

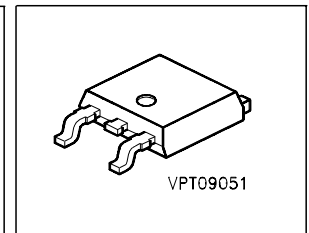
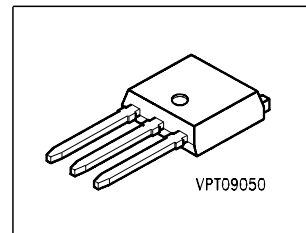
SIPMOS® Power Transistor

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	$R_{DS(on)}$	0.04	Ω
Continuous drain current	I_D	20	A



Type	Package	Ordering Code	Packaging	Pin 1	Pin 2	Pin 3
SPD21N05L	P-TO252	Q67040-S4137	Tape and Reel	G	D	S
SPU21N05L	P-TO251-3-1	Q67040-S4131-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	20 14	A
Pulsed drain current $T_C = 25\text{ °C}$	I_{Dpulse}	80	
Avalanche energy, single pulse $I_D = 20\text{ A}$, $V_{DD} = 25\text{ V}$, $R_{GS} = 25\text{ }\Omega$	E_{AS}	90	mJ
Avalanche energy, periodic limited by T_{jmax}	E_{AR}	5.5	
Reverse diode dv/dt $I_S = 20\text{ A}$, $V_{DS} = 40\text{ V}$, $di/dt = 200\text{ A}/\mu\text{s}$, $T_{jmax} = 175\text{ °C}$	dv/dt	6	kV/ μs
Gate source voltage	V_{GS}	± 20	V
Power dissipation $T_C = 25\text{ °C}$	P_{tot}	55	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}	-	-	2.7	K/W
Thermal resistance, junction - ambient, leded	R_{thJA}	-	-	100	
SMD version, device on PCB:	R_{thJA}				
@ min. footprint		-	-	75	
@ 6 cm ² cooling area ¹⁾		-	-	50	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain- source breakdown voltage $V_{GS} = 0\text{ V}$, $I_D = 0.25\text{ mA}$	$V_{(BR)DSS}$	55	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 40\text{ }\mu\text{A}$	$V_{GS(th)}$	1.2	1.6	2	
Zero gate voltage drain current $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 25\text{ }^\circ\text{C}$ $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$	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 $V_{GS} = 4.5\text{ V}$, $I_D = 14\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 14\text{ A}$	$R_{DS(on)}$	-	0.057	0.07	Ω
		-	0.034	0.04	

¹ Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm 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.	
Dynamic Characteristics					
Transconductance $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 14\text{ A}$	g_{fs}	7	14	-	S
Input capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{iss}	-	560	700	pF
Output capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{oss}	-	170	215	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{rss}	-	95	120	
Turn-on delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 20\text{ A}$, $R_G = 10\text{ }\Omega$	$t_{d(on)}$	-	15	25	ns
Rise time $V_{DD} = 30\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 20\text{ A}$, $R_G = 10\text{ }\Omega$	t_r	-	35	55	
Turn-off delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 20\text{ A}$, $R_G = 10\text{ }\Omega$	$t_{d(off)}$	-	15	25	
Fall time $V_{DD} = 30\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 20\text{ A}$, $R_G = 10\text{ }\Omega$	t_f	-	15	25	

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

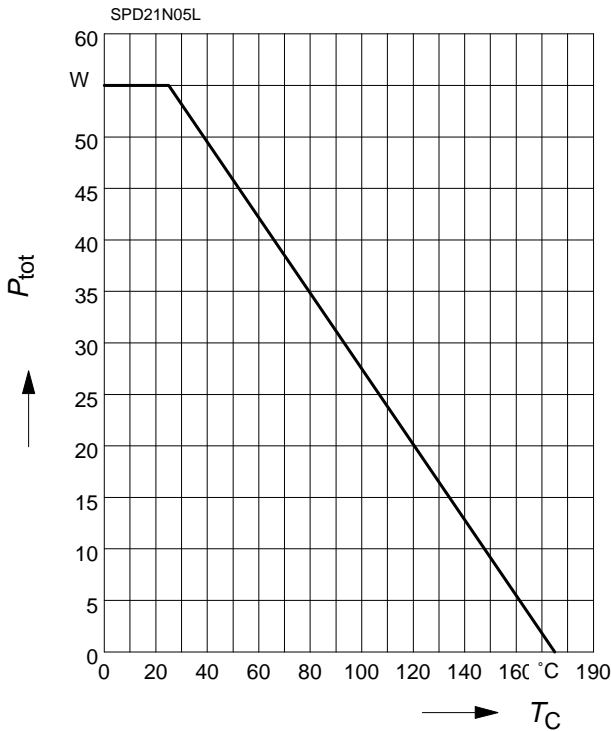
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Gate to source charge $V_{DD} = 40\text{ V}$, $I_D = 20\text{ A}$	Q_{gs}	-	3	4.5	nC
Gate to drain charge $V_{DD} = 40\text{ V}$, $I_D = 20\text{ A}$	Q_{gd}	-	10	15	
Gate charge total $V_{DD} = 40\text{ V}$, $I_D = 20\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$	Q_g	-	24	36	
Gate plateau voltage $V_{DD} = 40\text{ V}$, $I_D = 20\text{ A}$	$V_{(\text{plateau})}$	-	4.06	-	V

Reverse Diode

Inverse diode continuous forward current $T_C = 25\text{ }^\circ\text{C}$	I_S	-	-	20	A
Inverse diode direct current, pulsed $T_C = 25\text{ }^\circ\text{C}$	I_{SM}	-	-	80	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$, $I_F = 40\text{ A}$	V_{SD}	-	1.12	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}	-	0.12	0.18	μC

Power Dissipation

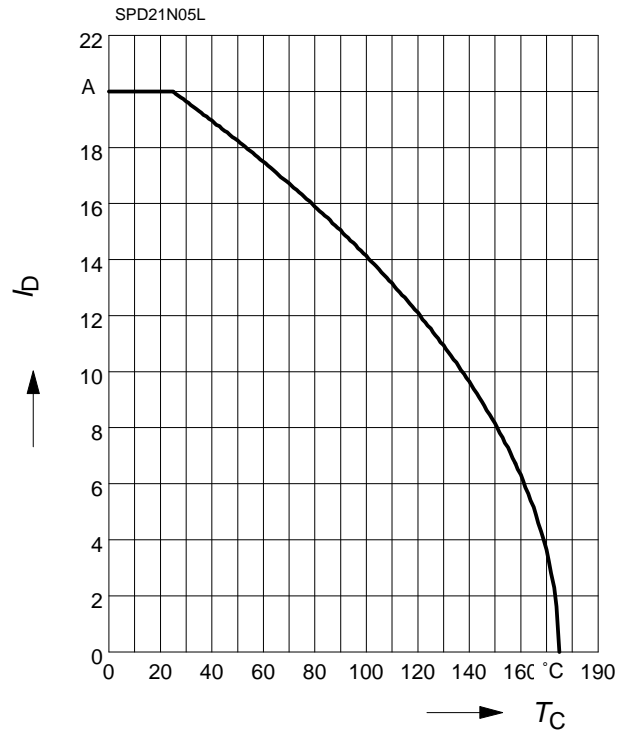
$$P_{tot} = f(T_C)$$



Drain current

$$I_D = f(T_C)$$

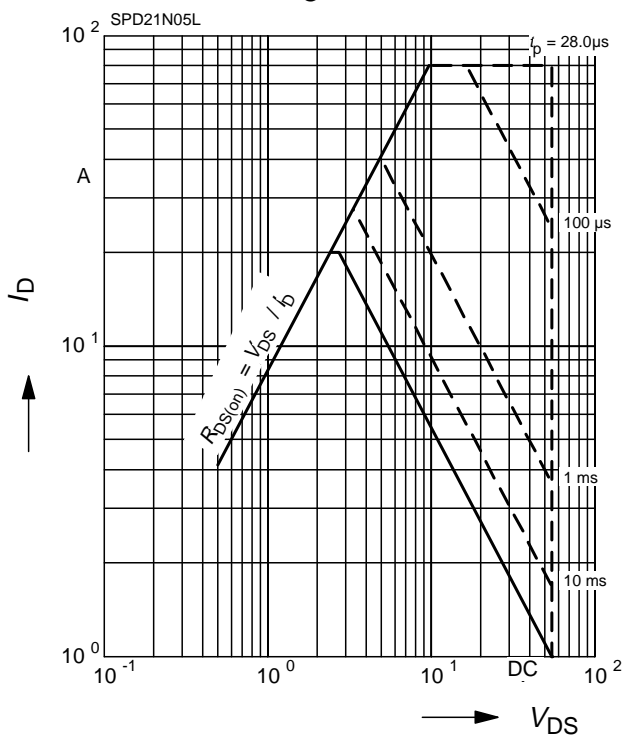
parameter: $V_{GS} \geq 10\text{ V}$



Safe operating area

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

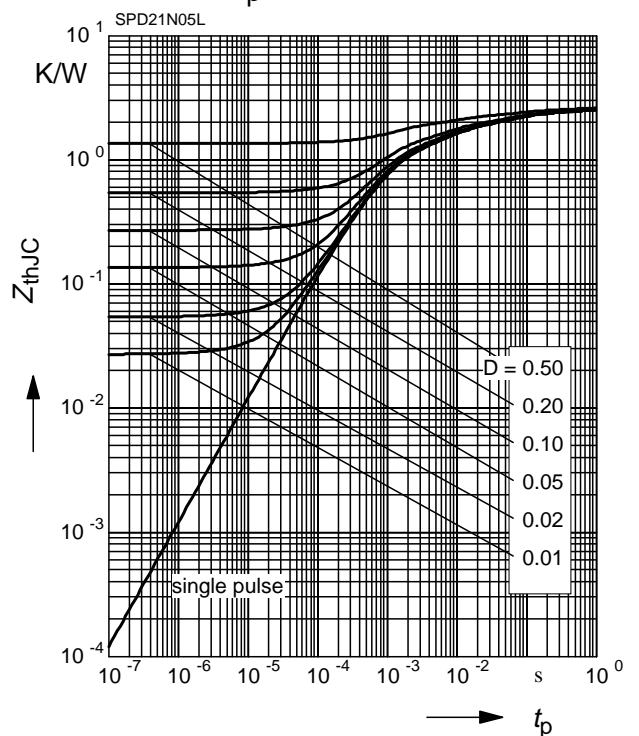
parameter : $D = 0$, $T_C = 25\text{ }^\circ\text{C}$



Transient thermal impedance

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

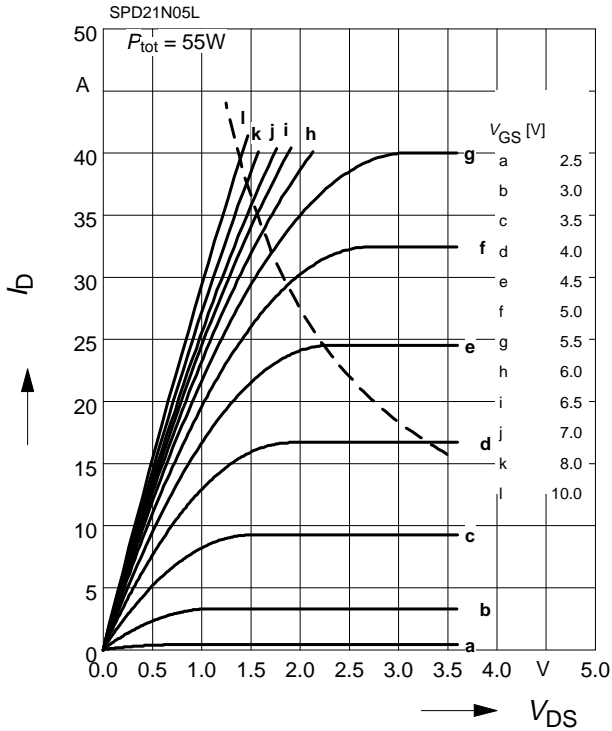
parameter : $D = t_p/T$



Typ. output characteristics

$I_D = f(V_{DS})$

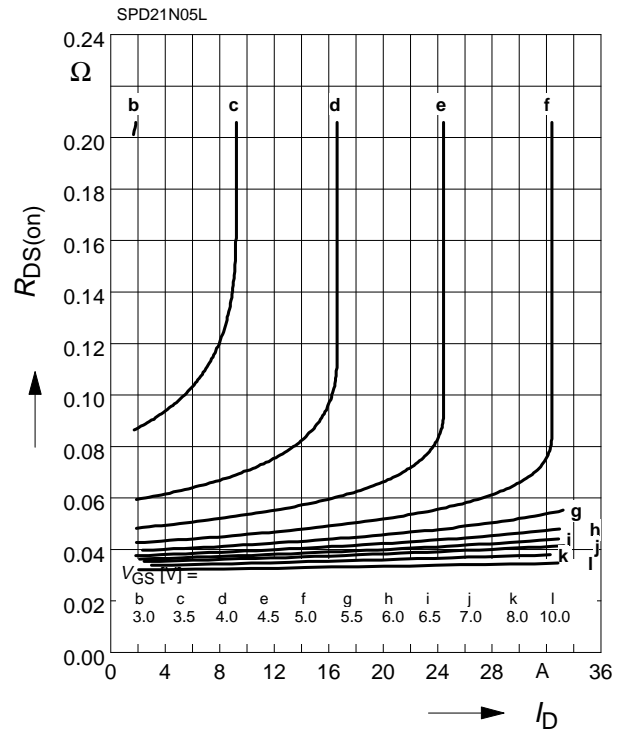
parameter: $t_p = 80 \mu s$



Typ. drain-source-on-resistance

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

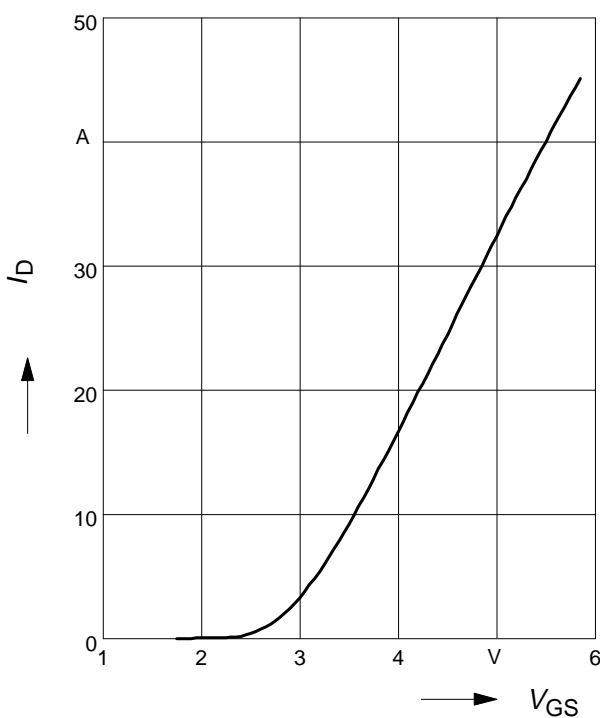
parameter: V_{GS}



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

parameter: $t_p = 80 \mu s$

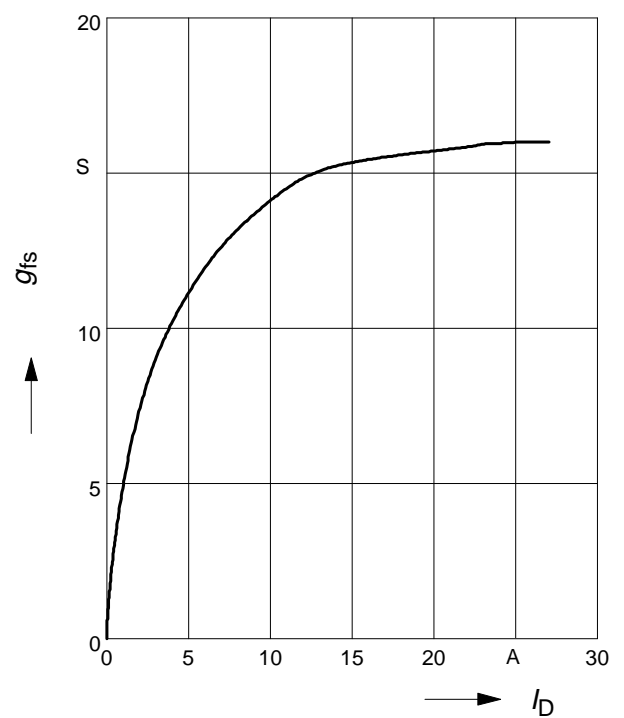
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



Typ. forward transconductance

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

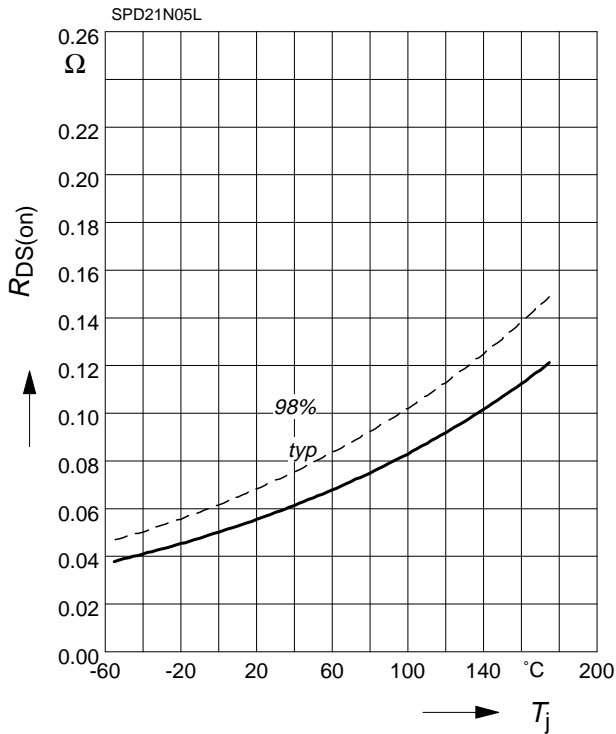
parameter: g_{fs}



Drain-source on-resistance

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

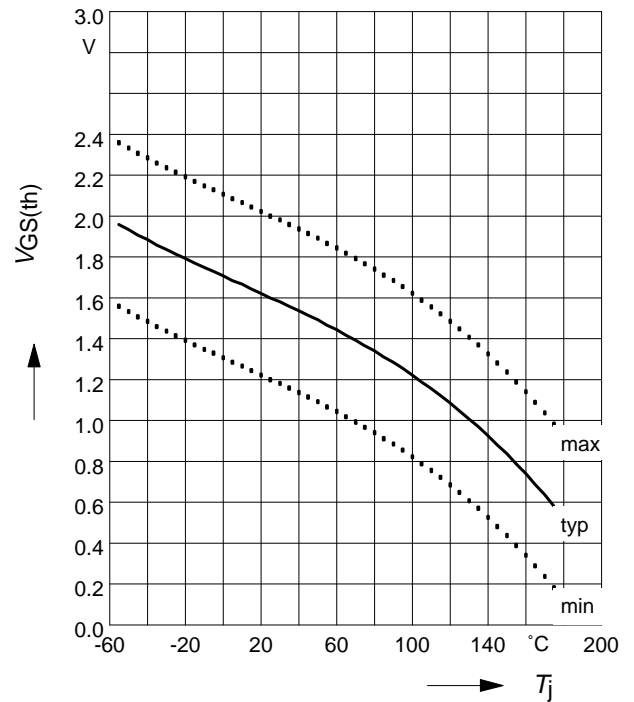
parameter : $I_D = 14 \text{ A}$, $V_{GS} = 4.5 \text{ V}$



Gate threshold voltage

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

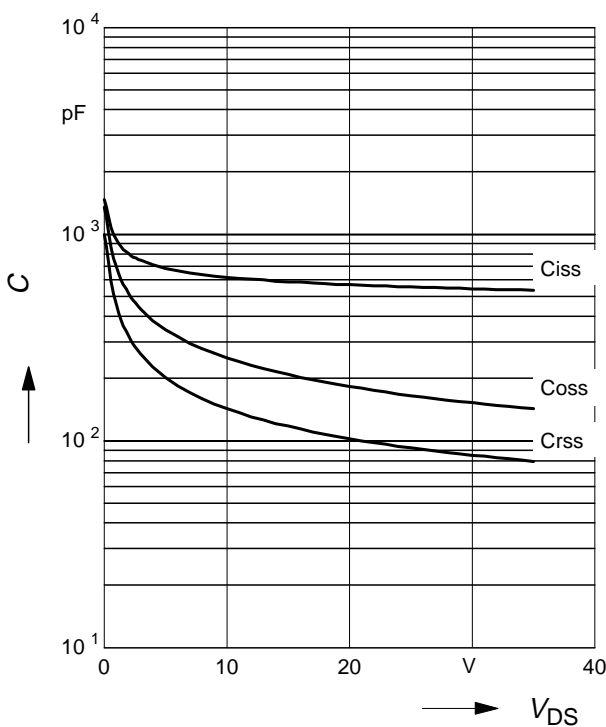
parameter : $V_{GS} = V_{DS}$, $I_D = 40 \mu\text{A}$



Typ. capacitances

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

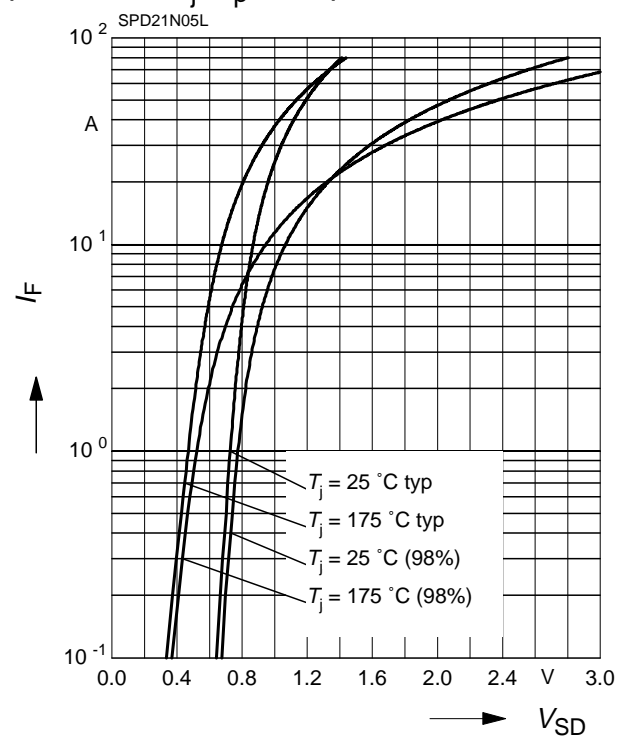
parameter: $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$



Forward characteristics of reverse diode

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

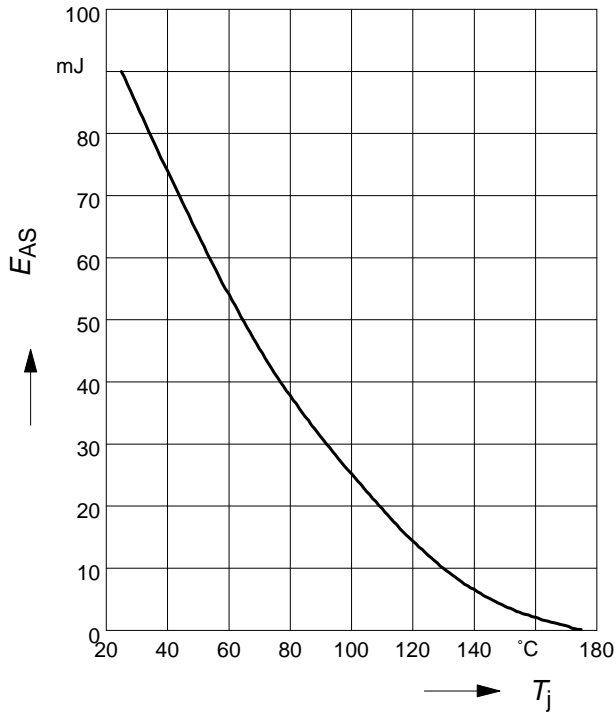
parameter: T_j , $t_p = 80 \mu\text{s}$



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

parameter: $I_D = 20\text{ A}$, $V_{DD} = 25\text{ V}$

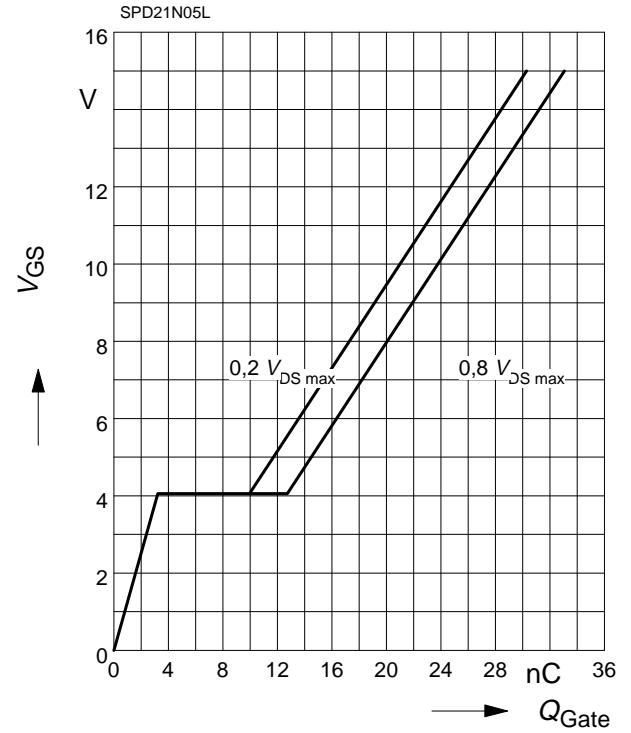
$R_{GS} = 25\ \Omega$



Typ. gate charge

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

parameter: $I_{D\text{ puls}} = 20\text{ A}$



Drain-source breakdown voltage

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

