

9A,1700V N-Channel Silicon Carbide Power MOSFET

Features

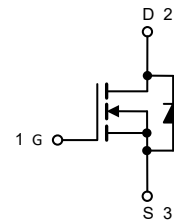
- High blocking voltage
- Low on-resistance with high junction temperature
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Qrr)
- RoHS compliant



TO-247AD

Applications

- Switch Mode Power Supplies
- DC/DC converters
- Solar Inverters
- Battery Chargers
- Motor Drives



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

| Parameter | Symbol | Ratings | Unit |
|--|----------------------------------|------------|------|
| Drain-Source Voltage | V _{DS} | 1700 | V |
| Gate Source Voltage | V _{GS} | -5/+20 | V |
| Drain Current Continuous | I _D | 9 | A |
| T _C =25°C | | | |
| Drain Current Pulse | I _{DM} | 18 | A |
| Power Dissipation(T _C =25°C) | P _D | 85 | W |
| Operating Temperature/ Storage Temperature | T _J /T _{STG} | -55 ~ +175 | °C |

Thermal Characteristics

| Parameter | Symbol | Typ | Unit |
|---|------------------|------|------|
| Thermal Resistance ,Junction-to-Ambient | R _{θJA} | -- | °C/W |
| Thermal Resistance Junction-to-Case | R _{θJC} | 1.74 | °C/W |

Electrical Characteristics (@T_J=25°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|----------------------------------|----------------------|--|------|------|------|------|
| Drain-Source Breakdown Voltage | V _{(BR)DSS} | V _{GS} =0V, I _D =100μA | 1700 | -- | -- | V |
| Gate Leakage Current | I _{GSS} | V _{GS} =20V | -- | -- | 250 | nA |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} =1700V, V _{GS} =0V | -- | -- | 100 | μA |
| Gate Threshold Voltage | V _{GS(TH)} | V _{DS} =V _{GS} , I _D =0.5mA | 1.8 | -- | 4 | V |
| Drain-Source On-state Resistance | R _{DS(on)} | V _{GS} =18V, I _D =2A | -- | 650 | 1000 | mΩ |
| Total Gate Charge | Q _g | V _{GS} =-5/+20V, V _{DS} =1200V, I _D =2A | -- | 13.2 | -- | nC |
| Gate- Source Charge | Q _{gs} | | -- | 5 | -- | nC |
| Gate- Drain Charge | Q _{gd} | | -- | 4.5 | -- | nC |
| Turn-on Delay Time | t _{d(on)} | V _{GS} =-5/+20V, V _{DS} =1000V, I _D =2A, R _G =2.5Ω, L=70mH | -- | 5 | -- | ns |
| Turn-on Rise Time | t _r | | -- | 17 | -- | ns |
| Turn-off Delay Time | t _{d(off)} | | -- | 13 | -- | ns |
| Turn-off Fall Time | t _f | | -- | 55.6 | -- | ns |
| Input Capacitance | C _{iss} | V _{GS} =0V, V _{DS} =1000V, f=1.0MHz, V _{AC} =25mV | -- | 183 | -- | pF |
| Output Capacitance | C _{oss} | | -- | 17.1 | -- | pF |
| Reverse Transfer Capacitance | C _{rss} | | -- | 2.1 | -- | pF |

Reverse Diode Characteristics (@T_J=25°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|----------------------------------|-----------------|---|-----|-----|-----|------|
| Continuous Diode Forward Current | I _S | V _{GS} =0V | -- | -- | 4 | A |
| Diode Forward Voltage | V _{SD} | I _S =1A, V _{GS} =0V | 4 | -- | -- | V |
| Reverse Recovery Time | t _{rr} | I _S = 2A, V _{GS} =-5V, V _{DS} =1200V di/dt =1200 A/μs, | -- | 33 | -- | ns |
| Reverse Recovery Charge | Q _{rr} | | -- | 32 | -- | nC |

Ratings and Characteristics Curves

($T_A = 25^\circ\text{C}$ unless otherwise noted)

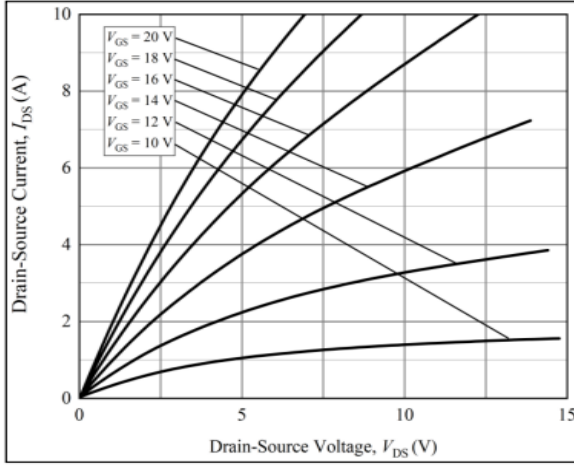


Figure 1. Typical Output Characteristics at $T_J = -55^\circ\text{C}$

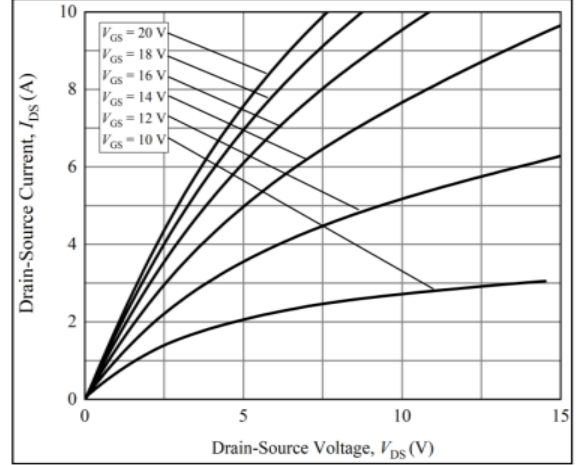


Figure 2. Typical Output Characteristics at $T_J = 25^\circ\text{C}$

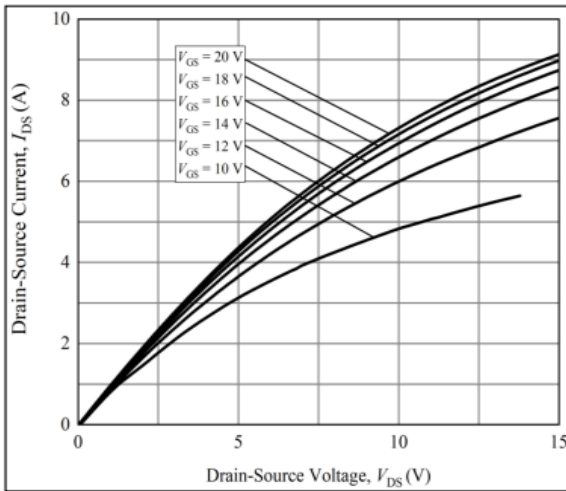


Figure 3. Typical Output Characteristics at $T_J = 175^\circ\text{C}$

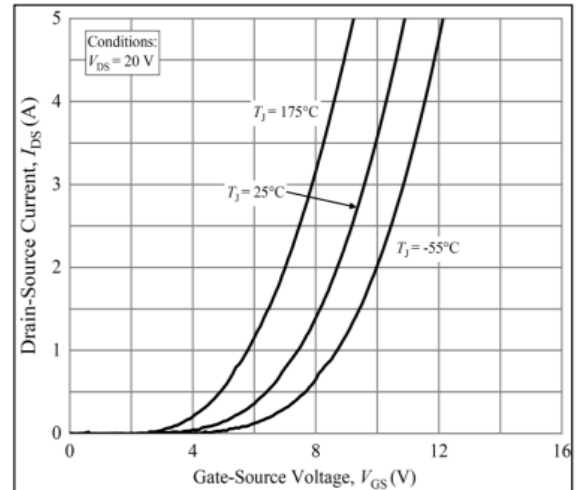


Figure 4. Typical Transfer Characteristics for Various Temperature

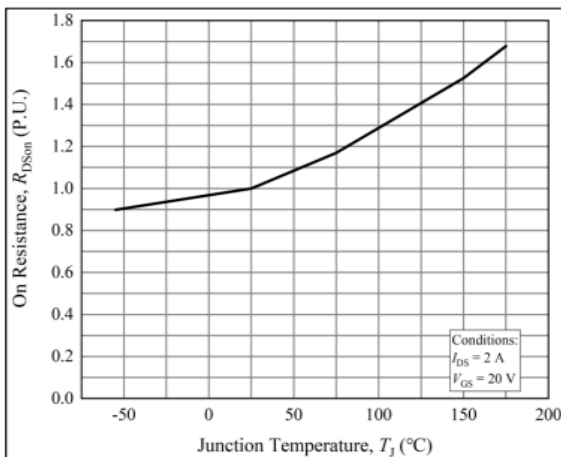


Figure 5. Normalized On-Resistance vs. Temperature

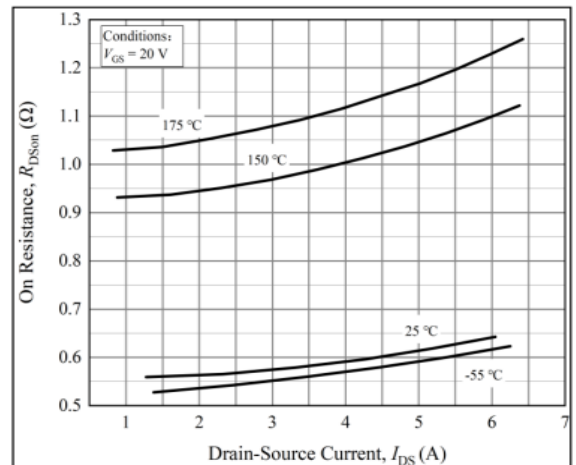


Figure 6. On-Resistance vs. Drain Current for Various Temperatures

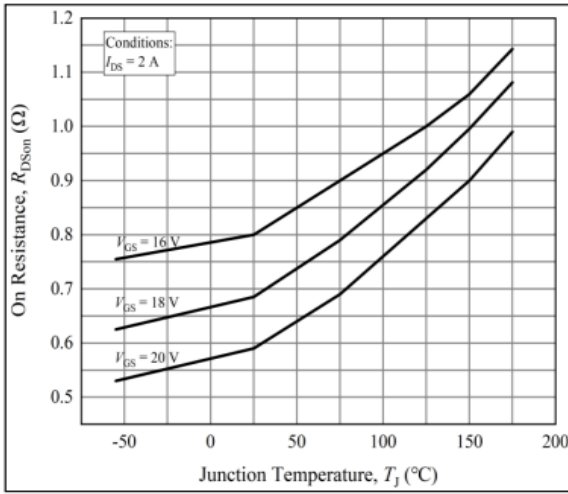


Figure 7. On-Resistance vs. Temperature for Gate

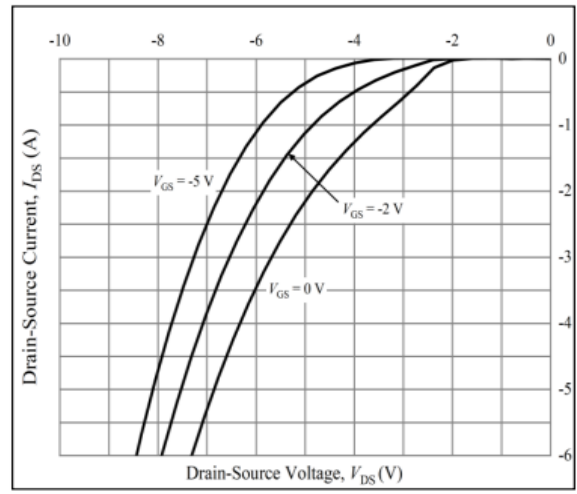


Figure 8. Typical Body Diode Characteristics at $T_J = -55\text{ }^\circ\text{C}$

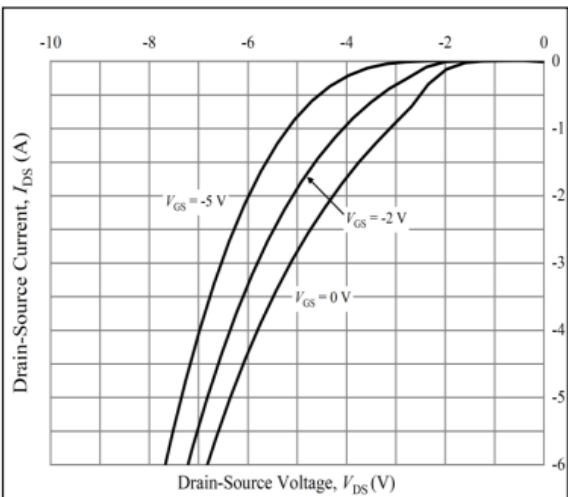


Figure 9. Typical Body Diode Characteristics at $T_J = 25\text{ }^\circ\text{C}$

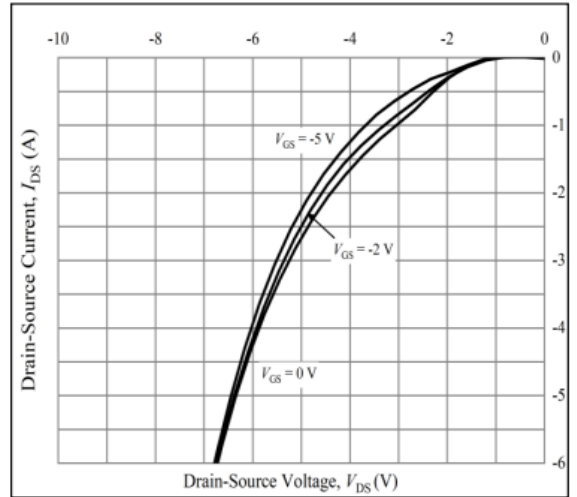


Figure 10. Typical Body Diode Characteristics at $T_J = 175\text{ }^\circ\text{C}$

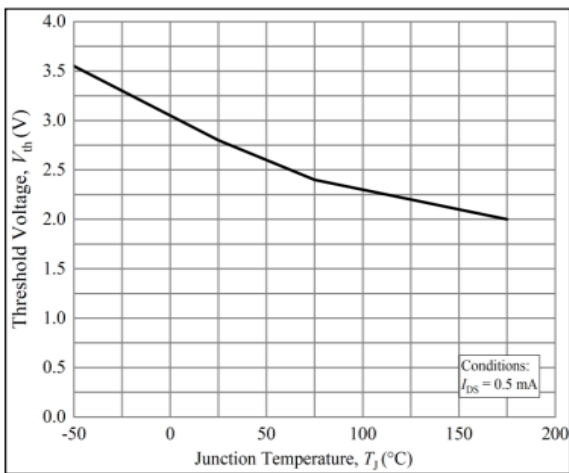


Figure 11. Typical Threshold Voltage vs. Temperature

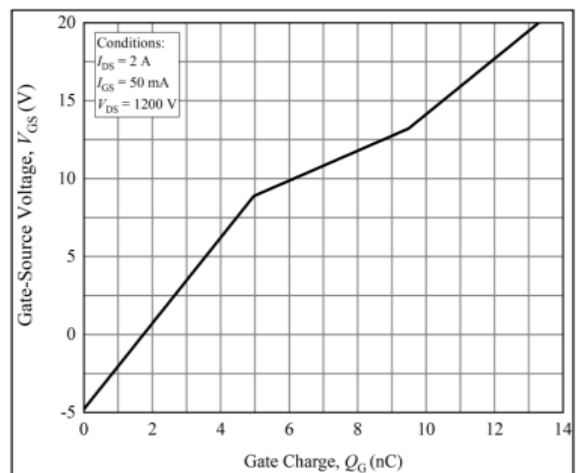


Figure 12. Typical Gate Charge Characteristics at $T_J = 25\text{ }^\circ\text{C}$

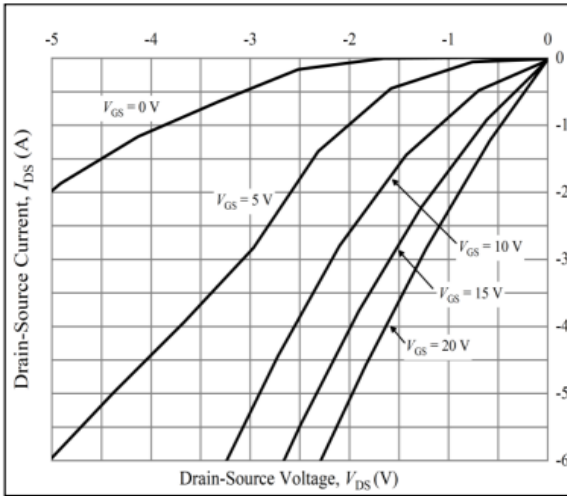


Figure 13. Typical 3rd Quadrant Characteristics at $T_J = -55\text{ }^\circ\text{C}$

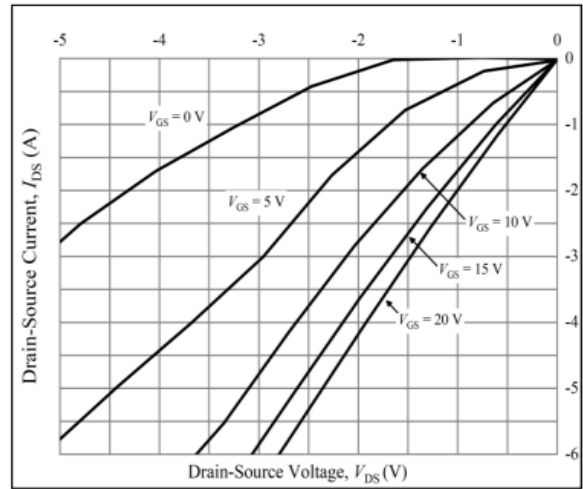


Figure 14. Typical 3rd Quadrant Characteristics at $T_J = 25\text{ }^\circ\text{C}$

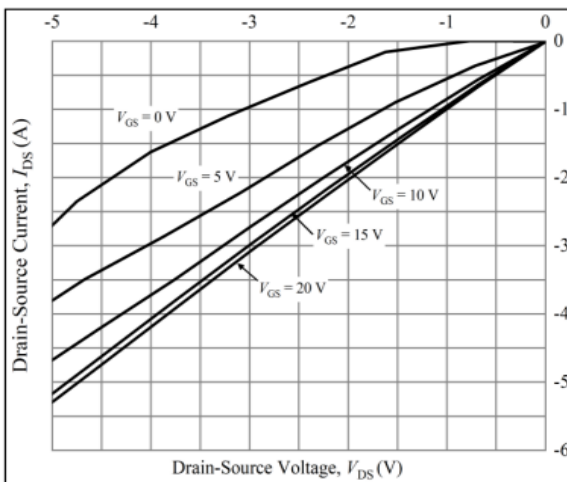


Figure 15. Typical 3rd Quadrant Characteristics at $T_J = 175\text{ }^\circ\text{C}$

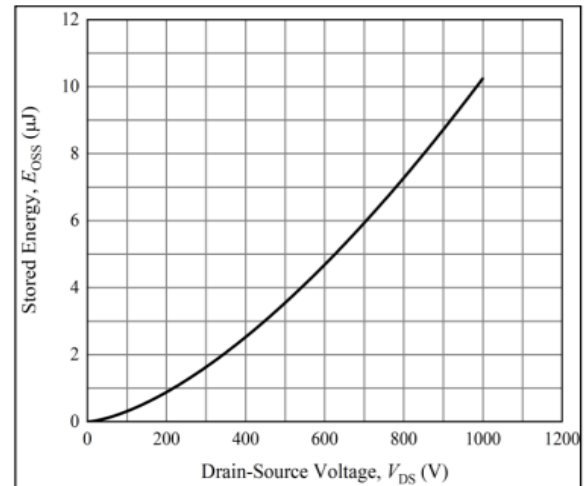


Figure 16. Typical Output Capacitor Stored Energy

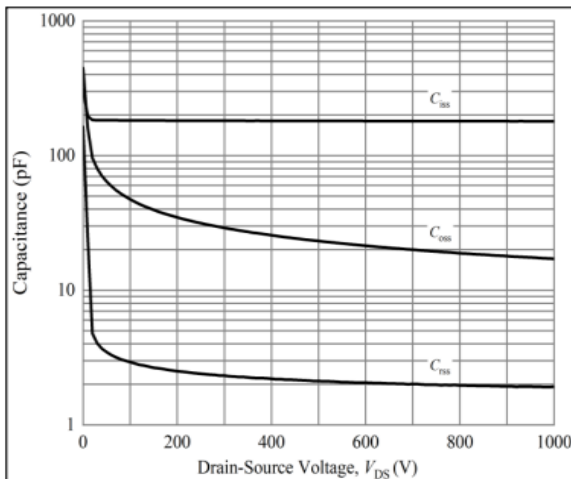


Figure 17. Typical Capacitances vs. Drain-Source Voltage

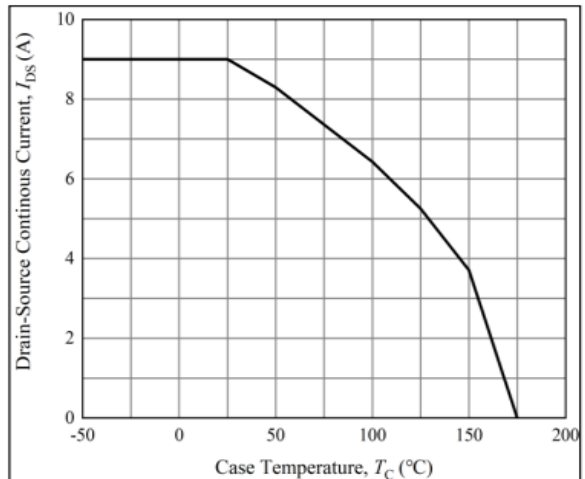


Figure 18. Continuous I_{DS} Current Derating Curve

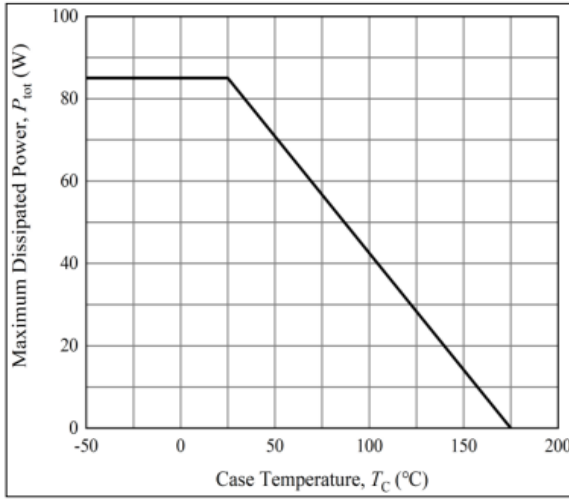


Figure 19. Power Dissipation Derating Curve

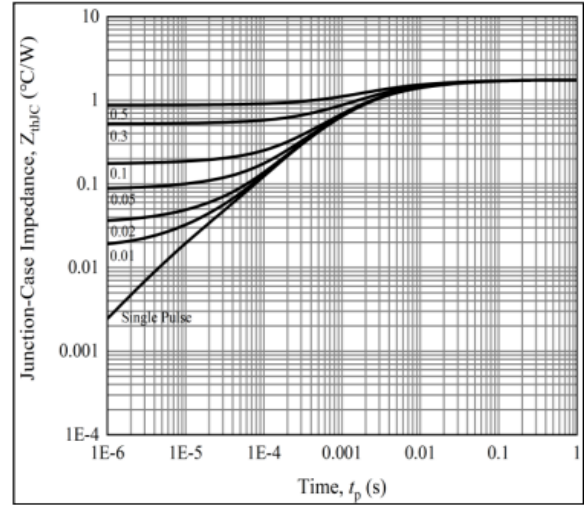


Figure 20. Typical Transient Thermal Impedance (Junction – Case) with Duty Cycle

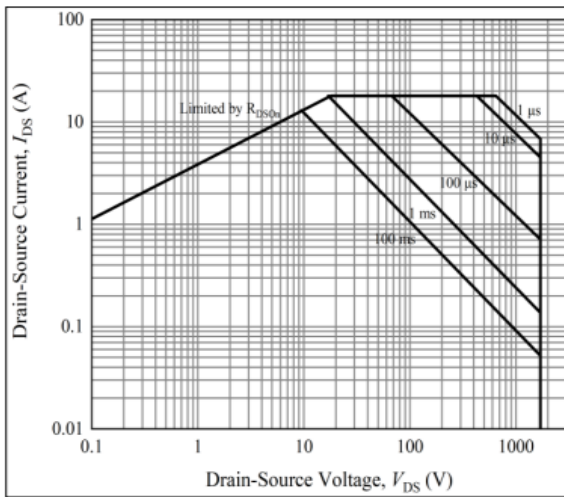


Figure 21. Safe Operate Area

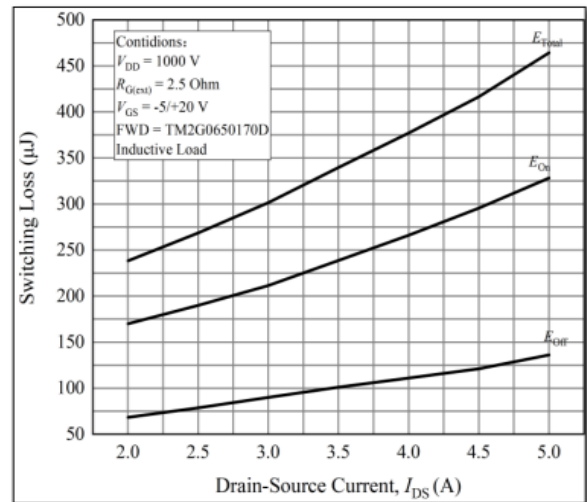


Figure 22. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 1000\text{ V}$)

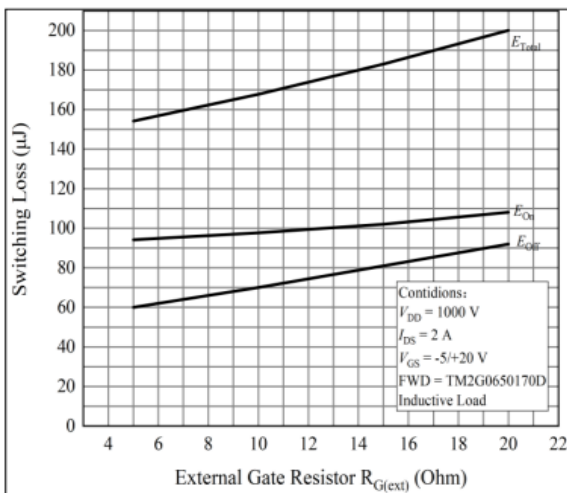


Figure 23. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

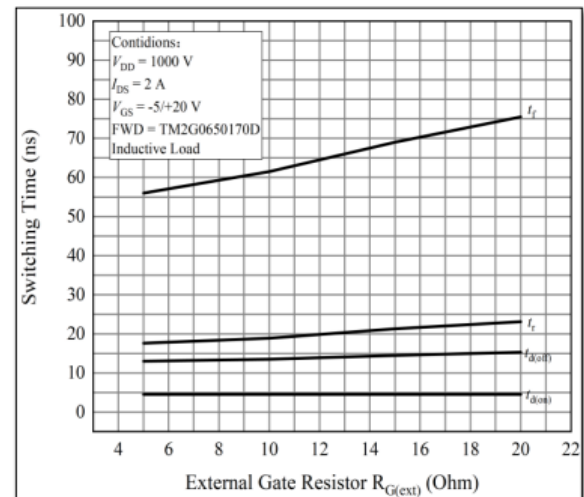
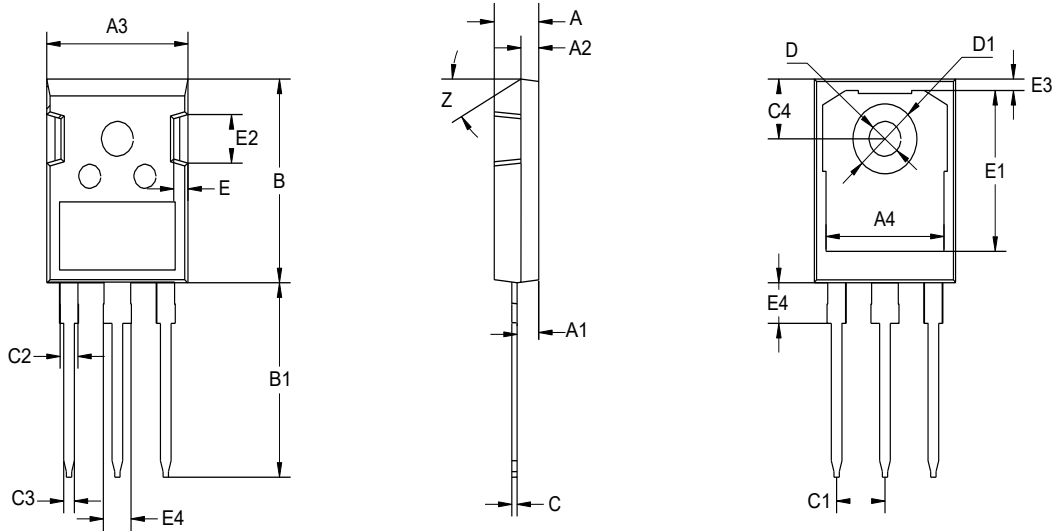


Figure 24. Switching Times vs. $R_{G(ext)}$

Package Outline Dimensions (Unit: millimeters)

TO-247AD



| TO-247AD | | | | | | | |
|----------|-------|-------|-------|----|------|-------|------|
| | Min. | Nom. | Max. | | Min. | Nom. | Max. |
| A | 4.7 | 5 | 5.2 | C3 | 1.1 | 1.2 | 1.3 |
| A1 | 2.3 | | 2.5 | C4 | 6.04 | 6.15 | 6.30 |
| A2 | 1.9 | 2 | 2.1 | D | 3.5 | 3.6 | 3.7 |
| A3 | 15.48 | 15.88 | 16.28 | D1 | 7 | 7.19 | 7.4 |
| A4 | 13.06 | 13.26 | 13.56 | E | 1.5 | 1.6 | 1.7 |
| B | 20.8 | 20.95 | 21.1 | E1 | | 16.55 | |
| B1 | 19.8 | 20 | 20.32 | E2 | 4.9 | 5.0 | 5.1 |
| C | 0.5 | 0.6 | 0.7 | E3 | 0.95 | 1.17 | 1.35 |
| C1 | 5.34 | 5.44 | 5.54 | E4 | | 4.17 | 4.5 |
| C2 | | 2 | | Z | | 30° | |

Revision History

| Document Version | Date of release | Description of changes |
|------------------|-----------------|------------------------|
| Rev.A | 2022.10.20 | Preliminary Datasheet |
| | | |
| | | |

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