D adjusted for a peak junction temperature of $+150^\circ\text{C}$. |
| $R_{\theta JA}$ | Junction-to-Ambient | 100 | | 1 cubic foot chamber, free air. |



ITD04N65R

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 | 650 | -- | -- | V | $V_{GS}=0V, I_D=250\mu A$ |
| I_{DSS} | Drain-to-Source Leakage Current | -- | -- | 1 | μA | $V_{DS}=650V, V_{GS}=0V$ $T_J=25^\circ\text{C}$ |
| | | -- | -- | 100 | | $V_{DS}=520V, V_{GS}=0V$ $T_J=125^\circ\text{C}$ |
| 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 | -- | 2.4 | 2.8 | Ω | $V_{GS}=10V, I_D=2A$ |
| $V_{GS(TH)}$ | Gate Threshold Voltage | 2 | -- | 4 | V | $V_{DS}=V_{GS}, I_D=250\mu A$ |
| g_{fs} | Forward Transconductance | -- | 3.5 | -- | S | $V_{DS}=15V, I_D=2A$ |

Dynamic Characteristics Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|-----------|---------------------------------|------|------|------|---------|--|
| C_{iss} | Input Capacitance | -- | 610 | -- | μF | $V_{GS}=0V, V_{DS}=25V$ $f=1.0\text{MHz}$ |
| C_{oss} | Output Capacitance | -- | 53 | -- | | |
| C_{rss} | Reverse Transfer Capacitance | -- | 3.5 | -- | | |
| Q_g | Total Gate Charge | -- | 14.5 | -- | nC | $I_D=4A, V_{DD}=520V$ $V_{GS}=10V$ |
| Q_{gs} | Gate-to-Source Charge | -- | 3 | -- | | |
| Q_{gd} | Gate-to-Drain ("Miller") Charge | -- | 6.5 | -- | | |

Resistive Switching Characteristics Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|--------------|---------------------|------|------|------|-------|--|
| $t_{d(ON)}$ | Turn-on Delay Time | -- | 14 | | ns | $V_{DD}=325V, I_D=4A,$ $V_{GS}=10V, R_G=10\Omega$ |
| t_{rise} | Rise Time | -- | 16 | | | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | -- | 32 | | | |
| t_{fall} | Fall Time | -- | 11 | | | |



ITD04N65R

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) | -- | -- | 4 | A | T _C =25°C |
| I _{SM} | Maximum Pulsed Current (Body Diode) | -- | -- | 16 | A | |
| V _{SD} | Diode Forward Voltage | -- | -- | 1.5 | V | I _{SD} =4A, V _{GS} =0V |
| t _{rr} | Reverse Recovery Time | -- | 256 | -- | ns | I _F = I _S di/dt=100A/us |
| Q _{rr} | Reverse Recovery Charge | -- | 1200 | -- | nC | |

Notes:

- *1. Repetitive rating; pulse width limited by maximum junction temperature.
- *2. L=10mH, I_D=6.3A, Start T_J=25°C

Characteristics Curve:

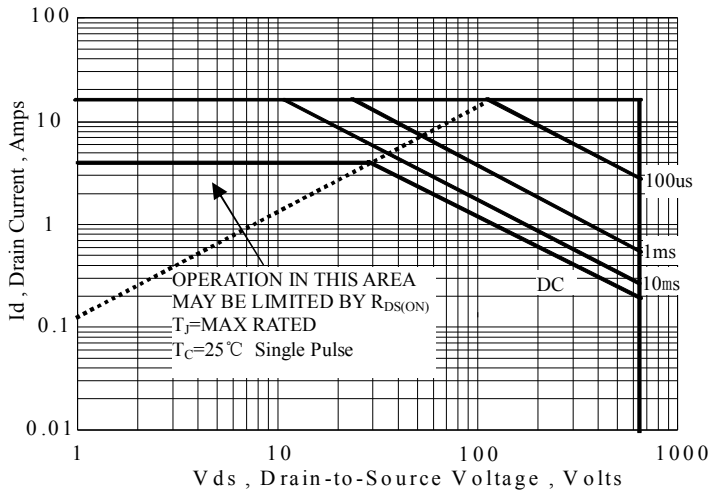


Figure 1 Maximum Forward Bias Safe Operating Area

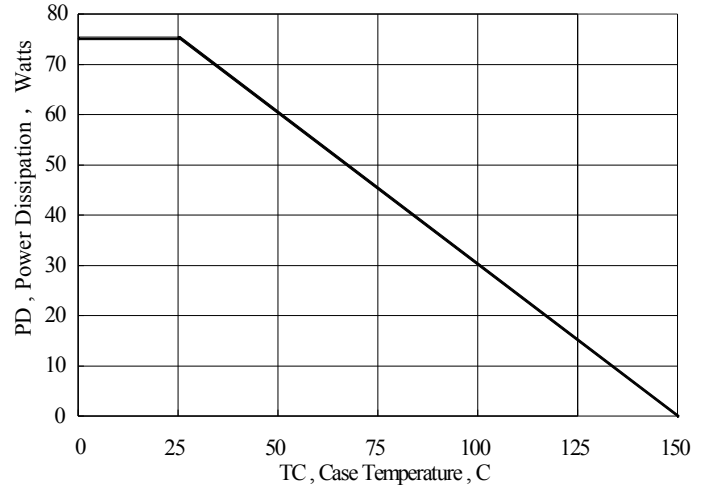


Figure 2 Maximum Power Dissipation vs Case Temperature

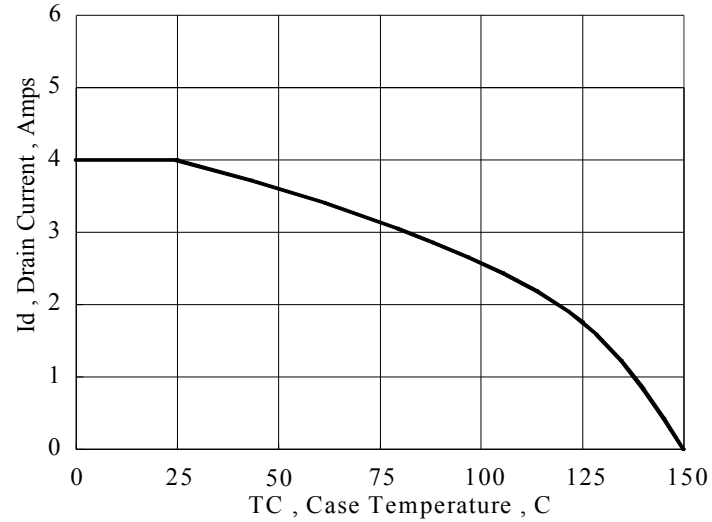


Figure 3 Maximum Continuous Drain Current vs Case Temperature

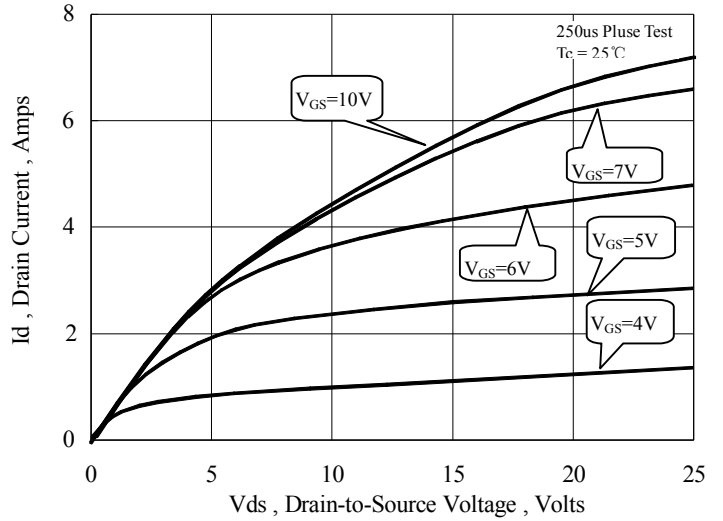


Figure 4 Typical Output Characteristics

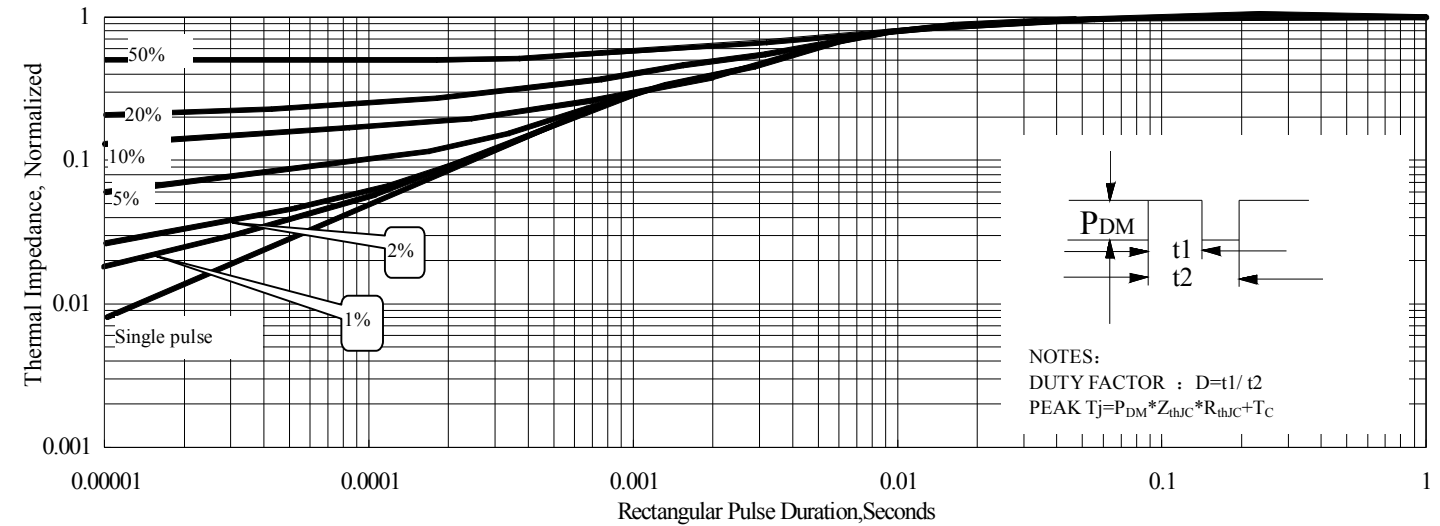


Figure 5 Maximum Effective Thermal Impedance , Junction to Case

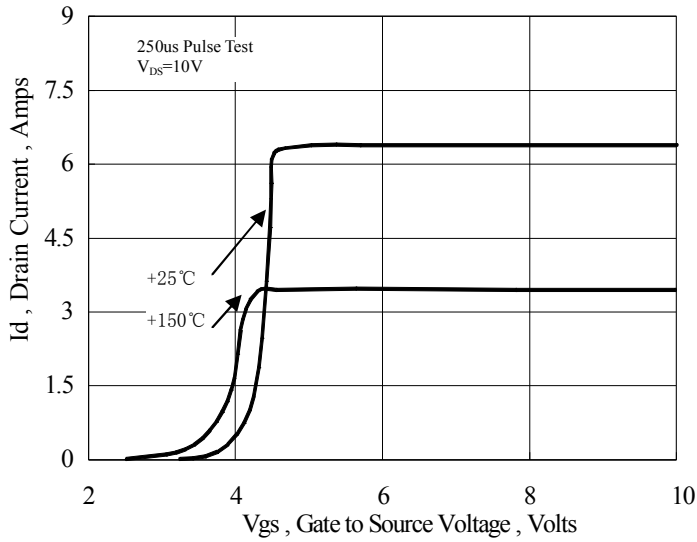


Figure 6 Typical Transfer Characteristics

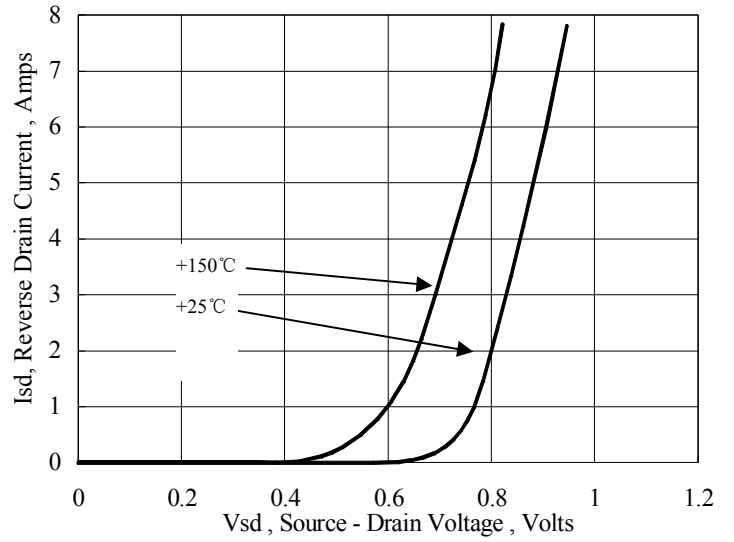


Figure 7 Typical Body Diode Transfer Characteristics

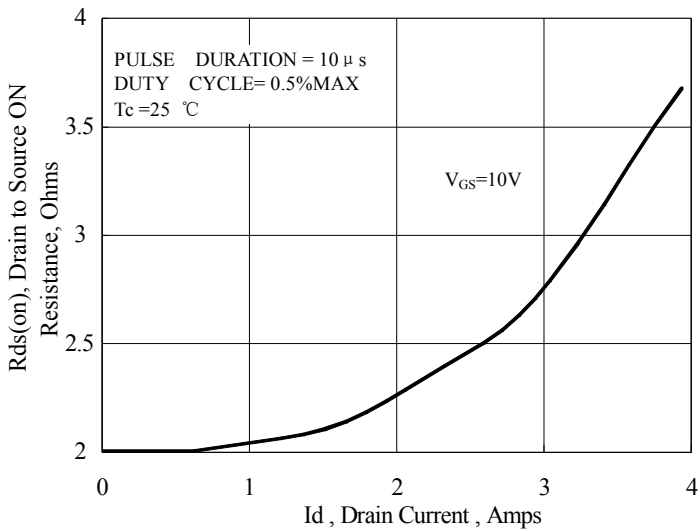


Figure 8 Typical Drain to Source ON Resistance vs Drain Current

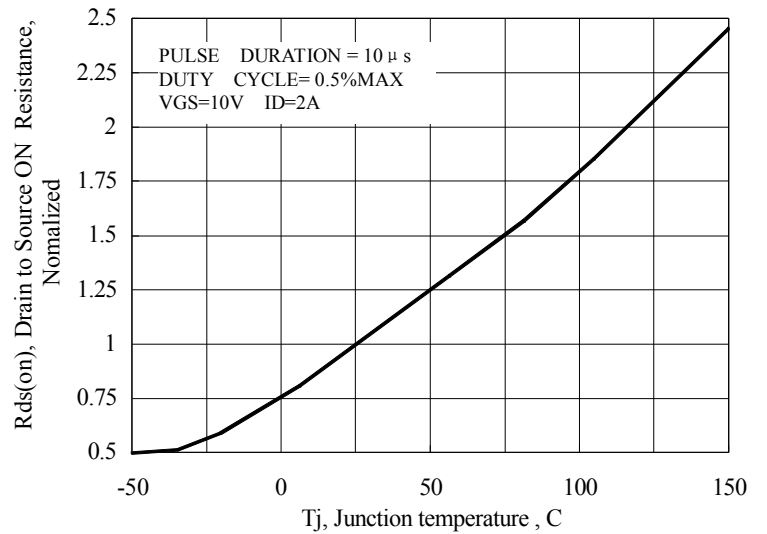


Figure 9 Typical Drain to Source on Resistance vs Junction Temperature

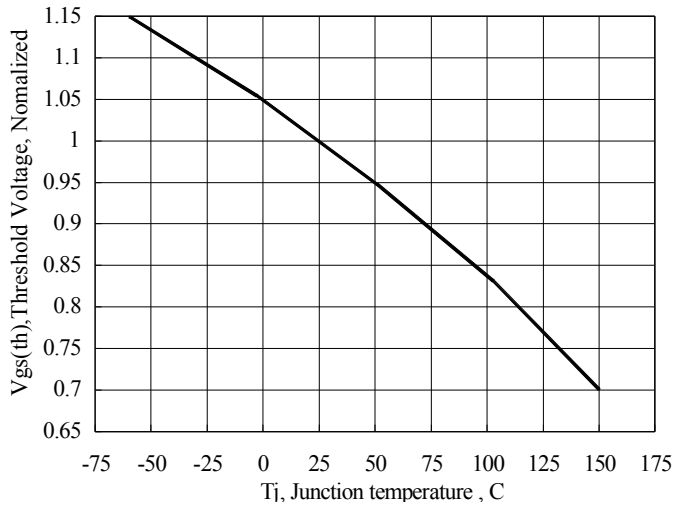


Figure 10 Typical Theshold Voltage vs Junction Temperature

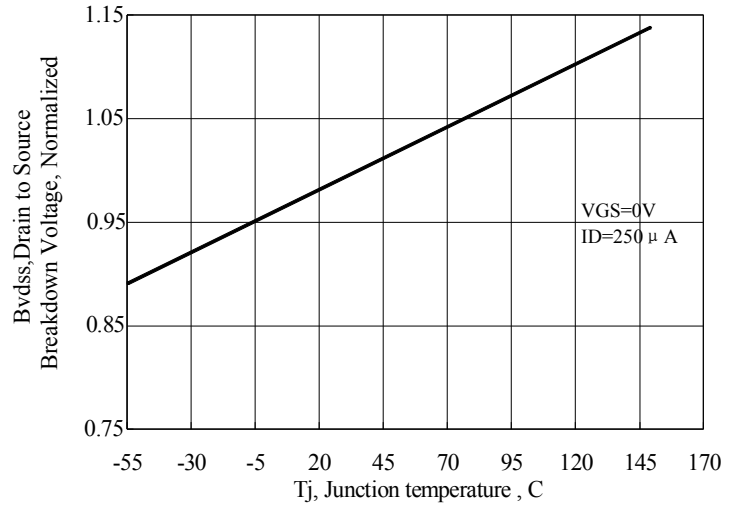


Figure 11 Typical Breakdown Voltage vs Junction Temperature

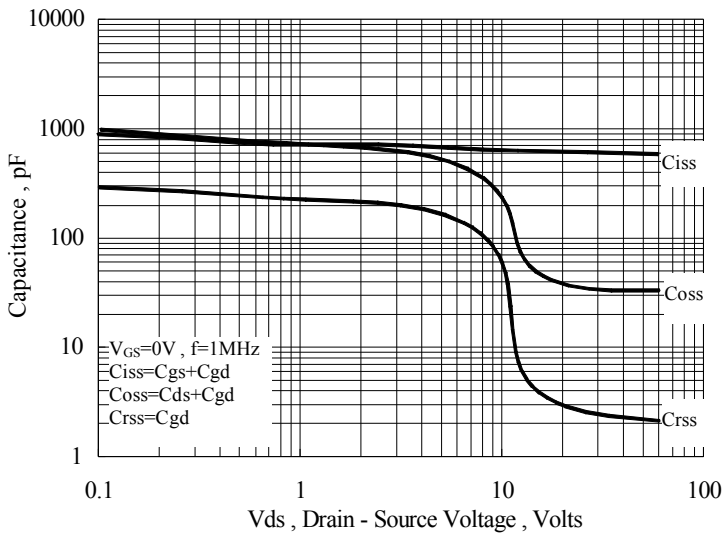


Figure 12 Typical Capacitance vs Drain to Source Voltage

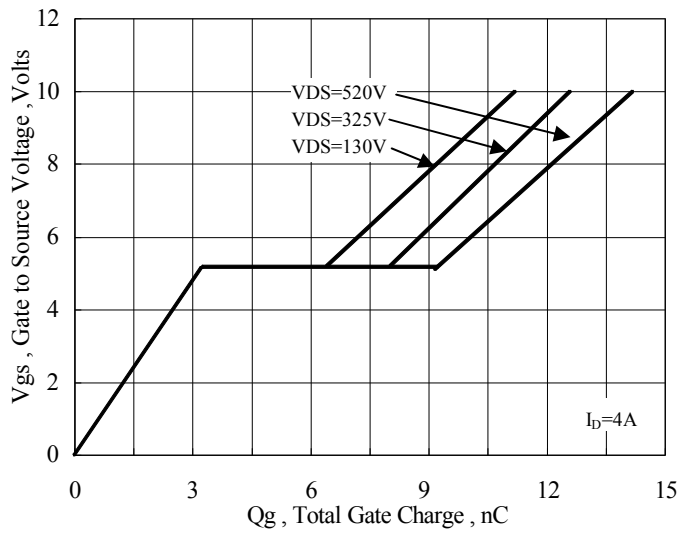


Figure 13 Typical Gate Charge vs Gate to Source Voltage

Test Circuits and Waveforms

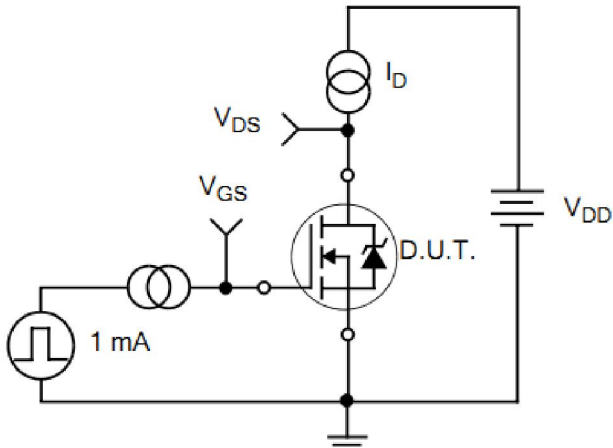


Figure 14. Gate Charge Test Circuit

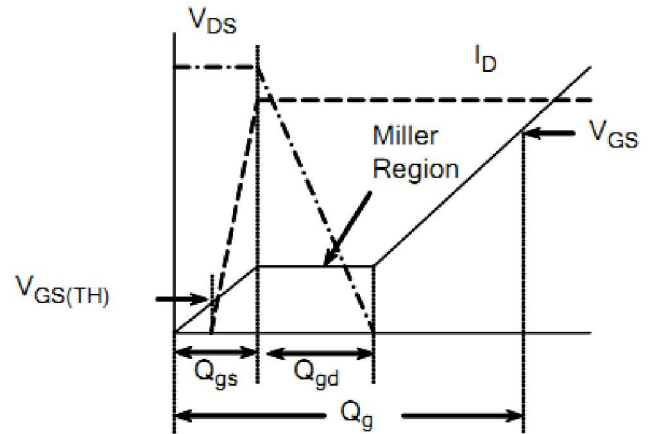


Figure 15. Gate Charge Waveforms

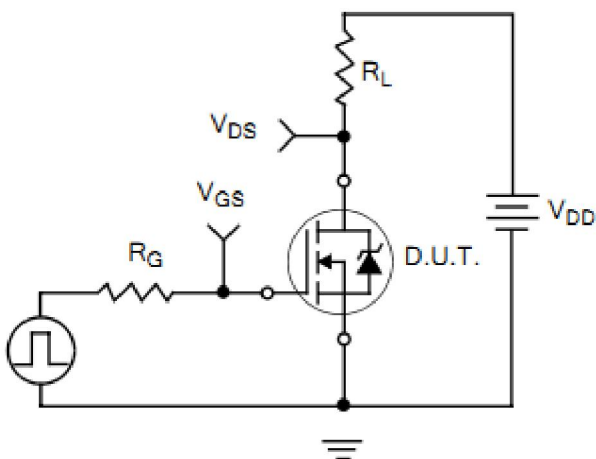


Figure 16. Resistive Switching Test Circuit

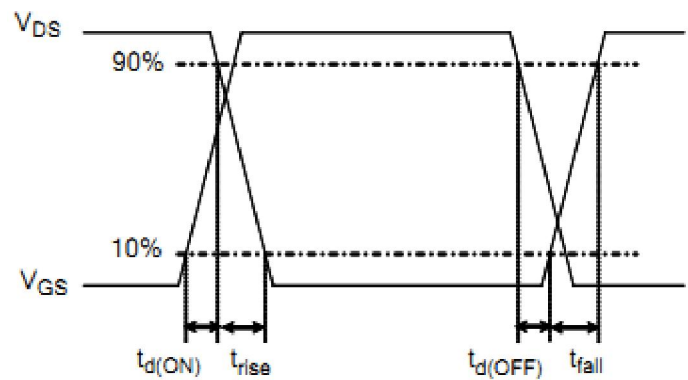


Figure 17. Resistive Switching Waveforms

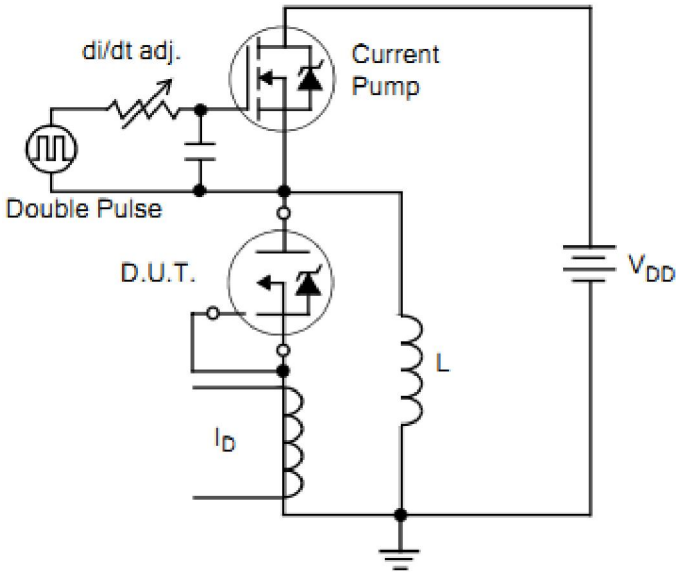


Figure 18. Diode Reverse Recovery Test Circuit

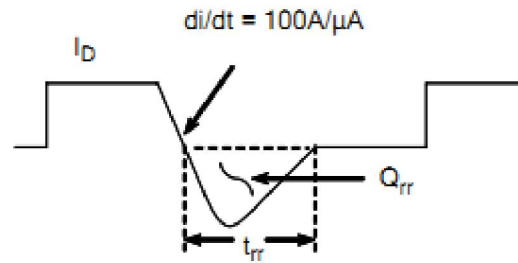


Figure 19. Diode Reverse Recovery Waveform

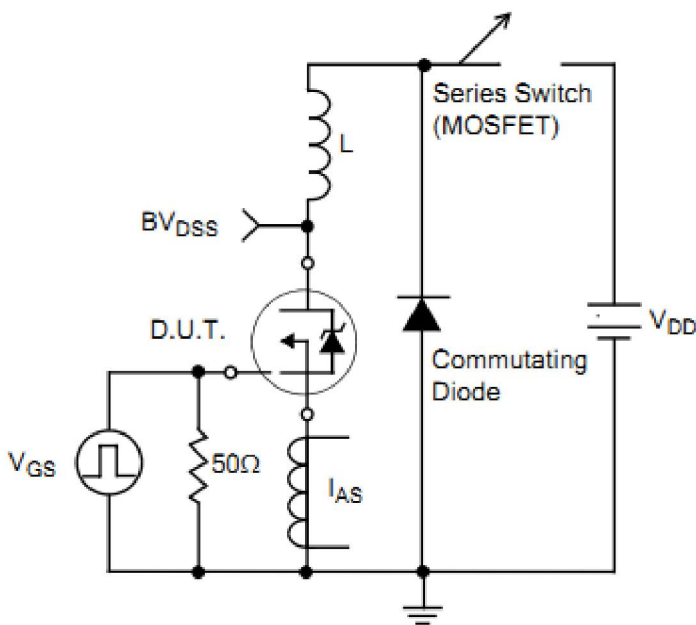


Figure 20. Unclamped Inductive Switching Test Circuit

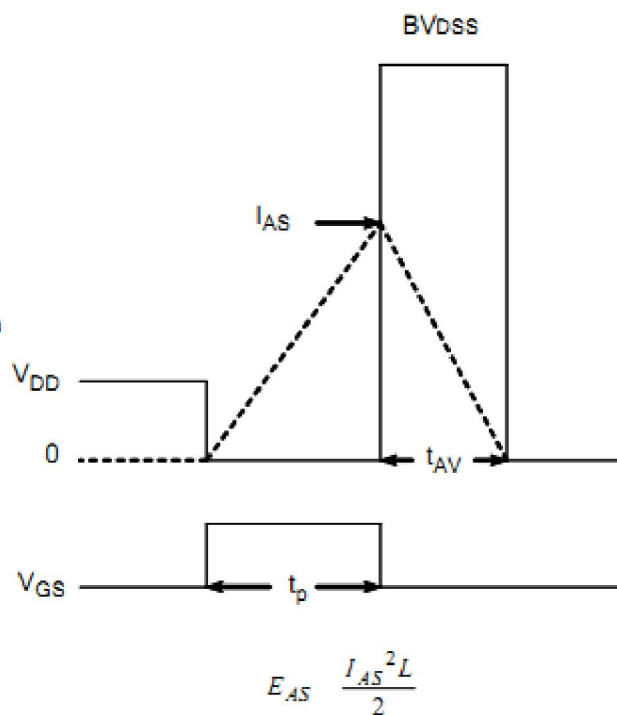


Figure 21. Unclamped Inductive Switching Waveform



Disclaimers:

InPower Semiconductor Co., Ltd (IPS) reserves the right to make changes without notice in order to improve reliability, function or design and to discontinue any product or service without notice. Customers should obtain the latest relevant information before orders and should verify that such information is current and complete. All products are sold subject to IPS's terms and conditions supplied at the time of order acknowledgement.

InPower Semiconductor Co., Ltd warrants performance of its hardware products to the specifications at the time of sale, Testing reliability and quality control are used to the extent IPS deems necessary to support this warrantee. Except where agreed upon by contractual agreement, testing of all parameters of each product is not necessarily performed.

InPower Semiconductor Co., Ltd does not assume any liability arising from the use of any product or circuit designs described herein. Customers are responsible for their products and applications using IPS's components. To minimize risk, customers must provide adequate design and operating safeguards.

InPower Semiconductor Co., Ltd does not warrant or convey any license either expressed or implied under its patent rights, nor the rights of others. Reproduction of information in IPS's data sheets or data books is permissible only if reproduction is without modification or alteration. Reproduction of this information with any alteration is an unfair and deceptive business practice. InPower Semiconductor Co., Ltd is not responsible or liable for such altered documentation.

Resale of IPS's products with statements different from or beyond the parameters stated by InPower Semiconductor Co., Ltd for that product or service voids all express or implied warranties for the associated IPS's product or service and is unfair and deceptive business practice. InPower Semiconductor Co., Ltd is not responsible or liable for any such statements.

Life Support Policy:

InPower Semiconductor Co., Ltd's products are not authorized for use as critical components in life support devices or systems without the expressed written approval of InPower Semiconductor Co., Ltd.

As used herein:

1. Life support devices or systems are devices or systems which:
 - a. are intended for surgical implant into the human body,
 - b. support or sustain life,
 - c. whose failure to perform when properly used in accordance with instructions for used provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.