

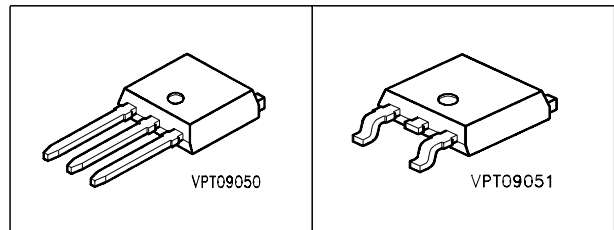
## SIPMOS® Power-Transistor

### Features

- P-Channel
- Enhancement mode
- Avalanche rated
- Logic Level
- dv/dt rated
- 175°C operating temperature

### Product Summary

Drain source voltage	$V_{DS}$	-60	V
Drain-source on-state resistance	$R_{DS(on)}$	0.25	$\Omega$
Continuous drain current	$I_D$	-9.7	A



Type	Package	Ordering Code
SPD09P06PL	P-TO252	Q67042-S4007
SPU09P06PL	P-TO251-3-1	Q67042-S4020

Pin 1	PIN 2/4	PIN 3
G	D	S

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

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

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Static Characteristics</b>					
Drain- source breakdown voltage $V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	$V_{(BR)DSS}$	-60	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = -250\text{ }\mu\text{A}$	$V_{GS(th)}$	-1	-1.5	-2	
Zero gate voltage drain current $V_{DS} = -60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ °C}$ $V_{DS} = -60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ °C}$	$I_{DSS}$	-	-0.1	-1	$\mu\text{A}$
Gate-source leakage current $V_{GS} = -20\text{ V}$ , $V_{DS} = 0\text{ V}$	$I_{GSS}$	-	-10	-100	
Drain-source on-state resistance $V_{GS} = -4.5\text{ V}$ , $I_D = -5.4\text{ A}$	$R_{DS(on)}$	-	0.3	0.4	$\Omega$
Drain-source on-state resistance $V_{GS} = -10\text{ V}$ , $I_D = -6.8\text{ A}$	$R_{DS(on)}$	-	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	Values			Unit
		min.	typ.	max.	
<b>Dynamic Characteristics</b>					
Transconductance $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = -5.4$	$g_{fs}$	1.8	3.5	-	S
Input capacitance $V_{GS} = 0\text{ V}$ , $V_{DS} = -25\text{ V}$ , $f = 1\text{ MHz}$	$C_{iss}$	-	360	450	pF
Output capacitance $V_{GS} = 0\text{ V}$ , $V_{DS} = -25\text{ V}$ , $f = 1\text{ MHz}$	$C_{oss}$	-	103	130	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$ , $V_{DS} = -25\text{ V}$ , $f = 1\text{ MHz}$	$C_{rss}$	-	40	50	
Turn-on delay time $V_{DD} = -30\text{ V}$ , $V_{GS} = -4.5\text{ V}$ , $I_D = -5.4$ , $R_G = 6\ \Omega$	$t_{d(on)}$	-	11	17	ns
Rise time $V_{DD} = -30\text{ V}$ , $V_{GS} = -4.5\text{ V}$ , $I_D = -5.4\text{ A}$ , $R_G = 6\ \Omega$	$t_r$	-	11	16	
Turn-off delay time $V_{DD} = -30\text{ V}$ , $V_{GS} = -4.5\text{ V}$ , $I_D = -5.4\text{ A}$ , $R_G = 6\ \Omega$	$t_{d(off)}$	-	124	186	
Fall time $V_{DD} = -30\text{ V}$ , $V_{GS} = -4.5\text{ V}$ , $I_D = -5.4\text{ A}$ , $R_G = 6\ \Omega$	$t_f$	-	59	89	

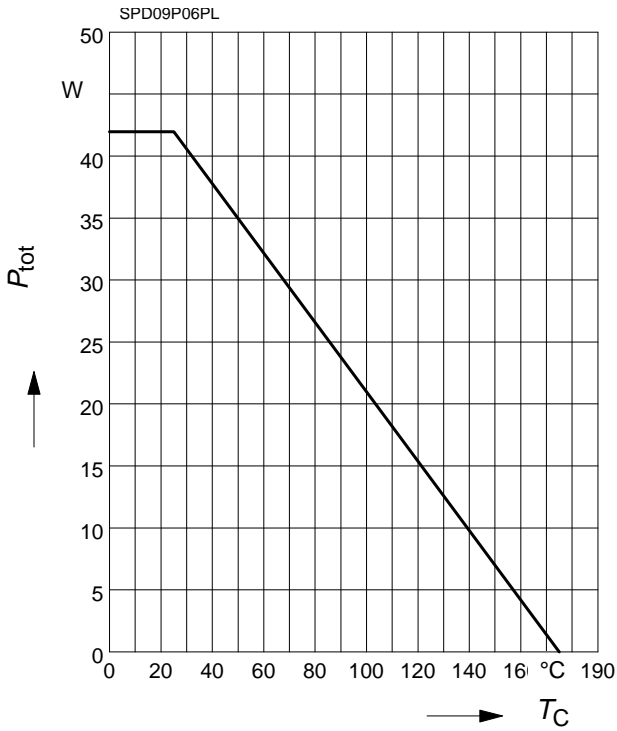
**Electrical Characteristics, at  $T_j = 25\text{ °C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Dynamic Characteristics</b>					
Gate to source charge $V_{DD} = -48\text{ V}, I_D = -9.7\text{ A}$	$Q_{gs}$	-	2.7	4	nC
Gate to drain charge $V_{DD} = -48\text{ V}, I_D = -9.7\text{ A}$	$Q_{gd}$	-	3.7	5.6	
Gate charge total $V_{DD} = -48\text{ V}, I_D = -9.7\text{ A}, V_{GS} = 0\text{ to }-10\text{ V}$	$Q_g$	-	14	21	
Gate plateau voltage $V_{DD} = -48\text{ V}, I_D = -9.7\text{ A}$	$V_{(plateau)}$	-	-3.5	-	V

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Reverse Diode</b>					
Inverse diode continuous forward current $T_C = 25\text{ °C}$	$I_S$	-	-	-9.7	A
Inverse diode direct current, pulsed $T_C = 25\text{ °C}$	$I_{SM}$	-	-	-38.8	
Inverse diode forward voltage $V_{GS} = 0\text{ V}, I_F = -9.7$	$V_{SD}$	-	-1.1	-1.4	V
Reverse recovery time $V_R = -30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$	$t_{rr}$	-	83	125	ns
Reverse recovery charge $V_R = -30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$	$Q_{rr}$	-	153	230	nC

**Power dissipation**

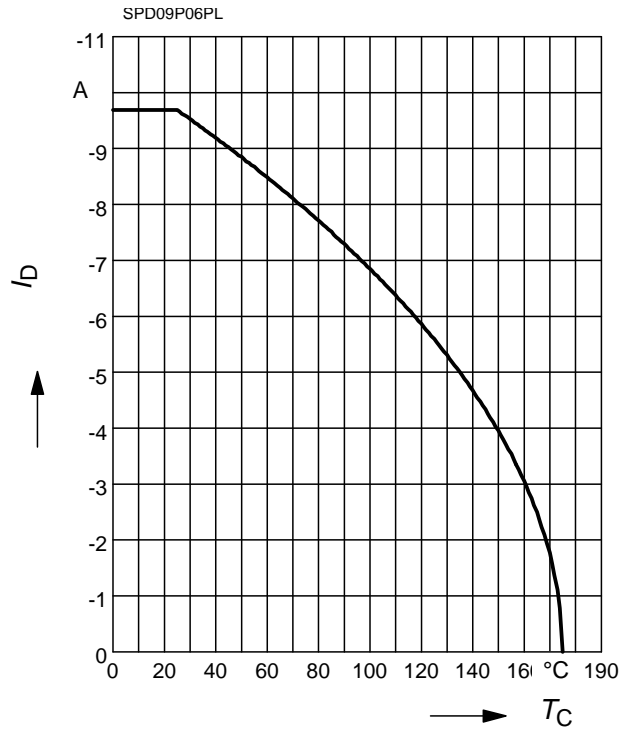
$$P_{tot} = f(T_C)$$



**Drain current**

$$I_D = f(T_C)$$

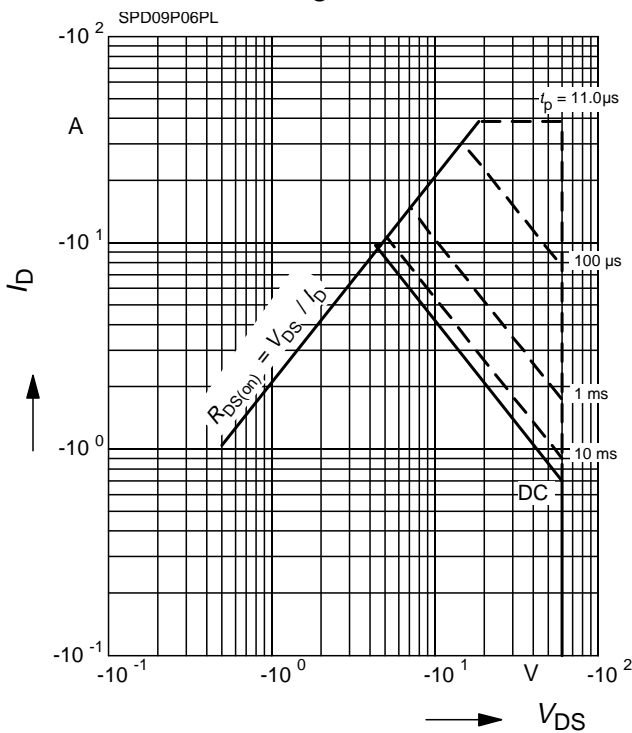
parameter:  $V_{GS} \geq 10 \text{ V}$



**Safe operating area**

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

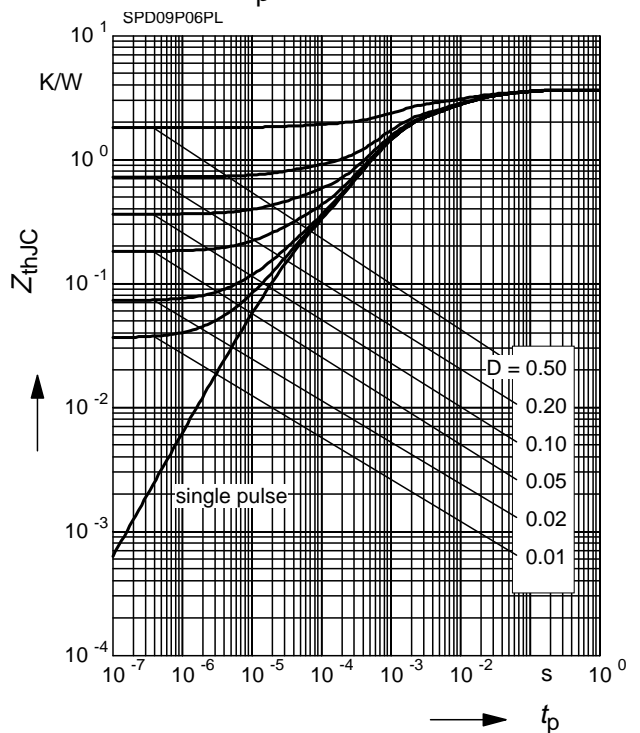
parameter:  $D = 0, T_C = 25 \text{ °C}$



**Transient thermal impedance**

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

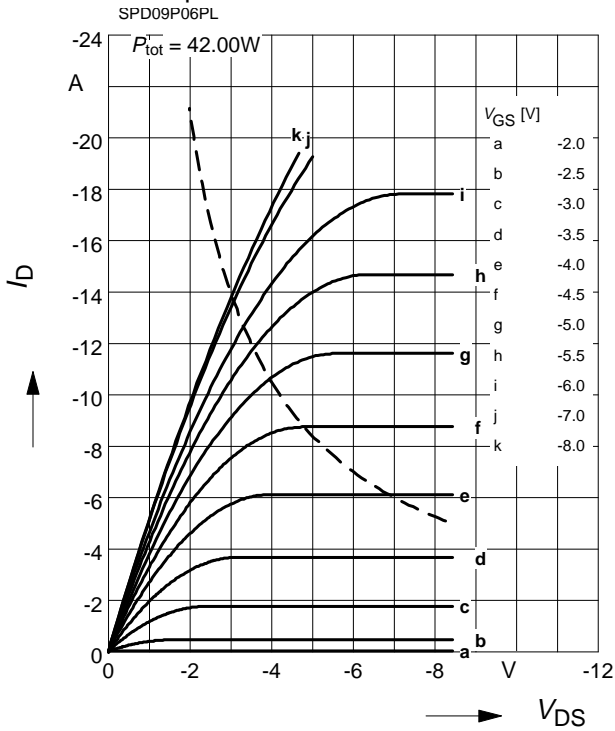
parameter:  $D = t_p / T$



**Typ. output characteristic**

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

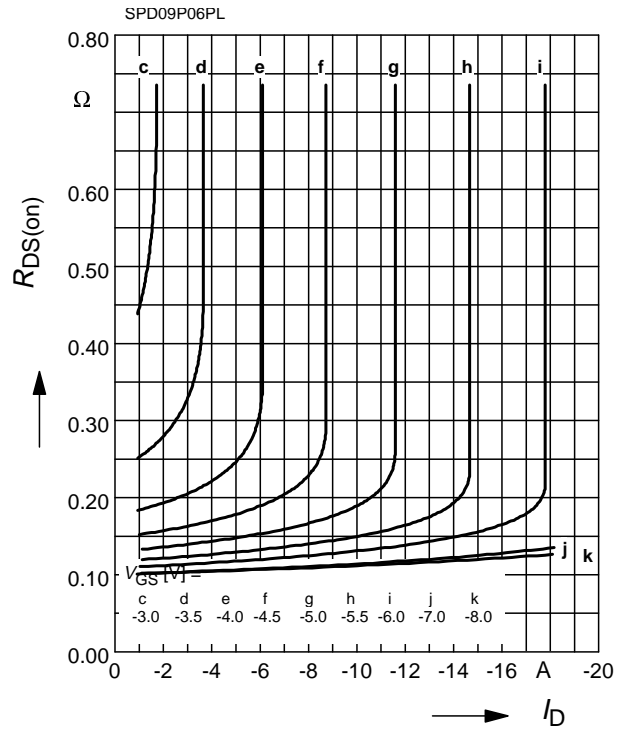
parameter:  $t_p = 80 \mu\text{s}$



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

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

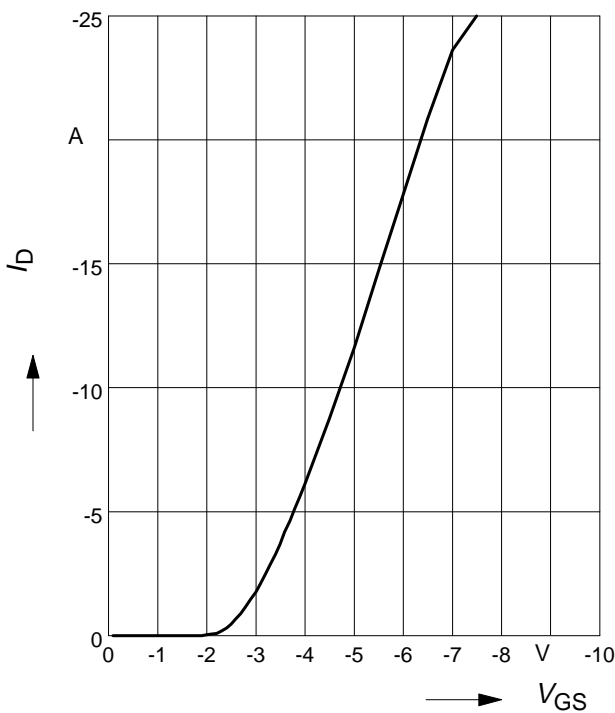
parameter:  $V_{GS}$



**Typ. transfer characteristics  $I_D = f(V_{GS})$**

$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$

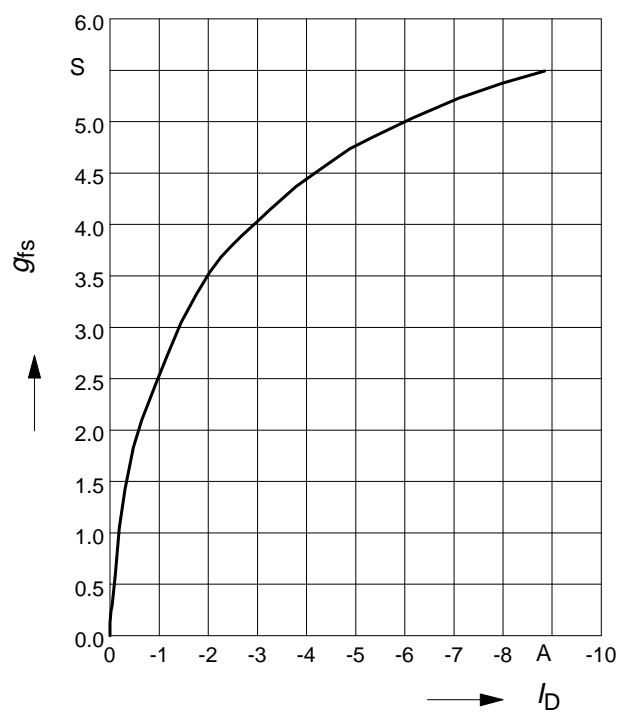
parameter:  $t_p = 80 \mu\text{s}$



**Typ. forward transconductance**

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

parameter:  $g_{fs}$

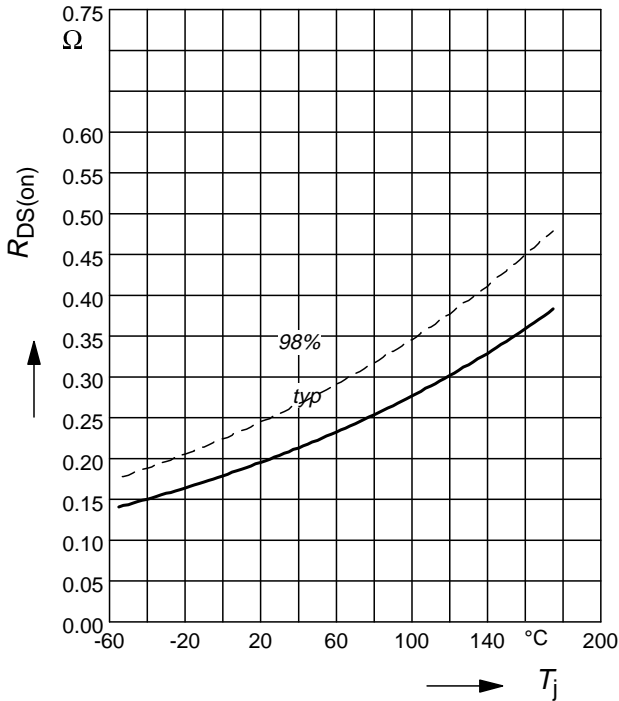


**Drain-source on-state resistance**

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

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

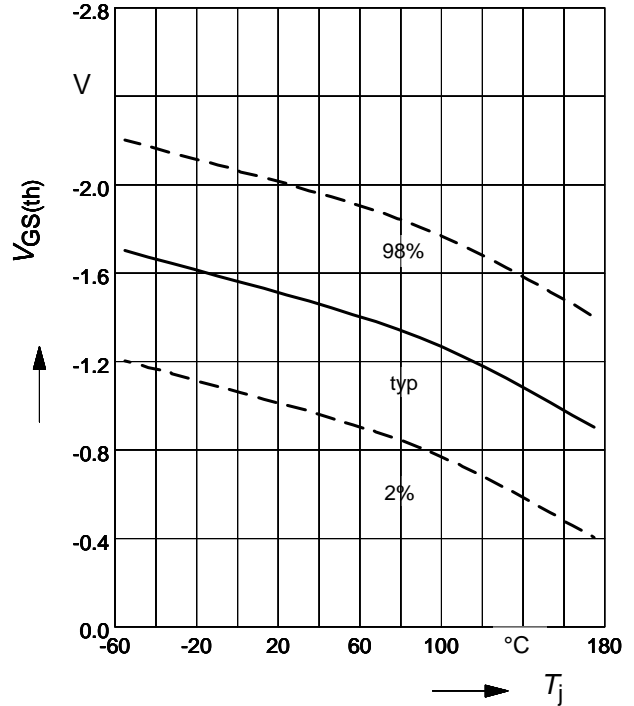
SPD09P06PL



**Gate threshold voltage**

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

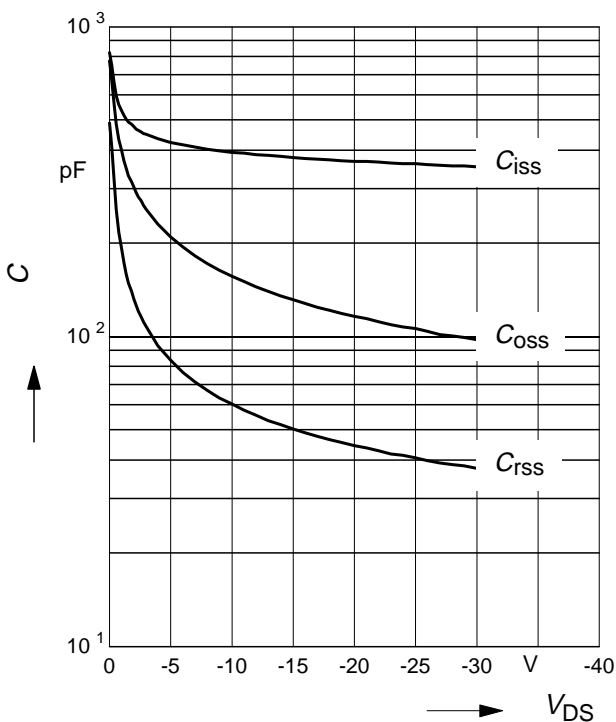
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = -250 \mu\text{A}$



**Typ. capacitances**

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

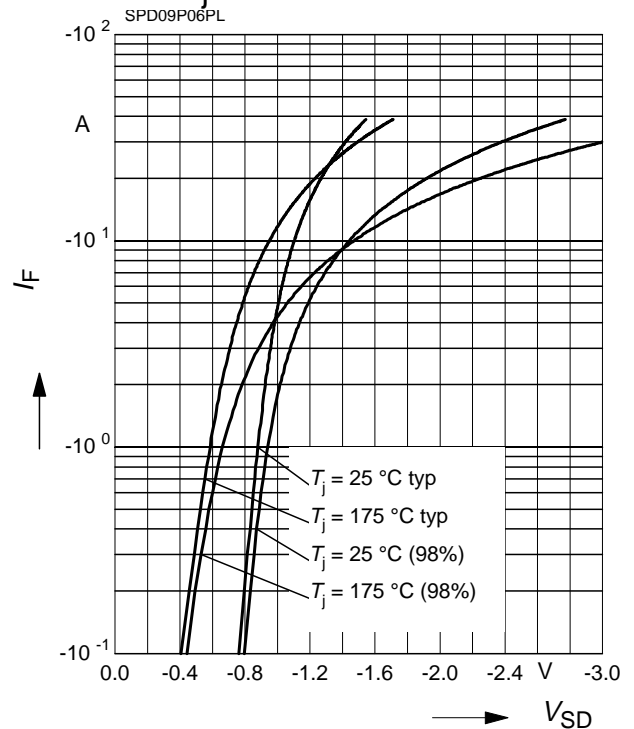
parameter:  $V_{GS} = 0\text{V}$ ,  $f = 1 \text{ MHz}$



**Forward characteristics of reverse diode**

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

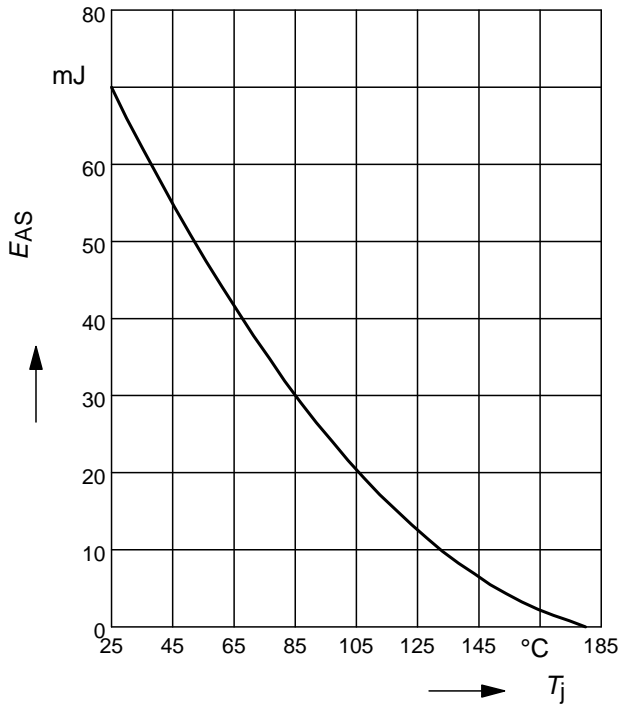
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



**Avalanche energy**

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

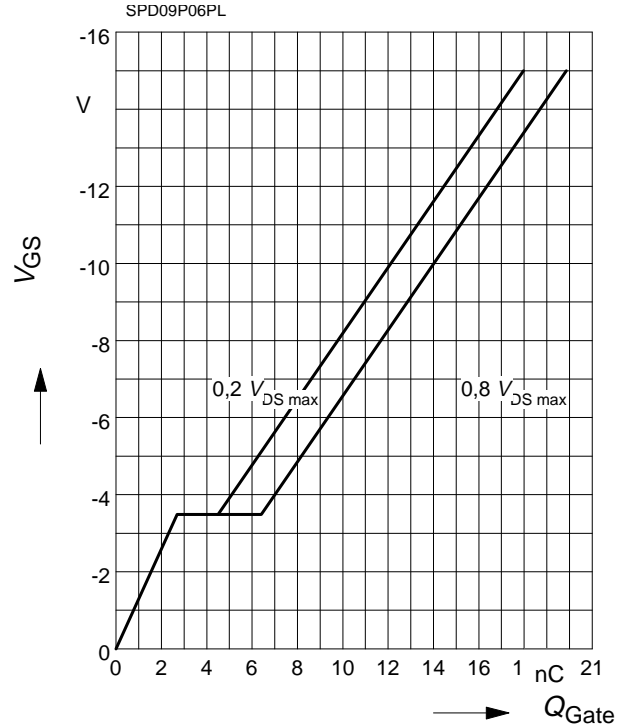
para.:  $I_D = -9.7 \text{ A}$  ,  $V_{DD} = -25 \text{ V}$  ,  $R_{GS} = 25 \Omega$



**Typ. gate charge**

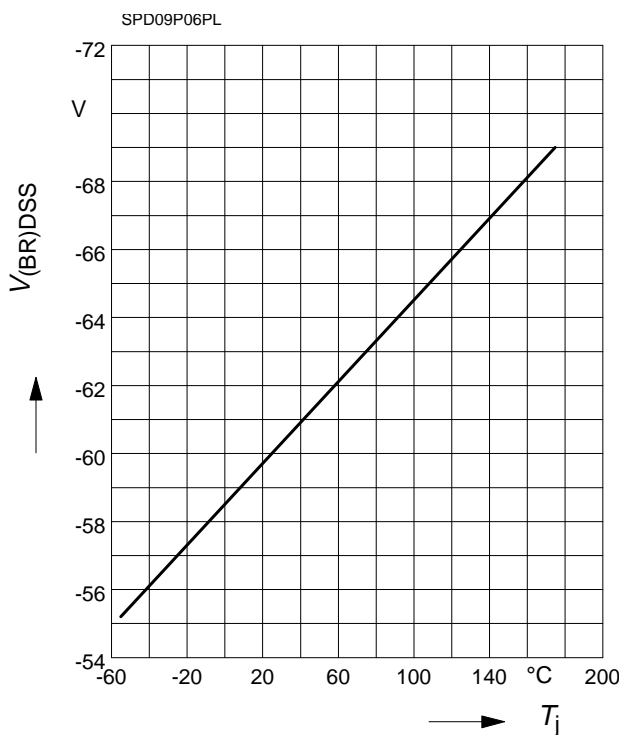
$$V_{GS} = f(Q_{Gate})$$

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



**Drain-source breakdown voltage**

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





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