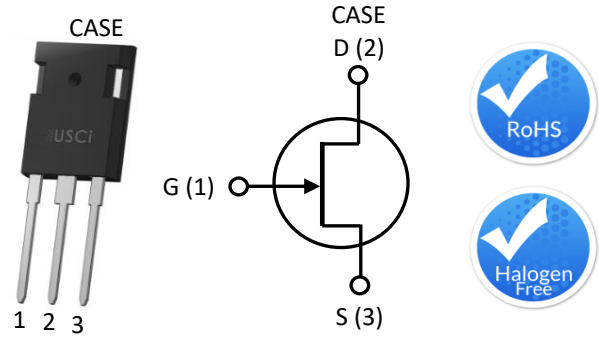


Description

United Silicon Carbide, Inc offers the high-performance G3 SiC normally-on JFET transistors. This series exhibits ultra-low on resistance ($R_{DS(ON)}$) and gate charge (Q_G) allowing for low conduction and switching loss. The device normally-on characteristics with low $R_{DS(ON)}$ at $V_{GS} = 0\text{ V}$ is also ideal for current protection circuits without the need for active control, as well as for cascode operation.



| Part Number | Package | Marking |
|---------------|-----------|---------------|
| UJ3N120070K3S | TO-247-3L | UJ3N120070K3S |

Features

- ◆ Typical on-resistance $R_{DS(on),typ}$ of 70mΩ
- ◆ Voltage controlled
- ◆ Maximum operating temperature of 175°C
- ◆ Extremely fast switching not dependent on temperature
- ◆ Low gate charge
- ◆ Low intrinsic capacitance
- ◆ RoHS compliant

Typical Applications

- ◆ Over current protection circuits
- ◆ DC-AC inverters
- ◆ Switch mode power supplies
- ◆ Power factor correction modules
- ◆ Motor drives
- ◆ Induction heating

Maximum Ratings

| Parameter | Symbol | Test Conditions | Value | Units |
|---|----------------|---------------------------|------------|-------|
| Drain-source voltage | V_{DS} | | 1200 | V |
| Gate-source voltage | V_{GS} | DC | -20 to +3 | V |
| | | AC ⁽¹⁾ | -20 to +20 | |
| Continuous drain current ⁽²⁾ | I_D | $T_C = 25^\circ\text{C}$ | 33.5 | A |
| | | $T_C = 100^\circ\text{C}$ | 24.5 | A |
| Pulsed drain current ⁽³⁾ | I_{DM} | $T_C = 25^\circ\text{C}$ | 85 | A |
| Power dissipation | P_{tot} | $T_C = 25^\circ\text{C}$ | 254 | W |
| Maximum junction temperature | $T_{J,max}$ | | 175 | °C |
| Operating and storage temperature | T_J, T_{STG} | | -55 to 175 | °C |
| Max. lead temperature for soldering, 1/8" from case for 5 seconds | T_L | | 250 | °C |

(1) +20V AC rating applies for turn-on pulses <200ns applied with external $R_G > 1\Omega$.

(2) Limited by $T_{J,max}$

(3) Pulse width t_p limited by $T_{J,max}$

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

Typical Performance - Static

| Parameter | Symbol | Test Conditions | Value | | | Units |
|--------------------------------|--------------|--|-------|-------|-----|------------------|
| | | | Min | Typ | Max | |
| Drain-source breakdown voltage | BV_{DS} | $V_{GS} = -20\text{V}, I_D = 1\text{mA}$ | 1200 | | | V |
| Total drain leakage current | I_D | $V_{DS} = 1200\text{V}, V_{GS} = -20\text{V}, T_J = 25^\circ\text{C}$ | | 5 | 30 | μA |
| | | $V_{DS} = 1200\text{V}, V_{GS} = -20\text{V}, T_J = 175^\circ\text{C}$ | | 18 | | |
| Total gate leakage current | I_G | $V_{GS} = -20\text{V}, T_J = 25^\circ\text{C}$ | | 5 | 50 | μA |
| | | $V_{GS} = -20\text{V}, T_J = 175^\circ\text{C}$ | | 20 | | |
| Drain-source on-resistance | $R_{DS(on)}$ | $V_{GS} = 2\text{V}, I_D = 10\text{A}, T_J = 25^\circ\text{C}$ | | 63 | | $\text{m}\Omega$ |
| | | $V_{GS} = 0\text{V}, I_D = 10\text{A}, T_J = 25^\circ\text{C}$ | | 70 | 90 | |
| | | $V_{GS} = 2\text{V}, I_D = 10\text{A}, T_J = 175^\circ\text{C}$ | | 139 | | |
| | | $V_{GS} = 0\text{V}, I_D = 10\text{A}, T_J = 175^\circ\text{C}$ | | 154 | | |
| Gate threshold voltage | $V_{G(th)}$ | $V_{DS} = 5\text{V}, I_D = 35\text{mA}$ | -14 | -11.5 | -6 | V |
| Gate resistance | R_G | $f = 1\text{MHz}, \text{open drain}$ | | 3.3 | | Ω |

Typical Performance - Dynamic

| Parameter | symbol | Test Conditions | Value | | | Units | |
|--|---------------|--|-------|-----|-----|-------|---------|
| | | | Min | Typ | Max | | |
| Input capacitance | C_{iss} | $V_{DS} = 100V,$ $V_{GS} = -20V,$ $f = 100kHz$ | | 985 | | pF | |
| Output capacitance | C_{oss} | | | 100 | | | |
| Reverse transfer capacitance | C_{rss} | | | 95 | | | |
| Effective output capacitance, energy related | $C_{oss(er)}$ | $V_{DS} = 0V$ to 800V, $V_{GS} = -20V$ | | 52 | | pF | |
| Total gate charge | Q_G | $V_{DS}=800V, I_D = 25A,$ $V_{GS}=-18V$ to 0V | | 116 | | nC | |
| Gate-drain charge | Q_{GD} | | | 63 | | | |
| Gate-source charge | Q_{GS} | | | 11 | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DS}=800V, I_D=25A,$ Gate Driver = -18V to 0V, $R_{G,EXT} = 1\Omega,$ Inductive Load, FWD: UJ2D1215T $T_J = 25^\circ C$ | | 17 | | ns | |
| Rise time | t_r | | | 25 | | | |
| Turn-off delay time | $t_{d(off)}$ | | | 29 | | | |
| Fall time | t_f | | | 39 | | | |
| Turn-on energy | E_{ON} | | | 434 | | | μJ |
| Turn-off energy | E_{OFF} | | | 393 | | | |
| Total switching energy | E_{TOTAL} | | 827 | | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DS}=800V, I_D=25A,$ Gate Driver = -18V to 0V, $R_{G,EXT} = 1\Omega,$ Inductive Load, FWD: UJ2D1215T $T_J = 150^\circ C$ | | 17 | | ns | |
| Rise time | t_r | | | 23 | | | |
| Turn-off delay time | $t_{d(off)}$ | | | 25 | | | |
| Fall time | t_f | | | 24 | | | |
| Turn-on energy | E_{ON} | | | 418 | | | μJ |
| Turn-off energy | E_{OFF} | | | 278 | | | |
| Total switching energy | E_{TOTAL} | | 696 | | | | |

Thermal Characteristics

| Parameter | symbol | Test Conditions | Value | | | Units |
|--------------------------------------|-----------------|-----------------|-------|------|------|--------------|
| | | | Min | Typ | Max | |
| Thermal resistance, junction-to-case | $R_{\theta JC}$ | | | 0.45 | 0.59 | $^\circ C/W$ |

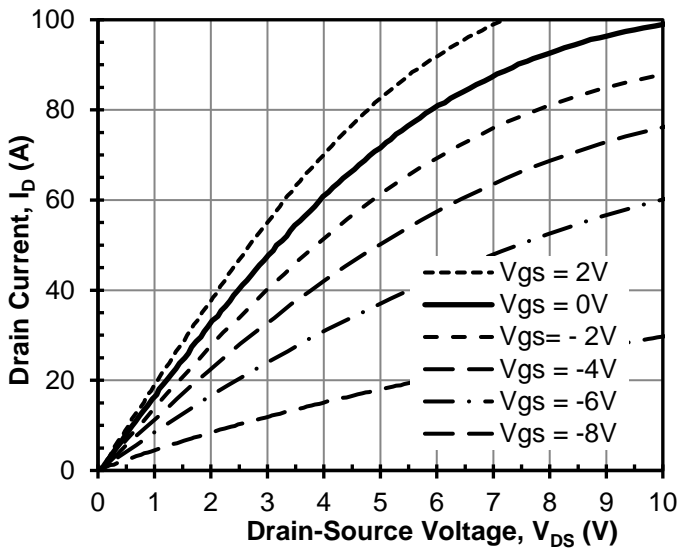
Typical Performance Diagrams


Figure 1 Typical output characteristics
at $T_J = -55^\circ\text{C}$

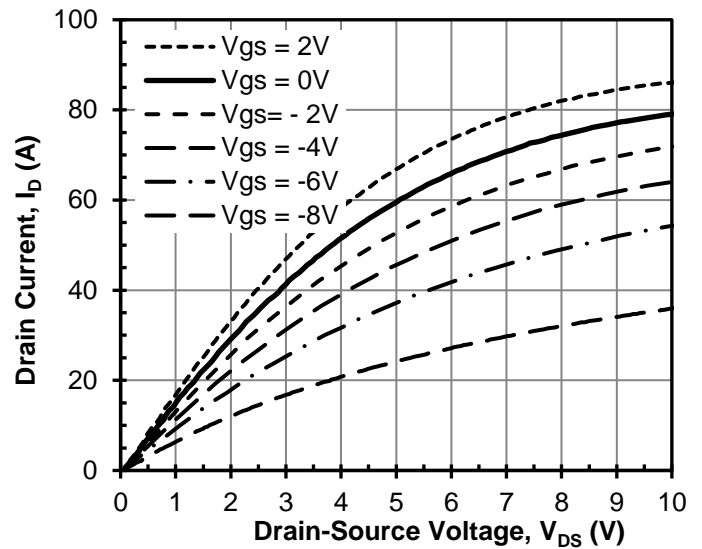


Figure 2 Typical output characteristics
at $T_J = 25^\circ\text{C}$

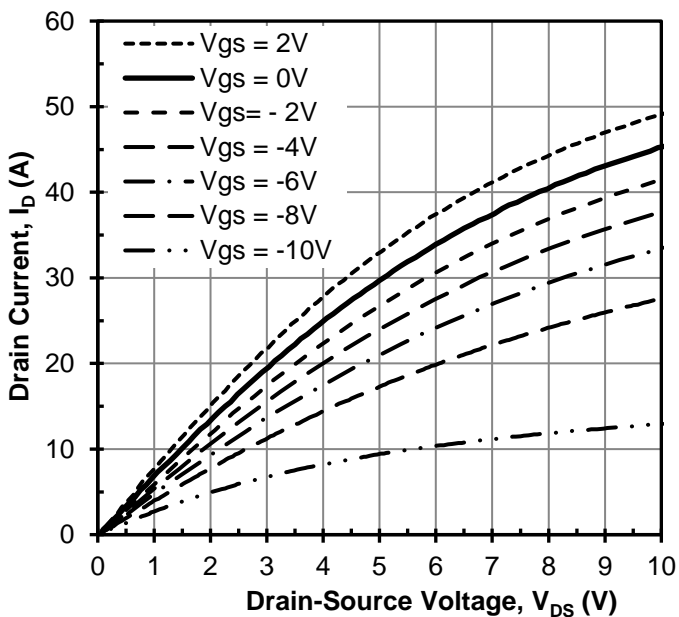


Figure 3 Typical output characteristics
at $T_J = 175^\circ\text{C}$

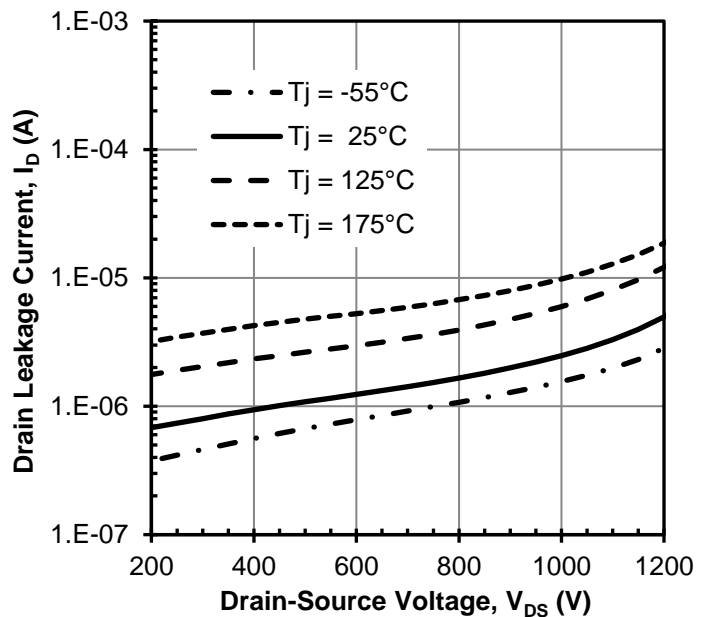


Figure 4 Typical drain-source leakage
at $V_{GS} = -20\text{V}$

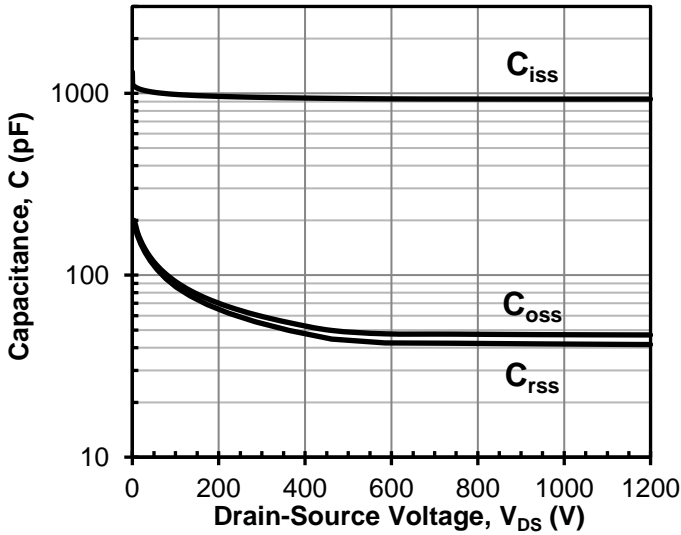


Figure 5 Typical capacitances at 100kHz and $V_{GS} = -20V$

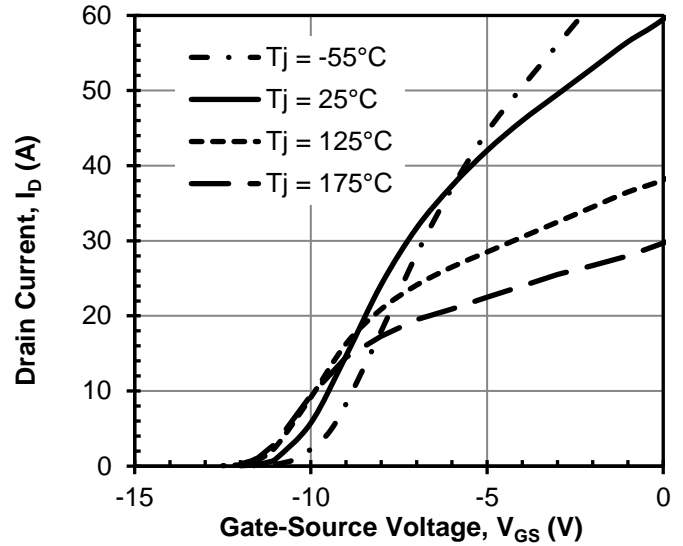


Figure 6 Typical transfer characteristics at $V_{DS} = 5V$

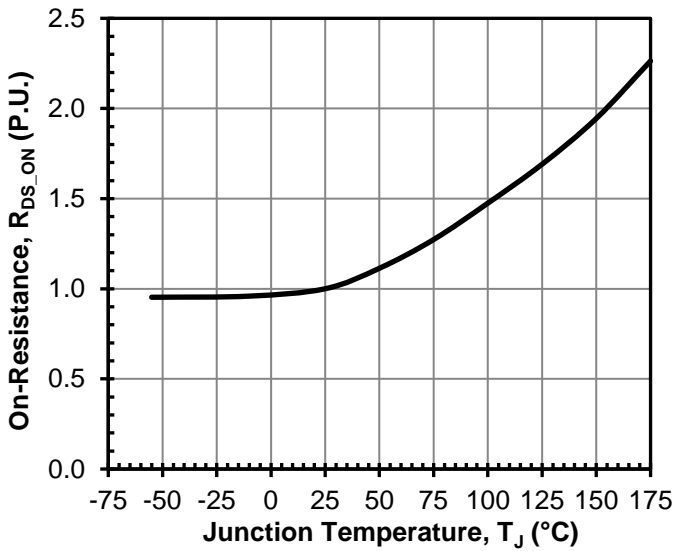


Figure 7 Normalized on-resistance vs. temperature at $V_{GS} = 0V$ and $I_D = 10A$

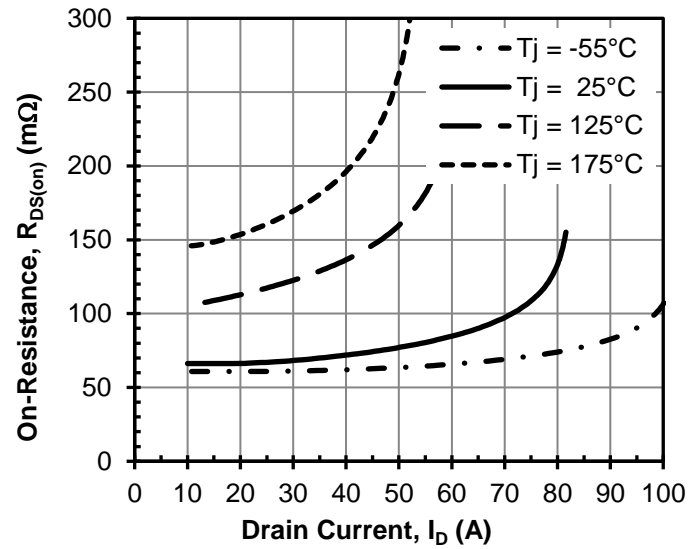


Figure 8 Typical drain-source on-resistance at $V_{GS} = 0V$

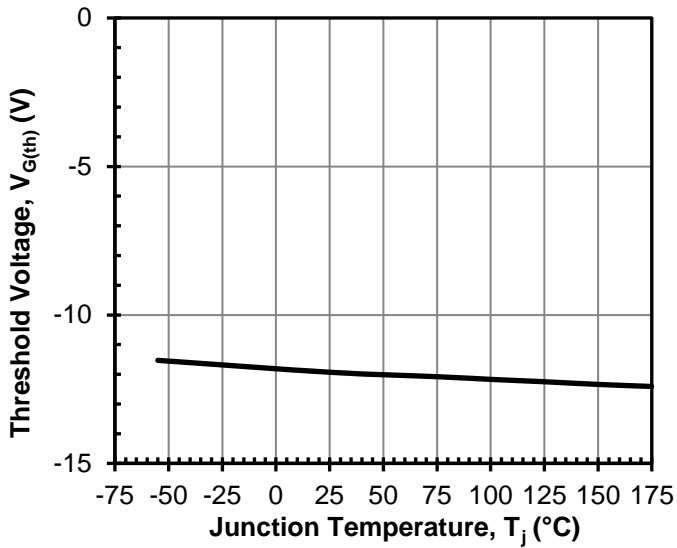


Figure 9 Threshold voltage vs. T_j
at $V_{DS} = 5V$ and $I_D = 35mA$

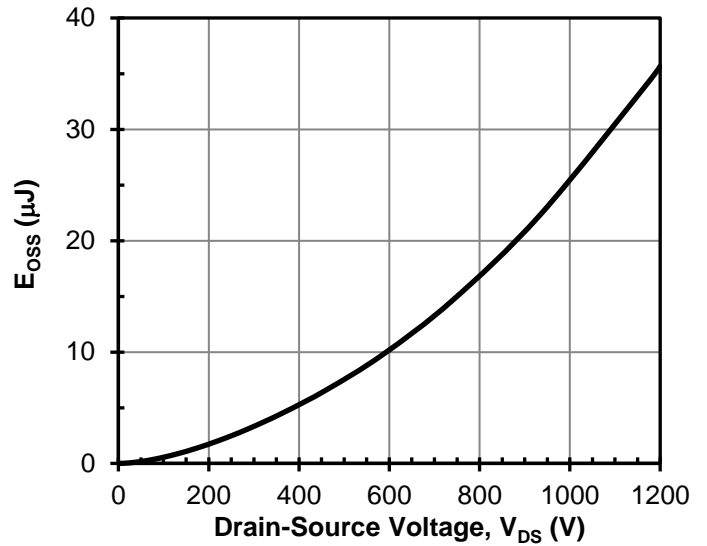


Figure 10 Typical stored energy in C_{OSS}
at $V_{GS} = -20V$

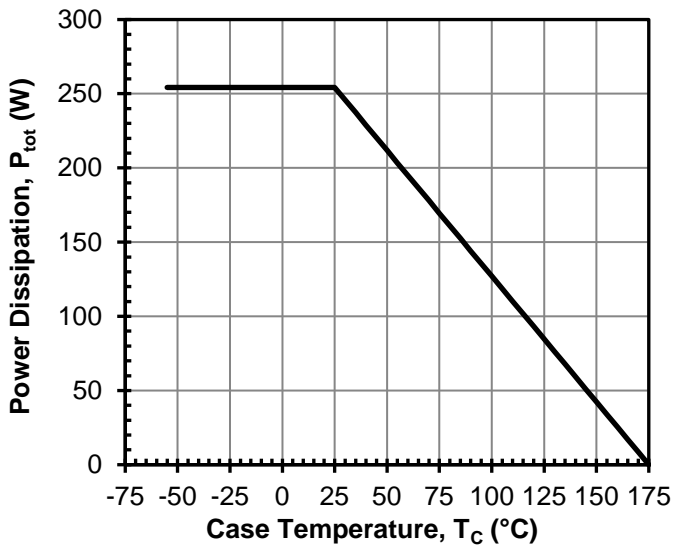


Figure 11 Total power Dissipation

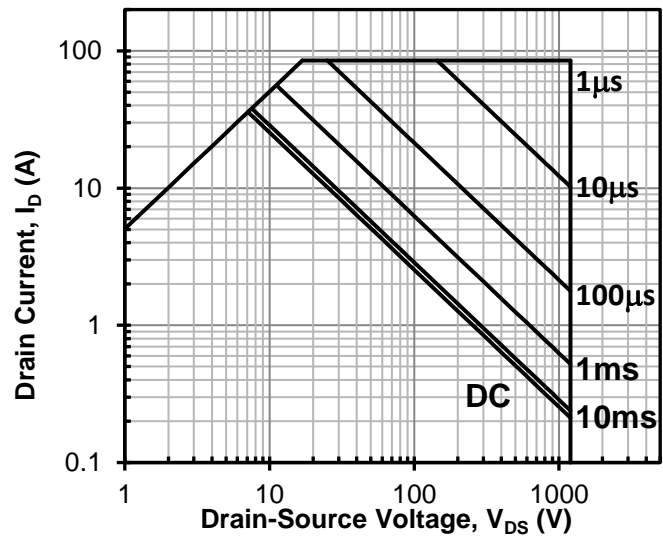


Figure 12 Safe operation area
 $T_c = 25^\circ C$, Parameter t_p

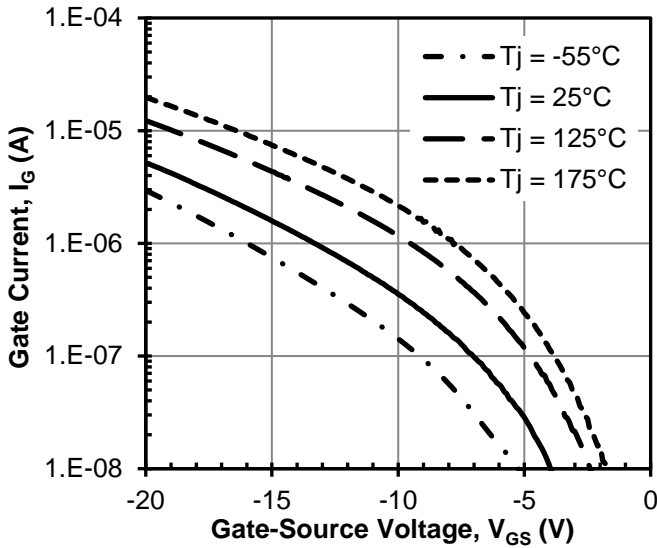


Figure 13 Typical gate leakage current
at $V_{DS} = 0V$

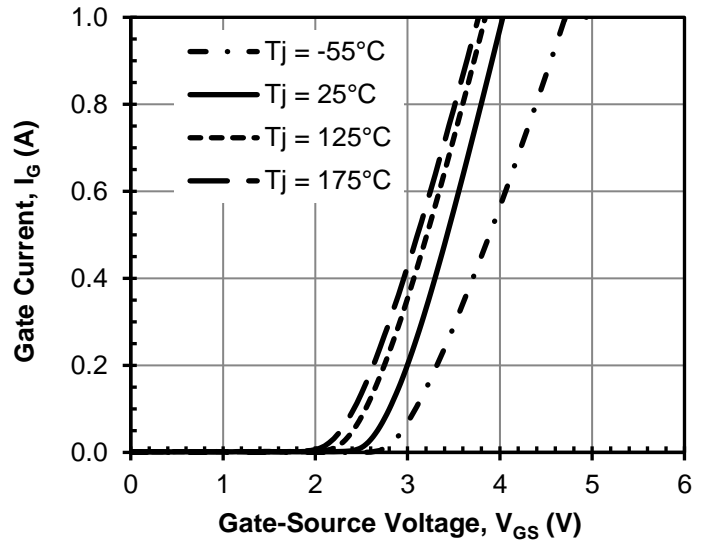


Figure 14 Typical gate forward current
at $V_{DS} = 0V$

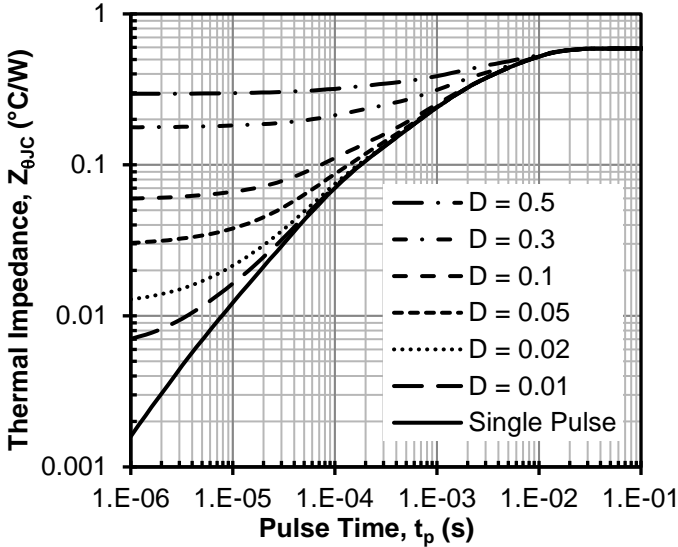


Figure 15 Maximum transient
thermal impedance

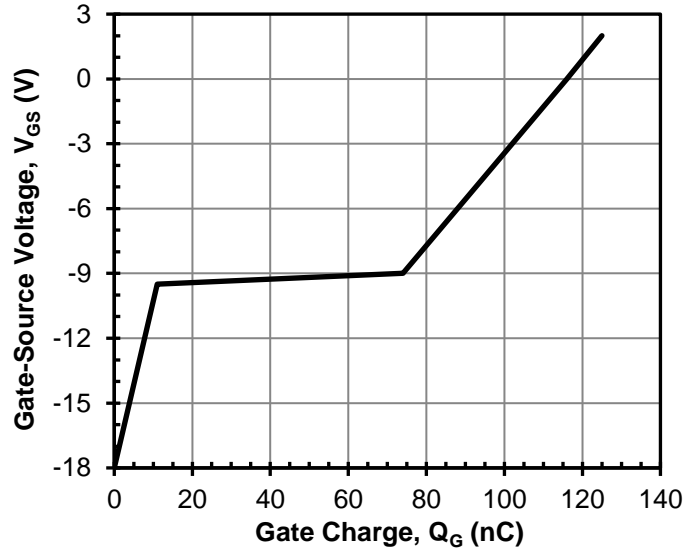


Figure 16 Typical gate charge
at $V_{DS} = 800V$ and $I_D = 25A$

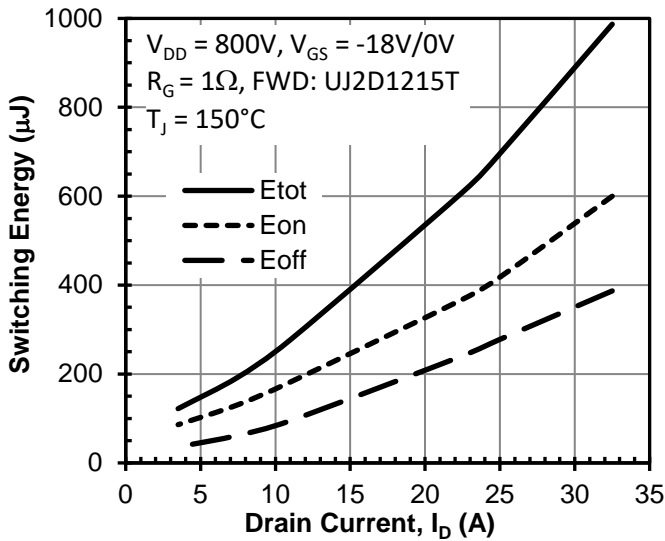


Figure 17 Clamped inductive switching energy vs. drain current at $T_J = 150^\circ C$

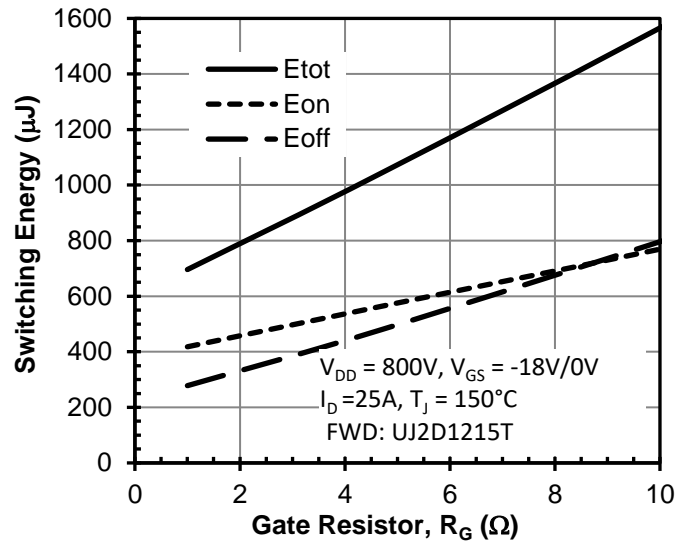


Figure 18 Clamped inductive switching energy vs. gate resistor R_G

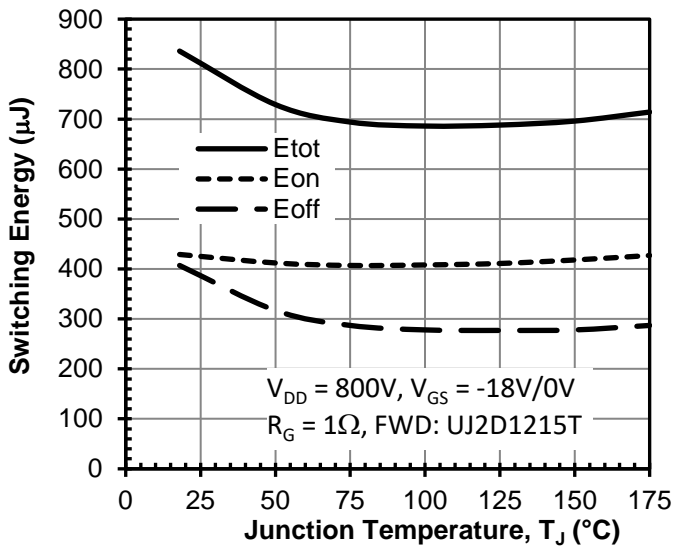


Figure 19 Clamped inductive switching energy vs. junction temperature at $I_D = 25A$

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