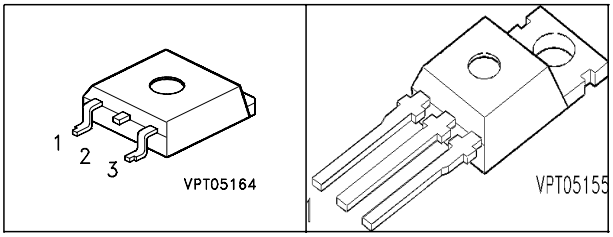
# OptiMOS™ Power-Transistor

## Features

- N-Channel
- Enhancement mode
- Avalanche rated
- d*v*/d*t* rated
- 175°C operating temperature

## Product Summary

| | | | |
|---|---|---|---|
| Drain source voltage | $V_{DS}$ | 40 | V |
| Drain-source on-state resistance | $R_{DS(on)}$ | 3.9 | mΩ |
| Continuous drain current | $I_D$ | 80 | A |




| Type | Package | Ordering Code |
|---|---|---|
| SPP80N04S2-04 | P-TO220-3-1 | Q67040-S4260 |
| SPB80N04S2-04 | P-TO263-3-2 | Q67040-S4257 |

| Pin 1 | PIN 2/4 | PIN 3 |
|---|---|---|
| G | D | S |

**Maximum Ratings**,at $T_j$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Continuous drain current<br>$T_C$ = 25 °C, 1)<br>$T_C$ = 100 °C | $I_D$ | <br>80<br>80 | A |
| Pulsed drain current<br>$T_C$ = 25 °C | $I_{D\ puls}$ | 320 | |
| Avalanche energy, single pulse<br>$I_D$ = 80 A , $V_{DD}$ = 25 V, $R_{GS}$ = 25 Ω | $E_{AS}$ | 810 | mJ |
| Reverse diode d*v*/d*t*<br>$I_S$ = 80 A, $V_{DS}$ = 32 V, d*i*/d*t* = 200 A/µs,<br>$T_{jmax}$ = 175 °C | d*v*/d*t* | 6 | kV/µs |
| Gate source voltage | $V_{GS}$ | ±20 | V |
| Power dissipation<br>$T_C$ = 25 °C | $P_{tot}$ | 300 | W |
| Operating and storage temperature | $T_j$ , $T_{stg}$ | -55...+175 | °C |
| IEC climatic category; DIN IEC 68-1 | | 55/175/56 | |

1Current limited by bondwire; with an $R_{thJC}$ = 0.5 K/W the chip is able to carry $I_D$ = 204 A

## Thermal Characteristics

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **Characteristics** | | | | | |
| Thermal resistance, junction - case | $R_{thJC}$ | - | - | 0.5 | K/W |
| Thermal resistance, junction - ambient, leaded | $R_{thJA}$ | - | - | 62 | |
| SMD version, device on PCB: | $R_{thJA}$ | | | | |
| @ min. footprint | | - | - | 62 | |
| @ 6 cm$^2$ cooling area [1)] | | - | - | 40 | |

**Electrical Characteristics**, at $T_j$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **Static Characteristics** | | | | | |
| Drain-source breakdown voltage<br>$V_{GS}$ = 0 V, $I_D$ = 1 mA | $V_{(BR)DSS}$ | 40 | - | - | V |
| Gate threshold voltage, $V_{GS}$ = $V_{DS}$<br>$I_D$ = 250 µA | $V_{GS(th)}$ | 2.1 | 3 | 4 | |
| Zero gate voltage drain current | $I_{DSS}$ | | | | µA |
| $V_{DS}$ = 40 V, $V_{GS}$ = 0 V, $T_j$ = 25 °C | | - | 0.01 | 1 | |
| $V_{DS}$ = 40 V, $V_{GS}$ = 0 V, $T_j$ = 125 °C | | - | 1 | 100 | |
| Gate-source leakage current<br>$V_{GS}$ = 20 V, $V_{DS}$ = 0 V | $I_{GSS}$ | - | 1 | 100 | nA |
| Drain-source on-state resistance<br>$V_{GS}$ = 10 V, $I_D$ = 80 A | $R_{DS(on)}$ | - | 3 | 3.9 | mΩ |

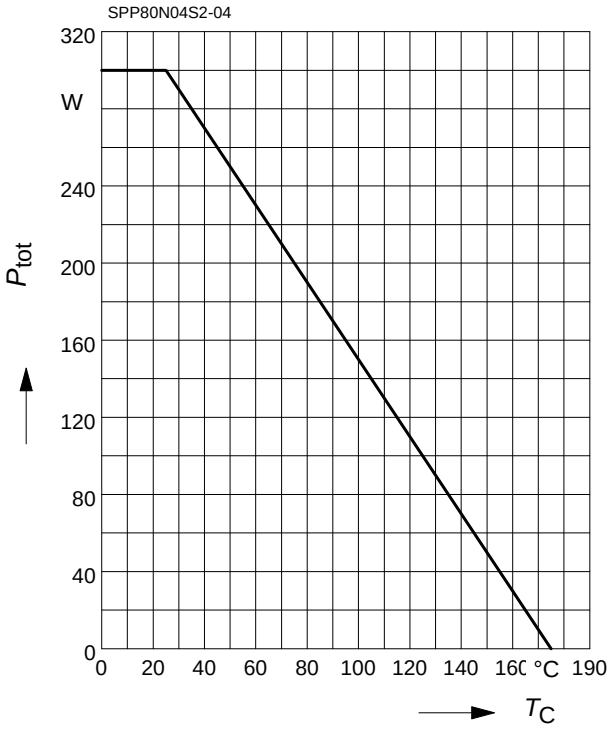
[1]Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 µm thick) copper area for drain connection. PCB is vertical without blown air.

**Electrical Characteristics**, at $T_j$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic Characteristics** | | | | | | |
| Transconductance | $g_{fs}$ | $V_{DS}\geq 2*I_D*R_{DS(on)max}$, $I_D$=80A | 60 | 125 | - | S |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=25V, $f$=1MHz | - | 5250 | 6500 | pF |
| Output capacitance | $C_{oss}$ | | - | 1870 | 2300 | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 380 | 510 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=20V, $V_{GS}$=10V, $I_D$=80A, $R_G$=2.2Ω | - | 16 | 24 | ns |
| Rise time | $t_r$ | | - | 200 | 300 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 50 | 75 | |
| Fall time | $t_f$ | | - | 40 | 60 | |
| **Gate Charge Characteristics** | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=32V, $I_D$=80A | - | 25 | 35 | nC |
| Gate to drain charge | $Q_{gd}$ | | - | 50 | 65 | |
| Gate charge total | $Q_g$ | $V_{DD}$=32V, $I_D$=80A, $V_{GS}$=0 to 10V | - | 135 | 170 | |
| Gate plateau voltage | $V_{(plateau)}$ | $V_{DD}$ = 32 V , $I_D$=80A | - | 5.3 | - | V |
| **Reverse Diode** | | | | | | |
| Inverse diode continuous forward current | $I_S$ | $T_C$=25°C | - | - | 80 | A |
| Inverse diode direct current, pulsed | $I_{SM}$ | | - | - | 320 | |
| Inverse diode forward voltage | $V_{SD}$ | $V_{GS}$=0V, $I_F$=80A | - | 0.9 | 1.3 | V |
| Reverse recovery time | $t_{rr}$ | $V_R$=20V, $I_F$=$I_S$, $di_F/dt$=100A/µs | - | 60 | 75 | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 100 | 125 | nC |

## Power dissipation

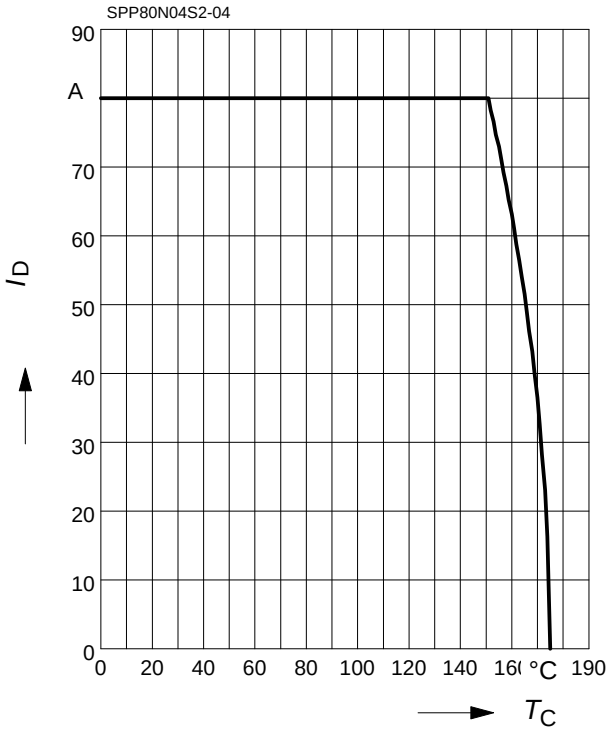
$P_{tot} = f(T_C)$




## Drain current

$I_D = f(T_C)$

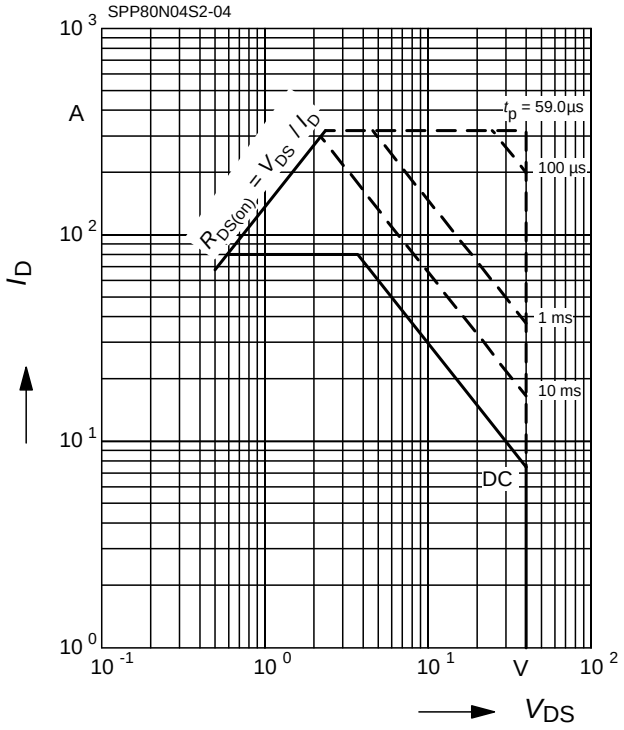
parameter: $V_{GS} \geq 10$ V




## Safe operating area

$I_D = f(V_{DS})$

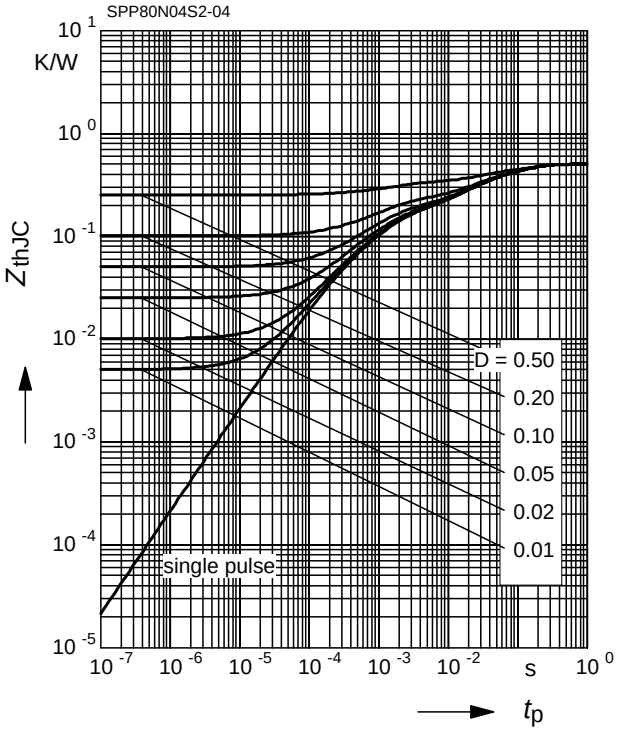
parameter : $D = 0$ , $T_C = 25$ °C




## Transient thermal impedance

$Z_{thJC} = f(t_p)$

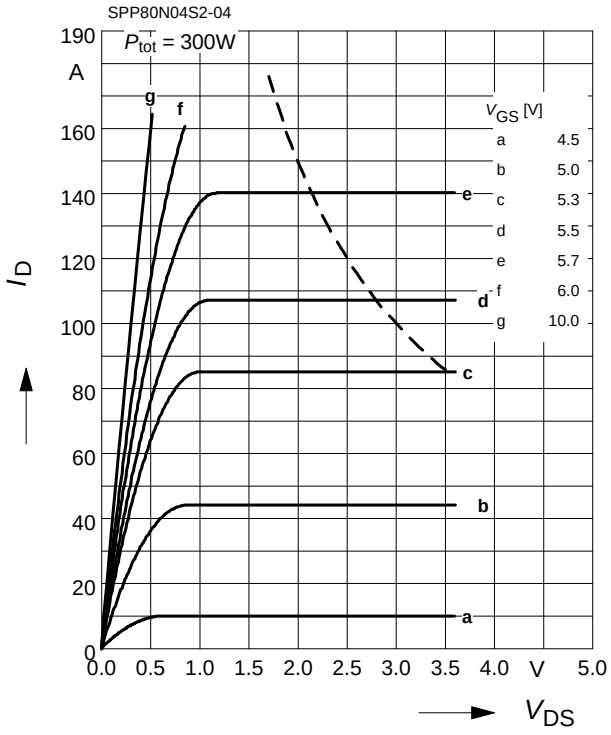
parameter : $D = t_p/T$



**Typ. output characteristic**

$I_D = f(V_{DS})$; $T_j$=25°C

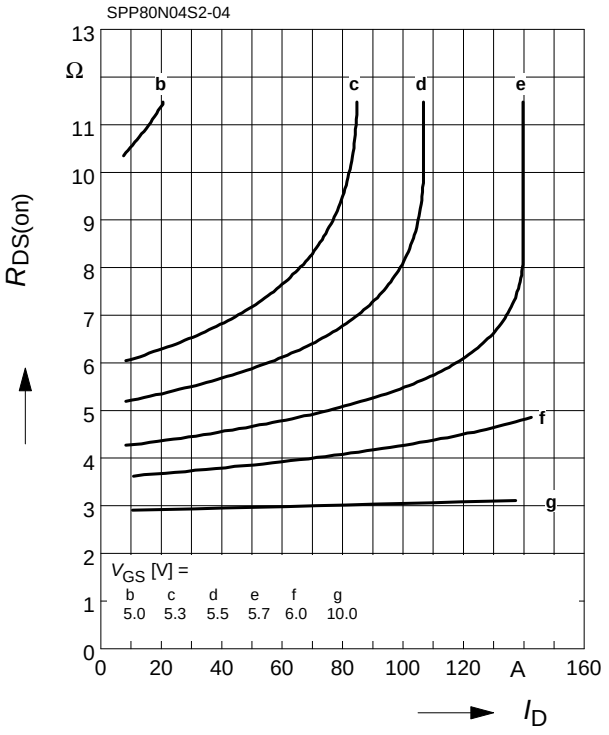
parameter: $t_p$ = 80 µs




**Typ. drain-source-on-resistance**

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

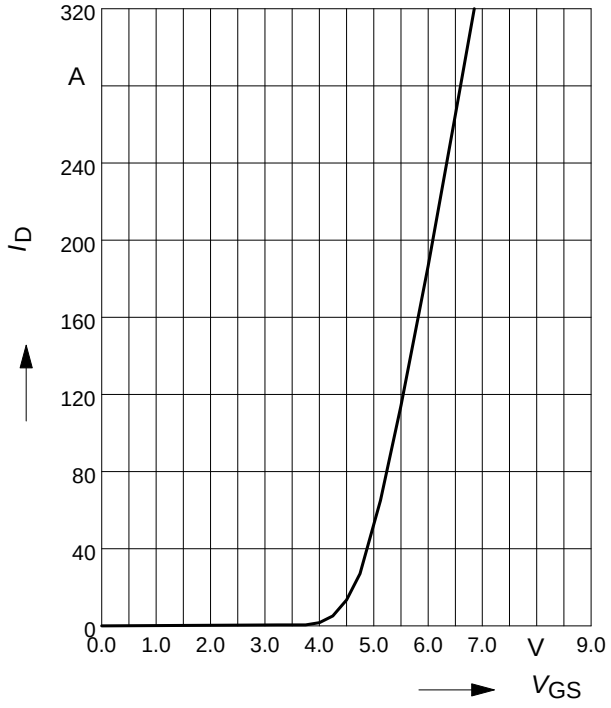
parameter: $V_{GS}$




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

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

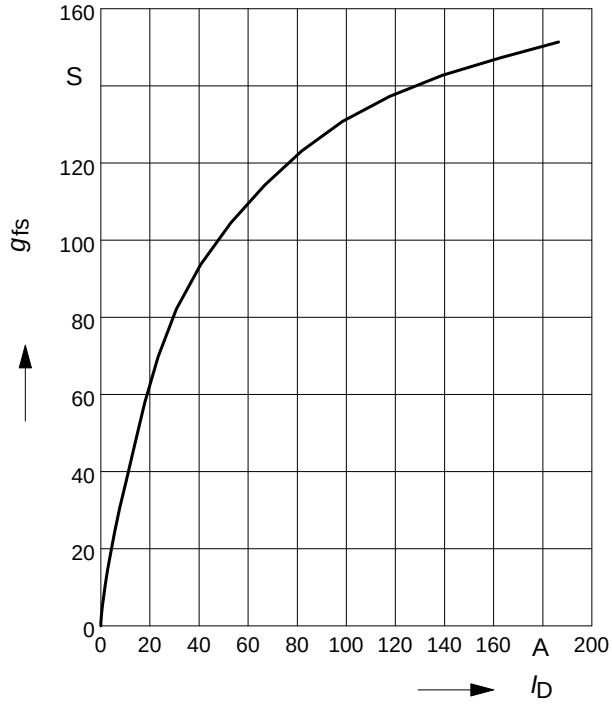
parameter: $t_p$ = 80 µs




**Typ. forward transconductance**

$g_{fs}$ = f($I_D$); $T_j$=25°C

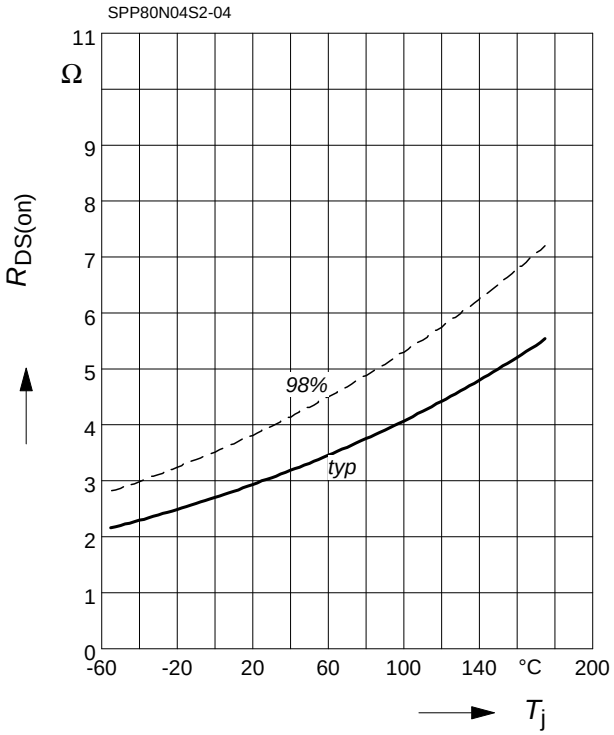
parameter: $g_{fs}$



**Drain-source on-state resistance**

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

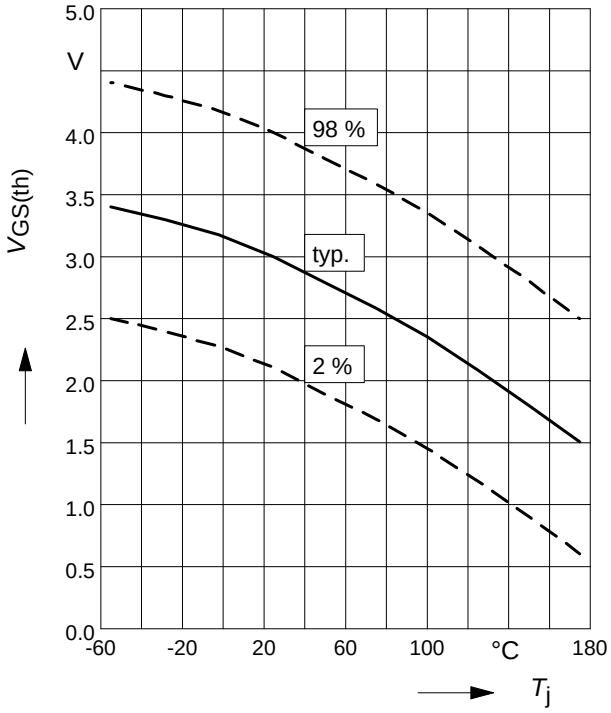
parameter : $I_D$ = 80 A, $V_{GS}$ = 10 V




**Gate threshold voltage**

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

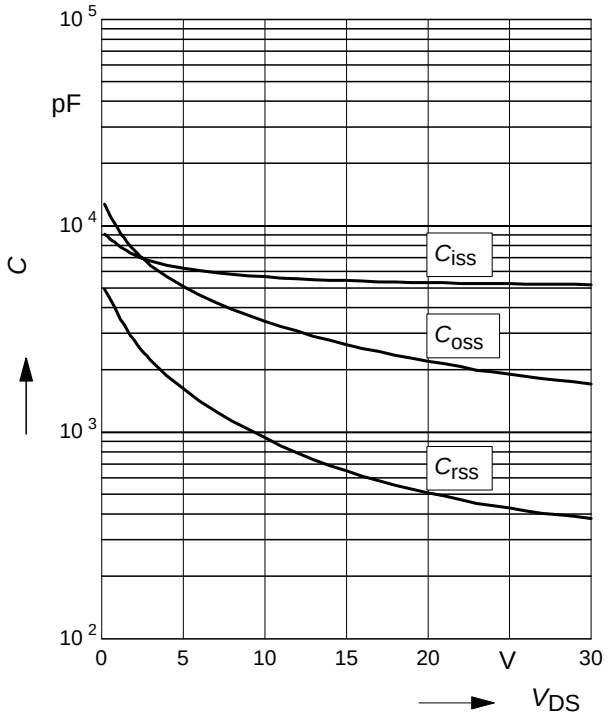
parameter: $V_{GS} = V_{DS}$, $I_D$ = 250 µA




**Typ. capacitances**

$C = f(V_{DS})$

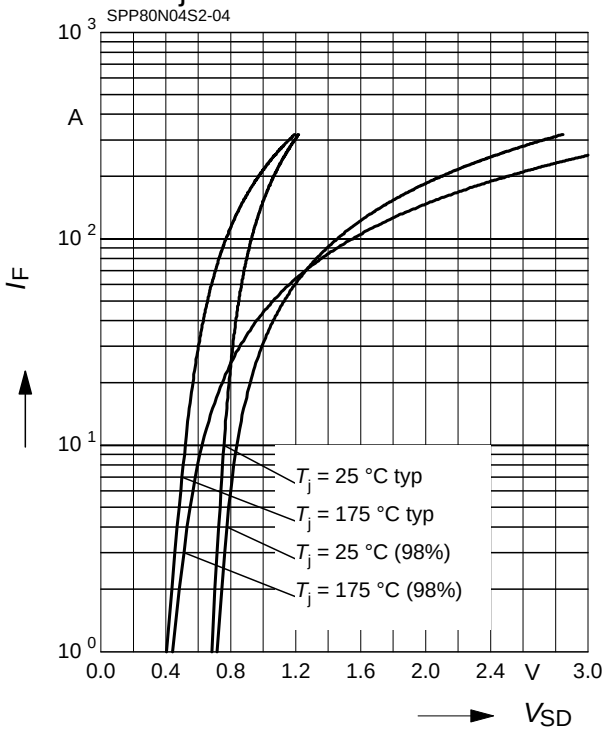
parameter: $V_{GS}$=0V, $f$=1 MHz




**Forward characteristics of reverse diode**

$I_F = f(V_{SD})$

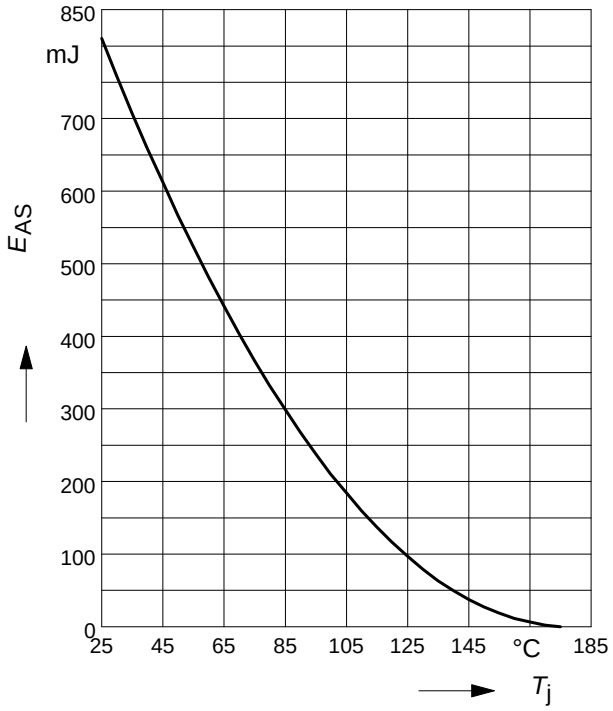
parameter: $T_j$ , tp = 80 µs



**Avalanche energy**

$E_{AS} = f(T_j)$

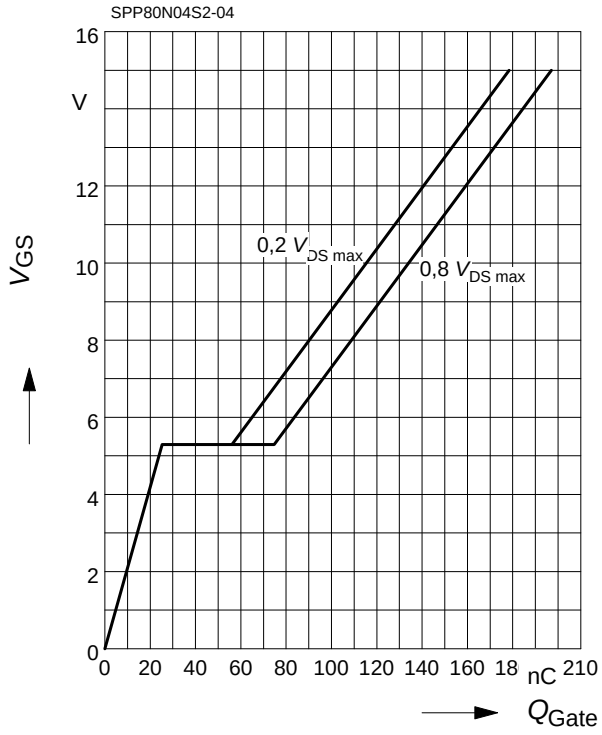
par.: $I_D$ = 80 A , $V_{DD}$ = 25 V, $R_{GS}$ = 25 Ω




**Typ. gate charge**

$V_{GS} = f(Q_{Gate})$

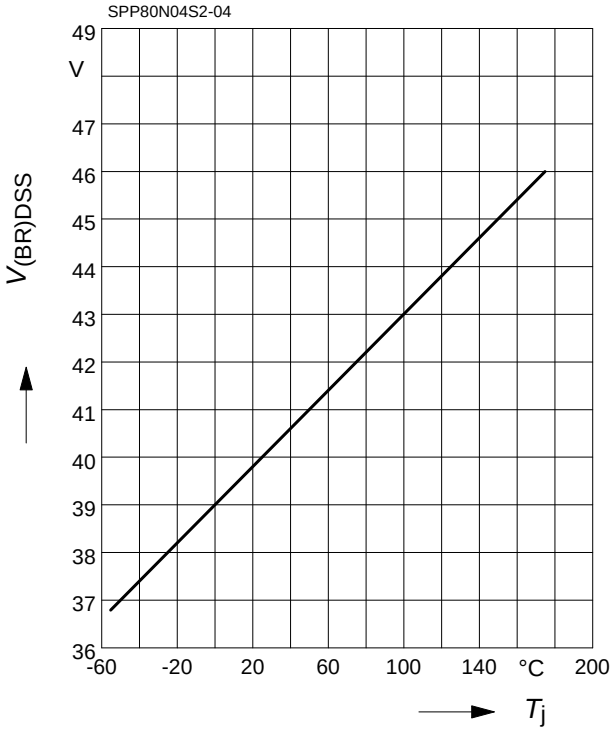
parameter: $I_D$ = 80 A pulsed




**Drain-source breakdown voltage**

$V_{(BR)DSS} = f(T_j)$

parameter: $I_D$ = 10 mA



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