

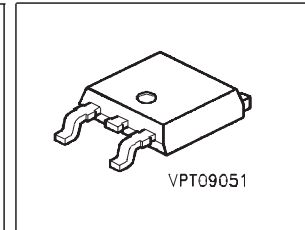
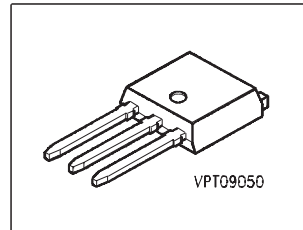
### SIPMOS® Power Transistor

#### Features

- N channel
- Enhancement mode
- Avalanche rated
- Logic Level
- dv/dt rated
- 175 °C operating temperature

#### Product Summary

Drain source voltage	$V_{DS}$	55	V
Drain-Source on-state resistance	$R_{DS(on)}$	0.064	$\Omega$
Continuous drain current	$I_D$	12.5	A



Type	Package	Ordering Code	Packaging	Pin 1	Pin 2	Pin 3
SPD13N05L	P-TO252	Q67040-S4124	Tape and Reel	G	D	S
SPU13N05L	P-TO251-3-1	Q67040-S4116-A2	Tube			

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

Parameter	Symbol	Value	Unit
Continuous drain current $T_C = 25\text{ °C}$ $T_C = 100\text{ °C}$	$I_D$	12.5 8.8	A
Pulsed drain current $T_C = 25\text{ °C}$	$I_{Dpulse}$	50	
Avalanche energy, single pulse $I_D = 12.5\text{ A}$ , $V_{DD} = 25\text{ V}$ , $R_{GS} = 25\text{ }\Omega$	$E_{AS}$	52	mJ
Avalanche energy, periodic limited by $T_{jmax}$	$E_{AR}$	3.5	
Reverse diode dv/dt $I_S = 12.5\text{ A}$ , $V_{DS} = 40\text{ V}$ , $di/dt = 200\text{ A}/\mu\text{s}$ , $T_{jmax} = 175\text{ °C}$	dv/dt	6	kV/ $\mu\text{s}$
Gate source voltage	$V_{GS}$	-20	V
Power dissipation $T_C = 25\text{ °C}$	$P_{tot}$	35	W
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	$R_{thJC}$	-	-	4.3	K/W
Thermal resistance, junction - ambient, leded	$R_{thJA}$	-	-	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 $V_{GS} = 0\text{ V}$ , $I_D = 0.25\text{ mA}$	$V_{(BR)DSS}$	55	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 20\text{ }\mu\text{A}$	$V_{GS(th)}$	1.2	1.6	2	
Zero gate voltage drain current $V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ °C}$ $V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ °C}$	$I_{DSS}$	-	0.1	1	$\mu\text{A}$
		-	-	100	
Gate-source leakage current $V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$	$I_{GSS}$	-	10	100	nA
Drain-Source on-state resistance $V_{GS} = 4.5\text{ V}$ , $I_D = 8.8\text{ A}$ $V_{GS} = 10\text{ V}$ , $I_D = 8.8\text{ A}$	$R_{DS(on)}$	-	0.1	0.11	$\Omega$
		-	0.061	0.064	

<sup>1)</sup> Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6 cm<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 $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 8.8\text{ A}$	$g_{fs}$	5	8	-	S
Input capacitance $V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$	$C_{iss}$	-	317	400	pF
Output capacitance $V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$	$C_{oss}$	-	97	120	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$	$C_{rss}$	-	54	70	
Turn-on delay time $V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 12.5\text{ A}$ , $R_G = 16\text{ }\Omega$	$t_{d(on)}$	-	15	22	ns
Rise time $V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 12.5\text{ A}$ , $R_G = 16\text{ }\Omega$	$t_r$	-	106	160	
Turn-off delay time $V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 12.5\text{ A}$ , $R_G = 16\text{ }\Omega$	$t_{d(off)}$	-	11	17	
Fall time $V_{DD} = 30\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 12.5\text{ A}$ , $R_G = 16\text{ }\Omega$	$t_f$	-	14	20	

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

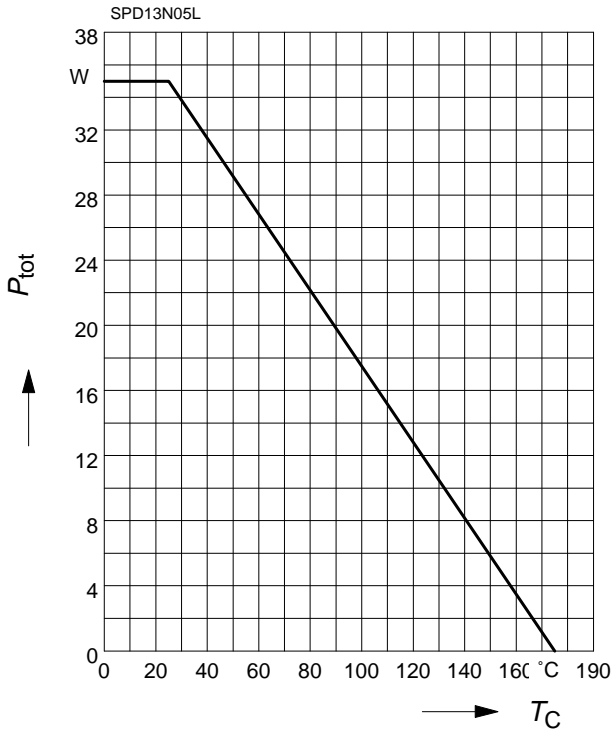
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Dynamic Characteristics</b>					
Gate to source charge $V_{DD} = 40\text{ V}, I_D = 12.5\text{ A}$	$Q_{gs}$	-	1.5	2.3	nC
Gate to drain charge $V_{DD} = 40\text{ V}, I_D = 12.5\text{ A}$	$Q_{gd}$	-	5.3	8	
Gate charge total $V_{DD} = 40\text{ V}, I_D = 12.5\text{ A}, V_{GS} = 0\text{ to }10\text{ V}$	$Q_g$	-	13.5	20	
Gate plateau voltage $V_{DD} = 40\text{ V}, I_D = 12.5\text{ A}$	$V_{(\text{plateau})}$	-	4	-	V

**Reverse Diode**

Inverse diode continuous forward current $T_C = 25\text{ }^\circ\text{C}$	$I_S$	-	-	12.5	A
Inverse diode direct current, pulsed $T_C = 25\text{ }^\circ\text{C}$	$I_{SM}$	-	-	50	
Inverse diode forward voltage $V_{GS} = 0\text{ V}, I_F = 25\text{ A}$	$V_{SD}$	-	1.15	1.8	V
Reverse recovery time $V_R = 30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$	$t_{rr}$	-	50	75	ns
Reverse recovery charge $V_R = 30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$	$Q_{rr}$	-	0.1	0.15	$\mu\text{C}$

**Power Dissipation**

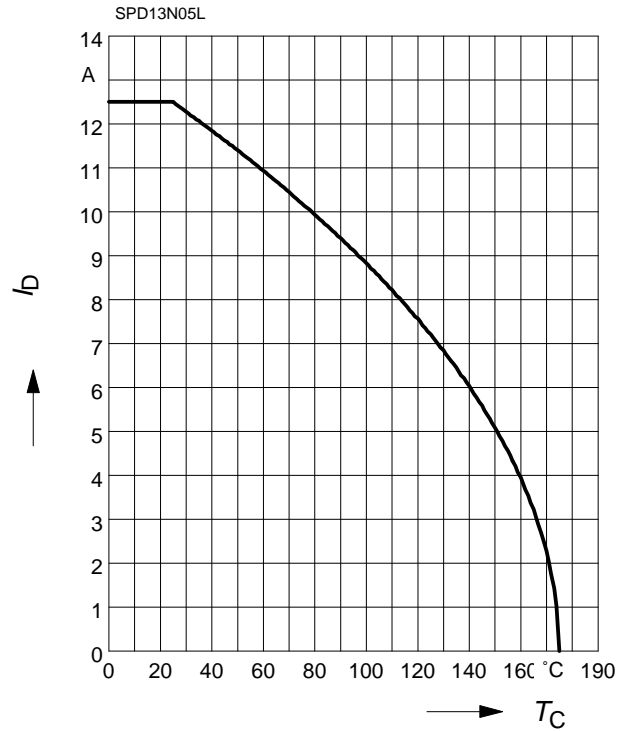
$$P_{tot} = f(T_C)$$



**Drain current**

$$I_D = f(T_C)$$

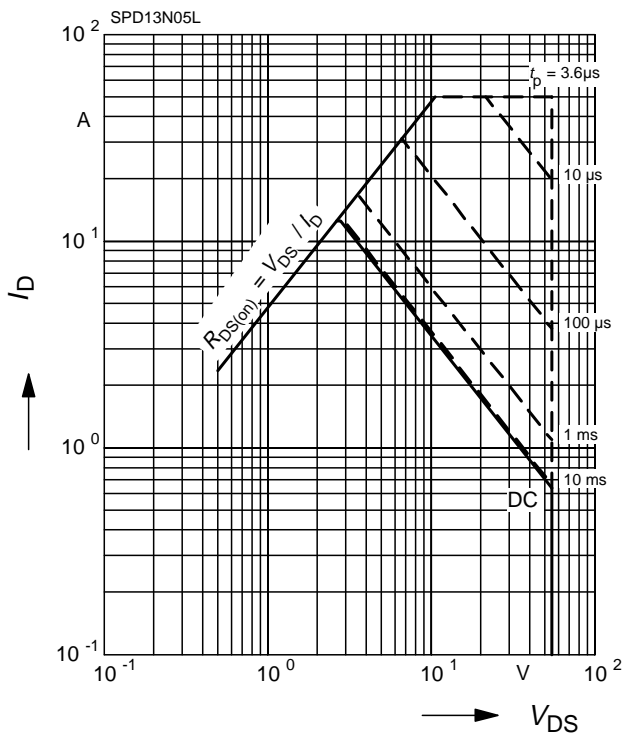
parameter:  $V_{GS} \geq 10\text{ V}$



**Safe operating area**

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

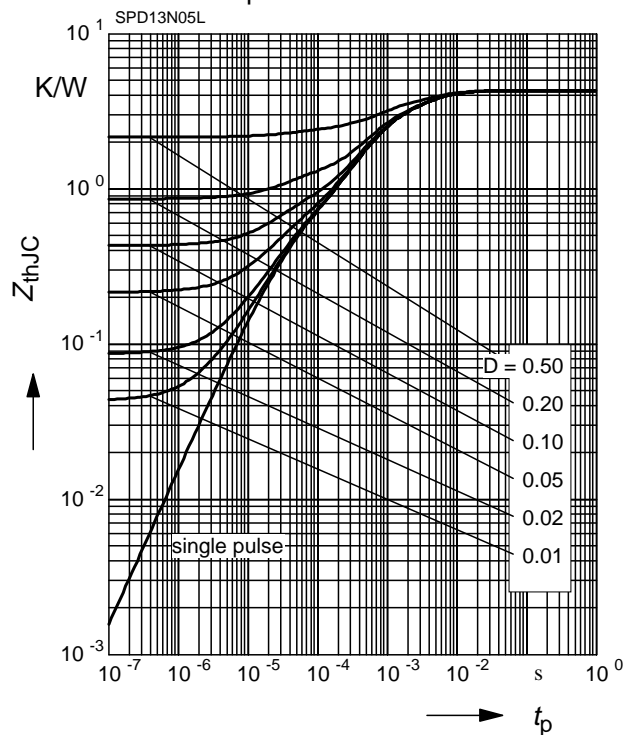
parameter:  $D = 0$ ,  $T_C = 25\text{ °C}$



**Transient thermal impedance**

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

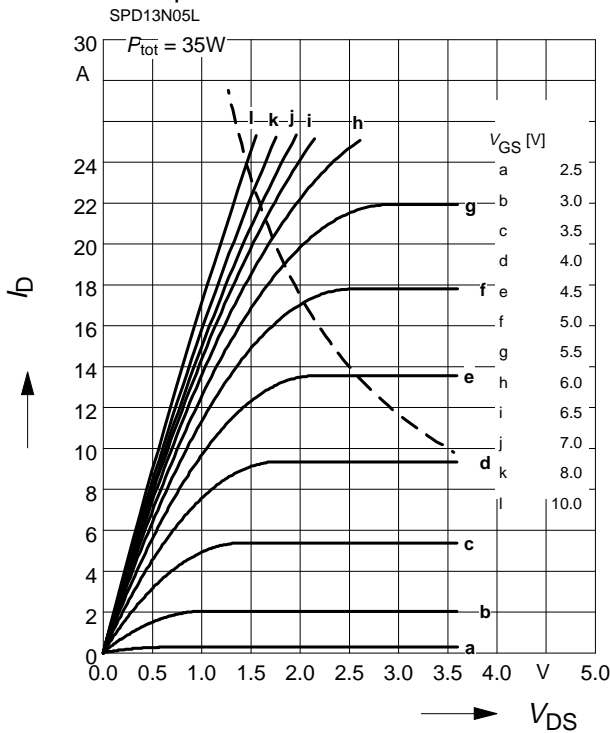
parameter:  $D = t_p/T$



**Typ. output characteristics**

$I_D = f(V_{DS})$

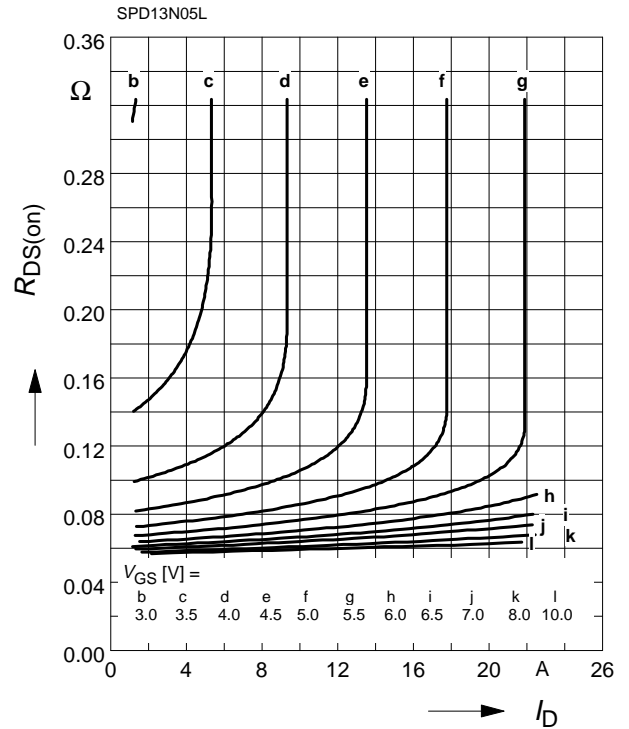
parameter:  $t_p = 80 \mu s$



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

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

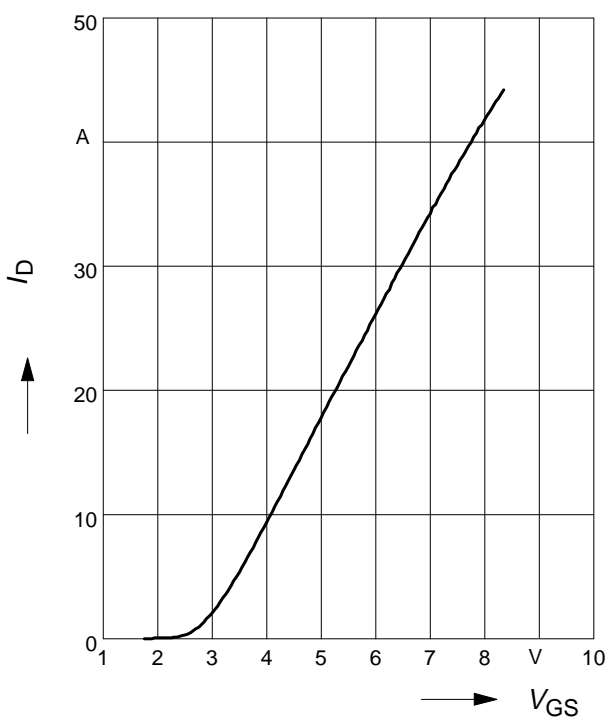
parameter:  $V_{GS}$



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

parameter:  $t_p = 80 \mu s$

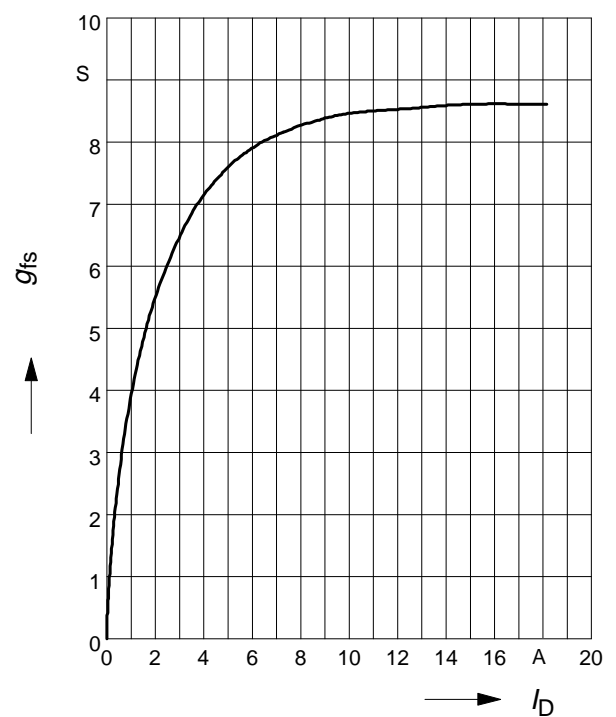
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



**Typ. forward transconductance**

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

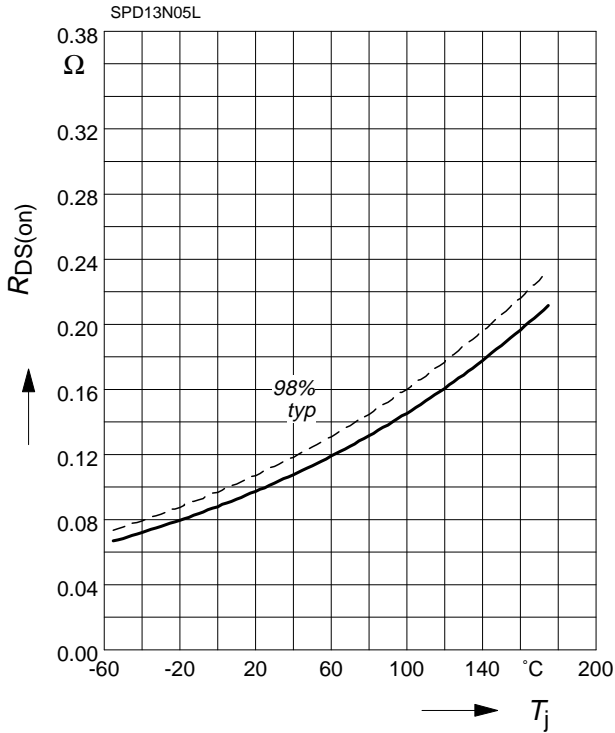
parameter:  $g_{fs}$



**Drain-source on-resistance**

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

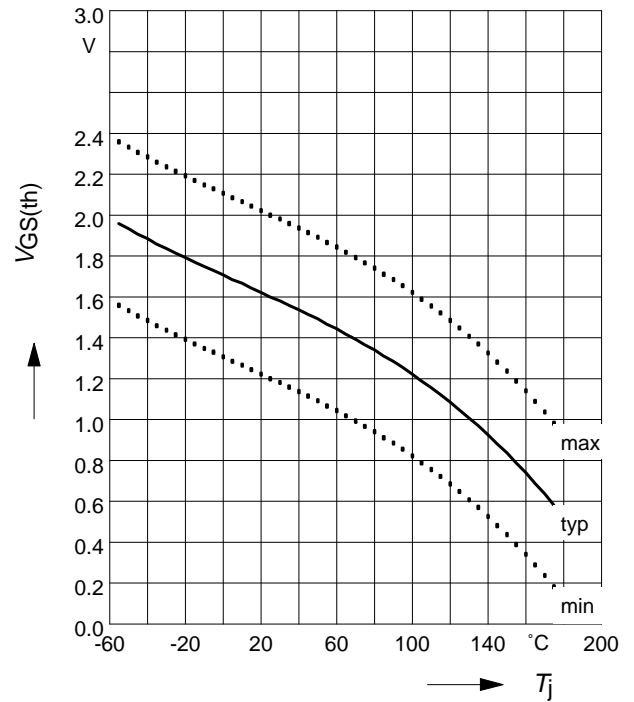
parameter :  $I_D = 8.8 \text{ A}$ ,  $V_{GS} = 4.5 \text{ V}$



**Gate threshold voltage**

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

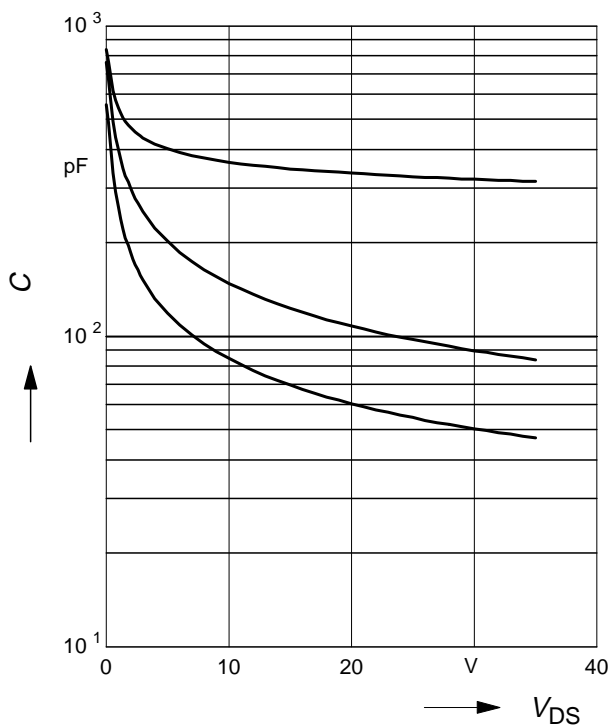
parameter :  $V_{GS} = V_{DS}$ ,  $I_D = 20 \mu\text{A}$



**Typ. capacitances**

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

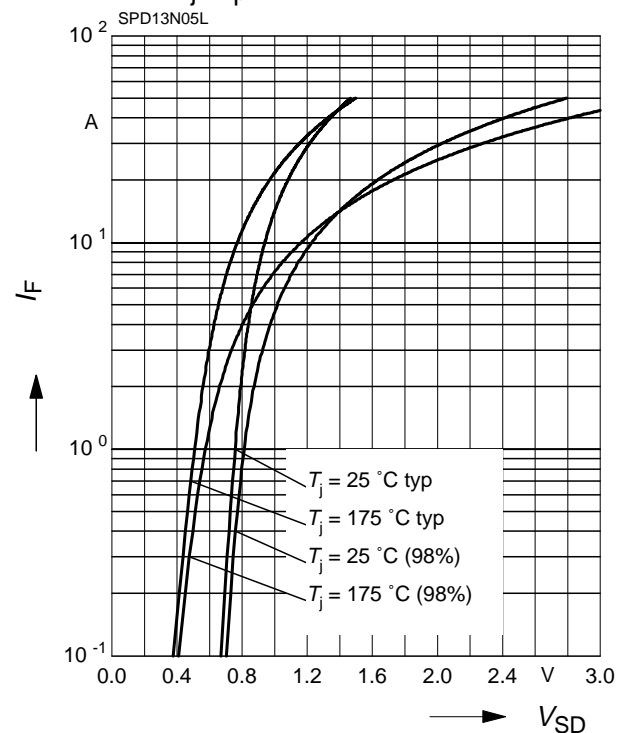
parameter:  $V_{GS} = 0 \text{ V}$ ,  $f = 1 \text{ MHz}$



**Forward characteristics of reverse diode**

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

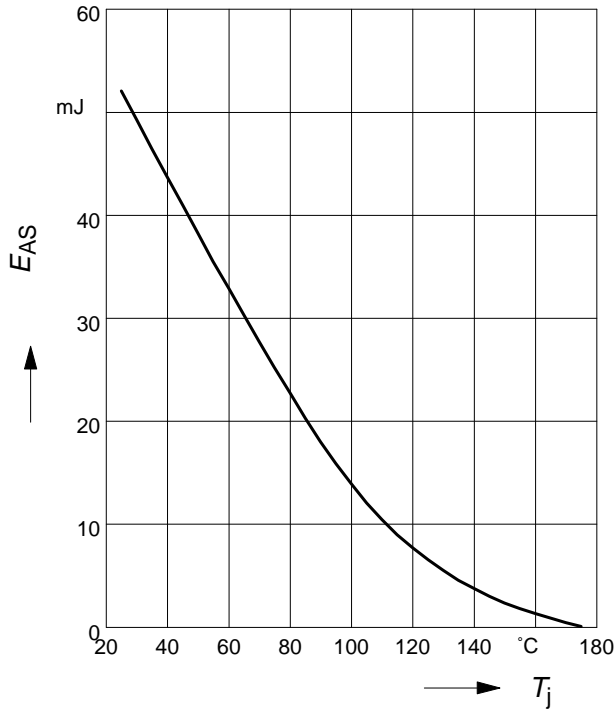
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



**Avalanche Energy  $E_{AS} = f(T_j)$**

parameter:  $I_D = 12.5\text{ A}$ ,  $V_{DD} = 25\text{ V}$

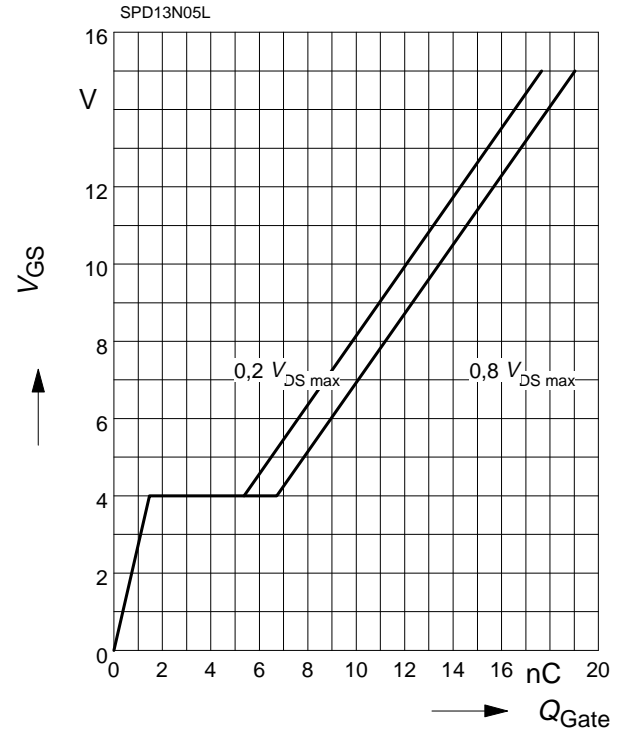
$R_{GS} = 25\ \Omega$



**Typ. gate charge**

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

parameter:  $I_{D\text{ puls}} = 12.5\text{ A}$



**Drain-source breakdown voltage**

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

