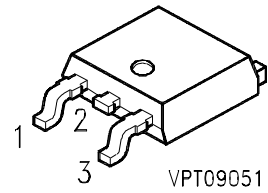
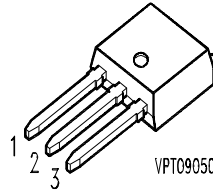


SIPMOS[®] Power Transistor

- N channel
- Enhancement mode
- Logic Level
- Avalanche-rated
- dv/dt rated
- 175°C operating temperature



| Pin 1 | Pin 2 | Pin 3 |
|-------|-------|-------|
| G | D | S |

| Type | V _{DS} | I _D | R _{DS(on)} | Package | Ordering Code |
|-----------|-----------------|----------------|---------------------|---------|---------------------|
| SPD13N05L | 55 V | 12.5 A | 0.12 Ω | P-TO252 | Q67040 - S4124 - A2 |
| SPU13N05L | 55 V | 12.5 A | 0.12 Ω | P-TO251 | Q67040 - S4116 - A2 |

Maximum Ratings

| Parameter | Symbol | Values | Unit |
|---|-------------|-------------|-------|
| Continuous drain current $T_C = 25\text{ °C}$ $T_C = 100\text{ °C}$ | I_D | 12.5 8.8 | A |
| Pulsed drain current $T_C = 25\text{ °C}$ | I_{Dpuls} | 50 | |
| Avalanche energy, single pulse $I_D = 12.5\text{ A}$, $V_{DD} = 25\text{ V}$, $R_{GS} = 25\text{ Ω}$ $L = 666\text{ μH}$, $T_j = 25\text{ °C}$ | E_{AS} | 52 | mJ |
| Avalanche current, limited by T_{jmax} | I_{AR} | 12.5 | A |
| Avalanche energy, periodic limited by T_{jmax} | E_{AR} | 3.5 | mJ |
| Reverse diode dv/dt $I_S = 12.5\text{ A}$, $V_{DS} = 40\text{ V}$, $di_F/dt = 200\text{ A/μs}$ $T_{jmax} = 175\text{ °C}$ | dv/dt | 6 | kV/μs |
| Gate source voltage | V_{GS} | ± 14 | V |
| Power dissipation $T_C = 25\text{ °C}$ | P_{tot} | 35 | W |

Maximum Ratings

| Parameter | Symbol | Values | Unit |
|--|------------|---------------|------|
| Operating temperature | T_j | -55 ... + 175 | °C |
| Storage temperature | T_{stg} | -55 ... + 175 | |
| Thermal resistance, junction - case | R_{thJC} | ≤ 4.3 | K/W |
| Thermal resistance, junction - ambient (PCB mount)** | R_{thJA} | ≤ 50 | |
| Thermal resistance, junction - ambient | R_{thJA} | ≤ 100 | |
| IEC climatic category, DIN IEC 68-1 | | 55 / 175 / 56 | |

** when mounted on 1 " square PCB (FR4);for recommended footprint

Electrical Characteristics, at $T_j = 25^\circ\text{C}$, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|-----------|--------|--------|------|------|------|
| | | min. | typ. | max. | |

Static Characteristics

| | | | | | |
|--|---------------|-----|----------------|-----------------|---------------|
| Drain- source breakdown voltage $V_{GS} = 0 \text{ V}, I_D = 0.25 \text{ mA}, T_j = 25^\circ\text{C}$ | $V_{(BR)DSS}$ | 55 | - | - | V |
| Gate threshold voltage $V_{GS}=V_{DS}, I_D = 20 \mu\text{A}$ | $V_{GS(th)}$ | 1.2 | 1.6 | 2 | |
| Zero gate voltage drain current $V_{DS} = 50 \text{ V}, V_{GS} = 0 \text{ V}, T_j = -40^\circ\text{C}$ $V_{DS} = 50 \text{ V}, V_{GS} = 0 \text{ V}, T_j = 25^\circ\text{C}$ $V_{DS} = 50 \text{ V}, V_{GS} = 0 \text{ V}, T_j = 150^\circ\text{C}$ | I_{DSS} | - | - | 0.1 1 100 | μA |
| Gate-source leakage current $V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$ | I_{GSS} | - | 10 | 100 | |
| Drain-Source on-resistance $V_{GS} = 4.5 \text{ V}, I_D = 8.8 \text{ A}$ $V_{GS} = 10 \text{ V}, I_D = 8.8 \text{ A}$ | $R_{DS(on)}$ | - | 0.105 0.062 | 0.12 0.07 | |

Electrical Characteristics, at $T_j = 25^\circ\text{C}$, unless otherwise specified

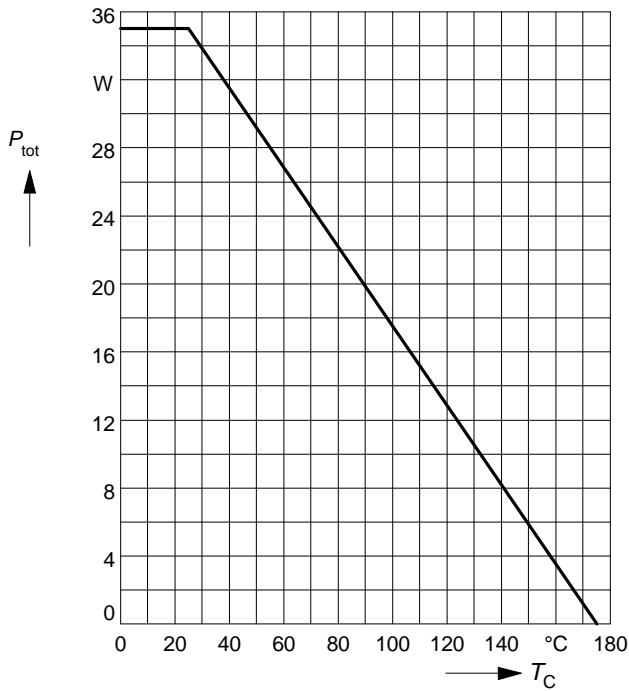
| Parameter | Symbol | Values | | | Unit |
|---|-----------------|--------|------|------|------|
| | | min. | typ. | max. | |
| Dynamic Characteristics | | | | | |
| Transconductance $V_{DS} \geq 2 * I_D * R_{DS(on)max}, I_D = 8.8 \text{ A}$ | g_{fs} | 5 | 8 | - | S |
| Input capacitance $V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$ | C_{iss} | - | 317 | 400 | pF |
| Output capacitance $V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$ | C_{oss} | - | 97 | 120 | |
| Reverse transfer capacitance $V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$ | C_{rss} | - | 54 | 70 | |
| Turn-on delay time $V_{DD} = 30 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 12.5 \text{ A}$ $R_G = 16 \Omega$ | $t_{d(on)}$ | - | 15 | 22 | ns |
| Rise time $V_{DD} = 30 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 12.5 \text{ A}$ $R_G = 16 \Omega$ | t_r | - | 106 | 160 | |
| Turn-off delay time $V_{DD} = 30 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 12.5 \text{ A}$ $R_G = 16 \Omega$ | $t_{d(off)}$ | - | 11 | 17 | |
| Fall time $V_{DD} = 30 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 12.5 \text{ A}$ $R_G = 16 \Omega$ | t_f | - | 14 | 20 | |
| Gate charge at threshold $V_{DD} = 40 \text{ V}, I_D \geq 0.1 \text{ A}, V_{GS} = 0 \text{ to } 1 \text{ V}$ | $Q_{g(th)}$ | - | 0.37 | 0.56 | nC |
| Gate charge at 5.0 V $V_{DD} = 40 \text{ V}, I_D = 12.5 \text{ A}, V_{GS} = 0 \text{ to } 5 \text{ V}$ | $Q_{g(5)}$ | - | 7.85 | 12 | |
| Gate charge total $V_{DD} = 40 \text{ V}, I_D = 12.5 \text{ A}, V_{GS} = 0 \text{ to } 10 \text{ V}$ | $Q_{g(total)}$ | - | 13.5 | 20 | |
| Gate plateau voltage $V_{DD} = 40 \text{ V}, I_D = 12.5 \text{ A}$ | $V_{(plateau)}$ | - | 4 | - | V |

Electrical Characteristics, at $T_j = 25^\circ\text{C}$, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|---|----------|--------|------|------|---------------|
| | | min. | typ. | max. | |
| Reverse Diode | | | | | |
| Inverse diode continuous forward current $T_C = 25^\circ\text{C}$ | I_S | - | - | 12.5 | A |
| Inverse diode direct current, pulsed $T_C = 25^\circ\text{C}$ | I_{SM} | - | - | 50 | |
| Inverse diode forward voltage $V_{GS} = 0\text{ V}, I_F = 25\text{ A}$ | V_{SD} | - | 1.15 | 1.8 | V |
| Reverse recovery time $V_R = 30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$ | t_{rr} | - | 50 | 75 | ns |
| Reverse recovery charge $V_R = 30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$ | Q_{rr} | - | 0.1 | 0.15 | μC |

Power dissipation

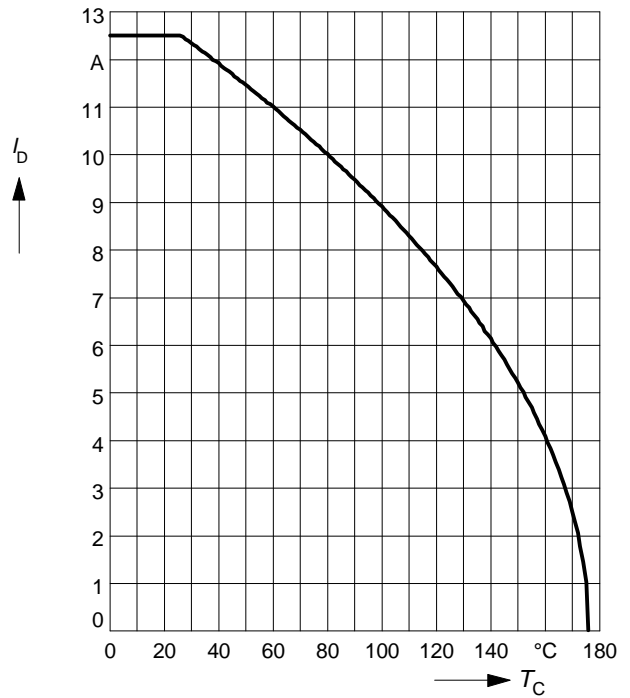
$$P_{\text{tot}} = f(T_C)$$



Drain current

$$I_D = f(T_C)$$

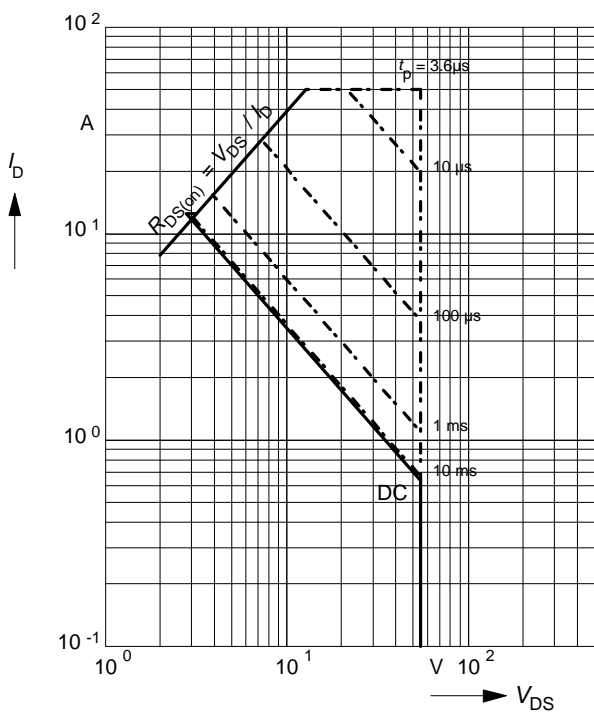
parameter: $V_{GS} \geq 4 \text{ V}$



Safe operating area

$$I_D = f(V_{DS})$$

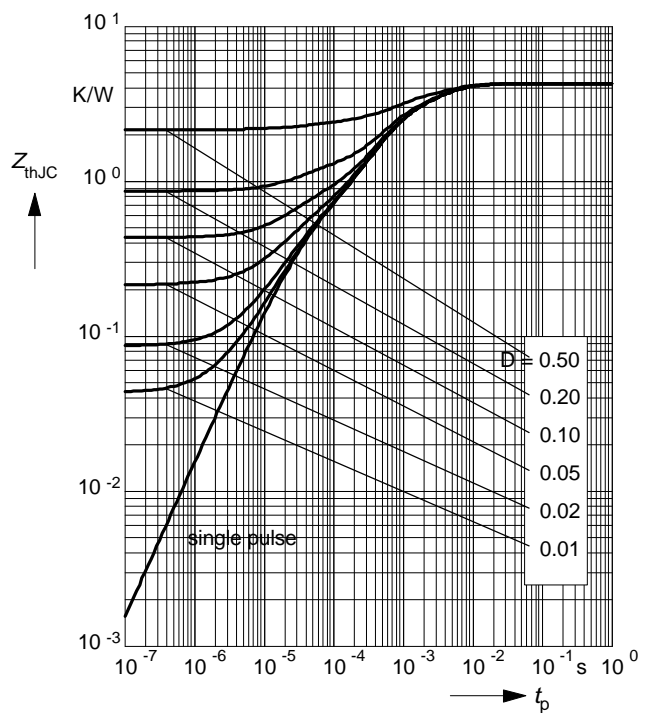
parameter: $D = 0.01, T_C = 25^\circ\text{C}$



Transient thermal impedance

$$Z_{\text{thJC}} = f(t_p)$$

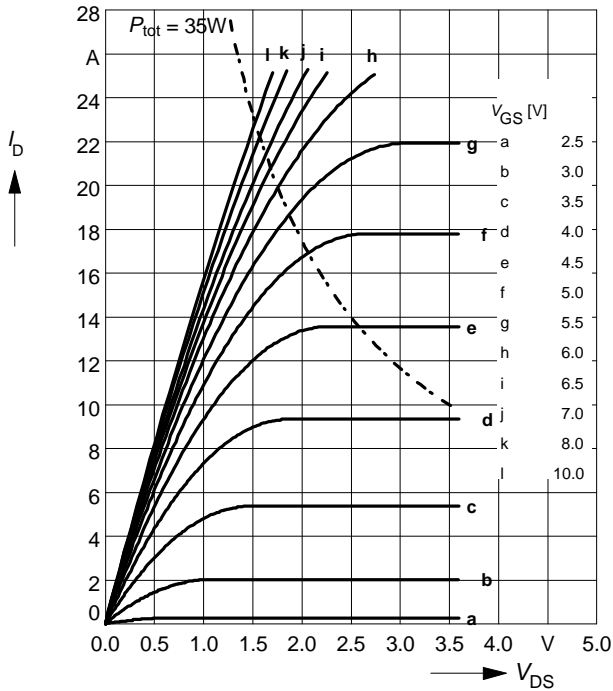
parameter: $D = t_p / T$



Typ. output characteristics

$$I_D = f(V_{DS})$$

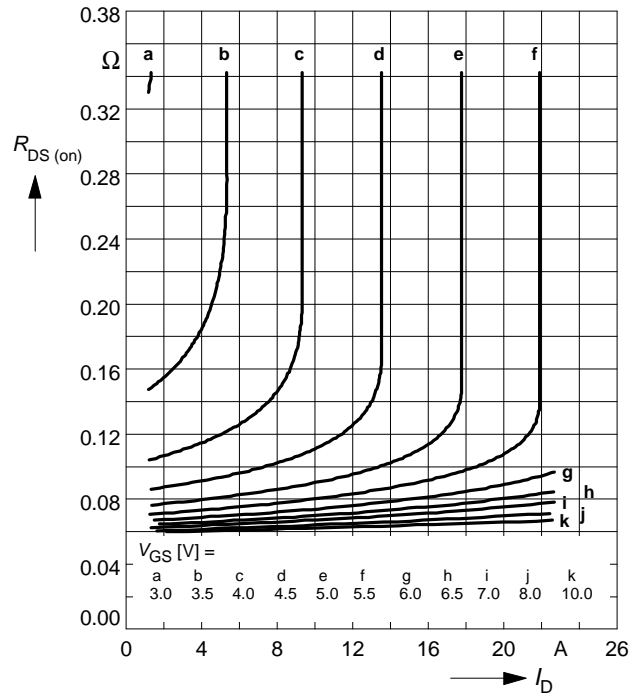
parameter: $t_p = 80 \mu s$



Typ. drain-source on-resistance

$$R_{DS(on)} = f(I_D)$$

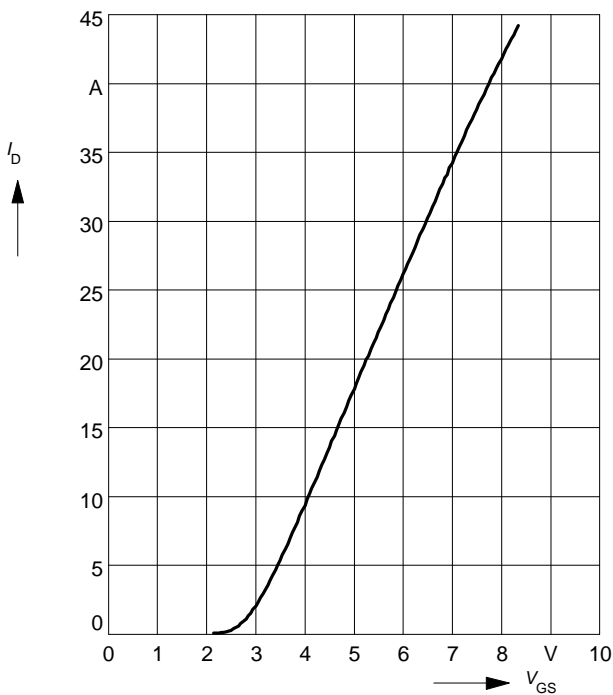
parameter: $t_p = 80 \mu s, T_j = 25^\circ C$



Typ. transfer characteristics $I_D = f(V_{GS})$

parameter: $t_p = 80 \mu s$

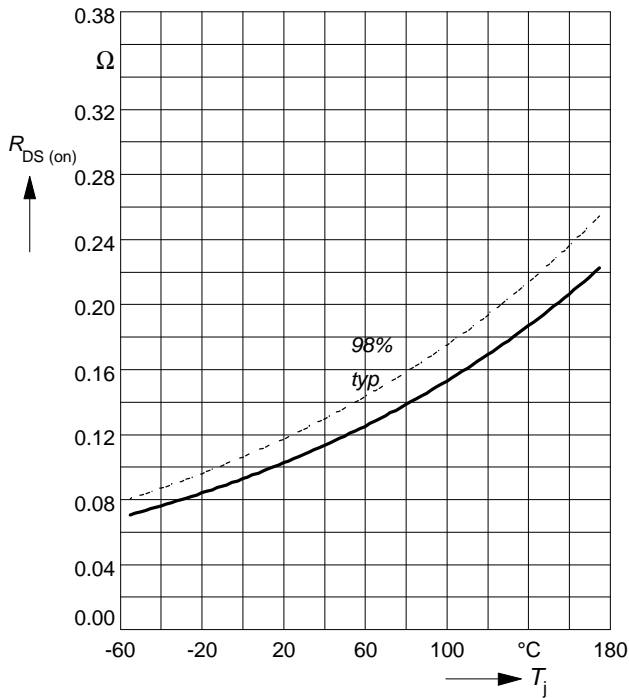
$$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$



Drain-source on-resistance

$$R_{DS(on)} = f(T_j)$$

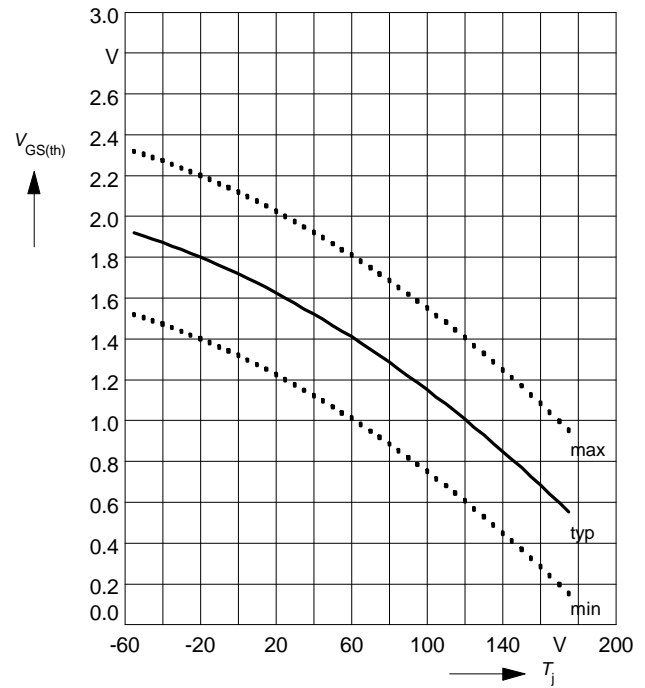
parameter: $I_D = 8.8 \text{ A}$, $V_{GS} = 4.5 \text{ V}$



Gate threshold voltage

$$V_{GS(th)} = f(T_j)$$

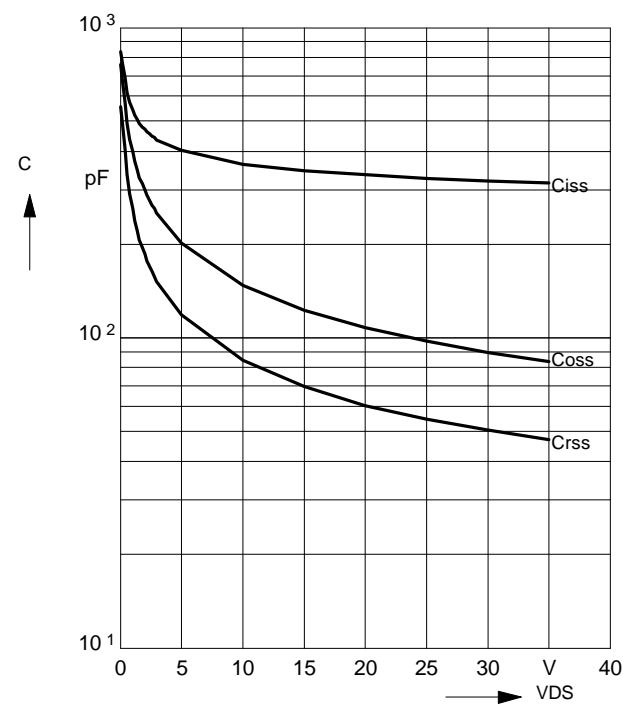
parameter: $V_{GS} = V_{DS}$, $I_D = 20 \mu\text{A}$



Typ. capacitances

$$C = f(V_{DS})$$

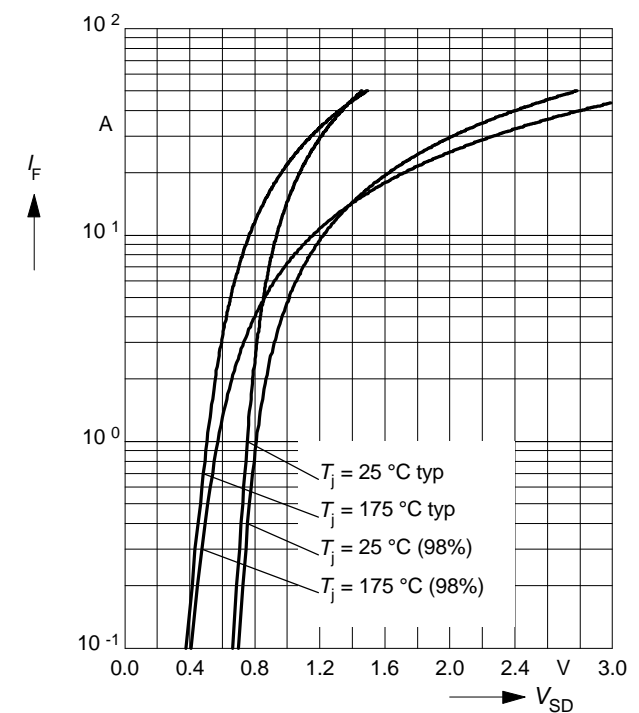
parameter: $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$



Forward characteristics of reverse diode

$$I_F = f(V_{SD})$$

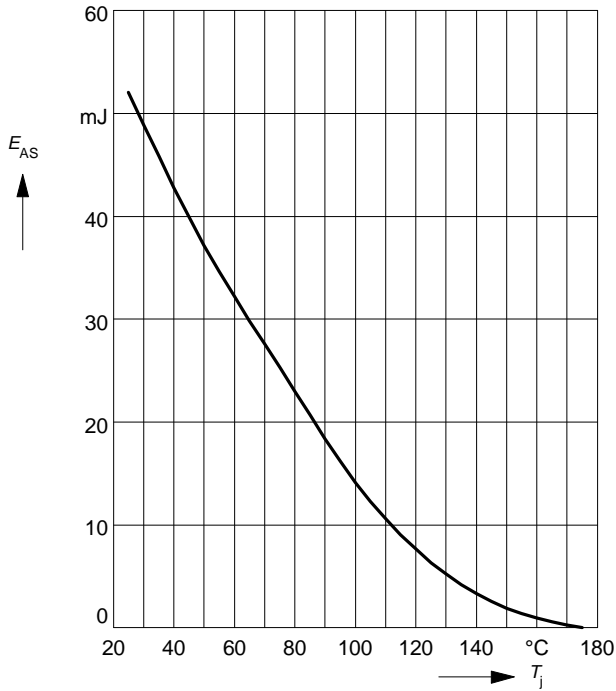
parameter: T_j , $t_p = 80 \mu\text{s}$



Avalanche energy $E_{AS} = f(T_j)$

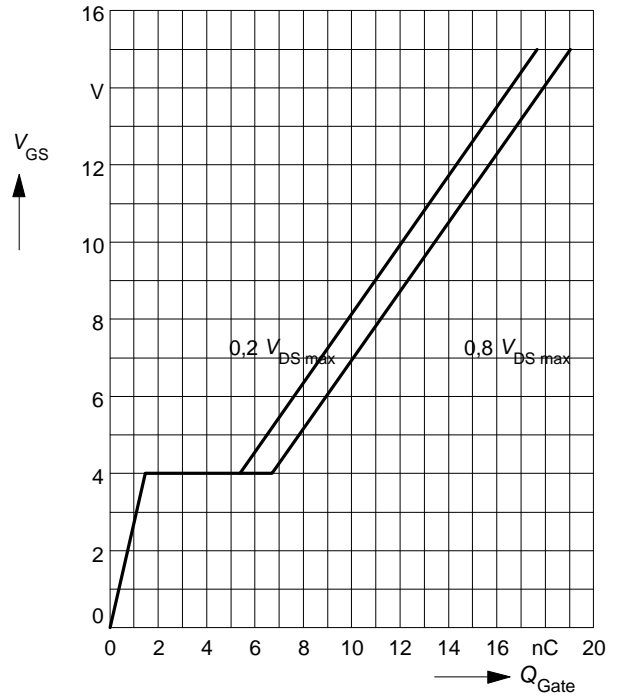
parameter: $I_D = 12.5 \text{ A}$, $V_{DD} = 25 \text{ V}$

$R_{GS} = 25 \Omega$, $L = 666 \mu\text{H}$



Typ. gate charge $V_{GS} = f(Q_{Gate})$

parameter: $I_{D \text{ puls}} = 13 \text{ A}$



Drain-source breakdown voltage $V_{(BR)DSS} = f(T_j)$

