

**SIPMOS® Power-Transistor**
**Feature**

- P-channel
- Enhancement mode
- Logic Level
- 175°C operating temperature
- Avalanche rated
- dv/dt rated
- Pb-free lead plating; RoHS compliant
- Qualified according to AEC Q101

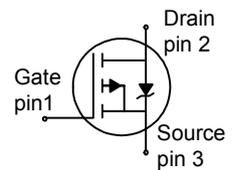
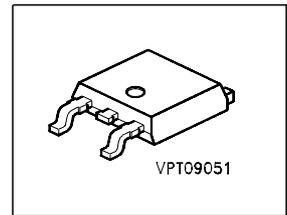


| Type         | Package    | Lead free |
|--------------|------------|-----------|
| SPD09P06PL G | PG-TO252-3 | Yes       |

**Product Summary**

|              |      |          |
|--------------|------|----------|
| $V_{DS}$     | -60  | V        |
| $R_{DS(on)}$ | 0.25 | $\Omega$ |
| $I_D$        | -9.7 | A        |

PG-TO252-3


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

| Parameter  | Symbol             | Value       | Unit              |
|--|--------------------|-------------|-------------------|
| Continuous drain current   | $I_D$              |             | A                 |
| $T_C=25\text{ }^\circ\text{C}$   |                    | -9.7        |                   |
| $T_C=100\text{ }^\circ\text{C}$  |                    | -6.8        |                   |
| Pulsed drain current   | $I_D \text{ puls}$ | -38.8       |                   |
| $T_C=25\text{ }^\circ\text{C}$   |                    |             |                   |
| Avalanche energy, single pulse   | $E_{AS}$           | 70          | mJ                |
| $I_D=-9.7\text{ A}$ , $V_{DD}=-25\text{ V}$ , $R_{GS}=25\text{ }\Omega$                                      |                    |             |                   |
| Avalanche energy, periodic limited by $T_{jmax}$   | $E_{AR}$           | 4.2         |                   |
| Reverse diode dv/dt  | dv/dt              | 6           | kV/ $\mu\text{s}$ |
| $I_S=-9.7\text{ A}$ , $V_{DS}=-48$ , $di/dt=200\text{ A}/\mu\text{s}$ , $T_{jmax}=175\text{ }^\circ\text{C}$ |                    |             |                   |
| Gate source voltage  | $V_{GS}$           | $\pm 20$    | V                 |
| Power dissipation  | $P_{tot}$          | 42          | W                 |
| $T_C=25\text{ }^\circ\text{C}$   |                    |             |                   |
| 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   | $R_{thJC}$ | -      | -    | 3.6      | K/W  |
| Thermal resistance, junction - ambient, leaded  | $R_{thJA}$ | -      | -    | 100      |      |
| SMD version, device on PCB:<br>@ min. footprint<br>@ 6 cm <sup>2</sup> cooling area <sup>1)</sup> | $R_{thJA}$ | -      | -    | 75<br>50 |      |

**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>$V_{GS}=0\text{V}$ , $I_D=-250\mu\text{A}$   | $V_{(BR)DSS}$ | -60    | -           | -          | V             |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D=-250\mu\text{A}$   | $V_{GS(th)}$  | -1     | -1.5        | -2         |               |
| Zero gate voltage drain current<br>$V_{DS}=-60\text{V}$ , $V_{GS}=0\text{V}$ , $T_j=25^\circ\text{C}$<br>$V_{DS}=-60\text{V}$ , $V_{GS}=0\text{V}$ , $T_j=150^\circ\text{C}$ | $I_{DSS}$     | -      | -0.1<br>-10 | -1<br>-100 | $\mu\text{A}$ |
| Gate-source leakage current<br>$V_{GS}=-20\text{V}$ , $V_{DS}=0\text{V}$   | $I_{GSS}$     | -      | -10         | -100       |               |
| Drain-source on-state resistance<br>$V_{GS}=-4.5\text{V}$ , $I_D=-5.4\text{A}$   | $R_{DS(on)}$  | -      | 0.3         | 0.4        | $\Omega$      |
| Drain-source on-state resistance<br>$V_{GS}=-10\text{V}$ , $I_D=-6.8\text{A}$  | $R_{DS(on)}$  | -      | 0.2         | 0.25       |               |

<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. |      |
| <b>Dynamic Characteristics</b> |              |   |        |      |      |      |
| Transconductance               | $g_{fs}$     | $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ ,<br>$I_D = -5.4$         | 1.8    | 3.5  | -    | S    |
| Input capacitance              | $C_{iss}$    | $V_{GS} = 0V$ , $V_{DS} = -25V$ ,<br>$f = 1MHz$                         | -      | 360  | 450  | pF   |
| Output capacitance             | $C_{oss}$    |   | -      | 103  | 130  |      |
| Reverse transfer capacitance   | $C_{rss}$    |   | -      | 40   | 50   |      |
| Turn-on delay time             | $t_{d(on)}$  | $V_{DD} = -30V$ , $V_{GS} = -4.5V$ ,<br>$I_D = -5.4$ , $R_G = 6\Omega$  | -      | 11   | 17   | ns   |
| Rise time                      | $t_r$        | $V_{DD} = -30V$ , $V_{GS} = -4.5V$ ,<br>$I_D = -5.4A$ , $R_G = 6\Omega$ | -      | 168  | 252  |      |
| Turn-off delay time            | $t_{d(off)}$ |   | -      | 49   | 74   |      |
| Fall time                      | $t_f$        |   | -      | 89   | 134  |      |

**Gate Charge Characteristics**

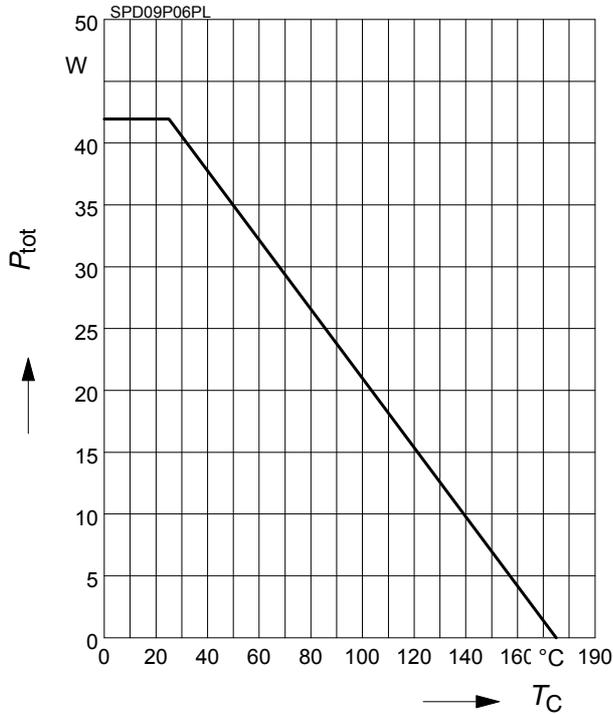
|                       |                 |   |   |      |     |    |
|-----------------------|-----------------|---|---|------|-----|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD} = -48V$ , $I_D = -9.7A$                             | - | 1.3  | 2   | nC |
| Gate to drain charge  | $Q_{gd}$        |   | - | 5.1  | 7.5 |    |
| Gate charge total     | $Q_g$           | $V_{DD} = -48V$ , $I_D = -9.7A$ ,<br>$V_{GS} = 0$ to $-10V$ | - | 14   | 21  |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD} = -48V$ , $I_D = -9.7A$                             | - | -4.1 | -   | V  |

**Reverse Diode**

|  |          |                               |   |      |       |    |
|--|----------|-------------------------------|---|------|-------|----|
| Inverse diode continuous forward current | $I_S$    | $T_C = 25^\circ\text{C}$      | - | -    | -9.7  | A  |
| Inverse diode direct current, pulsed     | $I_{SM}$ |                               | - | -    | -38.8 |    |
| Inverse diode forward voltage            | $V_{SD}$ | $V_{GS} = 0V$ , $I_F = -9.7A$ | - | -1.1 | -1.4  | V  |
| Reverse recovery time                    | $t_{rr}$ | $V_R = -30V$ , $I_F = I_S$    | - | 52   | 76    | ns |
| Reverse recovery charge                  | $Q_{rr}$ | $di_F/dt = 100A/\mu s$        | - | 64   | 96    |    |

### 1 Power dissipation

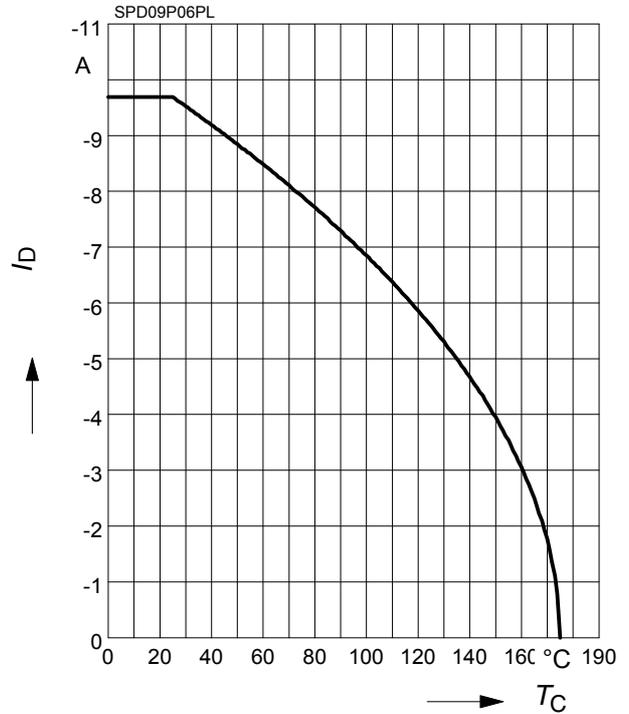
$$P_{tot} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

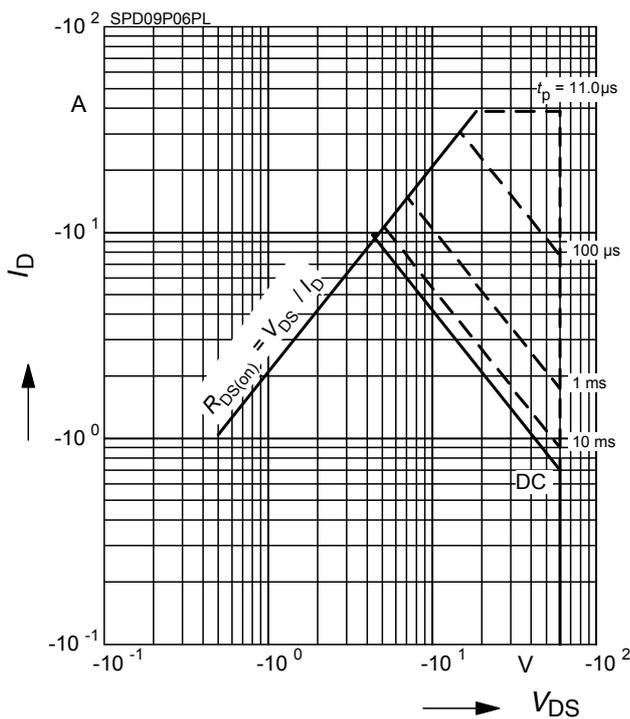
parameter:  $V_{GS} \geq 10 \text{ V}$



### 3 Safe operating area

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

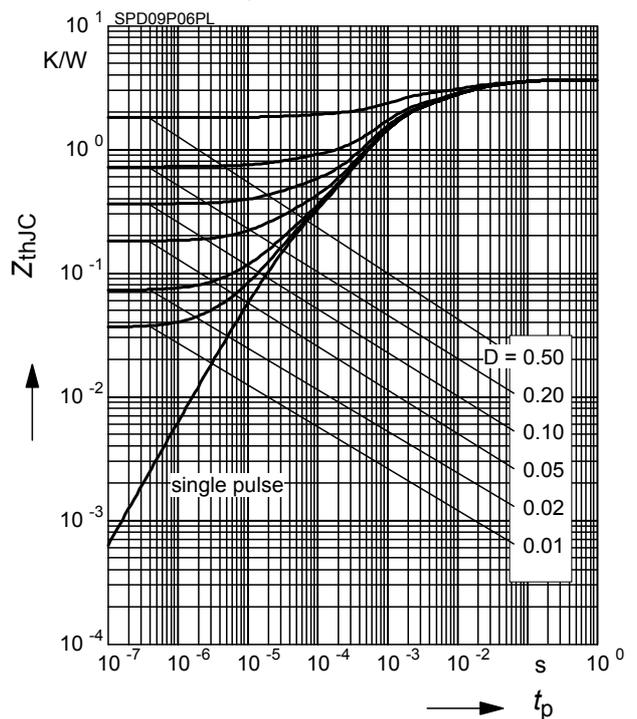
parameter:  $D = 0$ ,  $T_C = 25 \text{ °C}$



### 4 Transient thermal impedance

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

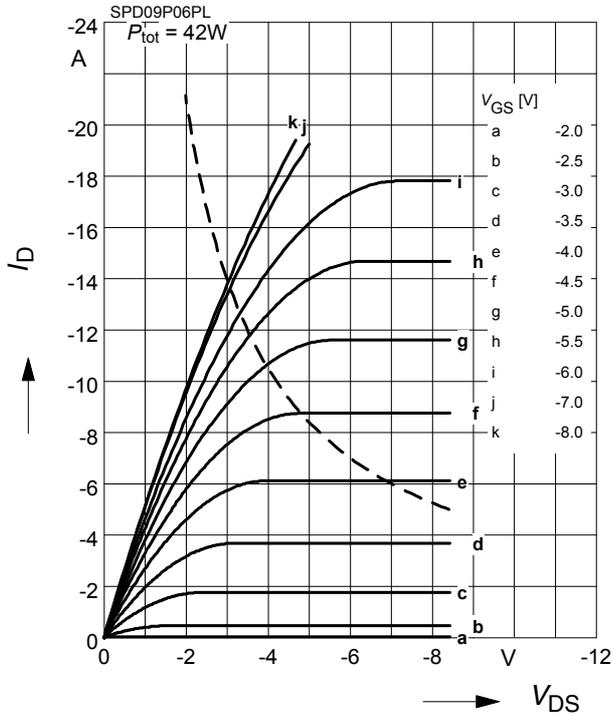
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

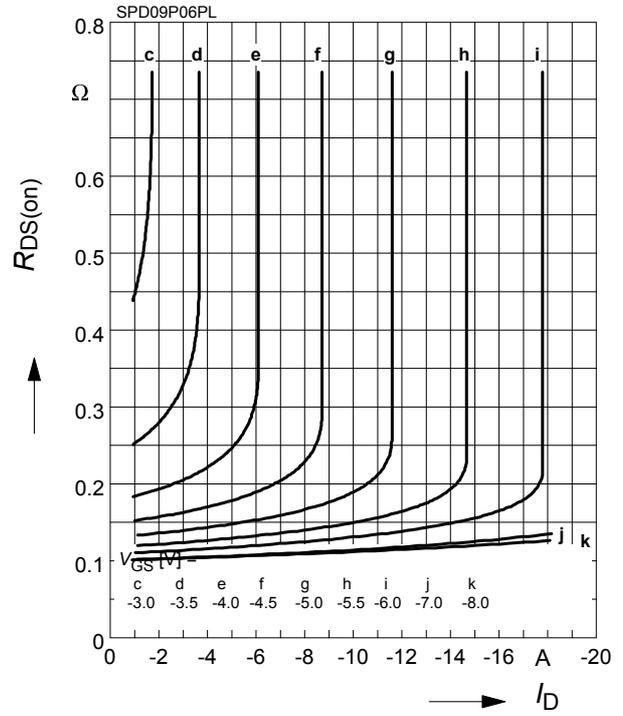
parameter:  $t_p = 80 \mu\text{s}$



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

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

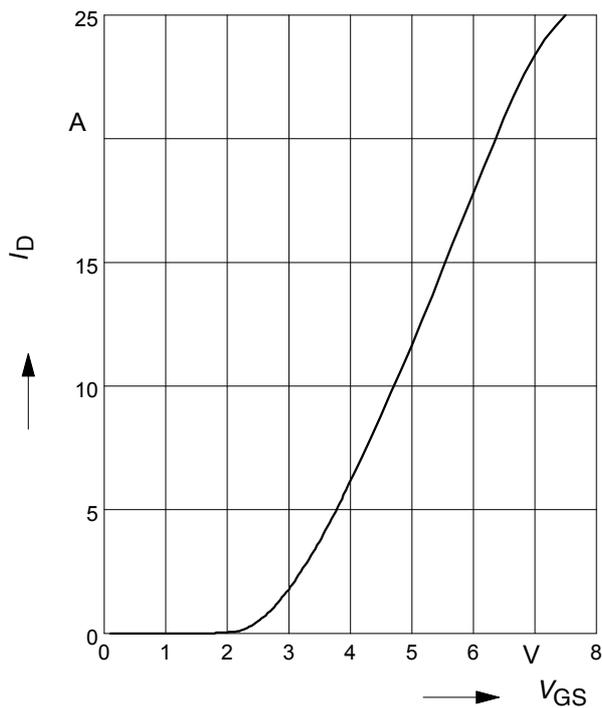
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

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

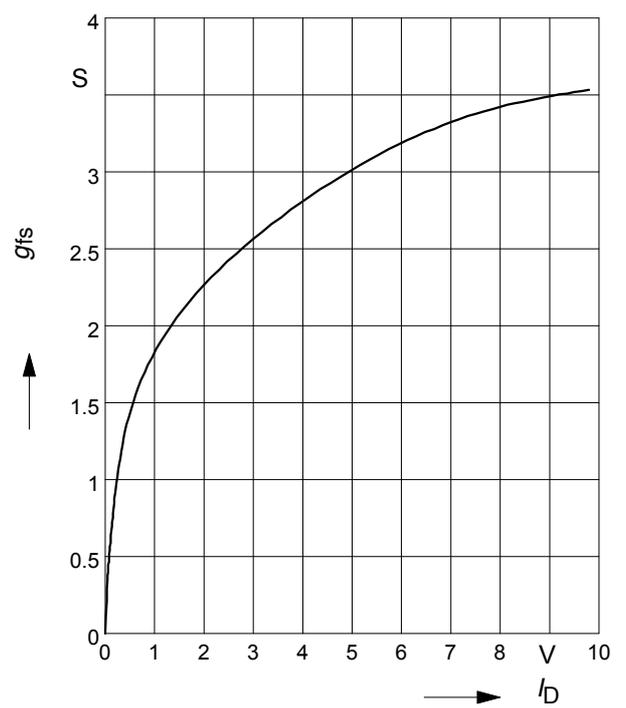
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

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

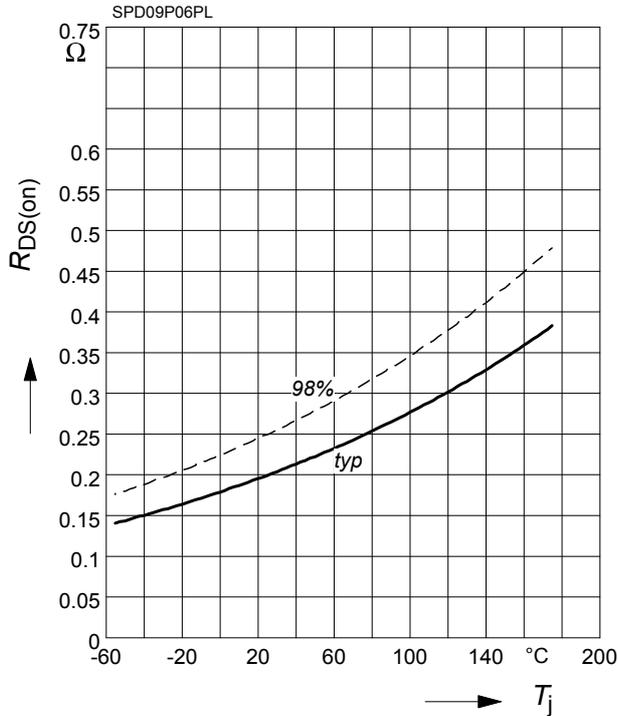
parameter:  $g_{fs}$



**9 Drain-source on-state resistance**

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

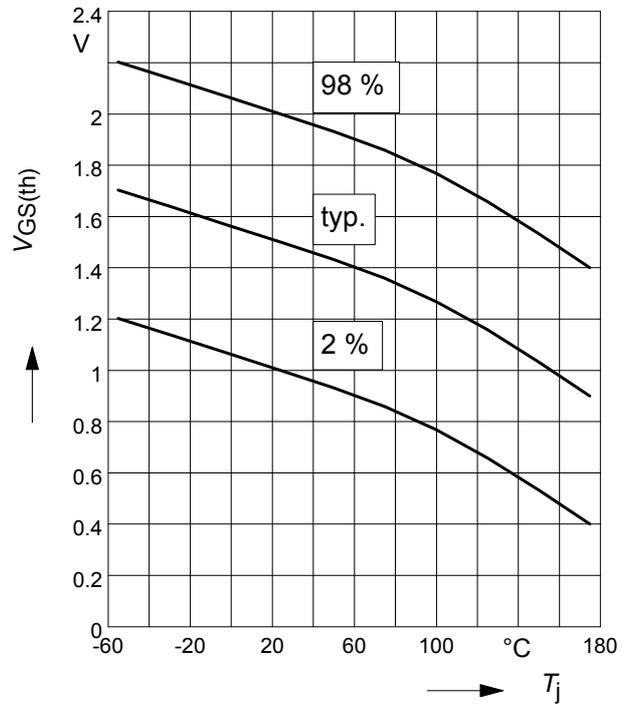
parameter :  $I_D = -6.8 \text{ A}$ ,  $V_{GS} = -10 \text{ V}$



**10 Gate threshold voltage**

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

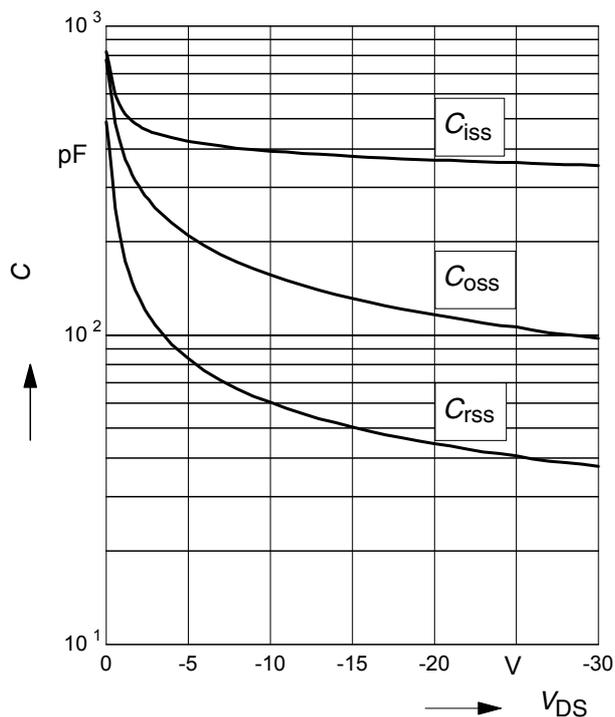
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = -250 \mu\text{A}$



**11 Typ. capacitances**

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

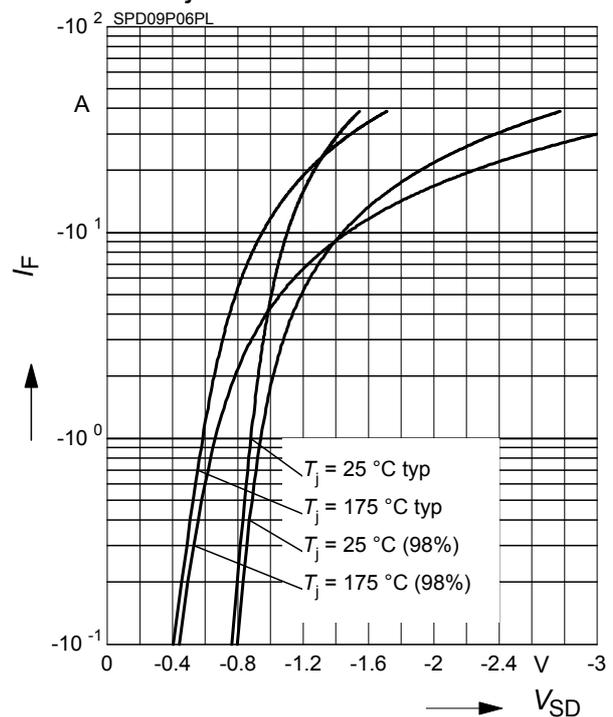
parameter:  $V_{GS}=0\text{V}$ ,  $f=1 \text{ MHz}$



**12 Forward character. of reverse diode**

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

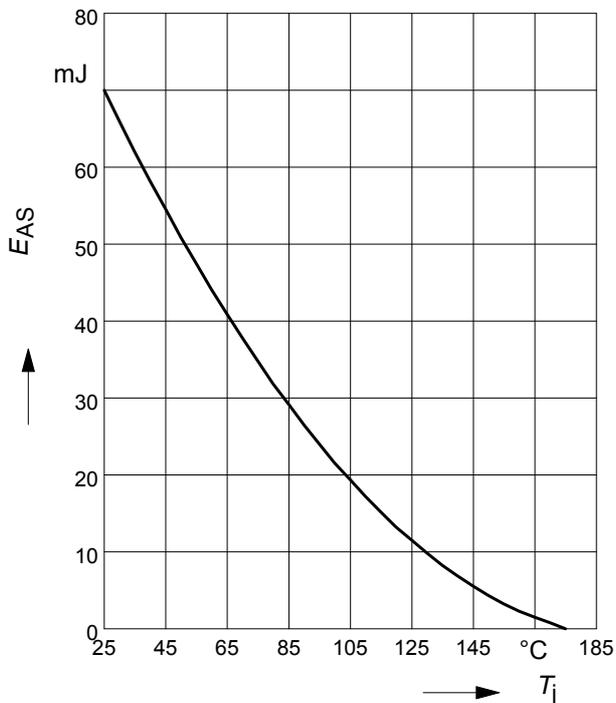
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



**13 Typ. avalanche energy**

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

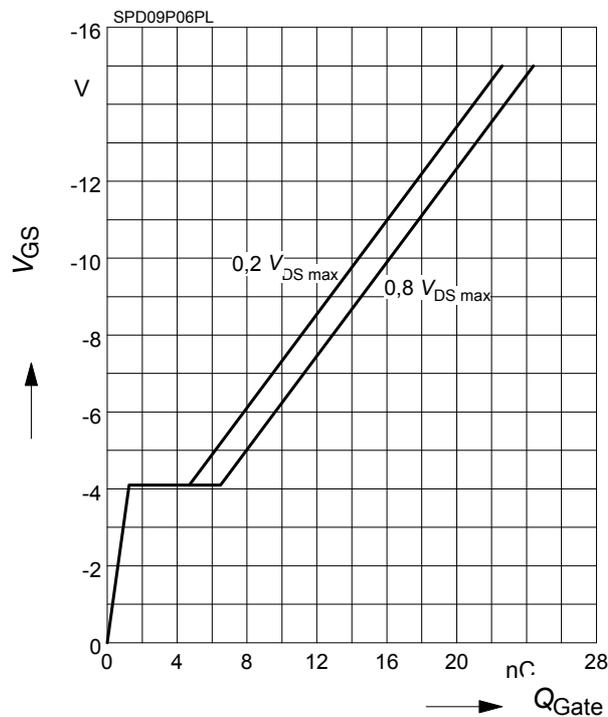
par.:  $I_D = -9.7 \text{ A}$  ,  $V_{DD} = -25 \text{ V}$  ,  $R_{GS} = 25 \Omega$



**14 Typ. gate charge**

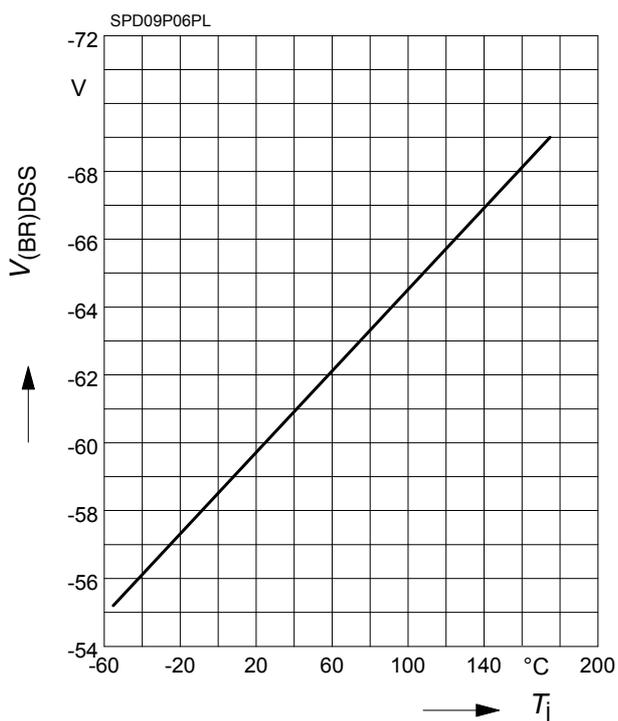
$$V_{GS} = f(Q_{Gate})$$

parameter:  $I_D = -9.7 \text{ A}$  pulsed

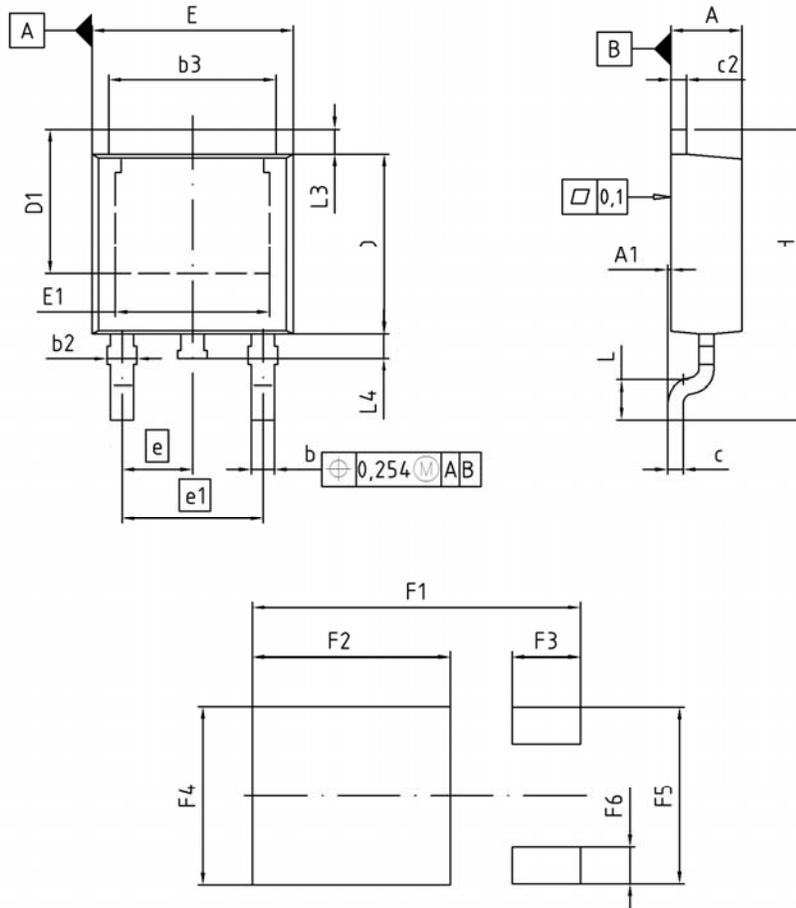


**15 Drain-source breakdown voltage**

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



Package outline: PG-TO252-3



| DIM | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN         | MAX   | MIN    | MAX   |
| A   | 2.16        | 2.41  | 0.085  | 0.095 |
| A1  | 0.00        | 0.15  | 0.000  | 0.006 |
| b   | 0.64        | 0.89  | 0.025  | 0.035 |
| b2  | 0.65        | 1.15  | 0.026  | 0.045 |
| b3  | 5.00        | 5.50  | 0.197  | 0.217 |
| c   | 0.46        | 0.60  | 0.018  | 0.024 |
| c2  | 0.46        | 0.98  | 0.018  | 0.039 |
| D   | 5.97        | 6.22  | 0.235  | 0.245 |
| D1  | 5.02        | 5.84  | 0.198  | 0.230 |
| E   | 6.40        | 6.73  | 0.252  | 0.265 |
| E1  | 4.70        | 5.21  | 0.185  | 0.205 |
| e   | 2.29        |       | 0.090  |       |
| e1  | 4.57        |       | 0.180  |       |
| N   | 3           |       | 3      |       |
| H   | 9.40        | 10.48 | 0.370  | 0.413 |
| L   | 1.18        | 1.70  | 0.046  | 0.067 |
| L3  | 0.90        | 1.25  | 0.035  | 0.049 |
| L4  | 0.51        | 1.00  | 0.020  | 0.039 |
| F1  | 10.50       | 10.70 | 0.413  | 0.421 |
| F2  | 6.30        | 6.50  | 0.248  | 0.256 |
| F3  | 2.10        | 2.30  | 0.083  | 0.091 |
| F4  | 5.70        | 5.90  | 0.224  | 0.232 |
| F5  | 5.66        | 5.86  | 0.223  | 0.231 |
| F6  | 1.10        | 1.30  | 0.043  | 0.051 |

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