



# THE DATASHEET OF SPB21N10



## SIPMOS® Power-Transistor

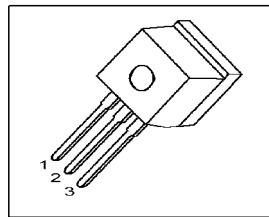
### Feature

- Pb-free, RoHS compliant
- N-Channel, Enhancement mode
- 175°C operating temperature
- Avalanche rated
- dv/dt rated

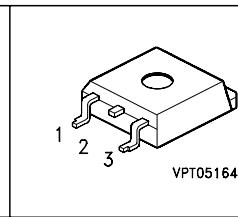
### Product Summary

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

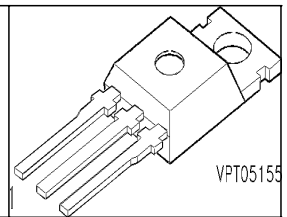
PG-TO262-3-1



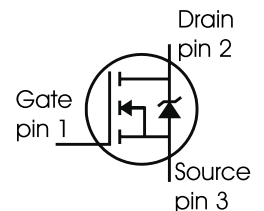
PG-TO263-3-2



PG-TO220-3-1



Type	Package	Marking
SPP21N10	PG-TO220-3-1	21N10
SPB21N10	PG-TO263-3-2	21N10
SPI21N10	PG-TO262-3-1	21N10



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

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

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Static Characteristics</b>					
Drain-source breakdown voltage $V_{GS}=0V, I_D=1mA$	$V_{(BR)DSS}$	100	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 44\text{ }\mu A$	$V_{GS(th)}$	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	$\mu A$
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 $\Omega$

<sup>1</sup>Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu m$  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.	

**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**

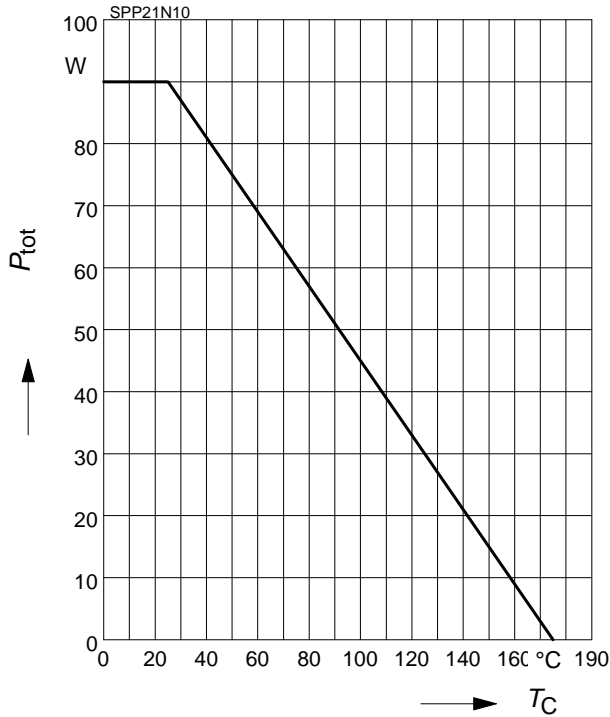
Gate to source charge	$Q_{gs}$	$V_{DD} = 80\text{V}$ , $I_D = 21\text{A}$	-	3.9	5.2	nC
Gate to drain charge	$Q_{gd}$		-	15.5	23.3	
Gate charge total	$Q_g$	$V_{DD} = 80\text{V}$ , $I_D = 21\text{A}$ , $V_{GS} = 0$ to $10\text{V}$	-	28.9	38.4	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 80\text{V}$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

**Reverse Diode**

Inverse diode continuous forward current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	-	-	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

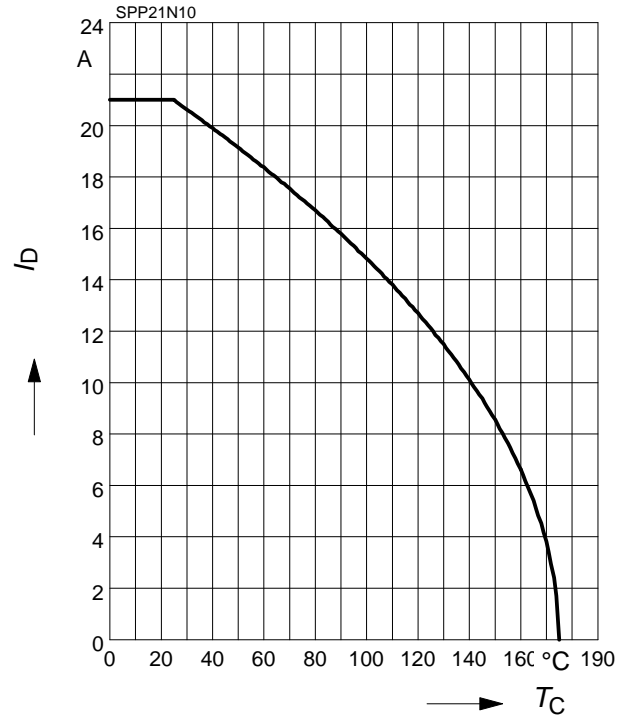
$$P_{tot} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

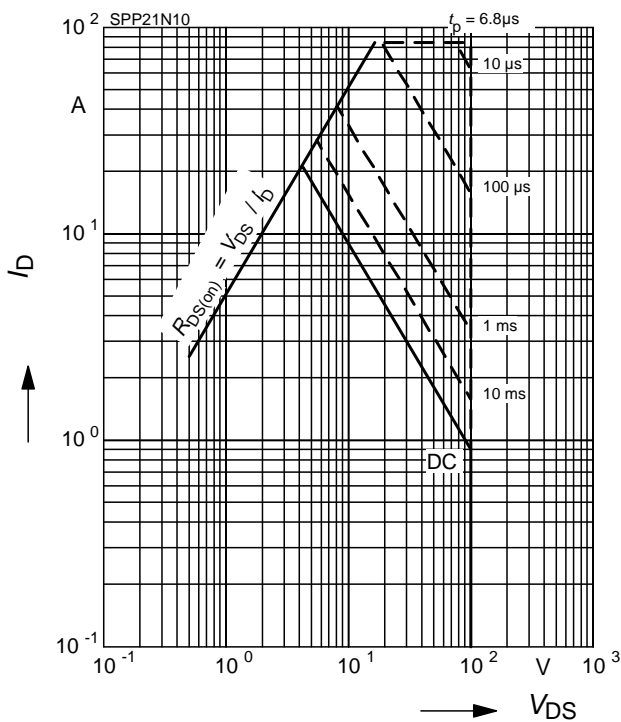
parameter:  $V_{GS} \geq 10 \text{ V}$



### 3 Safe operating area

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

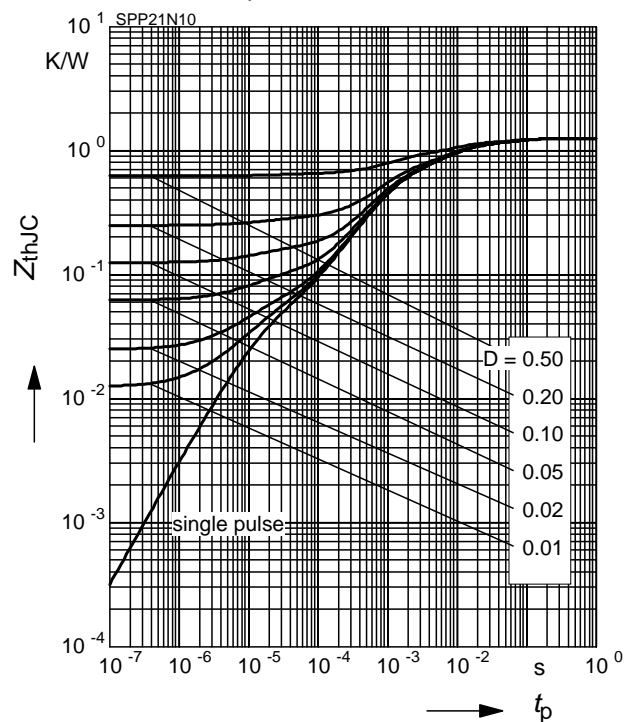
parameter:  $D = 0$ ,  $T_C = 25 \text{ °C}$



### 4 Transient thermal impedance

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

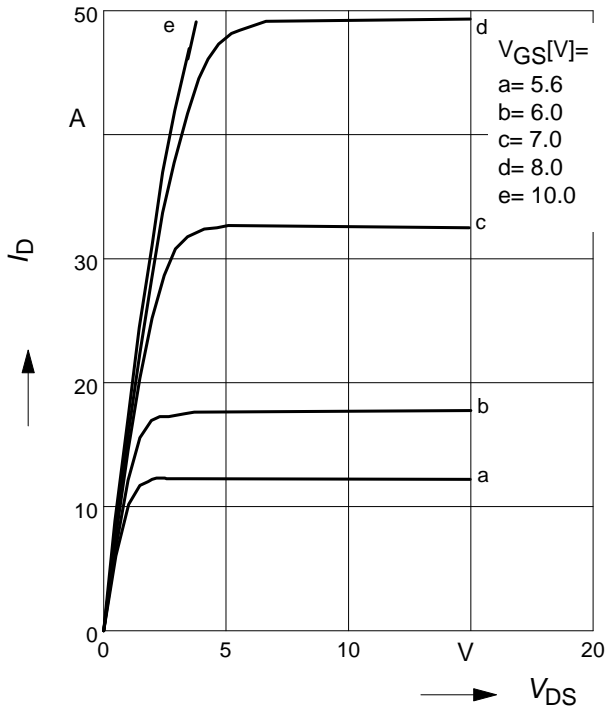
parameter:  $D = t_p/T$



### 5 Typ. output characteristic

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

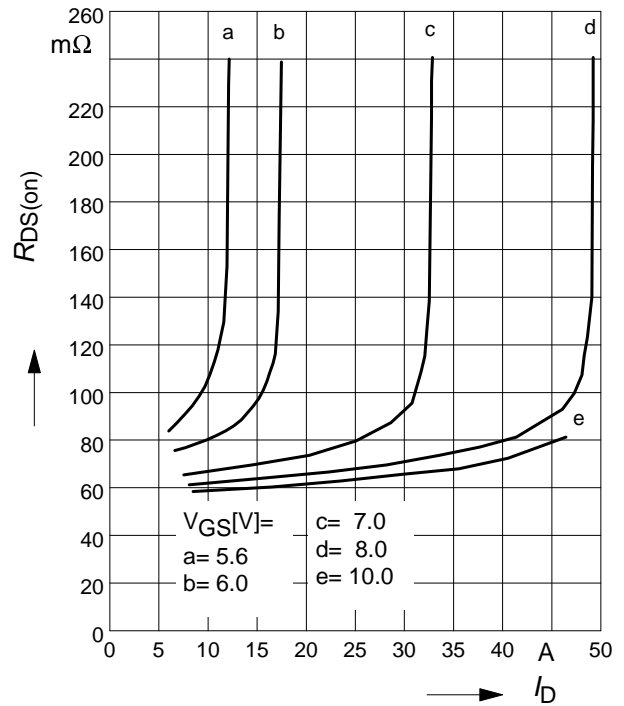
parameter:  $t_p = 80 \mu\text{s}$



### 6 Typ. drain-source on resistance

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

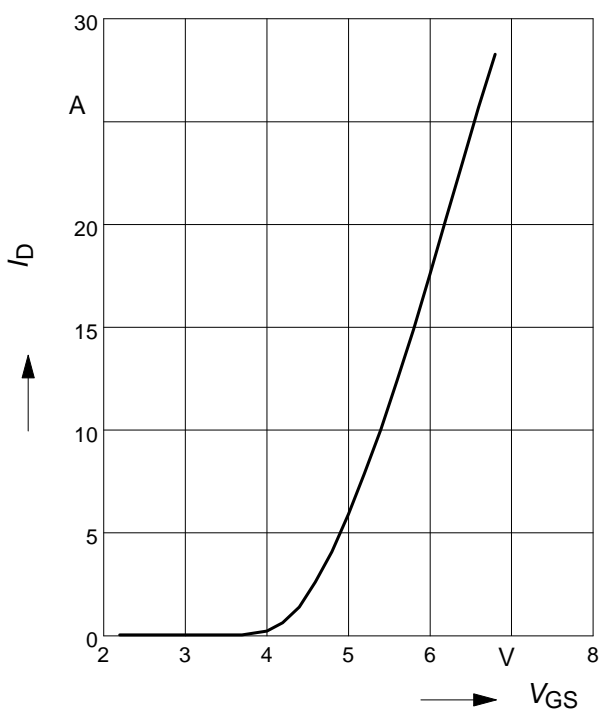
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

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

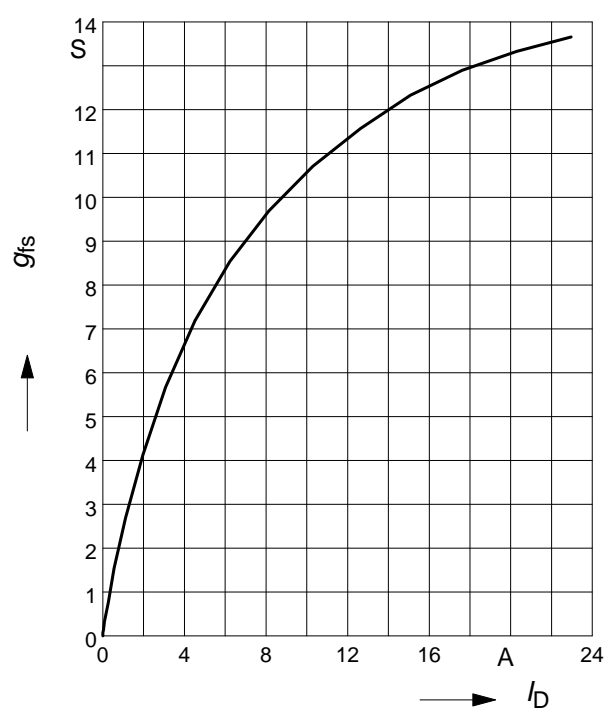
parameter:  $t_p = 80 \mu\text{s}$



### 8 Typ. forward transconductance

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

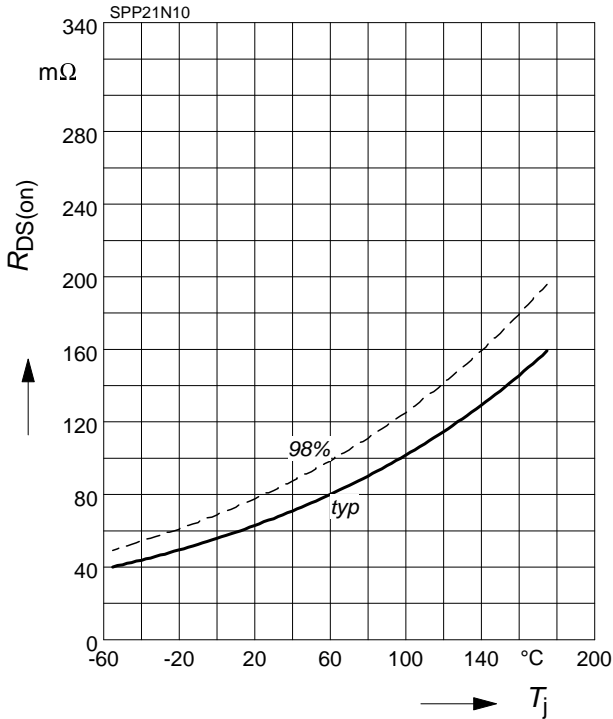
parameter:  $g_{fs}$



### 9 Drain-source on-state resistance

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

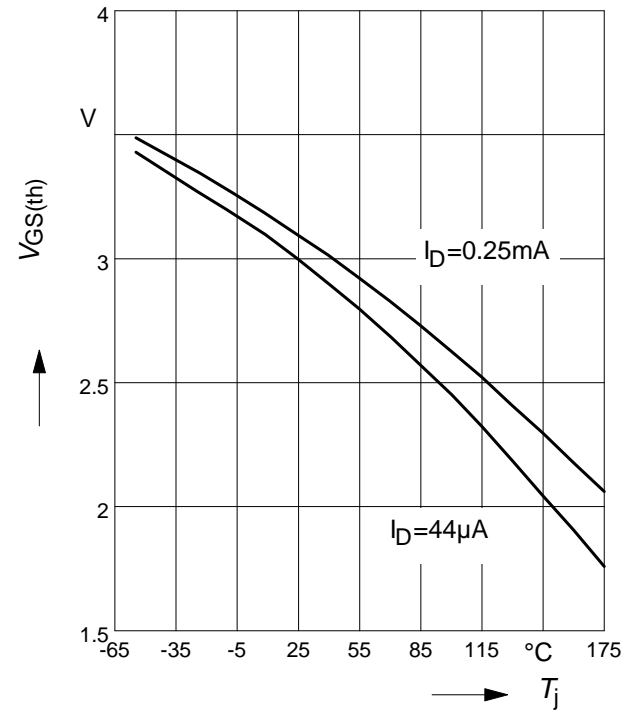
parameter :  $I_D = 15.0 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



### 10 Typ. gate threshold voltage

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

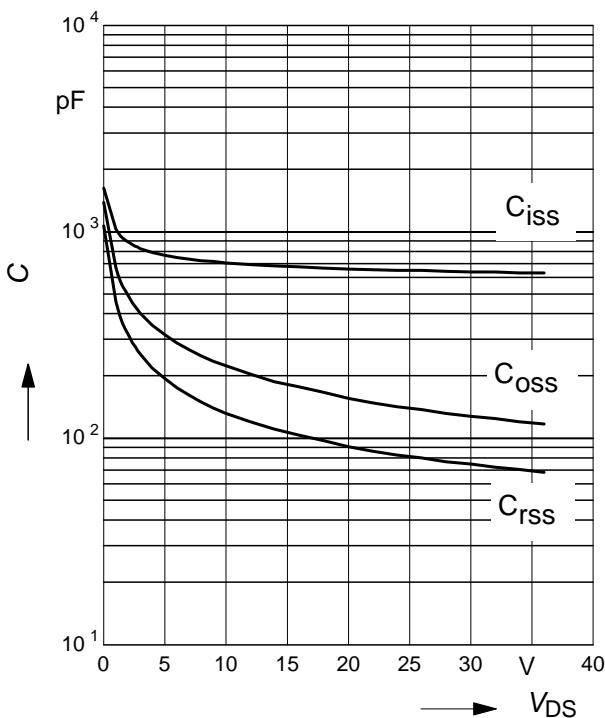
parameter:  $V_{GS} = V_{DS}$



### 11 Typ. capacitances

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

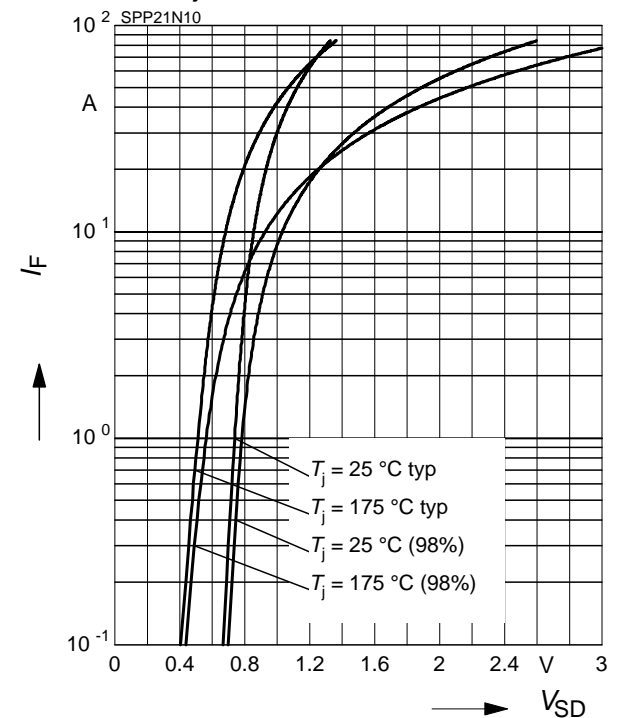
parameter:  $V_{GS}=0\text{V}$ ,  $f=1 \text{ MHz}$



### 12 Forward character. of reverse diode

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

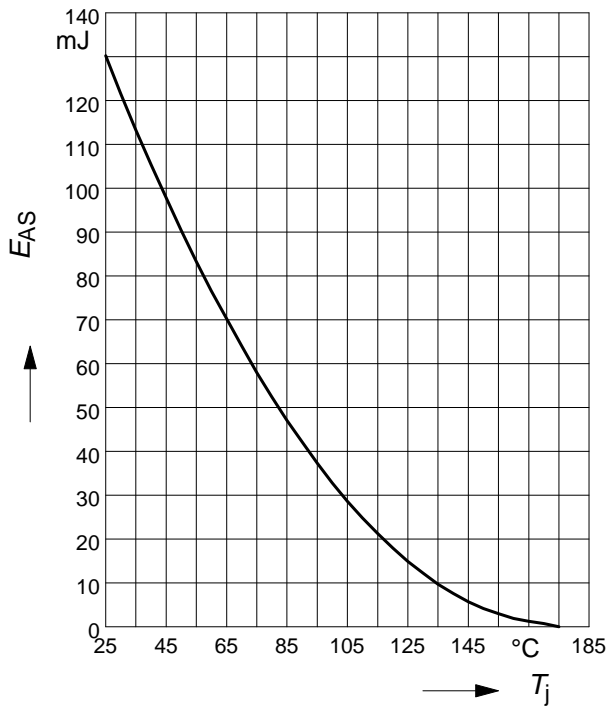
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



### 13 Typ. avalanche energy

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

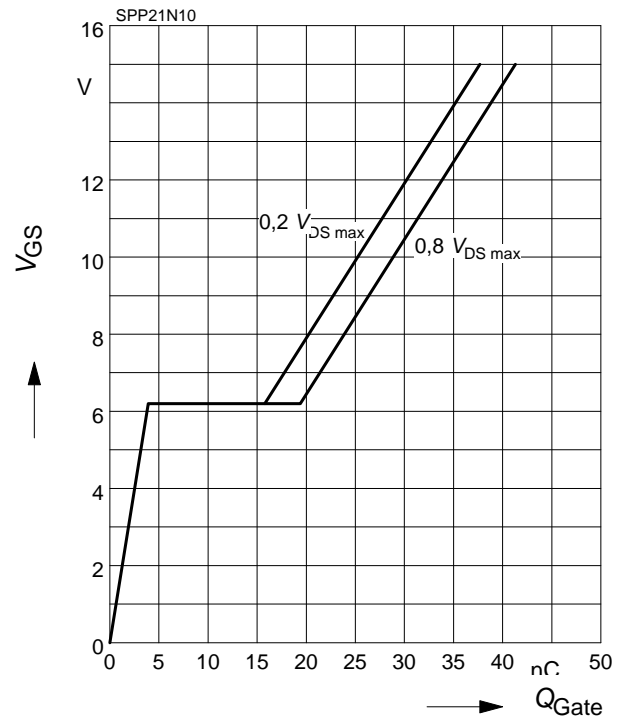
par.:  $I_D = 21 \text{ A}$  ,  $V_{DD} = 25 \text{ V}$ ,  $R_{GS} = 25 \Omega$



### 14 Typ. gate charge

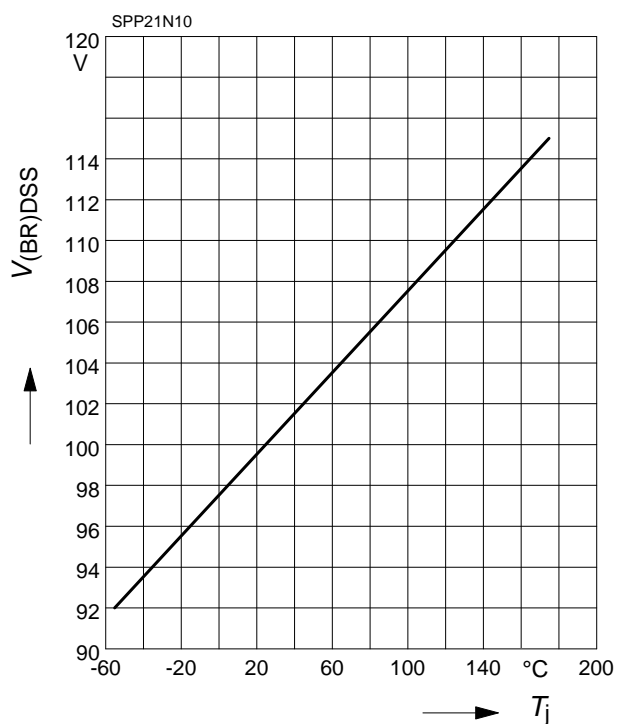
$$V_{GS} = f(Q_{Gate})$$

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



### 15 Drain-source breakdown voltage

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



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