# OptiMOS® Power-Transistor

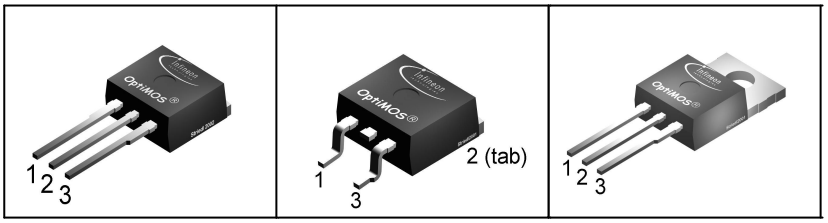
## Feature

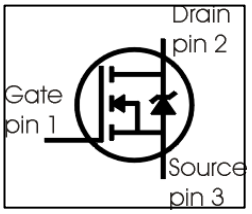
- N-Channel
- Enhancement mode
- Logic Level
- Excellent Gate Charge x $R_{DS(on)}$ product (FOM)
- Superior thermal resistance
- 175°C operating temperature
- Avalanche rated
- d*v*/d*t* rated

## Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 30 | V |
| $R_{DS(on)}$ max. SMD version | 3.9 | mΩ |
| $I_D$ | 80 | A |

P- TO262 -3-1 | P- TO263 -3-2 | P- TO220 -3-1




| Type | Package | Ordering Code | Marking |
|---|---|---|---|
| SPP80N03S2L-04 | P- TO220 -3-1 | Q67042-S4113 | 2N03L04 |
| SPB80N03S2L-04 | P- TO263 -3-2 | Q67042-S4112 | 2N03L04 |
| SPI80N03S2L-04 | P- TO262 -3-1 | Q67042-S4114 | 2N03L04 |

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

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Continuous drain current 1)<br>$T_C$=25°C | $I_D$ | 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 , $V_{DD}$=25V, $R_{GS}$=25Ω | $E_{AS}$ | 380 | mJ |
| Repetitive avalanche energy, limited by $T_{jmax}$ 2) | $E_{AR}$ | 18 | |
| Reverse diode d*v*/d*t*<br>$I_S$=80A, $V_{DS}$=24V, d*i*/d*t*=200A/µs, $T_{jmax}$=175°C | d*v*/d*t* | 6 | kV/µs |
| Gate source voltage | $V_{GS}$ | ±20 | V |
| Power dissipation<br>$T_C$=25°C | $P_{tot}$ | 188 | W |
| Operating and storage temperature | $T_j$ , $T_{stg}$ | -55... +175 | °C |
| IEC climatic category; DIN IEC 68-1 | | 55/175/56 | |

## Thermal Characteristics

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **Characteristics** | | | | | |
| Thermal resistance, junction - case | $R_{thJC}$ | - | 0.51 | 0.8 | 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 3) | | - | - | 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>$V_{GS}$=0V, $I_D$=1mA | $V_{(BR)DSS}$ | 30 | - | - | V |
| Gate threshold voltage, $V_{GS}$ = $V_{DS}$<br>$I_D$ = 130 µA | $V_{GS(th)}$ | 1.2 | 1.6 | 2 | |
| Zero gate voltage drain current | $I_{DSS}$ | | | | µA |
| $V_{DS}$=30V, $V_{GS}$=0V, $T_j$=25°C | | - | 0.01 | 1 | |
| $V_{DS}$=30V, $V_{GS}$=0V, $T_j$=125°C | | - | 10 | 100 | |
| Gate-source leakage current<br>$V_{GS}$=20V, $V_{DS}$=0V | $I_{GSS}$ | - | 1 | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | | | | mΩ |
| $V_{GS}$=4.5V, $I_D$=80A | | - | 5 | 6.5 | |
| $V_{GS}$=4.5V, $I_D$=80A, SMD version | | - | 4.6 | 6.2 | |
| Drain-source on-state resistance4) | $R_{DS(on)}$ | | | | |
| $V_{GS}$=10V, $I_D$=80A | | - | 3.6 | 4.2 | |
| $V_{GS}$=10V, $I_D$=80A, SMD version | | - | 3.2 | 3.9 | |

1Current limited by bondwire ; with an $R_{thJC}$ = 0.8K/W the chip is able to carry $I_D$= 163A at 25°C, for detailed information see app.-note ANPS071E available at *www.infineon.com/optimos*

2Defined by design. Not subject to production test.

3Device 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.

4Diagrams are related to straight lead versions

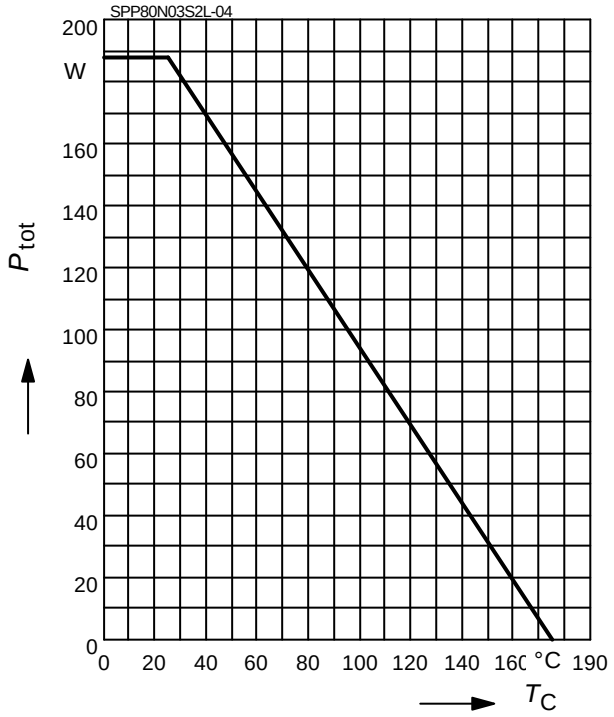
## Electrical Characteristics

| 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 | 11.5 | 23 | - | S |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=25V, $f$=1MHz | - | 2930 | 3900 | pF |
| Output capacitance | $C_{oss}$ | | - | 1150 | 1520 | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 268 | 402 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=15V, $V_{GS}$=10V, $I_D$=80A, $R_G$=2.2Ω | - | 13 | 19 | ns |
| Rise time | $t_r$ | | - | 20 | 30 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 54 | 81 | |
| Fall time | $t_f$ | | - | 19 | 28 | |
| **Gate Charge Characteristics** | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=24V, $I_D$=40A | - | 9 | 12 | nC |
| Gate to drain charge | $Q_{gd}$ | | - | 27 | 41 | |
| Gate charge total | $Q_g$ | $V_{DD}$=24V, $I_D$=40A, $V_{GS}$=0 to 10V | - | 79 | 105 | |
| Gate plateau voltage | $V_{(plateau)}$ | $V_{DD}$=24V, $I_D$=40A | - | 3.2 | - | V |
| **Reverse Diode** | | | | | | |
| Inverse diode continuous forward current | $I_S$ | $T_C$=25°C | - | - | 80 | A |
| Inv. diode direct current, pulsed | $I_{SM}$ | | - | - | 320 | |
| Inverse diode forward voltage | $V_{SD}$ | $V_{GS}$=0V, $I_F$=80A | - | 0.9 | 1.2 | V |
| Reverse recovery time | $t_{rr}$ | $V_R$=15V, $I_F$=$I_S$, $di_F/dt$=100A/µs | - | 50 | 62 | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 61 | 76 | nC |

## 1 Power dissipation

$P_{tot} = f(T_C)$

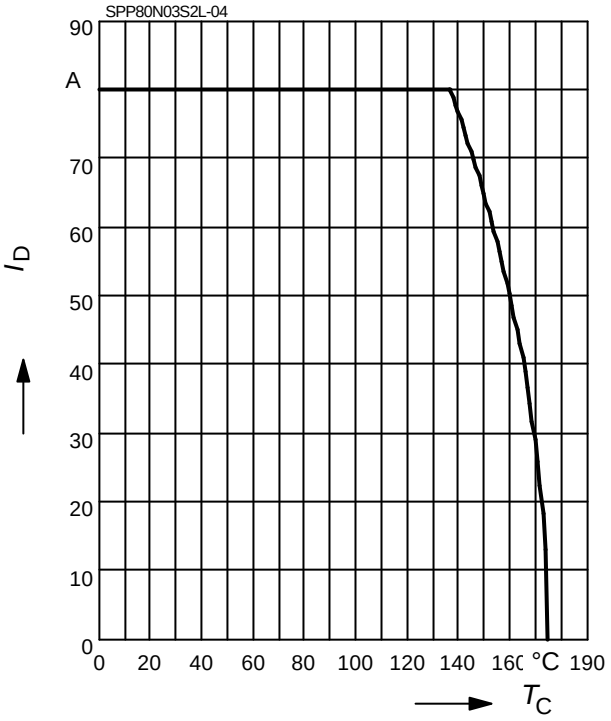
parameter: $V_{GS} \geq 4$ V




## 2 Drain current

$I_D = f(T_C)$

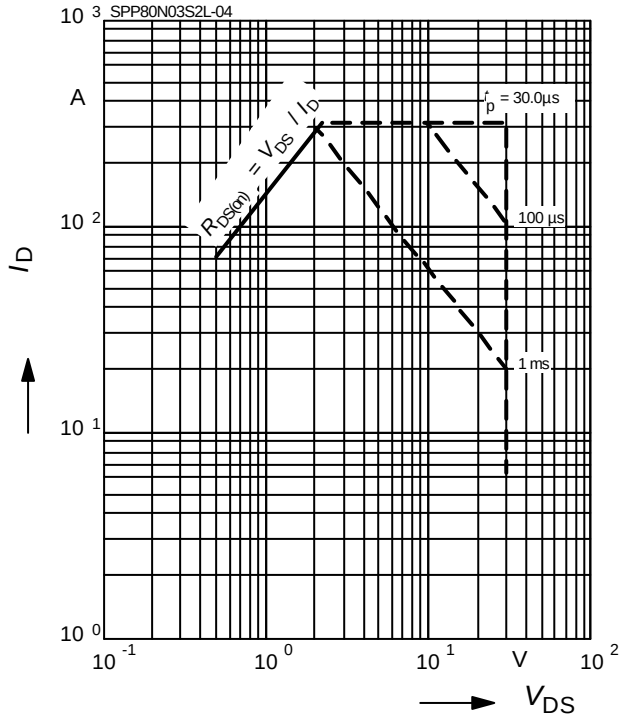
parameter: $V_{GS} \geq 10$ V




## 3 Safe operating area

$I_D = f(V_{DS})$

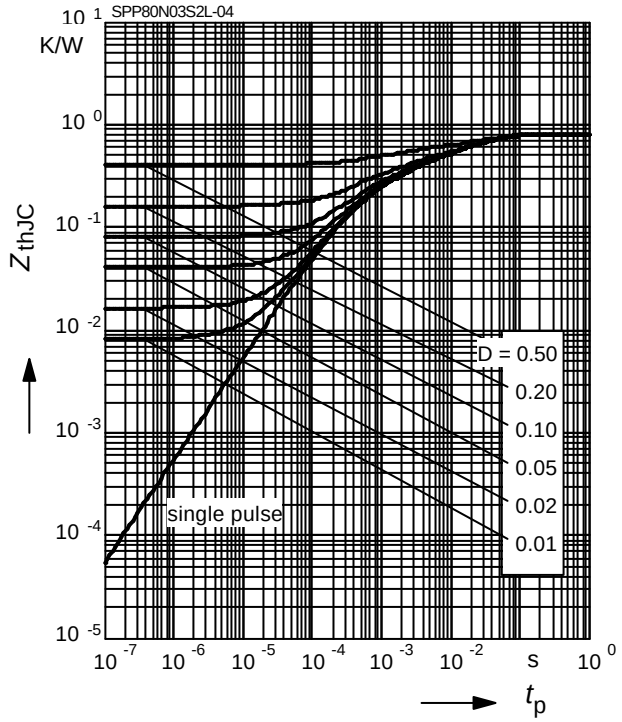
parameter : $D = 0$ , $T_C = 25$ °C




## 4 Max. transient thermal impedance

$Z_{thJC} = f(t_p)$

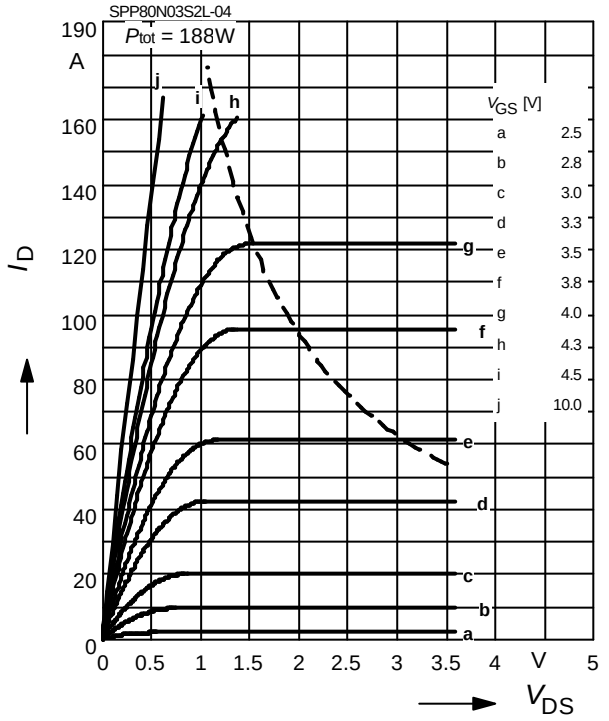
parameter : $D = t_p/T$



## 5 Typ. output characteristic

$I_D = f(V_{DS})$; $T_j$=25°C

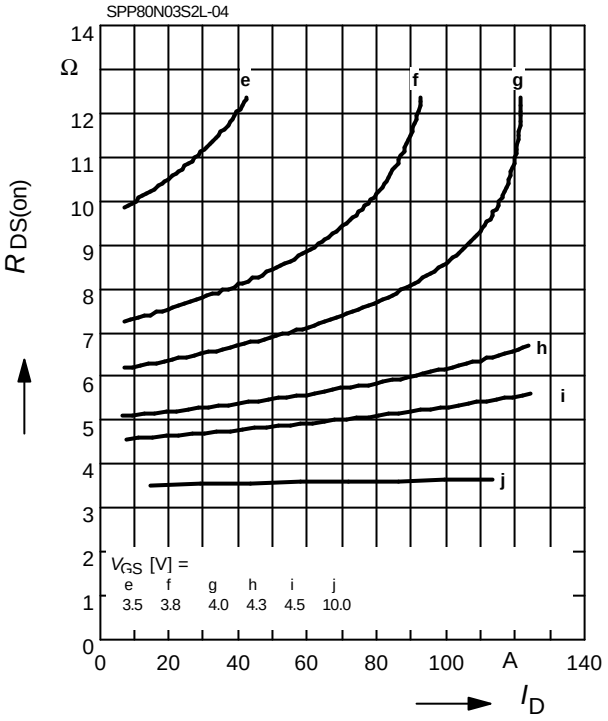
parameter: $t_p$ = 80 µs




## 6 Typ. drain-source on resistance

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

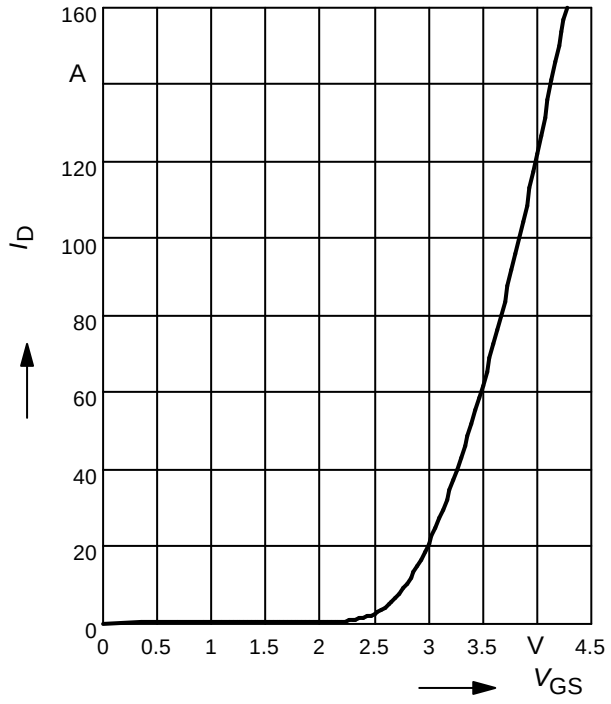
parameter: $V_{GS}$




## 7 Typ. transfer characteristics

$I_D = f(V_{GS})$; $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$

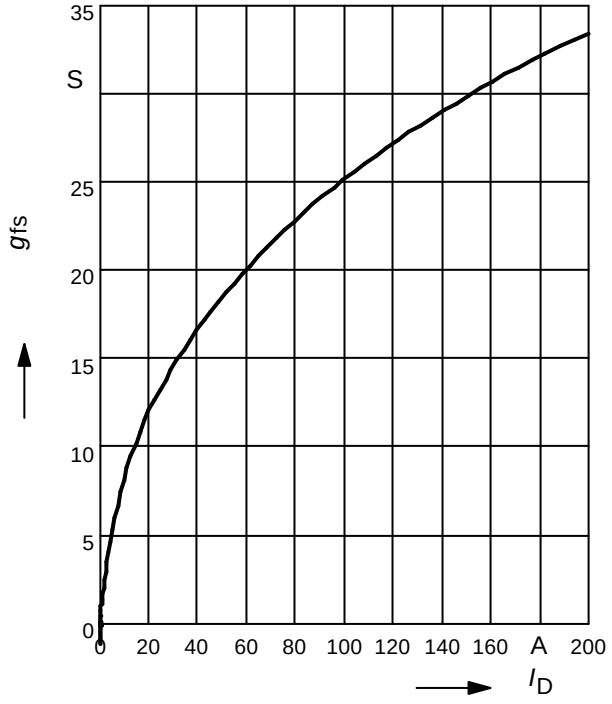
parameter: $t_p$ = 80 µs




## 8 Typ. forward transconductance

$g_{fs} = f(I_D)$; $T_j$=25°C

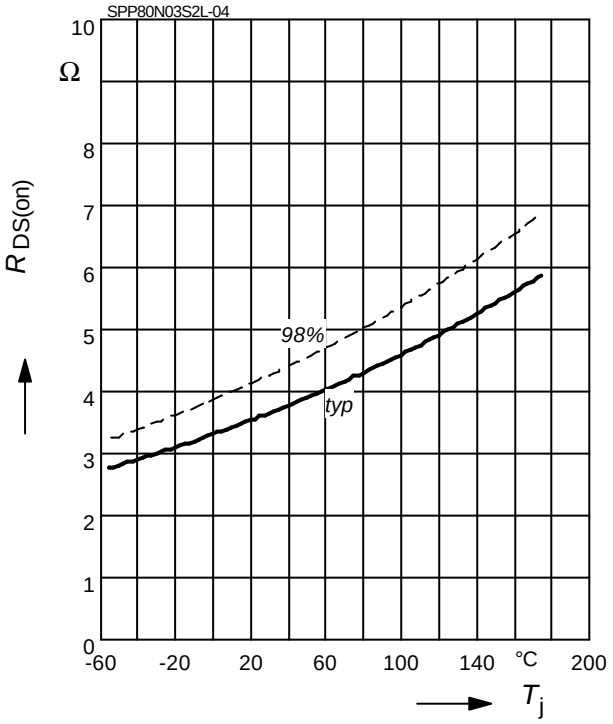
parameter: $g_{fs}$



## 9 Drain-source on-state resistance

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

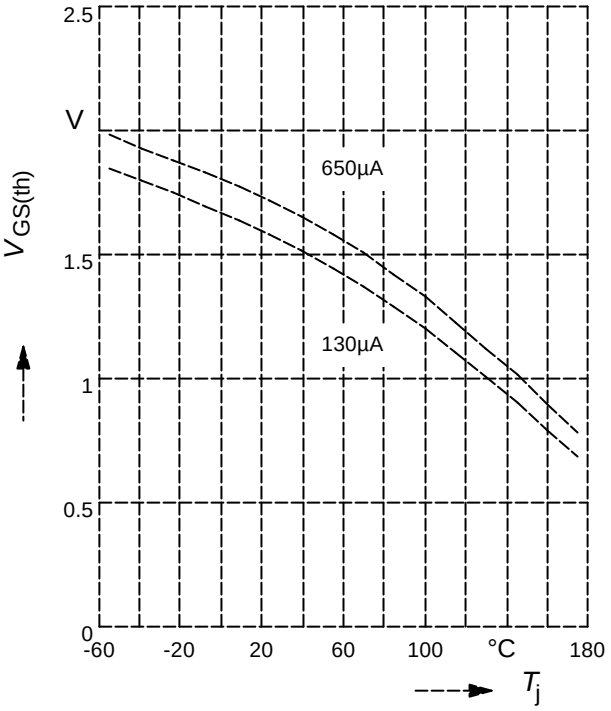
parameter : $I_D$ = 80 A, $V_{GS}$ = 10 V




## 10 Typ. gate threshold voltage

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

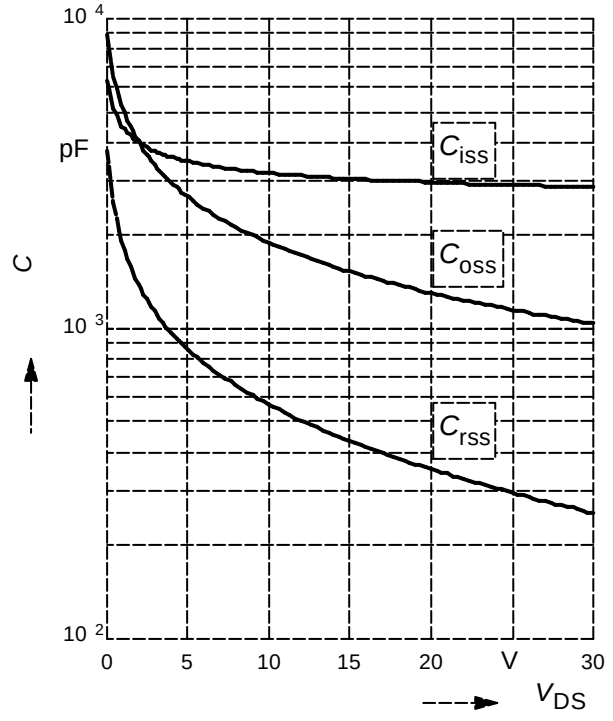
parameter: $V_{GS} = V_{DS}$




## 11 Typ. capacitances

$C = f(V_{DS})$

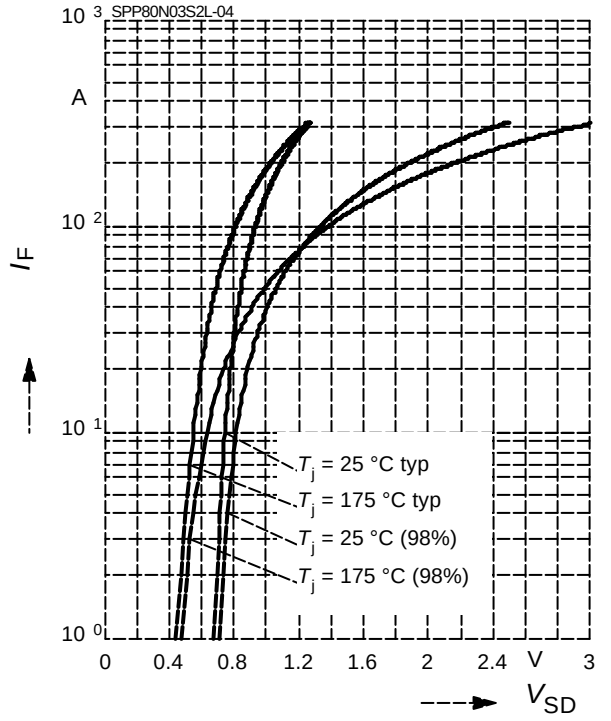
parameter: $V_{GS}$=0V, $f$=1 MHz




## 12 Forward character. of reverse diode

$I_F = f(V_{SD})$

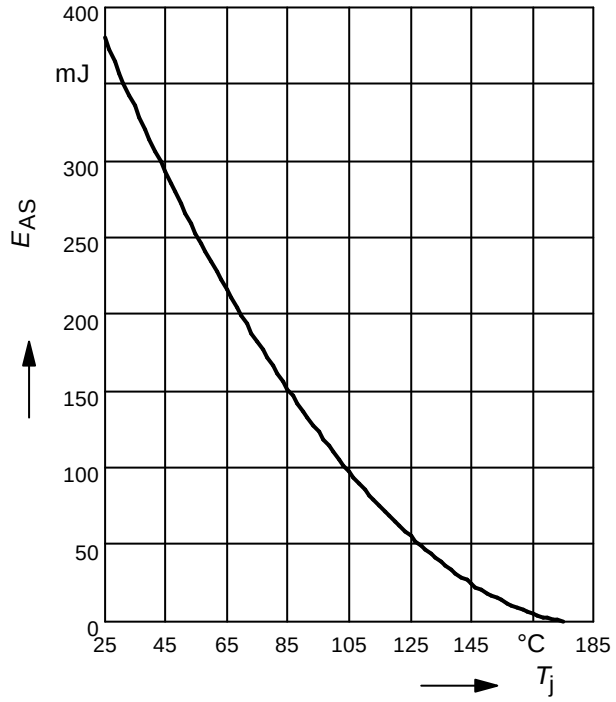
parameter: $T_j$ , tp = 80 µs



## 13 Typ. avalanche energy

$E_{AS} = f(T_j)$

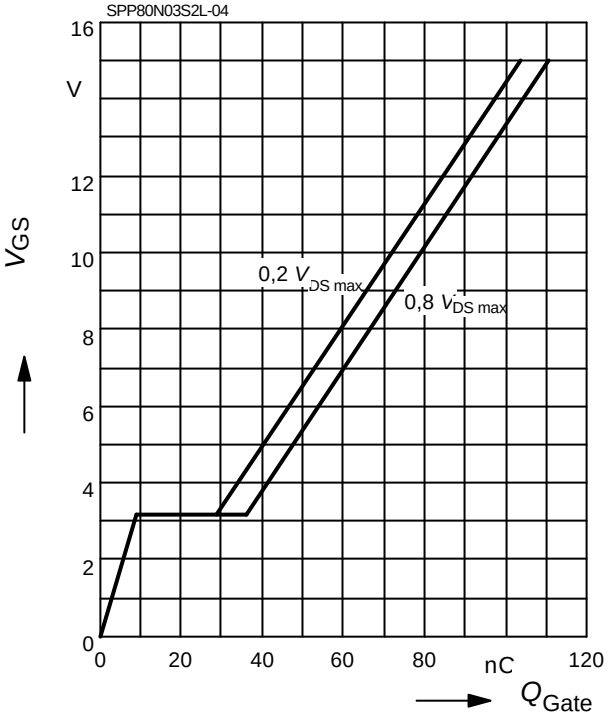
par.: $I_D = 80$ A , $V_{DD} = 25$ V, $R_{GS} = 25\ \Omega$




## 14 Typ. gate charge

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

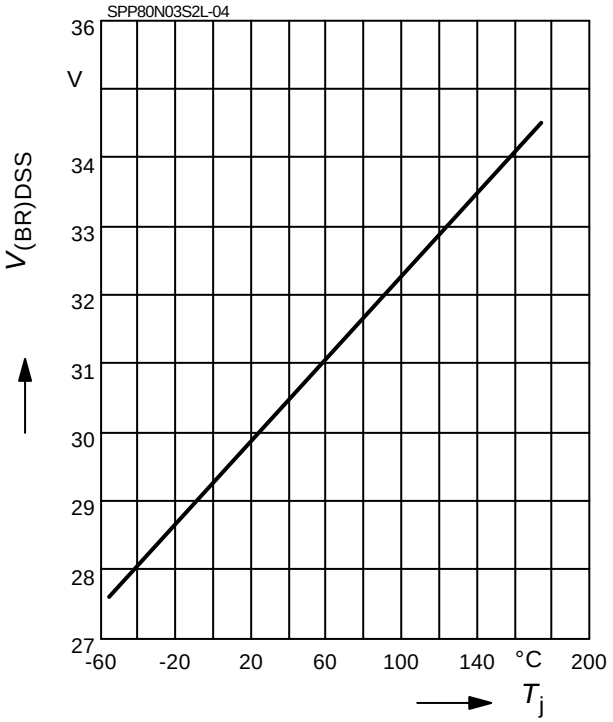
parameter: $I_D = 80$ A pulsed




## 15 Drain-source breakdown voltage

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

parameter: $I_D$=10 mA



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**Further information**
Please notice that the part number is BSPP80N03S2L-04, BSPB80N03S2L-04 and BSPI80N03S2L-04, for simplicity the device is referred to by the term SPP80N03S2L-04, SPB80N03S2L-04 and SPI80N03S2L-04 throughout this documentation