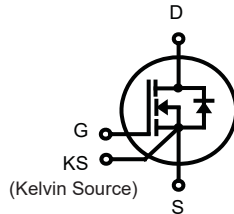


## Silicon Carbide Enhancement Mode MOSFET

### Features

- ◆  $V_{DSS} = 1200V$
- ◆  $R_{DS(ON)} < 25\text{ m}\Omega @ V_{GS} = 20\text{ V}$
- ◆ Fully Avalanche Rated
- ◆ Pb Free & RoHS Compliant
- ◆ Isolation Type Package
- ◆ Electrically Isolation base plate



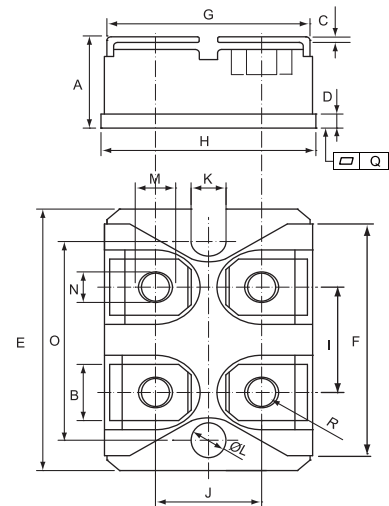
Dimensions in inches and (millimeters)

### Applications

- ◆ Solar Inverters
- ◆ Power Converters
- ◆ Motor Drive
- ◆ Switch Mode Power Supplies
- ◆ Battery Chargers

### Absolute Maximum Ratings ( $T_c=25^\circ\text{C}$ unless otherwise noted)

| Parameter  | Symbol            | Rated   | Unit                    |
|--|-------------------|---|-------------------------|
| Drain-Source Voltage   | $V_{DS}$          | 1200  | V                       |
| Gate-Source Voltage  | $V_{GS}$          | -10/+20   | V                       |
| Drain Current-Continuous   | $I_D$             | 120<br>90   | A                       |
|  |                   | @ $T_c = 25^\circ\text{C}$<br>@ $T_c = 100^\circ\text{C}$ |                         |
| Drain Current-Pulsed   | $I_{DM}$          | 268   | A                       |
|  |                   | @ $T_c = 25^\circ\text{C}$                                |                         |
| Maximum Power Dissipation  | $P_D$             | 500   | W                       |
| Storage Temperature Range  | $T_{STG}$         | -55 to +175   | $^\circ\text{C}$        |
| Operating Junction Temperature Range                                     | $T_{VJ}$          | -55 to +175   | $^\circ\text{C}$        |
| Thermal Resistance, Junction-to-Case                                     | $R_{\theta_{JC}}$ | 0.22  | $^\circ\text{C/W}$      |
| Isolation Voltage (A.C. 1 minute)<br>between All Terminals and Baseplate | $V_{iso}$         | 2500  | V                       |
| Mounting torque (M4 Screw)   | $M_d$             | 1.3<br>1.1  | $\text{N}\cdot\text{m}$ |
|  |                   | To heatsink<br>To terminals                               |                         |
| Avalanche energy, single pulse   | $E_{AS}$          | 812   | mJ                      |
|  |                   | $I_D = 40\text{A}$<br>$L = 0.7\text{mH}$                  |                         |



|   | DIMENSIONS |       |       |       |
|---|------------|-------|-------|-------|
|   | INCHES     |       | MM    |       |
|   | MIN        | MAX   | MIN   | MAX   |
| A | 0.460      | 0.483 | 11.68 | 12.28 |
| B | 0.307      | 0.323 | 7.80  | 8.20  |
| C | 0.030      | 0.033 | 0.75  | 0.85  |
| D | 0.071      | 0.081 | 1.80  | 2.05  |
| E | 1.488      | 1.504 | 37.80 | 38.20 |
| F | 1.248      | 1.260 | 31.70 | 32.00 |
| G | 0.917      | 0.957 | 23.30 | 24.30 |
| H | 0.996      | 1.008 | 25.30 | 25.60 |
| I | 0.579      | 0.602 | 14.70 | 15.30 |
| J | 0.492      | 0.516 | 12.50 | 13.10 |
| K | 0.161      | 0.169 | 4.10  | 4.30  |
| L | 0.161      | 0.169 | 4.10  | 4.30  |
| M | 0.181      | 0.197 | 4.60  | 5.00  |
| N | 0.165      | 0.181 | 4.20  | 4.60  |
| O | 1.181      | 1.197 | 30.00 | 30.40 |
| Q | -0.002     | 0.004 | -0.05 | 0.10  |
| R | M4*8       |       |       |       |

## Electrical Characteristics @ $T_{VJ} = 25^{\circ}\text{C}$ (unless otherwise specified)

| Parameter                        | Symbol        | Conditions  | Min.                           | Typ.  | Max. | Unit      |    |
|----------------------------------|---------------|---|--------------------------------|-------|------|-----------|----|
| <b>OFF Characteristics</b>       |               |   |                                |       |      |           |    |
| Drain-Source Breakdown Voltage   | $BV_{DSS}$    | $V_{GS} = 0V, I_{DS} = 0.3mA$   | 1200                           | -     | -    | V         |    |
| Zero Gate Voltage Drain Current  | $I_{DSS}$     | $V_{GS} = 0V, V_{DS} = 1200V$   | -                              | -     | 200  | $\mu A$   |    |
| Gate-Source Leakage Current      | $I_{GSS}$     | $V_{GS} = 20V, V_{DS} = 0V$   | -                              | -     | 500  | nA        |    |
| <b>ON Characteristics</b>        |               |   |                                |       |      |           |    |
| Gate Threshold Voltage           | $V_{TH}$      | $V_{DS} = V_{GS}, I_{DS} = 8mA$   | 2.0                            | 2.5   | 4.5  | V         |    |
| Drain-Source On-State Resistance | $R_{DS(on)}$  | $V_{GS} = 20V, I_{DS} = 120A$   | -                              | 20    | 25   | $m\Omega$ |    |
| Internal Gate Resistance         | $R_{G(int.)}$ |   | -                              | 1.6   | 2.9  | $\Omega$  |    |
| Forward Transconductance         | $g_{fs}$      | $V_{DS} = 20V, I_D = 45A$ <span style="float: right;">Note1</span>              | -                              | 28    | -    | S         |    |
| <b>Dynamic Characteristics</b>   |               |   |                                |       |      |           |    |
| Input Capacitance                | $C_{iss}$     | $V_{DS} = 800V$<br>$V_{GS} = 0V$<br>$V_{AC} = 25mV$<br>Freq.=1MHz               | -                              | 12000 | -    | pF        |    |
| Output Capacitance               | $C_{oss}$     |   | -                              | 363   | -    |           |    |
| Reverse Transfer Capacitance     | $C_{rss}$     |   | -                              | 10    | -    |           |    |
| Total Gate Charge                | $Q_g$         | $V_{DS} = 800V$<br>$V_{GS} = 20V$<br>$I_{DS} = 45A$                             | -                              | 543   | -    | nC        |    |
| Gate to Source Charge            | $Q_{gs}$      |   | -                              | 114   | -    |           |    |
| Gate to Drain Charge             | $Q_{gd}$      |   | -                              | 182   | -    |           |    |
| <b>Switching Characteristics</b> |               |   |                                |       |      |           |    |
| Turn-On Delay Time               | $t_{d(on)}$   | $V_{DD} = 800V$<br>$V_{GS} = -5/+18V$<br>$I_{DS} = 45A$<br>$R_G = 1\Omega$      | $T_{VJ} = 25^{\circ}\text{C}$  | -     | 95   | -         | ns |
|                                  |               |   | $T_{VJ} = 150^{\circ}\text{C}$ | -     | 84   | -         |    |
| Rise Time                        | $t_r$         |   | $T_{VJ} = 25^{\circ}\text{C}$  | -     | 72   | -         |    |
|                                  |               |   | $T_{VJ} = 150^{\circ}\text{C}$ | -     | 60   | -         |    |
| Turn-Off Delay Time              | $t_{d(off)}$  |   | $T_{VJ} = 25^{\circ}\text{C}$  | -     | 134  | -         |    |
|                                  |               |   | $T_{VJ} = 150^{\circ}\text{C}$ | -     | 139  | -         |    |
| Fall Time                        | $t_f$         |   | $T_{VJ} = 25^{\circ}\text{C}$  | -     | 25   | -         |    |
|                                  |               |   | $T_{VJ} = 150^{\circ}\text{C}$ | -     | 20   | -         |    |
| Turn-On Switching Energy         | $E_{on}$      | $V_{DD} = 800V$<br>$V_{GS} = -5V/+18V$<br>$I_D = 45A$<br>$R_{G(ext)} = 1\Omega$ | $T_{VJ} = 25^{\circ}\text{C}$  | -     | 1    | -         | mJ |
|                                  |               |   | $T_{VJ} = 150^{\circ}\text{C}$ | -     | 0.62 | -         |    |
| Turn-Off Switching Energy        | $E_{off}$     |   | $T_{VJ} = 25^{\circ}\text{C}$  | -     | 0.92 | -         |    |
|                                  |               |   | $T_{VJ} = 150^{\circ}\text{C}$ | -     | 0.75 | -         |    |

Notes:

1. Pulse Test: Pulse Width  $\leq 300 \mu s$ , Duty Cycle  $> 2\%$

## Electrical Characteristics @ $T_{VJ} = 25^{\circ}\text{C}$ (unless otherwise specified)

| Parameter   | Symbol    | Conditions                       | Values                      | Unit |   |
|---|-----------|----------------------------------|-----------------------------|------|---|
| <b>Body Diode Characteristics</b>   |           |                                  |                             |      |   |
| Drain-Source Voltage  | $V_{DSS}$ | $T_{VJ} \geq 25^{\circ}\text{C}$ | 1200                        | V    |   |
| Continuous Reverse Drain Current For $R_{th(j-c,max)}$ , limited by $T_{VJ(max)}$ | $I_{SDC}$ | $V_{GS} = 0\text{V}$             | $T_c = 25^{\circ}\text{C}$  | 120  | A |
|   |           |                                  | $T_c = 100^{\circ}\text{C}$ | 90   |   |
| Peak Reverse Drain Current $t_p$ limited by $T_{VJ(max)}$                         | $I_{RM}$  | $V_{GS} = 0\text{V}$             | 268                         | A    |   |

| Parameter                            | Symbol    | Note or test condition   |                                | Min. | Typ.  | Max. | Unit |
|--------------------------------------|-----------|--|--------------------------------|------|-------|------|------|
| Drain-Source Reverse Voltage         | $V_{SD}$  | $I_{SD} = 45\text{A}, V_{GS} = 0\text{V}$  | $T_{VJ} = 25^{\circ}\text{C}$  | -    | 3.8   | 5    | V    |
|                                      |           |  | $T_{VJ} = 150^{\circ}\text{C}$ | -    | 3.7   | -    |      |
| MOSFET Forward Recovery Charge       | $Q_{rr}$  | $V_{DD} = 800\text{V}, I_{SD} = 45\text{A}, V_{GS} = 0\text{V}, di_{SD}/dt = 2000\text{A}/\mu\text{s}$ | $T_{VJ} = 25^{\circ}\text{C}$  | -    | 1480  | -    | nC   |
|                                      |           |  | $T_{VJ} = 150^{\circ}\text{C}$ | -    | 1660  | -    |      |
| MOSFET Peak Forward Recovery Current | $I_{rr}$  | $V_{DD} = 800\text{V}, I_{SD} = 45\text{A}, V_{GS} = 0\text{V}, di_{SD}/dt = 2000\text{A}/\mu\text{s}$ | $T_{VJ} = 25^{\circ}\text{C}$  | -    | 43    | -    | A    |
|                                      |           |  | $T_{VJ} = 150^{\circ}\text{C}$ | -    | 50    | -    |      |
| MOSFET Reverse Recovery Time         | $T_{rr}$  | $V_{DD} = 800\text{V}, I_{SD} = 45\text{A}, V_{GS} = 0\text{V}, di_{SD}/dt = 2000\text{A}/\mu\text{s}$ | $T_{VJ} = 25^{\circ}\text{C}$  | -    | 55    | -    | ns   |
|                                      |           |  | $T_{VJ} = 150^{\circ}\text{C}$ | -    | 56    | -    |      |
| MOSFET Forward Recovery Energy       | $E_{rSD}$ | $V_{DD} = 800\text{V}, I_{SD} = 45\text{A}, V_{GS} = 0\text{V}, di_{SD}/dt = 2000\text{A}/\mu\text{s}$ | $T_{VJ} = 25^{\circ}\text{C}$  | -    | 0.944 | -    | mJ   |
|                                      |           |  | $T_{VJ} = 150^{\circ}\text{C}$ | -    | 1.641 | -    |      |

## Typical Characteristics

Figure 1. Maximum Power Dissipation (MOSFET) Derating vs. Case Temperature

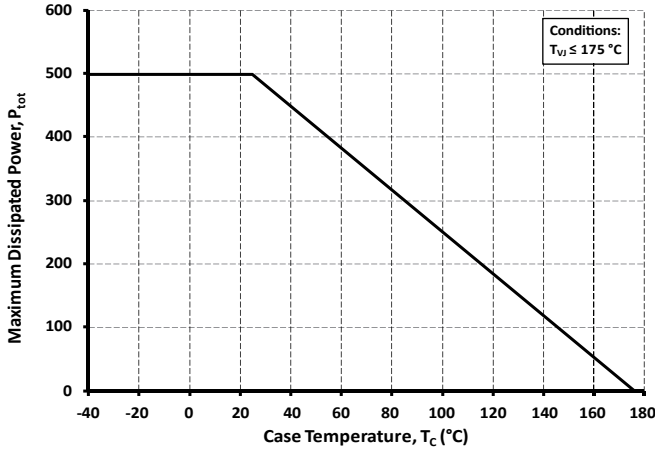


Figure 2. Continuous Drain Current (MOSFET) Derating vs. Case Temperature

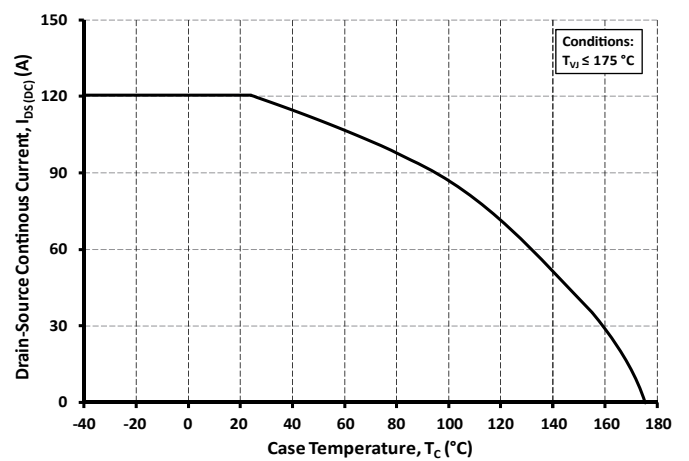


Figure 3. Maximum Power Dissipation (MOSFET) Derating vs. Case Temperature

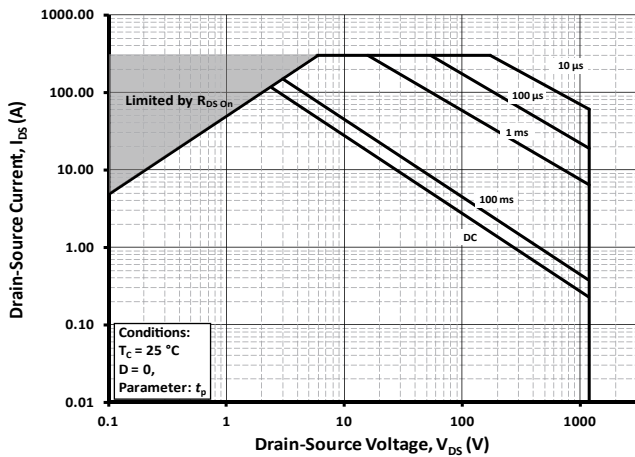


Figure 4. MOSFET Junction to Case Thermal Impedance

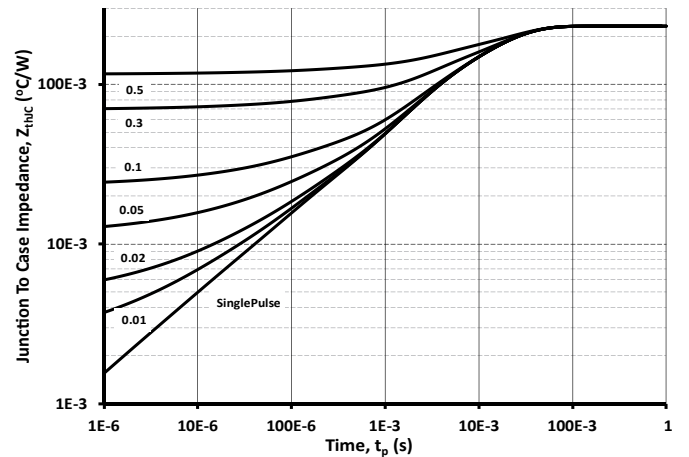


Figure 5. Output Characteristics  $T_j = 25$  °C

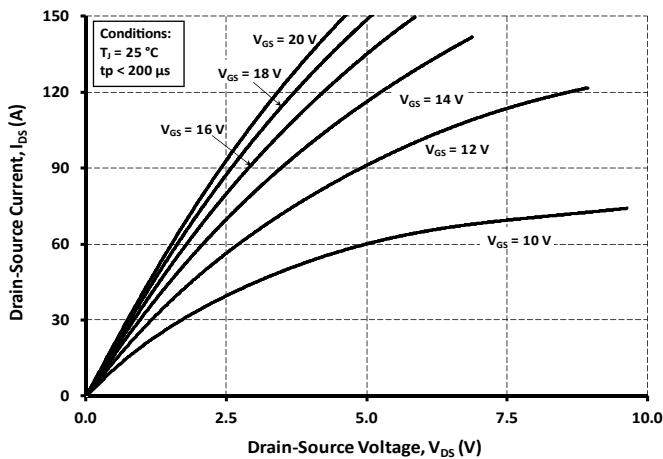
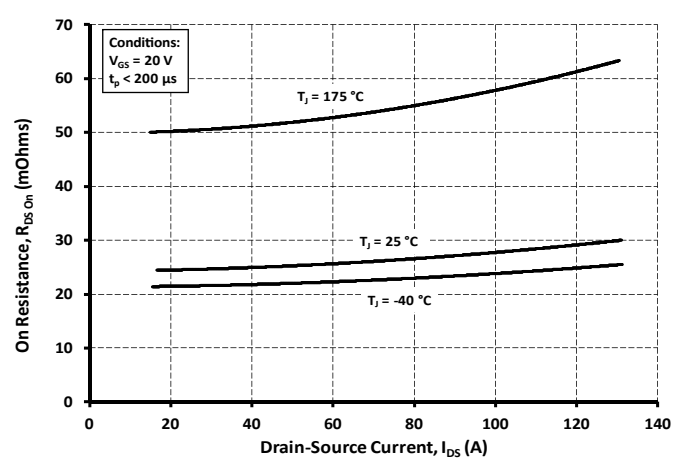


Figure 6. On-Resistance vs. Drain Current For Various Temperatures



## Typical Characteristics

Figure 7. On-Resistance vs. Temperature For Various Gate-Source Voltage

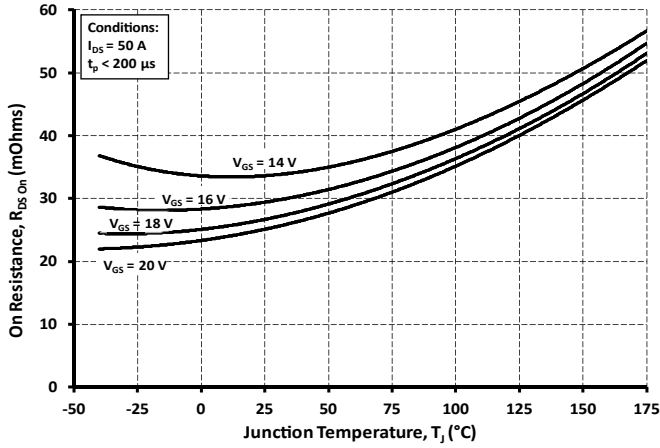


Figure 8. Threshold Voltage vs. Temperature

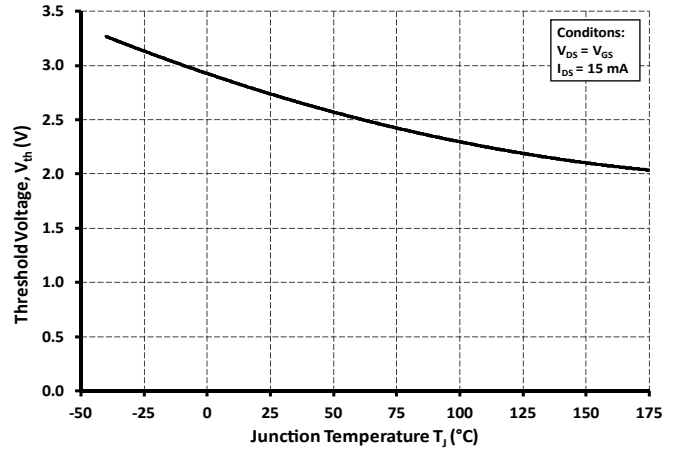


Figure 9. Transfer Characteristic for Various Junction Temperatures

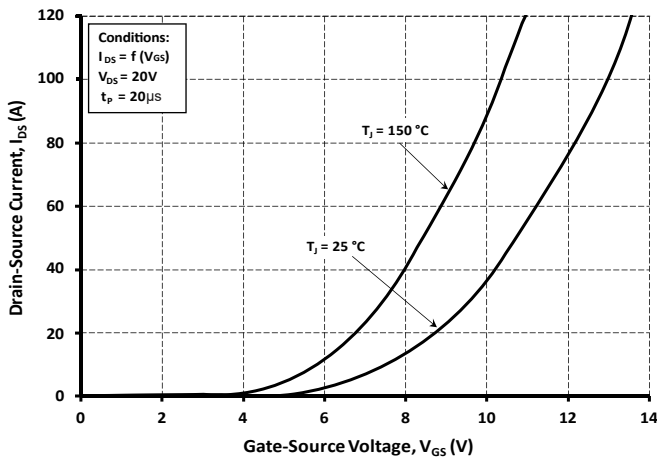


Figure 10. Capacitances vs. Drain-Source Voltage (0 - 1 kV)

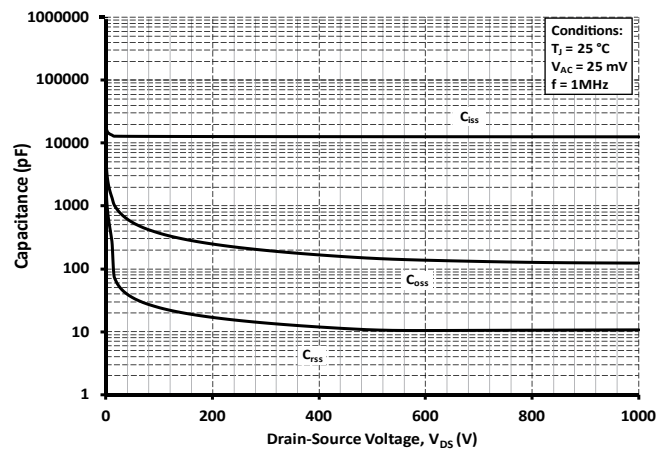


Figure 11. Typical forward characteristics of reverse diode

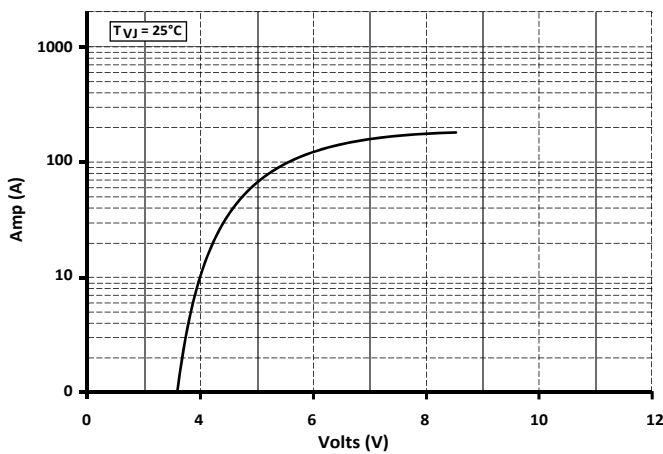
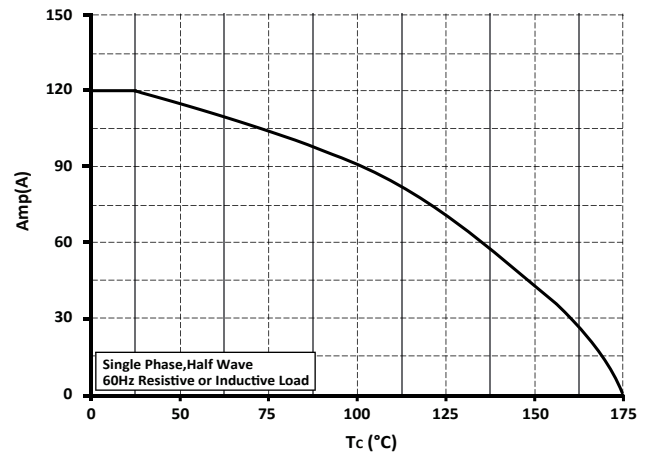


Figure 12. Forward derating curve of reverse diode



## Typical Characteristics

Figure 13. Peak forward surge current of reverse diode

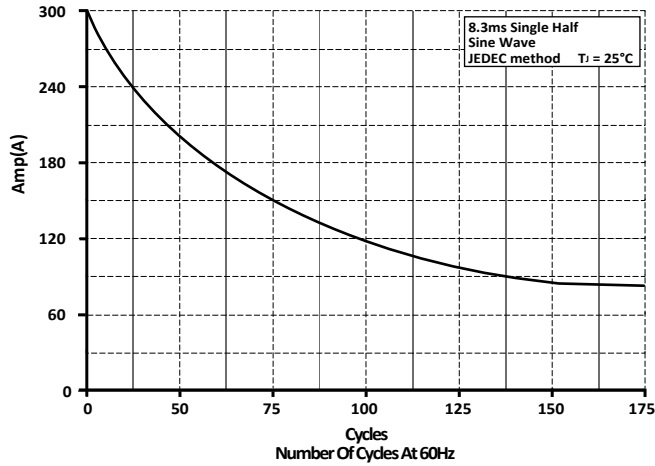


Figure 14. Typical reverse diode characteristics

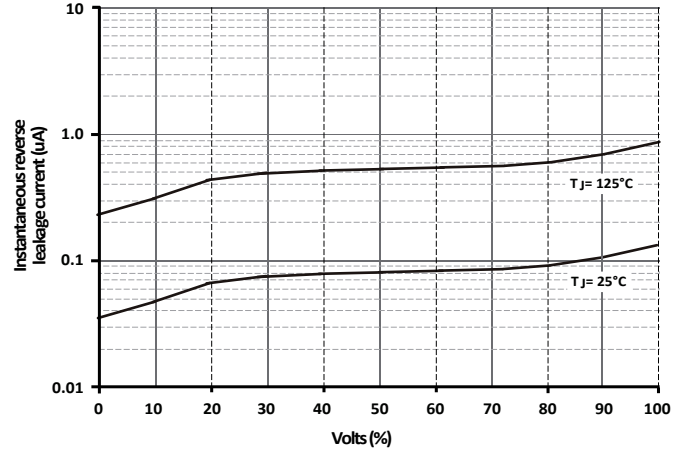


Figure 15. Gate Charge Characteristics Typical Gate Charge

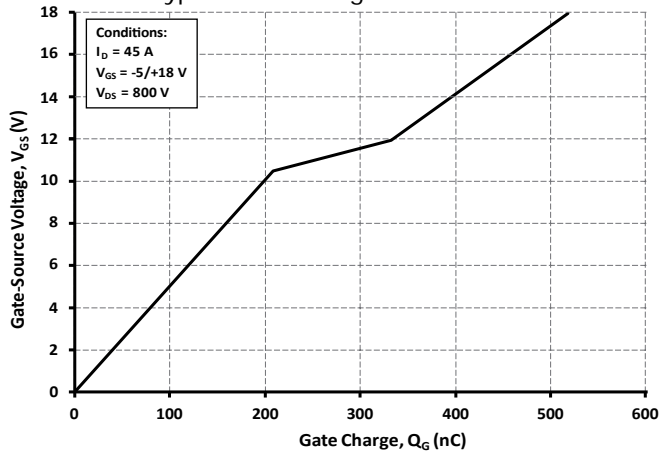


Figure 16. Inductive Switching Energy vs. Temperature

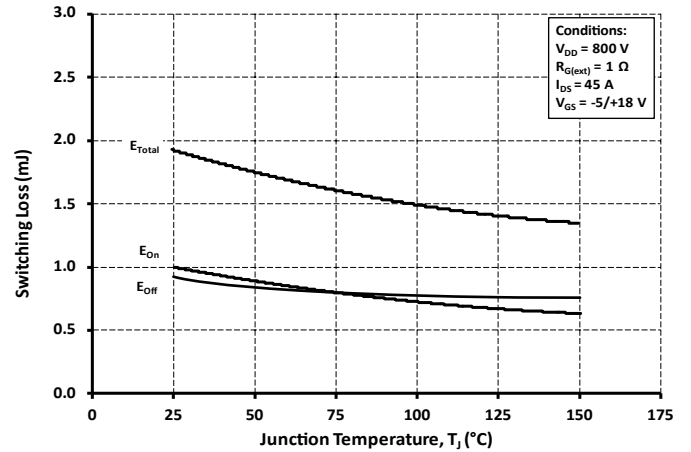


Figure 17. Timing vs.  $R_{G(ext)}$

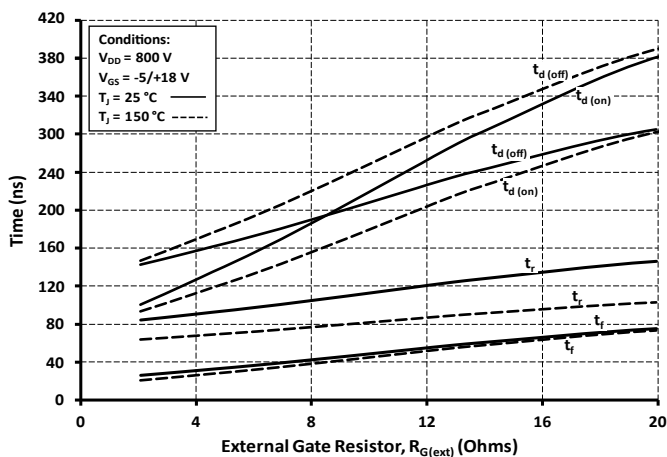
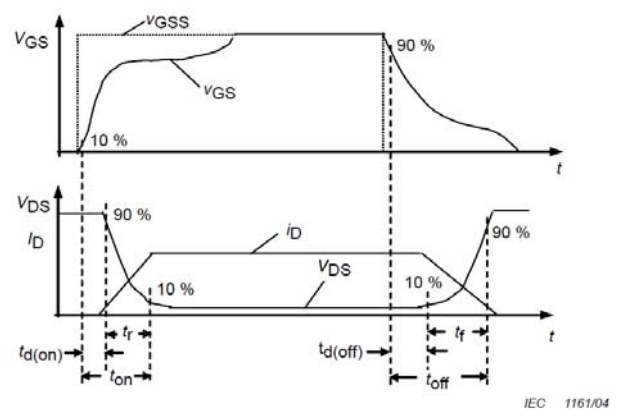


Figure 18. Resistive Switching Time Description



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