## N Channel MOSFET

Lead Free Package and Finish

### Applications:

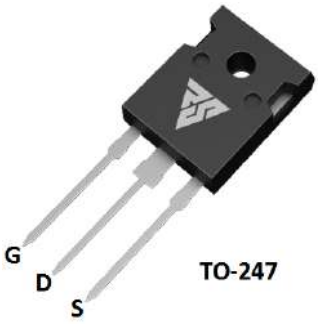
•Adapter & Charger

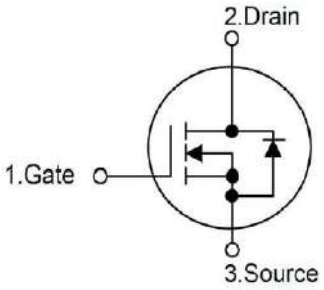
•DC-AC inverter Power

•AC-DC Switching Power Supply

•LED driving power

| $I_D$ | $R_{DS(ON)}$(Typ.) | $V_{DSS}$ |
|---|---|---|
| 20A | 0.23Ω | 500V |




Not to Scale

### Features:

•Low On Resistance

•Low Gate Charge

•Peak Current vs Pulse Width Curve

•RoHS Compliant

### Ordering Information

| Part Number | Package | Marking |
|---|---|---|
| RS20N50W | TO-247 | RS20N50W |

### Absolute Maximun Ratings Tc=25℃ unless otherwise specified

| Symbol | Parameter | RS20N50W | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage (Note*1) | 500 | V |
| $I_D$ | Continuous Drain Current | 20.0 | A |
| $I_D$@ 100 ℃ | Continuous Drain Current | 12.6 | |
| $I_{DM}$ | Pulsed Drain Current (Note*2) | 80 | |
| $P_D$ | Power Dissipation | 230 | W |
| | Derating Factor above 25℃ | 1.85 | W/℃ |
| $V_{GS}$ | Gate-to-Source Voltage | ±30 | V |
| $E_{AS}$ | Single Pulse Avalanche Engergy L=10mH $V_{DD}$=50V $R_G$=25Ω $T_J$=25℃ | 1200 | mJ |
| $T_L$ | Maximum Temperature for Soldering | 300 | ℃ |
| $T_{PKG}$ | Leads at 0.063in(1.6mm)from Case for 10 seconds<br>Package Body for 10 seconds | 260 | |
| $T_J$ and $T_{STG}$ | Operating Junction and Storage Temperature Range | -55 to 150 | |

*Drain Current Limited by Maximum Junction Temperature

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

### Thermal Resistance

| Symbol | Parameter | RS20N50W | Units | Test Conditions |
|---|---|---|---|---|
| RθJC | Junction-to-Case | 0.54 | ℃/W | Drain lead soldered to water cooled heatsink,PD adjusted for a peak junction temperature of +150℃. |
| RθJA | Junction-to-Ambient | 62.5 | | 1 cubic foot chamber,free air. |

**OFF Characteristics** TJ=25℃ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-source Breakdown Voltage | 500 | -- | -- | V | $V_{GS}$=0V,$I_D$=250μA |
| $I_{DSS}$ | Drain-to-Source Leakage Current | -- | -- | 1.0 | μA | $V_{DS}$=500V,$V_{GS}$=0V |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | -- | -- | 100 | μA | $V_{GS}$=+30V, $V_{DS}$=0V |
| | Gate-to-Source Reverse Leakage | -- | -- | -100 | | $V_{GS}$=-30V ,$V_{DS}$=0V |

**ON Characteristics TJ=25℃ unless otherwise specified**

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | -- | 0.23 | 0.28 | Ω | $V_{GS}$=10V,$I_D$=10A |
| $V_{GS(TH)}$ | Gate Threshold Voltage | 2.0 | -- | 4.0 | V | $V_{GS}$=$V_{DS}$,$I_D$=250μA |

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

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $t_{d(ON)}$ | Turn-on Delay Time | -- | 33 | -- | nS | $V_{DS}$=250V<br>$I_D$=20A<br>$R_G$=20Ω |
| $t_{rise}$ | Rise Time | -- | 75 | -- | | |
| $t_{d(OFF)}$ | Turn-OFF Delay Time | -- | 91 | -- | | |
| $t_{fall}$ | Fall Time | -- | 83 | -- | | |

**Dynamic Characteristics** Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | -- | 1920 | -- | pF | $V_{GS}$=0V<br>$V_{DS}$=25V<br>f=1.0MHz |
| $C_{oss}$ | Output Capacitance | -- | 290 | -- | | |
| $C_{rss}$ | Reverse Transfer Capacitance | -- | 18 | -- | | |
| $Q_g$ | Total Gate Charge | -- | 56 | -- | nC | $V_{DS}$=400V<br>$I_D$=20A<br>$V_{GS}$=10V |
| $Q_{gs}$ | Gate-to-Source Charge | -- | 13 | -- | | |
| $Q_{gd}$ | Gate-to-Drain("Miller"）Charge | -- | 20 | -- | | |

## Source-Drain Diode Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | -- | -- | 20 | A | Integral pn-diode in MOSFET |
| $I_{SM}$ | Maximum Pulsed Current | -- | -- | 80 | A | |
| $V_{SD}$ | Diode Forward Voltage | -- | -- | 1.2 | V | $I_S$=20A,$V_{GS}$=0V |
| $t_{rr}$ | Reverse Recovery Time | -- | 536 | -- | nS | $V_{GS}$=0V $I_S$=20A,di/dt=100A/μs |
| $Q_{rr}$ | Reverse Recovery Charge | -- | 5.6 | -- | μC | |

**Notes:**

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

## Typical Feature curve

Figure1 Typical Output Characteristics

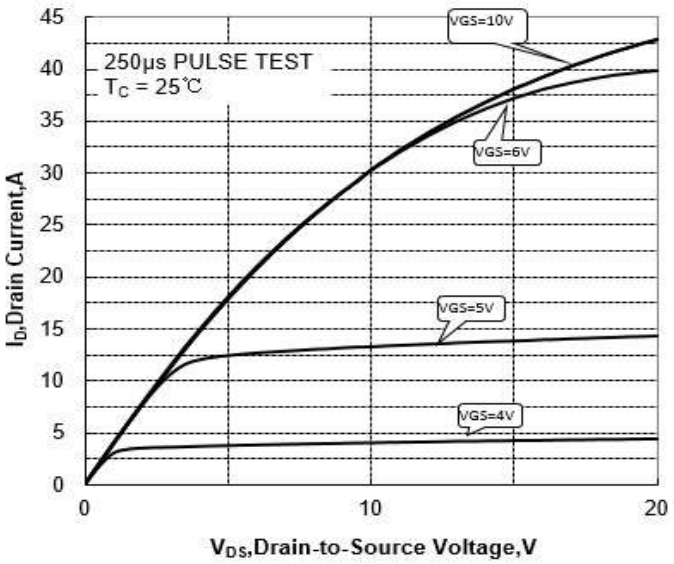



Figure2 Typical Transfer Characteristics

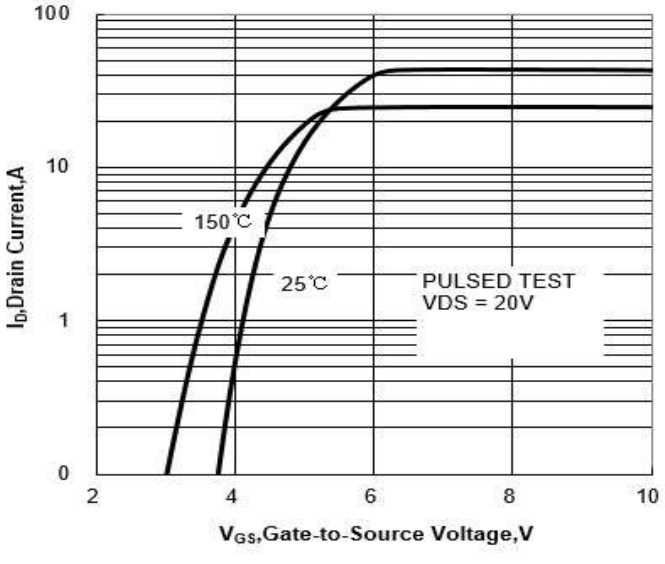


Figure3 Typical Drain to Source ON Resistance vs Drain Current

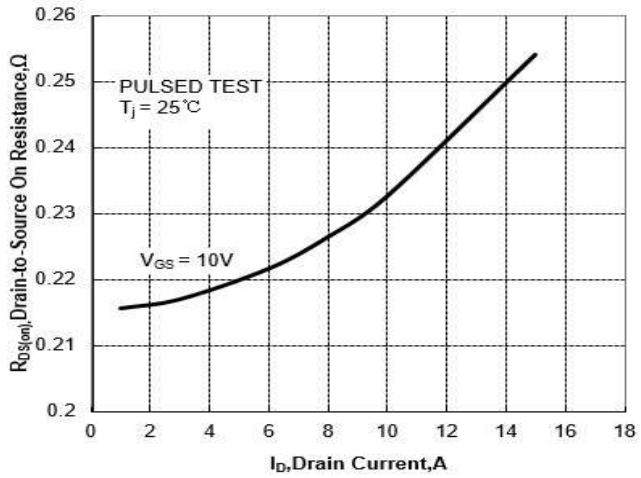



Figure4 Typical Drian to Source on Resistance vs Junction Temperature

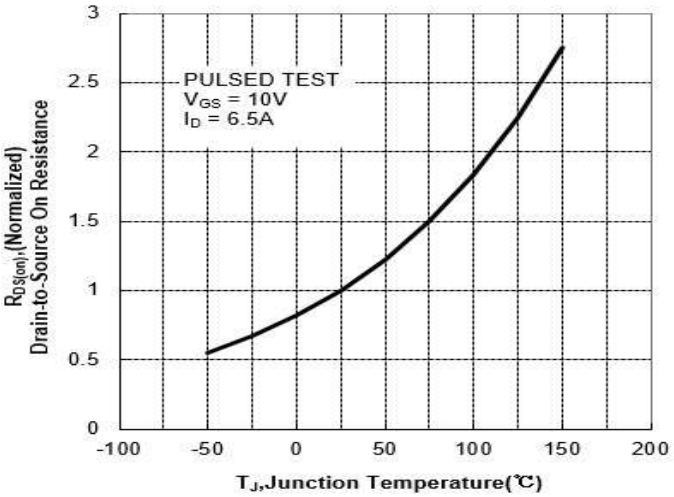



Figure5 Typical Theshold Voltage vs Junction Temperature

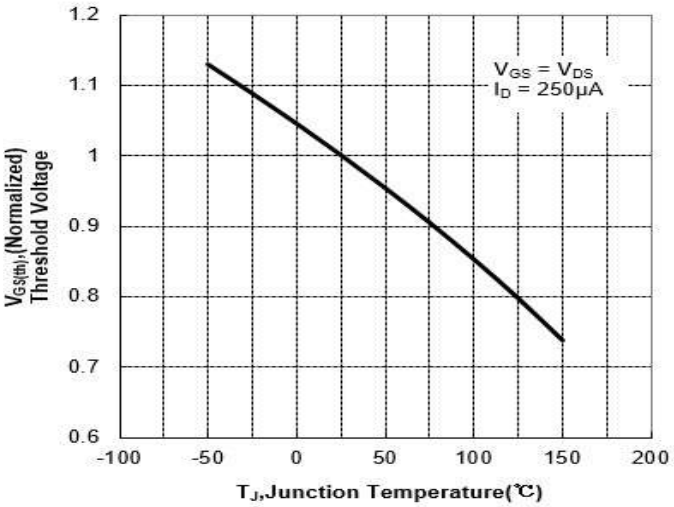



Figure6 Typical Breakdown Voltage vs Junction Temperature

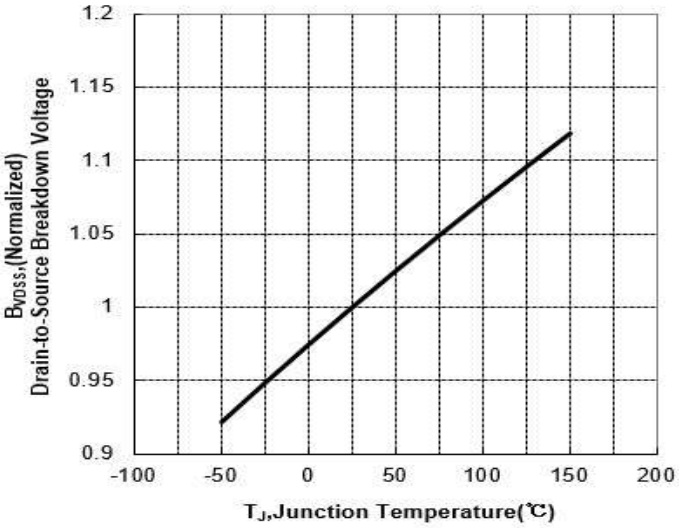



Figure7 Power Dissipation

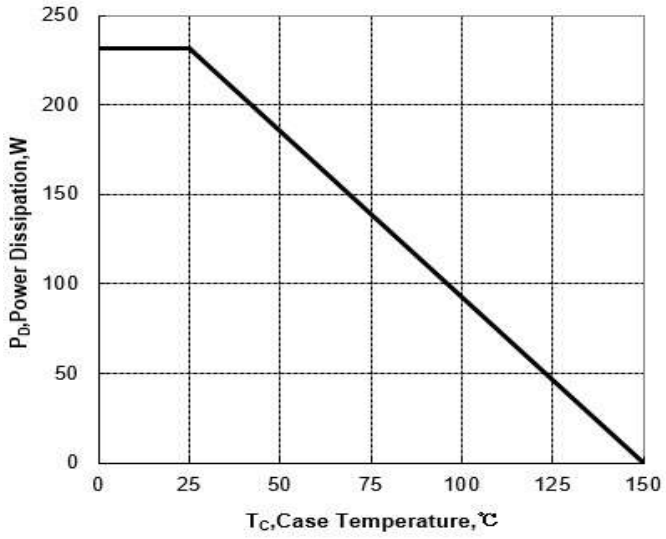



Figure8 Typical Breakdown Voltage vs Junction Temperature

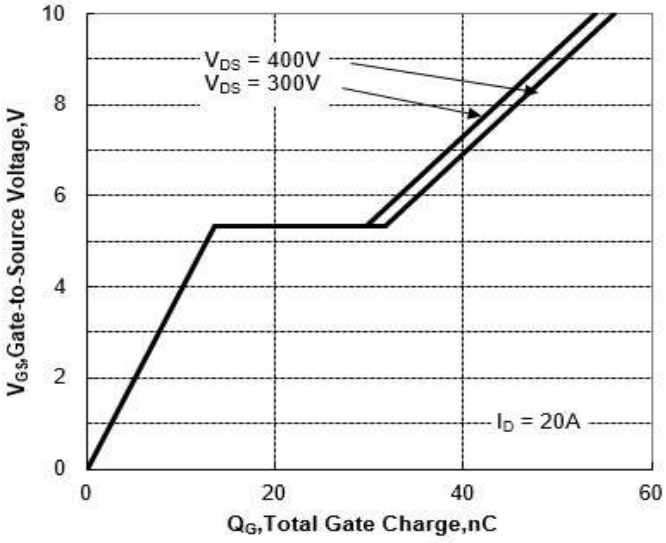


Figure9 Typical Theshold Voltage vs Junction Temperature

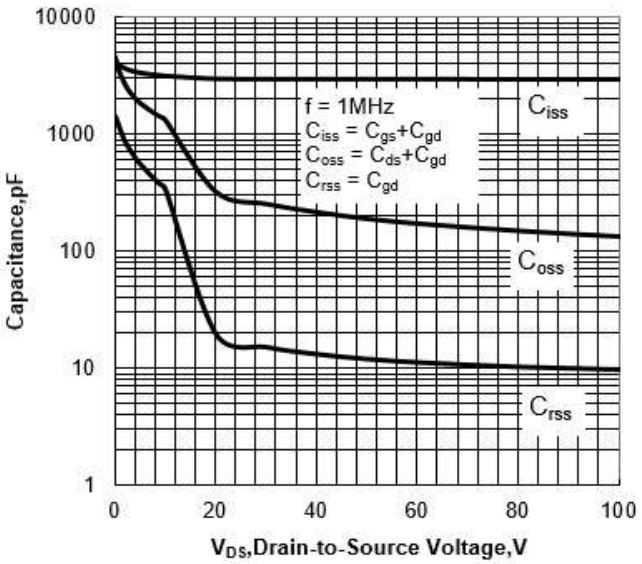



Figure10 Safe Operating Area

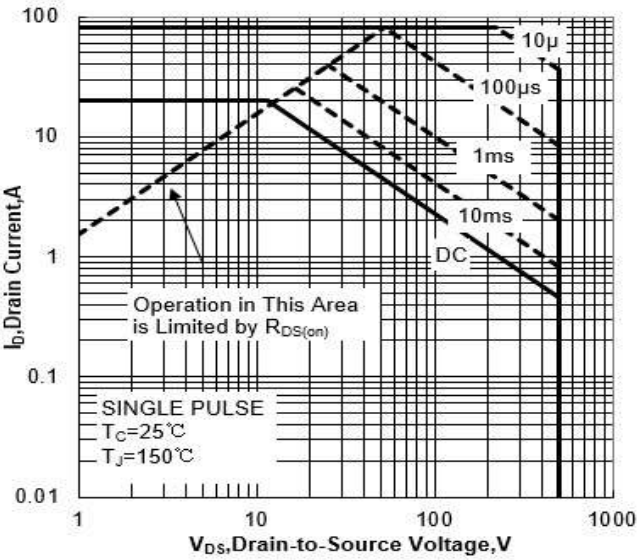
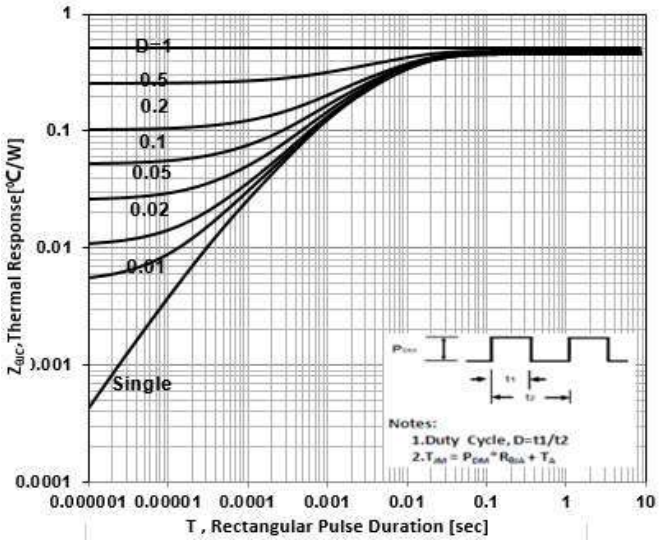



Figure11 Max Thermal Impendance



## Test Circuits and Waveforms

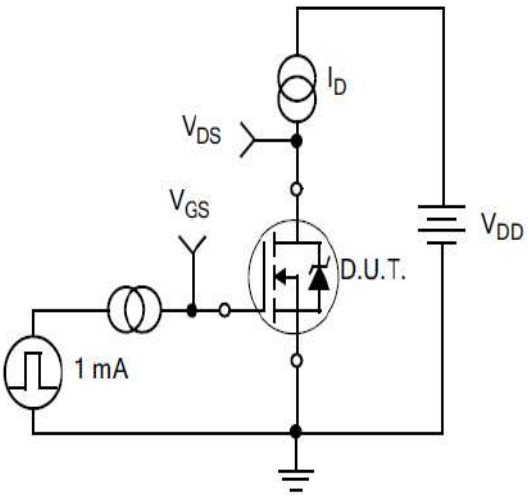



Figure12.
Gate Charge Test Circuit

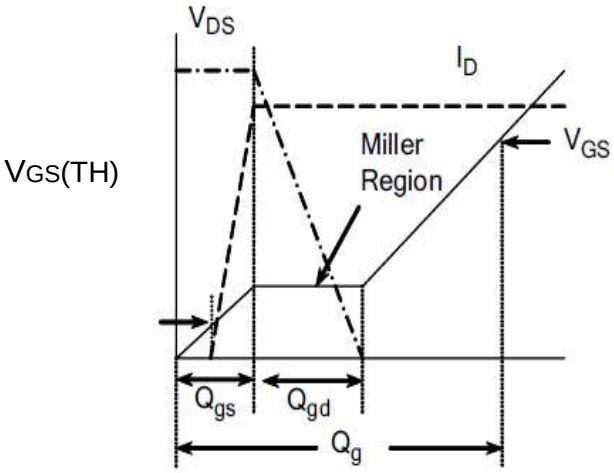



Figure13.
Gate Charge Waveform

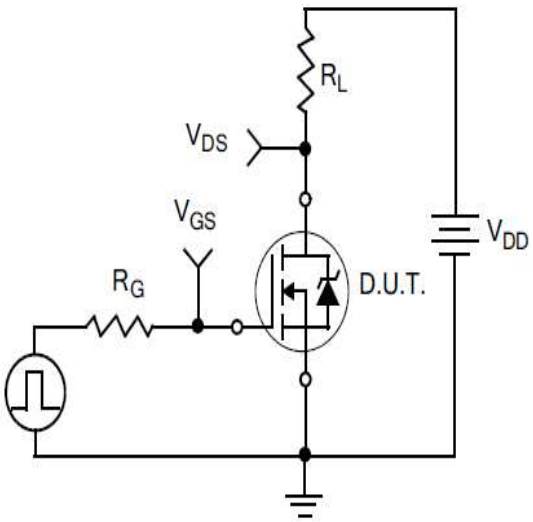



Figure14.
Resistive Switching Test Circuit

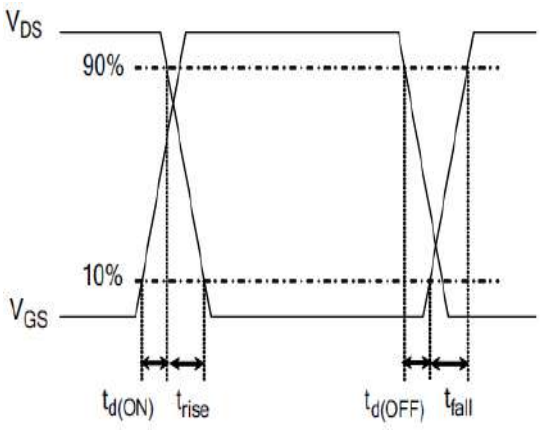



Figure15.
Resistive Switching Waveforms

**Test Circuits and Waveforms**

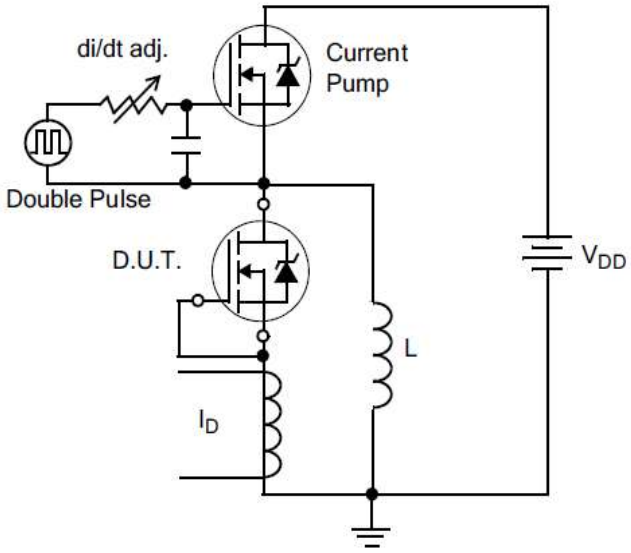



Figure16.Diode Reverse Recovery Test Circuit

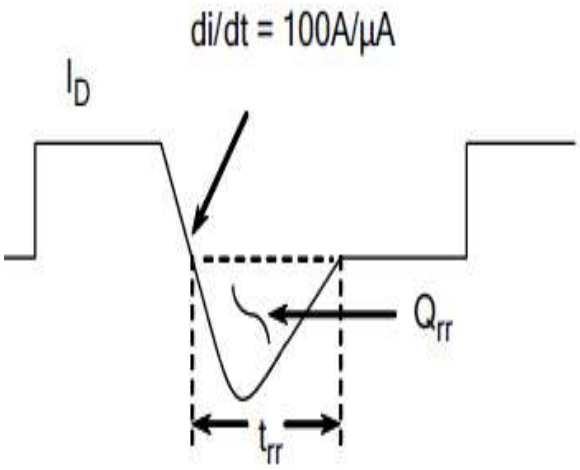



Figure17.Diode Reverse Recovery Waveform

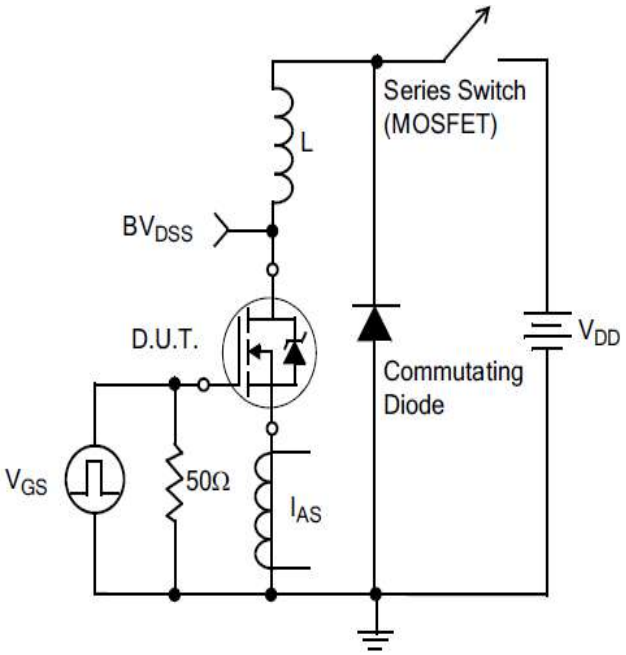
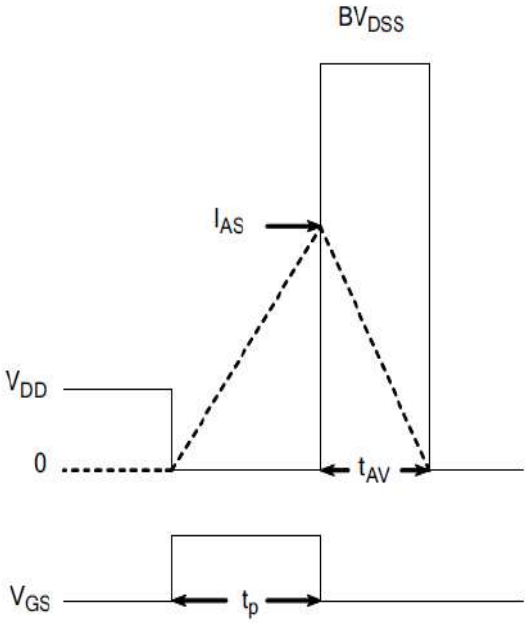



Figure18.Unclamped Inductive Switching Test Circuit

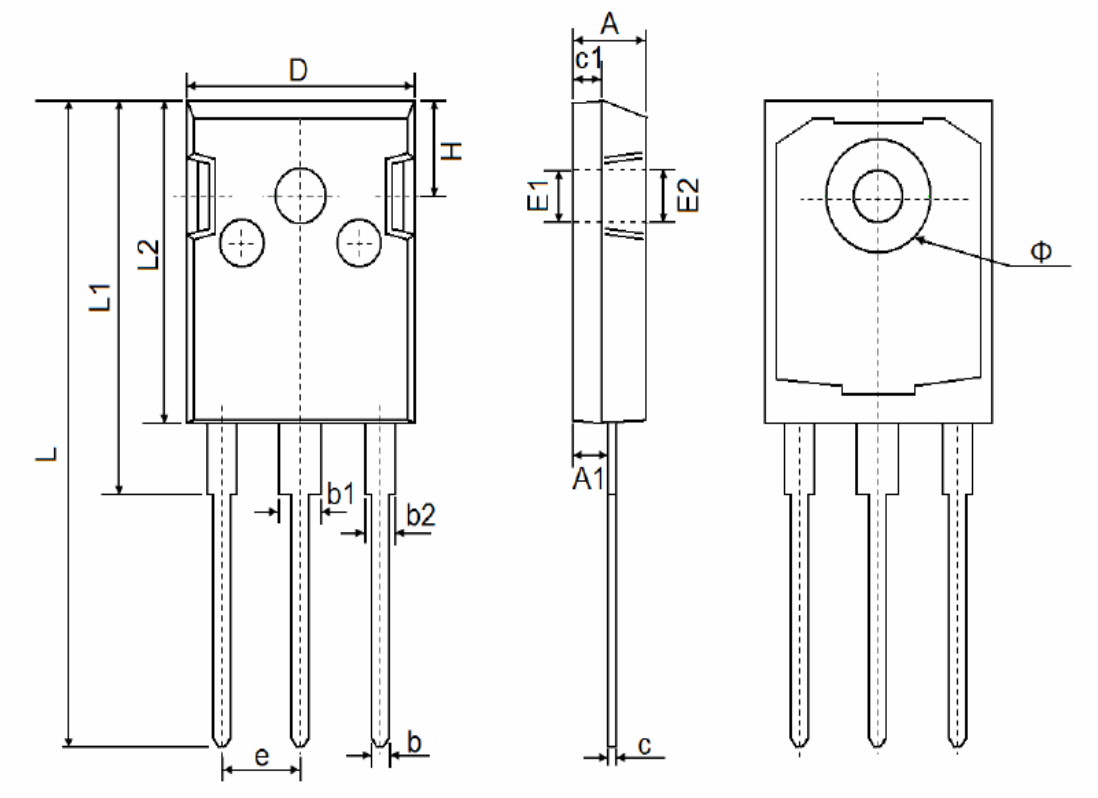



$$E_{AS}=\frac{I_{AS}^2 L}{2}$$

Figure19.Unclamped Inductive Switching Waveforms

## Package outline drawing

Unit:mm




### TO-247

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 4.850 | 5.150 | 0.191 | 0.200 |
| A1 | 2.200 | 2.600 | 0.087 | 0.102 |
| b | 1.000 | 1.400 | 0.039 | 0.055 |
| b1 | 2.800 | 3.200 | 0.110 | 0.126 |
| b2 | 1.800 | 2.200 | 0.071 | 0.087 |
| c | 0.500 | 0.700 | 0.020 | 0.028 |
| c1 | 1.900 | 2.100 | 0.075 | 0.083 |
| D | 15.450 | 15.750 | 0.608 | 0.620 |
| E1 | 3.500 REF | | 0.138 REF | |
| E2 | 3.600 REF | | 0.142 REF | |
| L | 40.900 | 41.300 | 1.610 | 1.626 |
| L1 | 24.800 | 25.100 | 0.976 | 0.988 |
| L2 | 20.300 | 20.600 | 0.799 | 0.811 |
| Φ | 7.100 | 7.300 | 0.280 | 0.287 |
| e | 5.450 TYP | | 0.215 TYP | |
| H | 5.980 REF | | 0.235 REF | |

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