

## OptiMOS® Power-Transistor

### Feature

- N-Channel
- Enhancement mode
- 175°C operating temperature
- Avalanche rated
- dv/dt rated

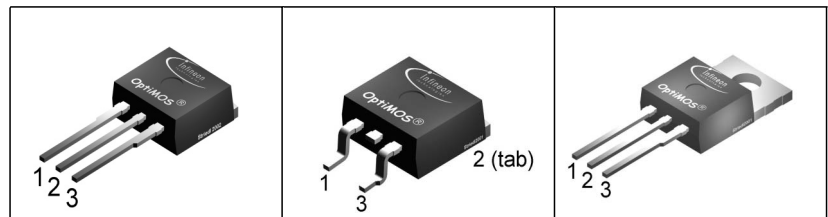
### Product Summary

|                               |     |    |
|-------------------------------|-----|----|
| $V_{DS}$                      | 40  | V  |
| $R_{DS(on)}$ max. SMD version | 3.4 | mΩ |
| $I_D$                         | 80  | A  |

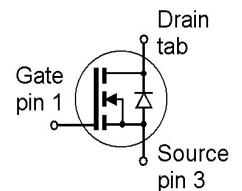
P- TO262 -3-1

P- TO263 -3-2

P- TO220 -3-1



| Type          | Package       | Ordering Code | Marking |
|---------------|---------------|---------------|---------|
| SPP80N04S2-04 | P- TO220 -3-1 | Q67040-S4260  | 2N0404  |
| SPB80N04S2-04 | P- TO263 -3-2 | Q67040-S4257  | 2N0404  |
| SPI80N04S2-04 | P- TO262 -3-1 | Q67060-S6173  | 2N0404  |



### Maximum Ratings, at $T_j = 25\text{ °C}$ , unless otherwise specified

| Parameter   | Symbol         | Value       | Unit  |
|---|----------------|-------------|-------|
| Continuous drain current <sup>1)</sup>  | $I_D$          | 80          | A     |
| $T_C=25\text{ °C}$  |                | 80          |       |
| $T_C=100\text{ °C}$   |                | 80          |       |
| Pulsed drain current  | $I_D$ puls     | 320         |       |
| $T_C=25\text{ °C}$  |                |             |       |
| Avalanche energy, single pulse  | $E_{AS}$       | 810         | mJ    |
| $I_D=80\text{ A}$ , $V_{DD}=25\text{ V}$ , $R_{GS}=25\text{ Ω}$                               |                |             |       |
| Repetitive avalanche energy, limited by $T_{jmax}$ <sup>2)</sup>                              | $E_{AR}$       | 30          |       |
| Reverse diode dv/dt   | dv/dt          | 6           | kV/μs |
| $I_S=80\text{ A}$ , $V_{DS}=32\text{ V}$ , $di/dt=200\text{ A/μs}$ , $T_{jmax}=175\text{ °C}$ |                |             |       |
| Gate source voltage   | $V_{GS}$       | ±20         | V     |
| Power dissipation   | $P_{tot}$      | 300         | W     |
| $T_C=25\text{ °C}$  |                |             |       |
| 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.     |      |
| <b>Characteristics</b>  |            |        |      |          |      |
| Thermal resistance, junction - case   | $R_{thJC}$ | -      | 0.3  | 0.5      | K/W  |
| Thermal resistance, junction - ambient, leaded  | $R_{thJA}$ | -      | -    | 62       |      |
| SMD version, device on PCB:<br>@ min. footprint<br>@ 6 cm <sup>2</sup> cooling area <sup>3)</sup> | $R_{thJA}$ | -      | -    | 62<br>40 |      |

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

| Parameter   | Symbol        | Values |           |            | Unit       |
|---|---------------|--------|-----------|------------|------------|
|   |               | min.   | typ.      | max.       |            |
| <b>Static Characteristics</b>   |               |        |           |            |            |
| Drain-source breakdown voltage<br>$V_{GS}=0V, I_D=1mA$  | $V_{(BR)DSS}$ | 40     | -         | -          | V          |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D=250\mu A$   | $V_{GS(th)}$  | 2.1    | 3         | 4          |            |
| Zero gate voltage drain current<br>$V_{DS}=40V, V_{GS}=0V, T_j=25^\circ\text{C}$<br>$V_{DS}=40V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$ | $I_{DSS}$     | -      | 0.01<br>1 | 1<br>100   | $\mu A$    |
| Gate-source leakage current<br>$V_{GS}=20V, V_{DS}=0V$  | $I_{GSS}$     | -      | 1         | 100        | nA         |
| Drain-source on-state resistance <sup>4)</sup><br>$V_{GS}=10V, I_D=80A$<br>$V_{GS}=10V, I_D=80A, \text{ SMD version}$                   | $R_{DS(on)}$  | -      | 3<br>2.7  | 3.7<br>3.4 | m $\Omega$ |

<sup>1</sup>Current limited by bondwire ; with an  $R_{thJC} = 0.5K/W$  the chip is able to carry  $I_D = 208A$  at  $25^\circ\text{C}$ , for detailed information see app.-note ANPS071E available at [www.infineon.com/optimos](http://www.infineon.com/optimos)

<sup>2</sup>Defined by design. Not subject to production test.

<sup>3</sup>Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical without blown air.

<sup>4</sup>Diagrams are related to straight lead versions

### Electrical Characteristics

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

### Dynamic Characteristics

|                              |              |   |    |      |      |    |
|------------------------------|--------------|---|----|------|------|----|
| Transconductance             | $g_{fs}$     | $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ ,<br>$I_D = 80A$          | 60 | 125  | -    | S  |
| Input capacitance            | $C_{iss}$    | $V_{GS} = 0V$ , $V_{DS} = 25V$ ,<br>$f = 1MHz$                          | -  | 5250 | 6980 | pF |
| Output capacitance           | $C_{oss}$    |   | -  | 1870 | 2490 |    |
| Reverse transfer capacitance | $C_{rss}$    |   | -  | 420  | 630  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD} = 20V$ , $V_{GS} = 10V$ ,<br>$I_D = 80A$ ,<br>$R_G = 2.2\Omega$ | -  | 16   | 24   | ns |
| Rise time                    | $t_r$        |   | -  | 45   | 68   |    |
| 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  | 75  |    |
| Gate charge total     | $Q_g$           | $V_{DD} = 32V$ , $I_D = 80A$ ,<br>$V_{GS} = 0$ to $10V$ | - | 135 | 170 |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD} = 32V$ , $I_D = 80A$                            | - | 5.3 | -   | V  |

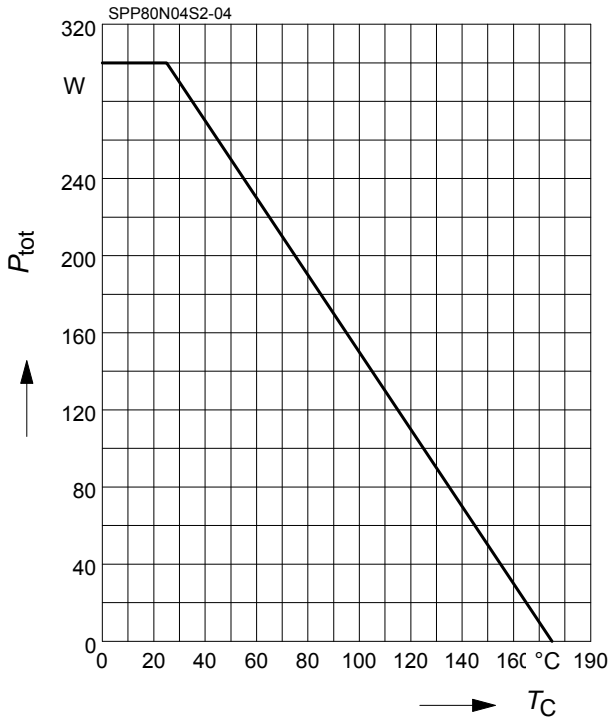
### Reverse Diode

|  |          |   |   |     |     |    |
|--|----------|---|---|-----|-----|----|
| Inverse diode continuous forward current | $I_S$    | $T_C = 25^\circ C$                                    | - | -   | 80  | A  |
| Inv. diode direct current, pulsed        | $I_{SM}$ |   | - | -   | 320 |    |
| Inverse diode forward voltage            | $V_{SD}$ | $V_{GS} = 0V$ , $I_F = 80A$                           | - | 0.9 | 1.3 | V  |
| Reverse recovery time                    | $t_{rr}$ | $V_R = 20V$ , $I_F = I_S$ ,<br>$di_F/dt = 100A/\mu s$ | - | 60  | 75  | ns |
| Reverse recovery charge                  | $Q_{rr}$ |   | - | 100 | 125 | nC |

### 1 Power dissipation

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

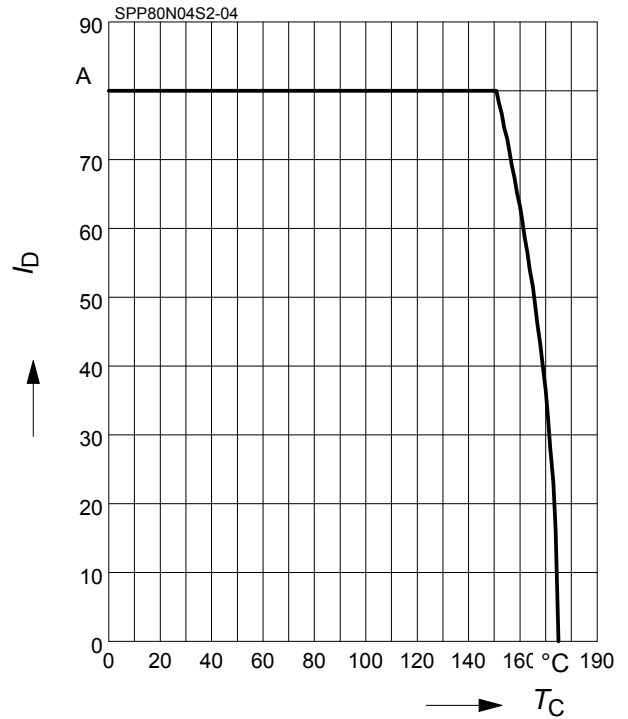
parameter:  $V_{GS} \geq 6 \text{ V}$



### 2 Drain current

$$I_D = f(T_C)$$

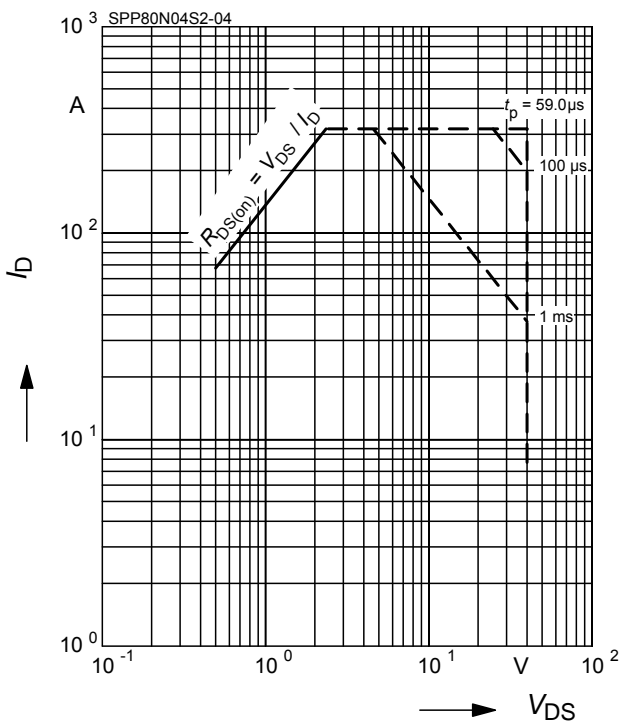
parameter:  $V_{GS} \geq 10 \text{ V}$



### 3 Safe operating area

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

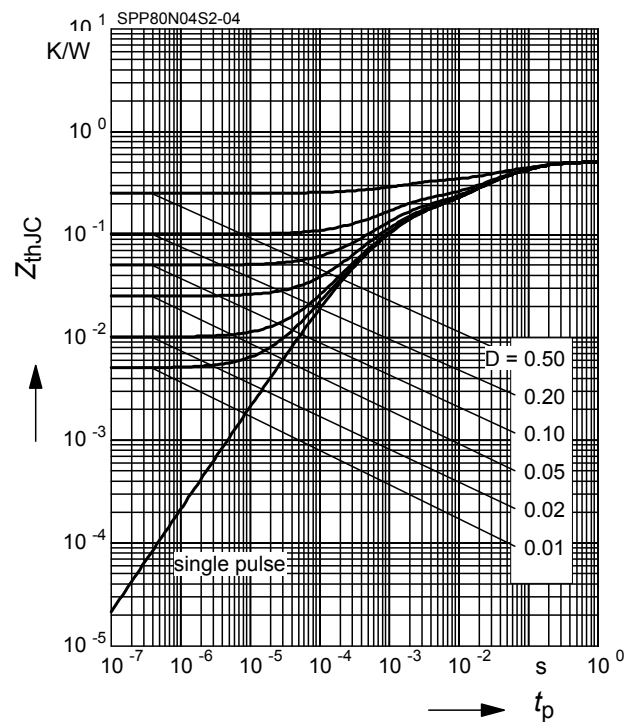
parameter:  $D = 0, T_C = 25 \text{ °C}$



### 4 Max. transient thermal impedance

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

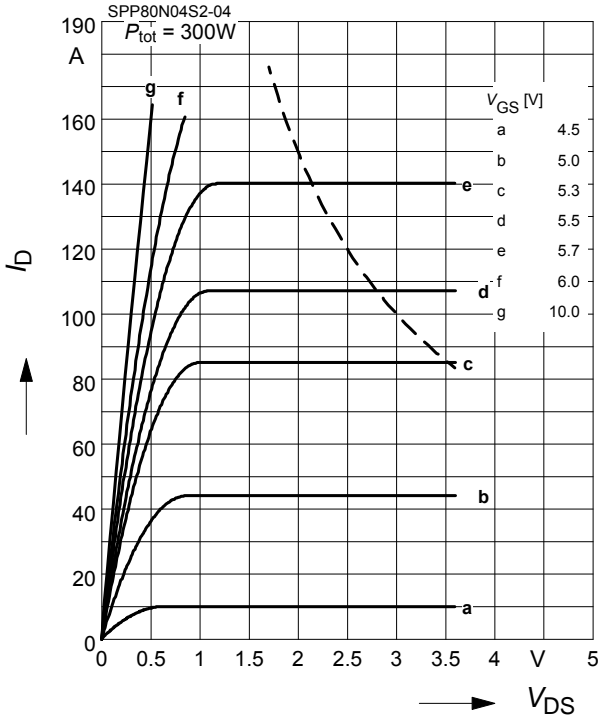
parameter:  $D = t_p/T$



### 5 Typ. output characteristic

$$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$$

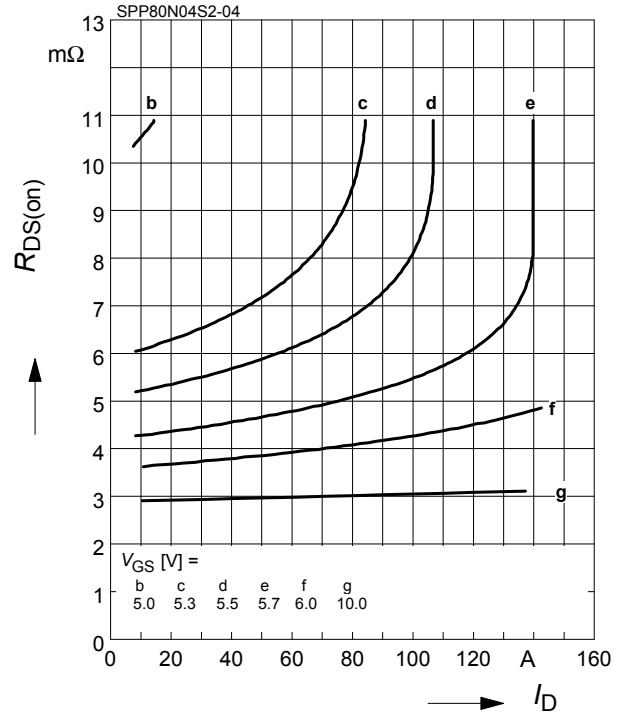
parameter:  $t_p = 80 \mu\text{s}$



### 6 Typ. drain-source on resistance

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

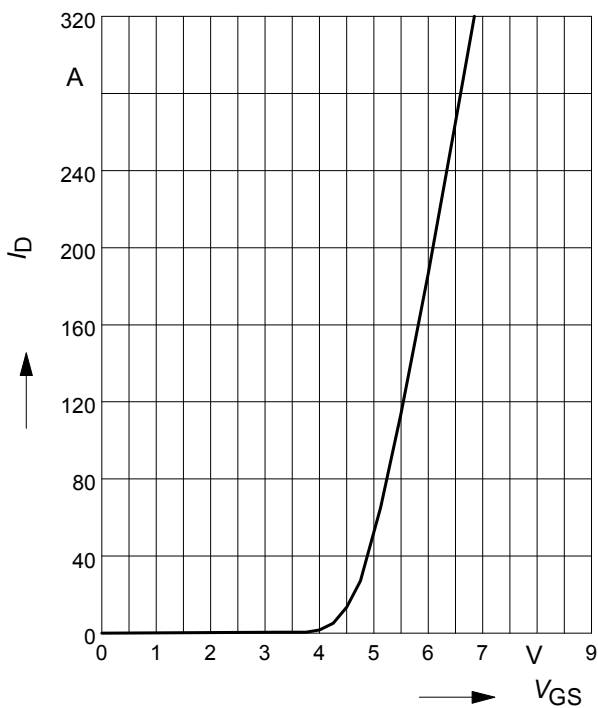
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

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

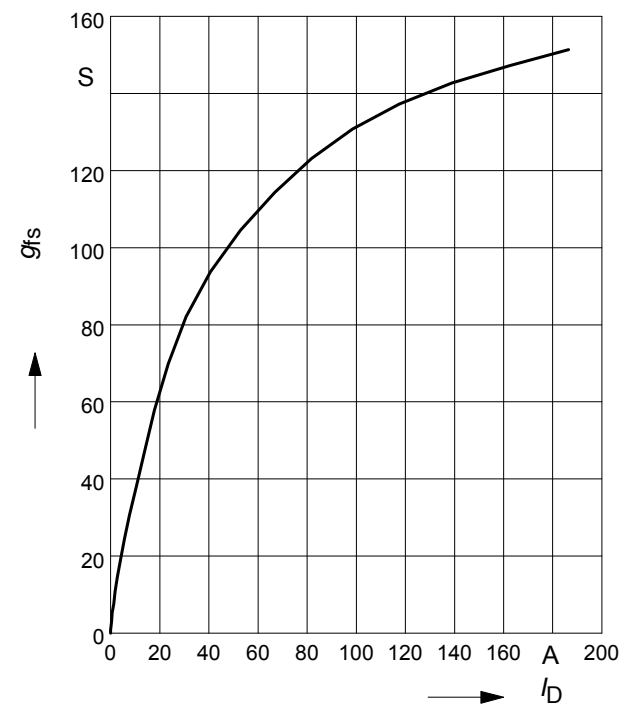
parameter:  $t_p = 80 \mu\text{s}$



### 8 Typ. forward transconductance

$$g_{fs} = f(I_D); T_j = 25^\circ\text{C}$$

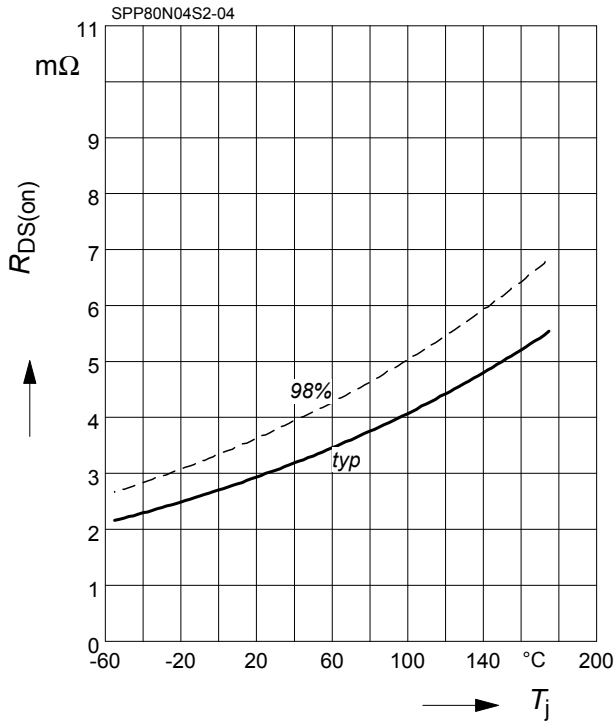
parameter:  $g_{fs}$



### 9 Drain-source on-state resistance

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

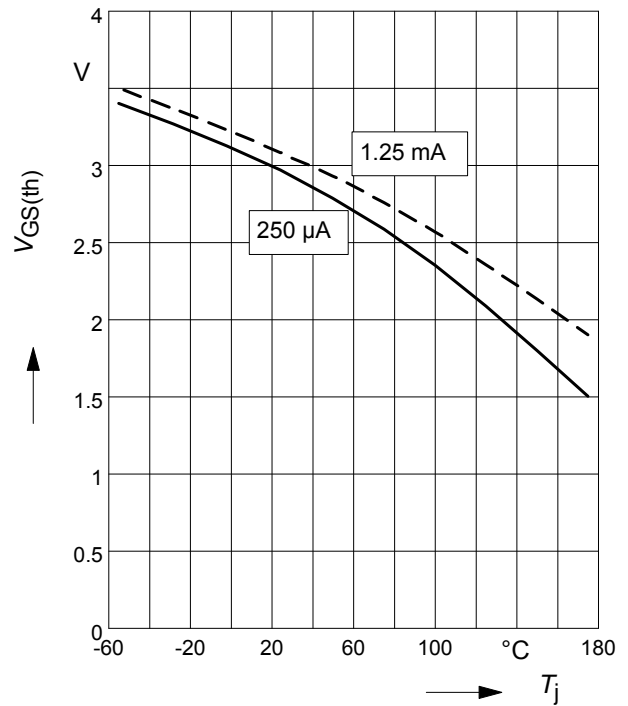
parameter:  $I_D = 80\text{ A}$ ,  $V_{GS} = 10\text{ V}$



### 10 Typ. gate threshold voltage

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

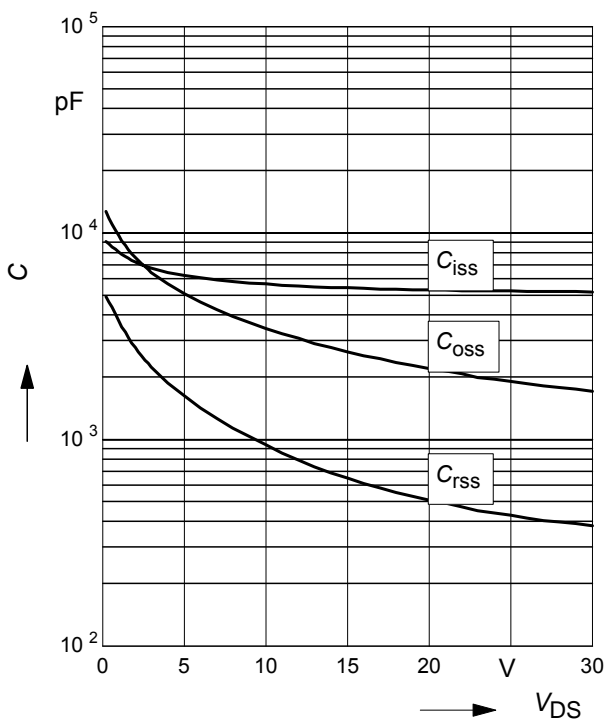
parameter:  $V_{GS} = V_{DS}$



### 11 Typ. capacitances

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

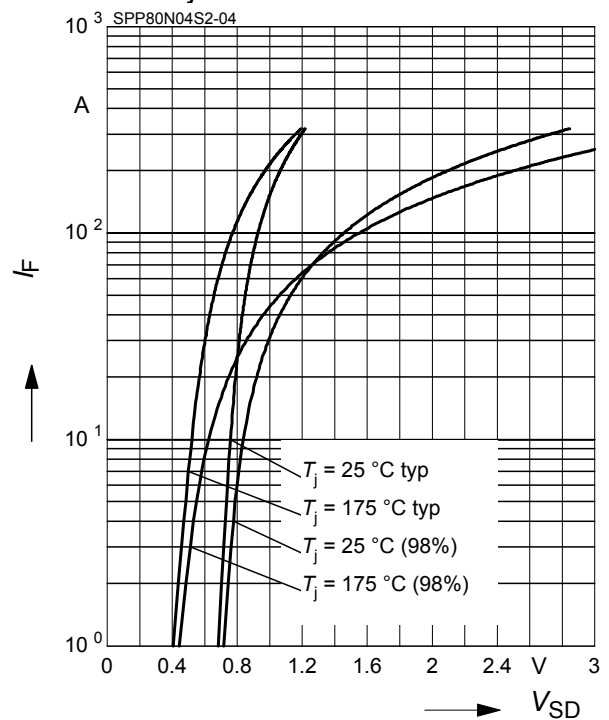
parameter:  $V_{GS} = 0\text{ V}$ ,  $f = 1\text{ MHz}$



### 12 Forward character. of reverse diode

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

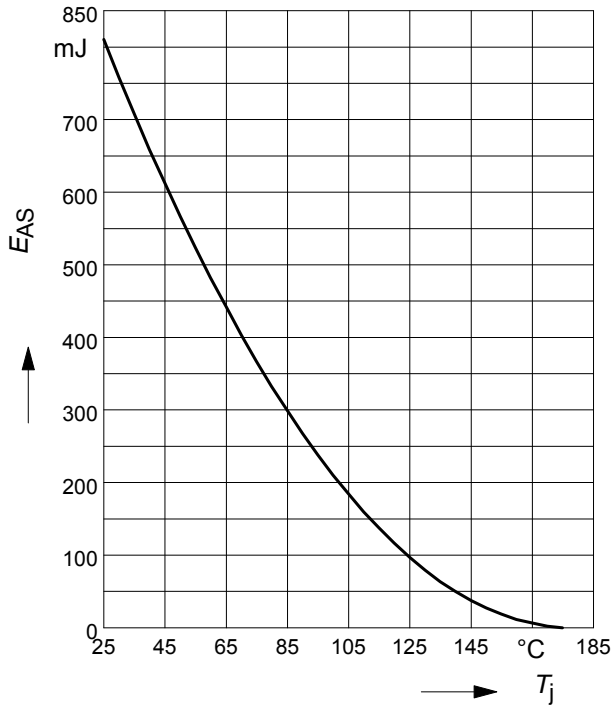
parameter:  $T_j$ ,  $t_p = 80\text{ μs}$



### 13 Typ. avalanche energy

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

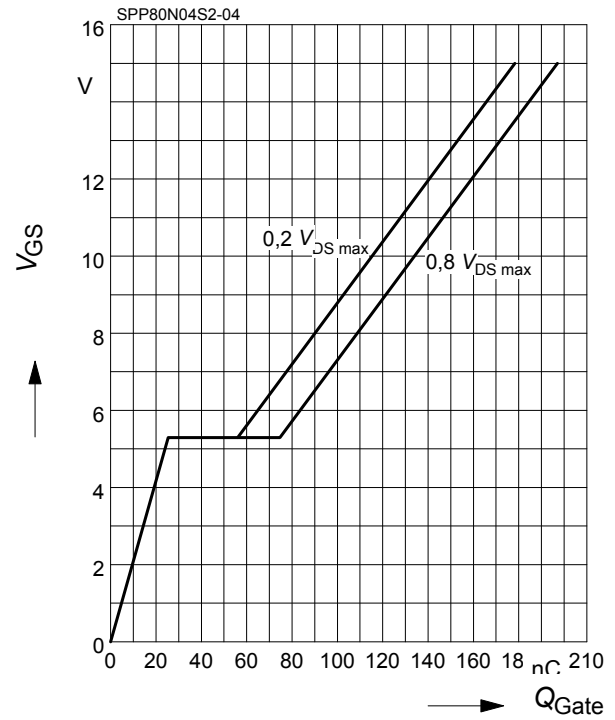
par.:  $I_D = 80\text{ A}$ ,  $V_{DD} = 25\text{ V}$ ,  $R_{GS} = 25\ \Omega$



### 14 Typ. gate charge

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

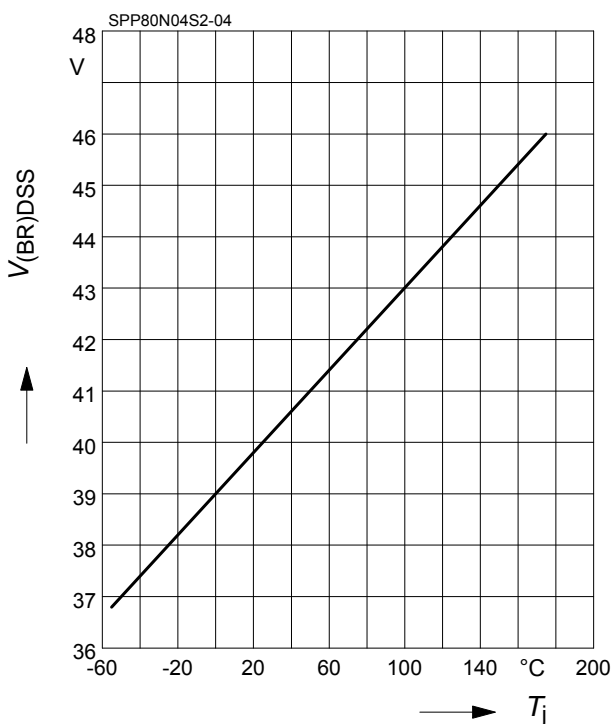
parameter:  $I_D = 80\text{ A}$  pulsed



### 15 Drain-source breakdown voltage

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

parameter:  $I_D = 10\text{ mA}$



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**Further information**

Please notice that the part number is **BSPP80N04S2-04** and **BSPB80N04S2-04**, for simplicity the device is referred to by the term **SPP80N04S2-04** and **SPB80N04S2-04** throughout this documentation.