

## SIPMOS® Power-Transistor

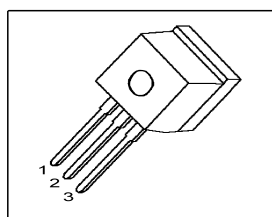
### Feature

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

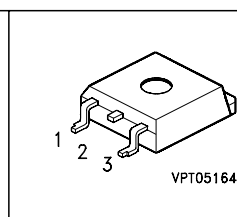
### Product Summary

|              |     |    |
|--------------|-----|----|
| $V_{DS}$     | 100 | V  |
| $R_{DS(on)}$ | 33  | mΩ |
| $I_D$        | 47  | A  |

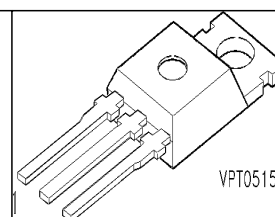
P-TO262-3-1



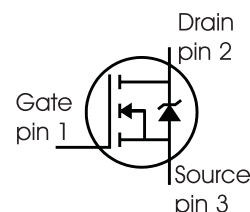
P-TO263-3-2



P-TO220-3-1



| Type     | Package     | Ordering Code | Marking |
|----------|-------------|---------------|---------|
| SPP47N10 | P-TO220-3-1 | Q67040-S4183  | 47N10   |
| SPB47N10 | P-TO263-3-2 | Q67040-S4173  | 47N10   |
| SPI47N10 | P-TO262-3-1 | tbd           | 47N10   |



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

| Parameter                                                               | Symbol               | Value       | Unit  |
|-------------------------------------------------------------------------|----------------------|-------------|-------|
| Continuous drain current                                                | $I_D$                |             | A     |
| $T_C = 25\text{ °C}$                                                    |                      | 47          |       |
| $T_C = 100\text{ °C}$                                                   |                      | 33          |       |
| Pulsed drain current                                                    | $I_{D \text{ puls}}$ | 188         |       |
| $T_C = 25\text{ °C}$                                                    |                      |             |       |
| Avalanche energy, single pulse                                          | $E_{AS}$             | 400         | mJ    |
| $I_D = 47\text{ A}$ , $V_{DD} = 25\text{ V}$ , $R_{GS} = 25\text{ Ω}$   |                      |             |       |
| Avalanche energy, periodic limited by $T_{jmax}$                        | $E_{AR}$             | 17.5        |       |
| Reverse diode dv/dt                                                     | dv/dt                | 6           | kV/μs |
| $I_S = 47\text{ A}$ , $V_{DS} = 0\text{ V}$ , $di/dt = 200\text{ A/μs}$ |                      |             |       |
| Gate source voltage                                                     | $V_{GS}$             | ±20         | V     |
| Power dissipation                                                       | $P_{tot}$            | 175         | 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. |      |
| Characteristics                                |            |        |      |      |      |
| Thermal resistance, junction - case            | $R_{thJC}$ | -      | -    | 0.85 | 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>1)</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>$V_{GS}=0V, I_D=2mA$                                                                     | $V_{(BR)DSS}$ | 100    | -        | -        | V         |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D = 2\text{ mA}$                                                           | $V_{GS(th)}$  | 2.1    | 3        | 4        |           |
| Zero gate voltage drain current<br>$V_{DS}=100V, V_{GS}=0V, T_j=25^{\circ}C$<br>$V_{DS}=100V, V_{GS}=0V, T_j=150^{\circ}C$ | $I_{DSS}$     | -<br>- | 0.1<br>- | 1<br>100 | $\mu A$   |
| Gate-source leakage current<br>$V_{GS}=20V, V_{DS}=0V$                                                                     | $I_{GSS}$     | -      | 10       | 100      |           |
| Drain-source on-state resistance<br>$V_{GS}=10V, I_D=33A$                                                                  | $R_{DS(on)}$  | -      | 25       | 33       | $m\Omega$ |

<sup>1</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.

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

| 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>$I_D = 33\text{A}$                     | 13 | 26   | -    | S  |
| Input capacitance            | $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ ,<br>$f = 1\text{MHz}$                       | -  | 2000 | 2500 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                           | -  | 370  | 465  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                           | -  | 190  | 240  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD} = 50\text{V}$ , $V_{GS} = 10\text{V}$ ,<br>$I_D = 47\text{A}$ , $R_G = 4.7\Omega$ | -  | 25   | 39   | ns |
| Rise time                    | $t_r$        |                                                                                           | -  | 23   | 36   |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                           | -  | 63   | 99   |    |
| Fall time                    | $t_f$        |                                                                                           | -  | 15   | 22.5 |    |

### Gate Charge Characteristics

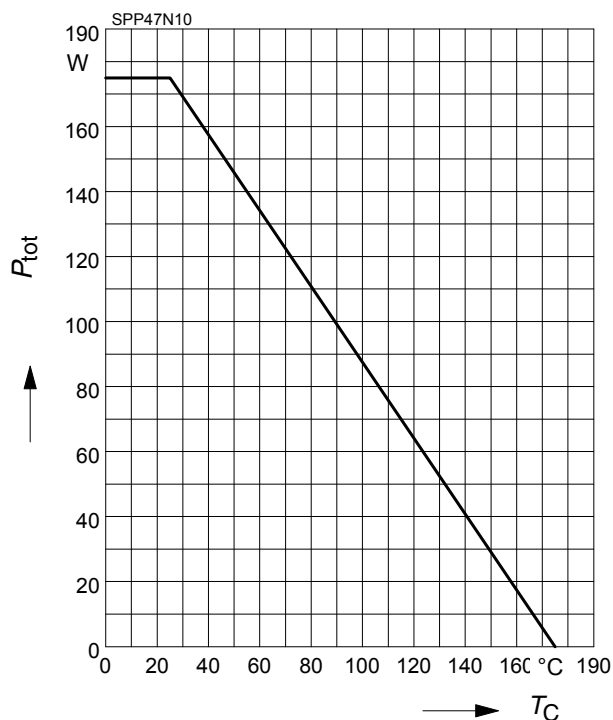
|                       |                 |                                                                                     |   |      |      |    |
|-----------------------|-----------------|-------------------------------------------------------------------------------------|---|------|------|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD} = 80\text{V}$ , $I_D = 47\text{A}$                                          | - | 19   | 28.5 | nC |
| Gate to drain charge  | $Q_{gd}$        |                                                                                     | - | 29   | 43.5 |    |
| Gate charge total     | $Q_g$           | $V_{DD} = 80\text{V}$ , $I_D = 47\text{A}$ ,<br>$V_{GS} = 0 \text{ to } 10\text{V}$ | - | 70   | 105  |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD} = 80\text{V}$ , $I_D = 47\text{A}$                                          | - | 6.03 | -    | V  |

### Reverse Diode

|                                          |          |                                                                           |   |     |     |    |
|------------------------------------------|----------|---------------------------------------------------------------------------|---|-----|-----|----|
| Inverse diode continuous forward current | $I_S$    | $T_C = 25^\circ\text{C}$                                                  | - | -   | 47  | A  |
| Inverse diode direct current, pulsed     | $I_{SM}$ |                                                                           | - | -   | 188 |    |
| Inverse diode forward voltage            | $V_{SD}$ | $V_{GS} = 0\text{V}$ , $I_F = 94\text{A}$                                 | - | 1.1 | 1.5 | V  |
| Reverse recovery time                    | $t_{rr}$ | $V_R = 50\text{V}$ , $I_F = I_S$ ,<br>$di_F/dt = 100\text{A}/\mu\text{s}$ | - | 100 | 150 | ns |
| Reverse recovery charge                  | $Q_{rr}$ |                                                                           | - | 400 | 600 | nC |

### 1 Power dissipation

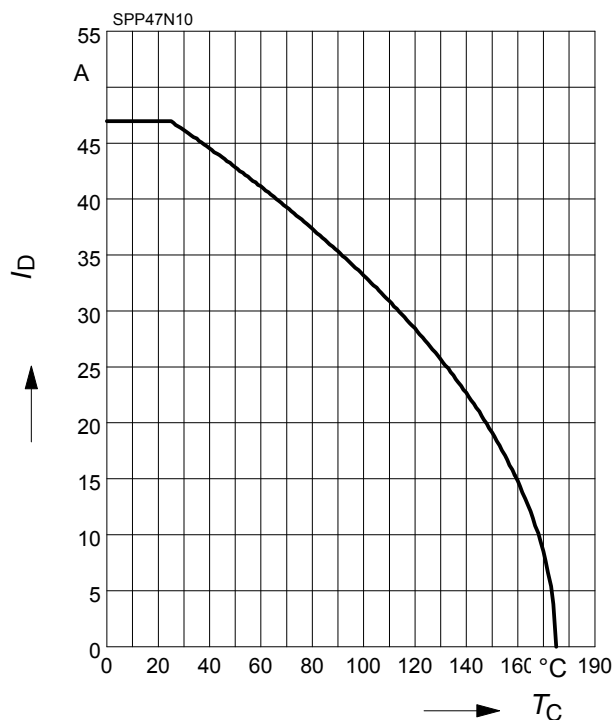
$$P_{\text{tot}} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

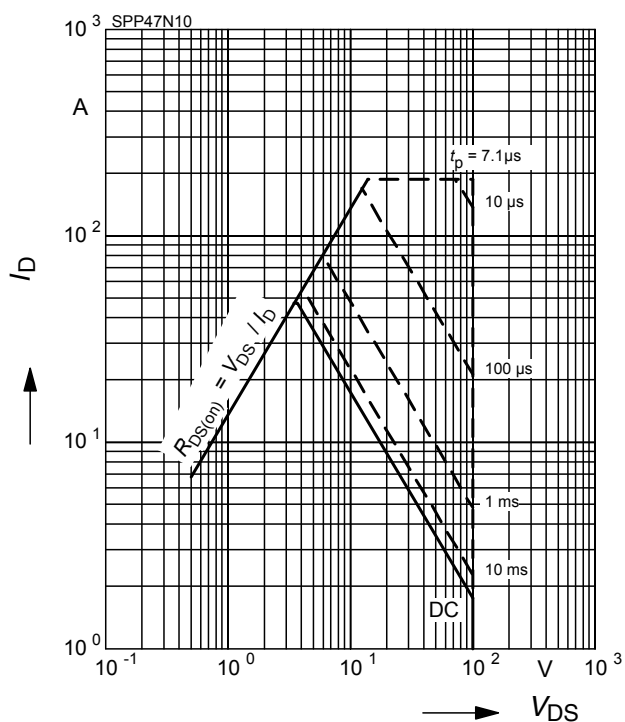
parameter:  $V_{GS} \geq 10$  V



### 3 Safe operating area

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

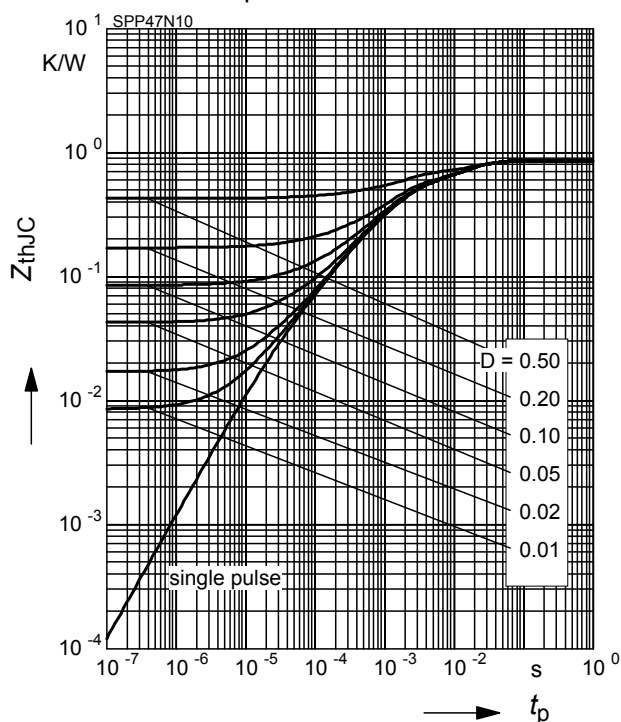
parameter:  $D = 0$ ,  $T_C = 25$  °C



### 4 Transient thermal impedance

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

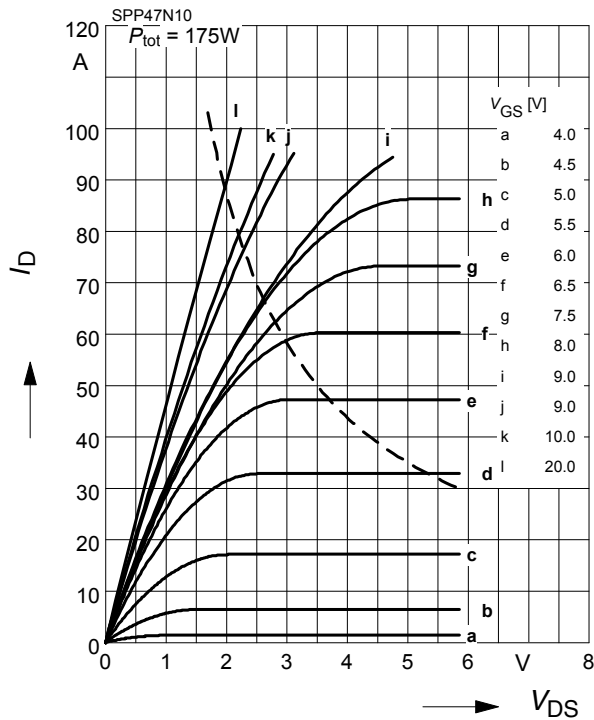
parameter:  $D = t_p / T$



### 5 Typ. output characteristic

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

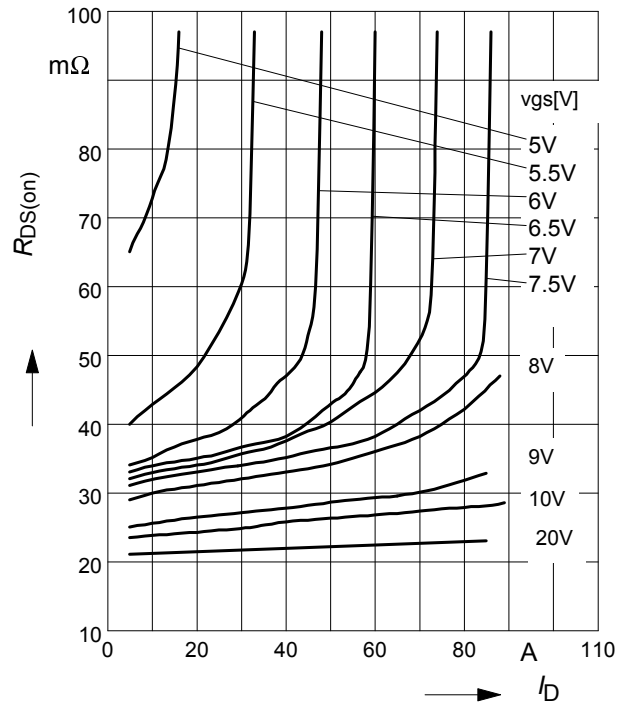
parameter:  $t_p = 80 \mu\text{s}$



### 6 Typ. drain-source on resistance

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

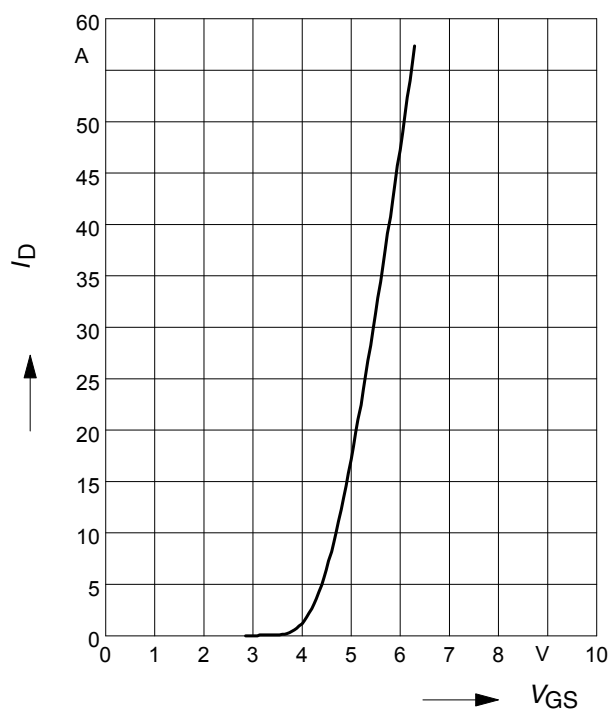
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

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

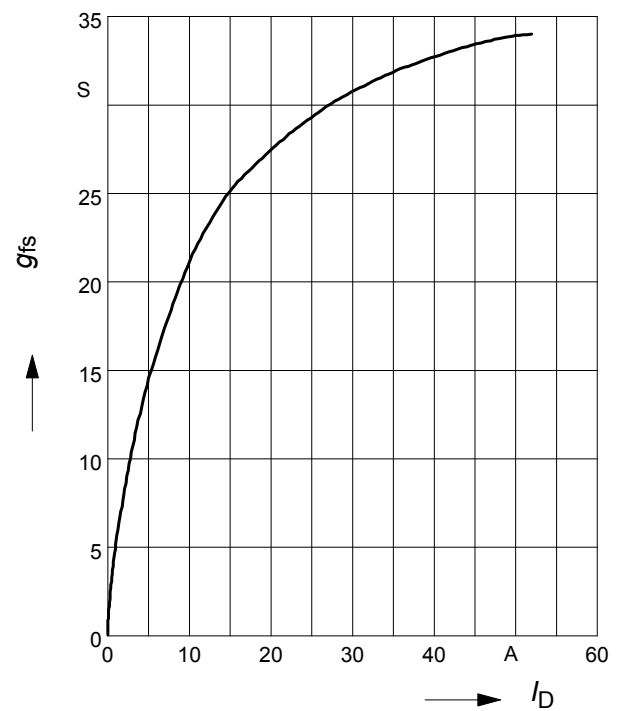
parameter:  $t_p = 80 \mu\text{s}$



### 8 Typ. forward transconductance

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

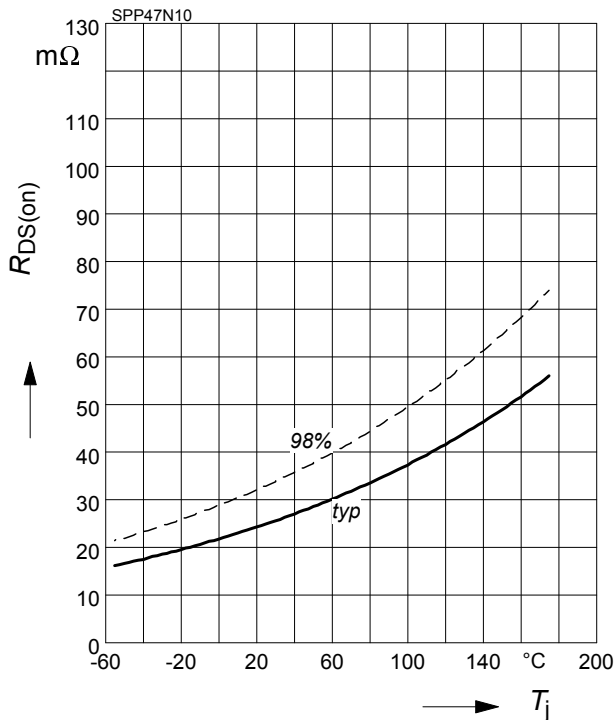
parameter:  $g_{fs}$



## 9 Drain-source on-state resistance

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

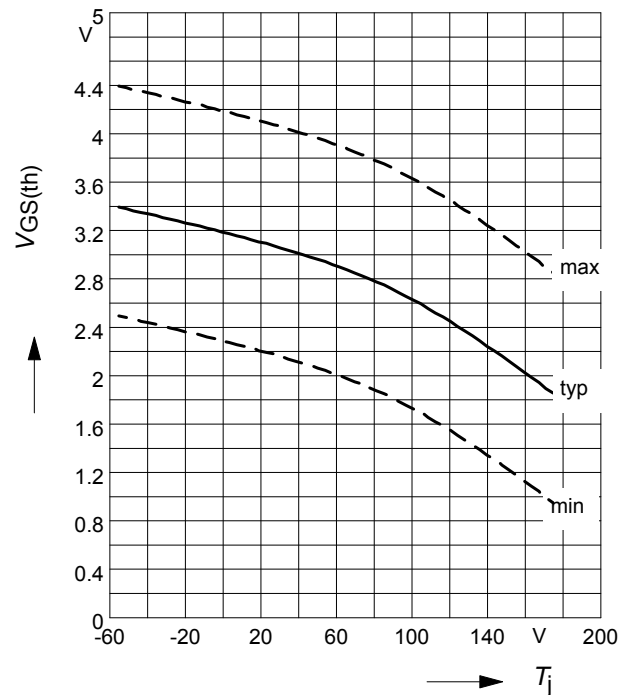
parameter:  $I_D = 33\text{ A}$ ,  $V_{GS} = 10\text{ V}$



## 10 Gate threshold voltage

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

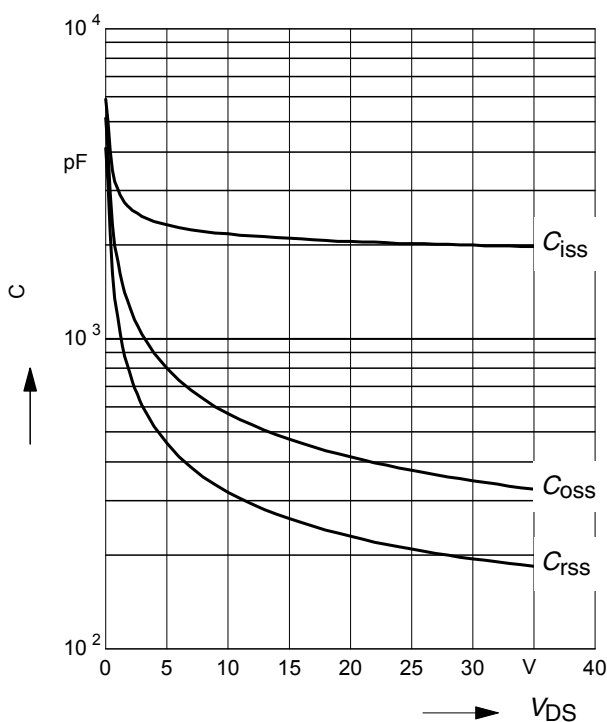
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 2\text{ mA}$



## 11 Typ. capacitances

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

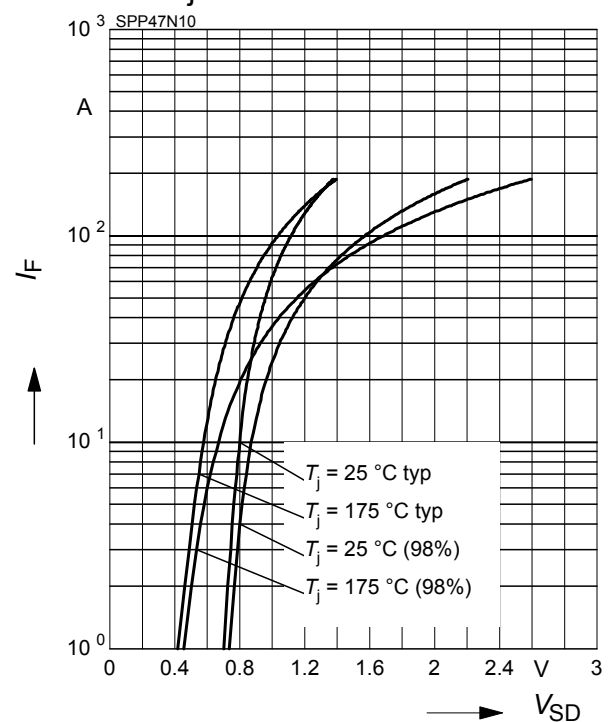
parameter:  $V_{GS} = 0\text{ V}$ ,  $f = 1\text{ MHz}$



## 12 Forward character. of reverse diode

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

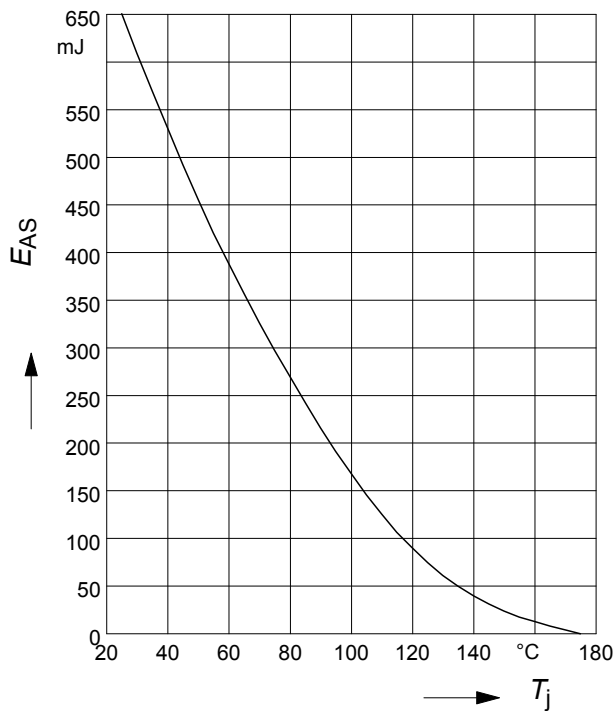
parameter:  $T_j$ ,  $t_p = 80\text{ μs}$



### 13 Typ. avalanche energy

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

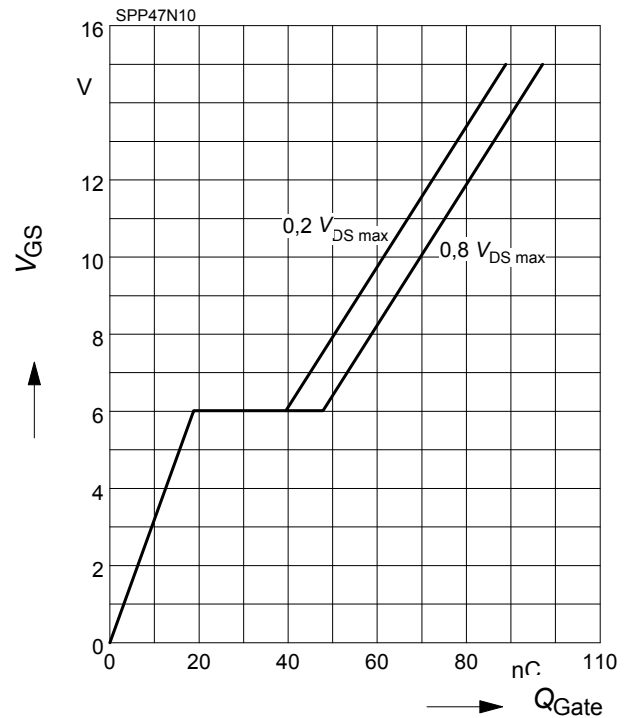
par.:  $I_D = 47\text{ A}$ ,  $V_{DD} = 25\text{ V}$ ,  $R_{GS} = 25\ \Omega$



### 14 Typ. gate charge

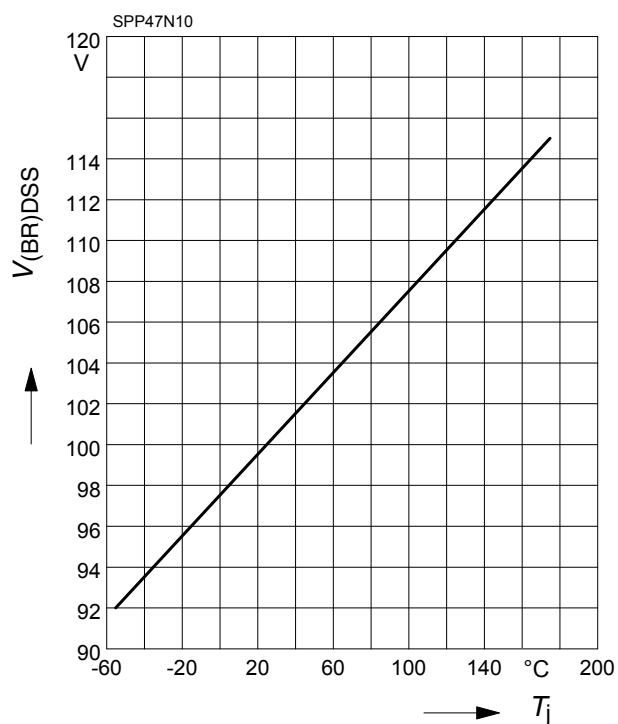
$$V_{GS} = f(Q_{Gate})$$

parameter:  $I_D = 47\text{ A}$  pulsed



### 15 Drain-source breakdown voltage

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



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**Further information**

Please notice that the part number is BSPP47N10, BSPB47N10 and BSPI47N10, for simplicity the device is referred to by the term SPP47N10, SPB47N10 and SPI47N10 throughout this documentation