

## OptiMOS® Power-Transistor

### Feature

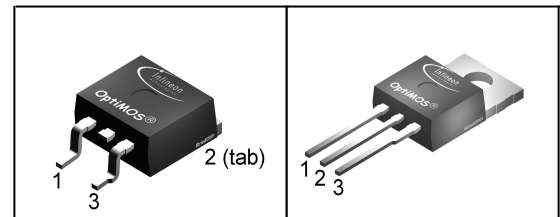
- N-Channel
- Enhancement mode
- 175°C operating temperature
- Avalanche rated
- dv/dt rated

### Product Summary

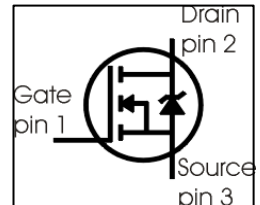
|              |     |    |
|--------------|-----|----|
| $V_{DS}$     | 55  | V  |
| $R_{DS(on)}$ | 9.1 | mΩ |
| $I_D$        | 80  | A  |

P- TO263 -3-2

P- TO220 -3-1



| Type          | Package       | Ordering Code | Marking |
|---------------|---------------|---------------|---------|
| SPP80N06S2-09 | P- TO220 -3-1 | Q67060-S6025  | 2N0609  |
| SPB80N06S2-09 | P- TO263 -3-2 | Q67060-S6027  | 2N0609  |



**Maximum Ratings**, at  $T_j = 25^\circ\text{C}$ , unless otherwise specified

| Parameter                                                                                                                      | Symbol               | Value       | Unit              |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------|-------------------|
| Continuous drain current 1)<br>$T_C=25^\circ\text{C}$                                                                          | $I_D$                | 80<br>70    | A                 |
| Pulsed drain current<br>$T_C=25^\circ\text{C}$                                                                                 | $I_{D \text{ puls}}$ | 320         |                   |
| Avalanche energy, single pulse<br>$I_D=80 \text{ A}$ , $V_{DD}=25\text{V}$ , $R_{GS}=25\Omega$                                 | $E_{AS}$             | 370         | mJ                |
| Repetitive avalanche energy, limited by $T_{jmax}^{2)}$                                                                        | $E_{AR}$             | 19          |                   |
| Reverse diode dv/dt<br>$I_S=80\text{A}$ , $V_{DS}=44\text{V}$ , $di/dt=200\text{A}/\mu\text{s}$ , $T_{jmax}=175^\circ\text{C}$ | dv/dt                | 6           | kV/ $\mu\text{s}$ |
| Gate source voltage                                                                                                            | $V_{GS}$             | $\pm 20$    | V                 |
| Power dissipation<br>$T_C=25^\circ\text{C}$                                                                                    | $P_{tot}$            | 190         | W                 |
| Operating and storage temperature                                                                                              | $T_j, T_{stg}$       | -55... +175 | $^\circ\text{C}$  |
| IEC climatic category; DIN IEC 68-1                                                                                            |                      | 55/175/56   |                   |

**Thermal Characteristics**

| Parameter                                      | Symbol     | Values |      |      | Unit |
|------------------------------------------------|------------|--------|------|------|------|
|                                                |            | min.   | typ. | max. |      |
| Characteristics                                |            |        |      |      |      |
| Thermal resistance, junction - case            | $R_{thJC}$ | -      | 0.52 | 0.8  | K/W  |
| Thermal resistance, junction - ambient, leaded | $R_{thJA}$ | -      | -    | 62   |      |
| SMD version, device on PCB:                    | $R_{thJA}$ |        |      |      |      |
| @ min. footprint                               |            | -      | -    | 62   |      |
| @ 6 cm <sup>2</sup> cooling area <sup>3)</sup> |            | -      | -    | 40   |      |

**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<br>$V_{GS}=0V, I_D=1mA$                                                                   | $V_{(BR)DSS}$ | 55     | -         | -        | V         |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D = 125 \mu A$                                                           | $V_{GS(th)}$  | 2.1    | 3         | 4        |           |
| Zero gate voltage drain current<br>$V_{DS}=55V, V_{GS}=0V, T_j=25^{\circ}C$<br>$V_{DS}=55V, V_{GS}=0V, T_j=125^{\circ}C$ | $I_{DSS}$     | -<br>- | 0.01<br>1 | 1<br>100 | $\mu A$   |
| Gate-source leakage current<br>$V_{GS}=20V, V_{DS}=0V$                                                                   | $I_{GSS}$     | -      | 1         | 100      |           |
| Drain-source on-state resistance<br>$V_{GS}=10V, I_D=50A$                                                                | $R_{DS(on)}$  | -      | 7.6       | 9.1      | $m\Omega$ |

<sup>1</sup>Current limited by bondwire ; with an  $R_{thJC} = 0.8K/W$  the chip is able to carry  $I_D = 99A$  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  $\mu m$  thick) copper area for drain connection. PCB is vertical without blown air.

**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>$I_D = 70A$          | 34 | 68   | -    | S  |
| Input capacitance            | $C_{iss}$    | $V_{GS} = 0V$ , $V_{DS} = 25V$ ,<br>$f = 1MHz$                          | -  | 2360 | 3140 | pF |
| Output capacitance           | $C_{oss}$    |                                                                         | -  | 610  | 810  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                         | -  | 150  | 230  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD} = 30V$ , $V_{GS} = 10V$ ,<br>$I_D = 80A$ ,<br>$R_G = 4.7\Omega$ | -  | 14   | 21   | ns |
| Rise time                    | $t_r$        |                                                                         | -  | 29   | 44   |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                         | -  | 39   | 58   |    |
| Fall time                    | $t_f$        |                                                                         | -  | 28   | 42   |    |

**Gate Charge Characteristics**

|                       |                 |                                                         |   |     |    |    |
|-----------------------|-----------------|---------------------------------------------------------|---|-----|----|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD} = 44V$ , $I_D = 80A$                            | - | 12  | 16 | nC |
| Gate to drain charge  | $Q_{gd}$        |                                                         | - | 24  | 37 |    |
| Gate charge total     | $Q_g$           | $V_{DD} = 44V$ , $I_D = 80A$ ,<br>$V_{GS} = 0$ to $10V$ | - | 60  | 80 |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD} = 44V$ , $I_D = 80A$                            | - | 5.8 | -  | V  |

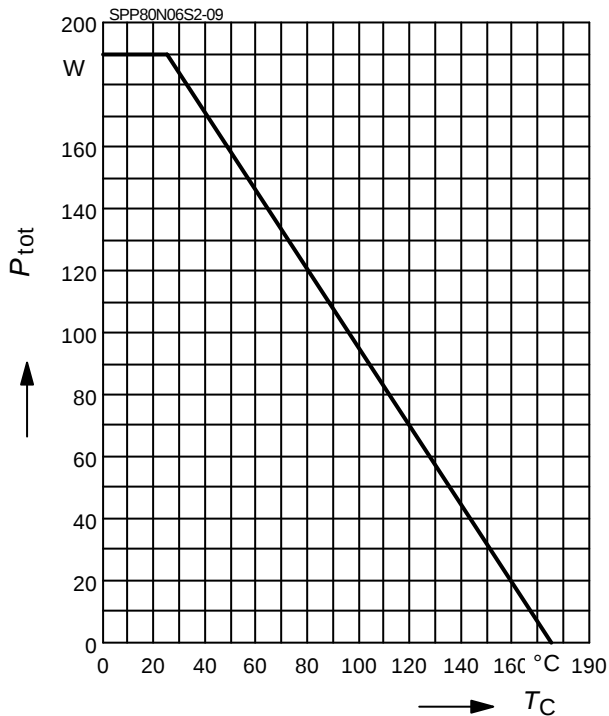
**Reverse Diode**

|                                          |          |                                                       |   |     |     |    |
|------------------------------------------|----------|-------------------------------------------------------|---|-----|-----|----|
| 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                    | $t_{rr}$ | $V_R = 30V$ , $I_F = I_S$ ,<br>$di_F/dt = 100A/\mu s$ | - | 50  | 63  | ns |
| Reverse recovery charge                  | $Q_{rr}$ |                                                       | - | 76  | 95  | nC |

### 1 Power dissipation

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

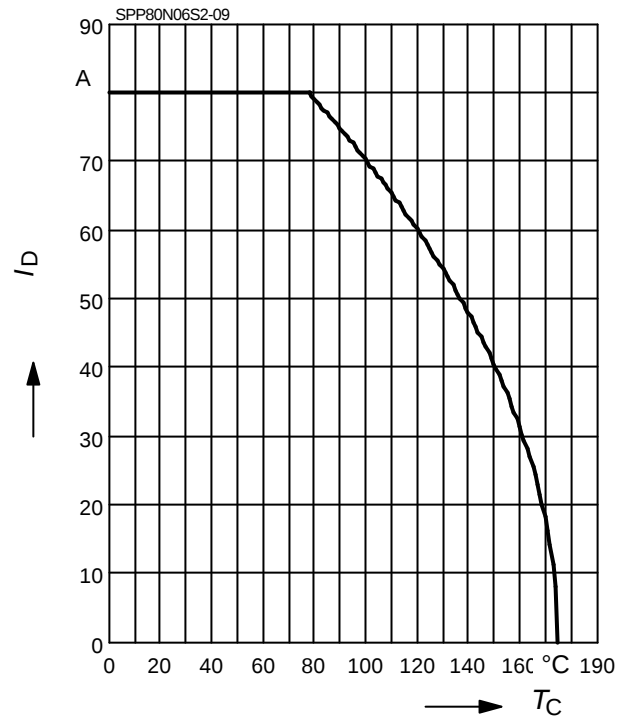
parameter:  $V_{GS} \geq 6 \text{ V}$



### 2 Drain current

$$I_D = f(T_C)$$

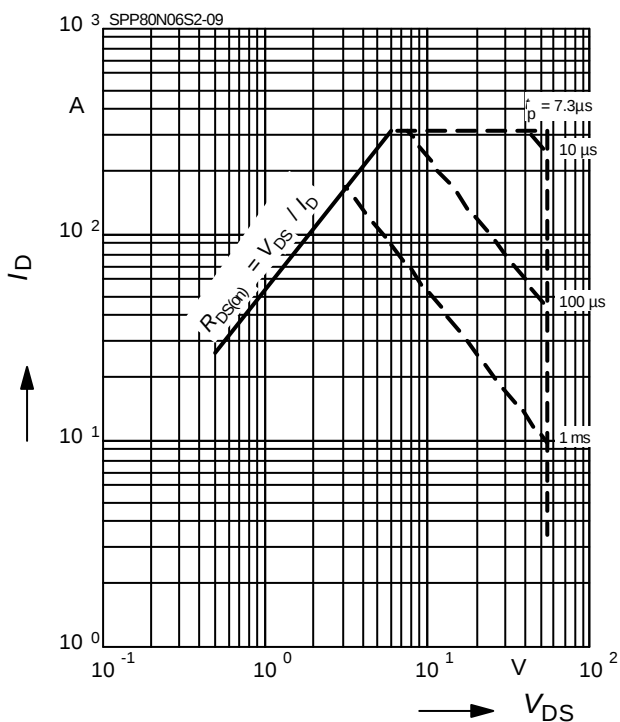
parameter:  $V_{GS} \geq 10 \text{ V}$



### 3 Safe operating area

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

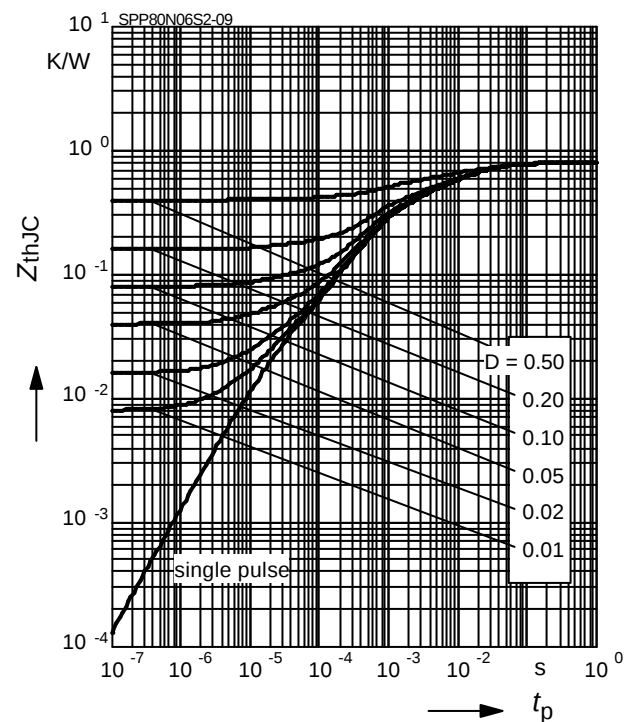
parameter:  $D = 0$ ,  $T_C = 25^\circ\text{C}$



### 4 Max. transient thermal impedance

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

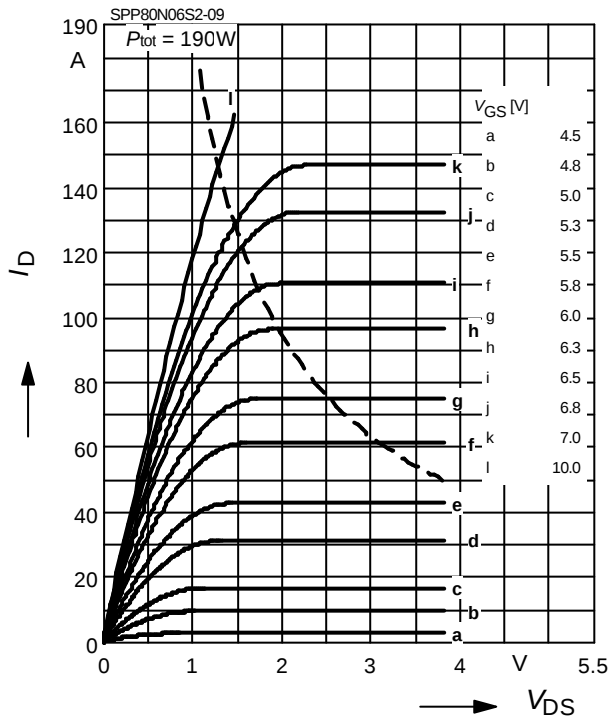
parameter:  $D = t_p/T$



### 5 Typ. output characteristic

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

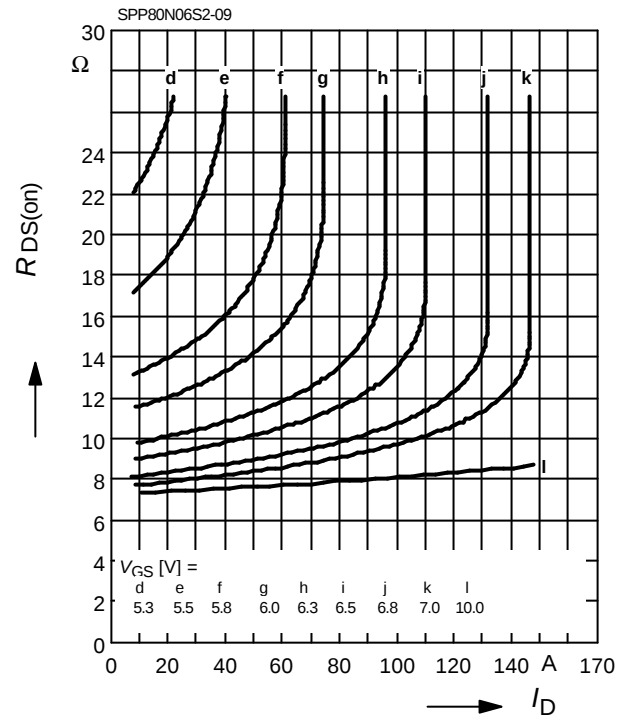
parameter:  $t_p = 80 \mu\text{s}$



### 6 Typ. drain-source on resistance

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

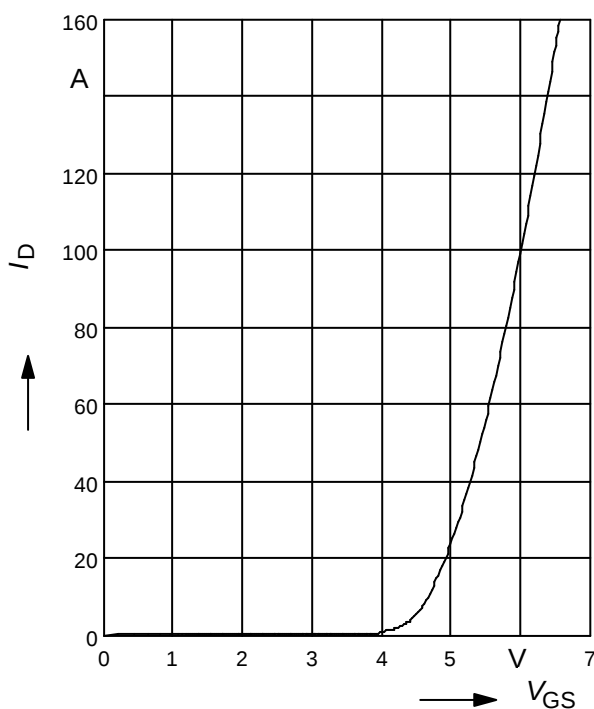
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

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

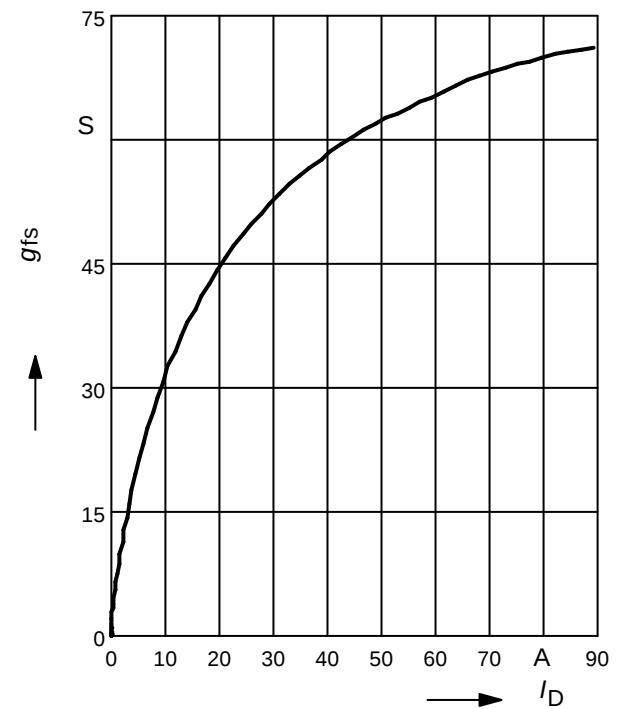
parameter:  $t_p = 80 \mu\text{s}$



### 8 Typ. forward transconductance

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

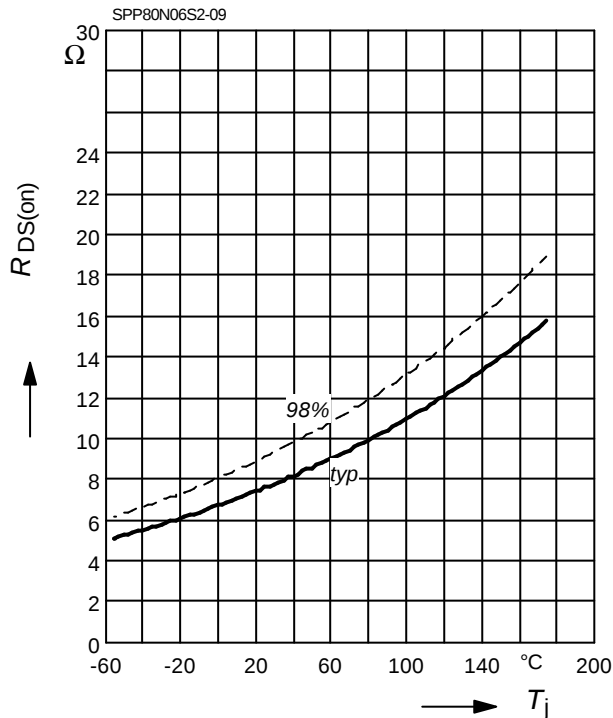
parameter:  $g_{fs}$



### 9 Drain-source on-state resistance

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

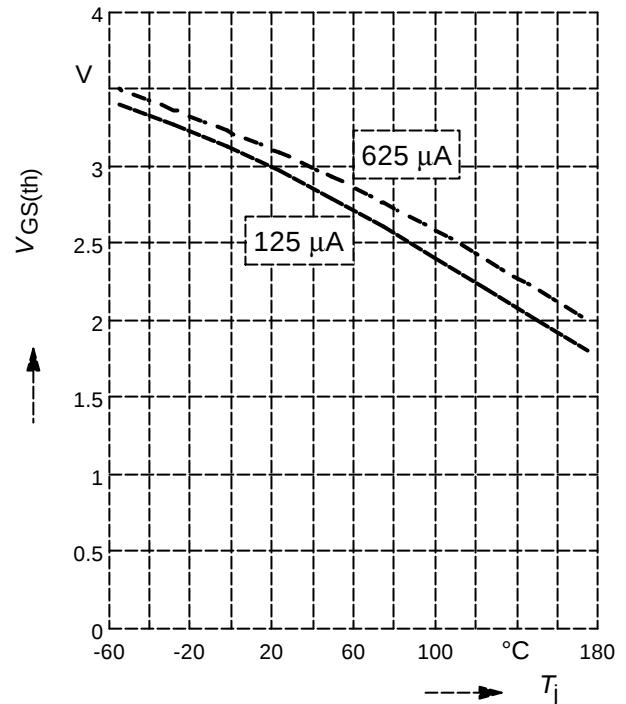
parameter:  $I_D = 50\text{ A}$ ,  $V_{GS} = 10\text{ V}$



### 10 Typ. gate threshold voltage

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

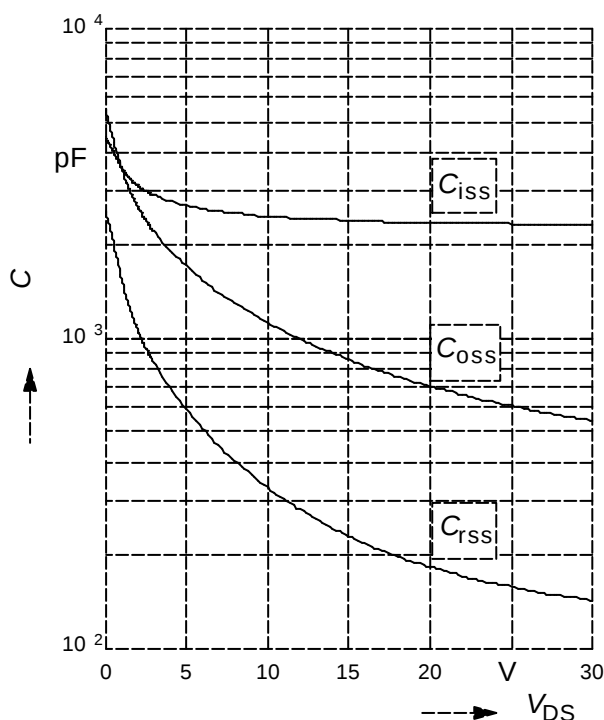
parameter:  $V_{GS} = V_{DS}$



### 11 Typ. capacitances

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

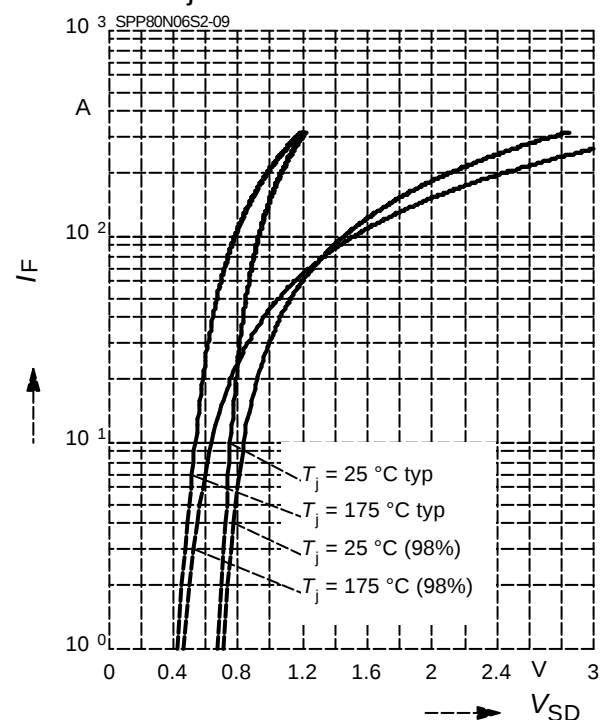
parameter:  $V_{GS} = 0\text{ V}$ ,  $f = 1\text{ MHz}$



### 12 Forward character. of reverse diode

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

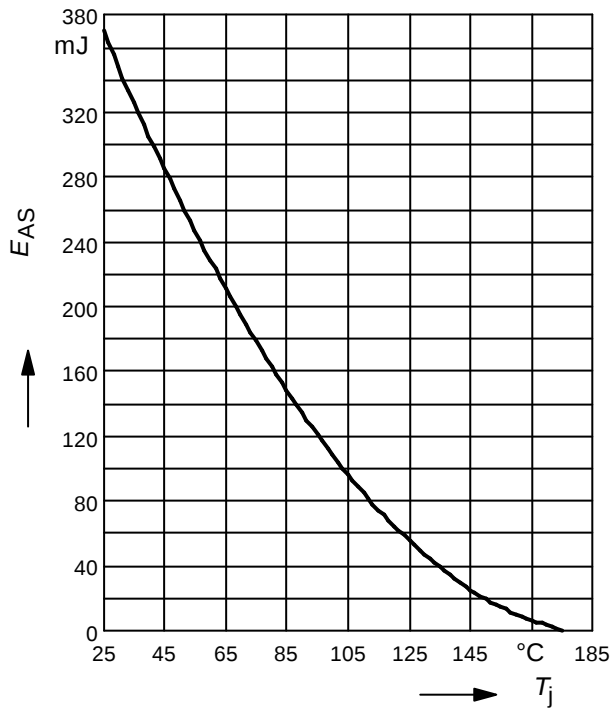
parameter:  $T_j$ ,  $t_p = 80\text{ }\mu\text{s}$



### 13 Typ. avalanche energy

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

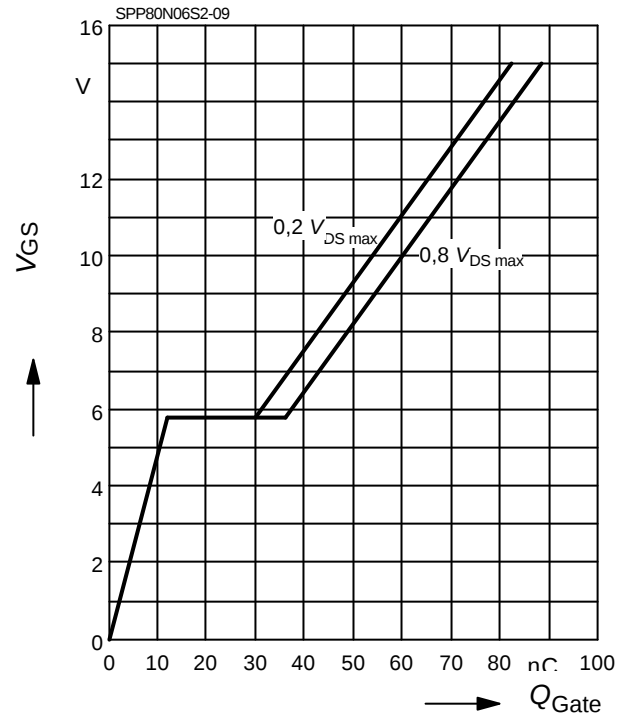
par.:  $I_D = 80\text{ A}$ ,  $V_{DD} = 25\text{ V}$ ,  $R_{GS} = 25\ \Omega$



### 14 Typ. gate charge

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

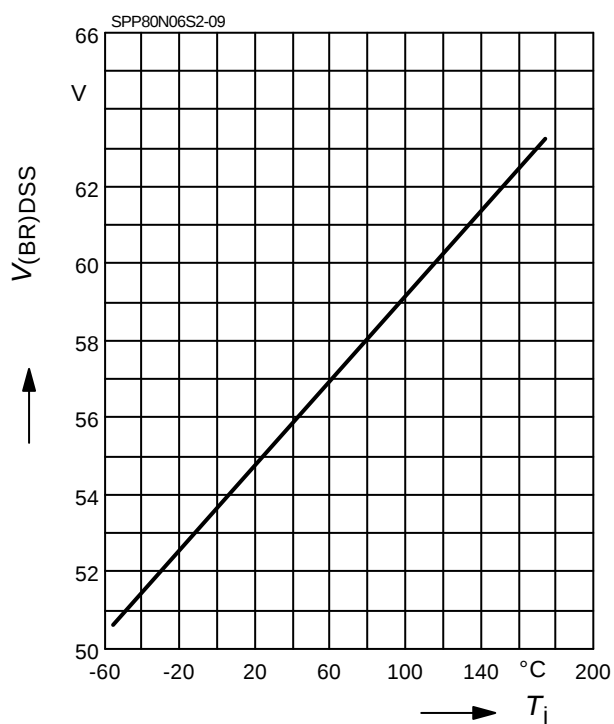
parameter:  $I_D = 80\text{ A}$  pulsed



### 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 **BSPP80N06S2-09** and **BSPB80N06S2-09**, for simplicity the device is referred to by the term **SPP80N06S2-09** and **SPB80N06S2-09** throughout this documentation.