

SIPMOS® Power-Transistor

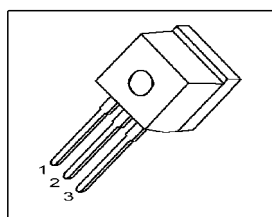
Feature

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

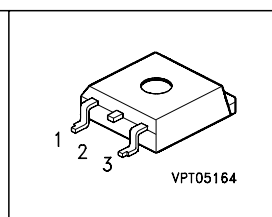
Product Summary

V_{DS}	100	V
$R_{DS(on)}$	80	mΩ
I_D	21	A

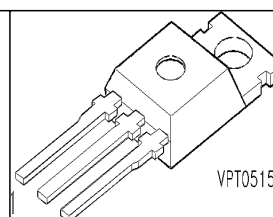
P-TO262-3-1



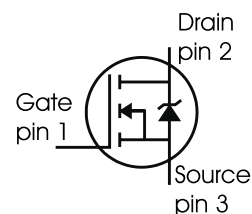
P-TO263-3-2



P-TO220-3-1



Type	Package	Ordering Code	Marking
SPP21N10	P-TO220-3-1	Q67042-S4116	21N10
SPB21N10	P-TO263-3-2	Q67042-S4102	21N10
SPI21N10	P-TO262-3-1	Q67042-S4117	21N10



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

Parameter	Symbol	Value	Unit
Continuous drain current	I_D	21	A
$T_C = 25^\circ\text{C}$		15.0	
$T_C = 100^\circ\text{C}$			
Pulsed drain current	$I_{D \text{ puls}}$	84	
$T_C = 25^\circ\text{C}$			
Avalanche energy, single pulse	E_{AS}	130	mJ
$I_D = 21 \text{ A}$, $V_{DD} = 25 \text{ V}$, $R_{GS} = 25 \Omega$			
Reverse diode dv/dt	dv/dt	6	kV/μs
$I_S = 21 \text{ A}$, $V_{DS} = 80 \text{ V}$, $di/dt = 200 \text{ A}/\mu\text{s}$, $T_{j \text{ max}} = 175^\circ\text{C}$			
Gate source voltage	V_{GS}	±20	V
Power dissipation	P_{tot}	90	W
$T_C = 25^\circ\text{C}$			
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.	
Characteristics					
Thermal resistance, junction - case	R_{thJC}	-	-	1.7	K/W
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	-	62	
SMD version, device on PCB:	R_{thJA}				
@ min. footprint		-	-	62	
@ 6 cm ² cooling area ^{F)}		-	-	40	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain-source breakdown voltage $V_{GS}=0V, I_D=1mA$	$V_{(BR)DSS}$	100	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 44 \mu A$	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current $V_{DS}=100V, V_{GS}=0V, T_j=25^{\circ}C$ $V_{DS}=100V, V_{GS}=0V, T_j=125^{\circ}C$	I_{DSS}	- -	0.01 1	1 100	μA
Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$	I_{GSS}	-	1	100	
Drain-source on-state resistance $V_{GS}=10V, I_D=15.0A$	$R_{DS(on)}$	-	65	80	$m\Omega$

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic Characteristics

Transconductance	g_{fs}	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 15.0\text{A}$	6.5	12.4	-	S
Input capacitance	C_{iss}	$V_{GS} = 0\text{V}$, $V_{DS} = 25\text{V}$, $f = 1\text{MHz}$	-	650	865	pF
Output capacitance	C_{oss}		-	140	186	
Reverse transfer capacitance	C_{rss}		-	80	120	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 50\text{V}$, $V_{GS} = 10\text{V}$, $I_D = 21\text{A}$, $R_G = 13\Omega$	-	10	15	ns
Rise time	t_r		-	56	84	
Turn-off delay time	$t_{d(off)}$		-	37	55	
Fall time	t_f		-	23	35	

Gate Charge Characteristics

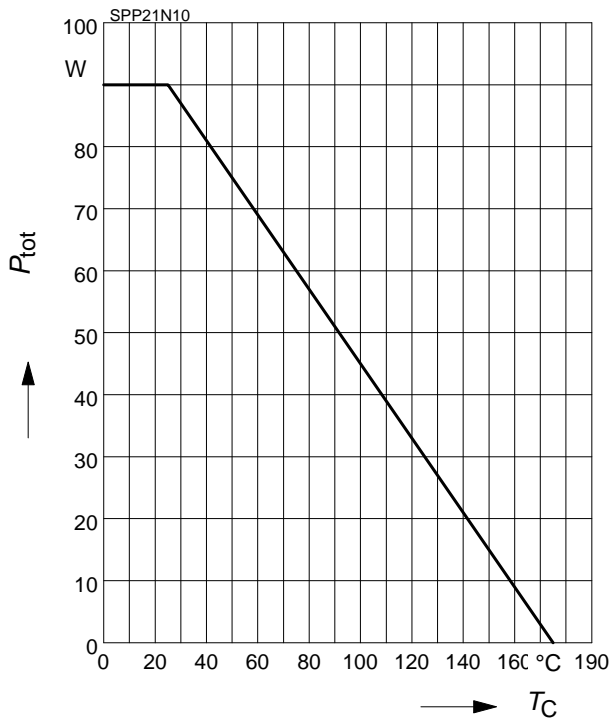
Gate to source charge	Q_{gs}	$V_{DD} = 80\text{V}$, $I_D = 21\text{A}$	-	3.9	5.2	nC
Gate to drain charge	Q_{gd}		-	15.5	23.3	
Gate charge total	Q_g	$V_{DD} = 80\text{V}$, $I_D = 21\text{A}$, $V_{GS} = 0 \text{ to } 10\text{V}$	-	28.9	38.4	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 80\text{V}$, $I_D = 21\text{A}$	-	6.2	-	V

Reverse Diode

Inverse diode continuous forward current	I_S	$T_C = 25^\circ\text{C}$	-	-	21	A
Inverse diode direct current, pulsed	I_{SM}		-	-	84	
Inverse diode forward voltage	V_{SD}	$V_{GS} = 0\text{V}$, $I_F = 21\text{A}$	-	0.94	1.25	V
Reverse recovery time	t_{rr}	$V_R = 50\text{V}$, $I_F = I_S$, $di/dt = 100\text{A}/\mu\text{s}$	-	65	81.5	ns
Reverse recovery charge	Q_{rr}		-	153	192	nC

1 Power dissipation

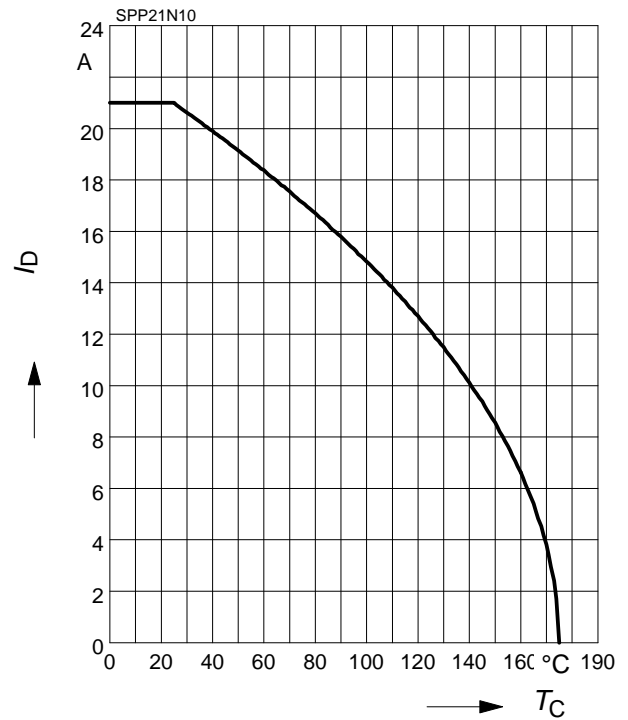
$$P_{\text{tot}} = f(T_C)$$



2 Drain current

$$I_D = f(T_C)$$

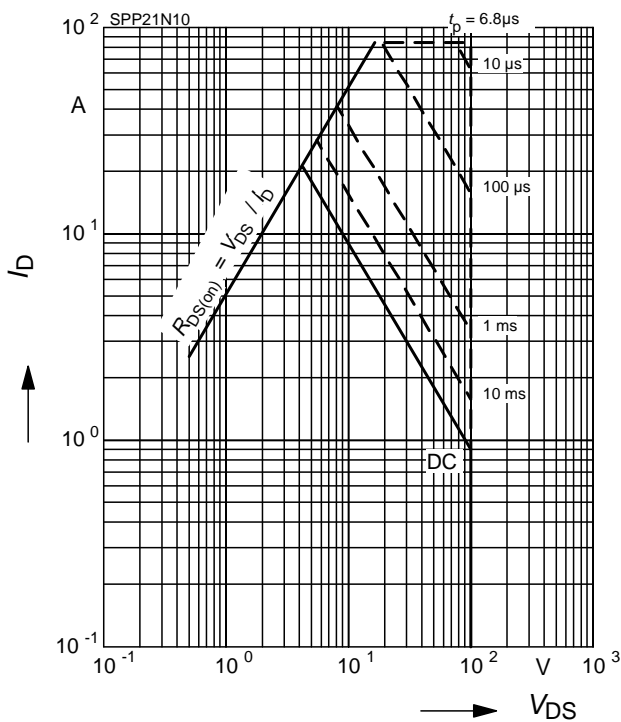
parameter: $V_{GS} \geq 10$ V



3 Safe operating area

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

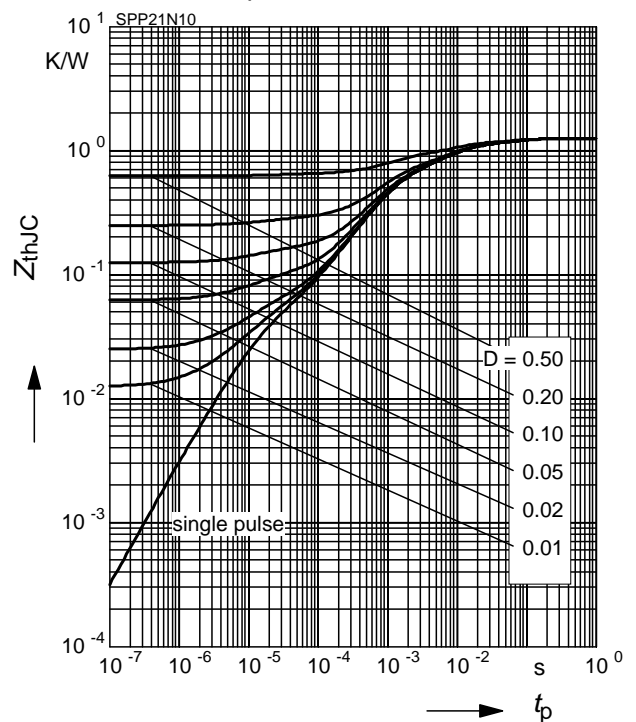
parameter: $D = 0$, $T_C = 25$ °C



4 Transient thermal impedance

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

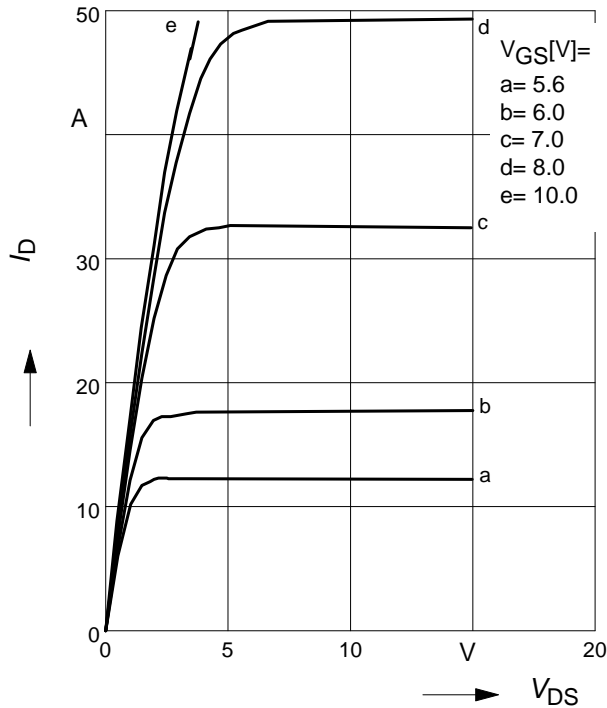
parameter: $D = t_p / T$



5 Typ. output characteristic

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

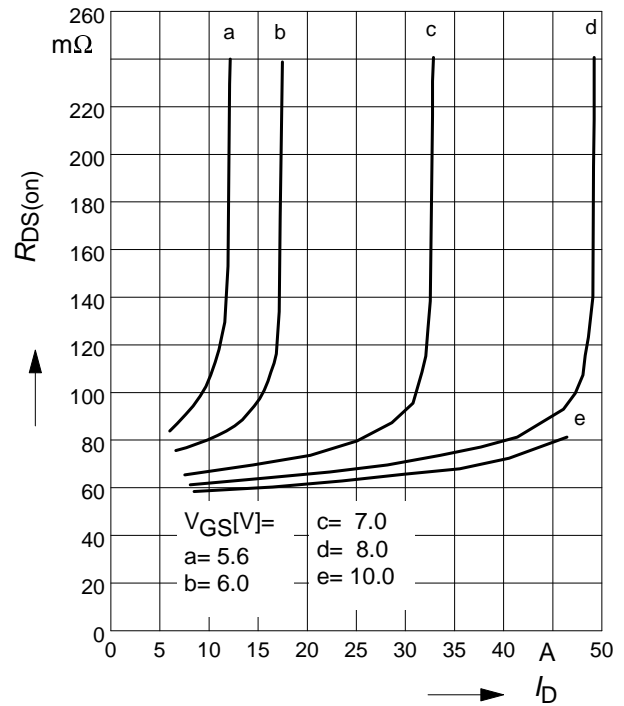
parameter: $t_p = 80 \mu\text{s}$



6 Typ. drain-source on resistance

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

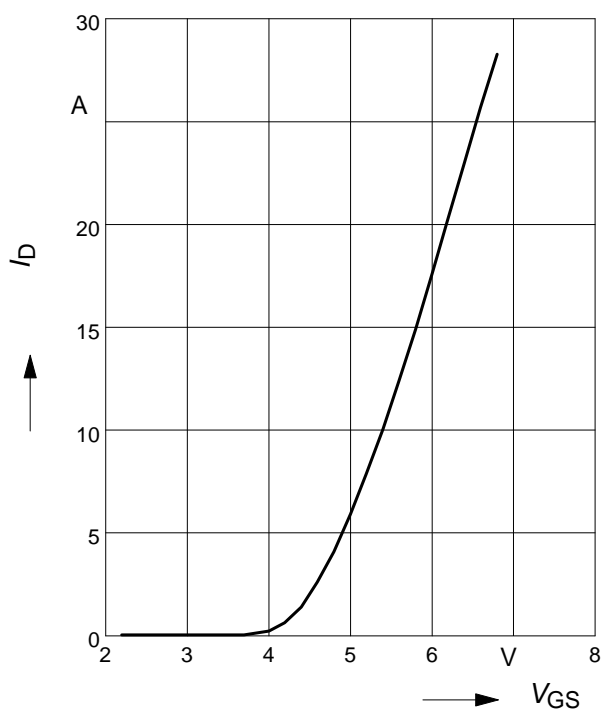
parameter: V_{GS}



7 Typ. transfer characteristics

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

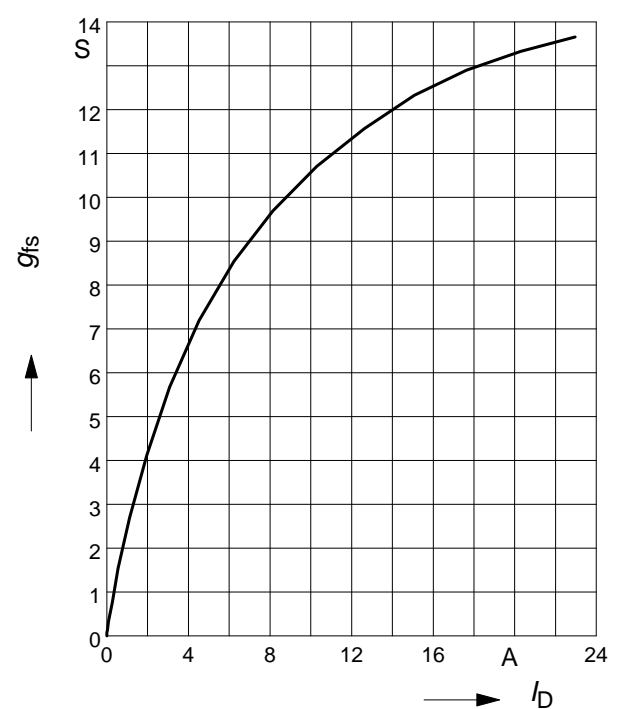
parameter: $t_p = 80 \mu\text{s}$



8 Typ. forward transconductance

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

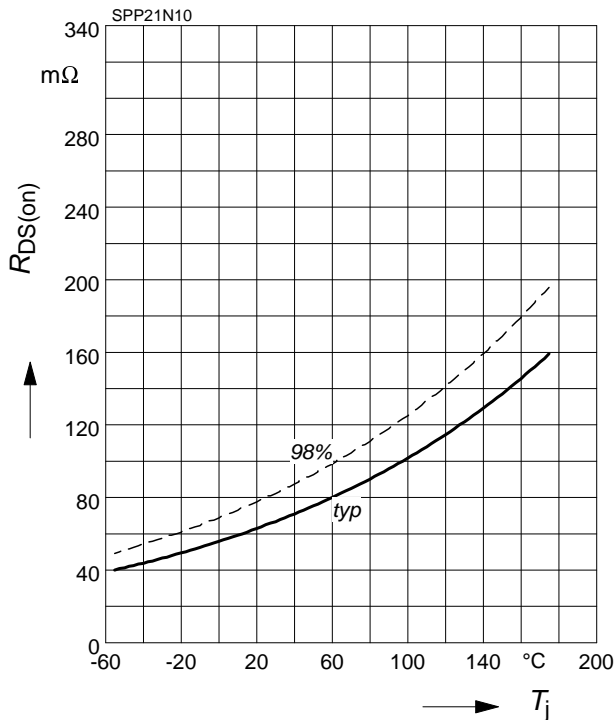
parameter: g_{fs}



9 Drain-source on-state resistance

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

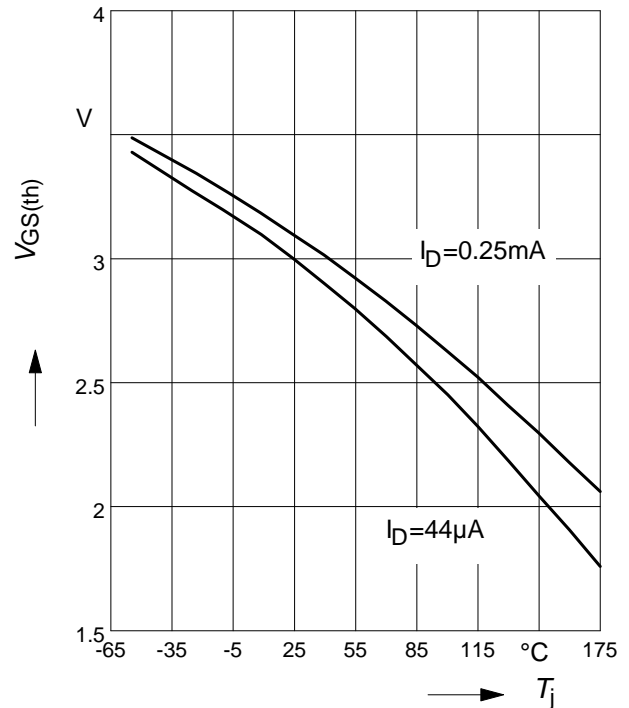
parameter: $I_D = 15.0 \text{ A}$, $V_{GS} = 10 \text{ V}$



10 Typ. gate threshold voltage

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

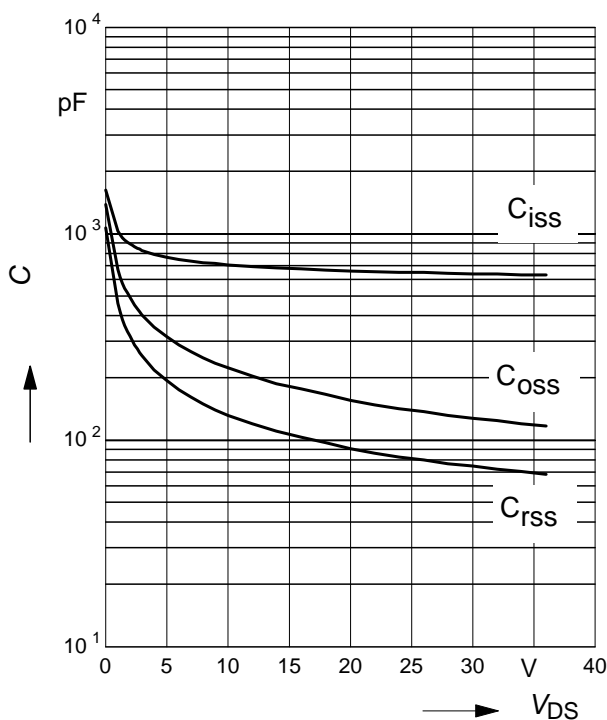
parameter: $V_{GS} = V_{DS}$



11 Typ. capacitances

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

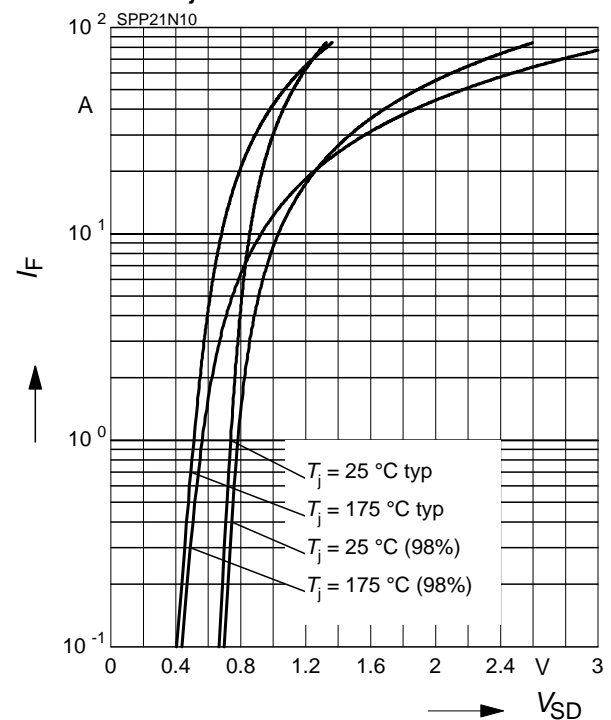
parameter: $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$



12 Forward character. of reverse diode

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

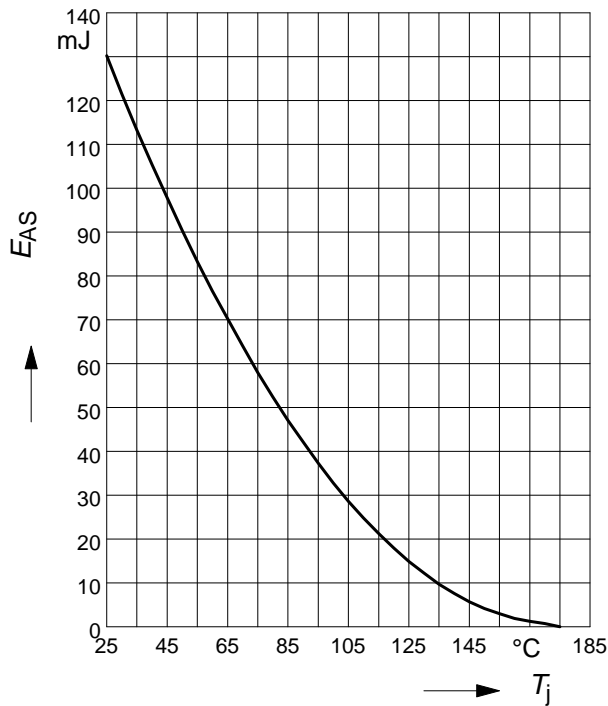
parameter: T_j , $t_p = 80 \mu\text{s}$



13 Typ. avalanche energy

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

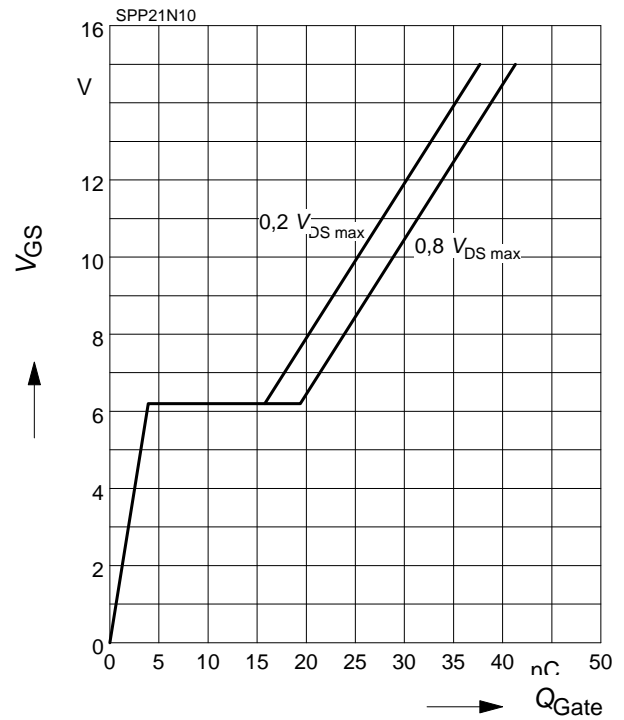
par.: $I_D = 21\text{ A}$, $V_{DD} = 25\text{ V}$, $R_{GS} = 25\ \Omega$



14 Typ. gate charge

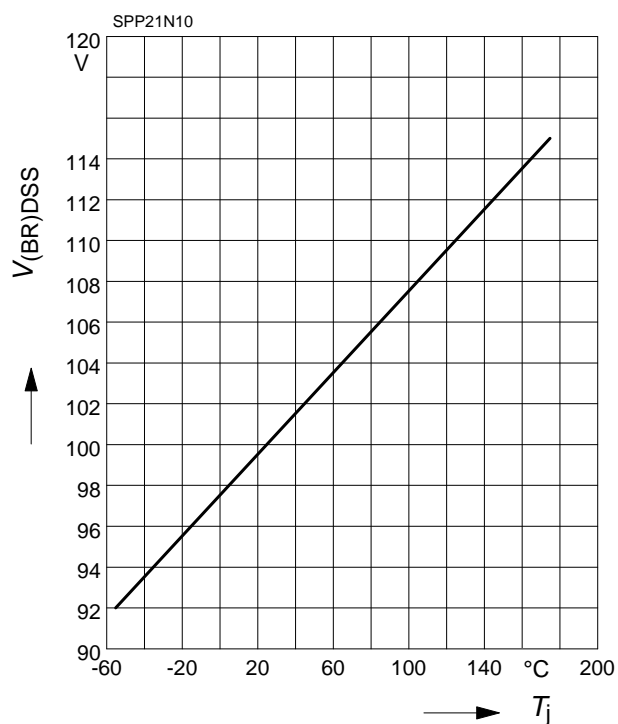
$$V_{GS} = f(Q_{Gate})$$

parameter: $I_D = 21\text{ A}$ pulsed



15 Drain-source breakdown voltage

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



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