

100V N-Channel Power MOSFET

Description

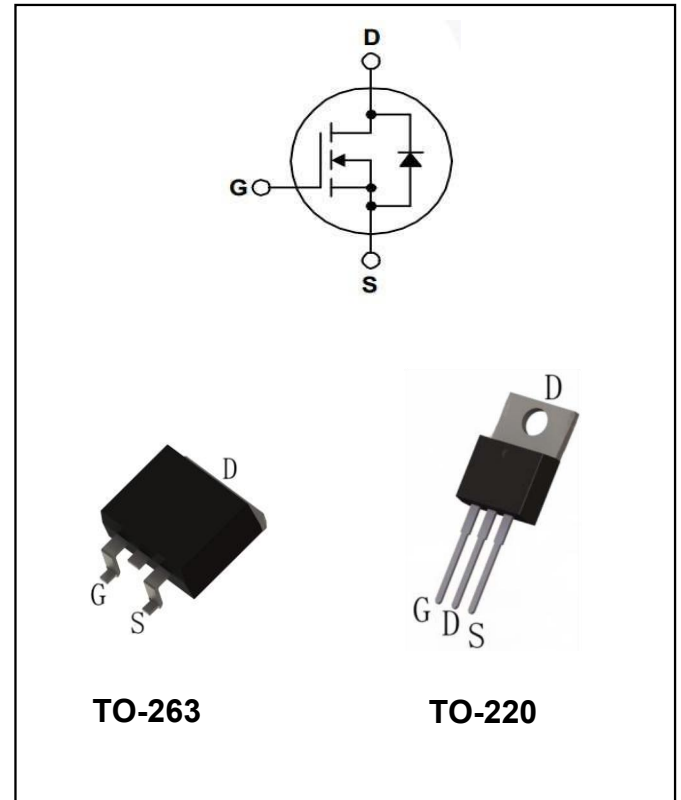
MPT042N10, the N-channel Enhanced Power MOSFETs, is obtained by advanced double trench technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. This is suitable device for motor drivers and high speed switching applications.

General Features

- ① $V_{DS}=100V$, $R_{dson}<4.2m\Omega$ @ $V_{GS}=10V$, $I_D=120A$ (Typ: $3.5m\Omega$)
- ② Fast Switching
- ③ Low On-Resistance ($R_{DS(on)}\leq 4.2m\Omega$)
- ④ Low Gate Charge
- ⑤ Low Reverse transfer capacitances
- ⑥ High avalanche ruggedness
- ⑦ RoHS product

Application

- ① Switching application
- ② Motor drivers



Package Marking And Ordering Information:

| Ordering Codes | Package | Product Code | Packing |
|----------------|---------|--------------|-----------|
| MPT042N10-P | TO-220 | MPT042N10P | Tube |
| MPT042N10-S | TO-263 | MPT042N10S | Tape Reel |

ABSOLUTE RATINGS at $T_c=25^\circ C$, unless otherwise specified

| Symbol | Parameter | Rating | Units |
|---------------------------|--|----------|-------|
| V_{DSS} | Drain-Source Voltage | 100 | V |
| I_D | Continuous Drain Current, Silicon Limited | 170 | A |
| | Continuous Drain Current, Package Limited | 120 | A |
| | Continuous Drain Current @ $T_c=100^\circ C$, Silicon Limited | 107.8 | A |
| I_{DM} ^{Note1} | Pulsed Drain Current | 480 | A |
| V_{GS} | Gate-Source Voltage | ± 20 | V |
| E_{AS} ^{Note2} | Avalanche Energy | 306 | mJ |



| | | | |
|-----------------------------------|--|-----------------|------|
| P _D | Power Dissipation | 227.2 | W |
| | Derating Factor above 25°C | 1.82 | W/°C |
| T _J , T _{stg} | Operating Junction and Storage Temperature Range | 150, -55 to 150 | °C |
| T _L | Maximum Temperature for Soldering | 260 | °C |

Note1: Repetitive Rating: Pulse width limited by maximum junction temperature Note2: L=0.5mH, I_{as}=35A, Start T_J=25°C

Thermal characteristics

| Symbol | Parameter | Max | Units |
|------------------|--------------------------------------|------|-------|
| R _{θJC} | thermal resistance, Junction-Case | 0.55 | °C/W |
| R _{θJA} | thermal resistance, Junction-Ambient | 62.5 | °C/W |

Electrical Characteristics at T_c=25°C, unless otherwise specified

| OFF Characteristics | | | | | | |
|----------------------------|--------------------------------|--|--------|------|------|--------|
| Symbol | Parameter | Test Conditions | Values | | | Units |
| | | | Min | Typ | Max | |
| V _{DSS} | Drain-Source Breakdown Voltage | V _{GS} =0V, I _D =250μA | 100 | -- | -- | V |
| I _{DSS} | Drain-Source Leakage Current | V _{DS} =100V, V _{GS} =0V | -- | -- | 1 | μA |
| | | V _{DS} =80V, V _{GS} =0V @T _c =125°C | -- | -- | 100 | μA |
| I _{GSS(F)} | Gate-Source Forward Leakage | V _{GS} =+20V | -- | -- | 100 | nA |
| I _{GSS(R)} | Gate-Source Reverse Leakage | V _{GS} =-20V | -- | -- | -100 | nA |
| ON Characteristics | | | | | | |
| Symbol | Parameter | Test Conditions | Values | | | Unit s |
| | | | Min | Typ | Max | |
| R _{DS(on)} | Drain-Source On-Resistance | V _{GS} =10V, I _D =50A | -- | 3.5 | 4.2 | mΩ |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} =V _{GS} , I _D =250μA | 2.0 | 3.0 | 4.0 | V |
| Pulse width tp≤300μs, δ≤2% | | | | | | |
| Dynamic Characteristics | | | | | | |
| Symbol | Parameter | Test Conditions | Values | | | Units |
| | | | Min | Typ | Max | |
| C _{iss} | Input Capacitance | V _{DS} =50V, V _{GS} =0, f=1MHz | -- | 7102 | -- | pF |
| C _{OSS} | Output Capacitance | | -- | 2584 | -- | |
| C _{rSS} | Reverse Transfer Capacitance | | -- | 174 | -- | |
| Q _g | Total Gate Charge | V _{DD} =50V, I _D =50A, V _{GS} =10V | -- | 102 | -- | nC |
| Q _{gs} | Gate-Source charge | | -- | 30 | -- | |



| Q_{gd} | Gate-Drain charge | | -- | 19.6 | -- | |
|---|---------------------------|--|--------|------|-----|---------|
| Switching Characteristics | | | | | | |
| Symbol | Parameter | Test Conditions | Values | | | Units |
| | | | Min | Typ | Max | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}=50V, I_D=50A,$ $V_{GS}=10V, R_G=3\Omega,$ Resistive Load | -- | 29 | -- | ns |
| t_r | Rise Time | | -- | 33 | -- | |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 48 | -- | |
| t_f | Fall Time | | -- | 26 | -- | |
| Source-Drain Diode Characteristics | | | | | | |
| Symbol | Parameter | Test Conditions | Values | | | Units |
| | | | Min | Typ | Max | |
| I_S | Continuous Source Current | | -- | -- | 120 | A |
| I_{SM} | Maximum Pulsed Current | | -- | -- | 480 | A |
| V_{SD} | Diode Forward Voltage | $V_{GS}=0V, I_S=50A$ | -- | -- | 1.2 | V |
| T_{rr} | Reverse Recovery Time | $I_S=50A,$ $di/dt=100A/us$ | -- | 80 | -- | ns |
| Q_{rr} | Reverse Recovery Charge | | -- | 189 | -- | μC |



Characteristics Curves

Figure 1. Safe Operating Area

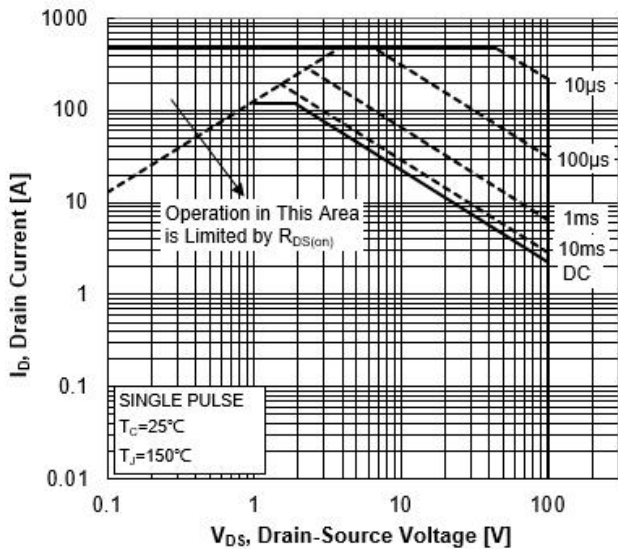


Figure 2. Maximum Power Dissipation vs Case Temperature

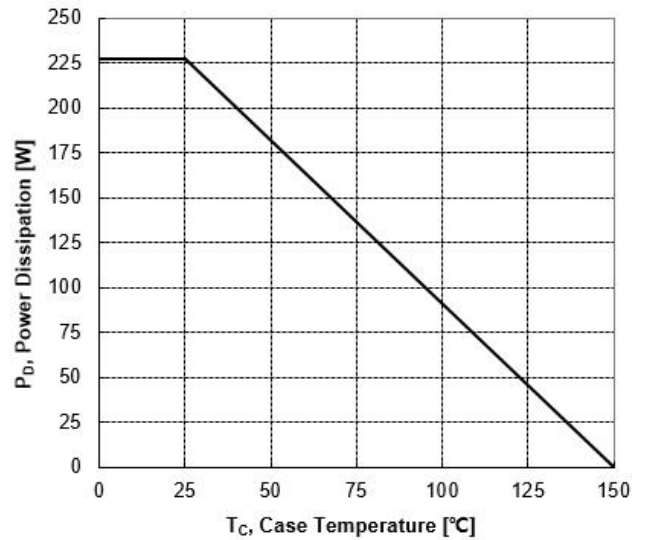


Figure 3. Maximum Continuous Drain Current vs Case Temperature

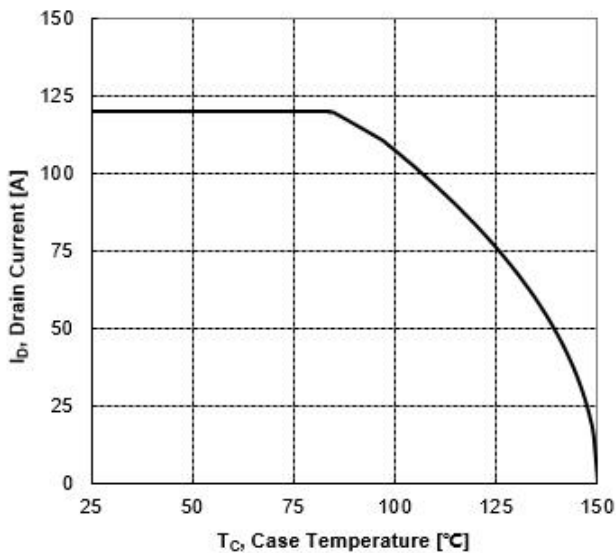


Figure 4. Typical Output Characteristics

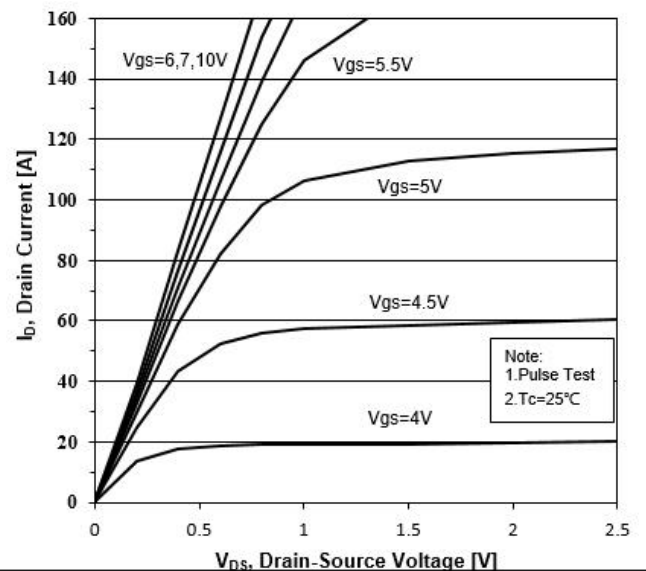


Figure 5. Transient Thermal Impedance

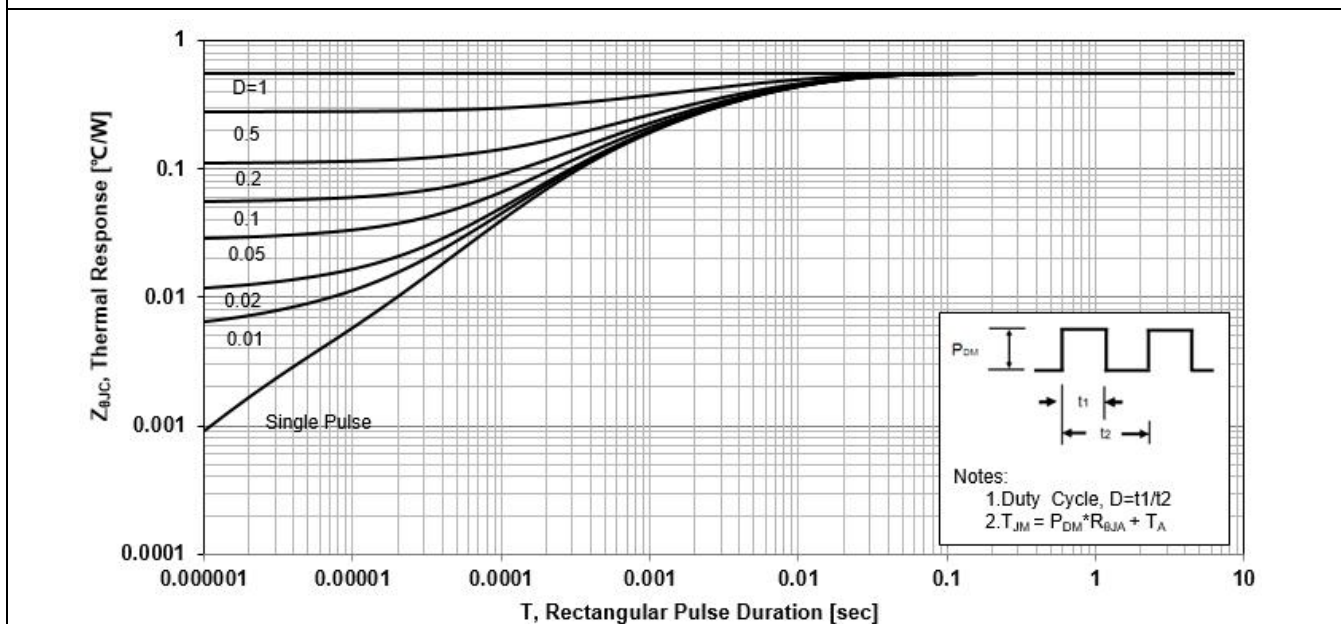


Figure 6. Typical Transfer Characteristics

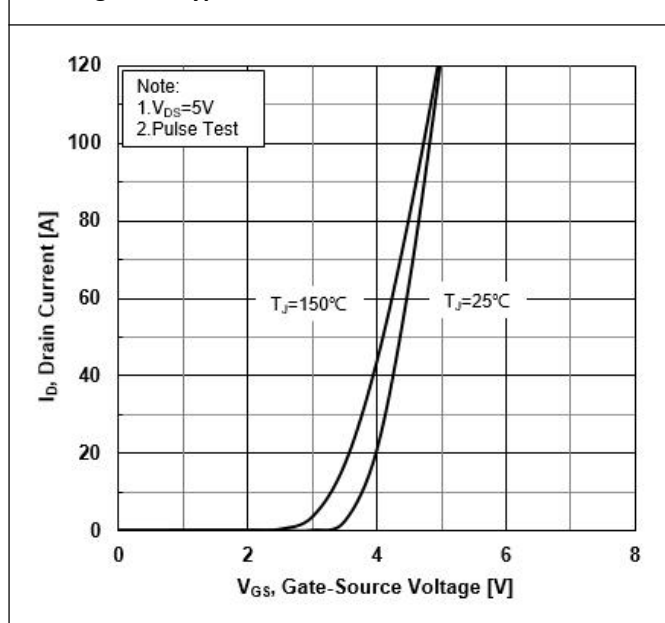


Figure 7. Source-Drain Diode Forward Characteristics

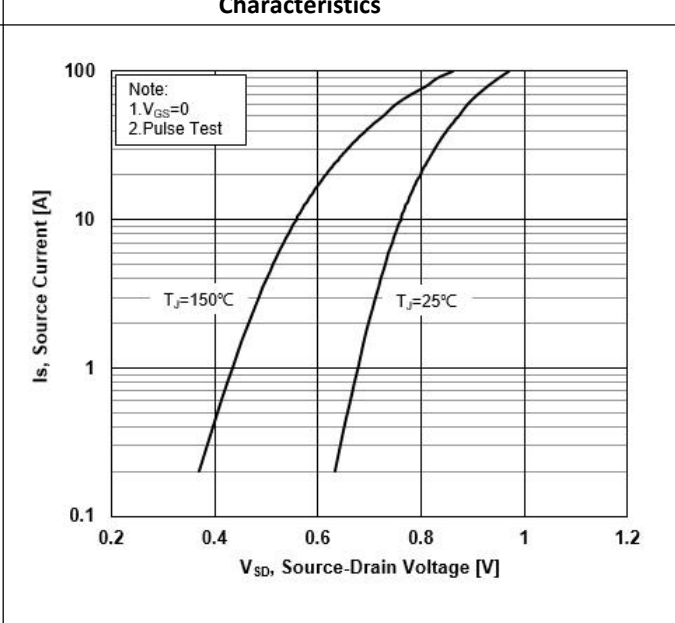


Figure 8. Drain-Source On-Resistance vs Drain Current

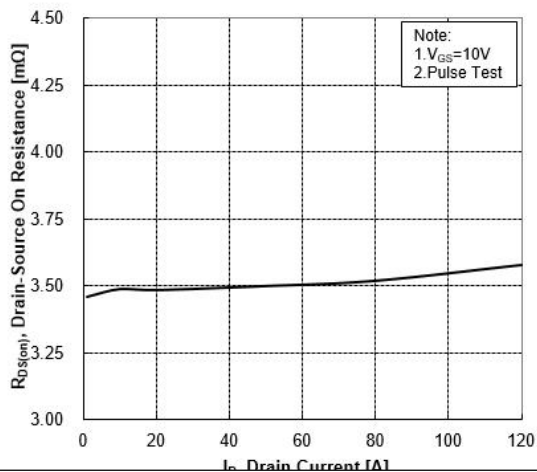


Figure 9. Normalized On-Resistance vs Junction

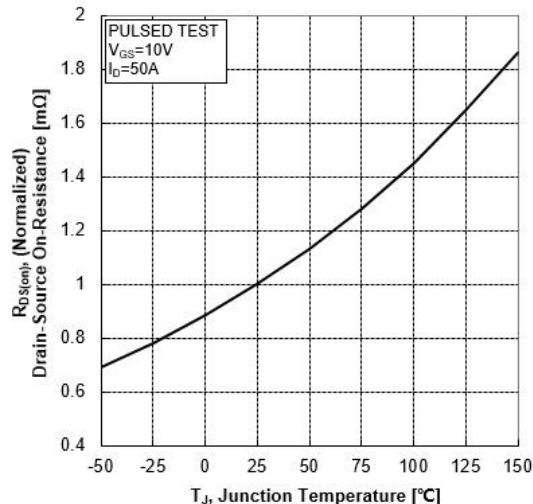


Figure 10. Normalized Threshold Voltage vs Junction Temperature

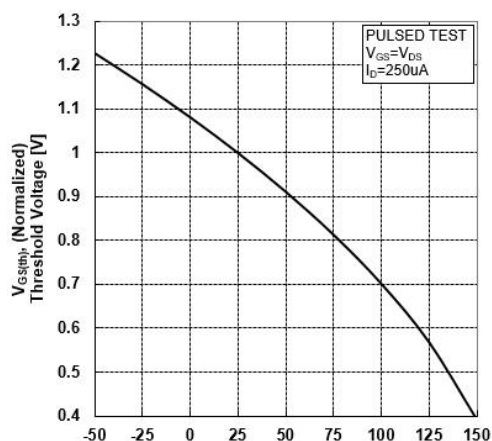


Figure 11. Normalized Breakdown Voltage vs Junction Temperature

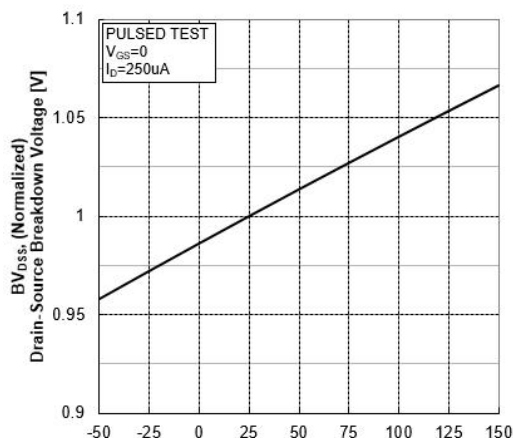


Figure 12. Capacitance Characteristics

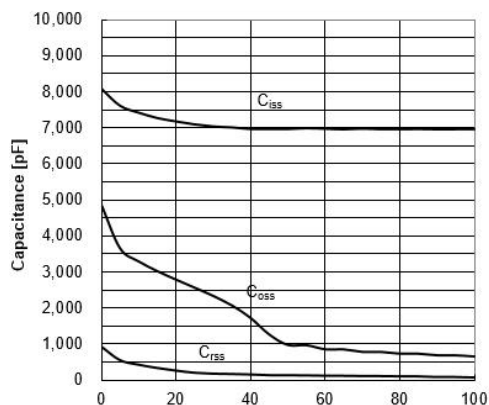
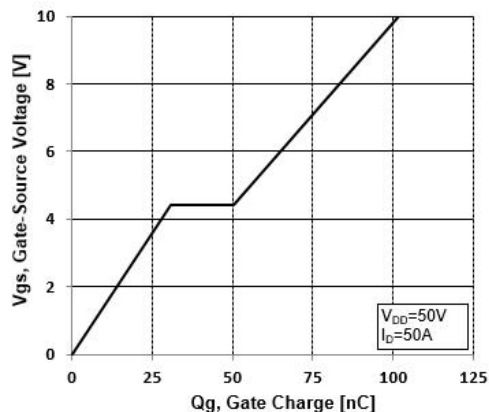


Figure 13. Typical Gate Charge vs Gate-Source Voltage



Test Circuit and Waveform

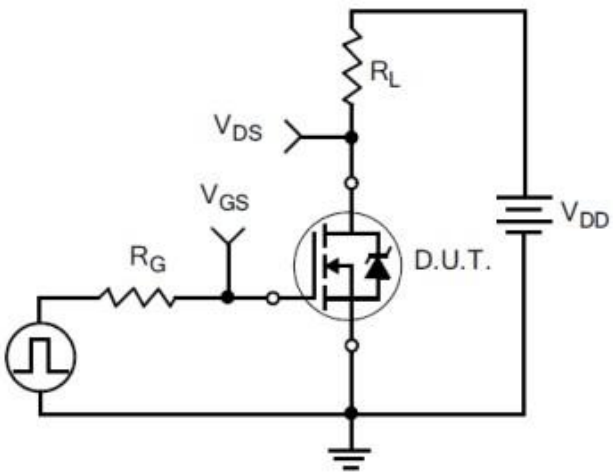
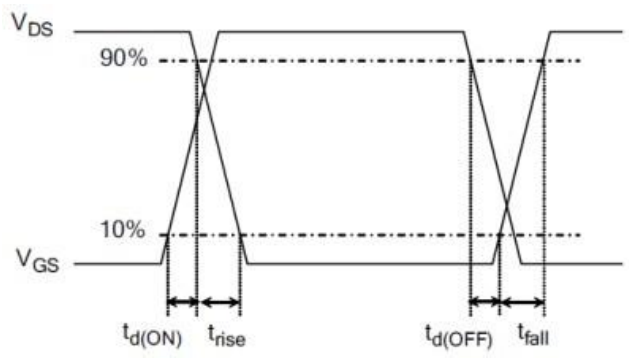
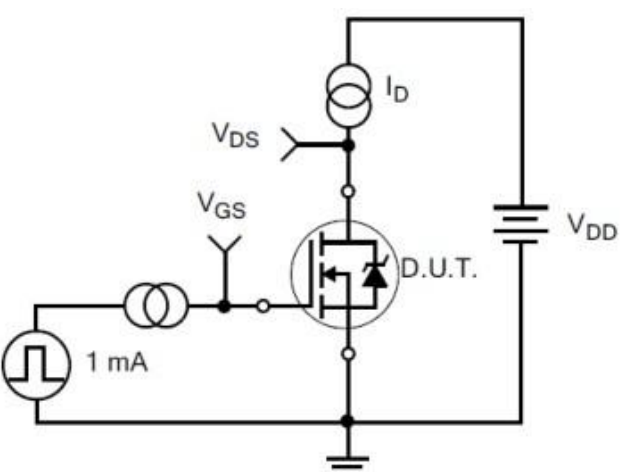
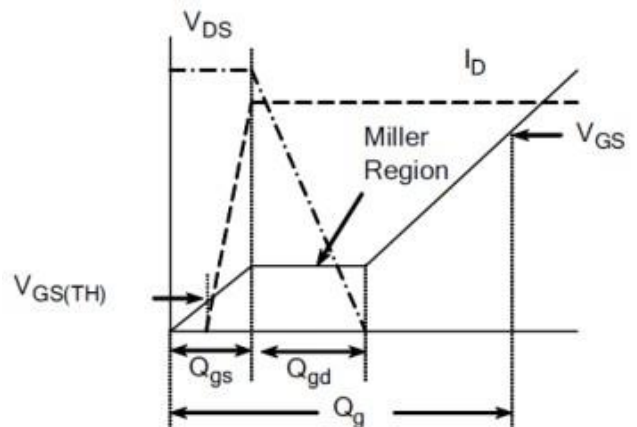
| Figure 14. Resistive Switching Test Circuit | Figure 15. Resistive Switching Waveforms |
|---|--|
|  <p>The diagram shows a MOSFET (D.U.T.) in a common-source configuration. The gate is driven by a square wave pulse through a gate resistor R_G. The drain is connected to a load resistor R_L and a supply voltage V_{DD}. The drain-source voltage is labeled V_{DS} and the gate-source voltage is labeled V_{GS}.</p> |  <p>The diagram shows the waveforms for V_{DS} and V_{GS} during a switching event. V_{GS} is a square wave pulse. V_{DS} shows a transition from a high state to a low state and back. Key parameters are marked: $t_{d(ON)}$ (delay to turn on), t_{rise} (rise time), $t_{d(OFF)}$ (delay to turn off), and t_{fall} (fall time). The 90% and 10% voltage levels are indicated for the transitions.</p> |
| Figure 16. Gate Charge Test Circuit | Figure 17. Gate Charge Waveforms |
|  <p>The diagram shows a MOSFET (D.U.T.) in a common-source configuration. The gate is driven by a square wave pulse through a gate resistor R_G. The drain is connected to a load resistor R_L and a supply voltage V_{DD}. The drain current is labeled I_D and the gate-source voltage is labeled V_{GS}. A 1 mA current source is connected to the gate.</p> |  <p>The diagram shows the waveforms for V_{DS} and I_D during a switching event. V_{GS} is a square wave pulse. V_{DS} shows a transition from a high state to a low state and back. The Miller Region is indicated. Key parameters are marked: $V_{GS(TH)}$ (threshold voltage), Q_{gs} (gate-source charge), Q_{gd} (gate-drain charge), and Q_g (total gate charge).</p> |

Figure 18. Diode Reverse Recovery Test Circuit

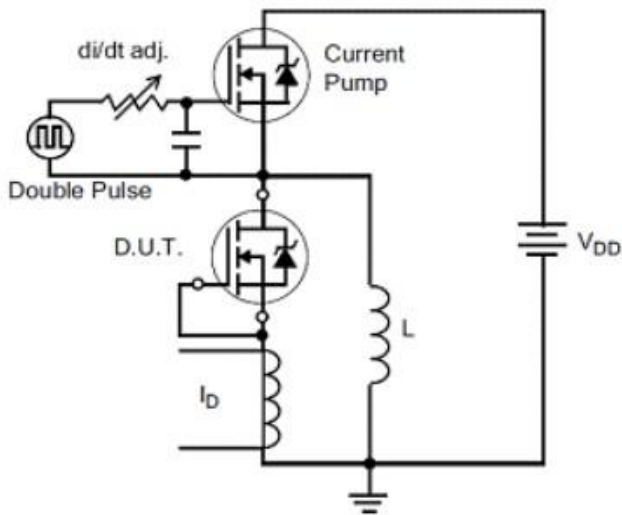


Figure 19. Diode Reverse Recovery Waveform

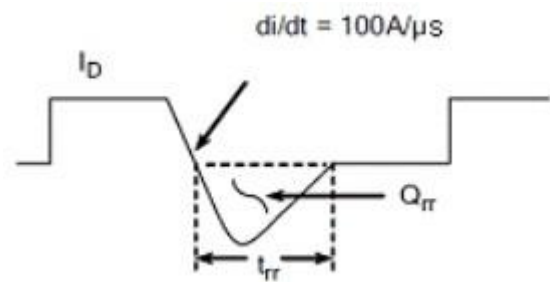


Figure 20. Unclamped Inductive Switching Test Circuit

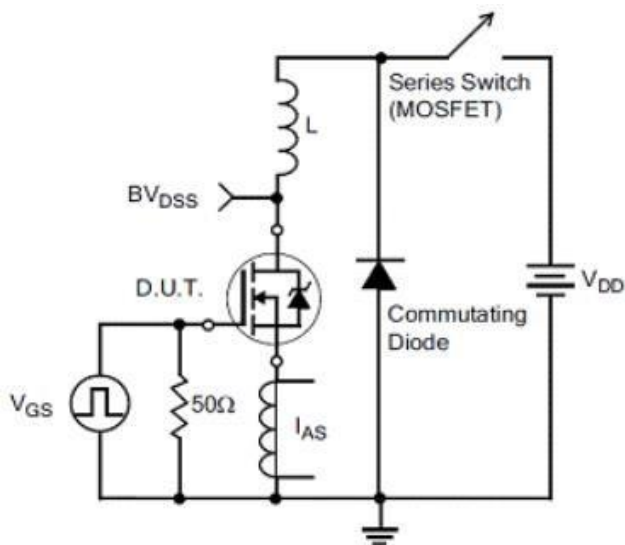
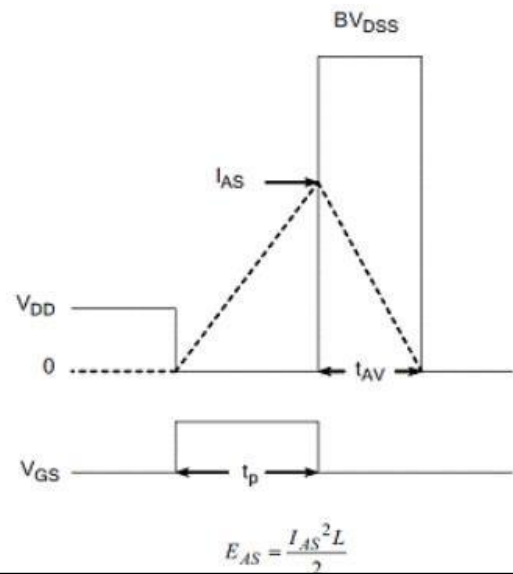
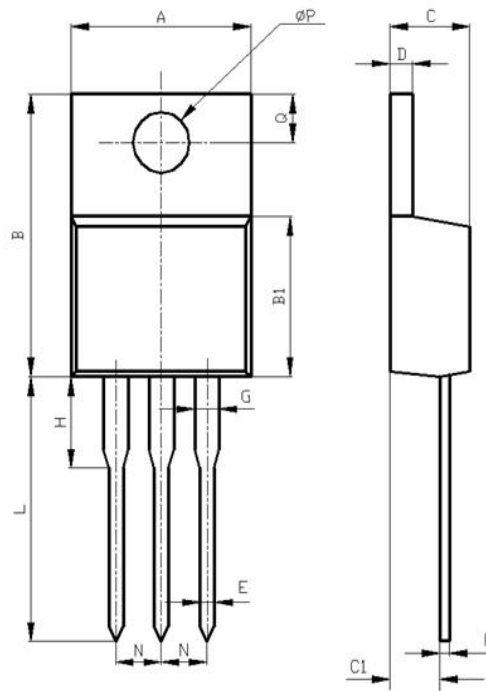


Figure 21. Unclamped Inductive Switching Waveform

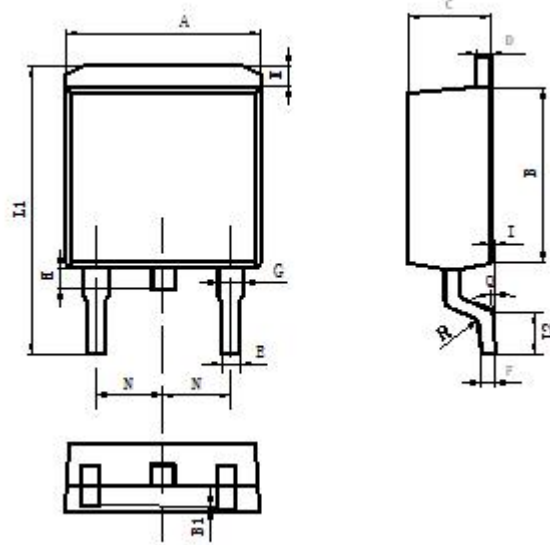


Package Description



| 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



| Items | Values(mm) | |
|-------|------------|-------|
| | MIN | MAX |
| A | 9.80 | 10.40 |
| B | 8.90 | 9.50 |
| B1 | 0 | 0.10 |
| C | 4.40 | 4.80 |
| D | 1.16 | 1.37 |
| E | 0.70 | 0.95 |
| F | 0.30 | 0.60 |
| G | 1.07 | 1.47 |
| H | 1.30 | 1.80 |
| K | 0.95 | 1.37 |
| L1 | 14.50 | 16.50 |
| L2 | 1.60 | 2.30 |
| I | 0 | 0.2 |
| Q | 0° | 8° |
| R | 0.4 | |
| N | 2.39 | 2.69 |

TO-263 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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