

IV2Q171R0T3 – 1700V 1000mΩ SiC MOSFET

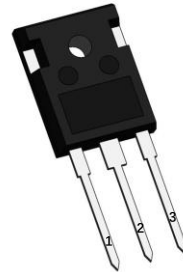
Features

- 2nd Generation SiC MOSFET Technology with +15~+18V gate drive
- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- 175°C operating junction temperature capability
- Ultra fast and robust intrinsic body diode

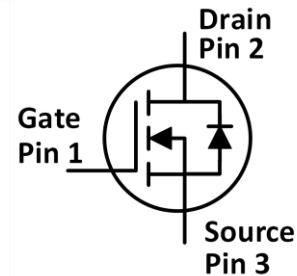
Applications

- Solar inverters
- Auxiliary power supplies
- Switch mode power supplies
- Smart meters

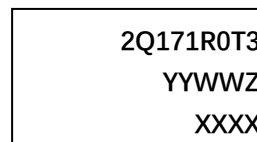
Outline:



TO247-3



Marking Diagram:



2Q171R0T3 = Specific Device Code
 YY = Year
 WW = Work Week
 Z = Assembly Location
 XXXX = Lot Traceability

Absolute Maximum Ratings (T_c=25°C unless otherwise specified)

| Symbol | Parameter | Value | Unit | Test Conditions | Note |
|-----------------------------------|--------------------------------|------------|------|--|-------------|
| V _{DS} | Drain-Source voltage | 1700 | V | V _{GS} =0V, I _D =100μA | |
| V _{GSmax} (Transient) | Maximum spike voltage | -10 to 23 | V | Duty cycle <1%, and pulse width<200ns | |
| V _{GSon} | Recommended turn-on voltage | 15 to 18 | V | | |
| V _{GSoff} | Recommended turn-off voltage | -5 to -2 | V | Typical value -3.5V | |
| I _D | Drain current (continuous) | 6.7 | A | V _{GS} =18V, T _c =25°C | Fig. 23 |
| | | 5.2 | A | V _{GS} =18V, T _c =100°C | |
| I _{DM} | Drain current (pulsed) | 16.7 | A | Pulse width limited by SOA and dynamic R _{θ(j-c)} | Fig. 25, 26 |
| I _{SM} | Body diode current (pulsed) | 16.7 | A | Pulse width limited by SOA and dynamic R _{θ(j-c)} | Fig. 25, 26 |
| P _{TOT} | Total power dissipation | 86 | W | T _c =25°C | Fig. 24 |
| T _{stg} | Storage temperature range | -55 to 175 | °C | | |
| T _J | Operating junction temperature | -55 to 175 | °C | | |
| T _L | Solder Temperature | 260 | °C | wave soldering only allowed at leads, 1.6mm from case for 10 s | |

Thermal Data

| Symbol | Parameter | Value | Unit | Note |
|---------------------|--|-------|------|---------|
| R _{θ(j-c)} | Thermal Resistance from Junction to Case | 1.73 | °C/W | Fig. 25 |

Electrical Characteristics ($T_c=25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Value | | | Unit | Test Conditions | Note |
|---------------------|-----------------------------------|-------|-------|------------------|---------------------------|---|-----------------|
| | | Min. | Typ. | Max. | | | |
| I_{DSS} | Zero gate voltage drain current | | 1 | 10 | μA | $V_{DS}=1700\text{V}, V_{GS}=0\text{V}$ | |
| I_{GSS} | Gate leakage current | | | ± 100 | nA | $V_{DS}=0\text{V}, V_{GS}=-5\sim 20\text{V}$ | |
| V_{TH} | Gate threshold voltage | 1.8 | 3.0 | 4.5 | V | $V_{GS}=V_{DS}, I_D=380\mu\text{A}$ | Fig. 8, 9 |
| | | | 2.0 | | V | $V_{GS}=V_{DS}, I_D=380\mu\text{A}$ @ $T_J=175^\circ\text{C}$ | |
| R_{ON} | Static drain-source on-resistance | | 700 | 910 | $\text{m}\Omega$ | $V_{GS}=18\text{V}, I_D=1\text{A}$ @ $T_J=25^\circ\text{C}$ | Fig. 4, 5, 6, 7 |
| | | | 1280 | | $\text{m}\Omega$ | @ $T_J=175^\circ\text{C}$ | |
| | | | 950 | 1250 | $\text{m}\Omega$ | $V_{GS}=15\text{V}, I_D=1\text{A}$ @ $T_J=25^\circ\text{C}$ | |
| | | 1450 | | $\text{m}\Omega$ | @ $T_J=175^\circ\text{C}$ | | |
| C_{ISS} | Input capacitance | | 285 | | pF | $V_{DS}=1000\text{V}, V_{GS}=0\text{V},$ $f=1\text{MHz}, V_{AC}=25\text{mV}$ | Fig. 16 |
| C_{OSS} | Output capacitance | | 15.3 | | pF | | |
| C_{RSS} | Reverse transfer capacitance | | 2.2 | | pF | | |
| E_{OSS} | C_{OSS} stored energy | | 11 | | μJ | | |
| Q_g | Total gate charge | | 16.5 | | nC | $V_{DS}=1000\text{V}, I_D=1\text{A},$ $V_{GS}=-5\text{ to }18\text{V}$ | Fig. 18 |
| Q_{gs} | Gate-source charge | | 2.7 | | nC | | |
| Q_{gd} | Gate-drain charge | | 12.5 | | nC | | |
| R_g | Gate input resistance | | 18 | | Ω | $f=1\text{MHz}$ | |
| E_{ON} | Turn-on switching energy | | 73.9 | | μJ | $V_{DS}=1000\text{V}, I_D=2\text{A},$ $V_{GS}=-3.5\text{V to }18\text{V},$ $R_{G(\text{ext})}=10\Omega, L=1880\mu\text{H}$ $T_J=25^\circ\text{C}$ | Fig. 19, 20 |
| E_{OFF} | Turn-off switching energy | | 20.4 | | μJ | | |
| $t_{d(\text{on})}$ | Turn-on delay time | | 6.2 | | ns | | |
| t_r | Rise time | | 13.7 | | | | |
| $t_{d(\text{off})}$ | Turn-off delay time | | 9.4 | | | | |
| t_f | Fall time | | 45.4 | | | | |
| E_{ON} | Turn-on switching energy | | 104.7 | | μJ | $V_{DS}=1000\text{V}, I_D=2\text{A},$ $V_{GS}=-3.5\text{V to }18\text{V},$ $R_{G(\text{ext})}=10\Omega, L=1880\mu\text{H}$ $T_J=175^\circ\text{C}$ | Fig. 22 |
| E_{OFF} | Turn-off switching energy | | 34.3 | | μJ | | |

Reverse Diode Characteristics ($T_c=25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Value | | | Unit | Test Conditions | Note |
|-----------|------------------------------------|-------|------|------|------|--|-----------------|
| | | Min. | Typ. | Max. | | | |
| V_{SD} | Diode forward voltage | | 4.0 | | V | $I_{SD}=1\text{A}, V_{GS}=0\text{V}$ | Fig. 10, 11, 12 |
| | | | 3.8 | | V | $I_{SD}=1\text{A}, V_{GS}=0\text{V}, T_J=175^\circ\text{C}$ | |
| I_S | Diode forward current (continuous) | | | 13.5 | A | $V_{GS}=-2\text{V}, T_c=25^\circ\text{C}$ | |
| | | | | 8.0 | A | $V_{GS}=-2\text{V}, T_c=100^\circ\text{C}$ | |
| t_{rr} | Reverse recovery time | | 33.5 | | ns | $V_{GS}=-3.5\text{V}/+18\text{V}, I_{SD}=2\text{A}, V_R=1000\text{V}, R_{G(\text{ext})}=30\Omega, L=1880\mu\text{H}, di/dt=1000\text{A}/\mu\text{s}$ | |
| Q_{rr} | Reverse recovery charge | | 56.1 | | nC | | |
| I_{RRM} | Peak reverse recovery current | | 2.4 | | A | | |

Typical Performance (curves)

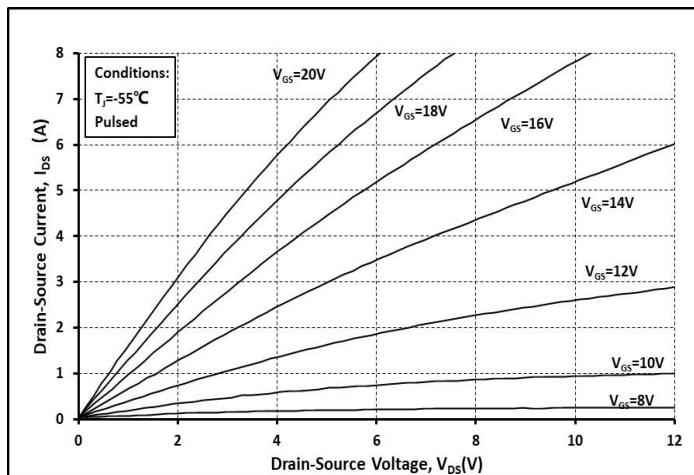


Fig. 1 Output Curve @ $T_J=-55^\circ\text{C}$

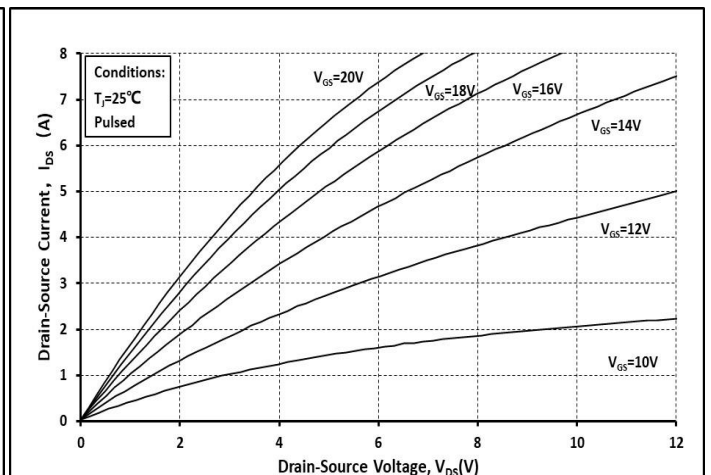


Fig. 2 Output Curve @ $T_J=25^\circ\text{C}$

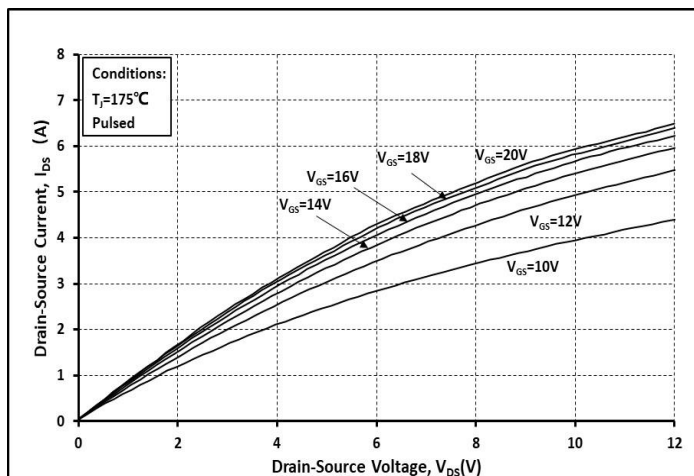


Fig. 3 Output Curve @ $T_J=175^\circ\text{C}$

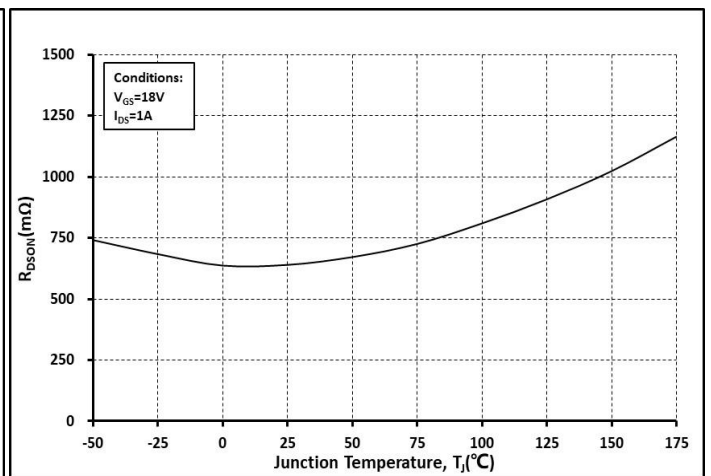


Fig. 4 R_{on} vs. Temperature

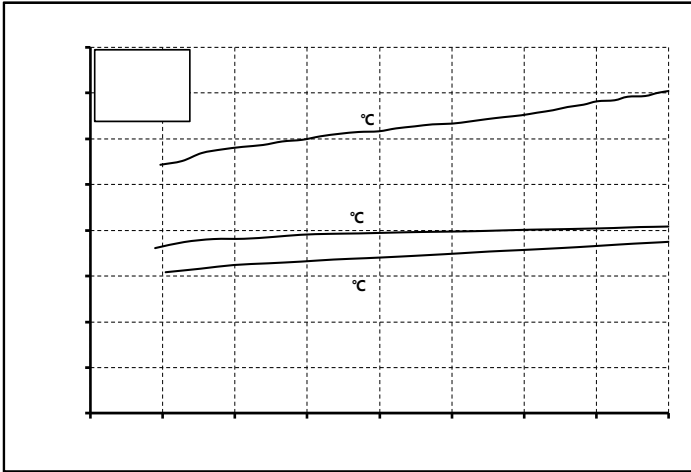


Fig. 5 R_{on} vs. I_{ds} @ Various Temperature

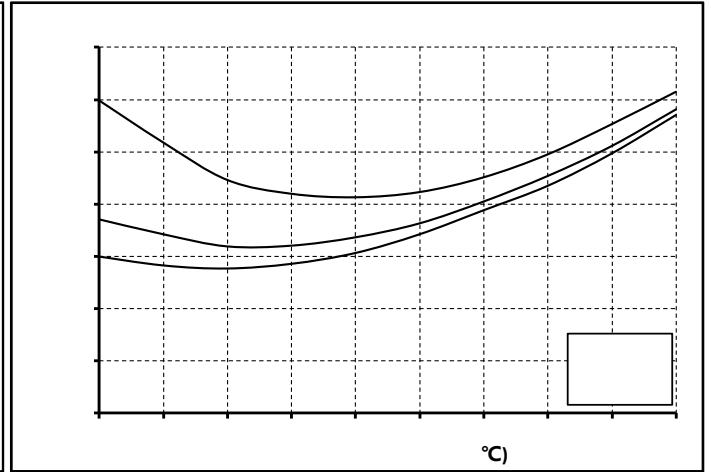


Fig. 6 R_{on} vs. Temperature @ Various V_{gs}

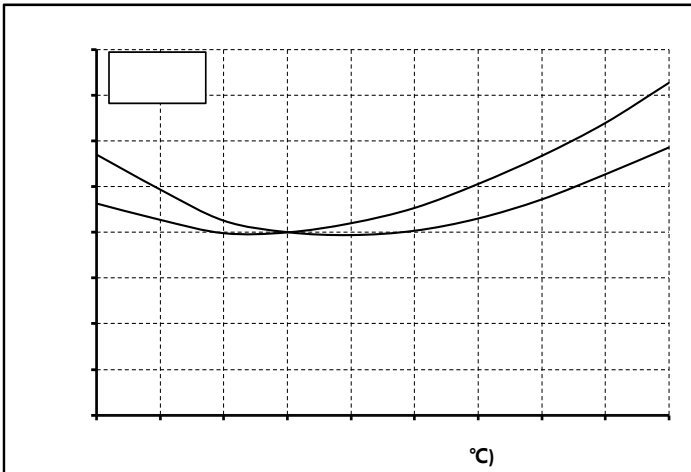


Fig. 7 Normalized R_{on} vs. Temperature

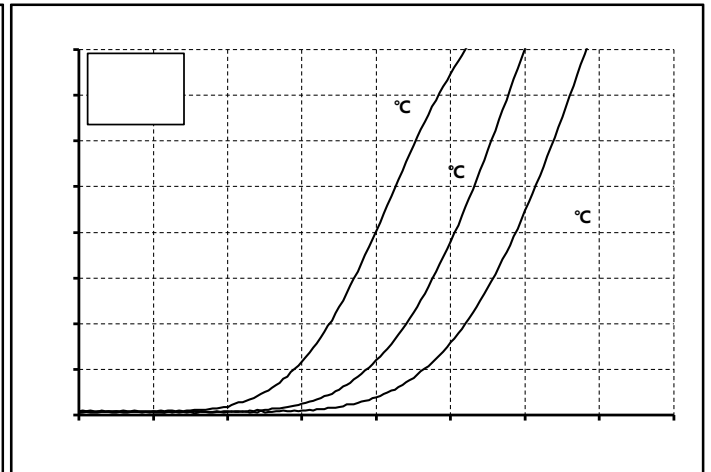


Fig. 8 Transfer Curves @ Various Temperature

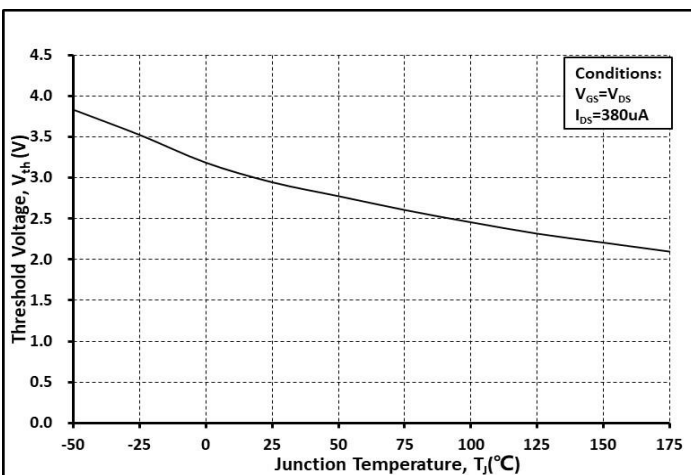


Fig. 9 Threshold Voltage vs. Temperature

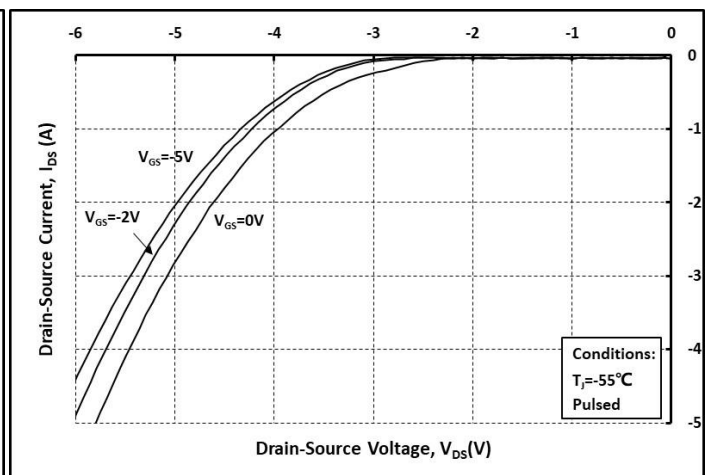


Fig. 10 Body Diode Curves @ $T_j = -55^{\circ}C$

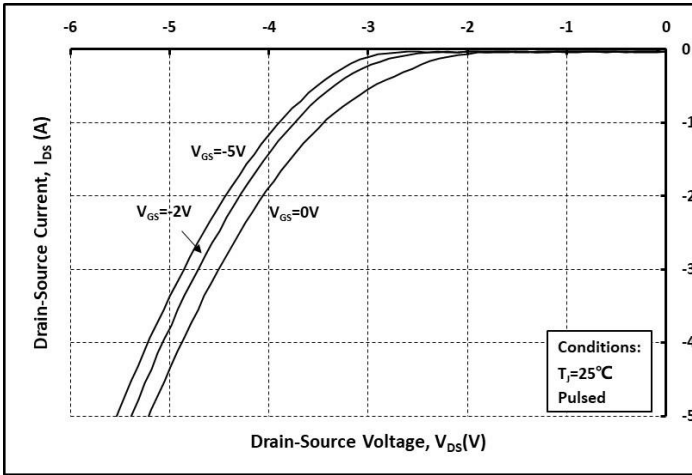


Fig. 11 Body Diode Curves @ $T_j=25^\circ\text{C}$

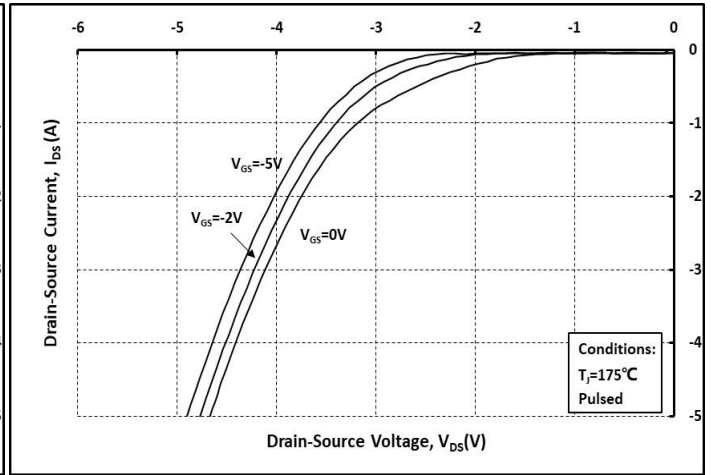


Fig. 12 Body Diode Curves @ $T_j=175^\circ\text{C}$

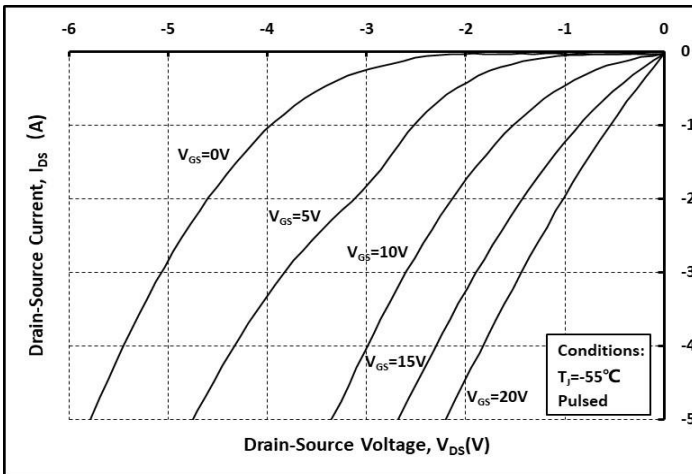


Fig. 13 3rd Quadrant Curves @ $T_j=-55^\circ\text{C}$

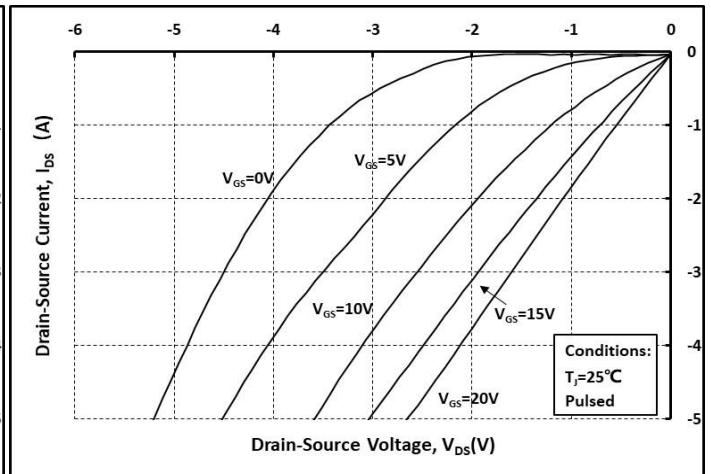


Fig. 14 3rd Quadrant Curves @ $T_j=25^\circ\text{C}$

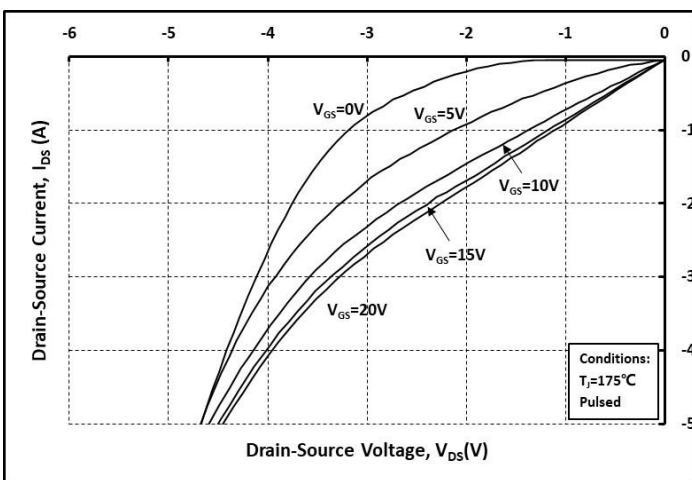


Fig. 15 3rd Quadrant Curves @ $T_j=175^\circ\text{C}$

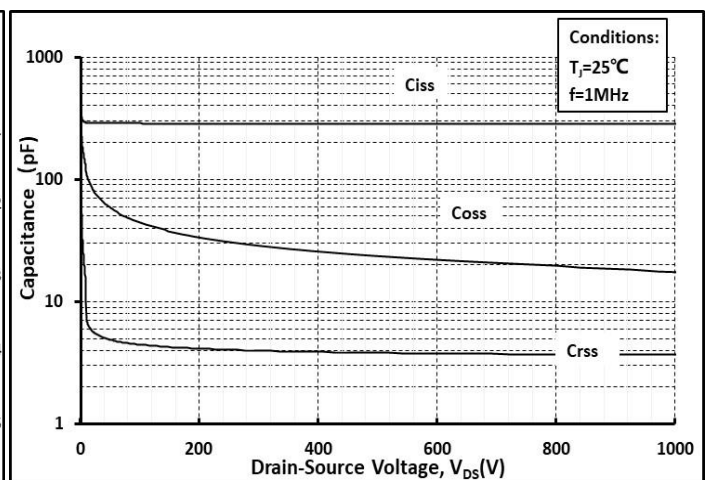


Fig. 16 Capacitance vs. V_{ds}

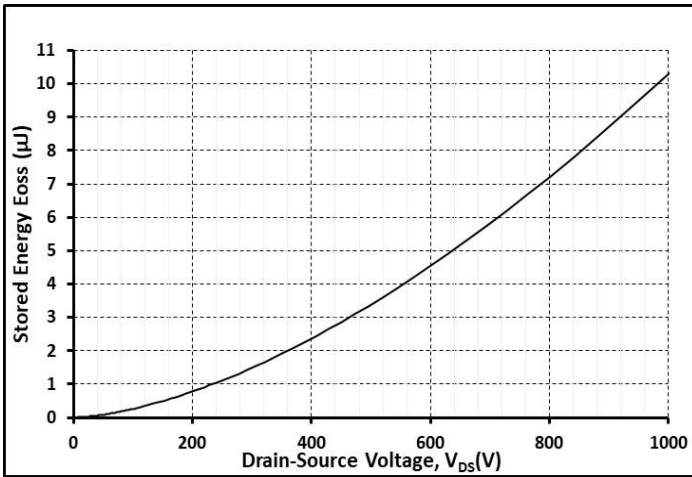


Fig. 17 Output Capacitor Stored Energy

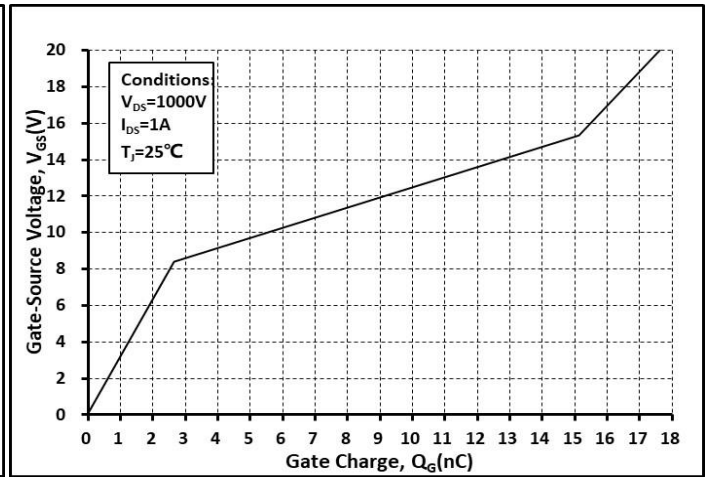


Fig. 18 Gate Charge Characteristics

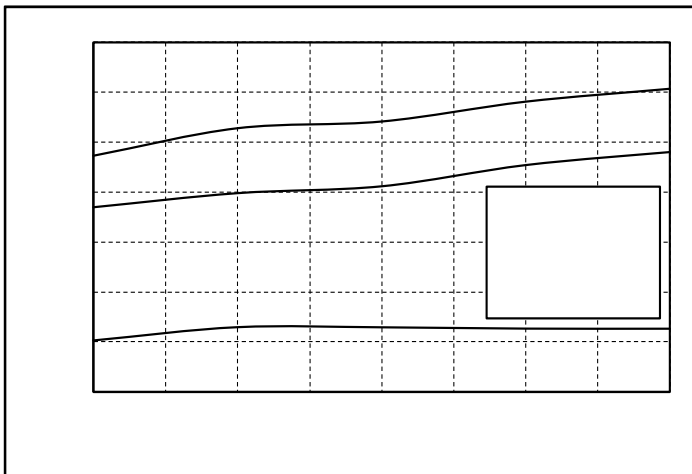


Fig. 19 Switching Energy vs. $R_{G(ext)}$

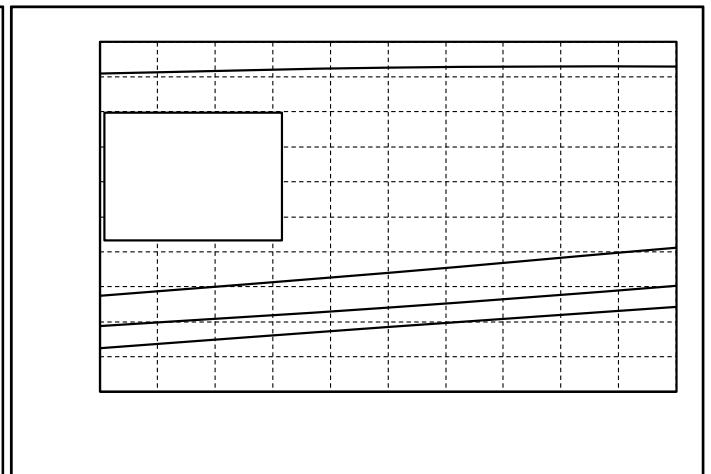


Fig. 20 Switching Times vs. $R_{G(ext)}$

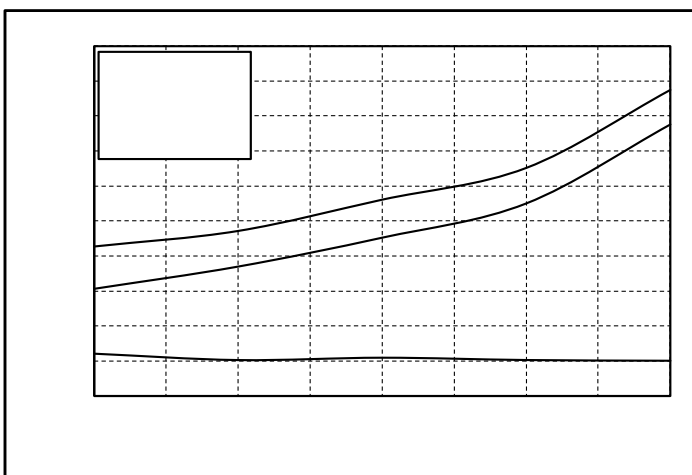


Fig. 21 Switching Energy vs. I_{DS}

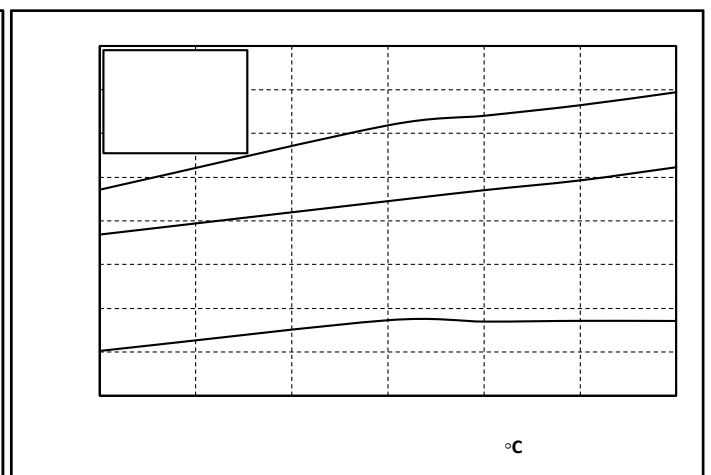


Fig. 22 Switching Energy vs. Temperature

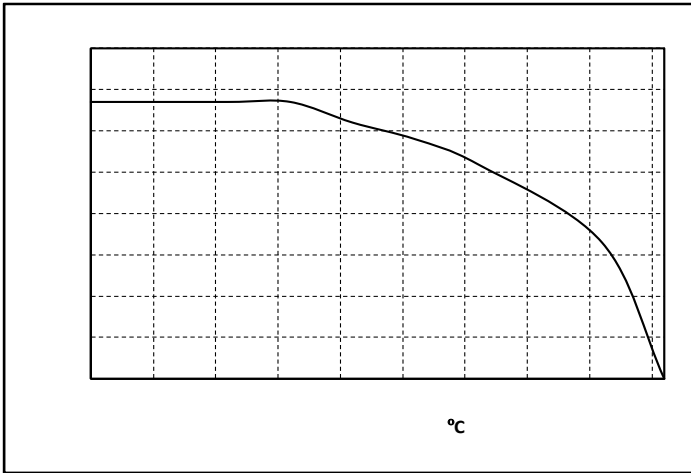


Fig. 21 Continuous Drain Current vs. Case Temperature

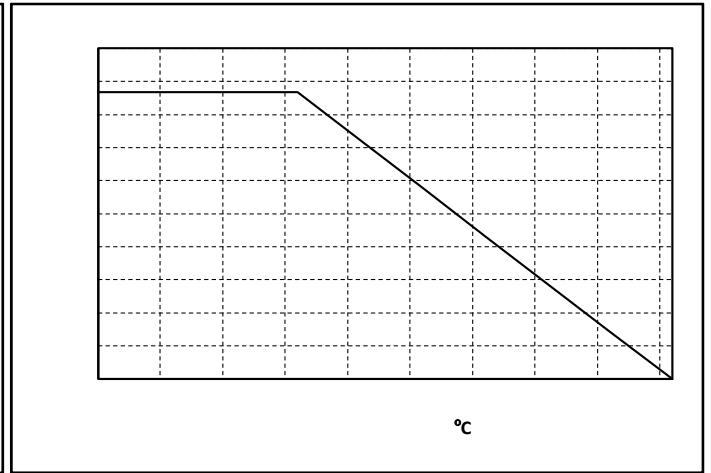


Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

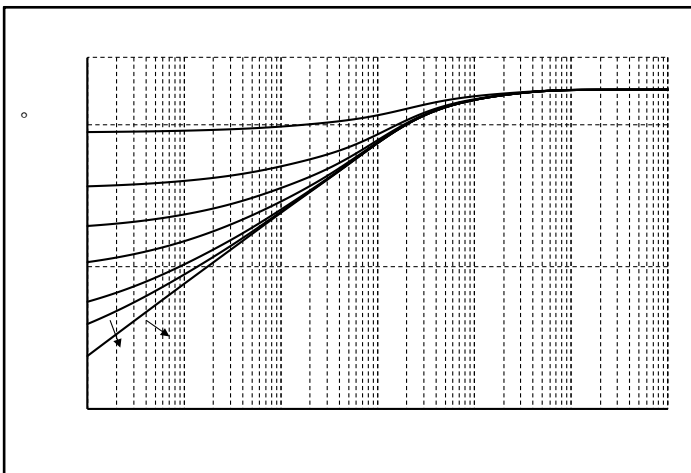


Fig. 23 Thermal Impedance

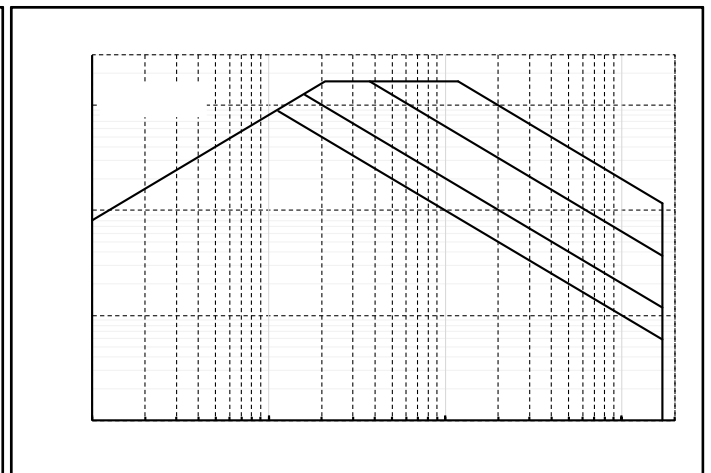
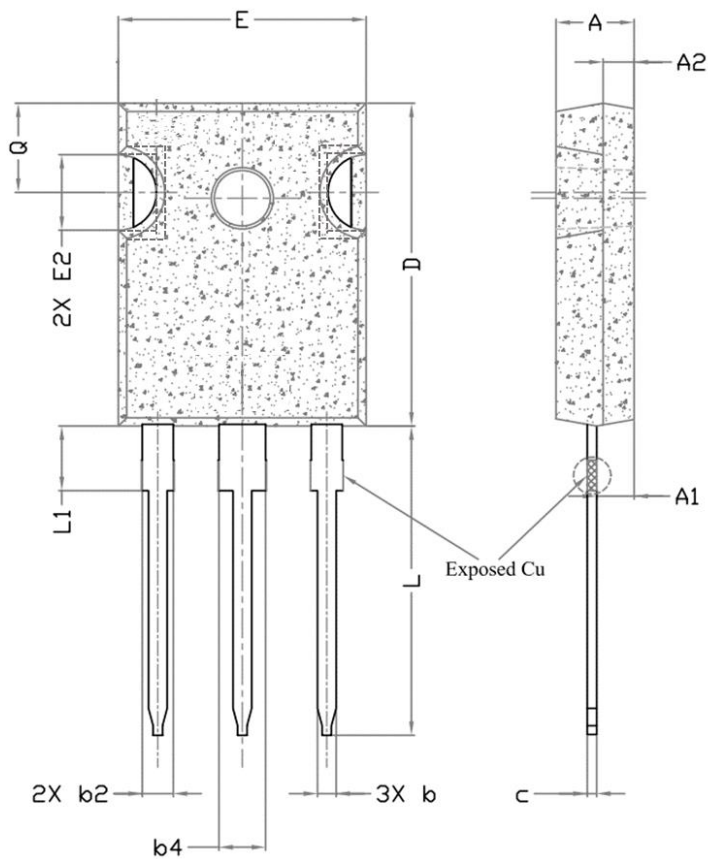
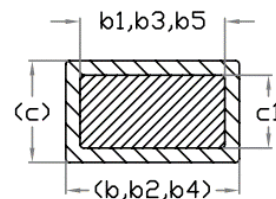
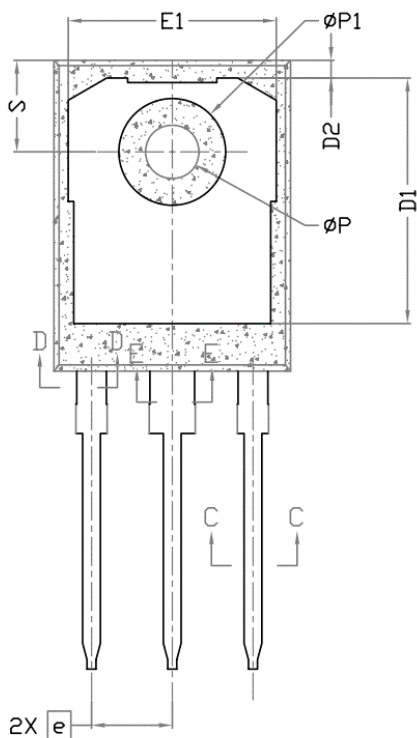


Fig. 24 Safe Operating Area

Package Dimensions



| Dimensions In Millimeters | | |
|---------------------------|----------|-------|
| SYMBOL | MIN. | MAX. |
| A | 4.83 | 5.21 |
| A1 | 2.29 | 2.55 |
| A2 | 1.50 | 2.49 |
| b | 1.07 | 1.33 |
| b1 | 1.07 | 1.28 |
| b2 | 1.91 | 2.41 |
| b3 | 1.91 | 2.34 |
| b4 | 2.87 | 3.38 |
| b5 | 2.87 | 3.18 |
| c | 0.55 | 0.69 |
| c1 | 0.55 | 0.65 |
| D | 20.80 | 21.10 |
| D1 | 16.25 | 17.65 |
| D2 | 0.51 | 1.35 |
| E | 15.70 | 16.13 |
| E1 | 13.10 | 14.16 |
| E2 | 3.68 | 5.49 |
| e | 5.44 BSC | |
| L | 19.80 | 20.32 |
| L1 | 3.95 | 4.40 |
| φP | 3.50 | 3.70 |
| φP1 | 7.00 | 7.40 |
| Q | 5.39 | 6.20 |
| S | 6.04 | 6.30 |



Section C--C, D--D, E--E

Note:

1. Package Reference: JEDEC TO247, Variation AD
2. All Dimensions are in mm
3. Slot Required, Notch May Be Rounded or Rectangular
4. Dimension D&E Do Not Include Mold Flash
5. Subject to Change Without Notice