

60V N-Channel Power MOSFET

DESCRIPTION

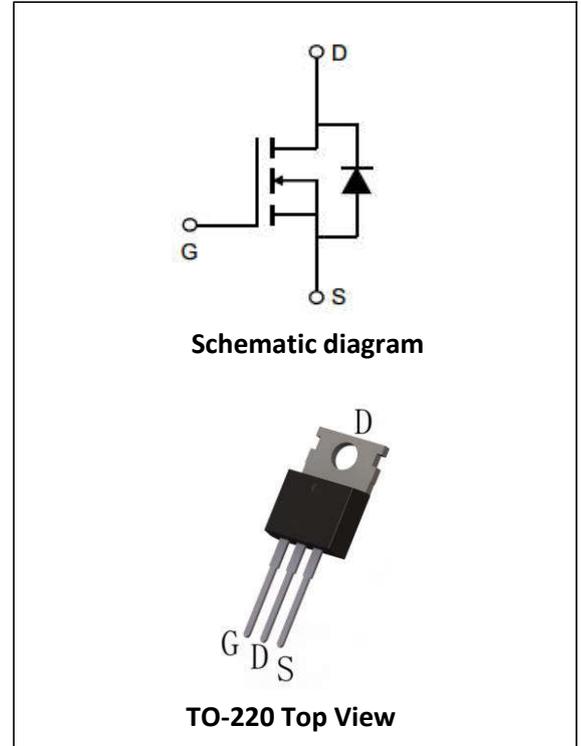
The IRFZ44N-MNS uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge. It can be used in a wide variety of applications.

Application

- ① Power switching application
- ② Hard switched and High frequency circuits
- ③ Uninterruptible power supply

KEY CHARACTERISTICS

- ① $V_{DS} = 60V, I_D = 60A$
 $R_{DS(ON)} < 15m\Omega @ V_{GS}=10V$
- ② High density cell design for lower R_{dson}
- ③ Fully characterized avalanche voltage and current
- ④ Good stability and uniformity with high EAS
- ⑤ Excellent package for good heat dissipation
 100% UIS TESTED!
 100% DVDS TESTED!



Package Marking And Ordering Information

| Device Marking | Ordering Codes | Package | Product Code | Packing |
|----------------|----------------|---------|--------------|---------|
| IRFZ44N-MNS | IRFZ44N | TO-220 | IRFZ44N | Tube |

Absolute Maximum Ratings (TA=25°C unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|--|----------------|------------|------------|
| Drain-Source Voltage | V_{DS} | 60 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Drain Current-Continuous | I_D | 60 | A |
| Drain Current-Pulsed (Note 1) | I_{DM} | 200 | A |
| Maximum Power Dissipation($T_c=25^\circ C$) | P_D | 87 | W |
| Single pulse avalanche energy(Note 2) | E_{AS} | 120 | mJ |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 175 | $^\circ C$ |

Thermal Characteristic

| | | | |
|-------------------------------------|-----------------|------|--------------|
| Thermal Resistance,Junction-to-Case | $R_{\theta JC}$ | 1.72 | $^\circ C/W$ |
|-------------------------------------|-----------------|------|--------------|

Electrical Characteristics (TA=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|--------------|--|-----|-----|-----------|------------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 60 | - | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=60V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2 | 3 | 4 | V |
| Drain-Source On-State Resistance(Note 3) | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=25A$ | - | 12 | 15 | m Ω |
| Forward Transconductance | g_{FS} | $V_{DS}=25V, I_D=25A$ | - | 25 | - | S |
| Dynamic Characteristics | | | | | | |
| Input Capacitance | C_{ISS} | $V_{DS}=25V, V_{GS}=0V, f=1.0MHz$ | - | 910 | - | pF |
| Output Capacitance | C_{OSS} | | - | 100 | - | pF |
| Reverse Transfer Capacitance | C_{rSS} | | - | 30 | - | pF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=30V, I_D=20A, V_{GS}=10V, R_{GEN}=5\Omega$ | - | 26 | - | nS |
| Turn-on Rise Time | t_r | | - | 6 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 52 | - | nS |
| Turn-Off Fall Time | t_f | | - | 7 | - | nS |
| Total Gate Charge | Q_g | $V_{DS}=30V, I_D=50A, V_{GS}=10V$ | - | 31 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 9 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 5 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage | V_{SD} | $V_{GS}=0V, I_S=50A$ | - | - | 1.2 | V |

Notes:

- 1.Repetitive Rating: Pulse width limited by maximum junction temperature.
- 2.EAS condition : $T_j=25^\circ C, V_{DD}=30V, V_{GS}=10V, L=0.5mH, R_g=25\Omega$
- 3.Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
- 4.Guaranteed by design, not subject to production.

Characteristics Curves

Figure 1 Output Characteristics

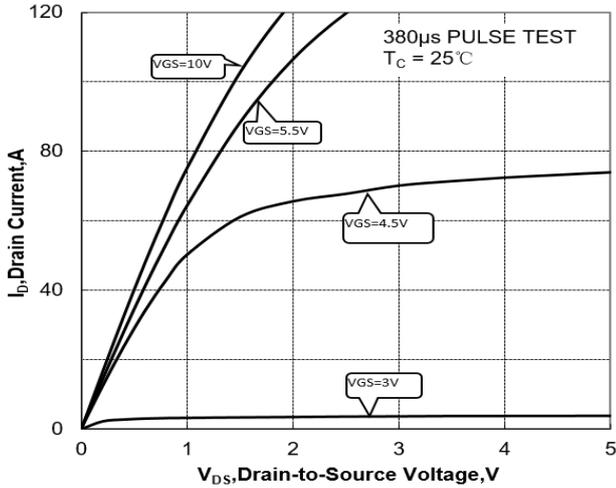


Figure 2 Transfer Characteristics

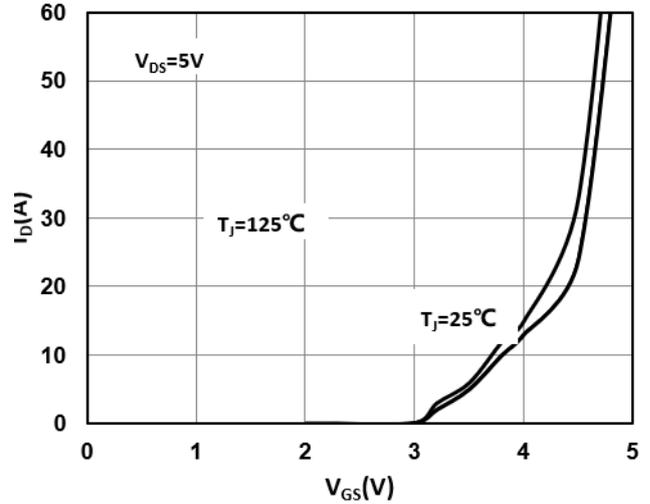


Figure 3 On-Resistance vs. ID and VGS

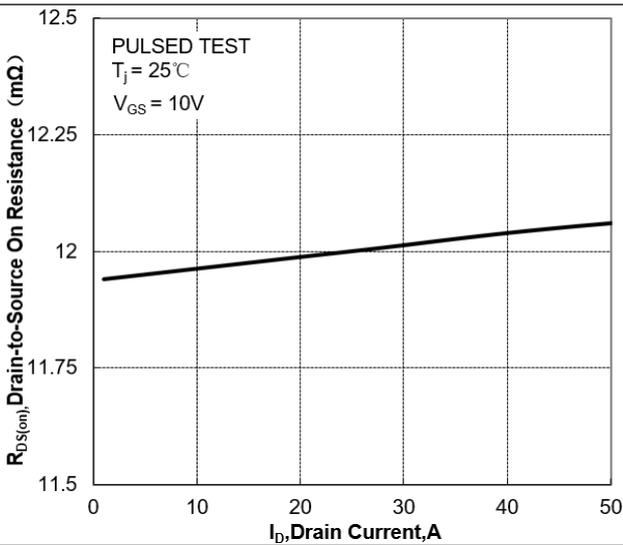


Figure 4 On-Resistance vs. Junction Temperature

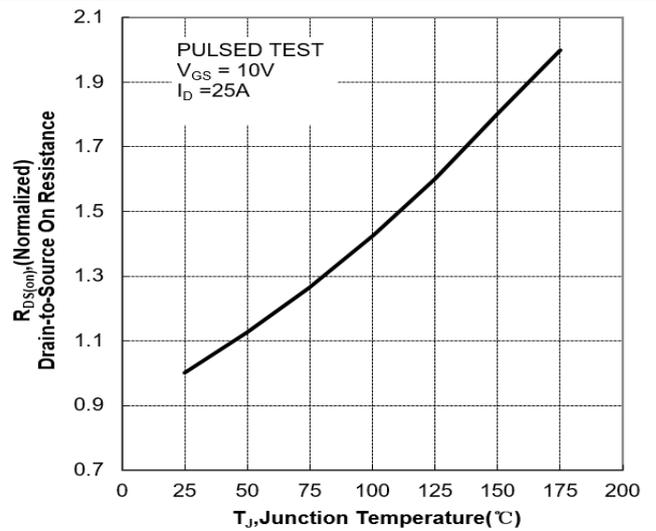


Figure 5 On-Resistance vs. VGS

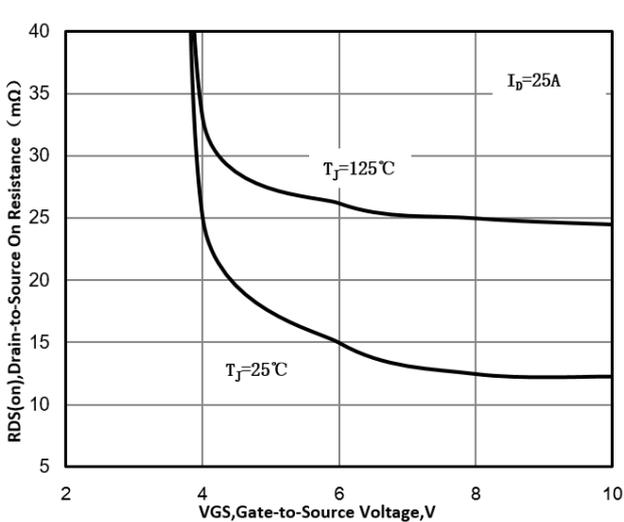


Figure 6 Body Diode Forward Voltage

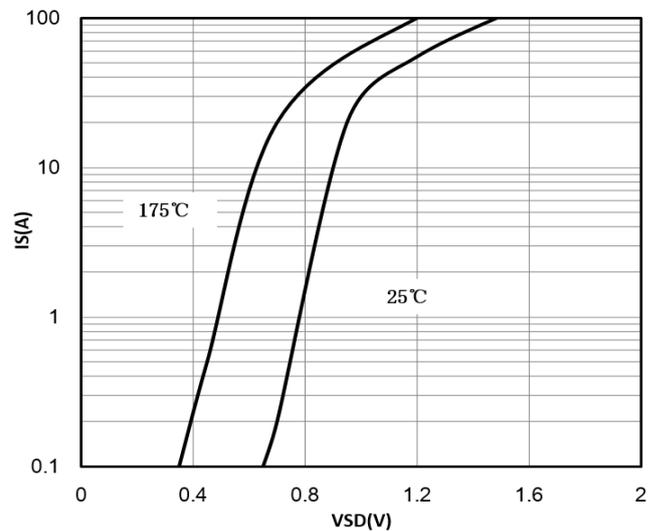


Figure 7 Gate-Charge Characteristics

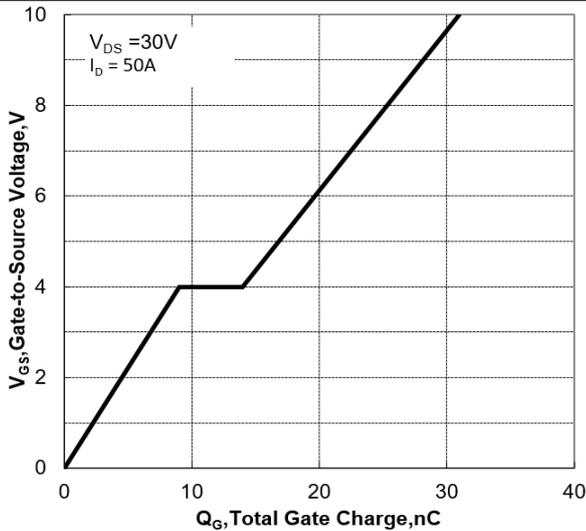


Figure 8 Capacitance Characteristics

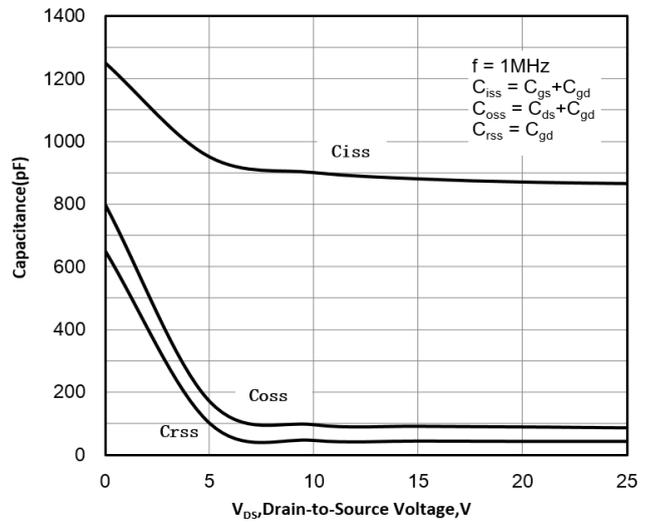


Figure 9 Maximum Forward Biased Safe Operation Area

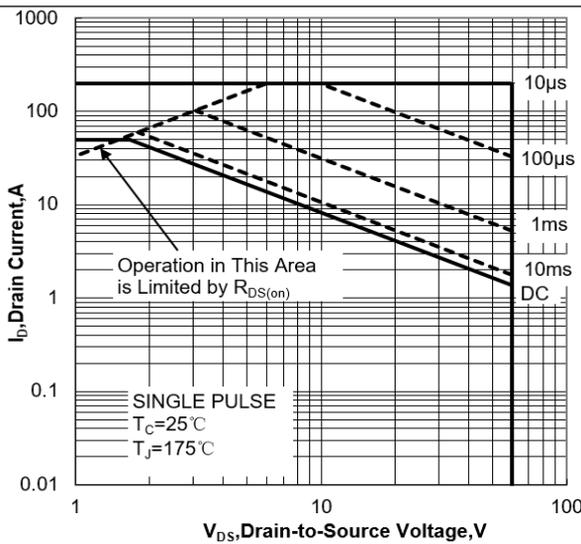


Figure 10 Single Pulse Power Rating Junction-to-Ambient

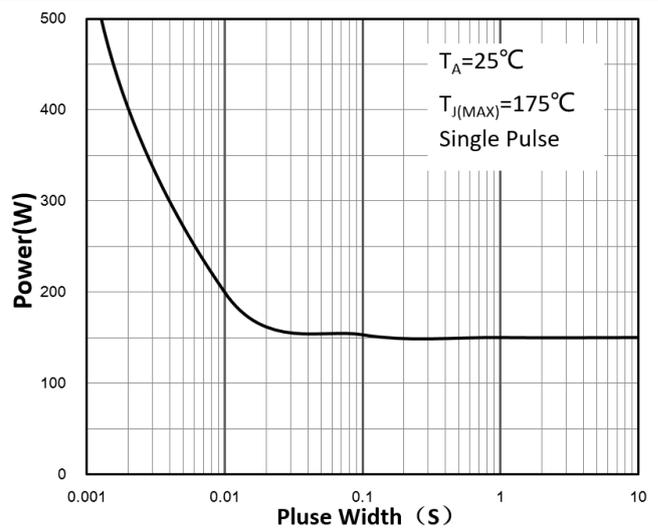
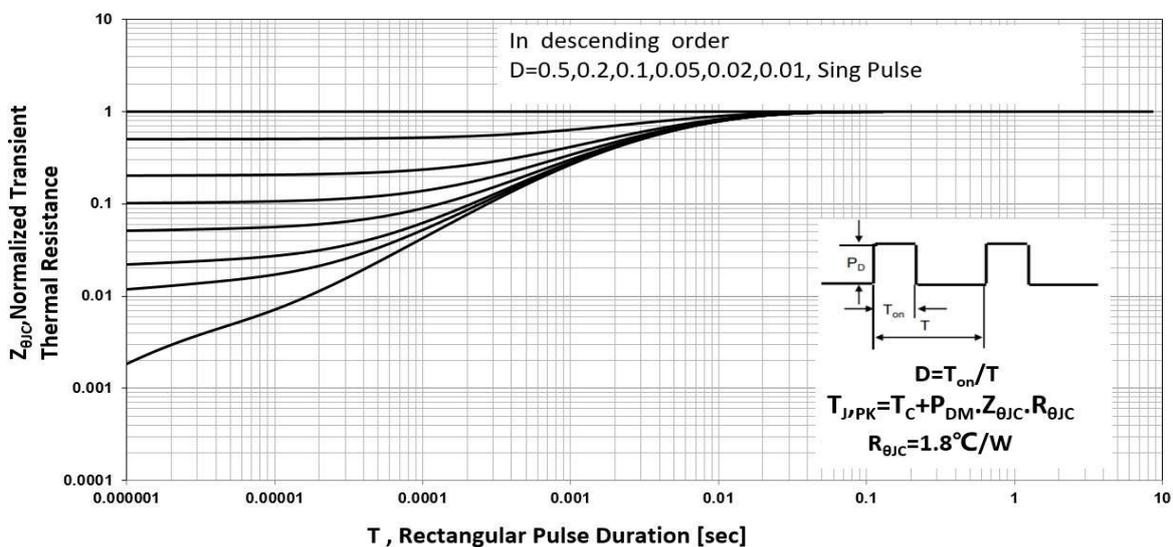
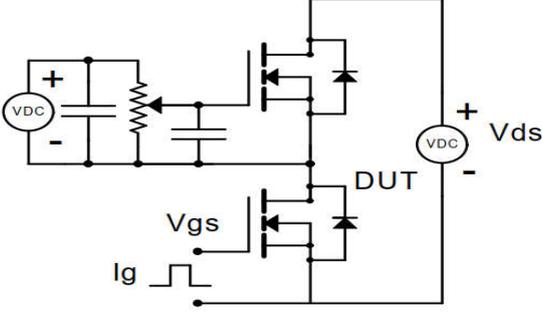
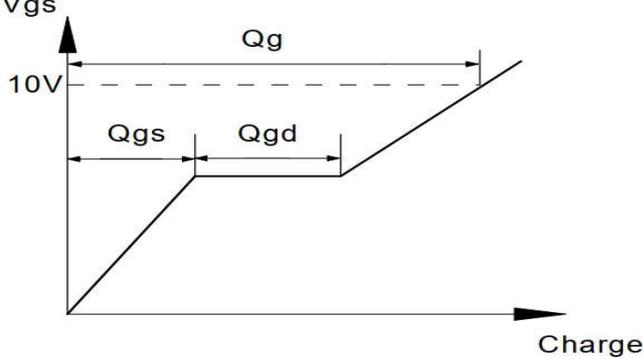
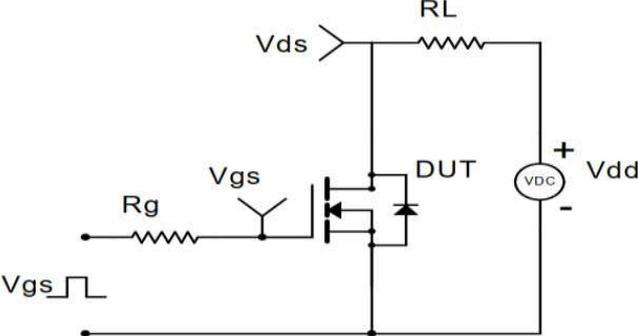
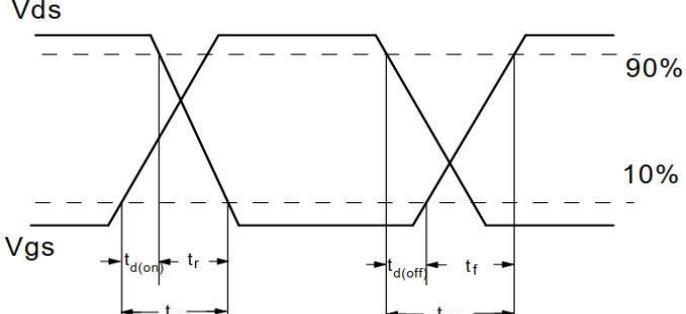
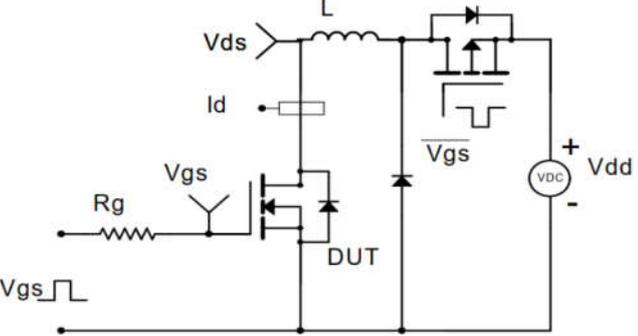
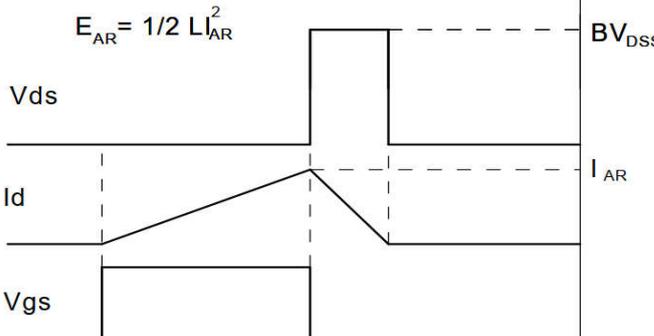
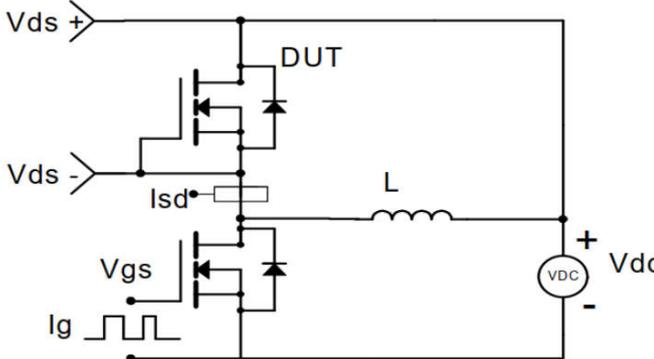
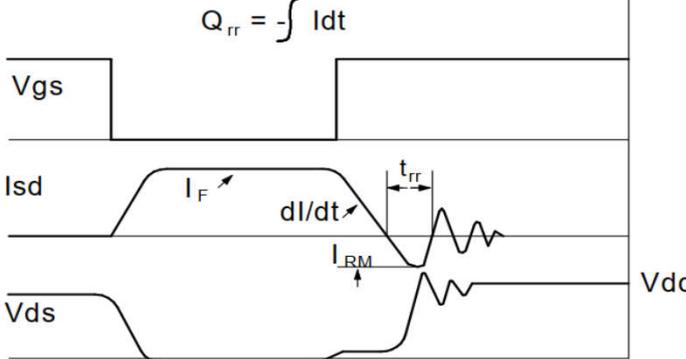


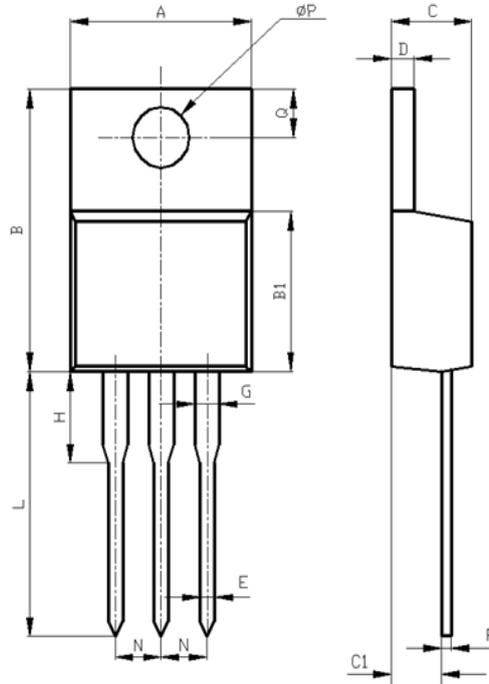
Figure 11 Normalized Maximum Transient Thermal Impedance



Test Circuit and Waveform

| Gate Charge Test Circuit | Gate Charge Test Waveform |
|--|---|
|  <p>The diagram shows a MOSFET (DUT) with its gate connected to a gate driver circuit. The driver includes a VDC source, a gate resistor, and a gate capacitor. The drain of the MOSFET is connected to a load resistor and a VDC source. The gate voltage is labeled Vgs and the gate current is labeled Ig.</p> |  <p>The waveform shows the gate voltage Vgs versus charge. The gate voltage rises linearly to 10V, then remains constant for a short duration, and then falls linearly. The total gate charge is labeled Qg. The gate charge during the rising and falling edges is labeled Qgs and Qgd respectively.</p> |
| Resistive Switching Test Circuit | Resistive Switching Test Waveforms |
|  <p>The diagram shows a MOSFET (DUT) with its gate connected to a gate driver circuit. The drain of the MOSFET is connected to a load resistor RL and a VDC source. The gate voltage is labeled Vgs and the gate resistor is labeled Rg.</p> |  <p>The waveforms show the drain voltage Vds and gate voltage Vgs versus time. The Vds waveform shows a trapezoidal pulse with a 90% to 10% fall time. The Vgs waveform shows a trapezoidal pulse with a turn-on time ton and a turn-off time toff. The rise time tr and fall time tf are also indicated.</p> |
| Unclamped Inductive Switching (UIS) Test Circuit | Unclamped Inductive Switching (UIS) Test Waveforms |
|  <p>The diagram shows a MOSFET (DUT) with its gate connected to a gate driver circuit. The drain of the MOSFET is connected to an inductor L and a VDC source. The gate voltage is labeled Vgs and the gate resistor is labeled Rg. The drain current is labeled Id.</p> |  <p>The waveforms show the drain voltage Vds, drain current Id, and gate voltage Vgs versus time. The Vds waveform shows a trapezoidal pulse with a peak voltage BV_{DSS}. The Id waveform shows a trapezoidal pulse with a peak current I_{AR}. The gate voltage Vgs shows a trapezoidal pulse. The energy stored in the inductor is given by the equation $E_{AR} = 1/2 L I_{AR}^2$.</p> |
| Diode Recovery Test Circuit | Diode Recovery Test Waveforms |
|  <p>The diagram shows a MOSFET (DUT) with its gate connected to a gate driver circuit. The drain of the MOSFET is connected to an inductor L and a VDC source. The gate voltage is labeled Vgs and the gate resistor is labeled Rg. The drain current is labeled Isd.</p> |  <p>The waveforms show the drain current Isd, drain voltage Vds, and gate voltage Vgs versus time. The Isd waveform shows a trapezoidal pulse with a peak current IF and a di/dt slope. The Vds waveform shows a trapezoidal pulse with a peak voltage Vdd. The gate voltage Vgs shows a trapezoidal pulse. The reverse recovery time trr is indicated. The reverse recovery charge Qrr is given by the equation $Q_{rr} = -\int Idt$.</p> |

Package Description



| Items | Values(mm) | |
|-------|------------|------|
| | MIN | MAX |
| A | 9.60 | 10.6 |
| B | 15.0 | 16.0 |
| B1 | 8.90 | 9.50 |
| C | 4.30 | 4.80 |
| C1 | 2.30 | 3.10 |
| D | 1.20 | 1.40 |
| E | 0.70 | 0.90 |
| F | 0.30 | 0.60 |
| G | 1.17 | 1.37 |
| H | 2.70 | 3.80 |
| L | 12.6 | 14.8 |
| N | 2.34 | 2.74 |
| Q | 2.40 | 3.00 |
| Φ P | 3.50 | 3.90 |

TO-220 Package



NOTE:

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. Please do not exceed the absolute maximum ratings of the device when circuit designing.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. MOSFETs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. Shenzhen Minos reserves the right to make changes in this specification sheet and is subject to change without prior notice.

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