

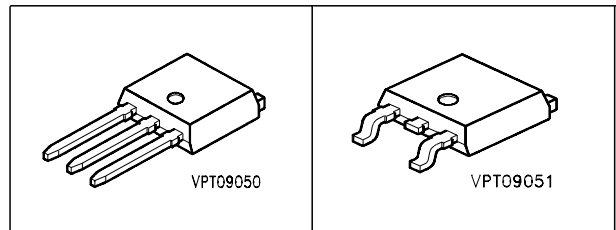
SIPMOS® Power-Transistor

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	Ω
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/ μs
Gate source voltage	V_{GS}	± 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.	
Characteristics					
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 ² cooling area ¹⁾		-	-	50	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
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	μA
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	Ω
Drain-source on-state resistance $V_{GS} = -10\text{ V}$, $I_D = -6.8\text{ A}$	$R_{DS(on)}$	-	0.2	0.25	

¹Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 μm thick) copper area for drain connection. PCB is vertical without blown air.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
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	

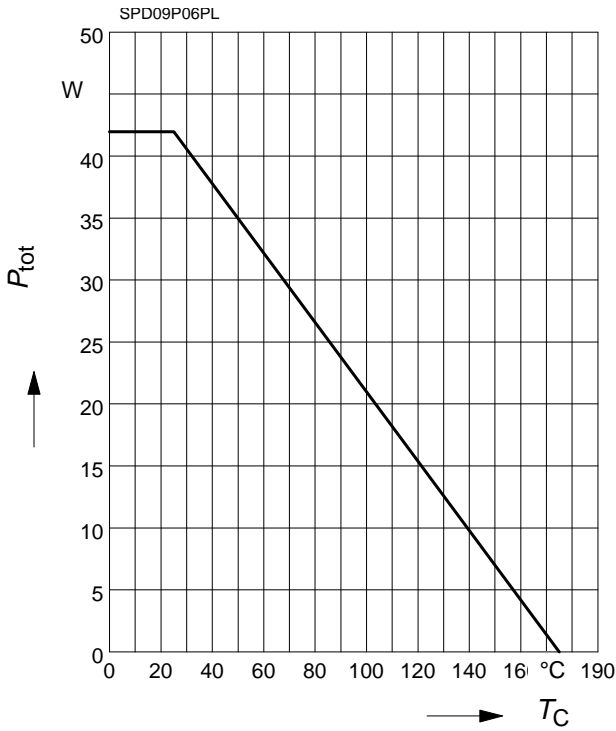
Electrical Characteristics, at $T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
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 $V_{DD} = -48\text{ V}, I_D = -9.7\text{ A}$	$V_{(\text{plateau})}$	-	-3.5	-	V

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
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

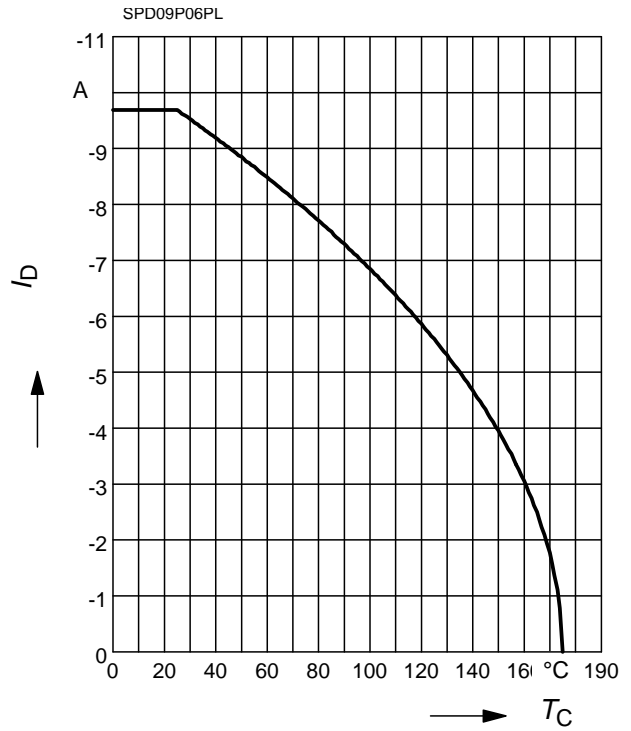
$$P_{tot} = f(T_C)$$



Drain current

$$I_D = f(T_C)$$

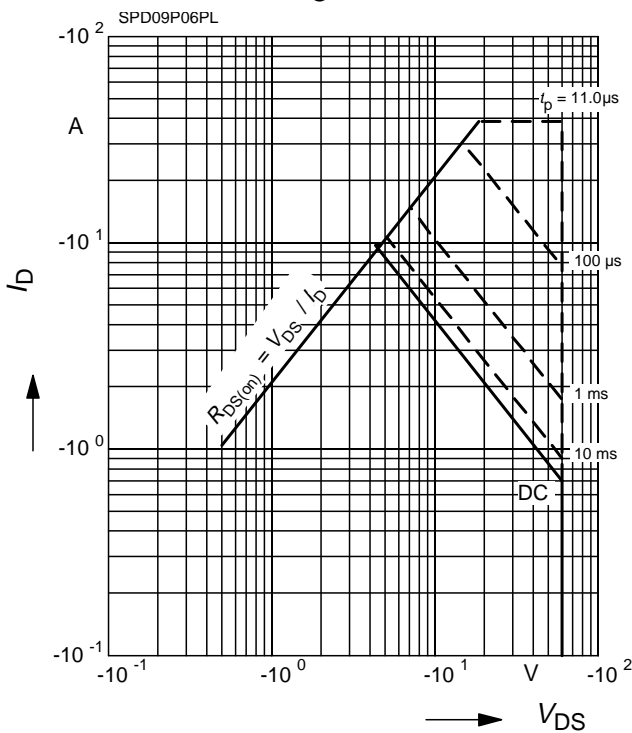
parameter: $V_{GS} \geq 10\text{ V}$



Safe operating area

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

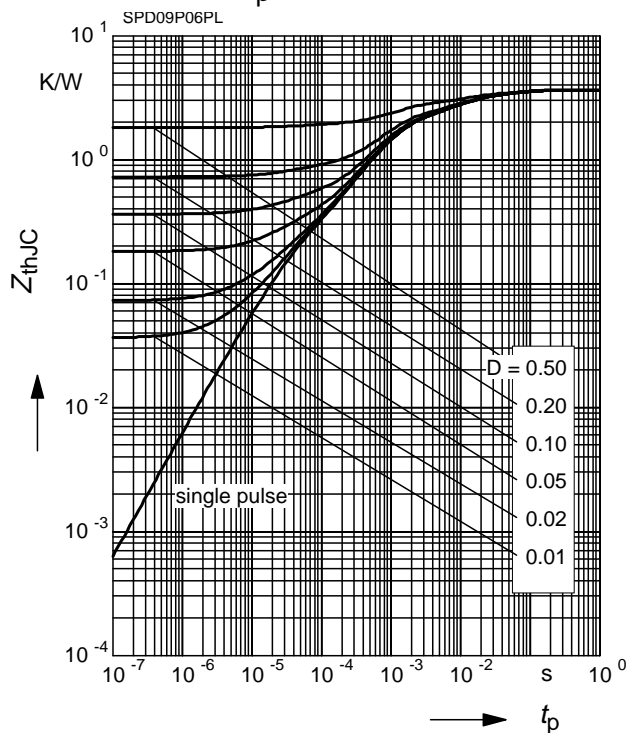
parameter: $D = 0$, $T_C = 25\text{ °C}$



Transient thermal impedance

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

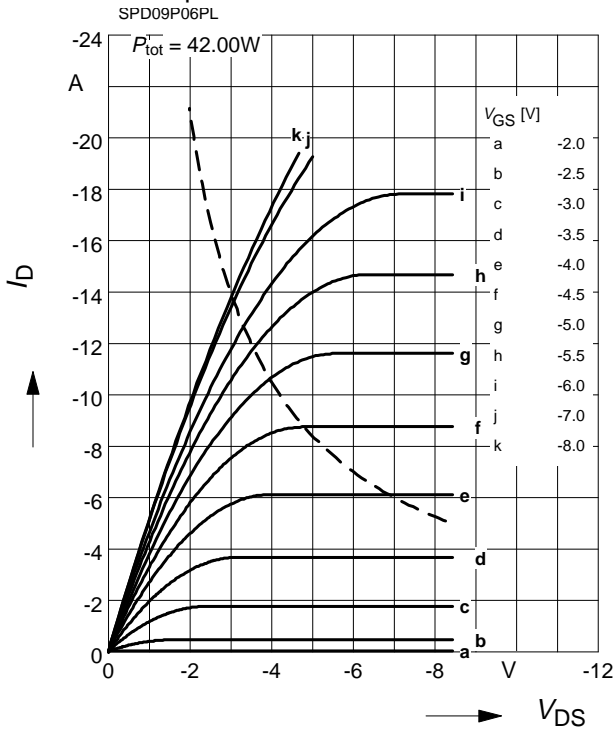
parameter: $D = t_p / T$



Typ. output characteristic

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

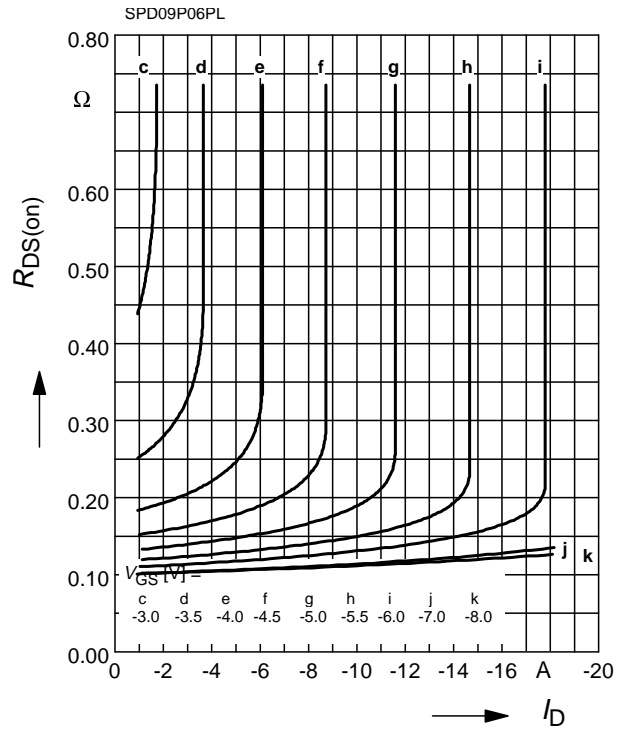
parameter: $t_p = 80 \mu\text{s}$



Typ. drain-source-on-resistance

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

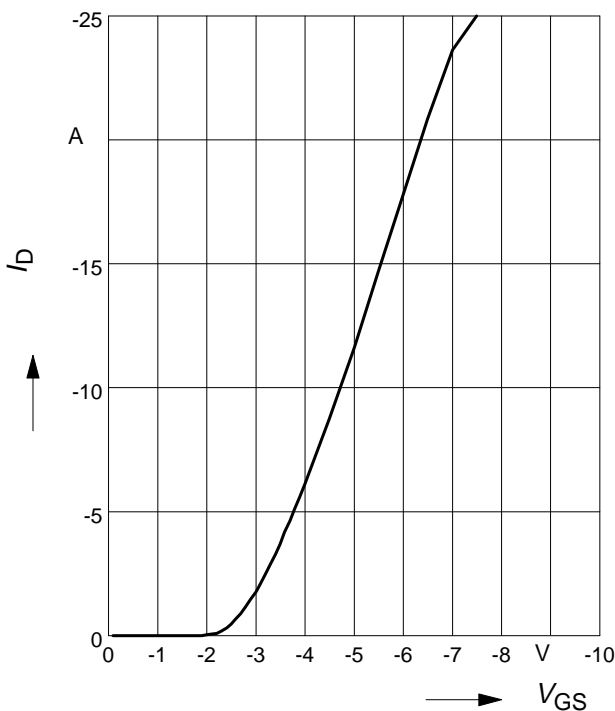
parameter: V_{GS}



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

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

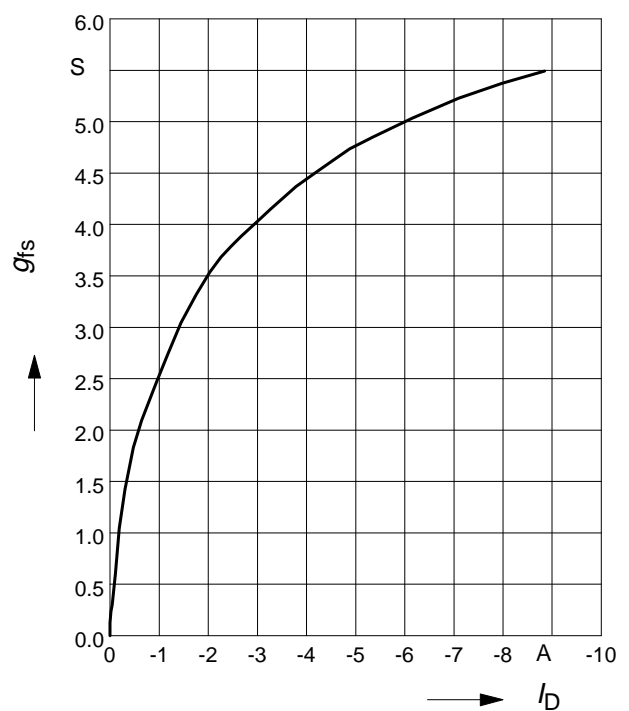
parameter: $t_p = 80 \mu\text{s}$



Typ. forward transconductance

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

parameter: g_{fs}

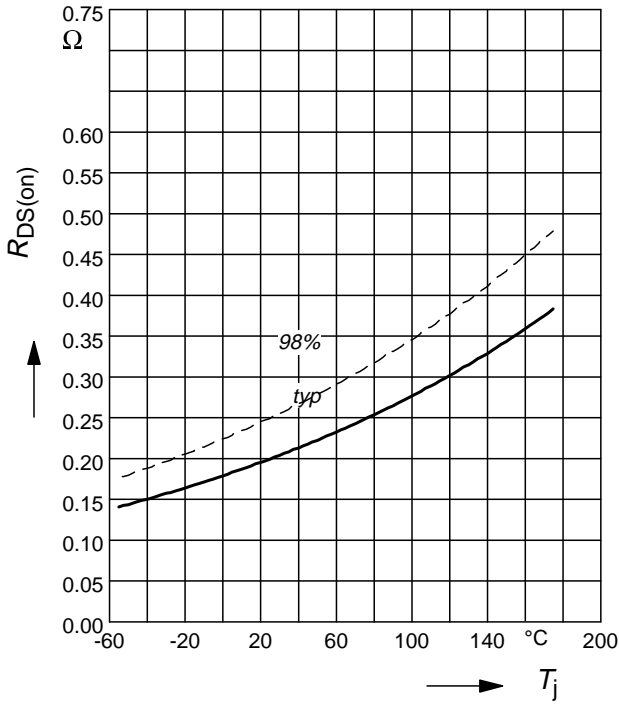


Drain-source on-state resistance

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

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

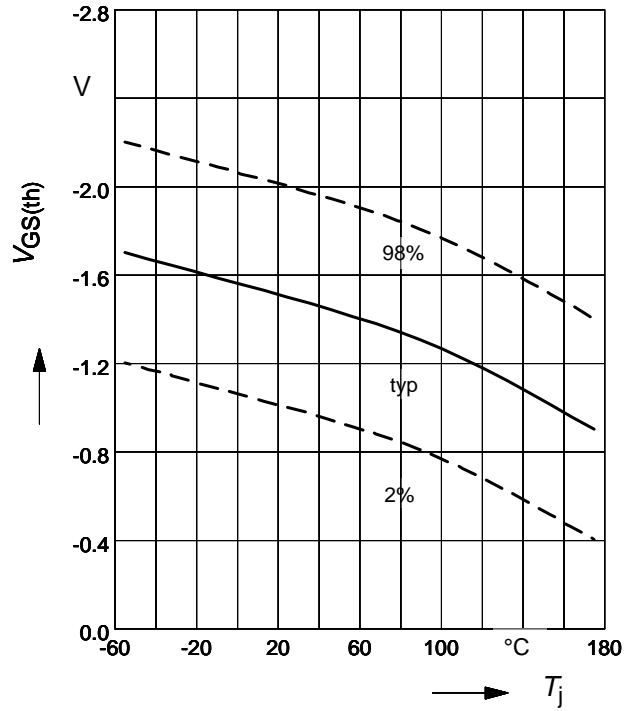
SPD09P06PL



Gate threshold voltage

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

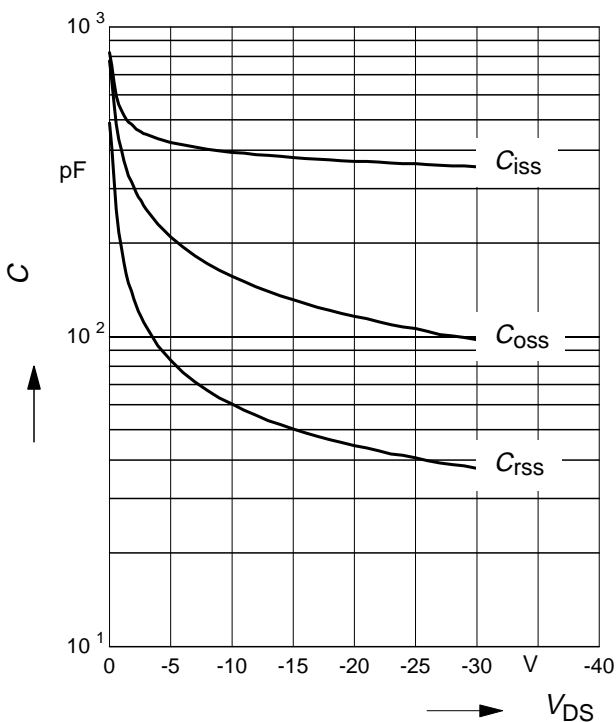
parameter: $V_{GS} = V_{DS}$, $I_D = -250 \mu\text{A}$



Typ. capacitances

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

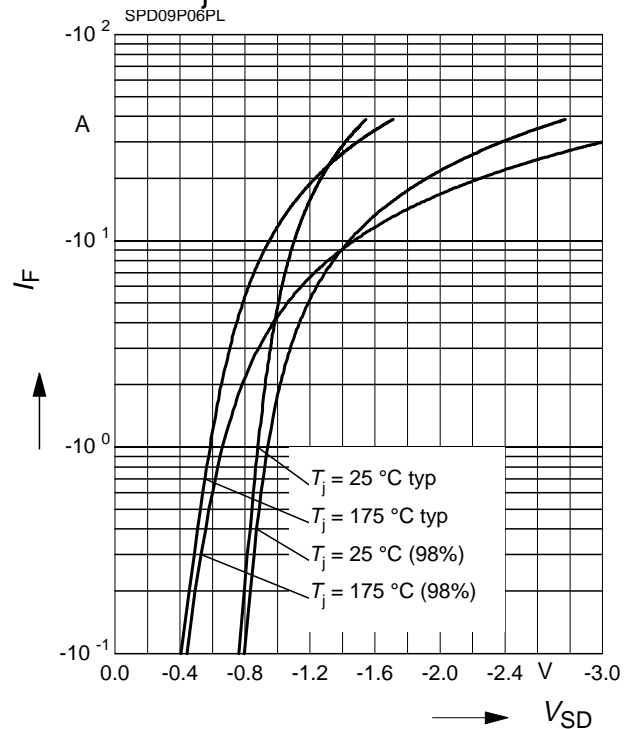
parameter: $V_{GS}=0\text{V}$, $f=1 \text{ MHz}$



Forward characteristics of reverse diode

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

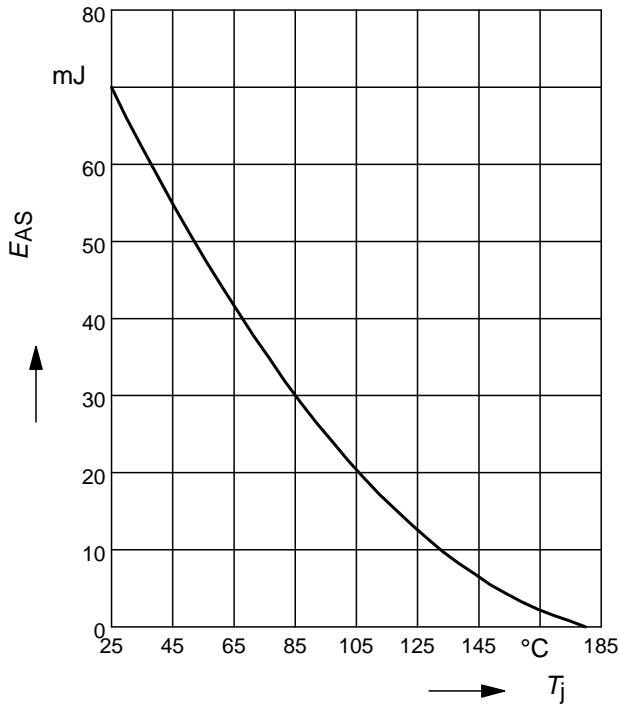
parameter: T_j , $t_p = 80 \mu\text{s}$



Avalanche energy

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

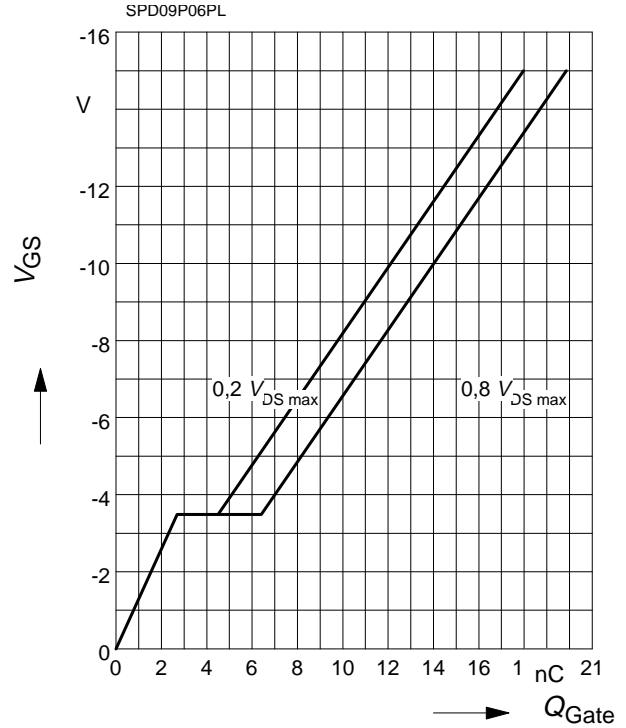
para.: $I_D = -9.7 \text{ A}$, $V_{DD} = -25 \text{ V}$, $R_{GS} = 25 \Omega$



Typ. gate charge

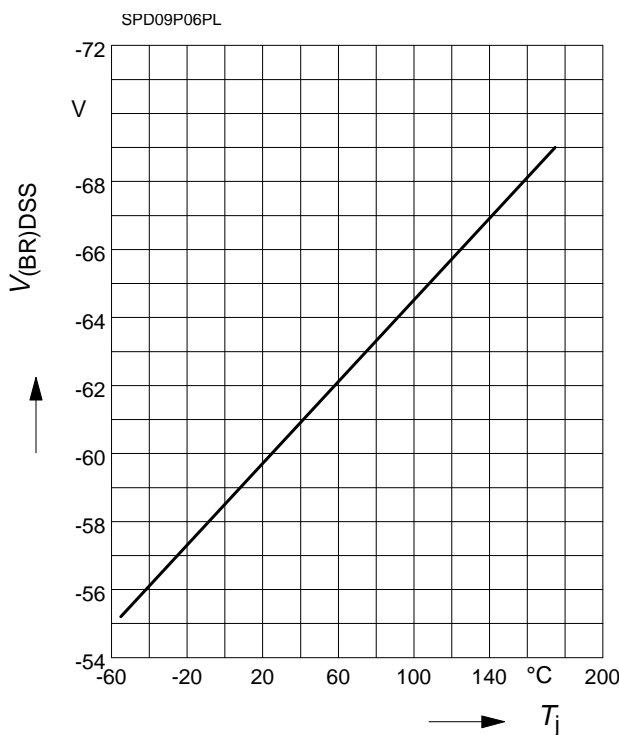
$$V_{GS} = f(Q_{Gate})$$

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



Drain-source breakdown voltage

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



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