

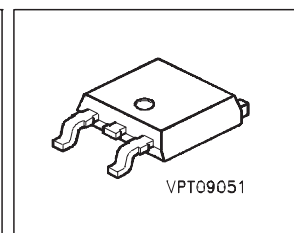
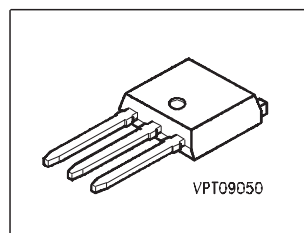
SIPMOS® Power Transistor

Features

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

Product Summary

Drain source voltage	V_{DS}	55	V
Drain-Source on-state resistance	$R_{DS(on)}$	0.036	Ω
Continuous drain current	I_D	31	A



Type	Package	Ordering Code	Packaging	Pin 1	Pin 2	Pin 3
SPD31N05	P-TO252	Q67040-S4121	Tape and Reel	G	D	S
SPU31N05	P-TO251-3-1	Q67040-S4113-A2	Tube			

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

Parameter	Symbol	Value	Unit
Continuous drain current $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	I_D	31 22	A
Pulsed drain current $T_C = 25^\circ\text{C}$	I_{Dpulse}	124	
Avalanche energy, single pulse $I_D = 31\text{ A}$, $V_{DD} = 25\text{ V}$, $R_{GS} = 25\ \Omega$	E_{AS}	140	mJ
Avalanche energy, periodic limited by T_{jmax}	E_{AR}	7.5	
Reverse diode dv/dt $I_S = 31\text{ A}$, $V_{DS} = 40\text{ V}$, $di/dt = 200\text{ A}/\mu\text{s}$, $T_{jmax} = 175^\circ\text{C}$	dv/dt	6	kV/ μs
Gate source voltage	V_{GS}	± 20	V
Power dissipation $T_C = 25^\circ\text{C}$	P_{tot}	75	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	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 $V_{GS} = 0\text{ V}$, $I_D = 0.25\text{ mA}$, $T_j = 25\text{ }^{\circ}\text{C}$	$V_{(BR)DSS}$	55	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 50\text{ }\mu\text{A}$	$V_{GS(th)}$	2.1	3	4	
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 -	1 100	μA
Gate-source leakage current $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	-	10	100	
Drain-Source on-state resistance $V_{GS} = 10\text{ V}$, $I_D = 22\text{ A}$	$R_{DS(on)}$	-	0.03	0.036	Ω

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 $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 22\text{ A}$	g_{fs}	10	15	-	S
Input capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{iss}	-	720	900	pF
Output capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{oss}	-	230	300	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{rss}	-	125	160	
Turn-on delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 31\text{ A}$, $R_G = 13\text{ }\Omega$	$t_{d(on)}$	-	10	15	ns
Rise time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 31\text{ A}$, $R_G = 13\text{ }\Omega$	t_r	-	25	40	
Turn-off delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 31\text{ A}$, $R_G = 13\text{ }\Omega$	$t_{d(off)}$	-	25	40	
Fall time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 31\text{ A}$, $R_G = 13\text{ }\Omega$	t_f	-	20	30	

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

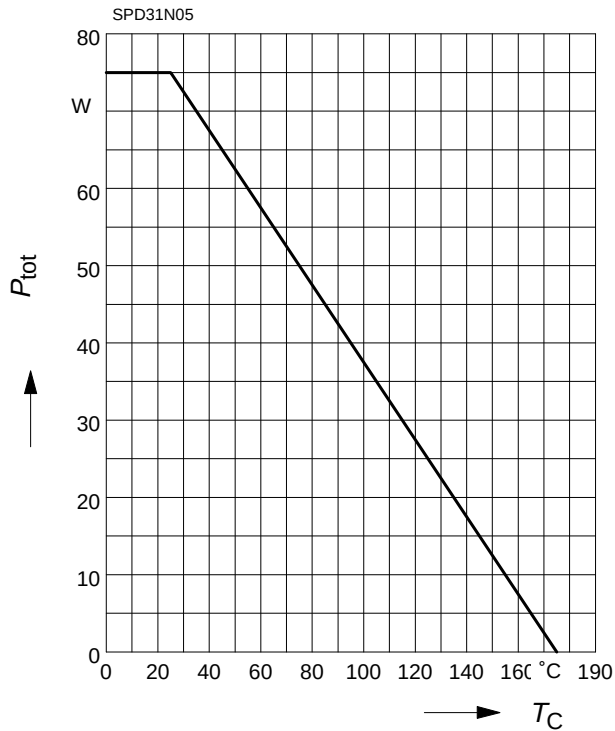
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Gate to source charge $V_{DD} = 40\text{ V}$, $I_D = 31\text{ A}$	Q_{gs}	-	4	6	nC
Gate to drain charge $V_{DD} = 40\text{ V}$, $I_D = 31\text{ A}$	Q_{gd}	-	13.6	20.4	
Gate charge total $V_{DD} = 40\text{ V}$, $I_D = 31\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$	Q_g	-	25	40	
Gate plateau voltage $V_{DD} = 40\text{ V}$, $I_D = 31\text{ A}$	$V_{(\text{plateau})}$	-	5.9	-	V

Reverse Diode

Inverse diode continuous forward current $T_C = 25\text{ }^{\circ}\text{C}$	I_S	-	-	31	A
Inverse diode direct current, pulsed $T_C = 25\text{ }^{\circ}\text{C}$	I_{SM}	-	-	124	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$, $I_F = 62\text{ A}$	V_{SD}	-	1.2	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}	-	55	85	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	μC

Power Dissipation

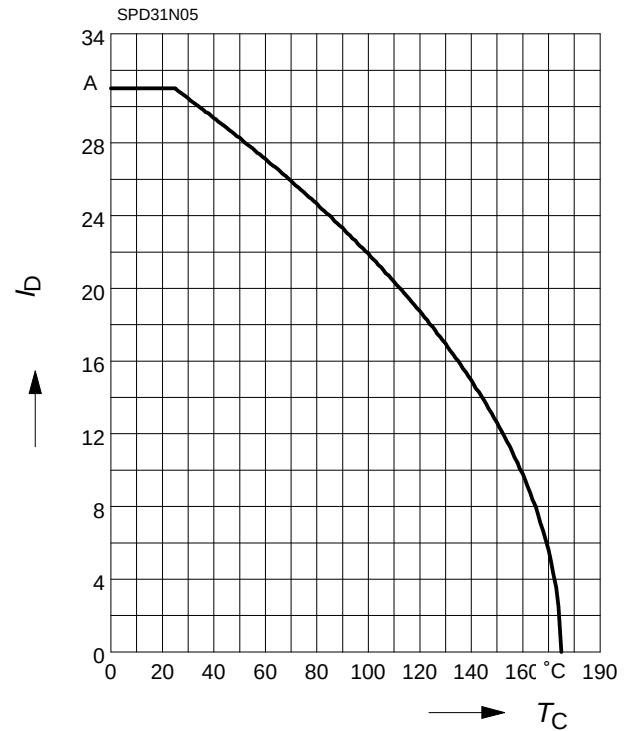
$$P_{\text{tot}} = f(T_C)$$



Drain current

$$I_D = f(T_C)$$

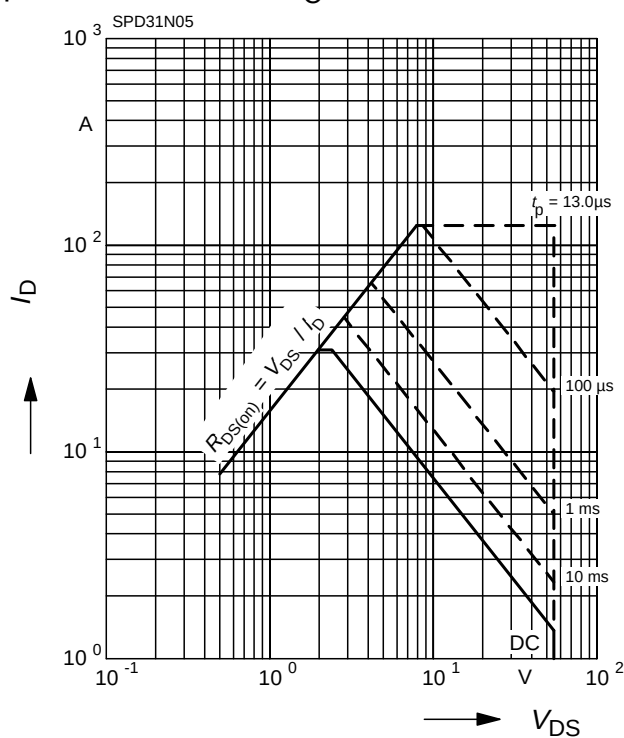
parameter: $V_{GS} \geq 10 \text{ V}$



Safe operating area

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

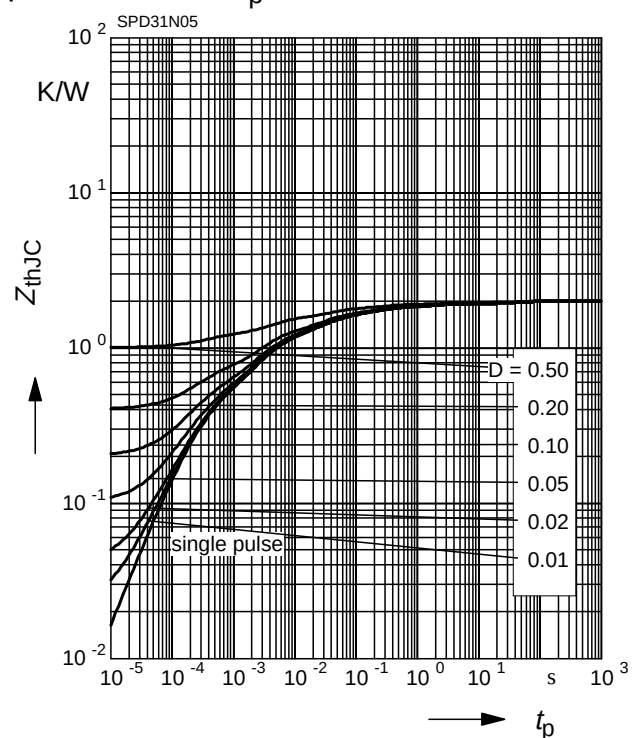
parameter : $D = 0$, $T_C = 25^\circ\text{C}$



Transient thermal impedance

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

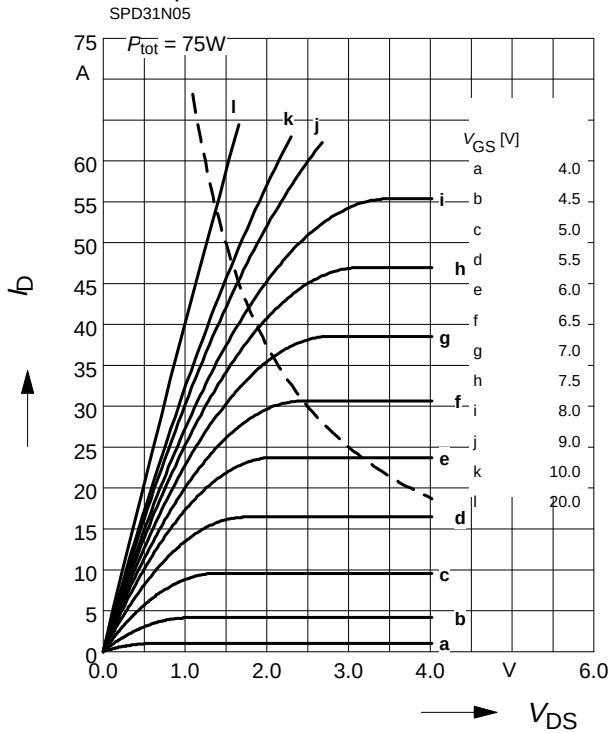
parameter : $D = t_p / T$



Typ. output characteristics

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

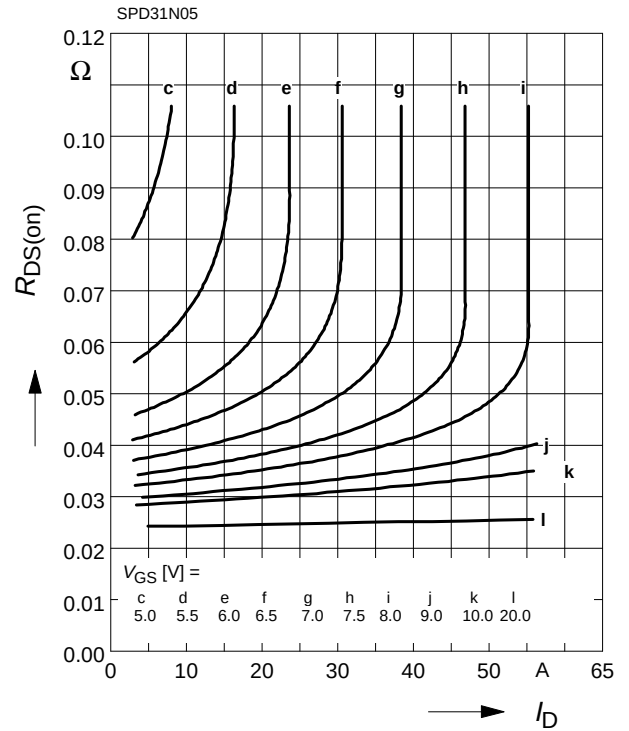
parameter: $t_p = 80 \mu s$



Typ. drain-source-on-resistance

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

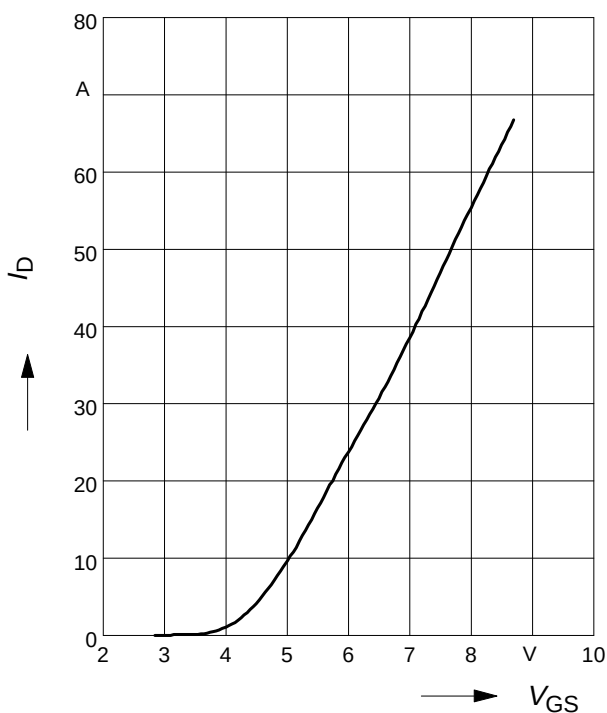
parameter: V_{GS}



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

parameter: $t_p = 80 \mu s$

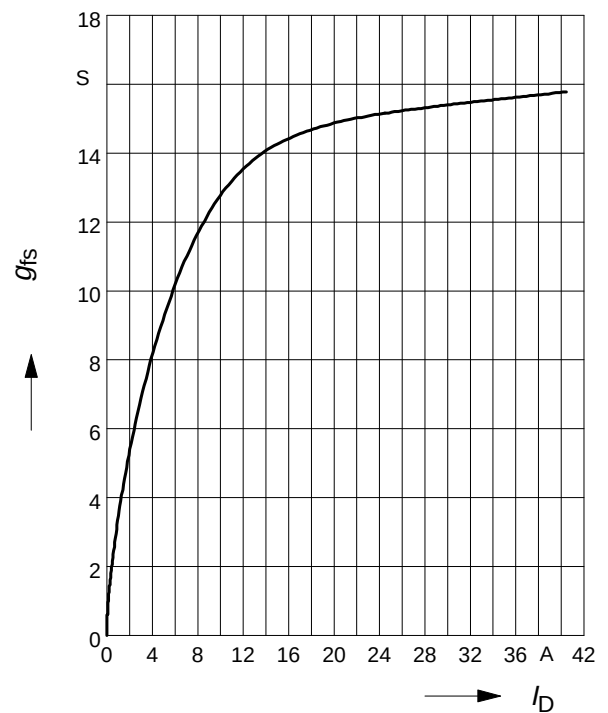
$V_{DS} \geq 2 \times I_D \times R_{DS(on)} \max$



Typ. forward transconductance

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

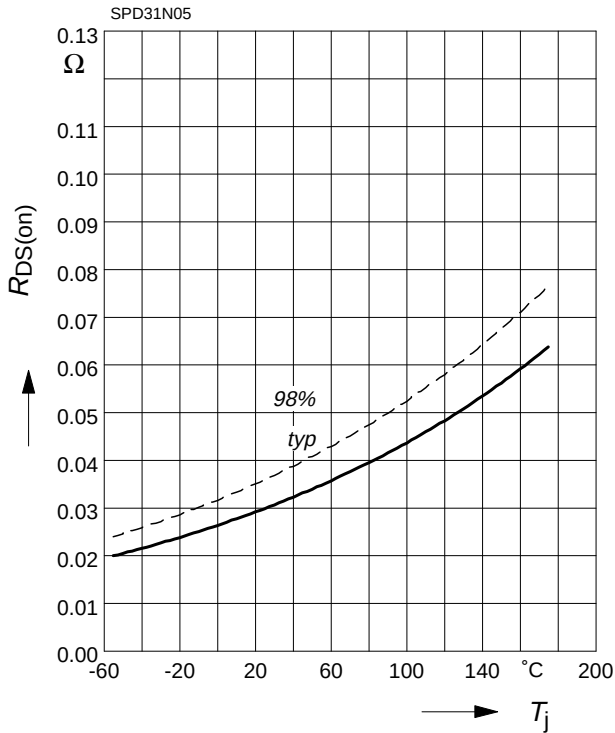
parameter: g_{fs}



Drain-source on-resistance

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

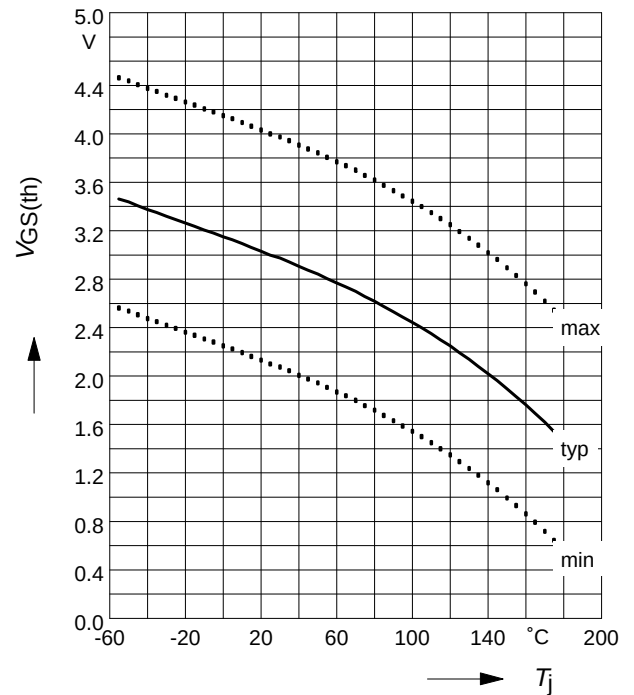
parameter : $I_D = 22\text{ A}$, $V_{GS} = 10\text{ V}$



Gate threshold voltage

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

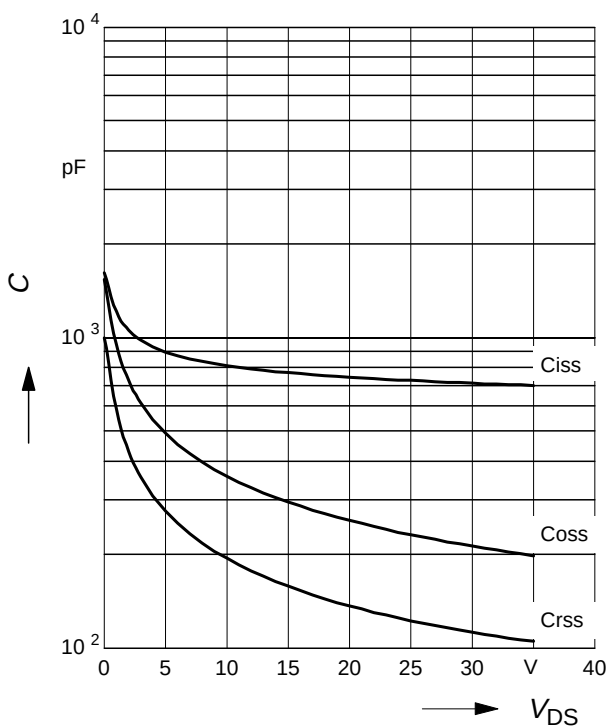
parameter : $V_{GS} = V_{DS}$, $I_D = 50\text{ }\mu\text{A}$



Typ. capacitances

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

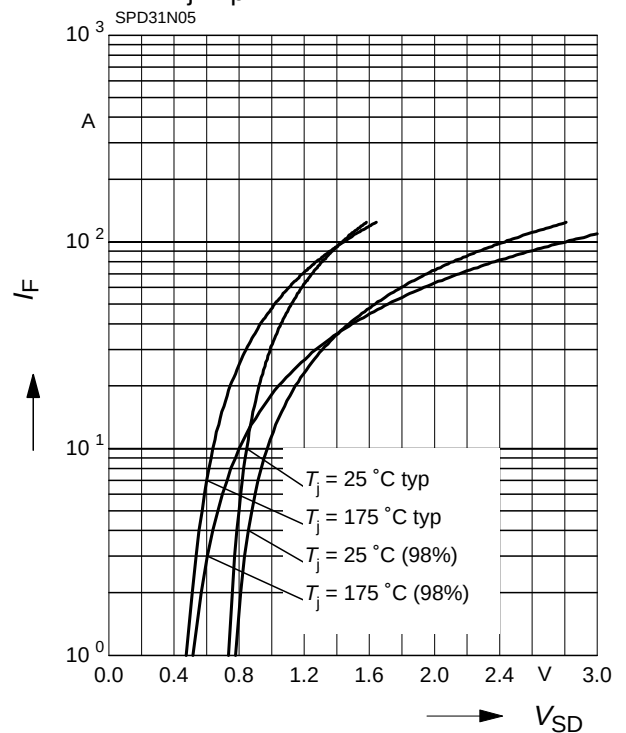
parameter: $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$



Forward characteristics of reverse diode

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

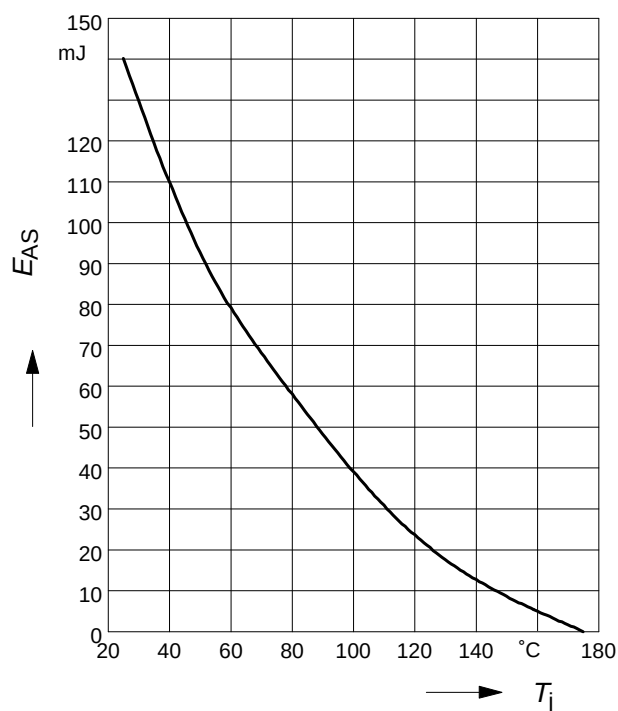
parameter: T_j , $t_p = 80\text{ }\mu\text{s}$



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

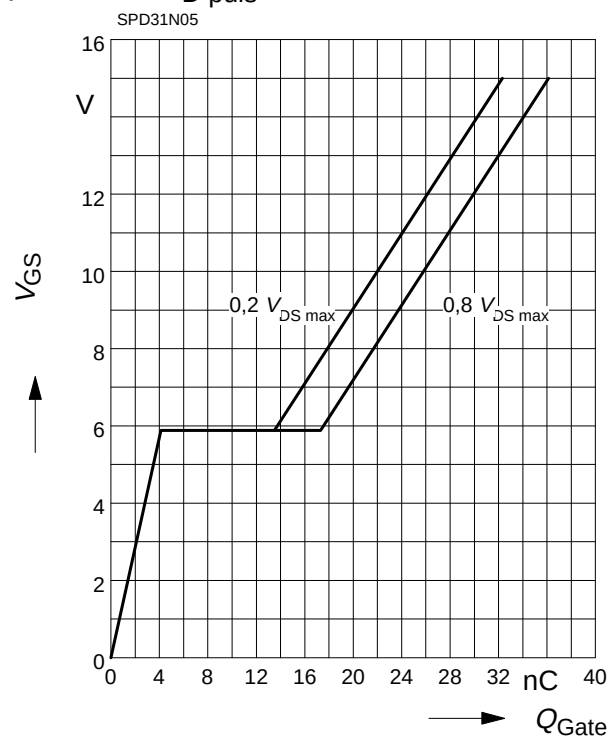
parameter: $I_D = 31\text{ A}$, $V_{DD} = 25\text{ V}$

$R_{GS} = 25\ \Omega$


Typ. gate charge

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

parameter: $I_{D\text{ puls}} = 31\text{ A}$


Drain-source breakdown voltage

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

