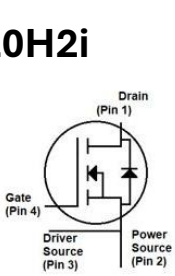
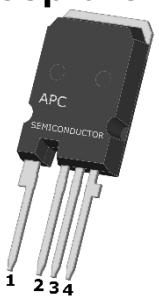
# SiC Power MOSFET with Ceramic Isolated Baseplate Tab

## AMR030V120H2i




## Applications:

- **Solar Inverters**
- **Uninterrupted power supplies**
- **Switch mode power supplies**
- **Motor drives**

## Features:

- **High blocking voltage with low on-resistance**
- **High switching speed with low capacitance**
- **Very low switching losses**
- **Excellent avalanche ruggedness**
- **Very fast and robust intrinsic body diode with low reverse recovery**
-

## Absolute Maximum Ratings ($T_{amb}$=25˚C, unless specified otherwise)

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | DC Reverse Voltage | 1200 | V |
| $V_{GSmax}$ | Gate-source voltage, max. transient voltage | -10/+25 | |
| $V_{GSmax}$ | Gate-source voltage, max. static voltage | -8/+22 | |
| $V_{GSop}$ | Gate-source voltage | -5/+18 | |
| $I_D$ | Continuous drain current (VGS = 18V) | 48 | A |
| | Continuous drain current (VGS = 18V), $T_C$ = 100°C | 34 | |
| $I_{D(pulse)}$ | Pulsed drain current (Pulse width limited by $T_{jmax}$) | 120 | A |
| $P_{tot}$ | Power dissipation | 201 | W |
| $T_j$ | Operating junction temperature | -55 to 175 | ˚C |
| $T_{stg}$ | Storage temperature | -55 to 175 | ˚C |
| M | Mounting torque | 0.7 | Nm |

## Thermal and Mechanical Characteristics

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-case thermal Resistance | - | 0.64 | - | °C/W |
| $R_{\theta JA}$ | Junction-to-ambient thermal Resistance | - | - | 40 | °C/W |

## Static Electrical Characteristics ($T_A$ =25˚C, unless specified otherwise)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 100μA | 1200 | - | - | V |
| $V_{GS(th)}$ | Gate-Source Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 10mA [ab] | 1.8 | 3.2 | 4.2 | |
| | | $V_{DS}$ = $V_{GS}$, $I_D$ = 10mA, $T_j$ = 175ºC [ab] | - | 2.4 | - | |
| $I_{DSS}$ | Drain-Source Leakage current | $V_{DS}$ = 1200V, $V_{GS}$ = 0V | - | 1 | 150 | μA |
| $I_{GSS}$ | Gate-Source leakage current | -10V < $V_{GS}$ < 25V | - | 1 | 100 | nA |
| $R_{DS(on)}$ | Drain-Source ON Resistance | $V_{GS}$ = 15V, $I_D$ = 40A | - | 37 | - | mΩ |
| | | $V_{GS}$ = 18V, $I_D$ = 40A | - | 32 | 42 | |
| | | $V_{GS}$ = 18V, $I_D$ = 40A, $T_j$ = 175ºC | - | 48 | - | |
| $g_{fs}$ | Transconductance | $V_{DS}$ = 20V, $I_D$ = 40A | - | 24 | - | S |
| | | $V_{DS}$ = 20V, $I_D$ = 40A, $T_j$ = 175ºC | - | 20 | - | |
| $R_{g(int)}$ | Internal gate resistance | f = 1MHz, $V_{AC}$ = 25mV | - | 3.6 | - | Ω |

[a] Pre-conditioned Vth, as per JEDEC standard JEP183A, (Revision of JEP183 January 2021)

[b] This SiC MOSFET can switch with driver pulses 0 V to 18 V with optimized PCB layouts and gate drive circuits.

## Dynamic Characteristics ($T_A$ = 25 °C, unless specified otherwise)

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = 1000V, f = 1MHz, $V_{AC}$ = 25mV | - | 2090 | - | pF |
| $C_{oss}$ | Output Capacitance | | - | 85 | - | |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 2 | - | |
| $E_{oss}$ | $C_{oss}$ stored energy | | - | 35 | - | μJ |
| $Q_{gs}$ | Gate-Source Gate Charge | $V_{DD}$ = 800V, $V_{GS}$ = -5/+18V, $I_D$ = 40A, $I_{GS}$ = 1mA | - | 30 | - | nC |
| $Q_{gd}$ | Gate-Drain Gate Charge | | - | 27 | - | |
| $Q_g$ | Total Gate Charge | | - | 91 | - | |

## Switching Characteristics ($T_A = 25\ °C$, unless specified otherwise)

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $T_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 800V, $V_{GS}$ = -5/+18V, $I_D$ = 40A, $R_{G(ext)}$ = 2.4Ω, L = 110μH | - | 14 | - | ns |
| $T_r$ | Rise time | | - | 18 | - | |
| $T_{d(off)}$ | Turn-off delay time | | - | 29 | - | |
| $T_f$ | Fall time | | - | 6 | - | |
| $E_{on}$ | Turn On Switching Energy | | - | 442 | - | μJ |
| $E_{off}$ | Turn Off Switching Energy | | - | 37 | - | |
| $T_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 800V, $V_{GS}$ = -5/+18V, $I_D$ = 40A, $R_{G(ext)}$ = 2.4Ω, L = 110μH, $T_j$ = 175ºC | - | 12 | - | ns |
| $T_r$ | Rise time | | - | 22 | - | |
| $T_{d(off)}$ | Turn-off delay time | | - | 35 | - | |
| $T_f$ | Fall time | | - | 7 | - | |
| $E_{on}$ | Turn On Switching Energy | | - | 578 | - | μJ |
| $E_{off}$ | Turn Off Switching Energy | | - | 44 | - | |

## Body Diode Characteristics ($T_A = 25\ °C$, unless specified otherwise)

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Body Diode Forward Voltage | $V_{GS}$ = -5V, $I_{SD}$ = 40A | - | 4.6 | - | V |
| | | $V_{GS}$ = -5V, $I_{SD}$ = 40A, $T_j$ = 175ºC | - | 4.0 | - | |
| $I_S$ | Continuous diode forward current | $T_C$ = 25℃ | - | - | 48 | A |
| $I_{S(pulse)}$ | Diode pulse current | $V_{GS}$ = -5V, pulse width $t_p$ limited by $T_{jmax}$ | - | - | 120 | A |
| $t_{rr}$ | Reverse recovery time | $V_{GS}$ = -5V, $I_{SD}$ = 40A, $V_R$ = 800V, $di_f/dt$ = 2.93kA/μs | - | 13 | - | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 0.24 | | μC |
| $I_{rrm}$ | Peak reverse recovery current | | - | 27 | - | A |
| $t_{rr}$ | Reverse recovery time | $V_{GS}$ = -5V, $I_{SD}$ = 40A, $V_R$ = 800V, $T_j$ = 175°C, $di_f/dt$ = 2.98kA/μs | - | 24 | - | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 0.70 | - | μC |
| $I_{rrm}$ | Peak reverse recovery current | | - | 44 | - | A |

## Electrical Characteristic Diagrams

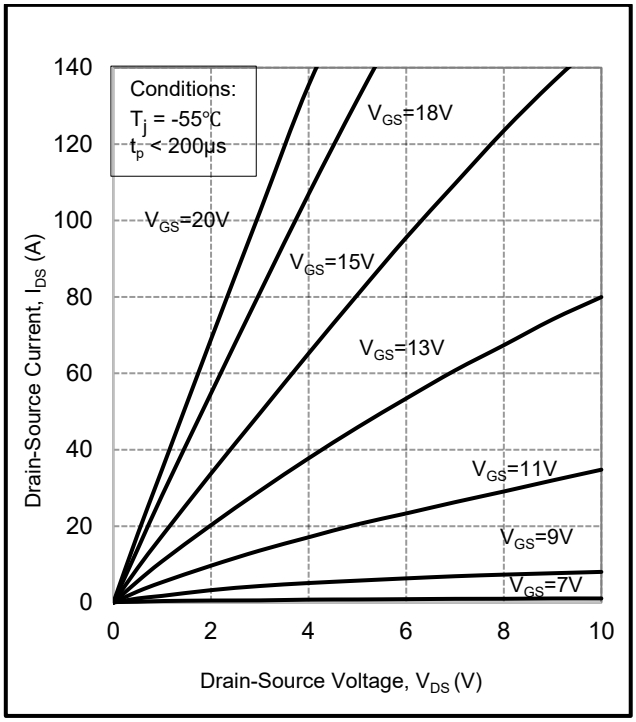



Figure 1. Output characteristics at $T_j$ = -55℃

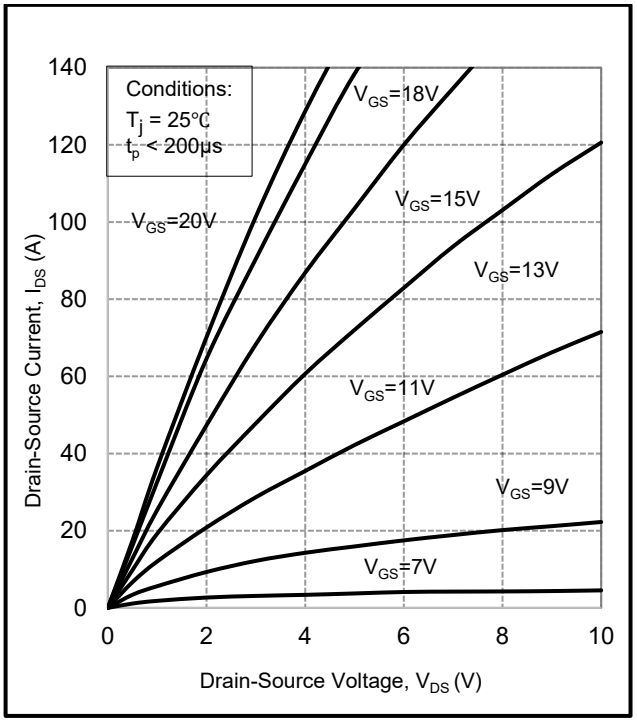



Figure 2. Output characteristics at $T_j$ = 25℃

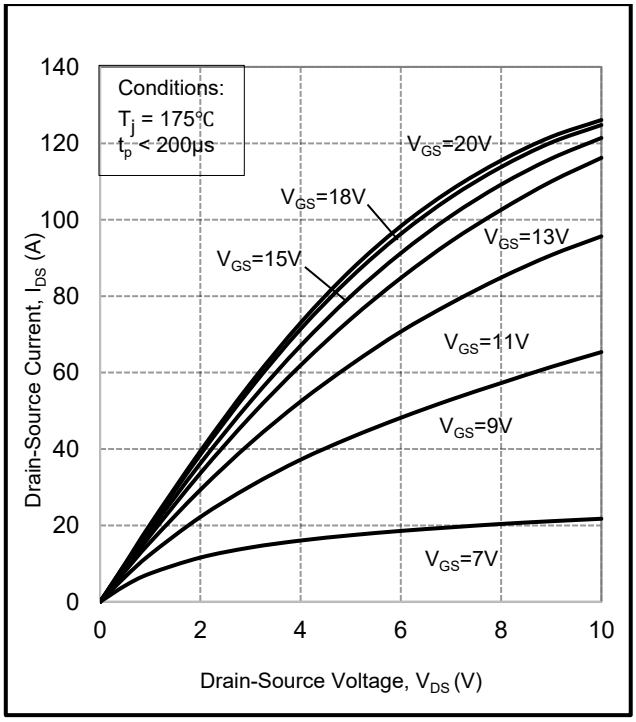



Figure 3. Output characteristics at $T_j$ = 175℃

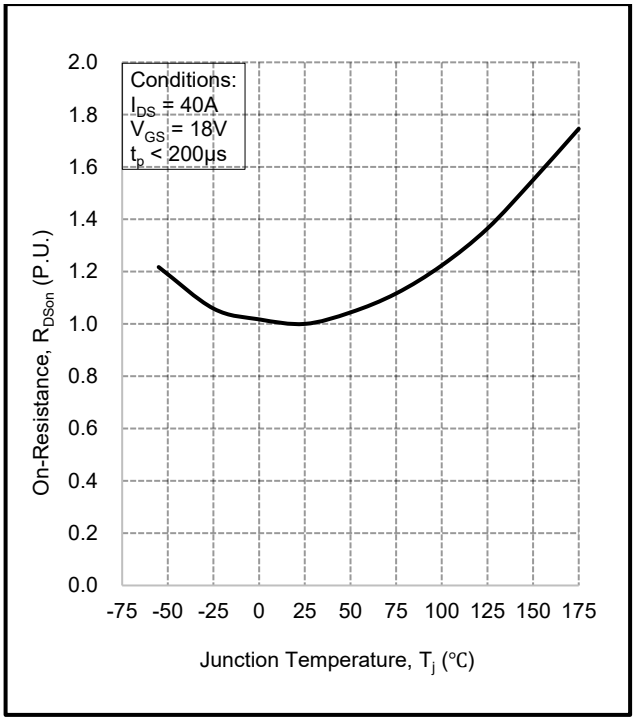



Figure 4. Normalized on-resistance vs. temperature

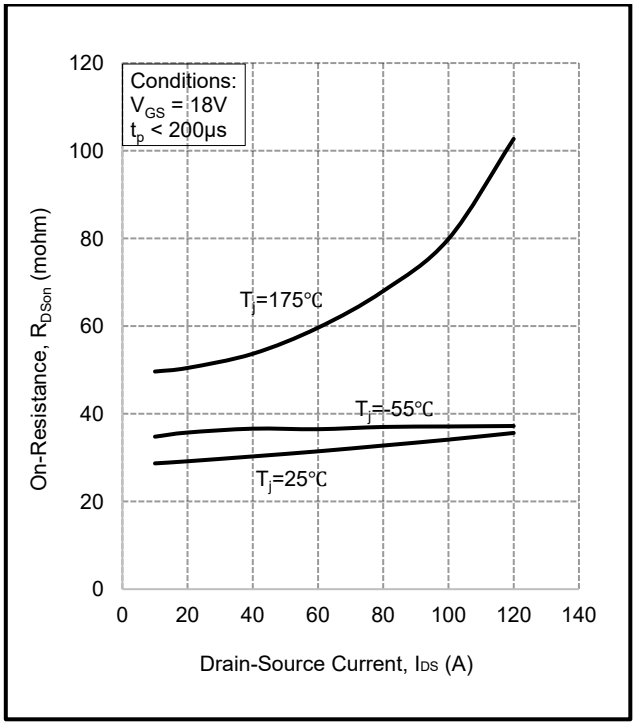



Figure 5. On-resistance vs. drain current for various temperatures

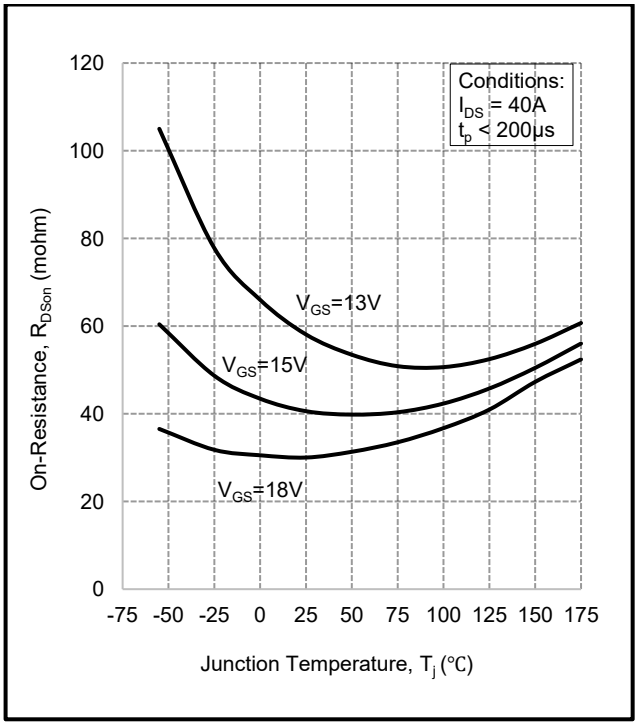



Figure 6. On-resistance vs. temperature for various gate voltages

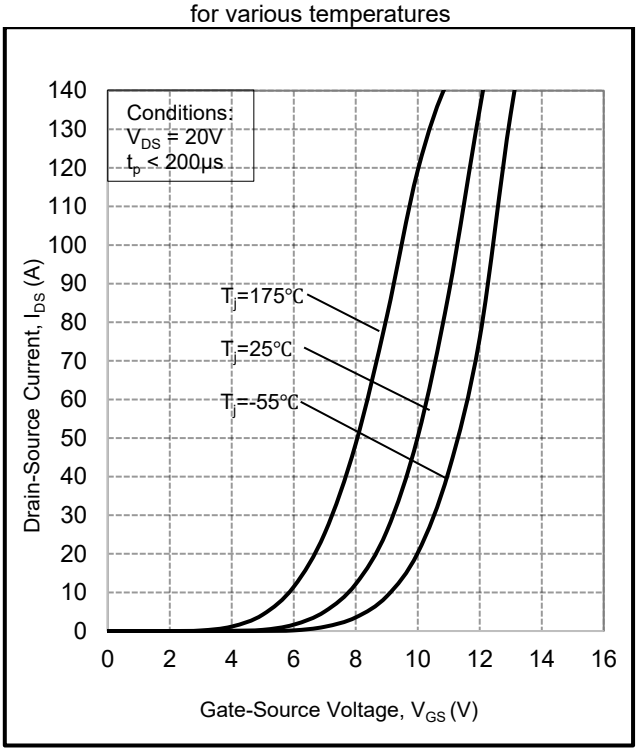



Figure 7. Transfer characteristic for various junction temperatures

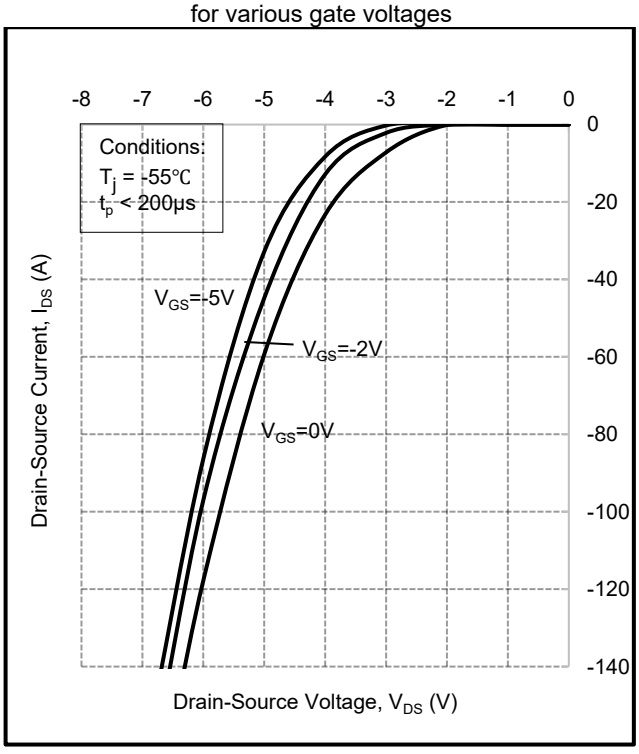



Figure 8. Body diode characteristic at $T_j$ = -55℃

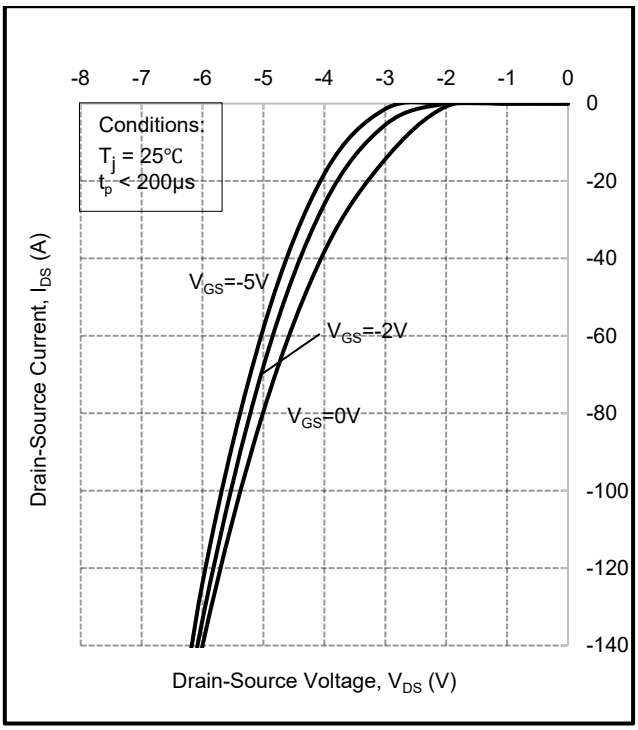



Figure 9. Body diode characteristic at $T_j$ = 25℃

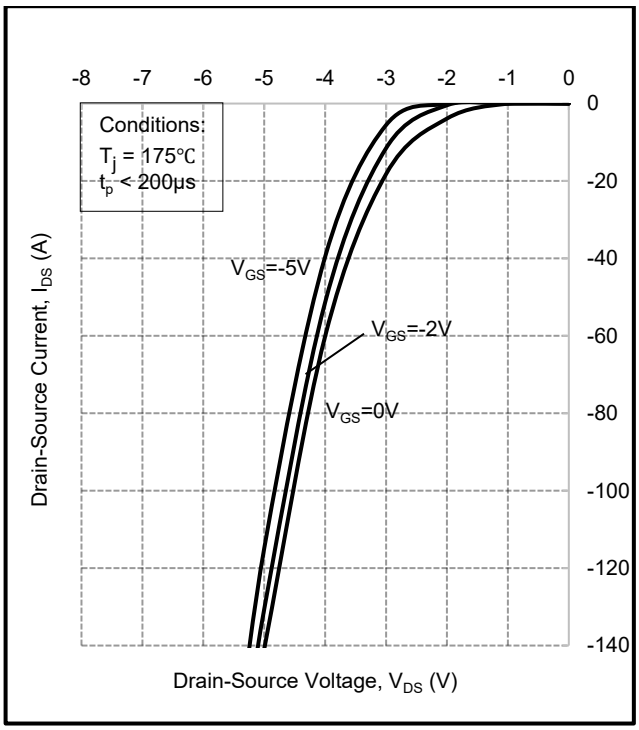



Figure 10. Body diode characteristic at $T_j$ = 175℃

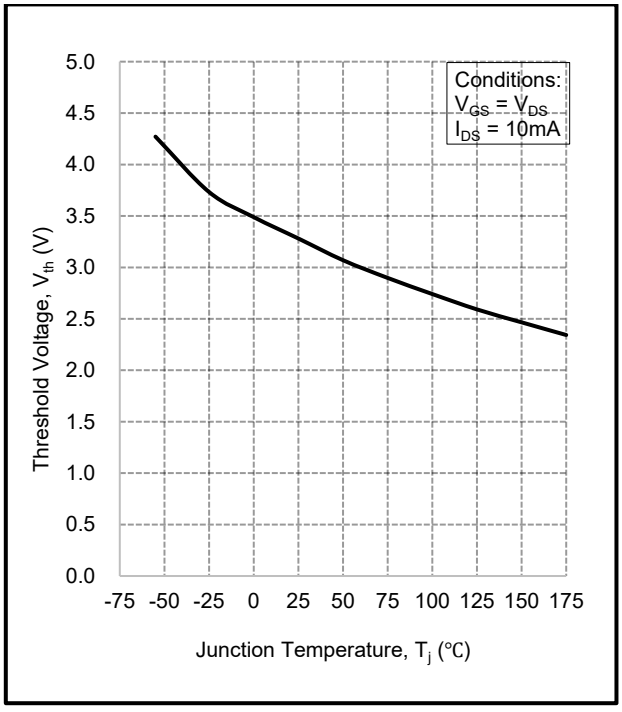



Figure 11. Threshold voltage vs. temperature

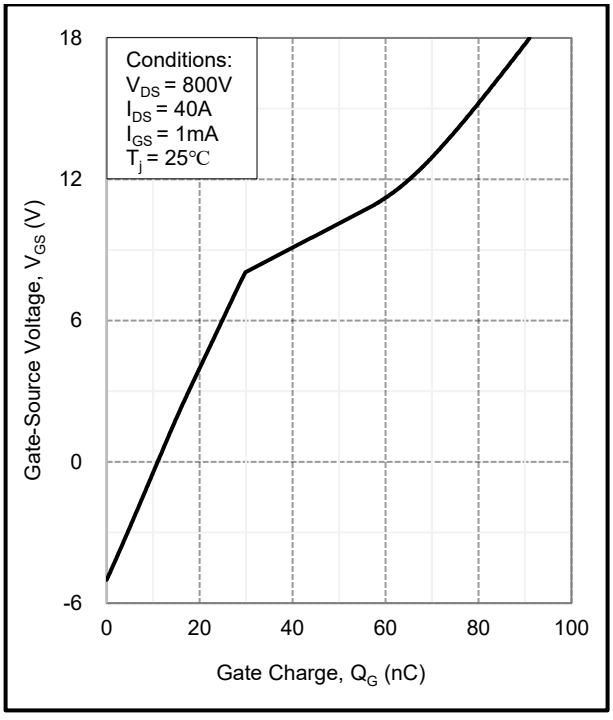



Figure 12. Gate charge characteristics

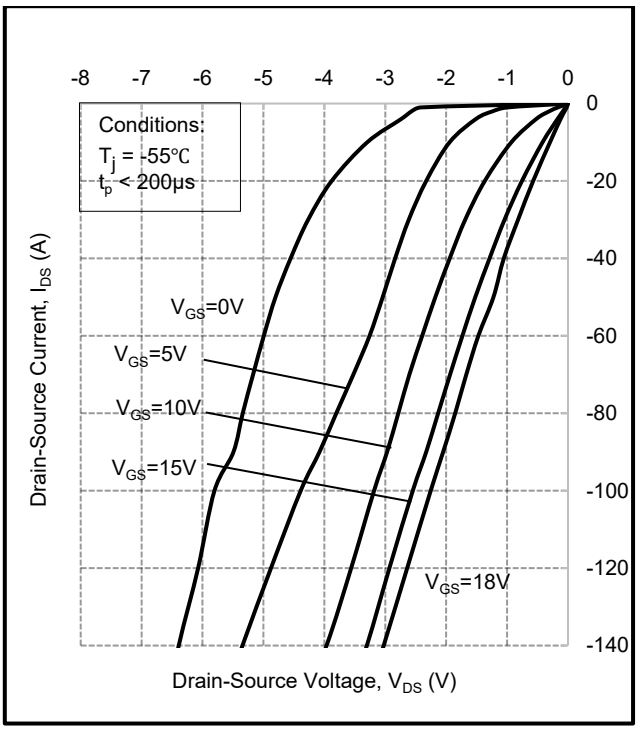



Figure 13. 3rd quadrant characteristic at $T_j$ = -55℃

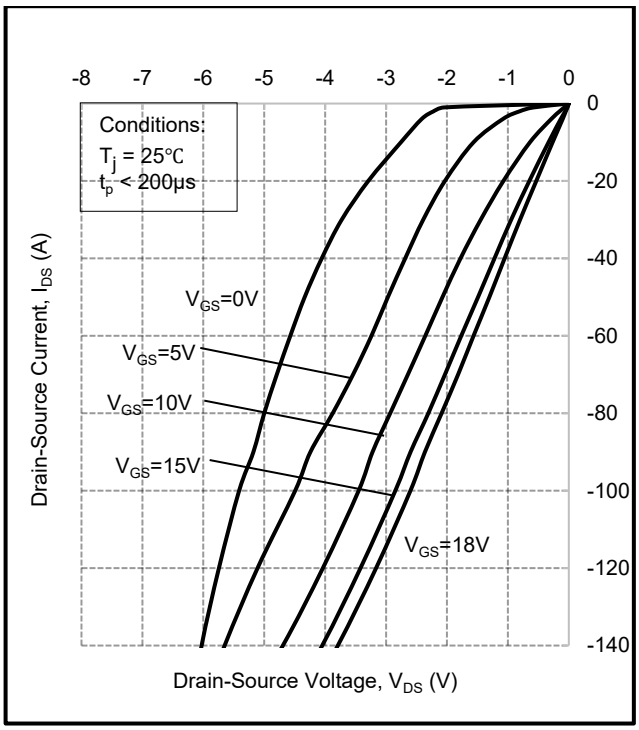



Figure 14. 3rd quadrant characteristic at $T_j$ = 25℃

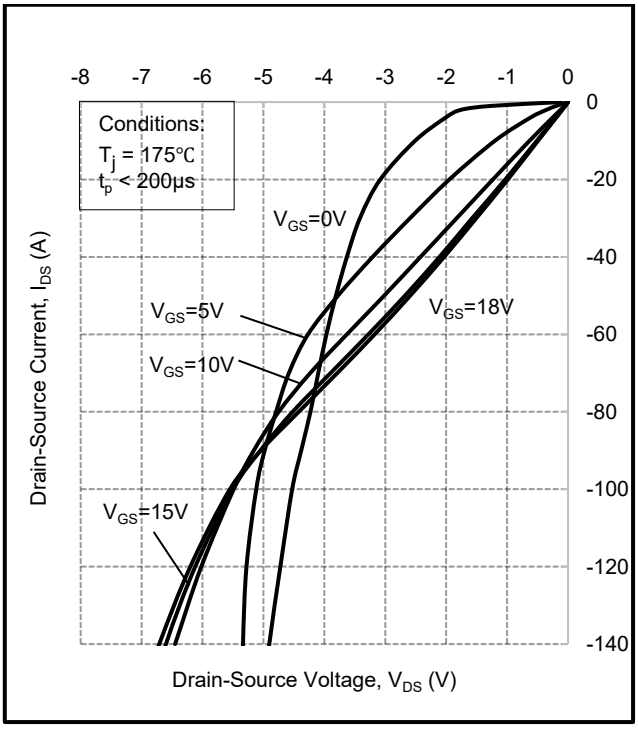



Figure 15. 3rd quadrant characteristic at $T_j$ = 175℃

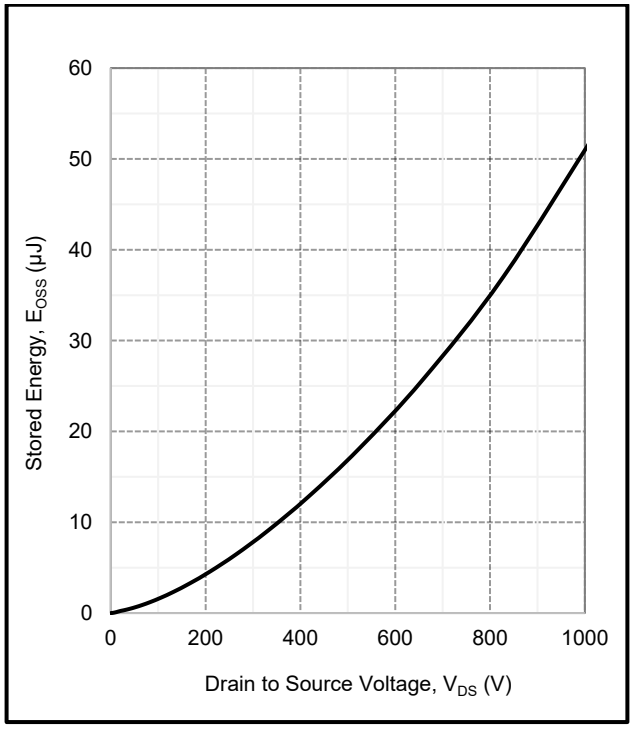



Figure 16. Output capacitor stored energy

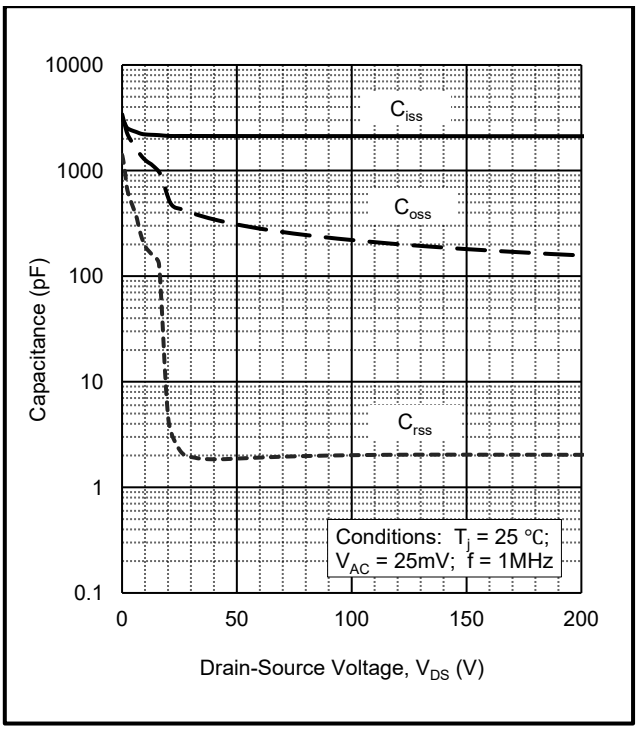



Figure 17. Capacitance vs. drain-source voltage (0 - 200V)

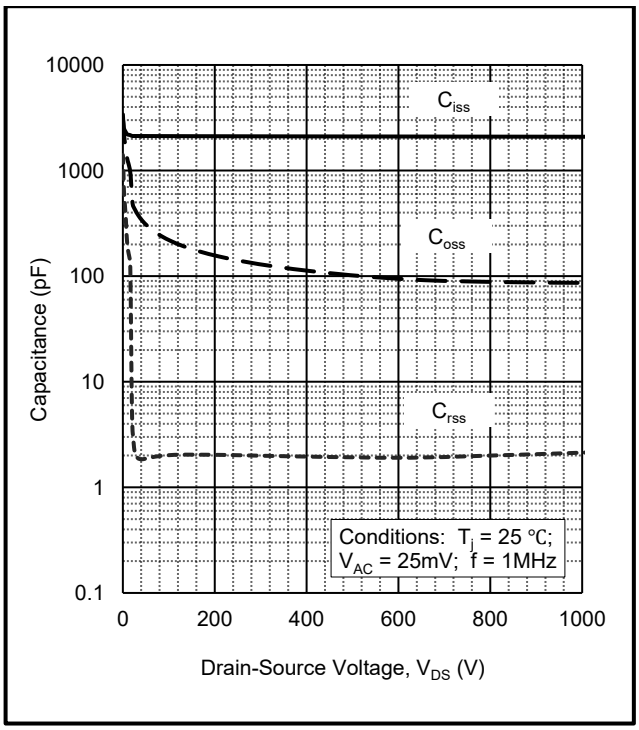



Figure 18. Capacitance vs. drain-source voltage (0 - 1000V)

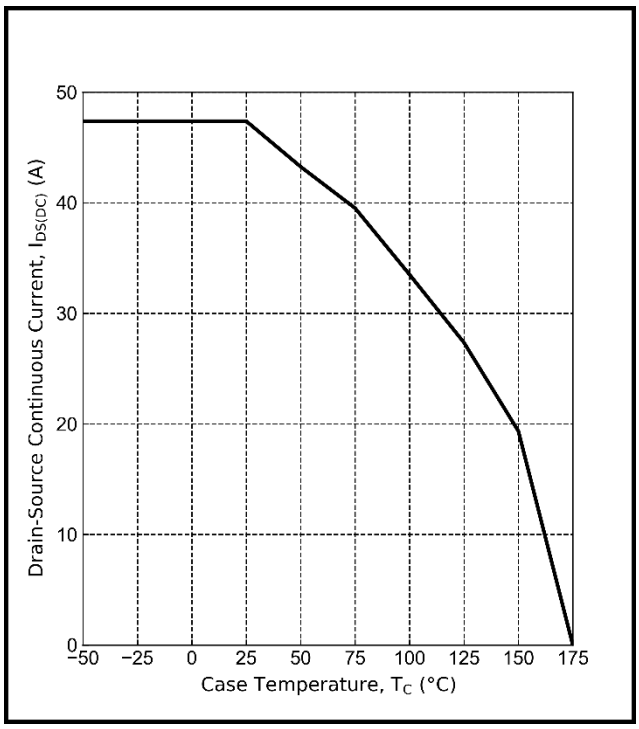



Figure 19. Continuous drain current derating vs. temperature

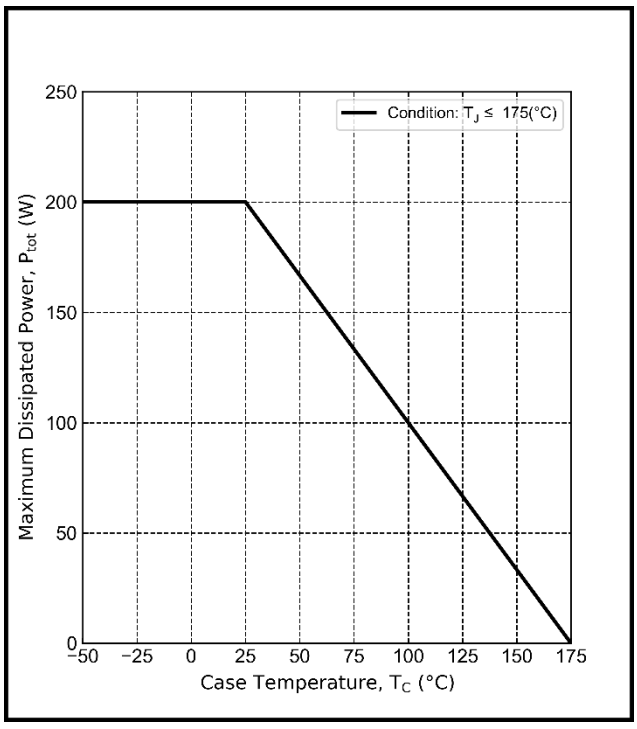



Figure 20. Maximum power dissipation derating vs. temperature

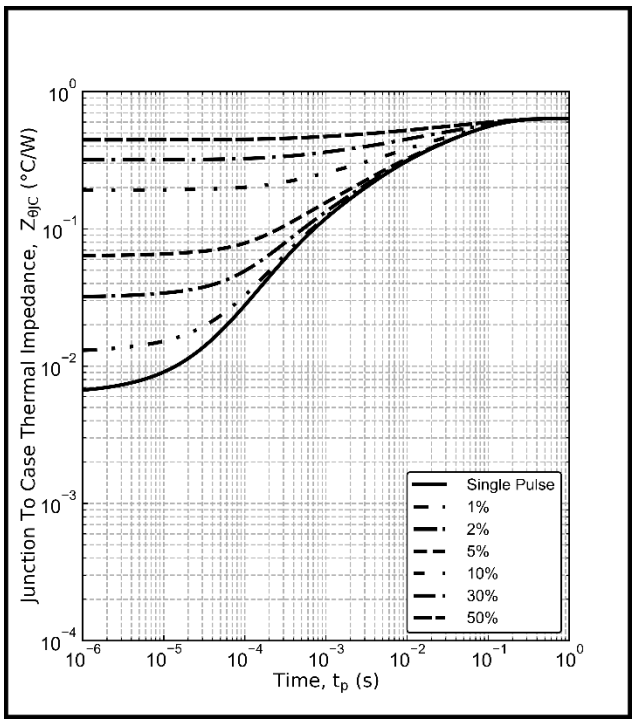



Figure 21. Transient thermal impedance

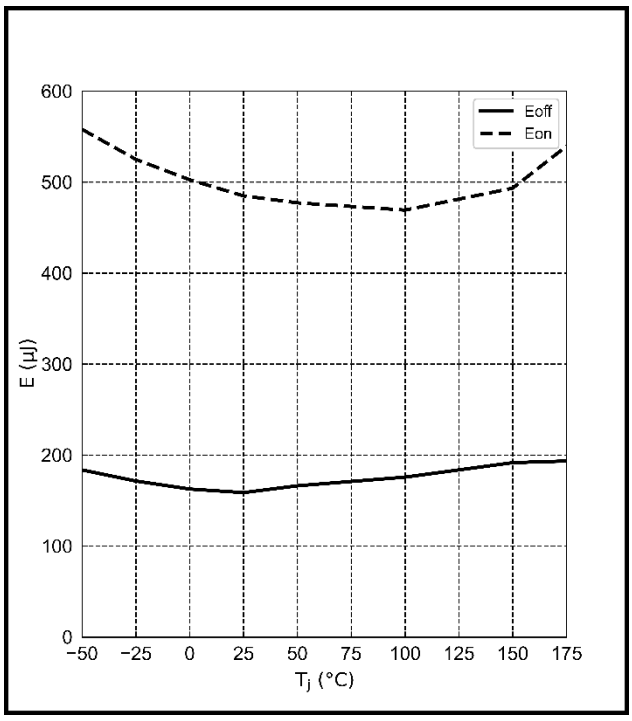



Figure 22. Typical switching energies Eon and Eoff with $T_j$ ,
(**Vg = -5 V to 18 V, $I_d$= 40 A Vds = 800 V, Rg = 2.2 Ω)**

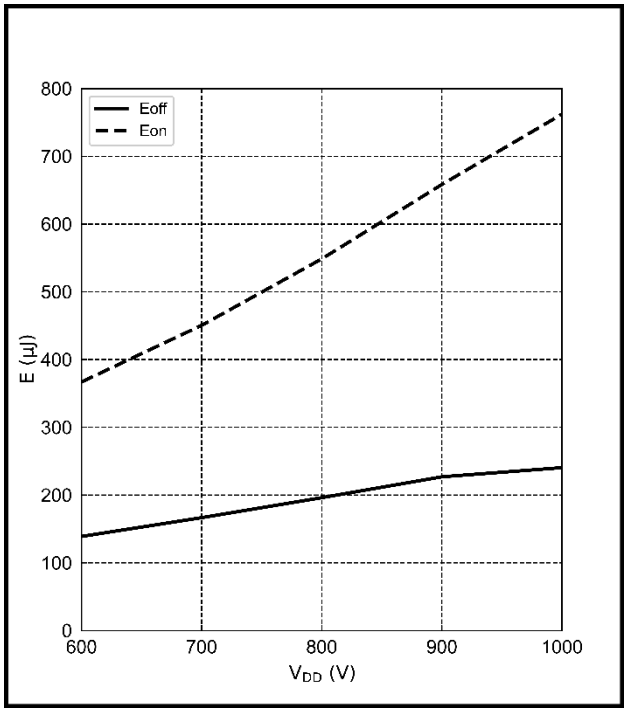



Figure 23. Typical switching energies Eon and Eoff with $V_{DD}$
**(Vg = -5 V to 18 V, $I_d$= 40 A, $T_j$ = 175°C, Rg = 2.2 Ω)**

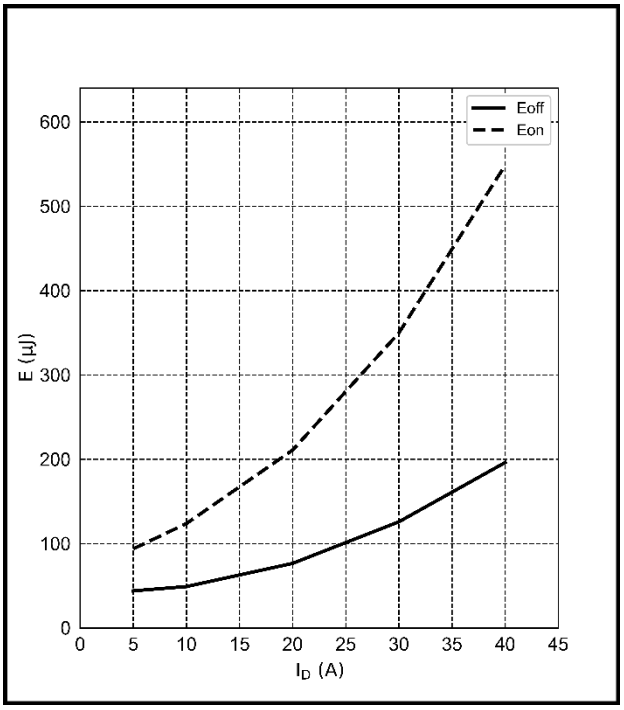



Figure 24. Typical switching energies Eon and Eoff with $I_D$
**(Vg = -5 V to 18 V, $V_{dd}$= 800 V, $T_j$ = 175°C, Rg = 2.2 Ω)**

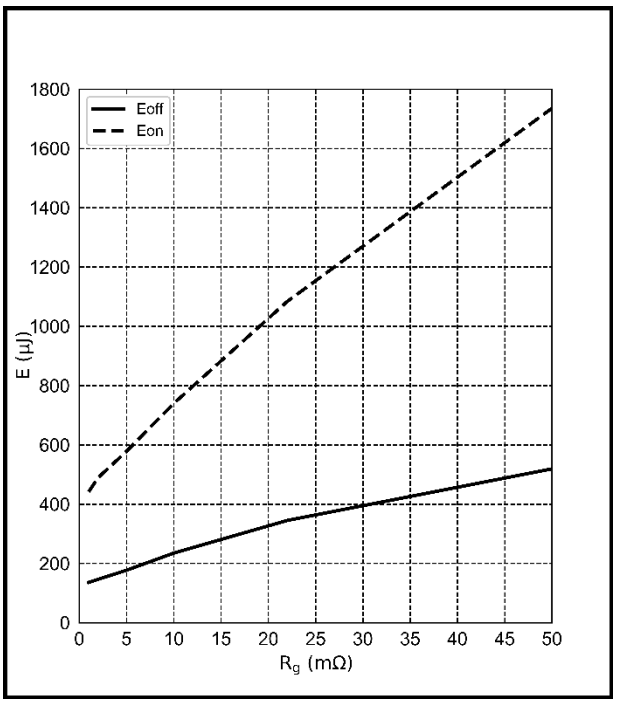



Figure 25. Typical switching energies Eon and Eoff with Rg
**(Vg = -5 V to 18 V, Vds = 800 V, $I_d$= 40 A, $T_j$ = 25℃)**

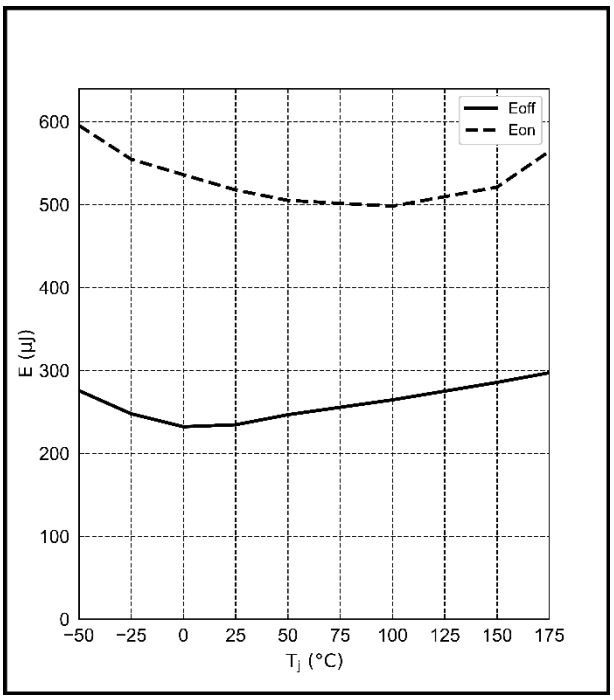



Figure 26. Typical switching energies Eon and Eoff with $T_j$ ,
**(Vg = 0 V to 18 V, $I_d$= 40 A Vds = 800 V, Rg = 2.2 Ω)**

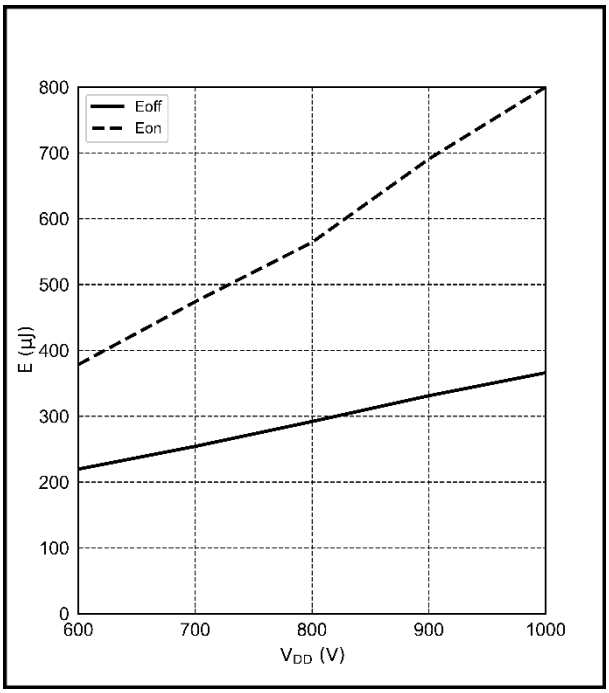



Figure 27. Typical switching energies Eon and Eoff with $V_{DD}$
**(Vg = 0 V to 18 V, $I_d$= 40 A, $T_j$ = 175℃, Rg = 2.2 Ω)**

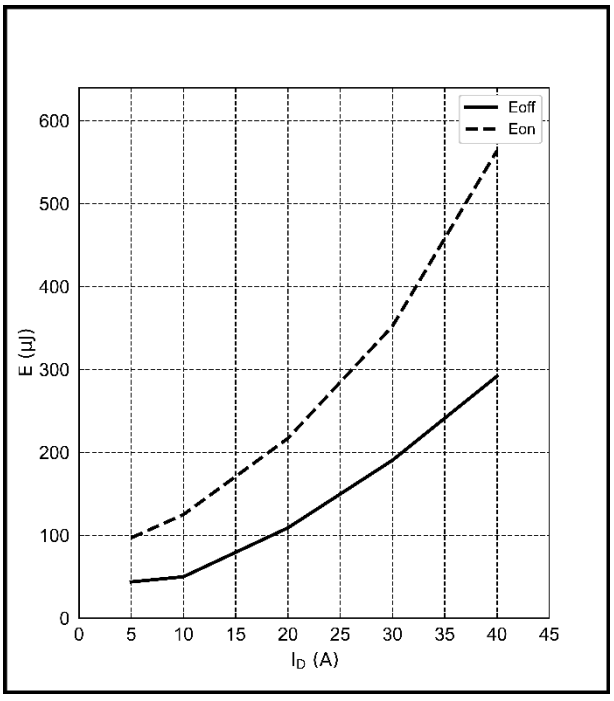



Figure 28. Typical switching energies Eon and Eoff with $I_D$
**(Vg = 0 V to 18 V, $V_{dd}$= 800 V, $T_j$ = 175℃, Rg = 2.2 Ω)**

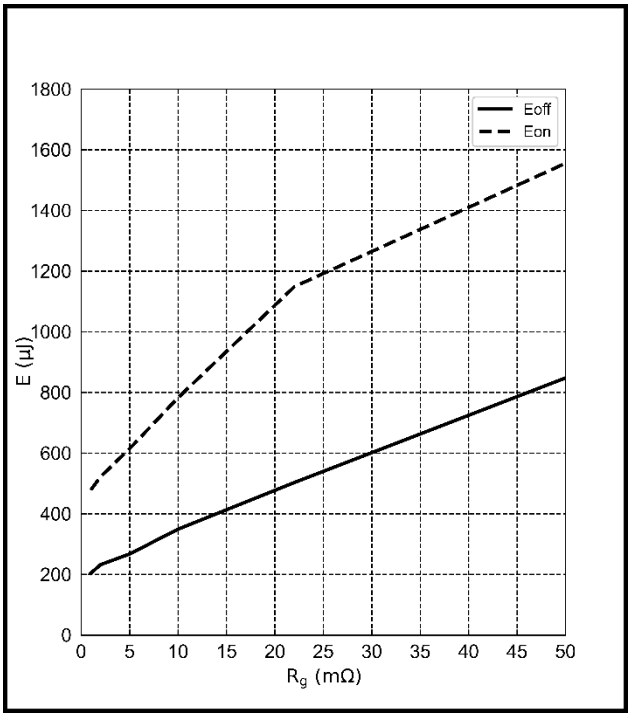



Figure 29. Typical switching energies Eon and Eoff with Rg
(**Vg = 0 V to 18 V, Vds = 800 V, $I_d$= 40 A, $T_j$ = 25℃)**

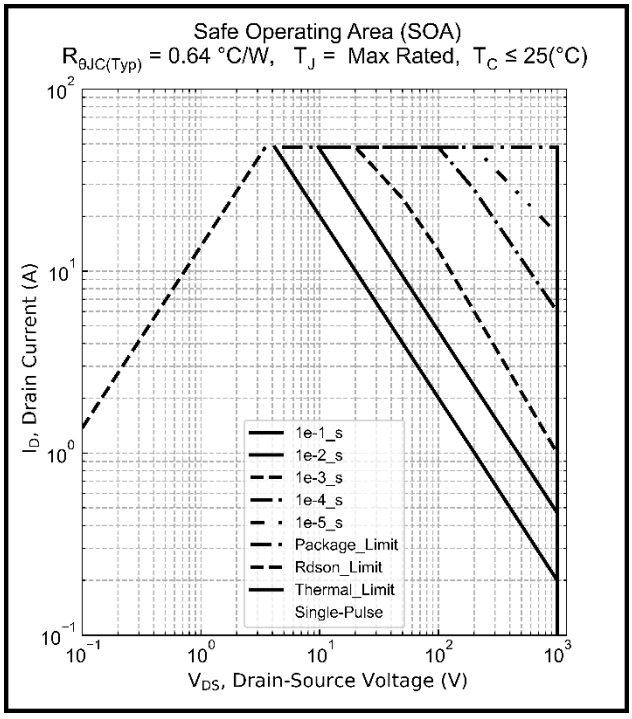



Figure 30. Safe Operating Area

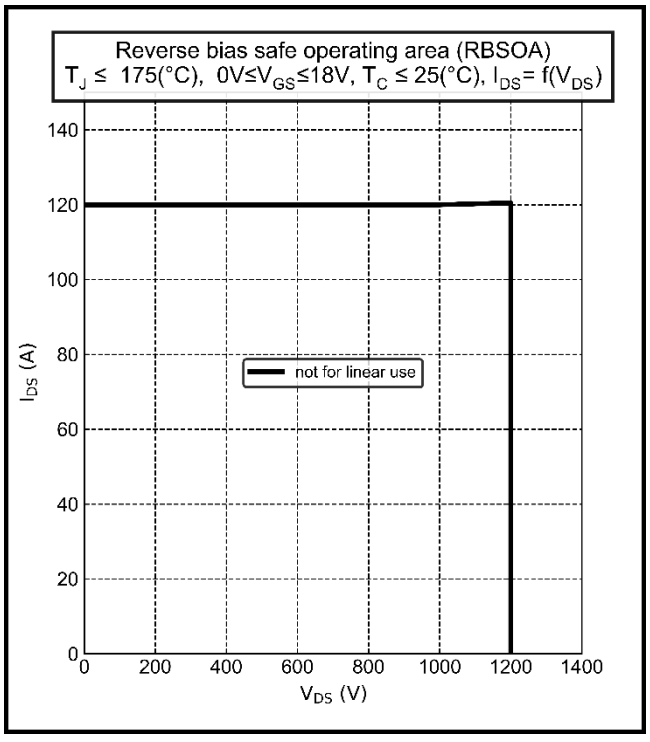



Figure 31. Reverse Bias Safe Operating Area

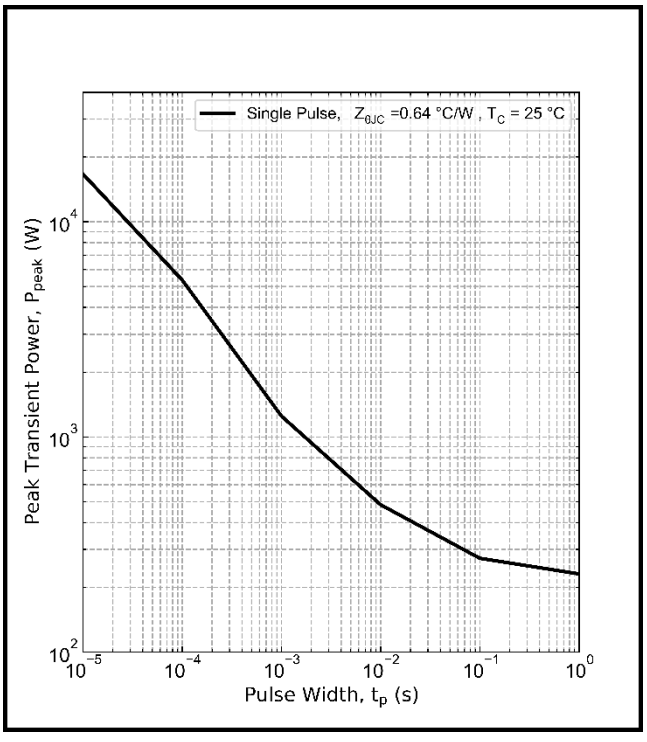



Figure 32. Single Pulse Maximum Power Dissipation

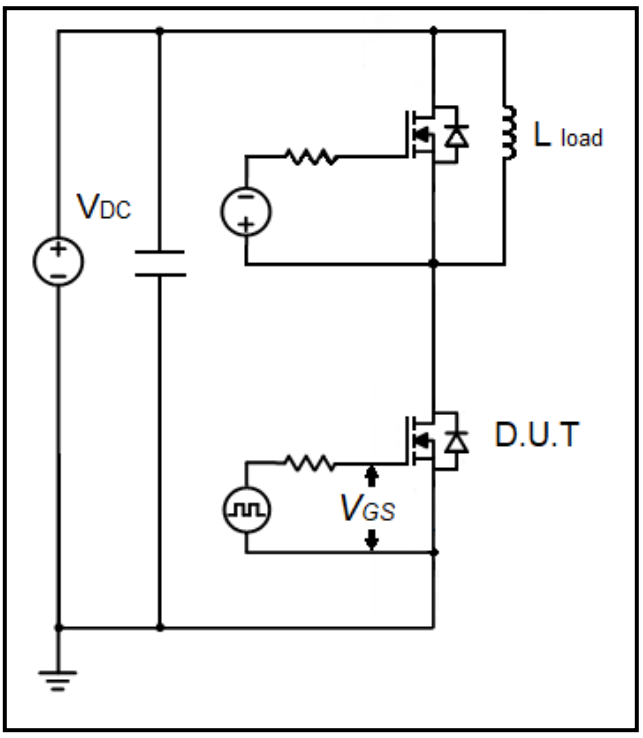



Figure 33. Clamped inductive switching waveform test circuit

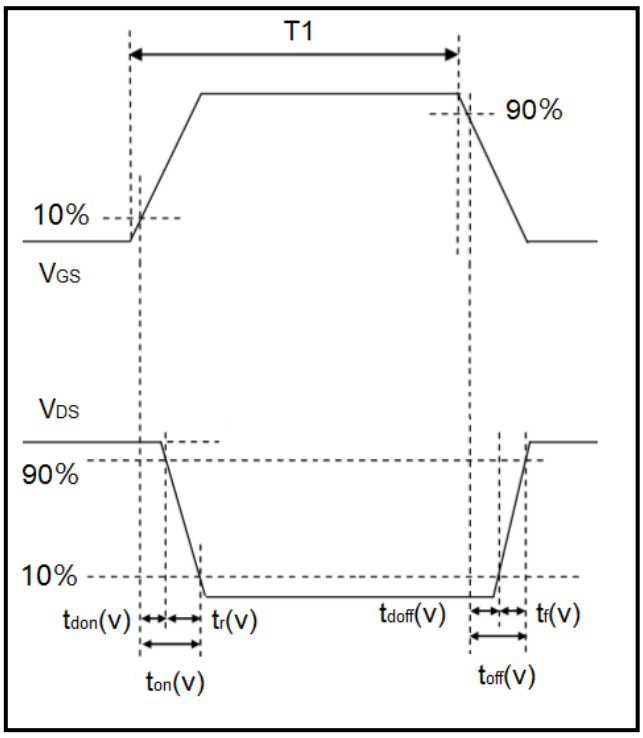
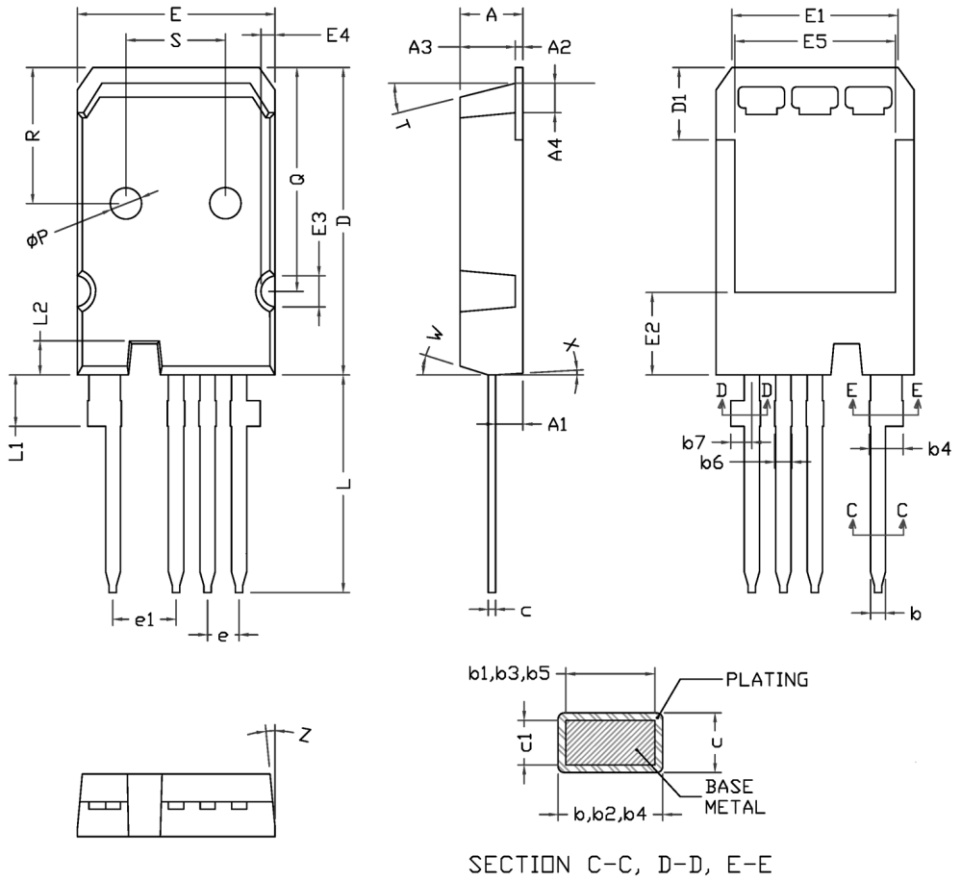



Figure 34. Switching times definition

## Package Information:




| AREA | MIN | NOM | MAX |
|---|---|---|---|
| A | 4,84 | 5.03 | 5.22 |
| Al | 2.29 | 2.39 | 2.49 |
| A2 | 0.65 | 0.70 | 0.78 |
| A3 | 4.20 | 4.33 | 4.46 |
| A4 | 2.07 | 2.20 | 2.33 |
| D | 24,60 | 24,75 | 24,85 |
| D1 | 5,68 | 5,83 | 5,98 |
| E | 15,71 | 15,90 | 16.09 |
| El | 13.22 | 13.35 | 13.48 |
| E2 | 5,93 | 6,63 | 7.33 |
| E3 | 1.82 | 2.53 | 3.24 |
| E4 | 0,81 | 1.04 | 1.24 |
| E5 | 12.37 | 12,90 | 13.43 |
| e | 2.54 BSC | | |
| e1 | 5.08 BSC | | |
| L | 17.27 | 17,52 | 17,77 |
| L1 | 3,97 | 4.17 | 4.37 |
| L2 | 2.35 | 2.50 | 2.65 |

| AREA | MIN | NOM | MAX |
|---|---|---|---|
| b | 1.07 | - | 1.33 |
| b1 | 1.07 | 1.20 | 1.28 |
| b2 | 2.39 | - | 2,64 |
| b3 | 2.39 | - | 2.69 |
| b4 | 2.39 | - | 2,94 |
| b5 | 2.39 | 2.53 | 2.84 |
| b6 | 1.07 | - | 1.60 |
| b7 | 1.30 | - | 1.70 |
| c | 0.65 | - | 0.78 |
| c1 | 0,65 | 0.70 | 0.75 |
| ΦP | 2.40 | 2.50 | 2.70 |
| Q | 17,77 | 18.02 | 18.27 |
| R | 10,78 | 10,98 | 11.18 |
| S | 7,80 | 8.00 | 8.20 |
| T | 14° REF | | |
| W | 21° REF | | |
| X | 3° REF | | |
| Z | 5° REF | | |

## Ordering Information

| | |
|---|---|
| Part number | AMR030V120H2i |
| Package | TO-247-4L (Isolated) |
| Unit quantity | 300 EA |
| Packing type | Tube |

For more information, visit https://www.apowerc2.com