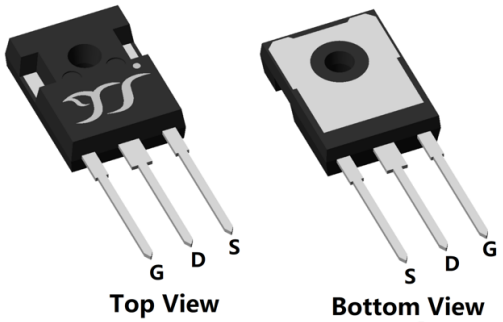
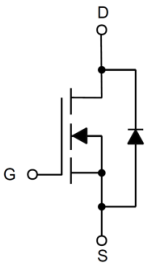
# N-Channel Enhancement Mode Field Effect Transistor




TO-247




## Product Summary

- $V_{DS}$ 600V
- $I_D$ 33.8A
- $R_{DS(ON)}$( at $V_{GS}$=10V) ＜99mΩ
- 100% EAS Tested
- 100% ▽$V_{DS}$ Tested
- ESD Level(HBM) H2

## General Description

- Super Junction High Voltage MOSFET technology
- Excellent package for heat dissipation
- High density cell design for low $R_{DS(ON)}$
- Epoxy Meets UL 94 V-0 Flammability Rating
- Halogen Free

## Applications

- Microinverter
- Charging pile

## ■ Limiting Values

| Parameter | Conditions | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|---|
| Drain-source Voltage | | | $V_{DS}$ | - | 600 | V |
| Gate-source Voltage | | | $V_{GS}$ | -20 | 20 | |
| Continuous Drain Current (Note 1,2) | Steady-State | $T_A$=25℃,$V_{GS}$=10V | $I_D$ | - | 3.3 | A |
| | | $T_A$=100℃,$V_{GS}$=10V | | - | 2.1 | |
| Continuous Drain Current (Note 1,3) | Steady-State | $T_C$=25℃,$V_{GS}$=10V | | - | 33.8 | |
| | | $T_C$ =100℃,$V_{GS}$=10V | | - | 21.3 | |
| Pulsed Drain Current | $T_C$=25℃,$t_p$≤10μs | | $I_{DM}$ | - | 135.2 | |
| Maximum Body-Diode Continuous Current | $T_C$=25℃ | | $I_S$ | | 33.8 | |
| Maximum Body-Diode Pulsed Current | $T_C$=25℃,$t_p$≤10μs | | $I_{SM}$ | - | 135.2 | |
| Avalanche Energy (non-repetitive ) | $T_J$=25℃,$V_G$=10V,$R_G$=25Ω,L=30mH,$I_{AS}$=7.05A | | EAS | - | 745.5 | mJ |
| Total Power Dissipation (Note 1,2) | Steady-State | $T_A$=25℃ | $P_D$ | - | 2.84 | W |
| | | $T_A$=100℃ | | - | 1.13 | |
| Total Power Dissipation (Note 1,3) | Steady-State | $T_C$=25℃ | | - | 290.6 | |
| | | $T_C$ =100℃ | | - | 116.2 | |
| MOSFET dv/dt Ruggedness | $V_{DS}$=0…325V,ID=13A,Rg=0Ω | | dv/dt | - | 50 | V/ns |
| Reverse Diode dv/dt | $V_{DS}$=0…325V,ID=13A,di/dt=100A/us | | dv/dt | - | 50 | |
| Junction and Storage Temperature Range | | | $T_J$ ,$T_{STG}$ | -55 | 150 | ℃ |

## ■Thermal Resistance

| Parameter | | Symbol | Typ | Max | Units |
|---|---|---|---|---|---|
| Thermal Resistance Junction-to-Ambient (Note 2) | Steady-State | $R_{\theta JA}$ | - | 44 | ℃/W |
| Thermal Resistance Junction-to-Case | Steady-State | $R_{\theta JC}$ | - | 0.43 | |

## ■ Electrical Characteristics

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Static Parameter** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V,$I_D$=250μA,Tj=25℃ | 600 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=600V,$V_{GS}$=0V,Tj=25℃ | - | - | 1 | μA |
| | | $V_{DS}$=600V,$V_{GS}$=0V,Tj=125℃ | - | - | 100 | |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V,Tj=25℃ | - | - | ±100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA,Tj=25℃ | 2.4 | 3.4 | 4.4 | V |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V,$I_D$=15A,Tj=25℃ | - | 75 | 99 | mΩ |
| | | $V_{GS}$=10V,$I_D$=15A,Tj=150℃ | - | 193 | 254 | |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=15A,$V_{GS}$=0V,Tj=25℃ | - | 0.83 | 1.2 | V |
| Gate Resistance | $R_G$ | f=1MHz,Tj=25℃ | - | 2 | - | Ω |
| **Dynamic Parameters** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=325V,$V_{GS}$=0V,f=100kHz,Tj=25℃ | - | 2496 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 61 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 1.7 | - | |
| Effective Output capacitance, Energy Related | $C_{o(er)}$ | $V_{DS}$=0…325V,$V_{GS}$=0V,f=100kHz, Tj=25℃ | - | 106 | - | |
| Effective Output Capacitance, Time Related | $C_{o(tr)}$ | | - | 657 | - | |
| **Switching Parameters** | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{GS}$=10V,$V_{DS}$=400V,$I_D$=9.7A,Tj=25℃ | - | 47.3 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 11.3 | - | |
| Gate-Drain Charge | $Q_{gd}$ | | - | 14.6 | - | |
| Reverse Recovery Charge | $Q_{rr}$ | $I_F$=9.7A,di/dt=100A/μs,$V_{GS}$=0V, $V_R$=400V,Tj=25℃ | - | 3267 | - | nC |
| Reverse Recovery Time | $t_{rr}$ | | - | 231 | - | ns |
| Peak Reverse Recovery Current | $I_{rrm}$ | | - | 27.7 | - | A |
| Turn-on Delay Time | $t_{D(on)}$ | $V_{GS}$=13V,$V_{DS}$=400V,$I_D$=9.7A, $R_{GEN}$=5.1Ω,Tj=25℃ | - | 26.9 | - | ns |
| Turn-on Rise Time | $t_r$ | | - | 13.1 | - | |
| Turn-off Delay Time | $t_{D(off)}$ | | - | 61.4 | - | |
| Turn-off Fall Time | $t_f$ | | - | 17.6 | - | |

Note：

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. The value of $R_{\theta JA}$ is measured in the still air environment with $T_A$ =25℃.The maximum allowed junction temperature of 150℃.
3. Thermal resistance from junction to soldering point (on the exposed drain pad).

## ■Typical Electrical and Thermal Characteristics Diagrams

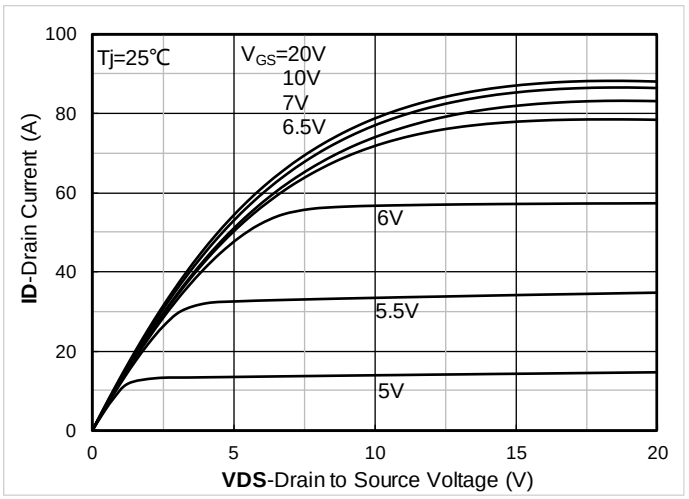



Figure 1. Output Characteristics; typical values

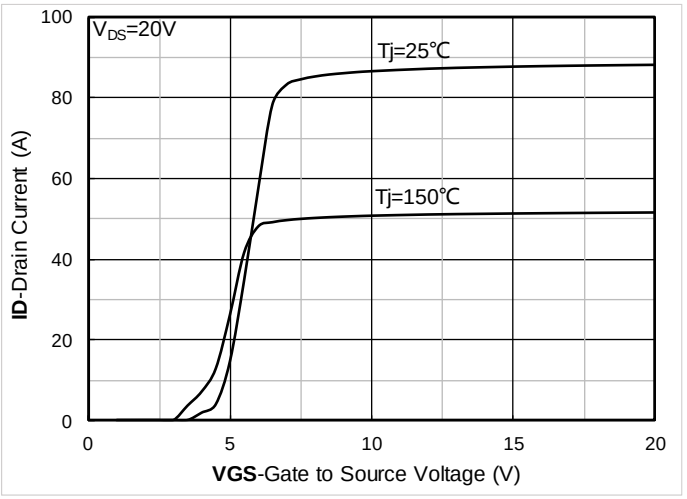



Figure 2. Transfer Characteristics; typical values

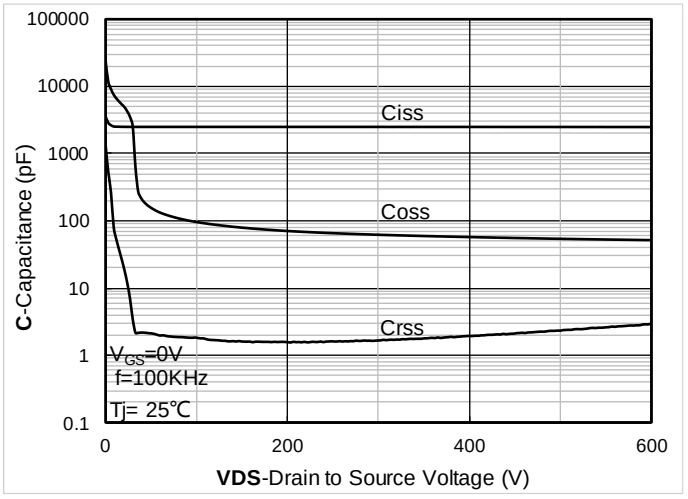



Figure 3. Capacitance Characteristics; typical values

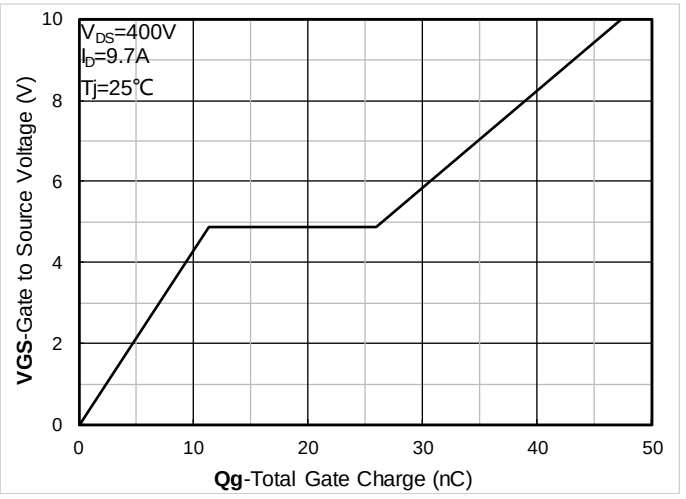



Figure 4. Gate Charge; typical values

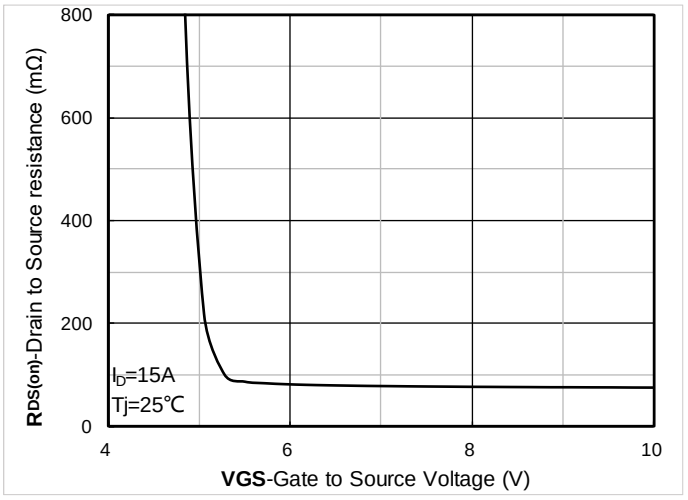



Figure 5. On-Resistance vs. Gate to Source Voltage; typical values

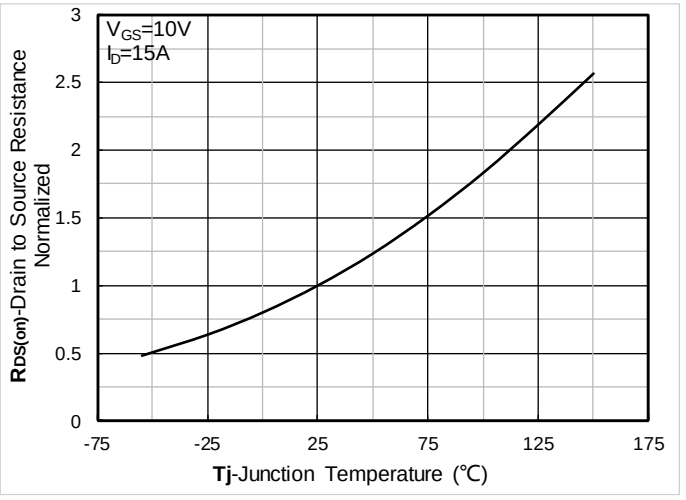



Figure 6. Normalized On-Resistance

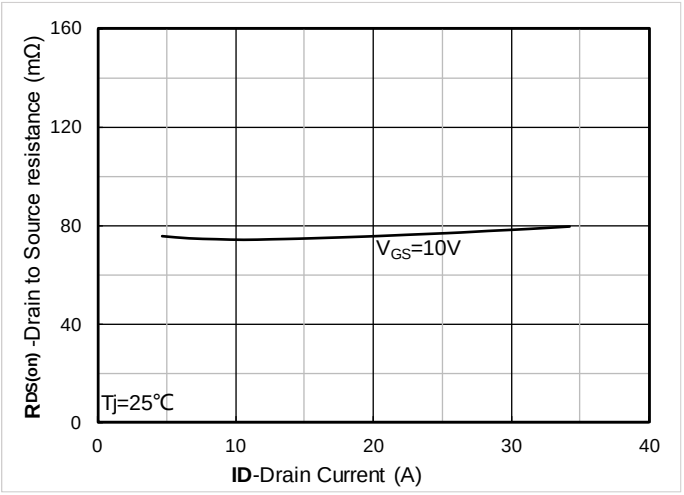



Figure 7. $R_{DS(on)}$ vs. Drain Current; typical values

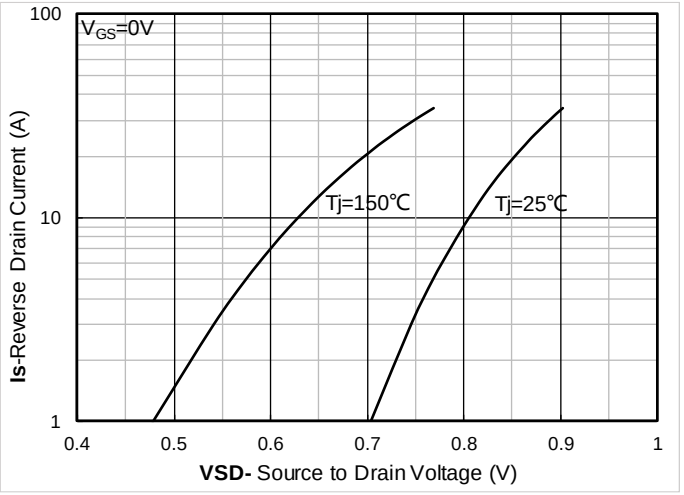



Figure 8. Forward characteristics of reverse diode; typical values

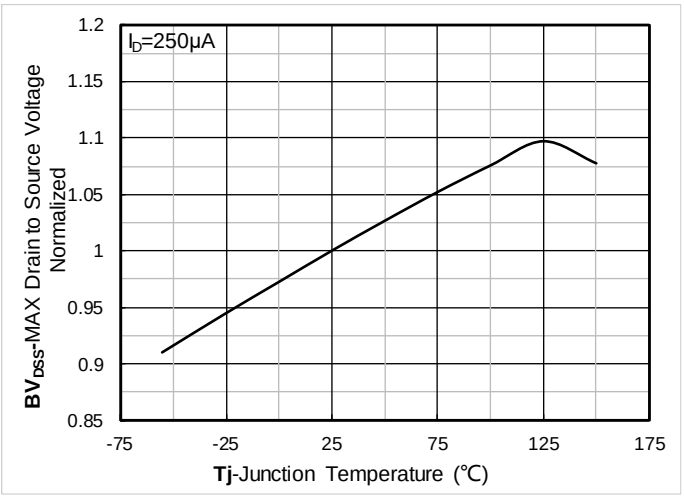



Figure 9. Normalized breakdown voltage

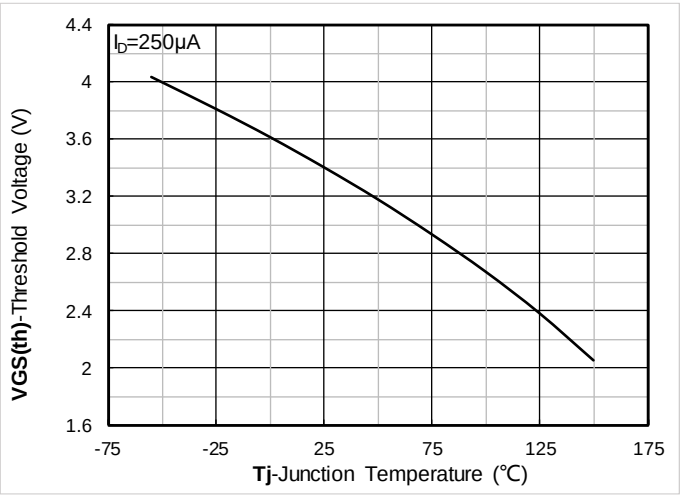



Figure 10. Gate Threshold voltage; typical values

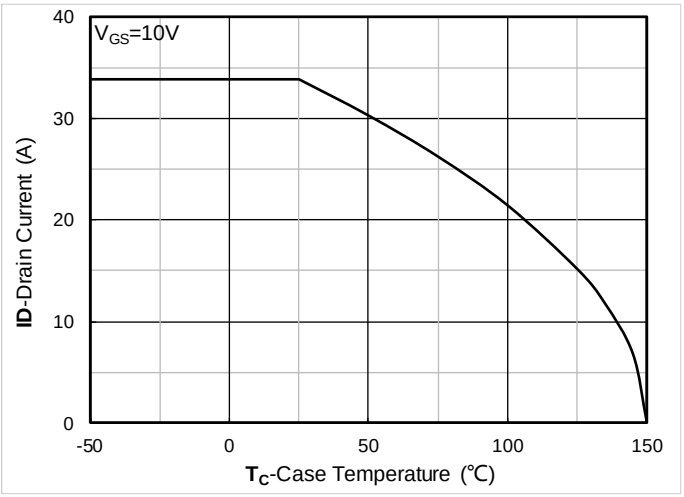



Figure 11. Current dissipation

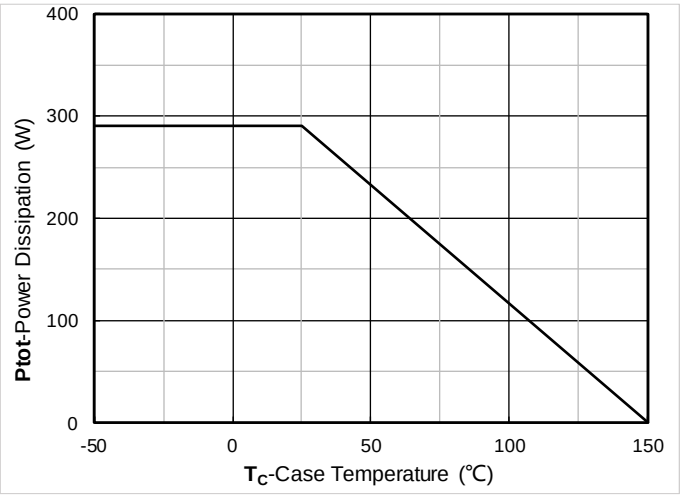



Figure 12. Power dissipation

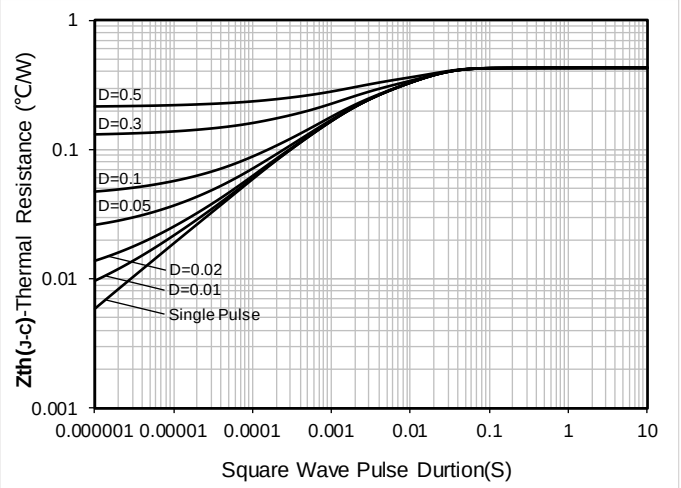



Figure 13. Maximum Transient Thermal Impedance

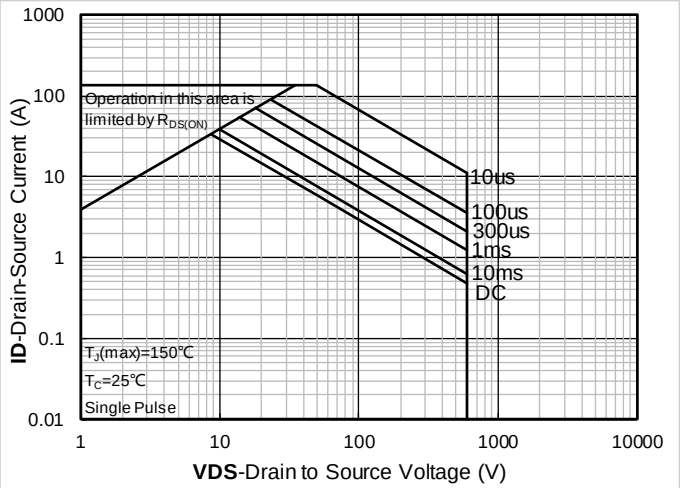



Figure 14. Safe Operation Area

## ■ Test Circuits & Waveforms

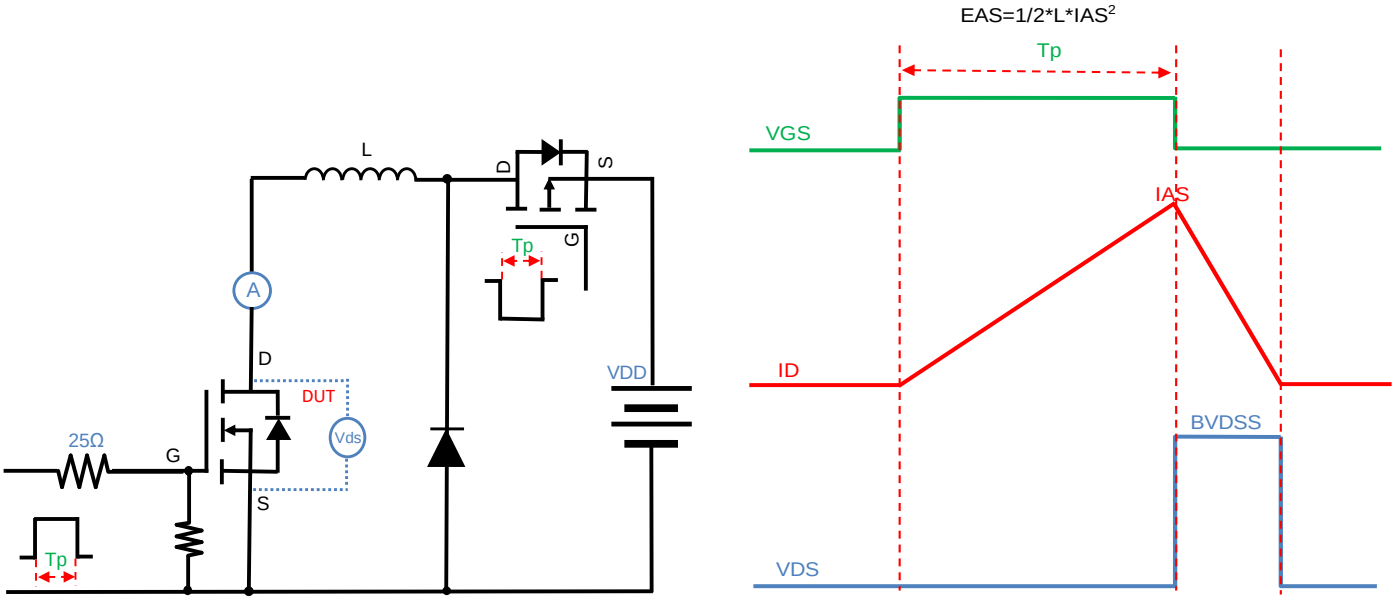



Figure A. Unclamped Inductive Switching (UIS) Test Circuit & Waveform

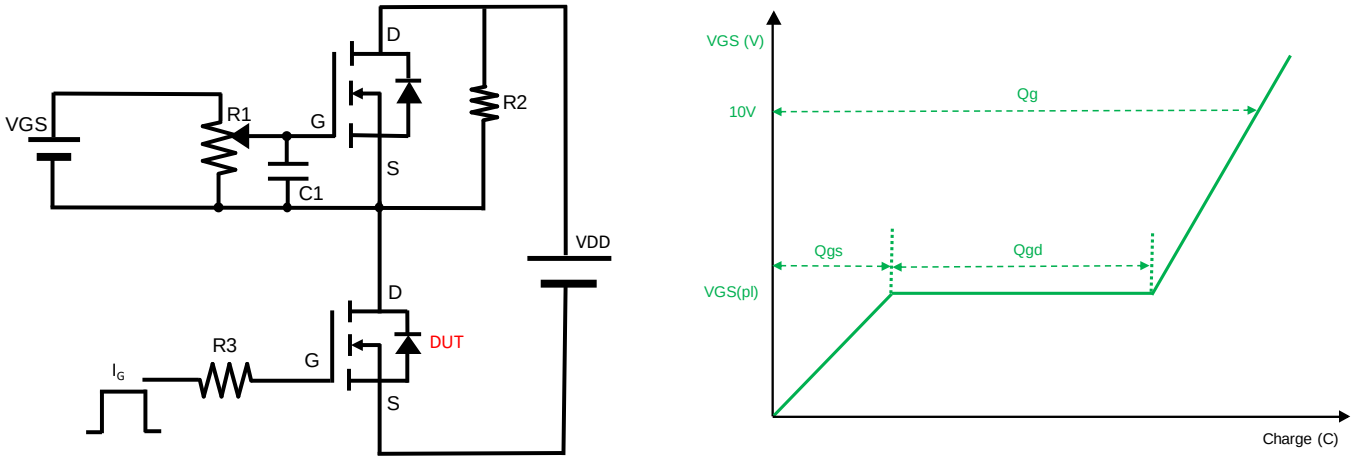



Figure B. Gate Charge Test Circuit & Waveform

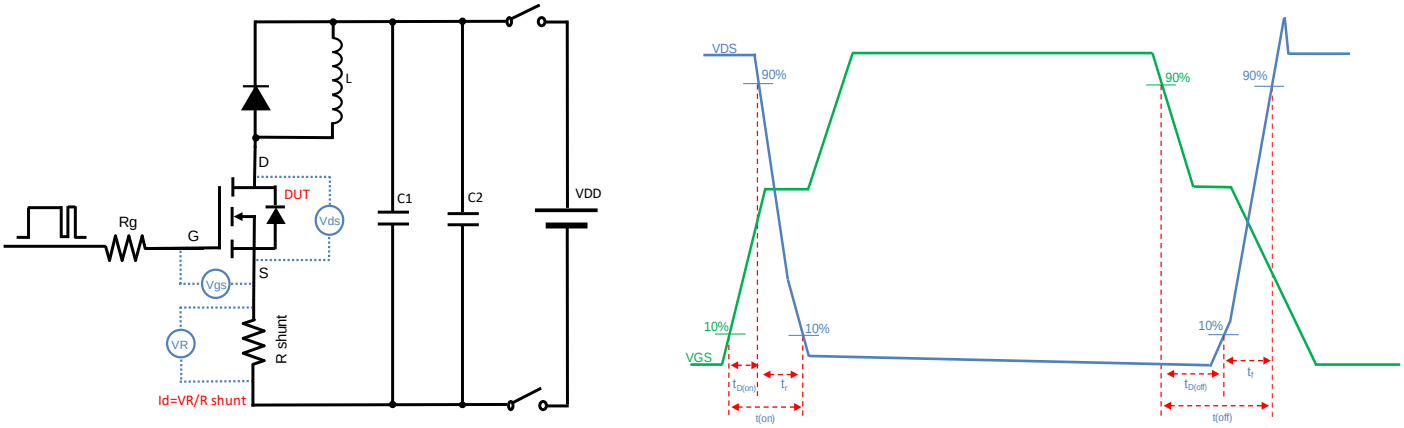



Figure C. Resistive Switching Test Circuit & Waveform

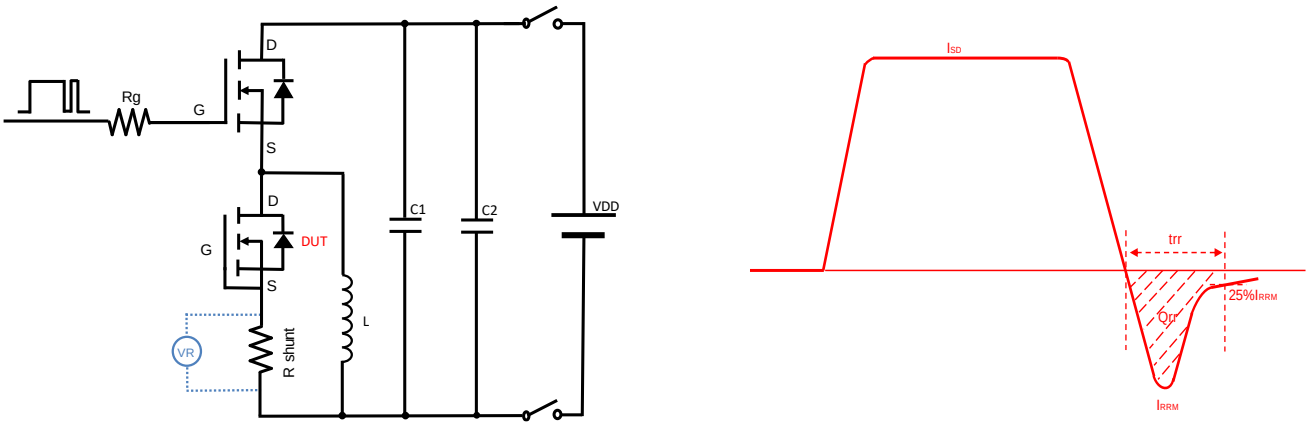
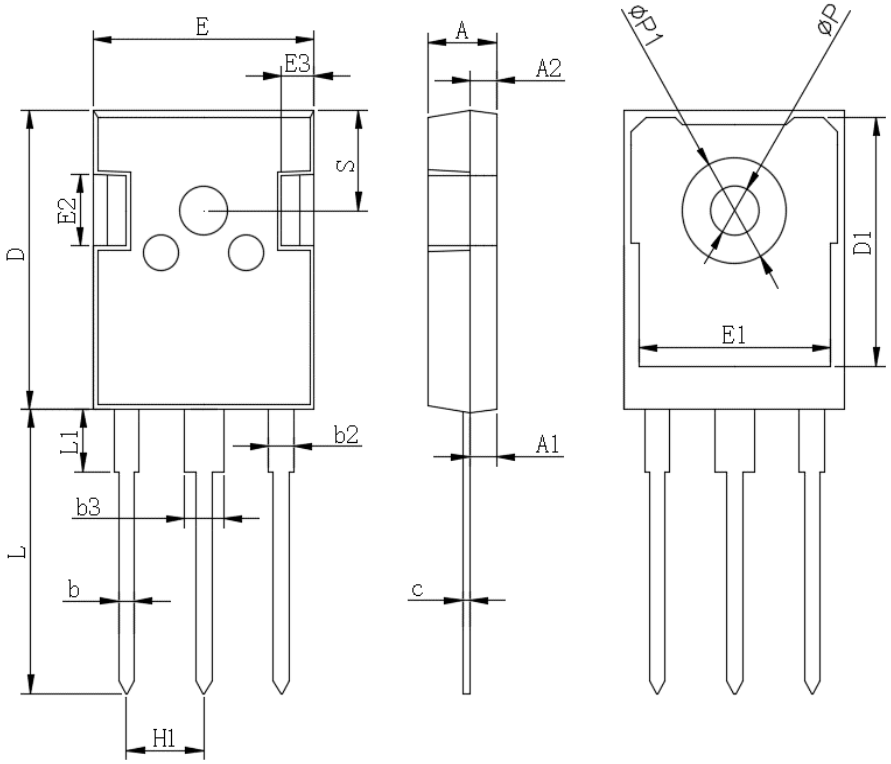



Figure D. Diode Recovery Test Circuit & Waveform

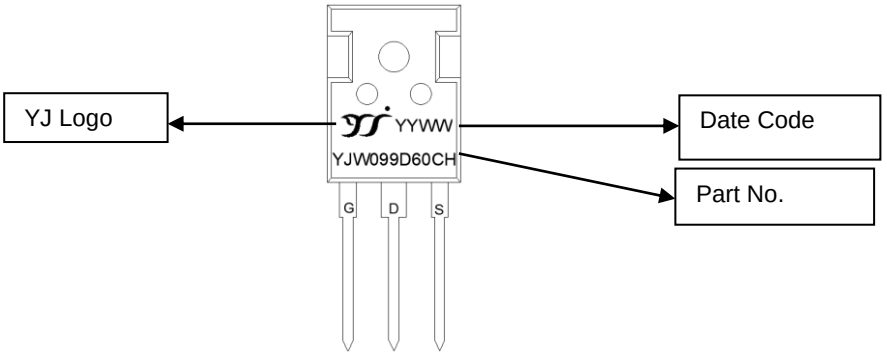
## ■ TO-247AB Package information

**TO-247AB**




| TO-247AB | | |
|---|---|---|
| Dim | Min | Max |
| A | 4.80 | 5.20 |
| A1 | 2.21 | 2.61 |
| A2 | 1.85 | 2.15 |
| b | 1.0 | 1.4 |
| b2 | 1.91 | 2.21 |
| c | 0.5 | 0.7 |
| D | 20.70 | 21.30 |
| D1 | 16.25 | 16.85 |
| E | 15.50 | 16.10 |
| E1 | 13.0 | 13.6 |
| E2 | 4.80 | 5.20 |
| E3 | 2.30 | 2.70 |
| L | 19.62 | 20.22 |
| L1 | - | 4.30 |
| ΦP | 3.40 | 3.80 |
| ΦP1 | - | 7.30 |
| S | 6.15TYP | |
| H1 | 5.44TYP | |
| b3 | 2.80 | 3.20 |

## ■ Marking Information




Note：
1. All marking is at middle of the product body
2. All marking is in laser printing
3. YJW099D60CH is part no., YYWW is date code, “YY” is year, “WW” is week
4. Body color: Black

## Disclaimer

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