



# THE DATASHEET OF SPI47N10



## SIPMOS® Power-Transistor

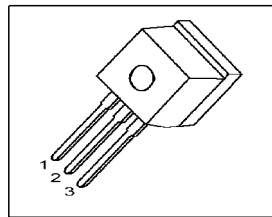
### Feature

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

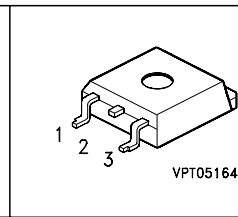
### Product Summary

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

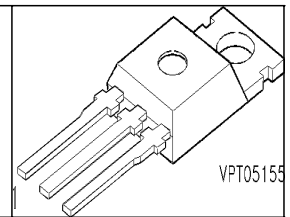
P-TO262-3-1



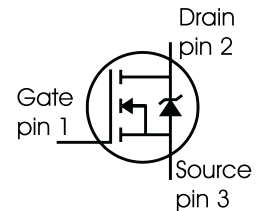
P-TO263-3-2



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 | Q67060-S7431  | 47N10   |



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

| Parameter   | Symbol             | Value       | Unit              |
|---|--------------------|-------------|-------------------|
| Continuous drain current  | $I_D$              | 47          | A                 |
| $T_C=25^\circ\text{C}$  |                    | 47          |                   |
| $T_C=100^\circ\text{C}$   |                    | 33          |                   |
| Pulsed drain current  | $I_D \text{ puls}$ | 188         |                   |
| $T_C=25^\circ\text{C}$  |                    |             |                   |
| Avalanche energy, single pulse  | $E_{AS}$           | 400         | mJ                |
| $I_D=47\text{ A}$ , $V_{DD}=25\text{V}$ , $R_{GS}=25\Omega$             |                    |             |                   |
| Avalanche energy, periodic limited by $T_{jmax}$                        | $E_{AR}$           | 17.5        |                   |
| Reverse diode dv/dt   | dv/dt              | 6           | kV/ $\mu\text{s}$ |
| $I_S=47\text{A}$ , $V_{DS}=0\text{V}$ , $di/dt=200\text{A}/\mu\text{s}$ |                    |             |                   |
| Gate source voltage   | $V_{GS}$           | $\pm 20$    | V                 |
| Power dissipation   | $P_{tot}$          | 175         | W                 |
| $T_C=25^\circ\text{C}$  |                    |             |                   |
| 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.     |      |
| <b>Characteristics</b>  |            |        |      |          |      |
| Thermal resistance, junction - case   | $R_{thJC}$ | -      | -    | 0.85     | 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>1)</sup> | $R_{thJA}$ | -      | -    | 62<br>40 |      |

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

| Parameter  | Symbol        | Values |      |          | Unit             |
|--|---------------|--------|------|----------|------------------|
|  |               | min.   | typ. | max.     |                  |
| <b>Static Characteristics</b>  |               |        |      |          |                  |
| Drain-source breakdown voltage<br>$V_{GS}=0V, I_D=2mA$   | $V_{(BR)DSS}$ | 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>$V_{DS}=100V, V_{GS}=0V, T_j=25^\circ\text{C}$<br>$V_{DS}=100V, V_{GS}=0V, T_j=150^\circ\text{C}$ | $I_{DSS}$     | -      | 0.1  | 1<br>100 | $\mu\text{A}$    |
| 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       | $\text{m}\Omega$ |

<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  $T_j = 25\text{ }^\circ\text{C}$ , 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>$I_D = 33A$       | 13 | 26   | -    | S  |
| Input capacitance            | $C_{iss}$    | $V_{GS} = 0V$ , $V_{DS} = 25V$ ,<br>$f = 1MHz$                       | -  | 2000 | 2500 | pF |
| Output capacitance           | $C_{oss}$    |  | -  | 370  | 465  |    |
| Reverse transfer capacitance | $C_{rss}$    |  | -  | 190  | 240  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD} = 50V$ , $V_{GS} = 10V$ ,<br>$I_D = 47A$ , $R_G = 4.7\Omega$ | -  | 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**

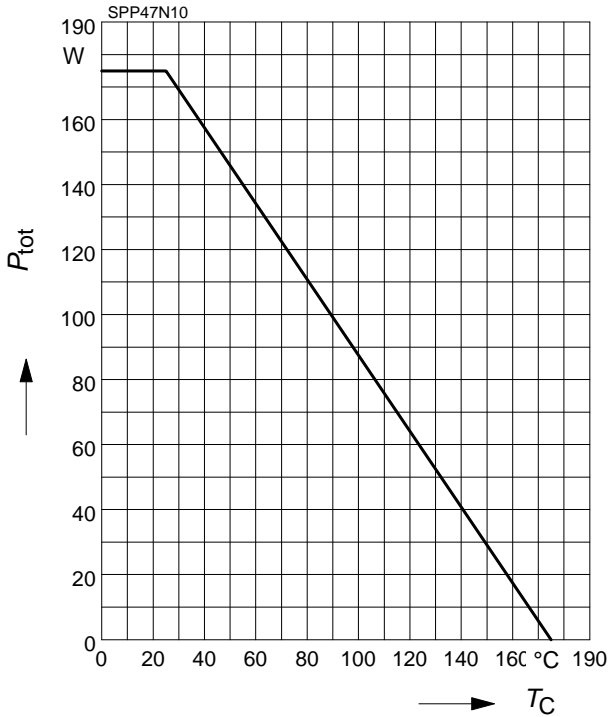
|                       |                 |   |   |      |      |    |
|-----------------------|-----------------|---|---|------|------|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD} = 80V$ , $I_D = 47A$                            | - | 19   | 28.5 | nC |
| Gate to drain charge  | $Q_{gd}$        |   | - | 29   | 43.5 |    |
| Gate charge total     | $Q_g$           | $V_{DD} = 80V$ , $I_D = 47A$ ,<br>$V_{GS} = 0$ to $10V$ | - | 70   | 105  |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD} = 80V$ , $I_D = 47A$                            | - | 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            | $V_{SD}$ | $V_{GS} = 0V$ , $I_F = 94A$                           | - | 1.1 | 1.5 | V  |
| Reverse recovery time                    | $t_{rr}$ | $V_R = 50V$ , $I_F = I_S$ ,<br>$di_F/dt = 100A/\mu s$ | - | 100 | 150 | ns |
| Reverse recovery charge                  | $Q_{rr}$ |   | - | 400 | 600 |    |

### 1 Power dissipation

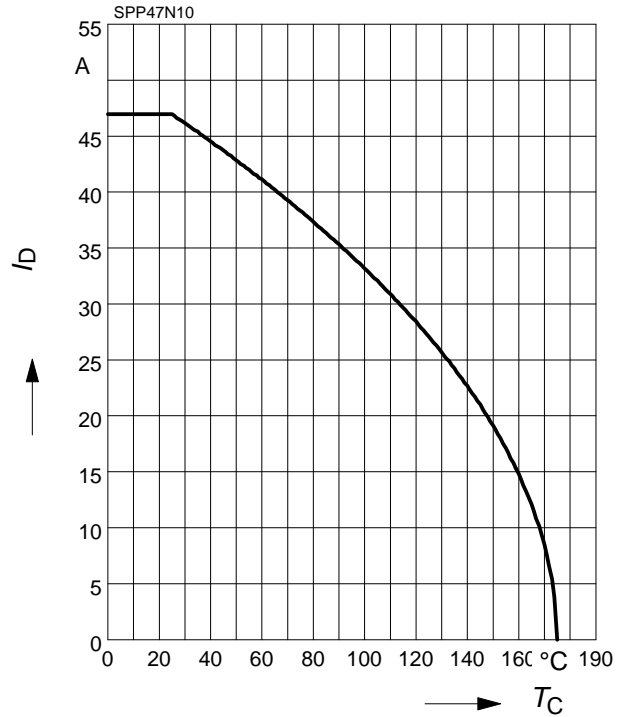
$$P_{tot} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

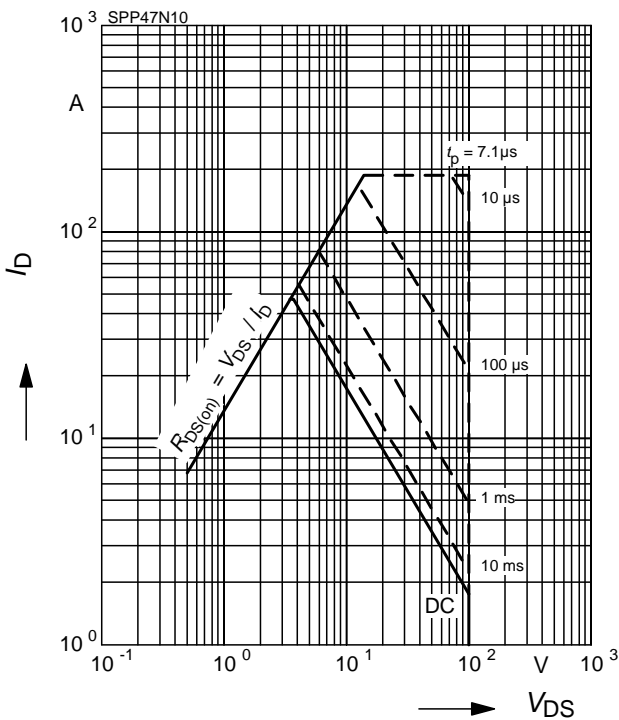
parameter:  $V_{GS} \geq 10\text{ V}$



### 3 Safe operating area

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

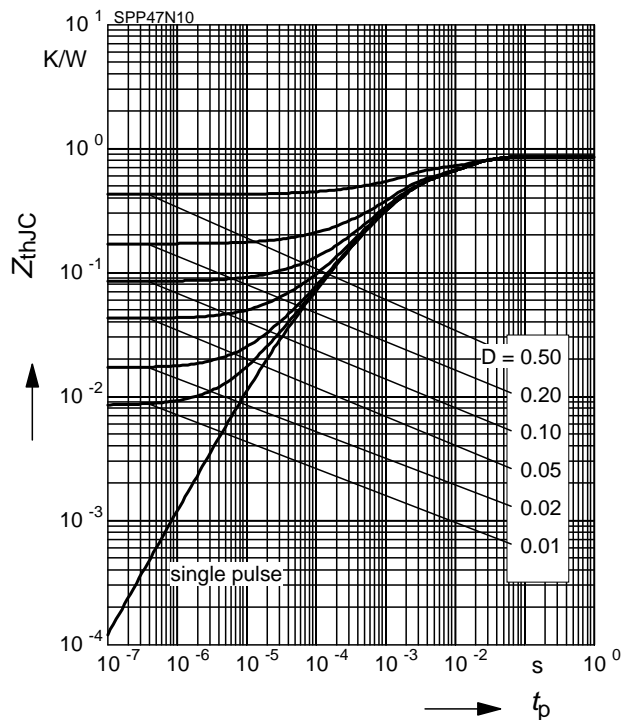
parameter:  $D = 0, T_C = 25\text{ °C}$



### 4 Transient thermal impedance

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

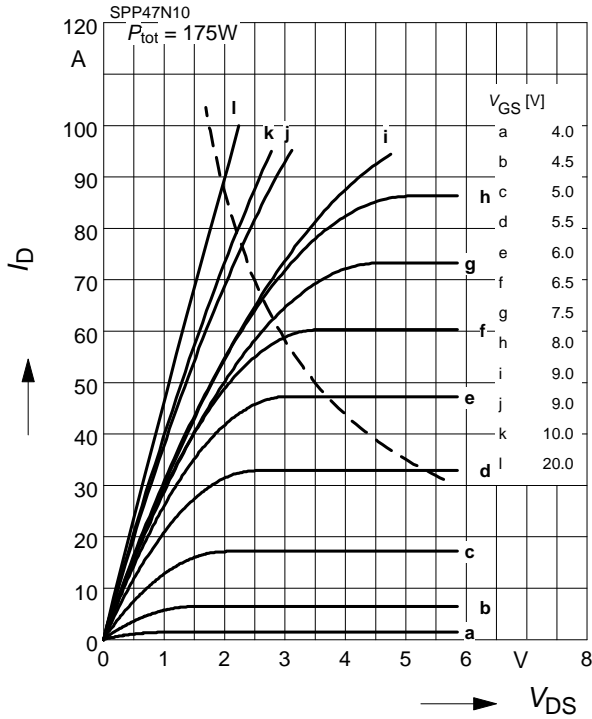
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

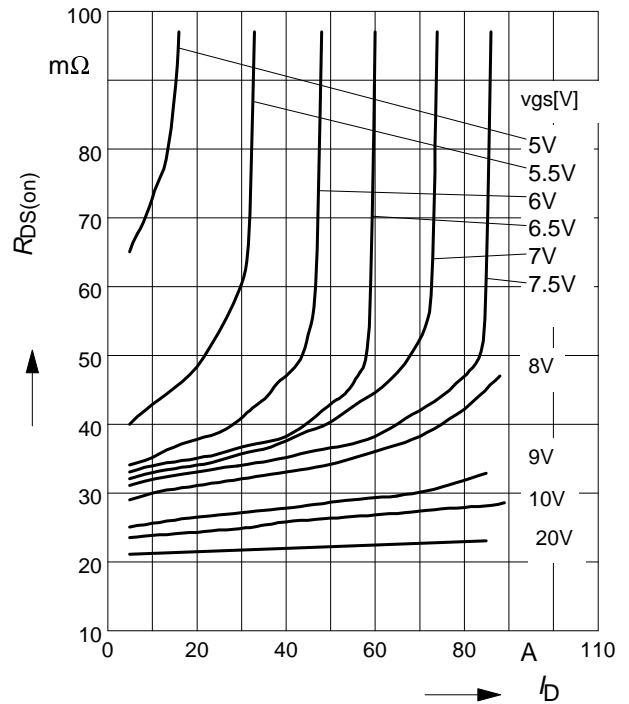
parameter:  $t_p = 80 \mu\text{s}$



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

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

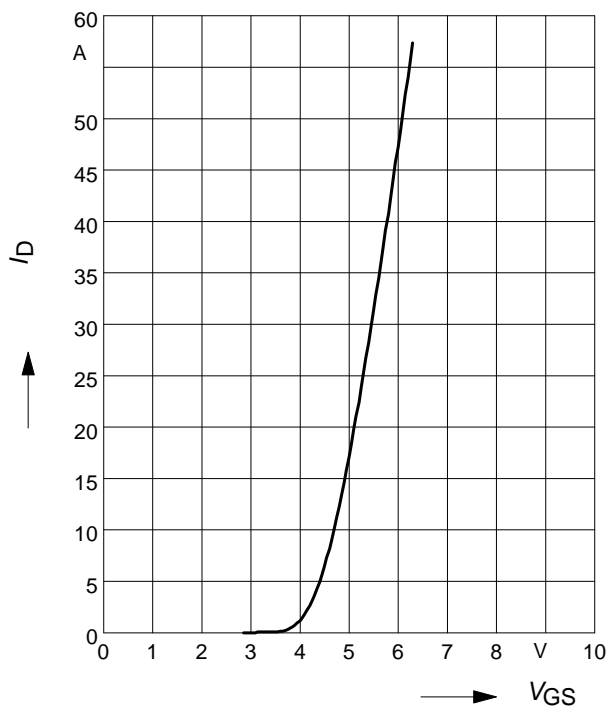
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

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

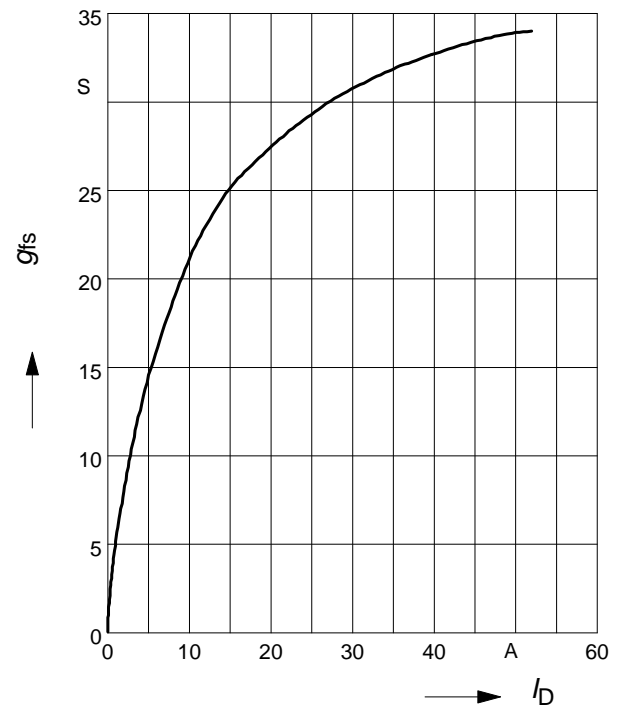
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

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

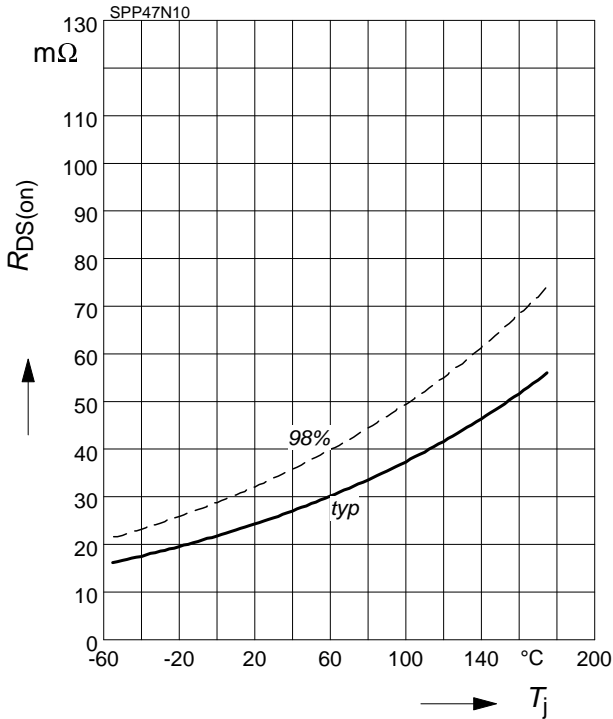
parameter:  $g_{fs}$



### 9 Drain-source on-state resistance

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

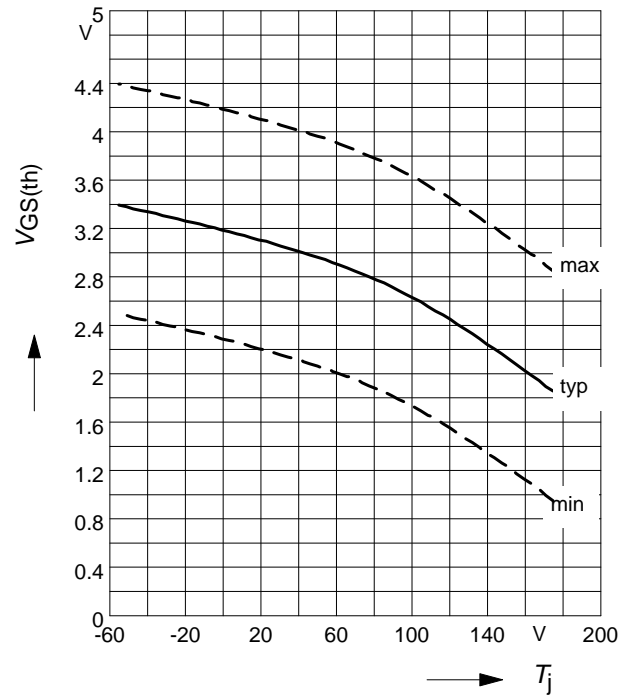
parameter:  $I_D = 33\text{ A}$ ,  $V_{GS} = 10\text{ V}$



### 10 Gate threshold voltage

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

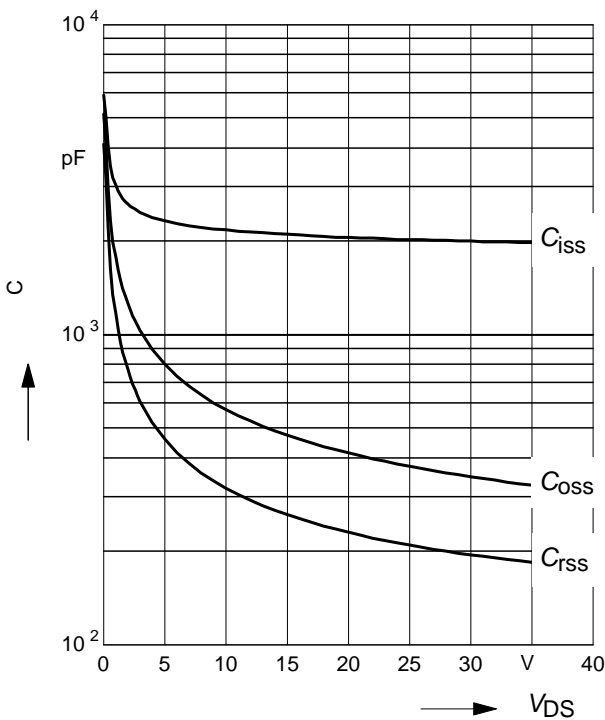
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 2\text{ mA}$



### 11 Typ. capacitances

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

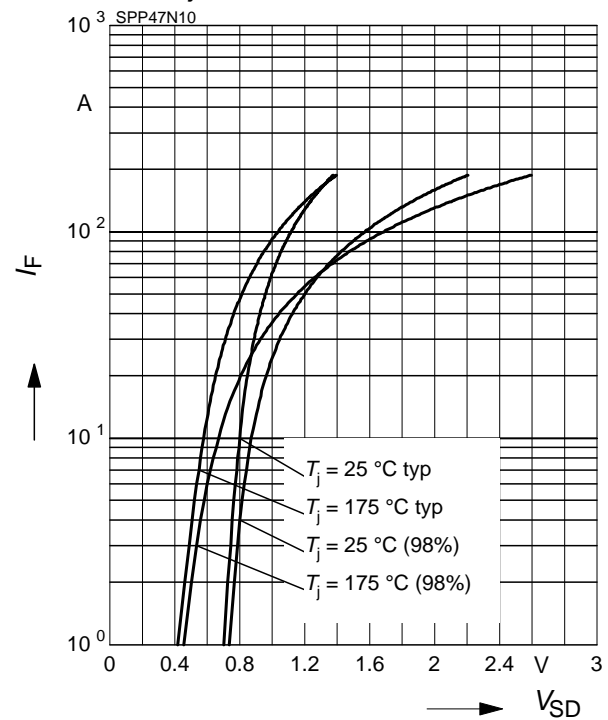
parameter:  $V_{GS} = 0\text{ V}$ ,  $f = 1\text{ MHz}$



### 12 Forward character. of reverse diode

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

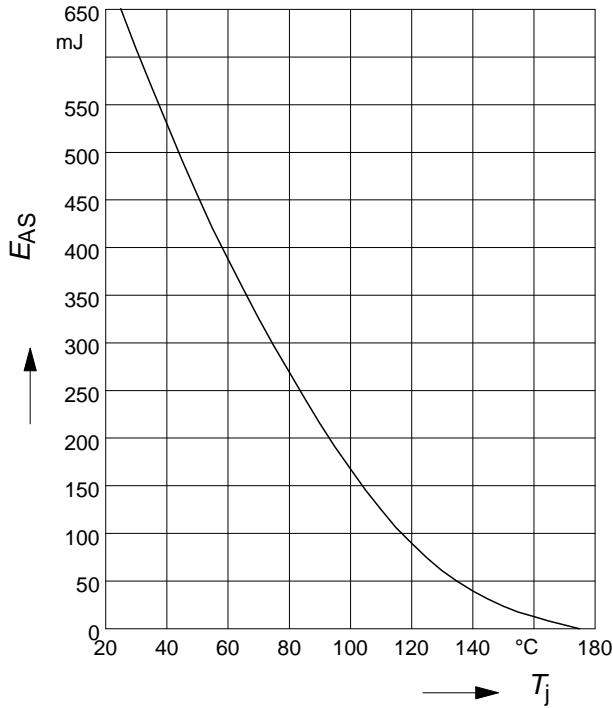
parameter:  $T_j$ ,  $t_p = 80\text{ }\mu\text{s}$



**13 Typ. avalanche energy**

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

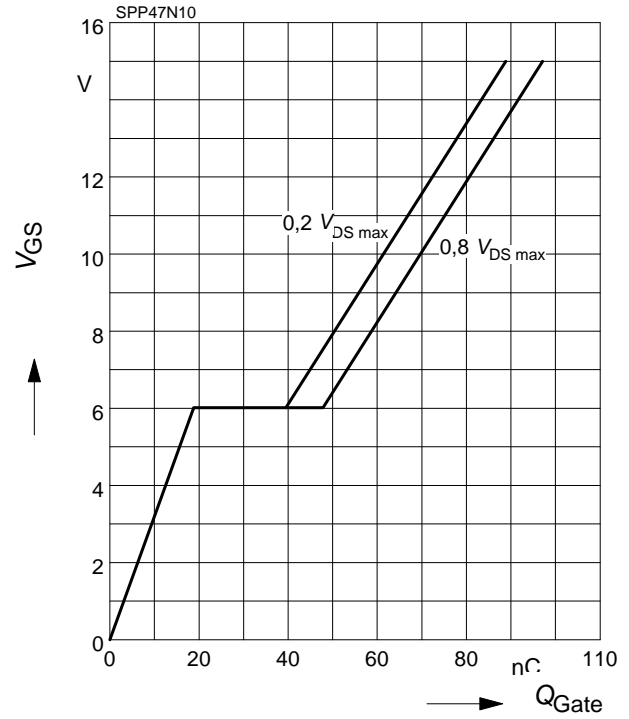
par.:  $I_D = 47\text{ A}$  ,  $V_{DD} = 25\text{ V}$ ,  $R_{GS} = 25\ \Omega$



**14 Typ. gate charge**

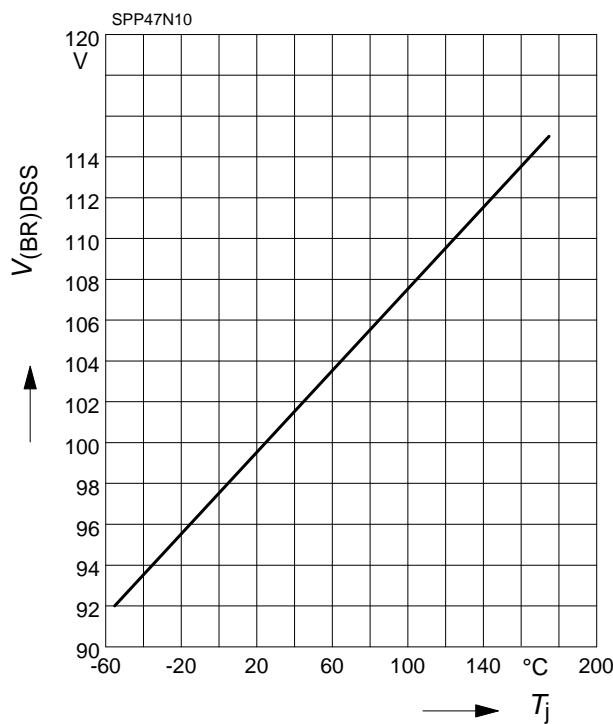
$$V_{GS} = f(Q_{Gate})$$

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

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