

## Features

- 1) Low on-resistance
- 2) Fast switching speed
- 3) Fast reverse recovery
- 4) Easy to parallel
- 5) Simple to drive
- 6) Pb-free lead plating ; RoHS compliant

| Parameter    | Rating      | Units      |
|--------------|-------------|------------|
| $V_{DS}$     | <b>1200</b> | V          |
| $I_D$ @ 25°C | <b>102</b>  | A          |
| $R_{DS(on)}$ | <b>21</b>   | m $\Omega$ |



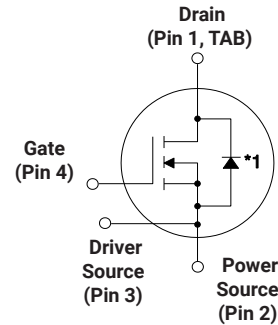
## Applications

- Solar inverters
- DC/DC converters
- Switch mode power supplies
- Induction heating



Inner circuit

TO-247-4  
Package



- (1) Drain
- (2) Power Source
- (3) Driver Source
- (4) Gate

\*1 Body Diode

## Maximum Ratings ( $T_C = 25^\circ\text{C}$ unless otherwise specified)

| Symbol         | Parameter                                  | Value       | Unit             | Test Conditions                                     | Note |
|----------------|--------------------------------------------|-------------|------------------|-----------------------------------------------------|------|
| $V_{DSmax}$    | Drain - Source Voltage                     | 1200        | V                | $V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$ |      |
| $V_{GSmax}$    | Gate - Source Voltage (dynamic)            | -8/+19      | V                | AC ( $f > 1\text{ Hz}$ )                            |      |
| $V_{GSop}$     | Gate - Source Voltage (static)             | -4/+15      | V                | Static                                              |      |
| $I_D$          | Continuous Drain Current                   | 102         | A                | $V_{GS} = 15\text{ V}, T_C = 25^\circ\text{C}$      |      |
|                |                                            | 74          |                  | $V_{GS} = 15\text{ V}, T_C = 100^\circ\text{C}$     |      |
| $I_{D(pulse)}$ | Pulsed Drain Current                       | 200         | A                | Pulse width $t_p$ limited by $T_{jmax}$             |      |
| $P_D$          | Power Dissipation                          | 469         | W                | $T_C = 25^\circ\text{C}, T_J = 175^\circ\text{C}$   |      |
| $T_J, T_{stg}$ | Operating Junction and Storage Temperature | -40 to +175 | $^\circ\text{C}$ |                                                     |      |
| $T_L$          | Solder Temperature                         | 260         | $^\circ\text{C}$ | 1.6mm (0.063") from case for 10s                    |      |

Note (1): When using MOSFET Body Diode  $V_{GSmax} = -4\text{V}/+19\text{V}$

Note (2): MOSFET can also safely operate at 0/+15 V



### Electrical Characteristics (T<sub>c</sub> = 25°C unless otherwise specified)

| Symbol               | Parameter                                  | Min. | Typ. | Max. | Unit | Test Conditions                                                                                                                                 | Note |
|----------------------|--------------------------------------------|------|------|------|------|-------------------------------------------------------------------------------------------------------------------------------------------------|------|
| V <sub>(BR)DSS</sub> | Drain-Source Breakdown Voltage             | 1200 |      |      | V    | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 100 μA                                                                                                  |      |
| V <sub>GS(th)</sub>  | Gate Threshold Voltage                     | 1.8  | 2.5  | 3.6  | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 17.7 mA                                                                                    |      |
|                      |                                            |      | 2.0  |      | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 17.7 mA, T <sub>J</sub> = 175°C                                                            |      |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current            |      | 1    | 50   | μA   | V <sub>DS</sub> = 1200 V, V <sub>GS</sub> = 0 V                                                                                                 |      |
| I <sub>GSS</sub>     | Gate-Source Leakage Current                |      | 10   | 250  | nA   | V <sub>GS</sub> = 15 V, V <sub>DS</sub> = 0 V                                                                                                   |      |
| R <sub>DS(on)</sub>  | Drain-Source On-State Resistance           |      | 21   | 28.8 | mΩ   | V <sub>GS</sub> = 15 V, I <sub>D</sub> = 50 A                                                                                                   |      |
|                      |                                            |      | 38   |      |      | V <sub>GS</sub> = 15 V, I <sub>D</sub> = 50 A, T <sub>J</sub> = 175°C                                                                           |      |
| g <sub>fs</sub>      | Transconductance                           |      | 35   |      | S    | V <sub>DS</sub> = 20 V, I <sub>DS</sub> = 50 A                                                                                                  |      |
|                      |                                            |      | 33   |      |      | V <sub>DS</sub> = 20 V, I <sub>DS</sub> = 50 A, T <sub>J</sub> = 175°C                                                                          |      |
| C <sub>iss</sub>     | Input Capacitance                          |      | 4763 |      | pF   | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 800 V<br>f = 1 MHz<br>V <sub>AC</sub> = 25 mV                                                          |      |
| C <sub>oss</sub>     | Output Capacitance                         |      | 180  |      |      |                                                                                                                                                 |      |
| C <sub>rss</sub>     | Reverse Transfer Capacitance               |      | 12   |      |      |                                                                                                                                                 |      |
| E <sub>oss</sub>     | C <sub>oss</sub> Stored Energy             |      | 99   |      |      |                                                                                                                                                 |      |
| E <sub>ON</sub>      | Turn-On Switching Energy (SiC Diode FWD)   |      | 0.69 |      | mJ   | V <sub>DS</sub> = 800 V, V <sub>GS</sub> = -4 V/+15 V, I <sub>D</sub> = 50 A,<br>R <sub>G(ext)</sub> = 2.5Ω, L = 157 μH, T <sub>J</sub> = 175°C |      |
| E <sub>OFF</sub>     | Turn Off Switching Energy (SiC Diode FWD)  |      | 0.42 |      |      |                                                                                                                                                 |      |
| E <sub>ON</sub>      | Turn-On Switching Energy (Body Diode FWD)  |      | 1.58 |      | mJ   | V <sub>DS</sub> = 800 V, V <sub>GS</sub> = -4 V/+15 V, I <sub>D</sub> = 50 A,<br>R <sub>G(ext)</sub> = 2.5Ω, L = 157 μH, T <sub>J</sub> = 175°C |      |
| E <sub>OFF</sub>     | Turn Off Switching Energy (Body Diode FWD) |      | 0.34 |      |      |                                                                                                                                                 |      |
| t <sub>d(on)</sub>   | Turn-On Delay Time                         |      | 29   |      | ns   | V <sub>DD</sub> = 800 V, V <sub>GS</sub> = -4 V/15 V<br>R <sub>G(ext)</sub> = 2.5 Ω,<br>L = 157 μH                                              |      |
| t <sub>r</sub>       | Rise Time                                  |      | 33   |      |      |                                                                                                                                                 |      |
| t <sub>d(off)</sub>  | Turn-Off Delay Time                        |      | 57   |      |      |                                                                                                                                                 |      |
| t <sub>f</sub>       | Fall Time                                  |      | 14   |      |      |                                                                                                                                                 |      |
| R <sub>G(int)</sub>  | Internal Gate Resistance                   |      | 3.3  |      | Ω    | f = 1 MHz, V <sub>AC</sub> = 25 mV                                                                                                              |      |
| Q <sub>gs</sub>      | Gate to Source Charge                      |      | 49   |      | nC   | V <sub>DS</sub> = 800 V, V <sub>GS</sub> = -4 V/15 V<br>I <sub>D</sub> = 50 A<br>Per IEC60747-8-4 pg 21                                         |      |
| Q <sub>gd</sub>      | Gate to Drain Charge                       |      | 50   |      |      |                                                                                                                                                 |      |
| Q <sub>g</sub>       | Total Gate Charge                          |      | 160  |      |      |                                                                                                                                                 |      |

### Reverse Diode Characteristics (T<sub>c</sub> = 25°C unless otherwise specified)

| Symbol                | Parameter                        | Typ. | Max. | Unit | Test Conditions                                                                                                       | Note |
|-----------------------|----------------------------------|------|------|------|-----------------------------------------------------------------------------------------------------------------------|------|
| V <sub>SD</sub>       | Diode Forward Voltage            | 4.6  |      | V    | V <sub>GS</sub> = -4 V, I <sub>SD</sub> = 25 A, T <sub>J</sub> = 25 °C                                                |      |
|                       |                                  | 4.2  |      | V    | V <sub>GS</sub> = -4 V, I <sub>SD</sub> = 25 A, T <sub>J</sub> = 175 °C                                               |      |
| I <sub>S</sub>        | Continuous Diode Forward Current |      | 90   | A    | V <sub>GS</sub> = -4 V, T <sub>c</sub> = 25°C                                                                         |      |
| I <sub>S, pulse</sub> | Diode pulse Current              |      | 200  | A    | V <sub>GS</sub> = -4 V, pulse width t <sub>p</sub> limited by T <sub>Jmax</sub>                                       |      |
| t <sub>rr</sub>       | Reverse Recover time             | 34   |      | ns   | V <sub>GS</sub> = -4 V, I <sub>SD</sub> = 50 A, V <sub>R</sub> = 800 V<br>dif/dt = 2600 A/μs, T <sub>J</sub> = 175 °C |      |
| Q <sub>rr</sub>       | Reverse Recovery Charge          | 928  |      | nC   |                                                                                                                       |      |
| I <sub>rrm</sub>      | Peak Reverse Recovery Current    | 42   |      | A    |                                                                                                                       |      |

### Thermal Characteristics

| Symbol           | Parameter                                   | Typ. | Unit | Test Conditions | Note |
|------------------|---------------------------------------------|------|------|-----------------|------|
| R <sub>θJC</sub> | Thermal Resistance from Junction to Case    | 0.32 | °C/W |                 |      |
| R <sub>θJA</sub> | Thermal Resistance From Junction to Ambient | 40   |      |                 |      |

## Typical Performance

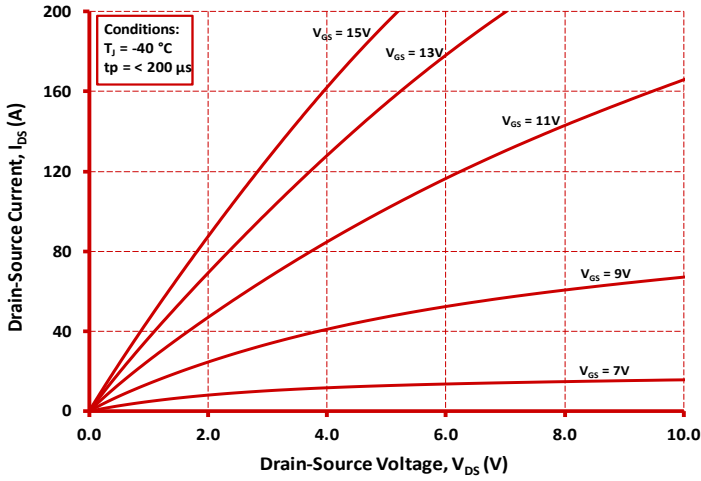


Figure 1. Output Characteristics  $T_j = -40\text{ }^{\circ}\text{C}$

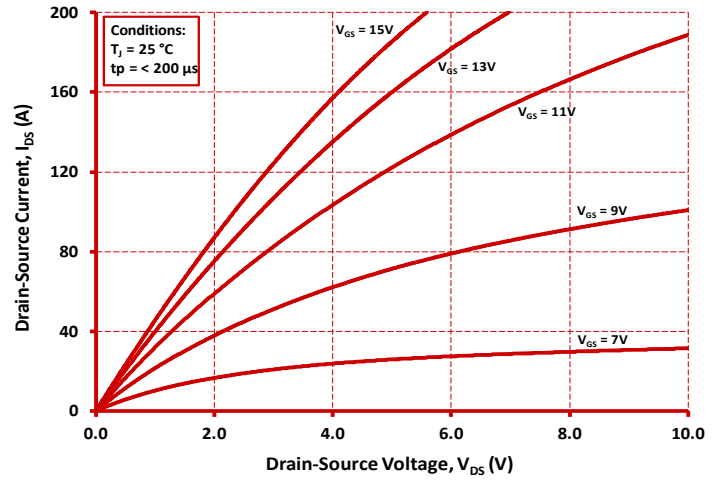


Figure 2. Output Characteristics  $T_j = 25\text{ }^{\circ}\text{C}$

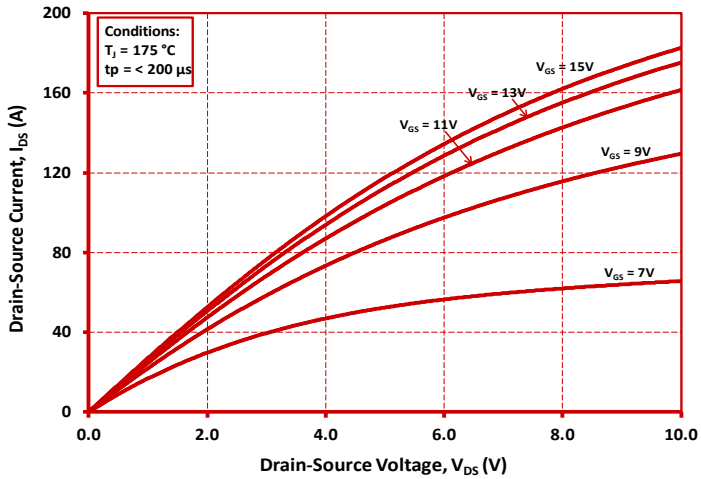


Figure 3. Output Characteristics  $T_j = 175\text{ }^{\circ}\text{C}$

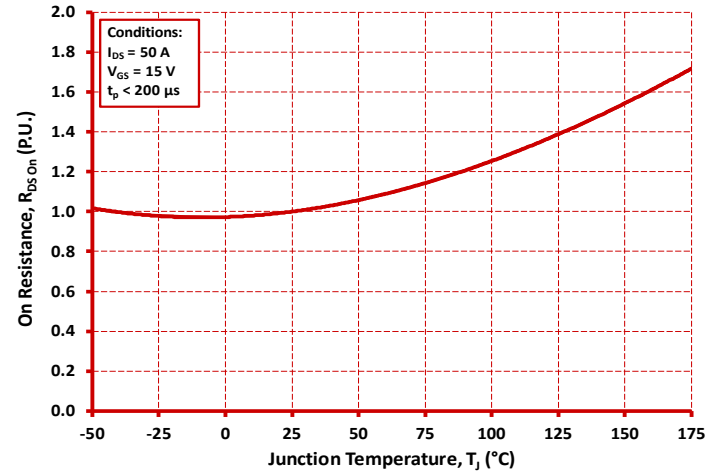


Figure 4. Normalized On-Resistance vs. Temperature

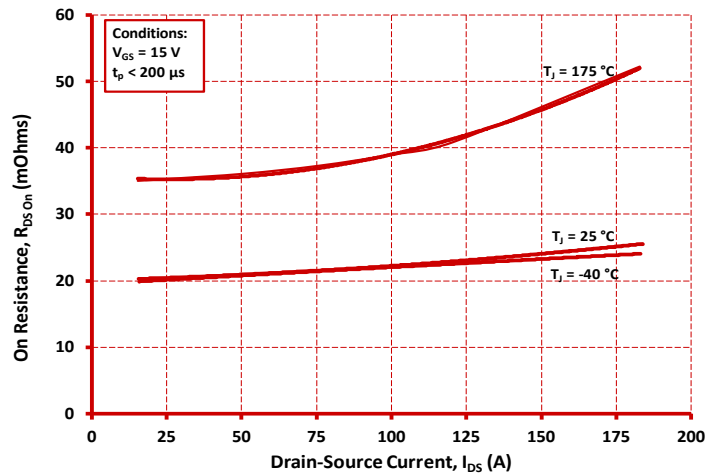


Figure 5. On-Resistance vs. Drain Current  
For Various Temperatures

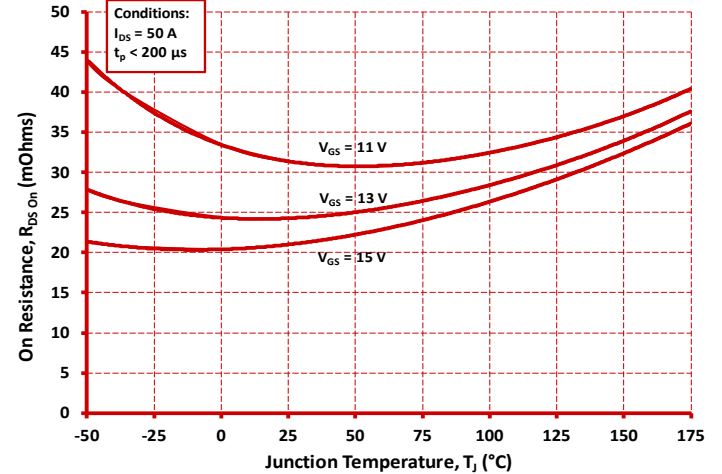


Figure 6. On-Resistance vs. Temperature  
For Various Gate Voltage

## Typical Performance

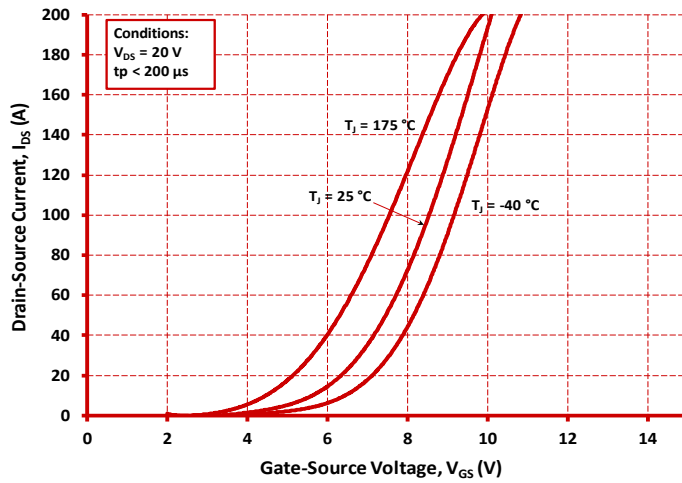


Figure 7. Transfer Characteristic for Various Junction Temperatures

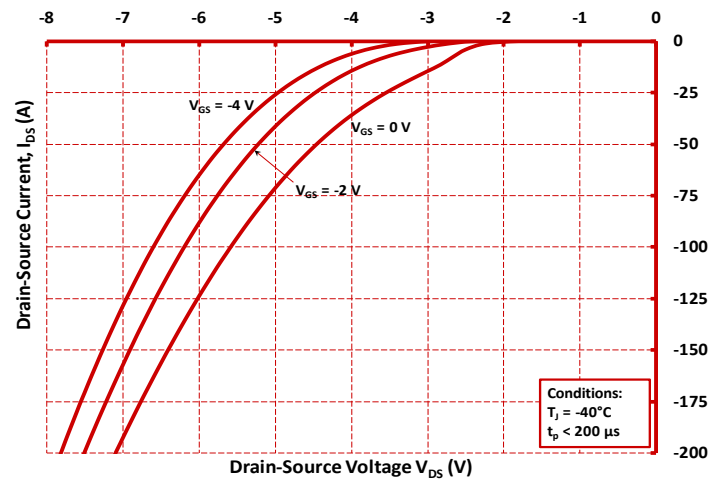


Figure 8. Body Diode Characteristic at -40 °C

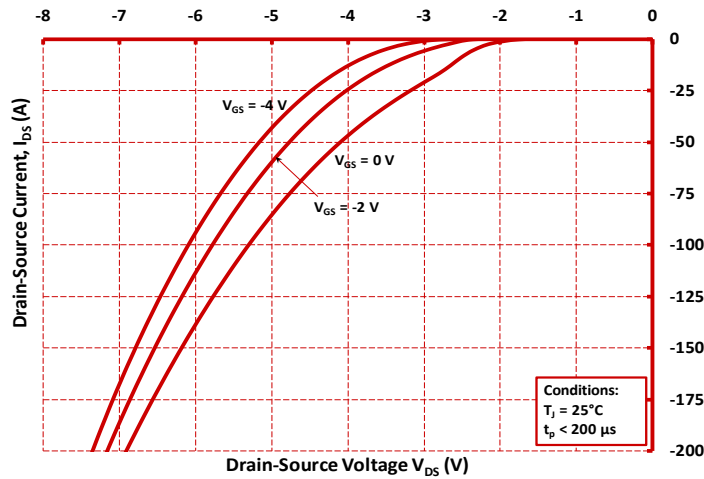


Figure 9. Body Diode Characteristic at 25 °C

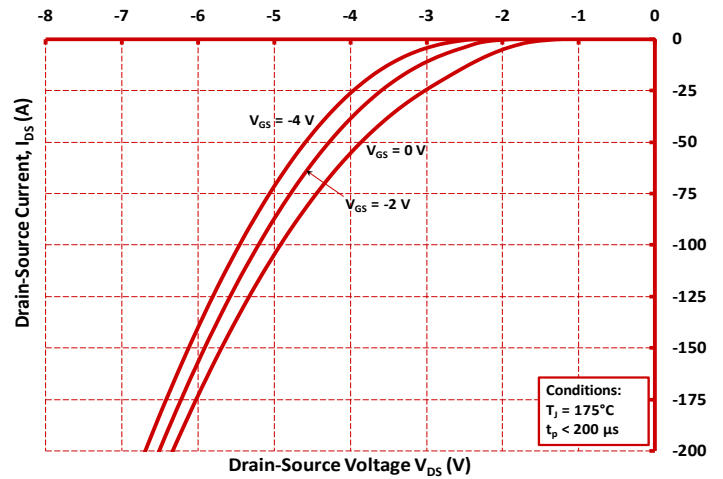


Figure 10. Body Diode Characteristic at 175 °C

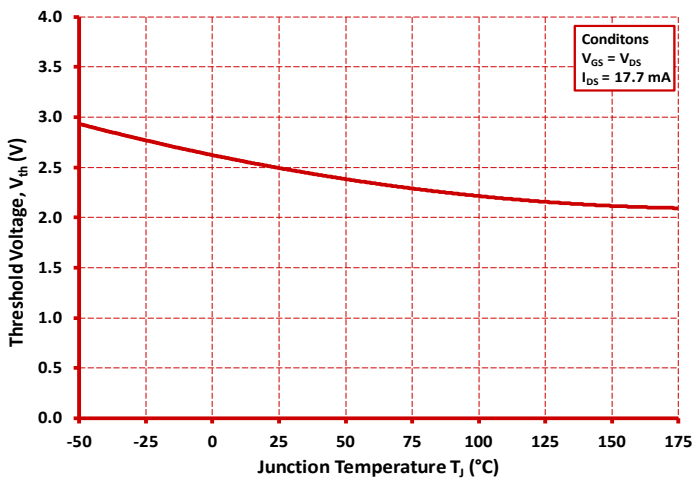


Figure 11. Threshold Voltage vs. Temperature

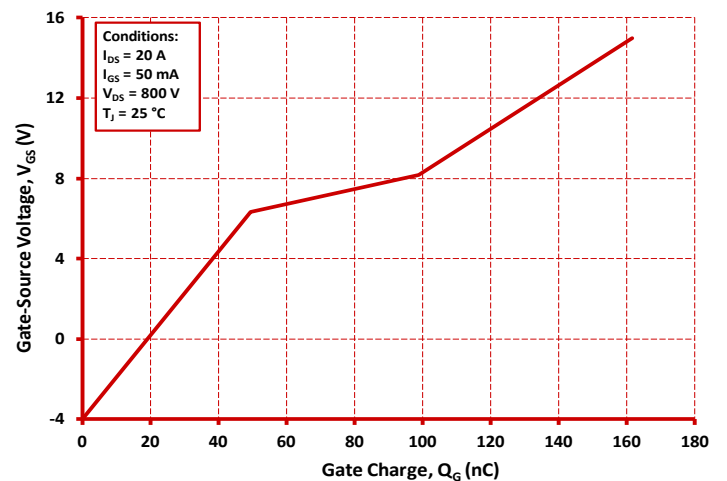


Figure 12. Gate Charge Characteristics

### Typical Performance

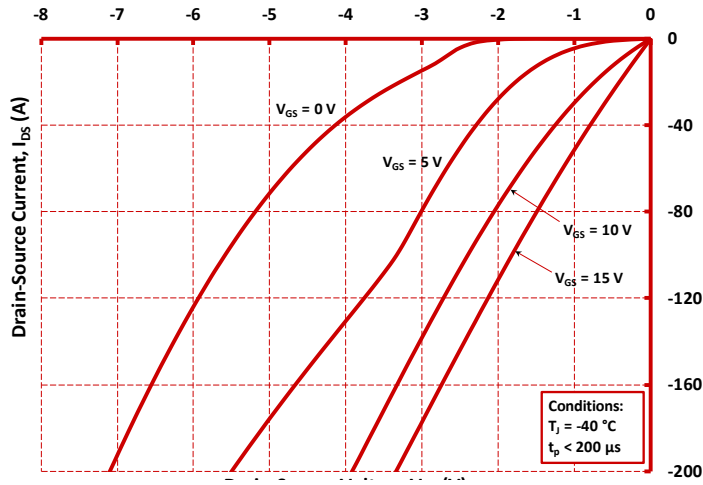


Figure 13. 3rd Quadrant Characteristic at  $-40\text{ }^{\circ}\text{C}$

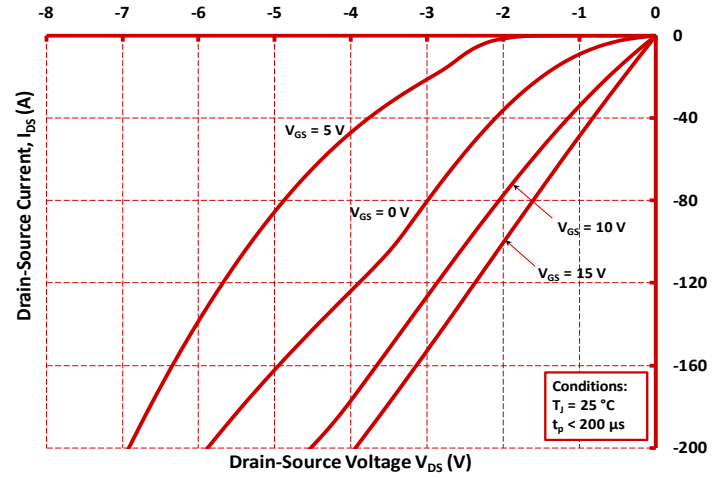


Figure 14. 3rd Quadrant Characteristic at  $25\text{ }^{\circ}\text{C}$

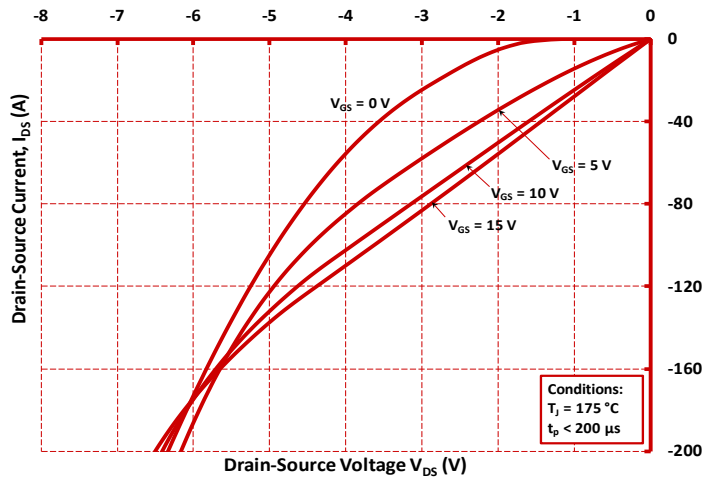


Figure 15. 3rd Quadrant Characteristic at  $175\text{ }^{\circ}\text{C}$

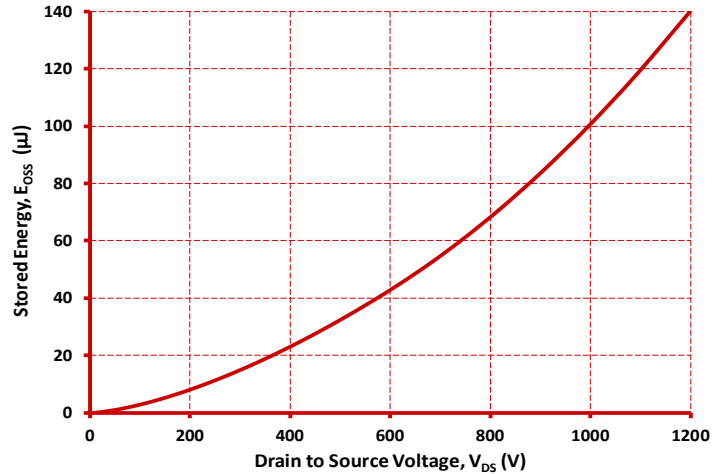


Figure 16. Output Capacitor Stored Energy

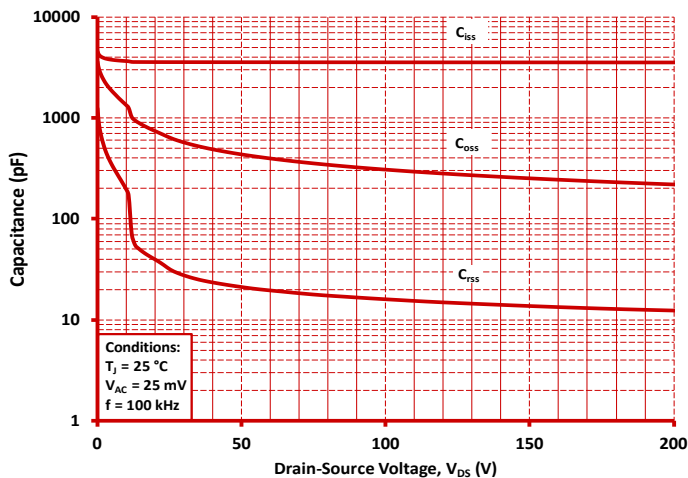


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

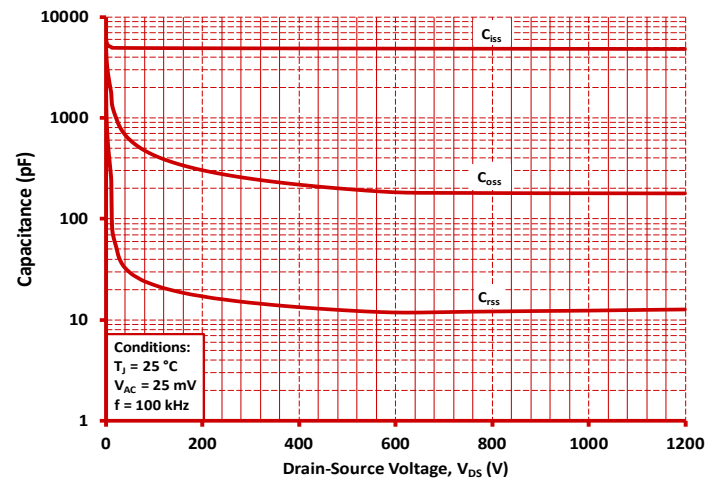


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

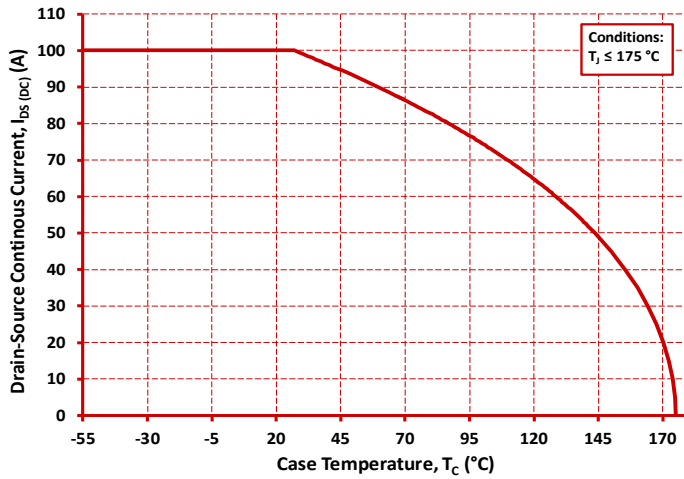
**Typical Performance**


Figure 19. Continuous Drain Current Derating vs. Case Temperature

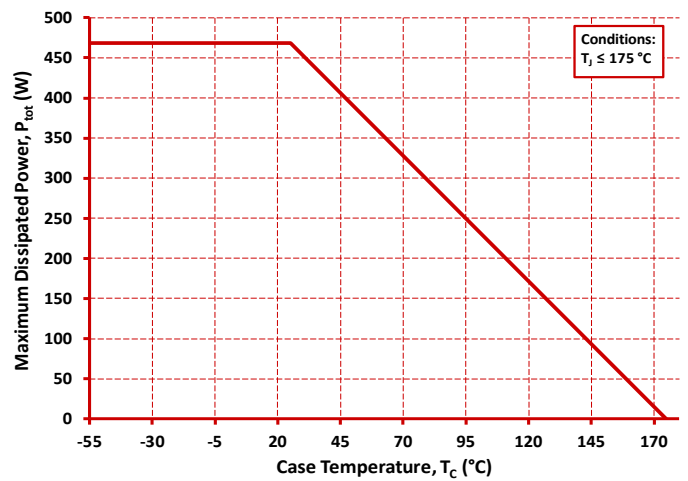


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

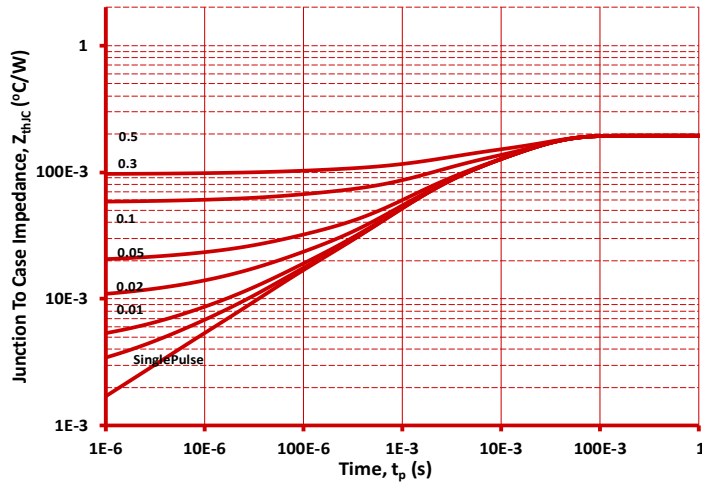


Figure 21. Transient Thermal Impedance (Junction - Case)

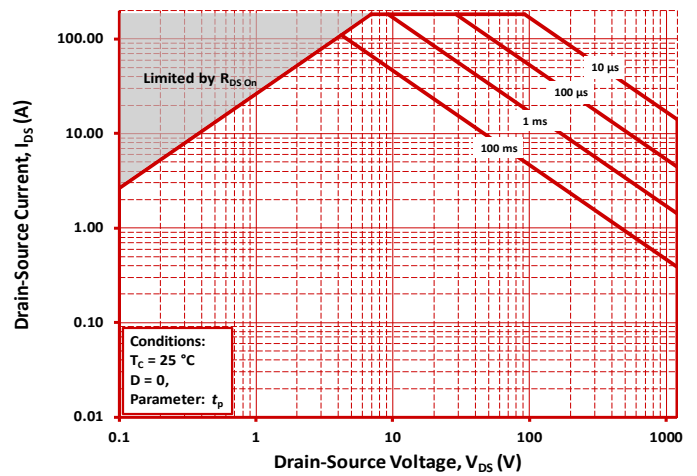
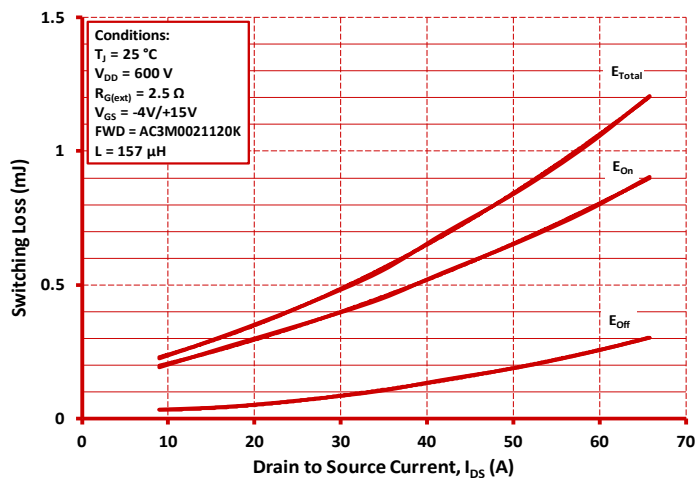
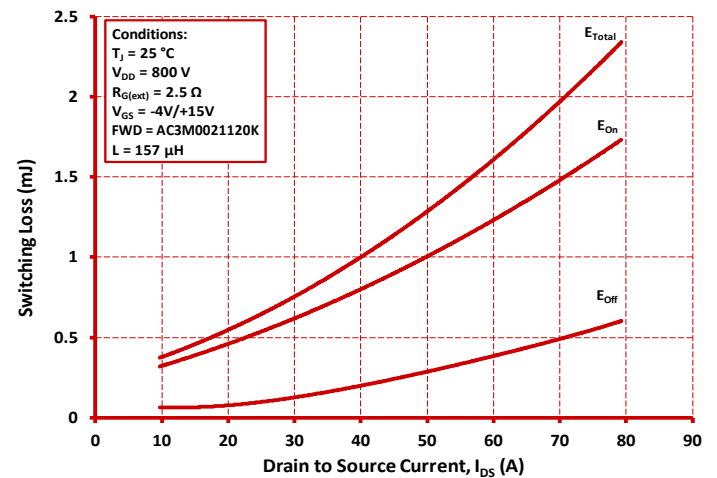


Figure 22. Safe Operating Area


 Figure 23. Clamped Inductive Switching Energy vs. Drain Current ( $V_{DD} = 600V$ )

 Figure 24. Clamped Inductive Switching Energy vs. Drain Current ( $V_{DD} = 800V$ )

### Typical Performance

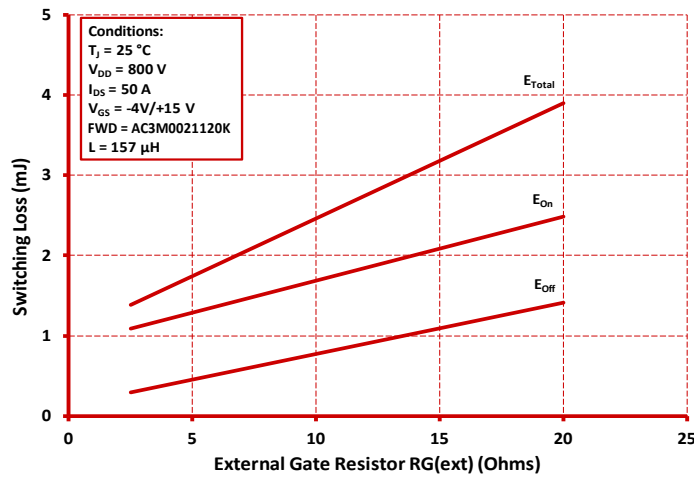


Figure 25. Clamped Inductive Switching Energy vs.  $R_{G(\text{ext})}$

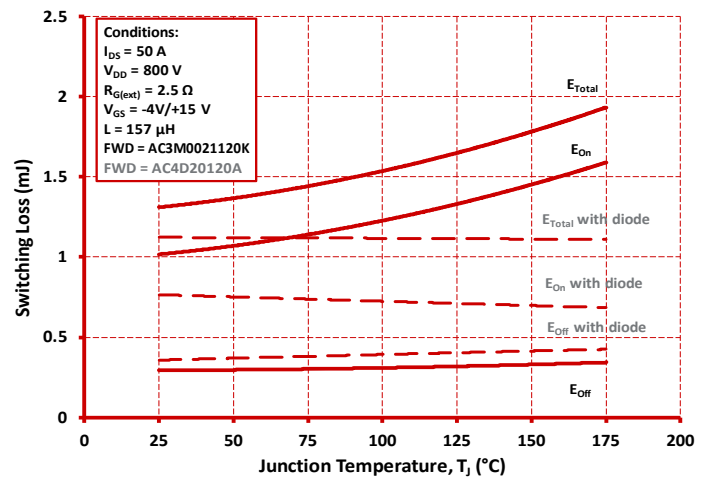


Figure 26. Clamped Inductive Switching Energy vs. Temperature

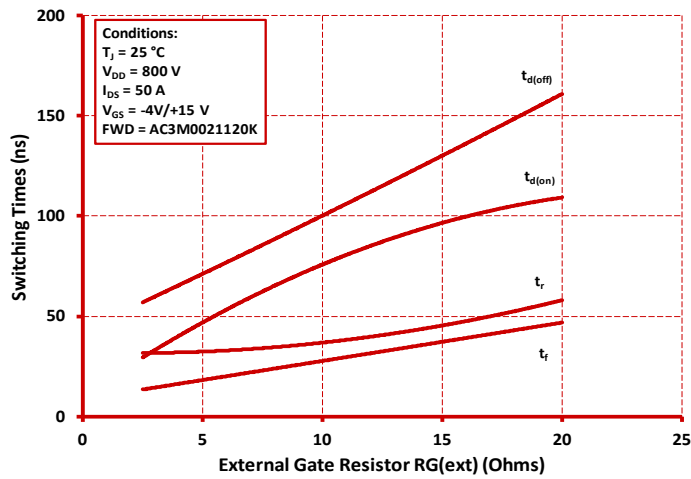


Figure 27. Switching Times vs.  $R_{G(\text{ext})}$

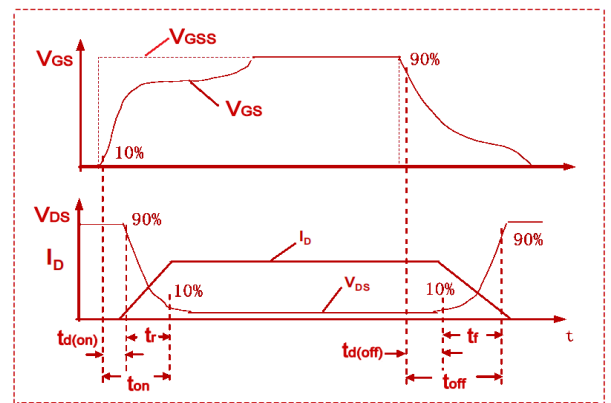


Figure 28. Switching Times Definition

### Test Circuit Schematic

Fig.29 Switching Time Measurement Circuit

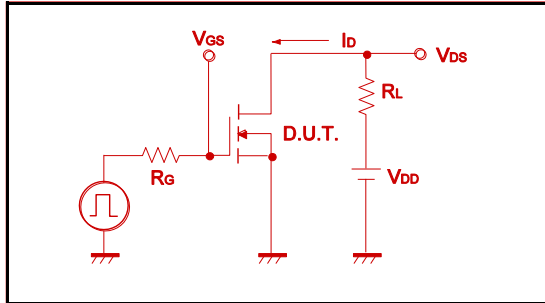


Fig.30 Switching Waveforms

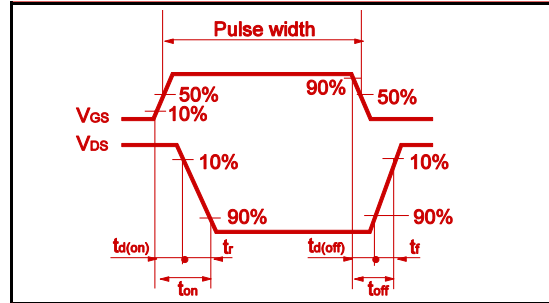


Fig.30-1 Gate Charge Measurement Circuit

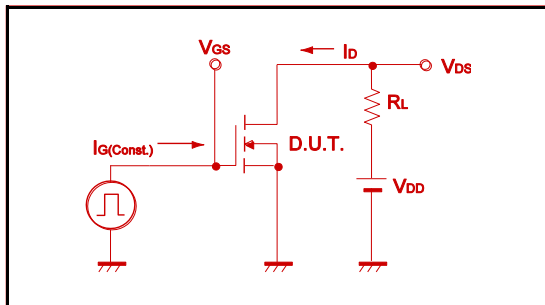


Fig.30-2 Gate Charge Waveform

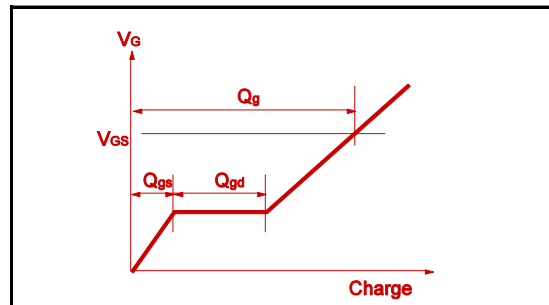


Fig.31-1 Switching Energy Measurement Circuit

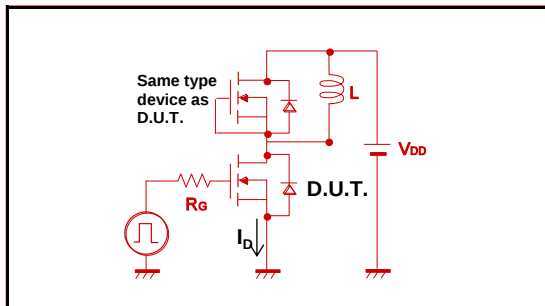


Fig.31-2 Switching Waveforms

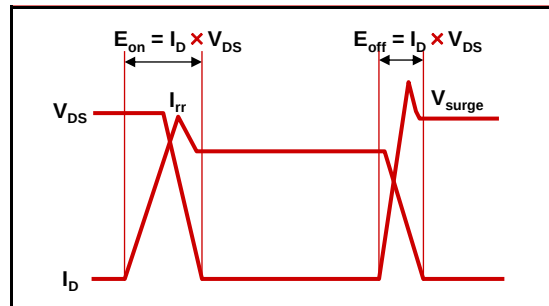
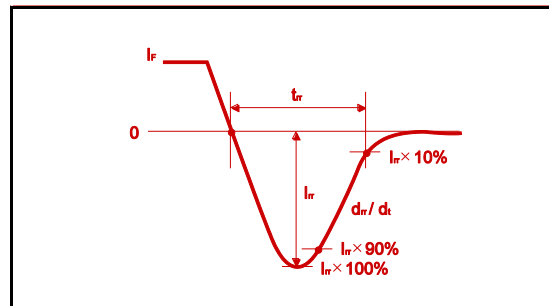
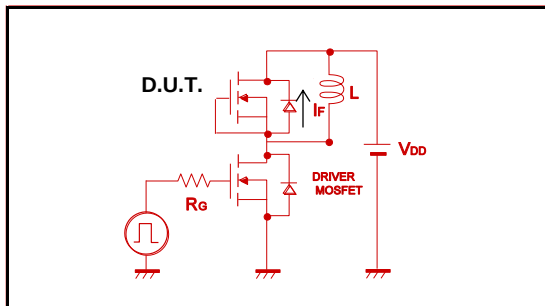


Fig.32-1 Reverse Recovery Time Measurement Circuit Fig.32-2 Reverse Recovery Waveform



**Package Dimensions**

Unit: mm

