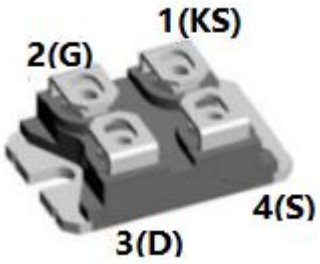
Technical Data
Data Sheet N2612, REV.A

RoHS

# S2M0080120N
# 1200V SIC POWER MOSFET

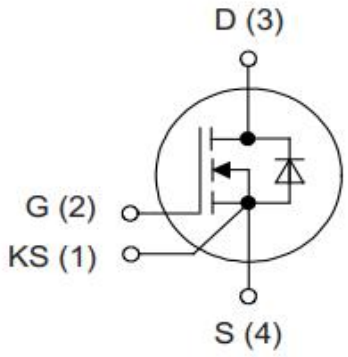



$V_{DS}$ = 1200 V
$I_{DS}$ = 36 A
$R_{DS}$(on) = 77 mΩ

## Description

S2M0080120N is single SiC Power MOSFET packaged in SOT-227 case. The device is a high voltage n-channel enhancement mode MOSFET that has very low total conduction losses and very stable switching characteristics over temperature extremes. The S2M0080120N is ideal for energy sensitive, high frequency applications in challenging environments.

## Circuit Diagram




## Features

- Positive temperature characteristics, easy to parallel.
- Low on-resistance Typ. RDS(on) = 77mΩ .
- Fast switching speed and low switching losses.
- Very fast and robust intrinsic body diode.
- Process of non-bright Tin electroplatin

## Applications

- EV Fast Charging Modules
- EV On Board Chargers
- Solar Inverters
- Online UPS/Industrial UPS
- SMPS (Switch Mode Power Supplies)
- DC-DC Converters
- ESS (Energy Storage Systems)

## Maximum Ratings(T=25℃ unless otherwise specified)

| Characteristics | Symbol | Condition | Max. | Units |
|---|---|---|---|---|
| Drain Source Voltage | $V_{DSS}$ | $V_{GS}$ = 0V, $I_{DS}$ = 100uA, $T_C$ = 25°C | 1200 | V |
| Gate Source Voltage | $V_{GSS}$ | $T_C$ = 25°C, Absolute maximum values, AC (f>1Hz) | -10 to +25 | V |
| Gate Source Voltage | $V_{GSOP}$ | $T_C$ = 25°C Recommended Operational Values | -5 to +20 | V |
| Continuous Drain Current | $I_D$ | $V_{GS}$ = 20V, $T_C$ = 25°C | 36 | A |
| | $I_D$ | $V_{GS}$ = 20V, $T_C$ = 100°C | 25 | A |
| Pulsed Drain Current | $I_{D,pulse}$ | $T_C$=25˚C | 82 | A |
| Power Dissipation | $P_D$ | $T_C$=25˚C | 176 | W |
| SOT-227 Mounting Torque | | M4 Screw | 1 | Nm |

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## Electrical Characteristics(T=25℃ unless otherwise specified)

| Characteristics | Symbol | Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Drain Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = 1mA | 1200 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 10mA | 2.0 | 2.8 | 4.0 | V |
| | | $V_{DS}$ = $V_{GS}$, $I_D$ = 10mA, $T_J$ = 175 °C | | 1.8 | | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 1200V, $V_{GS}$ = 0V | | 0.1 | 1.0 | uA |
| | $I_{DSS}$ | $V_{DS}$ = 1200V, $V_{GS}$ = 0V, $T_J$ = 175 °C | | 1 | | uA |
| Gate Source Leakage Current | $I_{GSS+}$ | $V_{GS}$ = 20V, $V_{DS}$ = 0V | | 10 | 100 | nA |
| | $I_{GSS-}$ | $V_{GS}$ = -5V, $V_{DS}$ = 0V | | -10 | -100 | nA |
| Drain Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}$ = 20V, $I_D$ = 20A | | 77 | 100 | mΩ |
| | | $V_{GS}$ = 20V, $I_D$ = 20A, $T_J$ = 175 °C | | 137 | | mΩ |
| Transconductance | gfs | $V_{DS}$= 20 V, $I_D$= 20 A | | 10.5 | | S |
| | | $V_{DS}$= 20 V, $I_D$= 20 A, $T_J$ = 175 °C | | 8 | | S |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0V, | | 1324 | | pF |
| Output Capacitance | $C_{OSS}$ | $V_{DS}$ = 1000V | | 74 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | $V_{AC}$ = 25mV | | 3.4 | | |
| $C_{OSS}$ Stored Energy | $E_{OSS}$ | f = 200kHz | | 37 | | uJ |
| Turn-On Switching Energy | $E_{ON}$ | $V_{DS}$ = 800V, $V_{GS}$ = -5/20V | | 290 | | uJ |
| Turn-Off Switching Energy | $E_{OFF}$ | $I_D$ = 20A, $R_{G(ext)}$= 2.5Ω | | 20 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DS}$ = 800V, $V_{GS}$ = -5/20V | | 20 | | ns |
| Rise Time | $t_r$ | $I_D$ = 20A, $R_{G(ext)}$= 2.5Ω, L=975uH | | 11 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | FWD=S2M0080120N | | 20 | | |
| Fall Time | $t_f$ | | | 7.8 | | |
| Internal Gate Resistance | $R_{G(int)}$ | f = 1MHz, VAC = 25 mV, D-S short | | 3.3 | | Ω |
| Gate to Source Charge | $Q_{gs}$ | $V_{DS}$ = 800V, $V_{GS}$ = -5/20V | | 23 | | nC |
| Gate to Drain Charge | $Q_{gd}$ | $I_D$ = 20A | | 14 | | |
| Total Gate Charge | $Q_g$ | | | 54 | | |

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## Reverse Diode Characteristics:

| Characteristics | Symbol | Condition | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$= -5V, $I_{SD}$= 10A | 4.0 | | V |
| | $V_{SD}$ | $V_{GS}$= -5V, $I_{SD}$= 10A, $T_J$= 175°C | 3.5 | | V |
| Continuous Diode Forward Current | $I_S$ | $V_{GS}$= -5V, $T_C$= 25℃ | | 41 | A |
| Reverse Recovery Time | $t_{rr}$ | $V_{GS}$= -5V, $I_{SD}$= 20A, $T_J$= 25°C | 25 | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | $V_R$= 800V | 102 | | nC |
| Peak Reverse Recovery Current | $I_{mm}$ | dif/dt= 1950A/μs | 6.7 | | A |

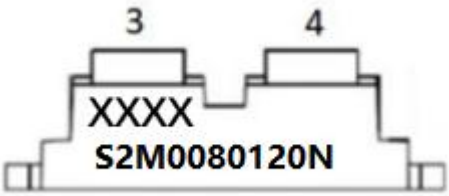
## Thermal-Mechanical Specifications:

| Characteristics | Symbol | Condition | Specification | Units |
|---|---|---|---|---|
| Junction Temperature | $T_J$ | - | -55 to +175 | °C |
| Storage Temperature | $T_{stg}$ | - | -55 to +175 | °C |
| Typical Thermal Resistance Junction to Case | $R_{\theta JC}$ | DC operation | 0.85 | °C/W |

## Ordering Information:

| Device | Package | Shipping |
|---|---|---|
| S2M0080120N | SOT-227 | 36pcs/box |

## Marking Diagram




Where XXXXX is YYWWL

S2M = Device Type
0080 = $R_{DS}$(on)
120 = Reverse Voltage (1200V)
N = Package
SSG = SSG
YY = Year
WW = Week

**Cautions:** Molding resin
Epoxy resin UL:94V-0

## Ratings and Characteristics Curves

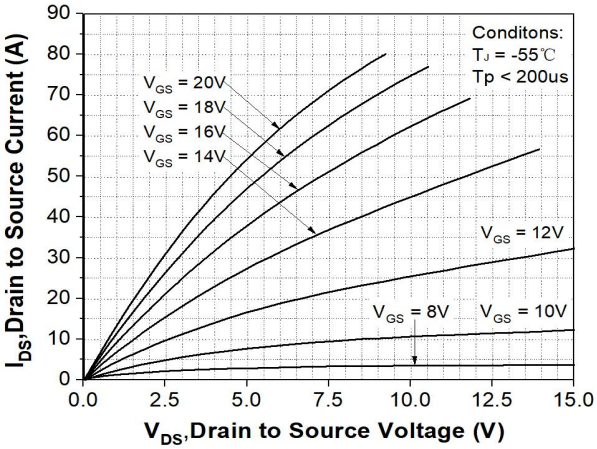



**Figure 1. Output Characteristics $T_J$ = -55 °C**

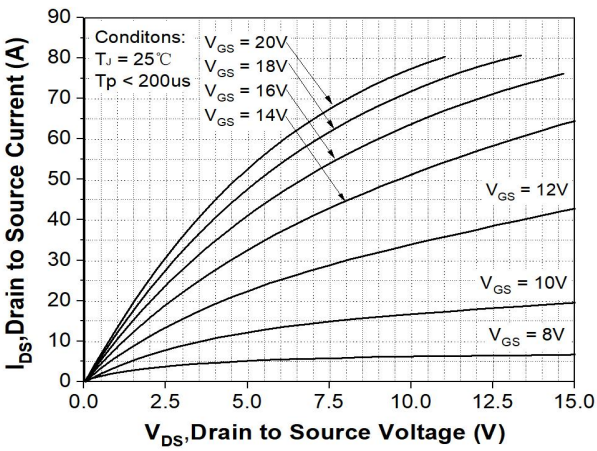



**Figure 2. Output Characteristics $T_J$ = 25 °C**

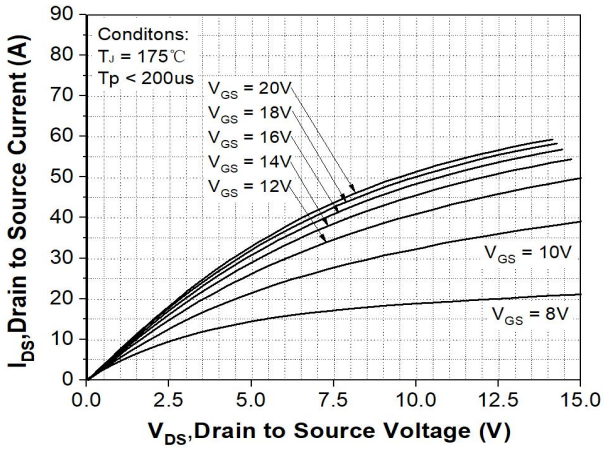



**Figure 3. Output Characteristics $T_J$ = 175°C**

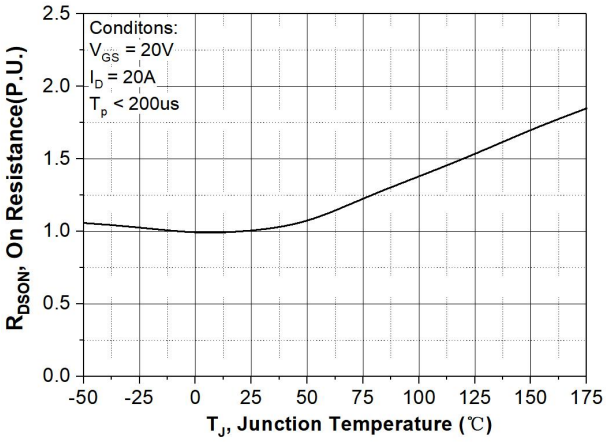



**Figure 4. Normalized On-Resistance vs. Temperature**

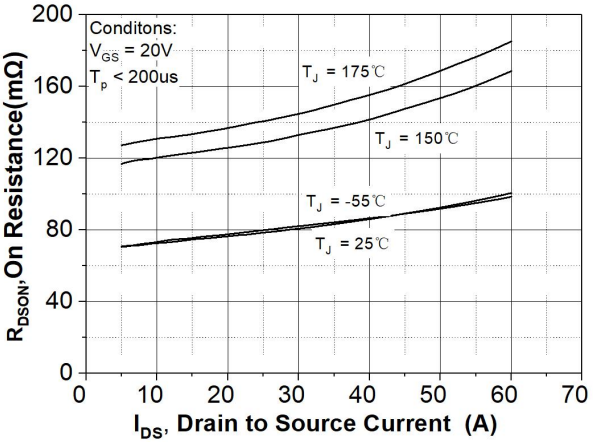



**Figure 5. On-Resistance vs. Drain Current For Various Temperatures**

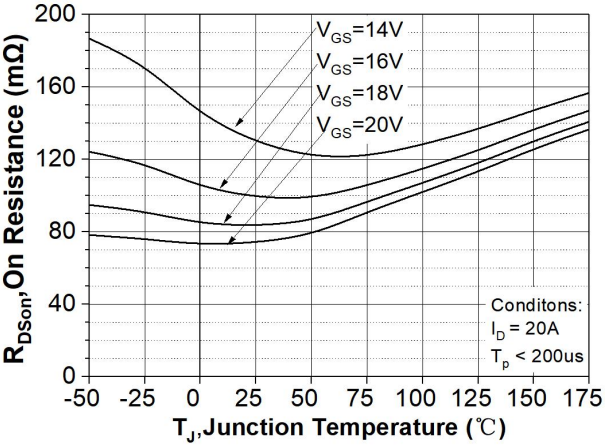



**Figure 6. On-Resistance vs. Temperature For Various Gate Voltage**

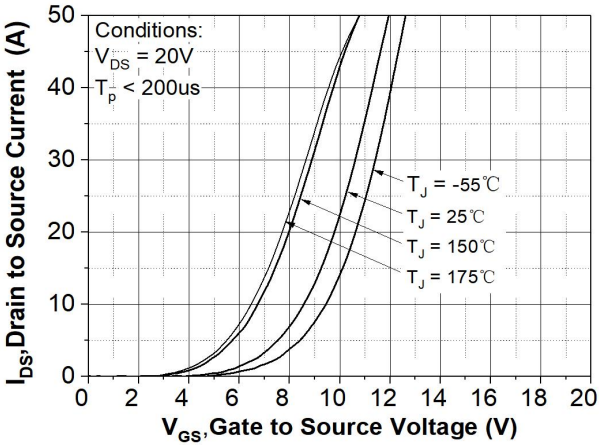



**Figure 7. Transfer Characteristic for Various Junction Temperatures**

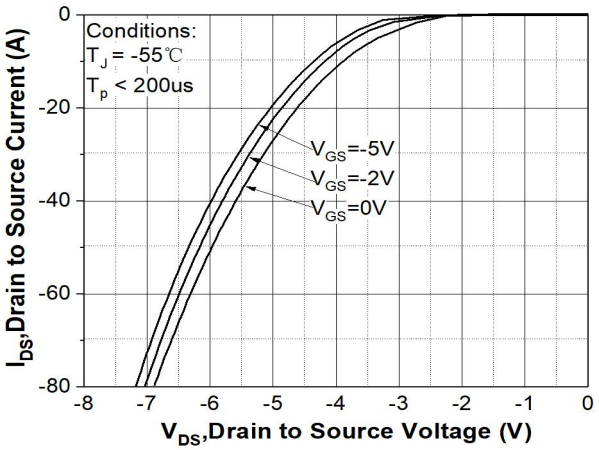



**Figure 8. Body Diode Characteristic at $T_J$ = -55 °C**

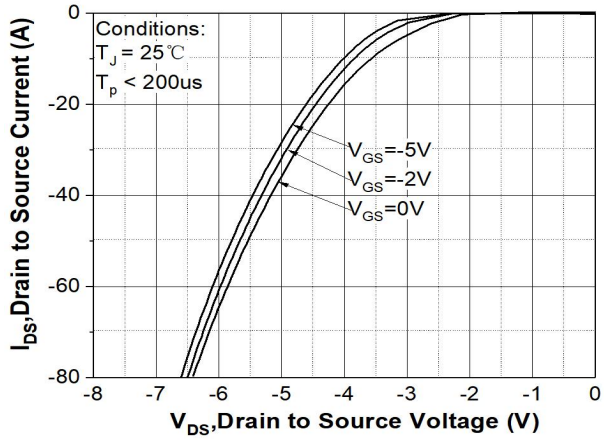



**Figure 9. Body Diode Characteristic at $T_J$ = 25 °C**

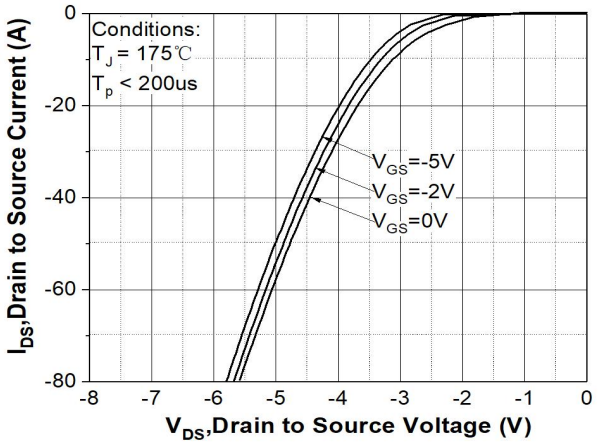



**Figure 10. Body Diode Characteristic at $T_J$ = 175 °C**

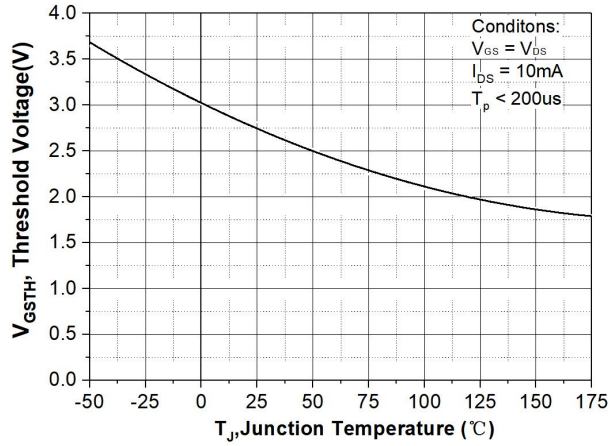



**Figure 11. Threshold Voltage vs. Temperature**

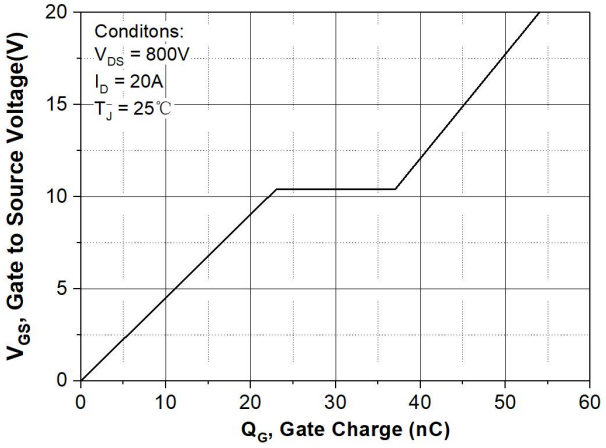



**Figure 12. Gate Charge Characteristic**

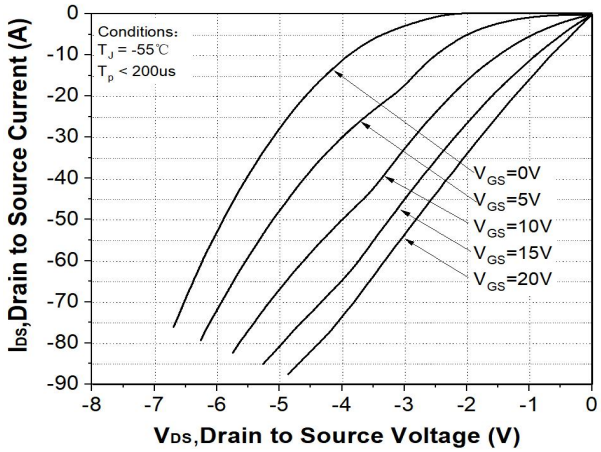



Figure 13. 3rd Quadrant Characteristic at $T_J$ = -55 °C

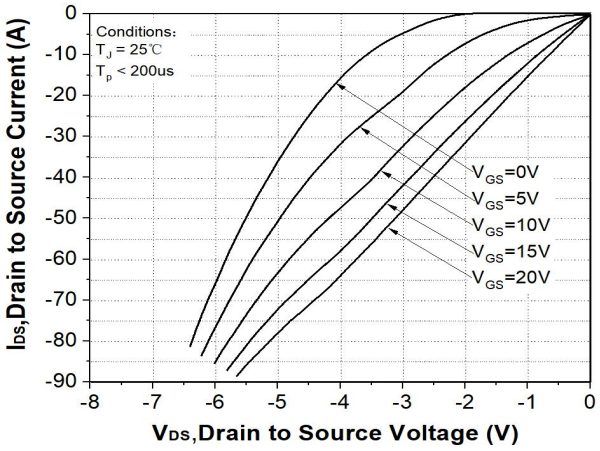



Figure 14. 3rd Quadrant Characteristic at $T_J$ = 25 °C

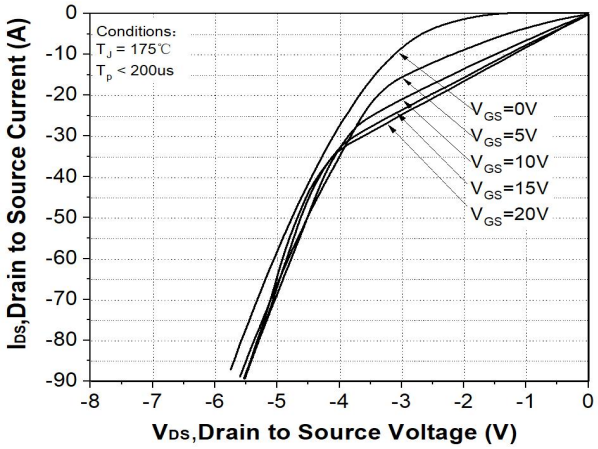



Figure 15. 3rd Quadrant Characteristic at $T_J$ = 175°C

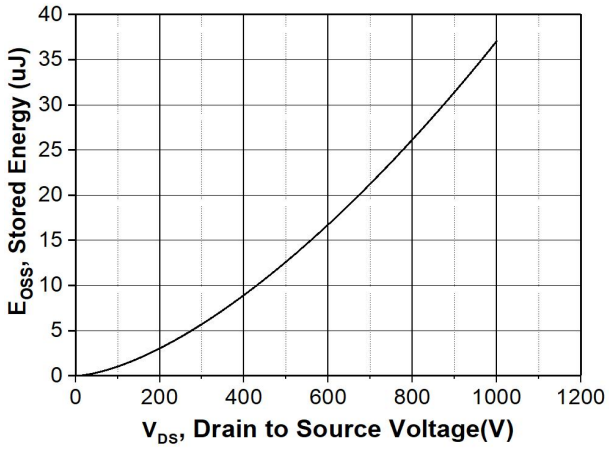



Figure 16. Output Capacitor Stored Energy

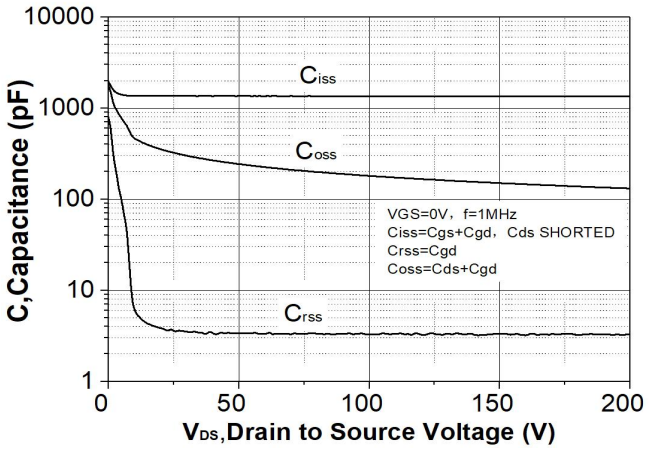



Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

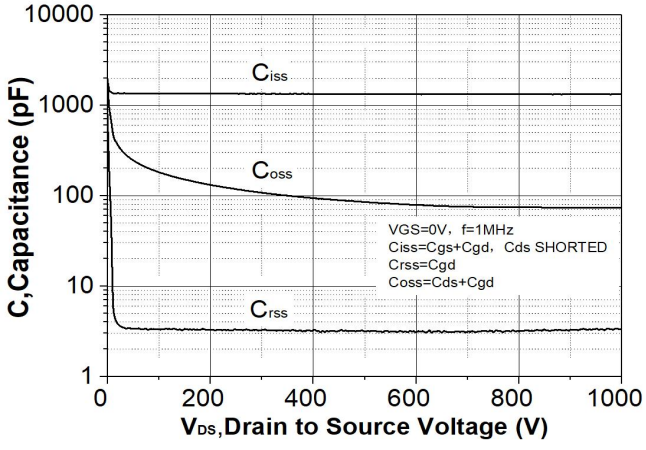



Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

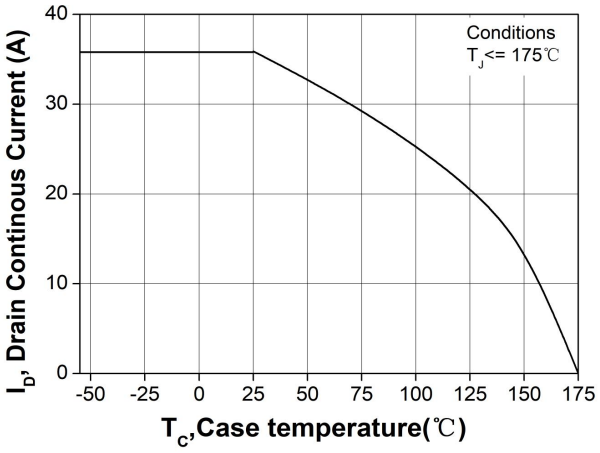



Figure 19. Continuous Drain Current Derating vs. Case Temperature

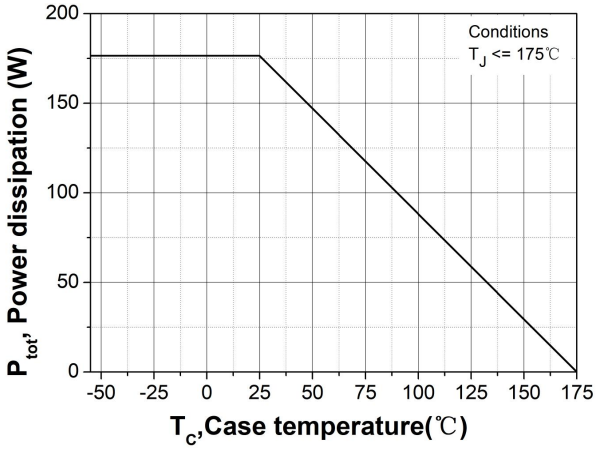



Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

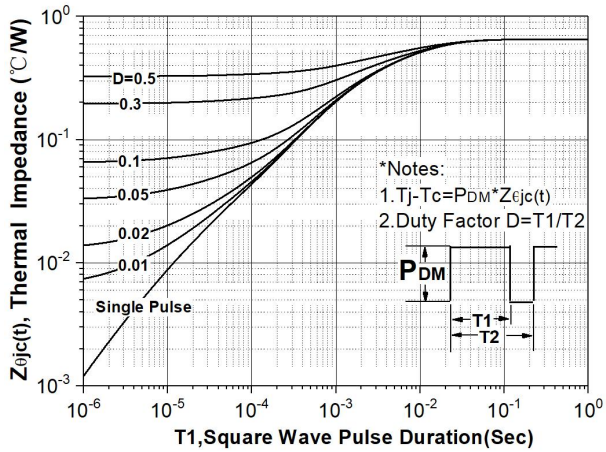



Figure 21. Transient Thermal Impedance (Junction - Case)

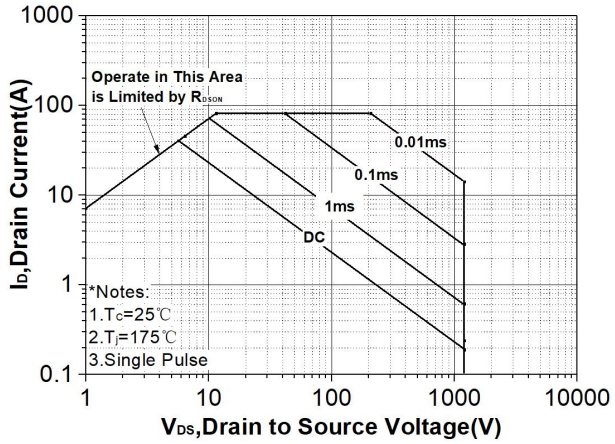



Figure 22. Safe Operating Area

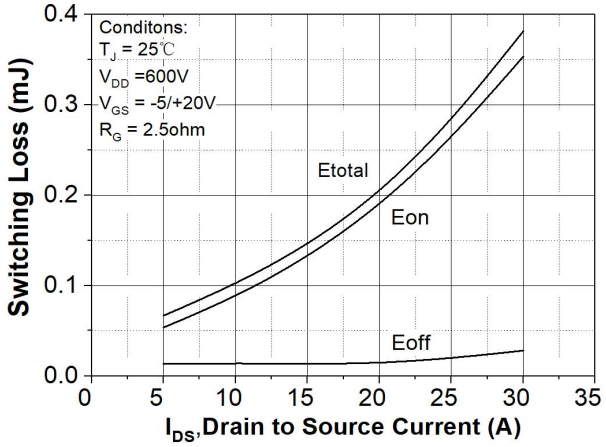



Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD}$ = 600V)

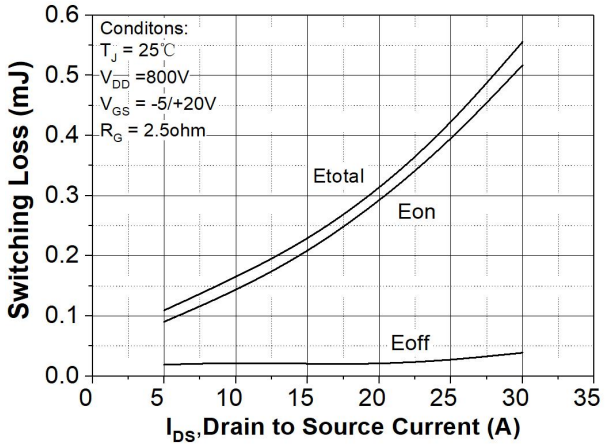



Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD}$ = 800V)

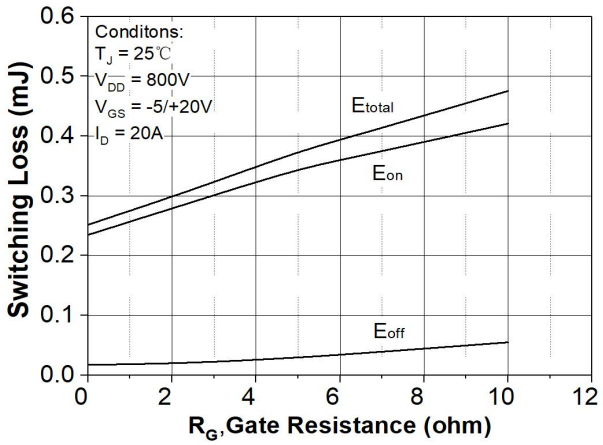



**Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$**

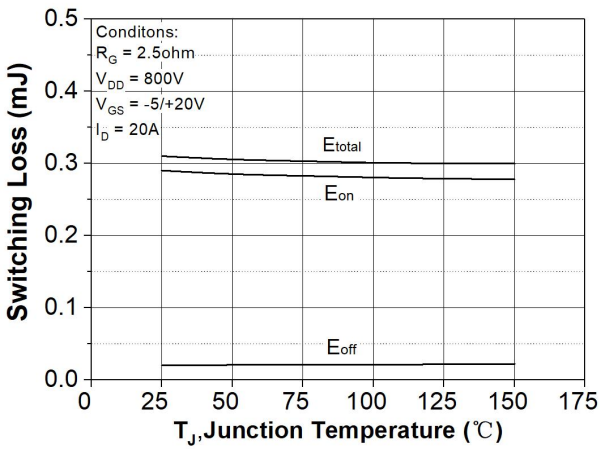



**Figure 26. Clamped Inductive Switching Energy vs. Temperature**

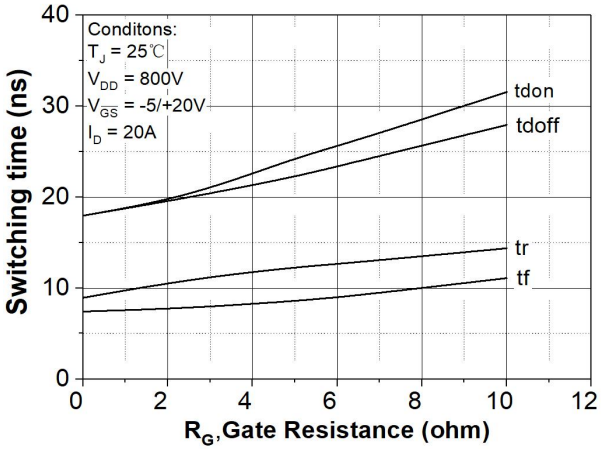



**Figure 27. Switching Times vs. $R_{G(ext)}$**

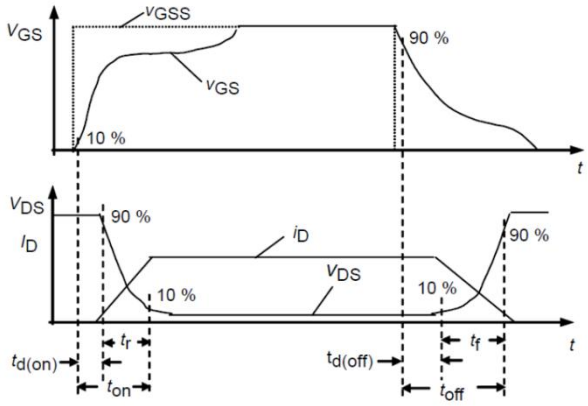



**Figure 28. Switching Times Definition**

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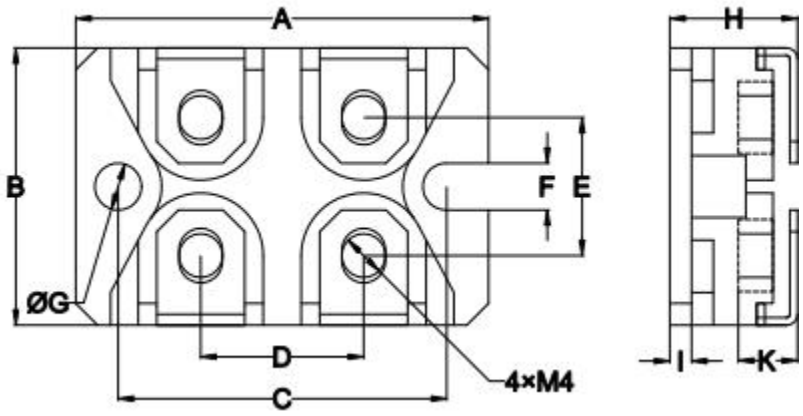
## Mechanical Dimensions SOT-227




| SYMBOL | Dimensions in millimeters | |
|---|---|---|
| | Min. | Max. |
| A | 37.8 | 38.2 |
| B | 24.8 | 25.21 |
| C | 29.9 | 30.55 |
| D | 14.5 | 15.5 |
| E | 12.2 | 13.45 |
| F | 4.1 | 4.31 |
| G | φ4.1 | φ4.31 |
| H | 11 | 12.5 |
| I | 1.9 | 2.1 |
| K | 4.3 | 6.5 |

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