

**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

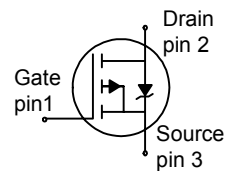
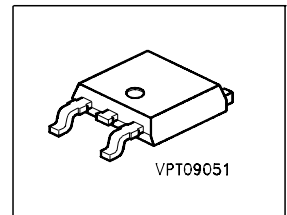


Type	Package	Lead free
SPD09P06PL G	PG-TO252-3	Yes

**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	$I_D$	-9.7	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: @ min. footprint @ 6 cm <sup>2</sup> cooling area <sup>1)</sup>	$R_{thJA}$	-	-	75 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 $V_{GS}=0V, I_D=-250\mu A$	$V_{(BR)DSS}$	-60	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D=-250\mu A$	$V_{GS(th)}$	-1	-1.5	-2	
Zero gate voltage drain current $V_{DS}=-60V, V_{GS}=0V, T_j=25^\circ\text{C}$ $V_{DS}=-60V, V_{GS}=0V, T_j=150^\circ\text{C}$	$I_{DSS}$	-	-0.1 -10	-1 -100	$\mu A$
Gate-source leakage current $V_{GS}=-20V, V_{DS}=0V$	$I_{GSS}$	-	-10	-100	
Drain-source on-state resistance $V_{GS}=-4.5V, I_D=-5.4A$	$R_{DS(on)}$	-	0.3	0.4	$\Omega$
Drain-source on-state resistance $V_{GS}=-10V, I_D=-6.8A$	$R_{DS(on)}$	-	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	$g_{fs}$	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = -5.4$	1.8	3.5	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0V$ , $V_{DS} = -25V$ , $f = 1MHz$	-	360	450	pF
Output capacitance	$C_{oss}$		-	103	130	
Reverse transfer capacitance	$C_{rss}$		-	40	50	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -30V$ , $V_{GS} = -4.5V$ , $I_D = -5.4$ , $R_G = 6\Omega$	-	11	17	ns
Rise time	$t_r$	$V_{DD} = -30V$ , $V_{GS} = -4.5V$ , $I_D = -5.4A$ , $R_G = 6\Omega$	-	168	252	
Turn-off delay time	$t_{d(off)}$		-	49	74	
Fall time	$t_f$		-	89	134	

**Gate Charge Characteristics**

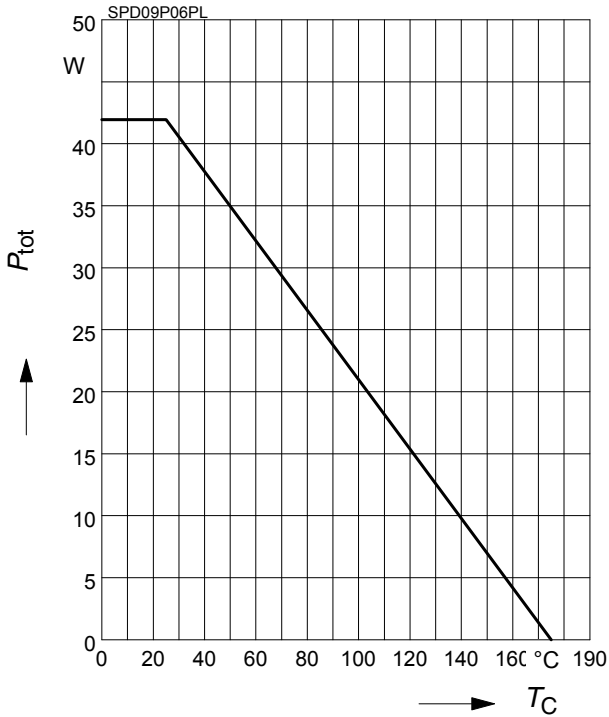
Gate to source charge	$Q_{gs}$	$V_{DD} = -48V$ , $I_D = -9.7A$	-	1.3	2	nC
Gate to drain charge	$Q_{gd}$		-	5.1	7.5	
Gate charge total	$Q_g$	$V_{DD} = -48V$ , $I_D = -9.7A$ , $V_{GS} = 0$ to $-10V$	-	14	21	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = -48V$ , $I_D = -9.7A$	-	-4.1	-	V

**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

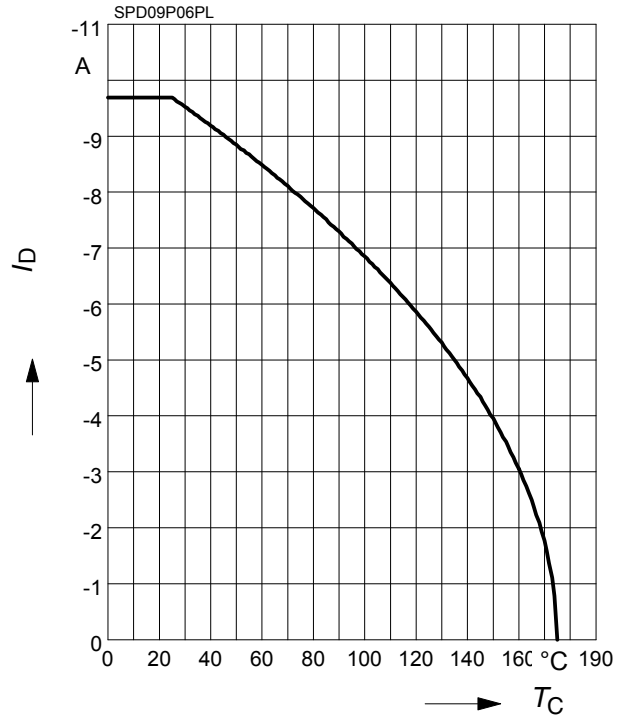
$$P_{\text{tot}} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

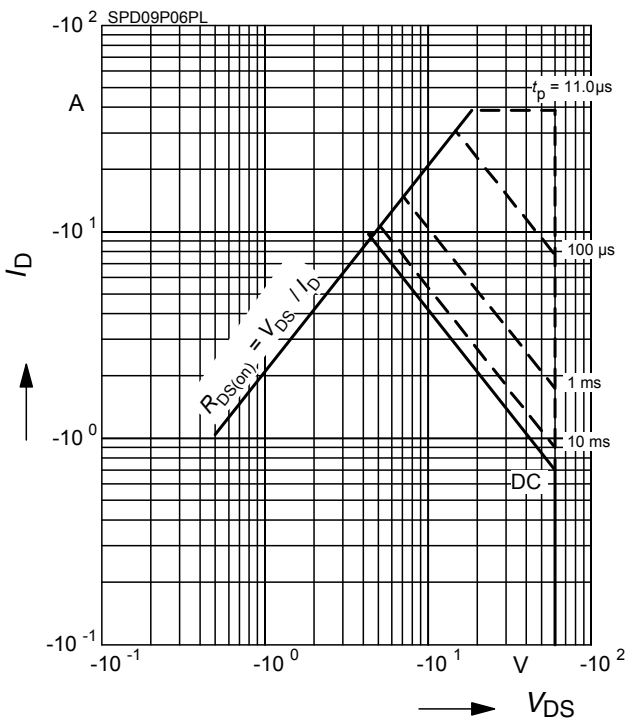
parameter:  $V_{GS} \geq 10 \text{ V}$



### 3 Safe operating area

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

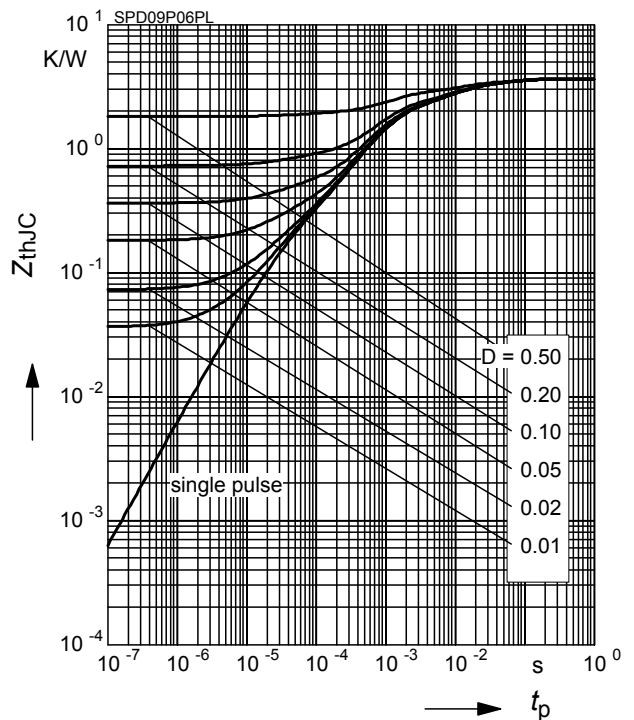
parameter:  $D = 0$ ,  $T_C = 25 \text{ °C}$



### 4 Transient thermal impedance

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

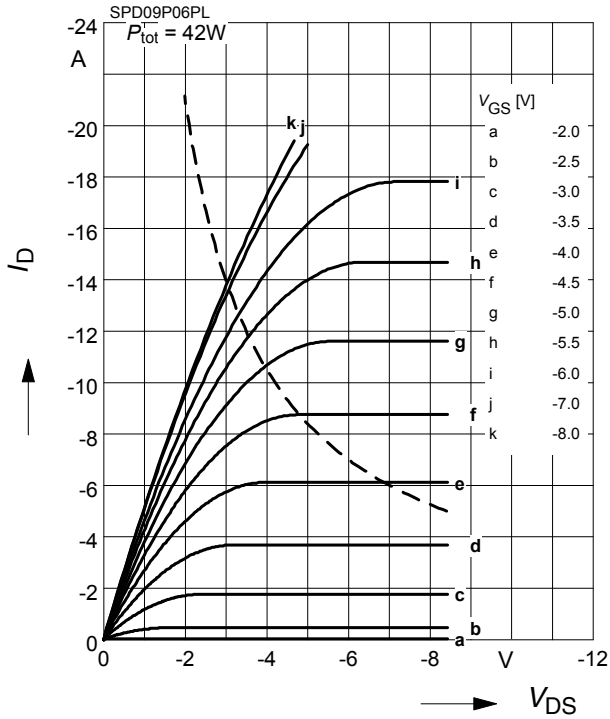
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

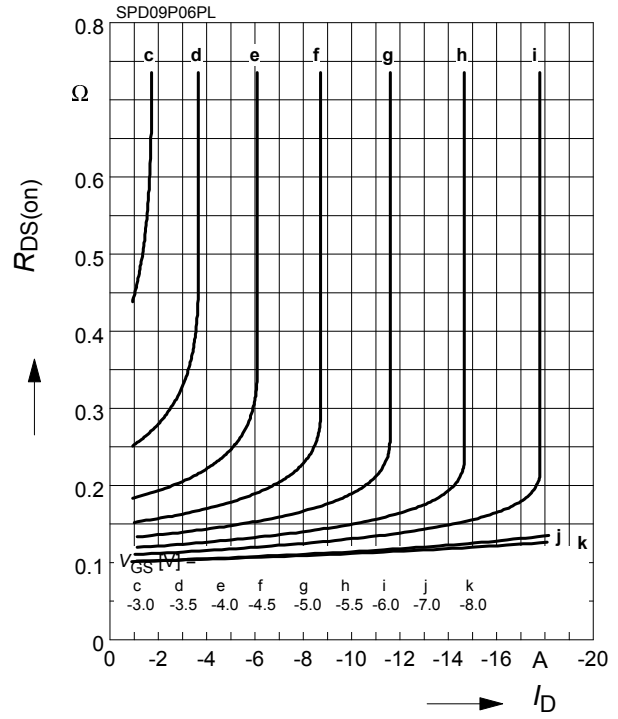
parameter:  $t_p = 80 \mu\text{s}$



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

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

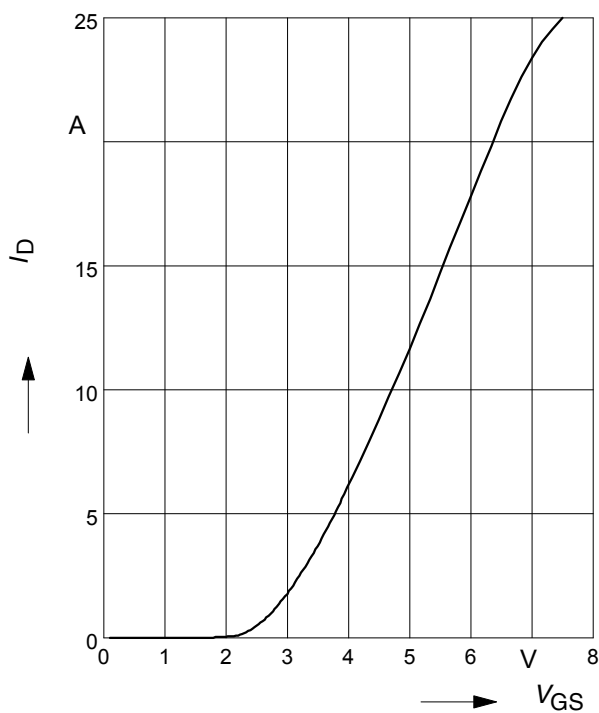
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

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

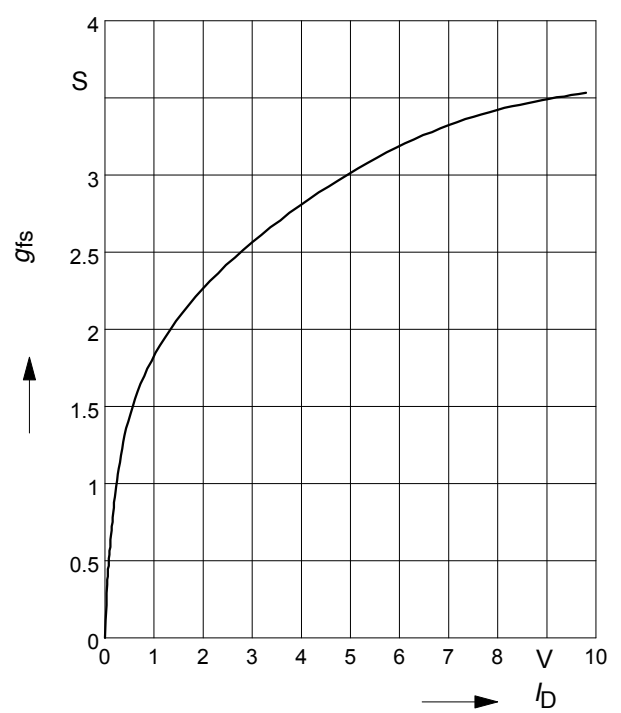
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

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

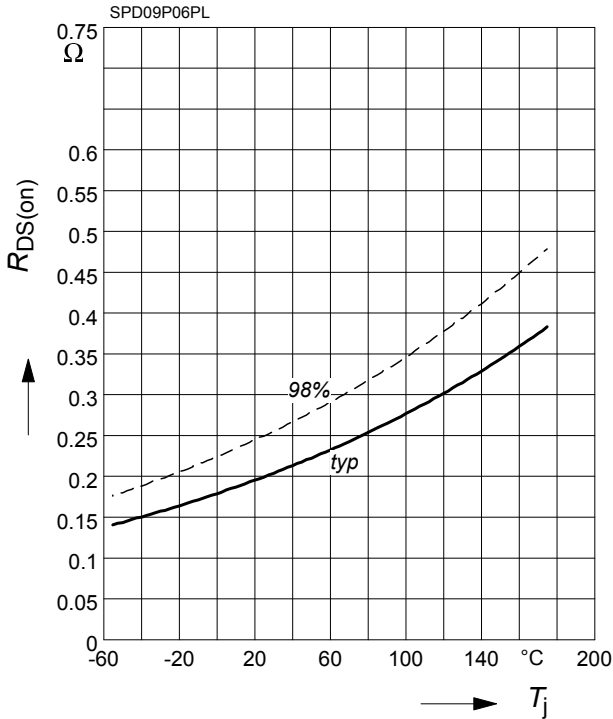
parameter:  $g_{fs}$



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

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

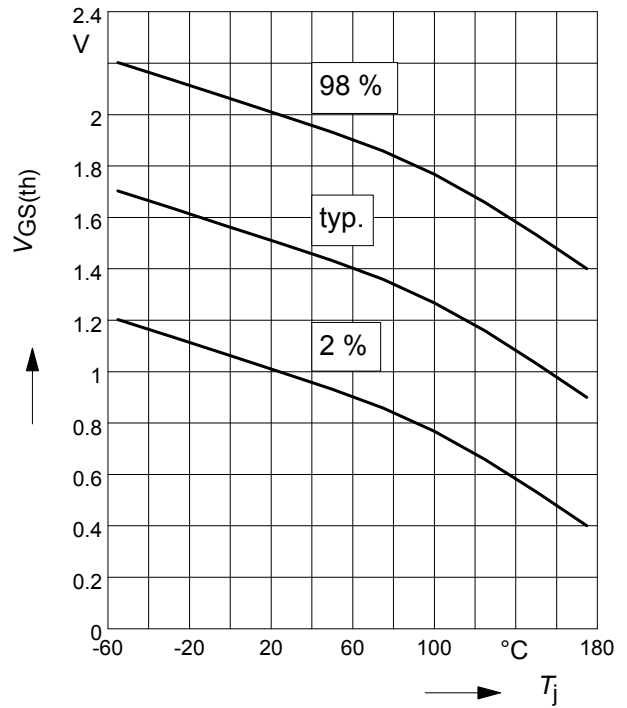
parameter :  $I_D = -6.8 \text{ A}$ ,  $V_{GS} = -10 \text{ V}$



**10 Gate threshold voltage**

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

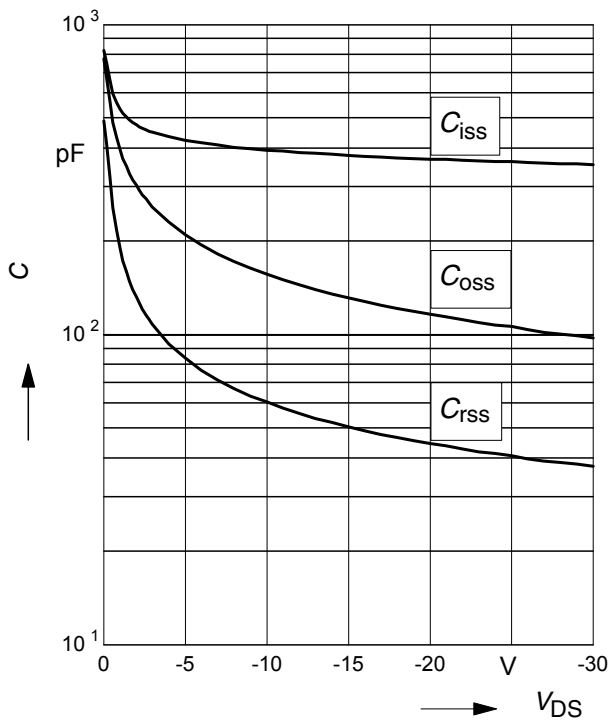
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = -250 \mu\text{A}$



**11 Typ. capacitances**

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

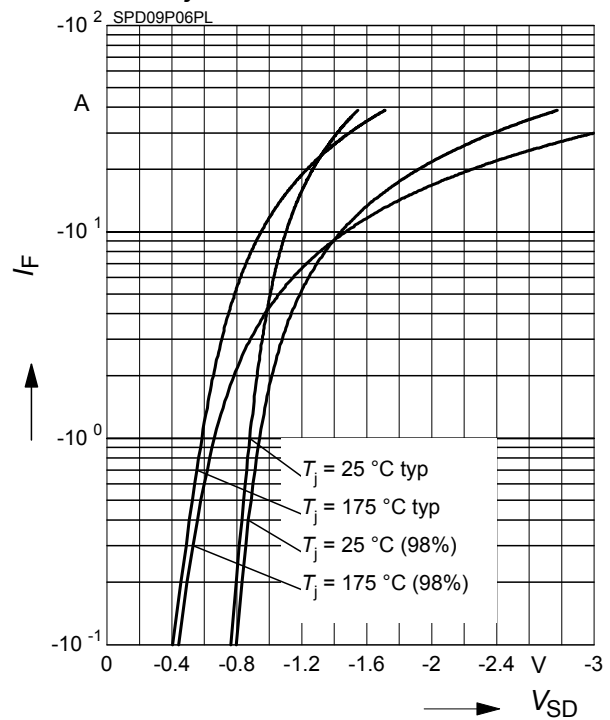
parameter:  $V_{GS}=0\text{V}$ ,  $f=1 \text{ MHz}$



**12 Forward character. of reverse diode**

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

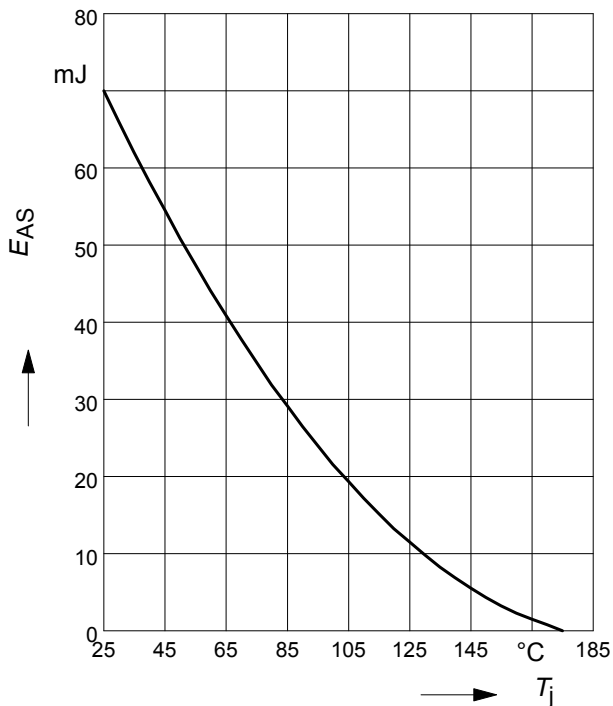
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



**13 Typ. avalanche energy**

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

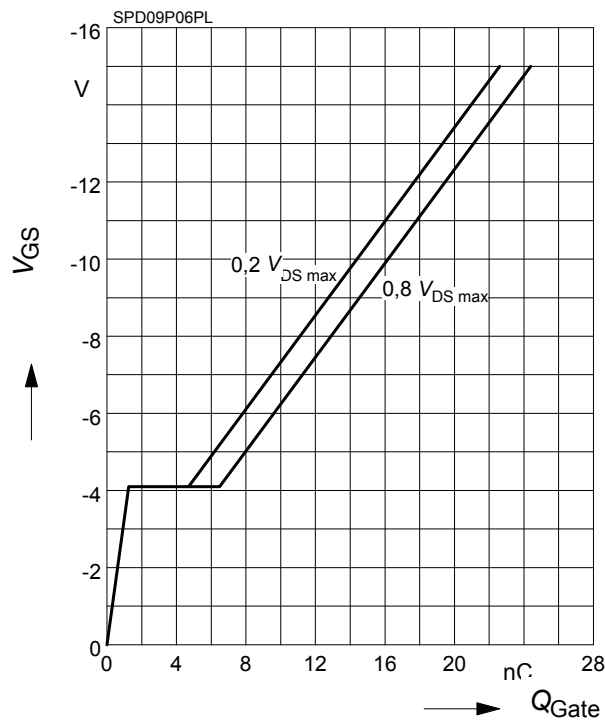
par.:  $I_D = -9.7 \text{ A}$  ,  $V_{DD} = -25 \text{ V}$  ,  $R_{GS} = 25 \Omega$



**14 Typ. gate charge**

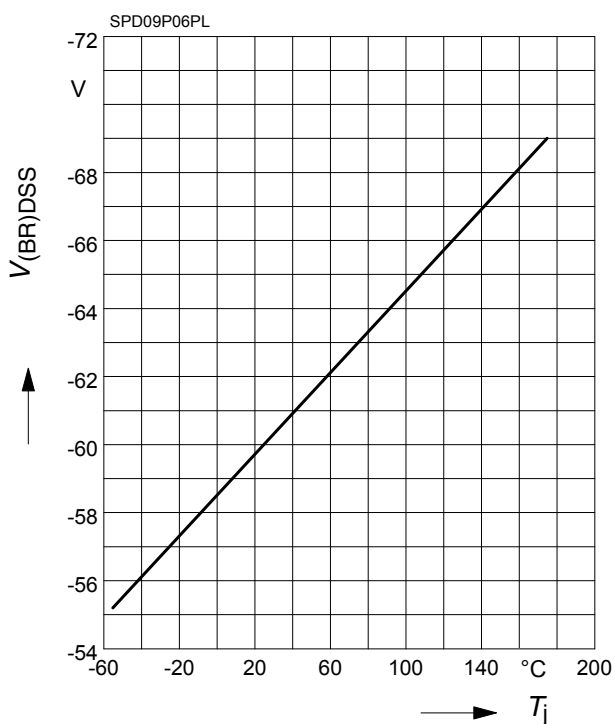
$$V_{GS} = f(Q_{Gate})$$

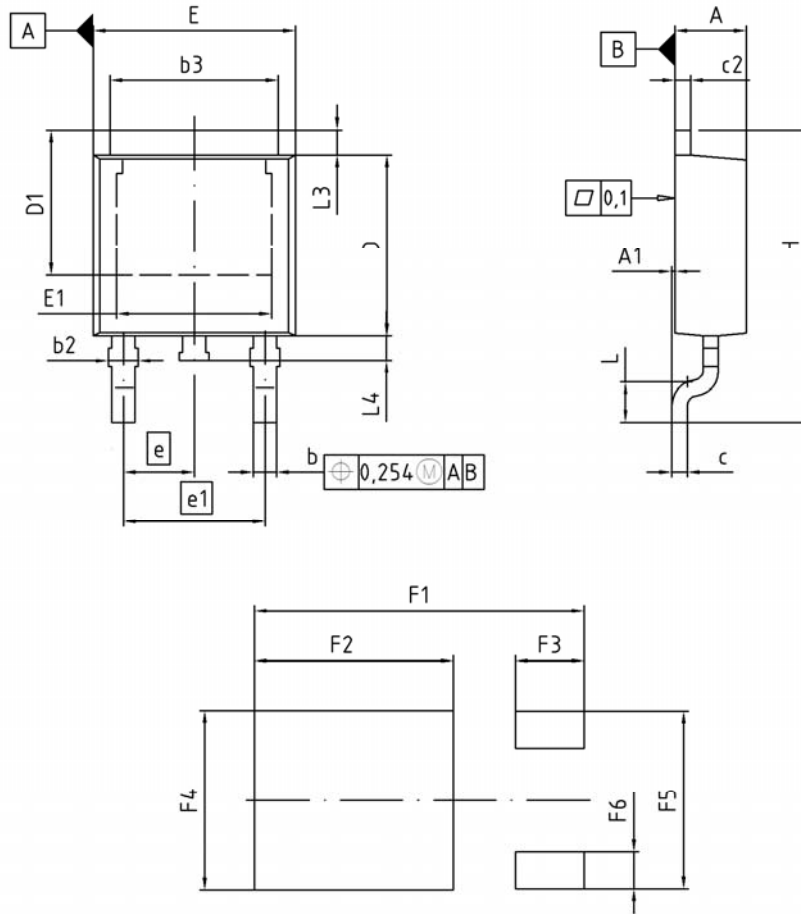
parameter:  $I_D = -9.7 \text{ A}$  pulsed



**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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