

## SIPMOS® Power-Transistor

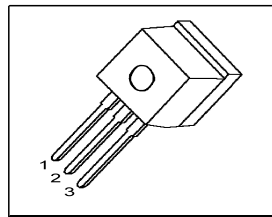
### Feature

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

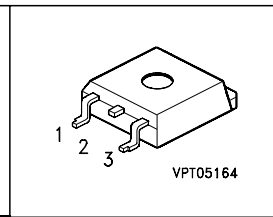
### Product Summary

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

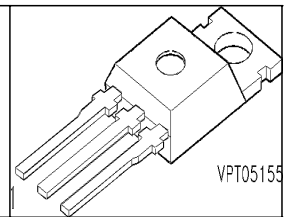
P-TO262-3-1



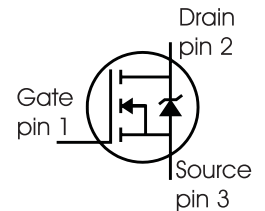
P-TO263-3-2



P-TO220-3-1



| Type         | Package      | Ordering Code | Marking |
|--------------|--------------|---------------|---------|
| IPP47N10S-33 | PG-TO220-3-1 | SP0002-25706  | N1033   |
| IPB47N10S-33 | PG-TO263-3-2 | SP0002-25702  | N1033   |
| IPI47N10S-33 | PG-TO262-3-1 | SP0002-25703  | N1033   |



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

| Parameter  | Symbol             | Value       | Unit              |
|--|--------------------|-------------|-------------------|
| Continuous drain current   | $I_D$              | 47          | 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                |
| $I_D=47\text{ A}$ , $V_{DD}=25\text{ V}$ , $R_{GS}=25\text{ }\Omega$       |                    |             |                   |
| 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                 |
| $T_C=25\text{ °C}$   |                    |             |                   |
| 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            | $R_{thJC}$ | -      | -    | 0.85 | 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. |               |
| <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    | $\mu\text{A}$ |
|  |               | -      | -    | 100  |               |
| Gate-source leakage current<br>$V_{GS}=20V, V_{DS}=0V$   | $I_{GSS}$     | -      | 10   | 100  | nA            |
| 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**

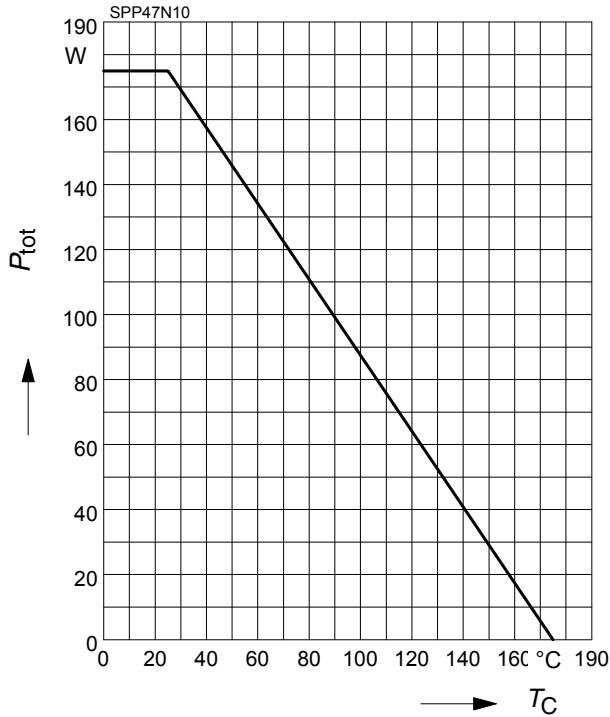
|                       |                 |  |   |      |      |    |
|-----------------------|-----------------|--|---|------|------|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD} = 80\text{V}$ , $I_D = 47\text{A}$                                   | - | 19   | 28.5 | nC |
| Gate to drain charge  | $Q_{gd}$        |  | - | 29   | 43.5 |    |
| Gate charge total     | $Q_g$           | $V_{DD} = 80\text{V}$ , $I_D = 47\text{A}$ ,<br>$V_{GS} = 0$ 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                    | $t_{rr}$ | $V_R = 50\text{V}$ , $f = 5$ ,<br>$di_F/dt = 100\text{A}/\mu\text{s}$ | - | 100 | 150 | ns |
| Reverse recovery charge                  | $Q_{rr}$ |   | - | 400 | 600 |    |

### 1 Power dissipation

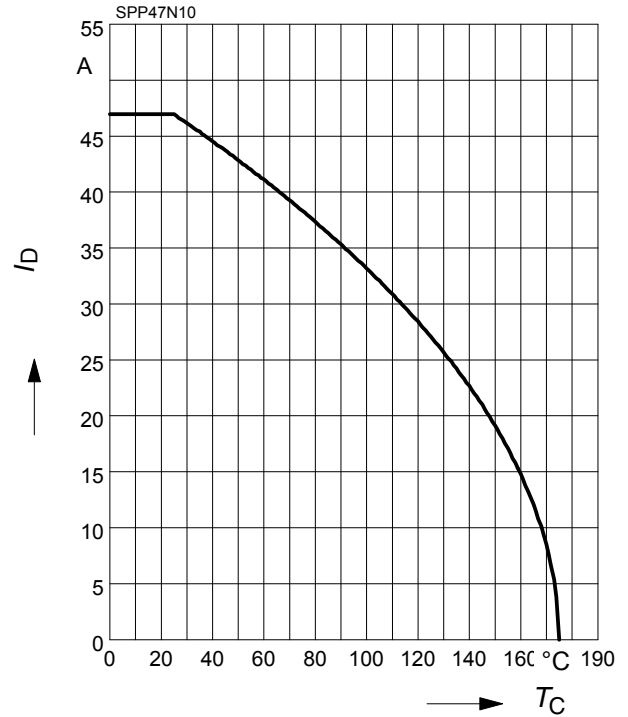
$$P_{\text{tot}} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

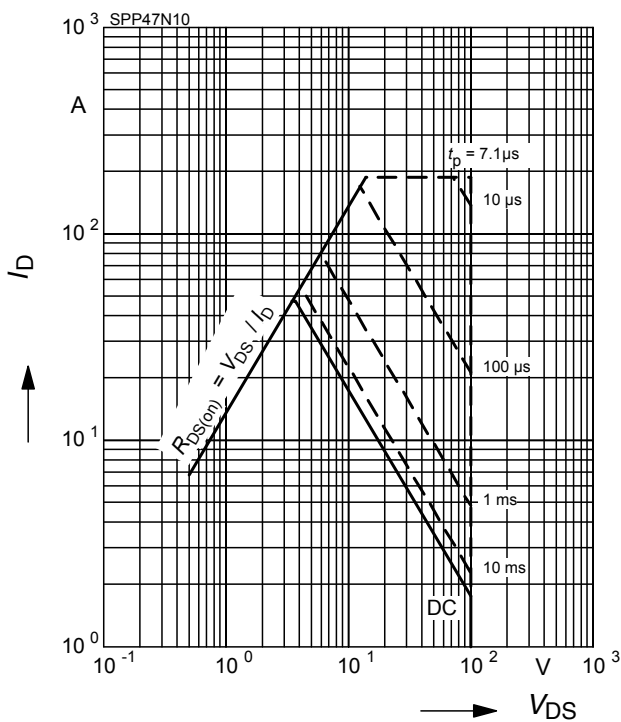
parameter:  $V_{GS} \geq 10 \text{ V}$



### 3 Safe operating area

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

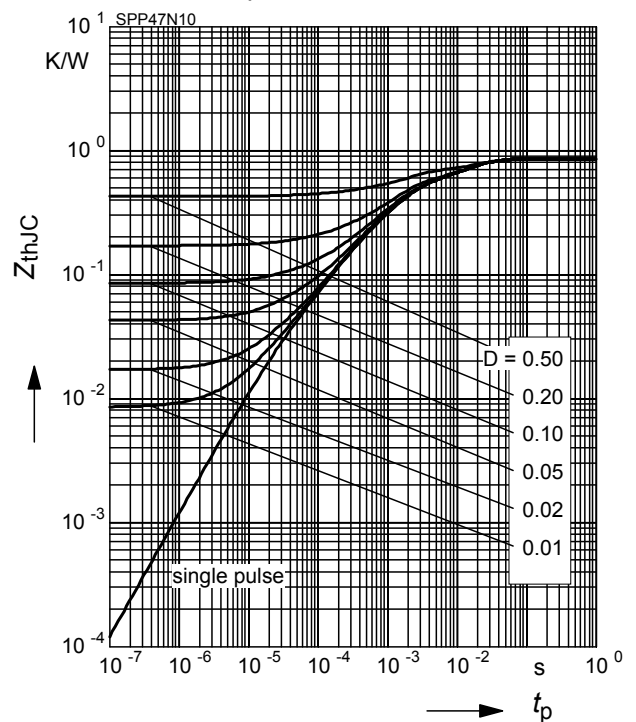
parameter:  $D = 0, T_C = 25^\circ\text{C}$



### 4 Transient thermal impedance

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

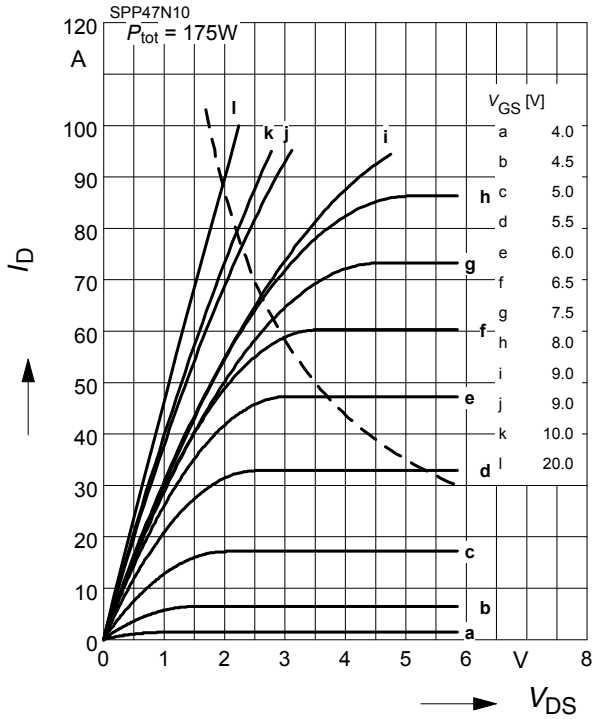
parameter:  $D = t_p/T$



### 5 Typ. output characteristic

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

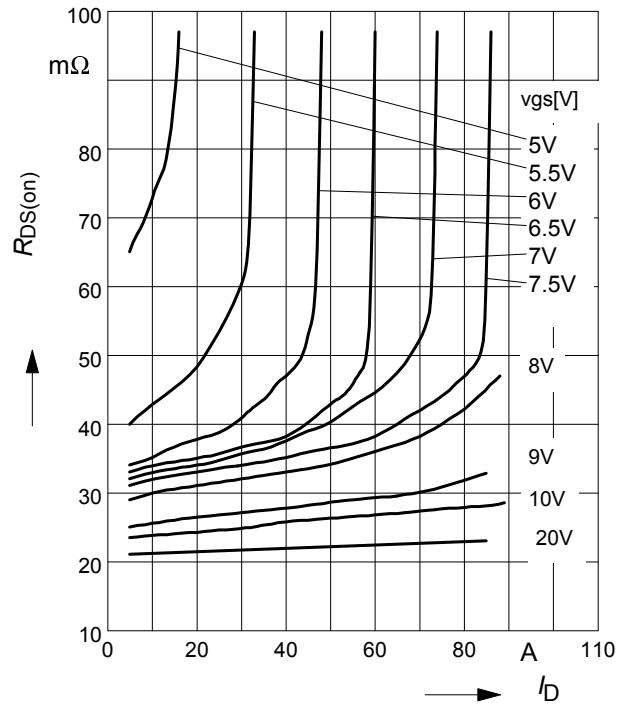
parameter:  $t_p = 80 \mu\text{s}$



### 6 Typ. drain-source on resistance

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

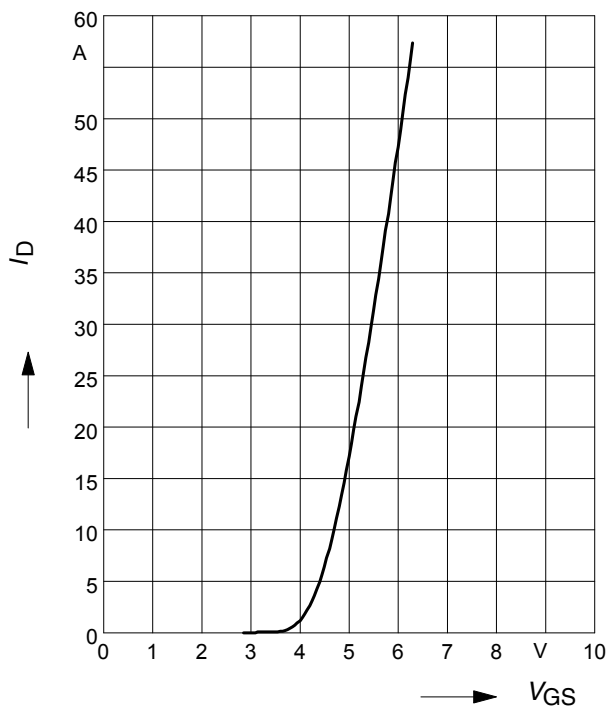
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

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

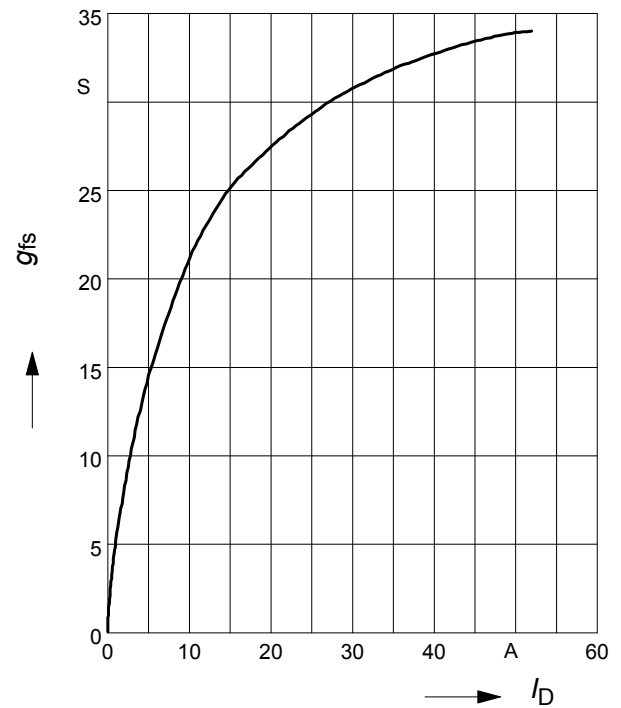
parameter:  $t_p = 80 \mu\text{s}$



### 8 Typ. forward transconductance

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

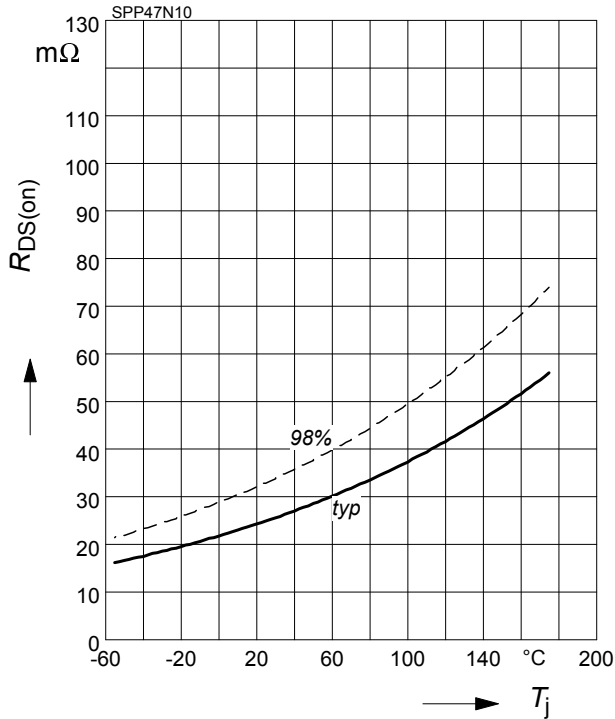
parameter:  $g_{fs}$



### 9 Drain-source on-state resistance

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

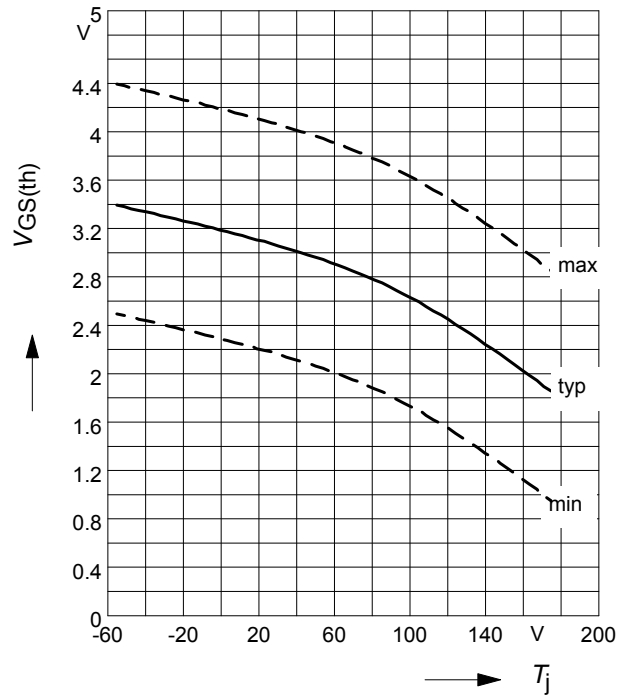
parameter:  $I_D = 33\text{ A}$ ,  $V_{GS} = 10\text{ V}$



### 10 Gate threshold voltage

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

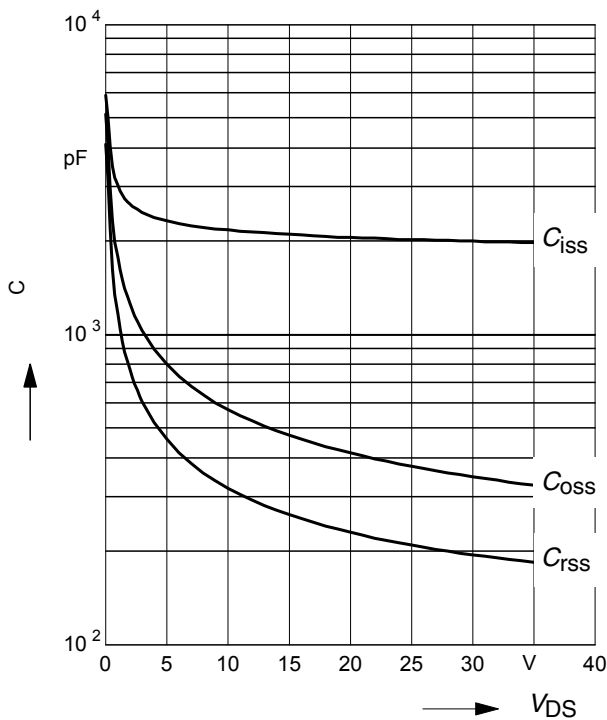
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 2\text{ mA}$



### 11 Typ. capacitances

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

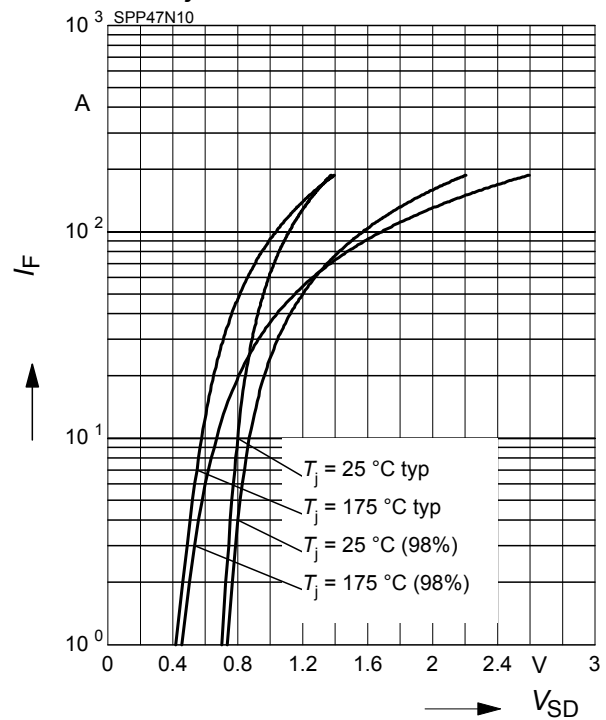
parameter:  $V_{GS} = 0\text{ V}$ ,  $f = 1\text{ MHz}$



### 12 Forward character. of reverse diode

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

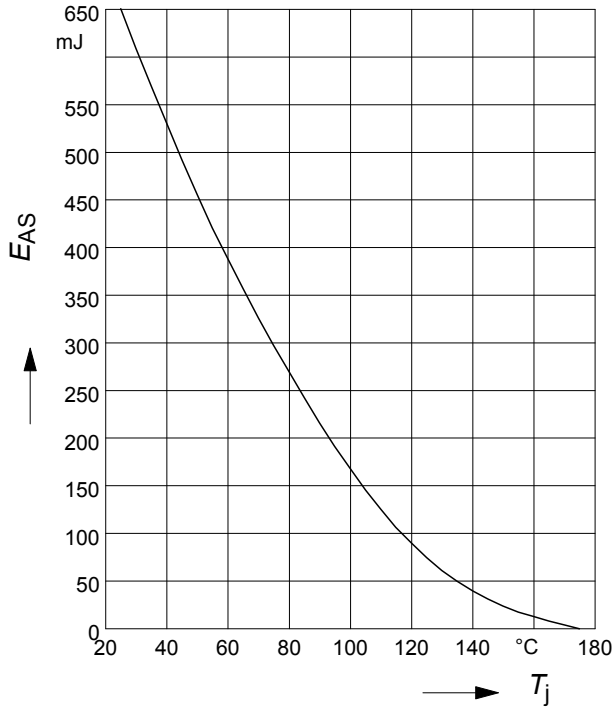
parameter:  $T_j$ ,  $t_p = 80\text{ }\mu\text{s}$



### 13 Typ. avalanche energy

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

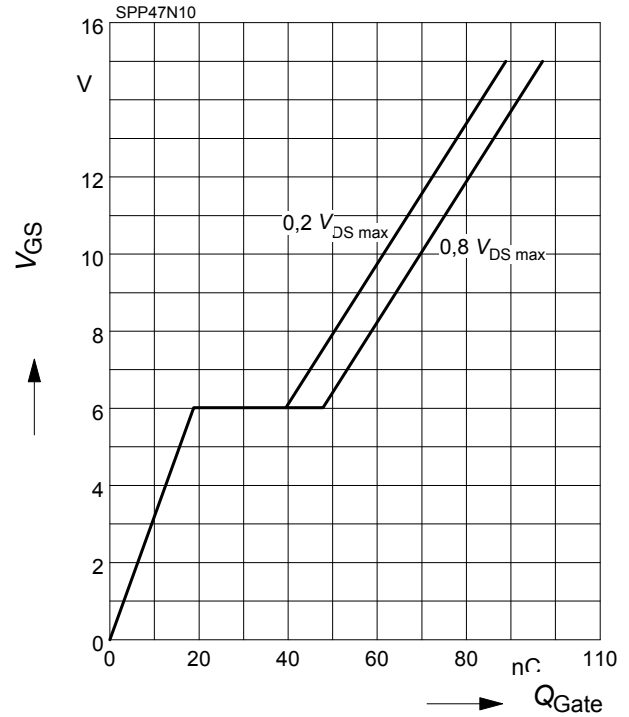
par.:  $I_D = 47\text{ A}$  ,  $V_{DD} = 25\text{ V}$  ,  $R_{GS} = 25\ \Omega$



### 14 Typ. gate charge

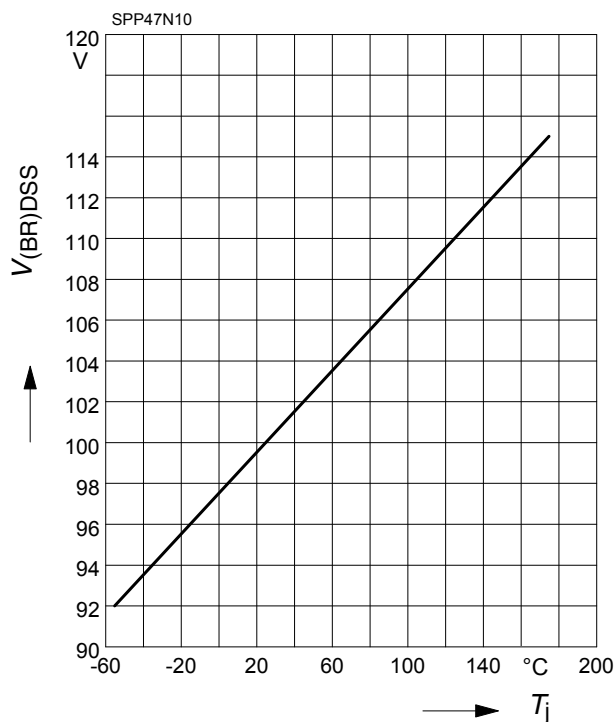
$$V_{GS} = f(Q_{Gate})$$

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



### 15 Drain-source breakdown voltage

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



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