

## SIPMOS® Power-Transistor

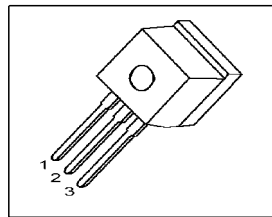
### Feature

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

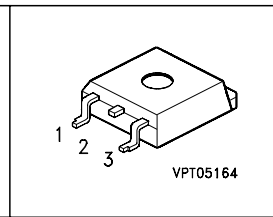
### Product Summary

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

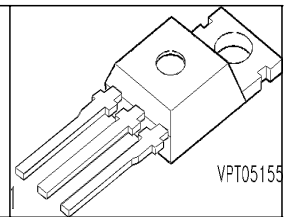
P-TO262-3-1



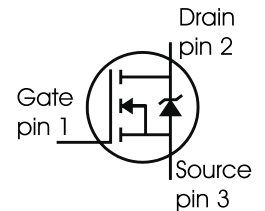
P-TO263-3-2



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 $T_j = 25\text{ °C}$ , 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
$I_S=21\text{ A}$ , $V_{DS}=80\text{ V}$ , $di/dt=200\text{ A/μs}$ , $T_{j\text{ max}}=175\text{ °C}$			
Gate source voltage	$V_{GS}$	±20	V
Power dissipation	$P_{\text{tot}}$	90	W
$T_C=25\text{ °C}$			
Operating and storage temperature	$T_j, T_{\text{stg}}$	-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, $V_{GS} = V_{DS}$ $I_D = 44\ \mu A$	$V_{GS(th)}$	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  $T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

### Dynamic Characteristics

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

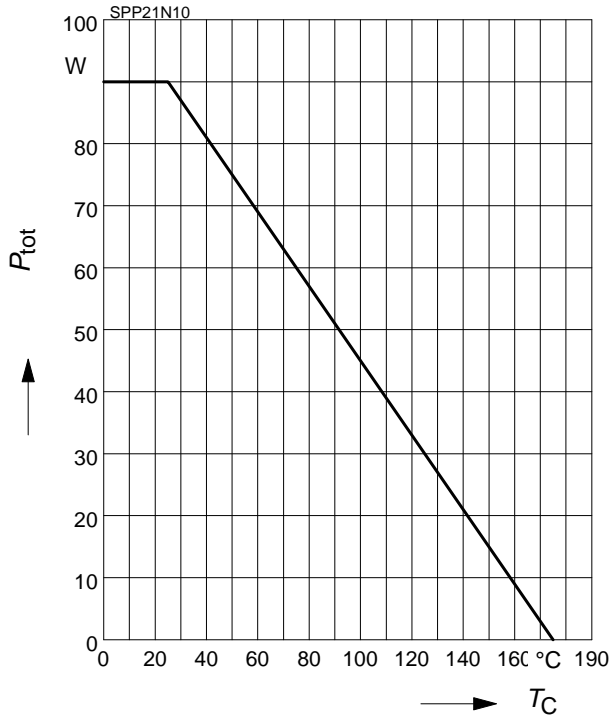
Gate to source charge	$Q_{gs}$	$V_{DD} = 80V$ , $I_D = 21A$	-	3.9	5.2	nC
Gate to drain charge	$Q_{gd}$		-	15.5	23.3	
Gate charge total	$Q_g$	$V_{DD} = 80V$ , $I_D = 21A$ , $V_{GS} = 0$ to $10V$	-	28.9	38.4	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 80V$ , $I_D = 21A$	-	6.2	-	V

### Reverse Diode

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

### 1 Power dissipation

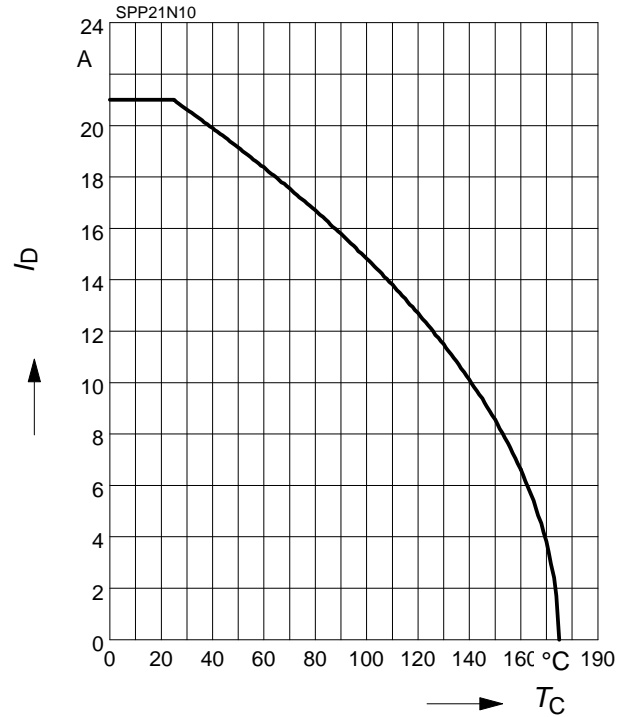
$$P_{tot} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

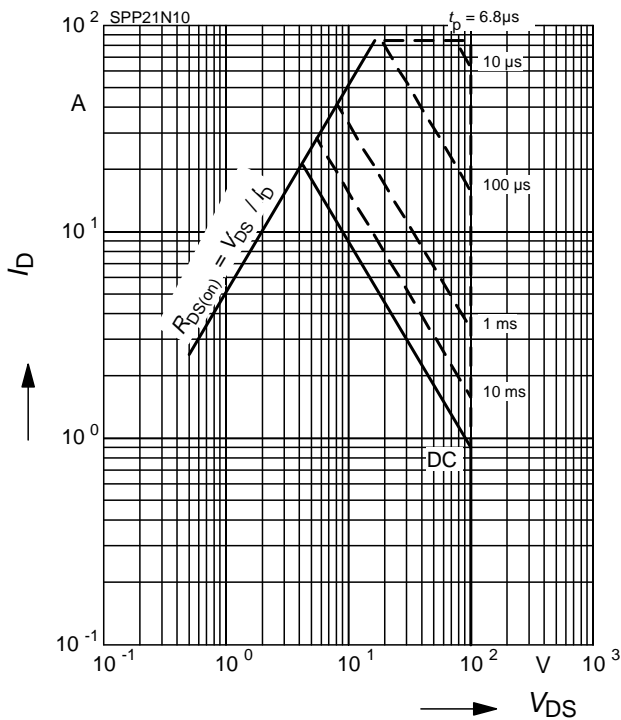
parameter:  $V_{GS} \geq 10$  V



### 3 Safe operating area

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

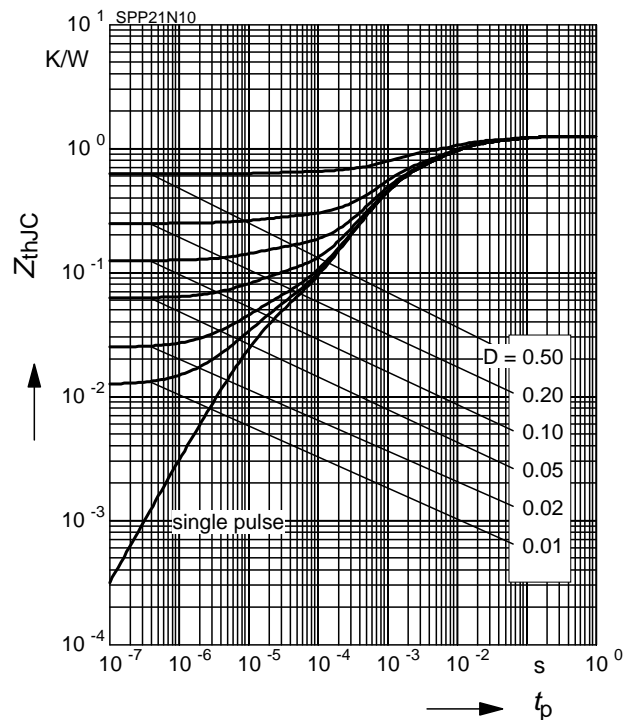
parameter:  $D = 0$ ,  $T_C = 25$  °C



### 4 Transient thermal impedance

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

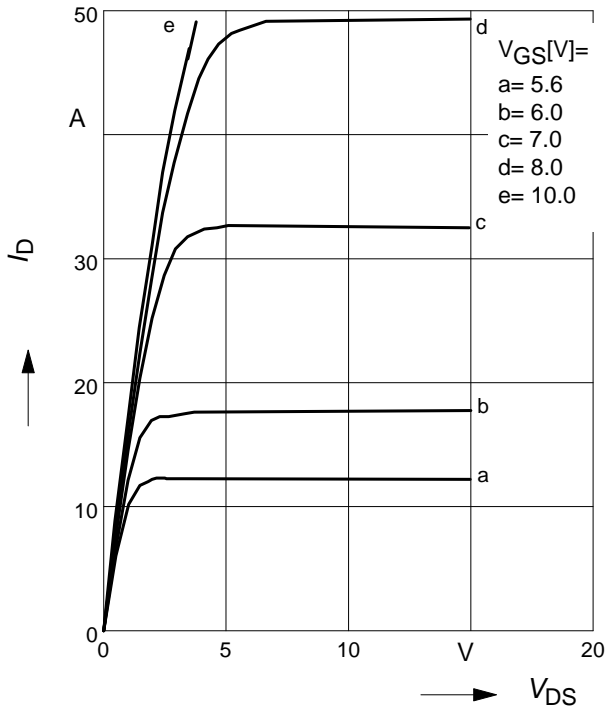
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

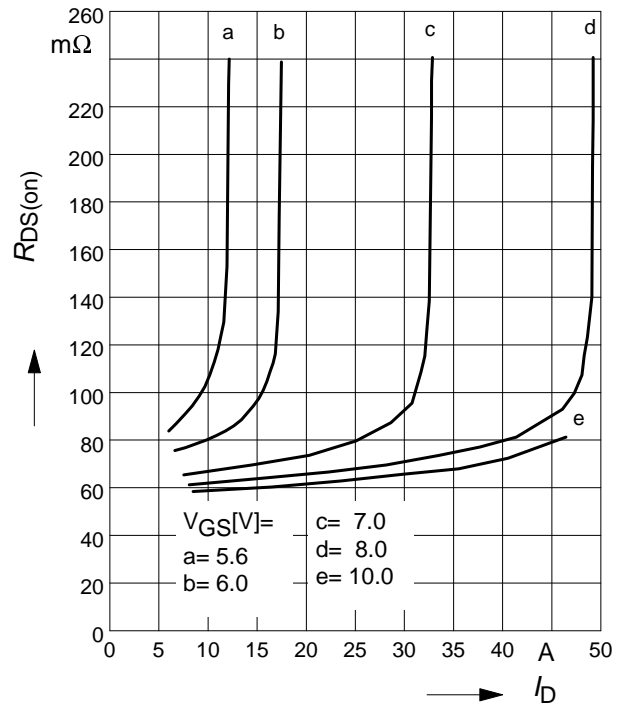
parameter:  $t_p = 80 \mu\text{s}$



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

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

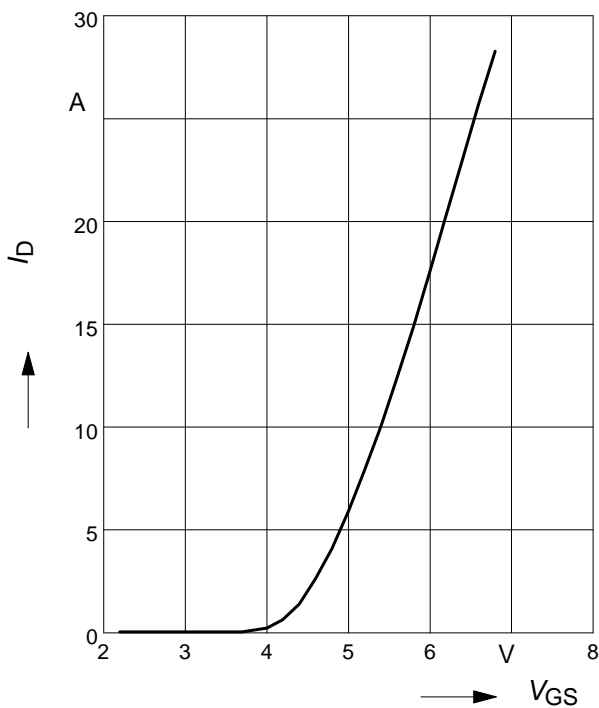
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

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

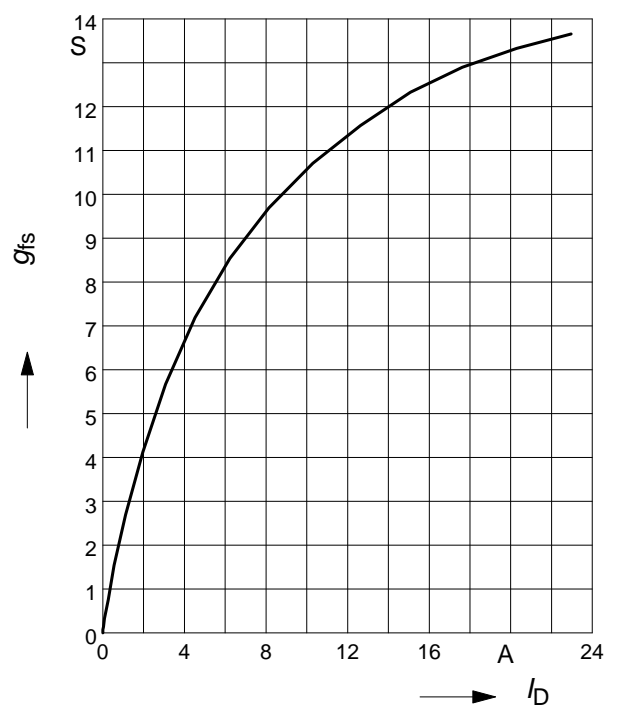
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

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

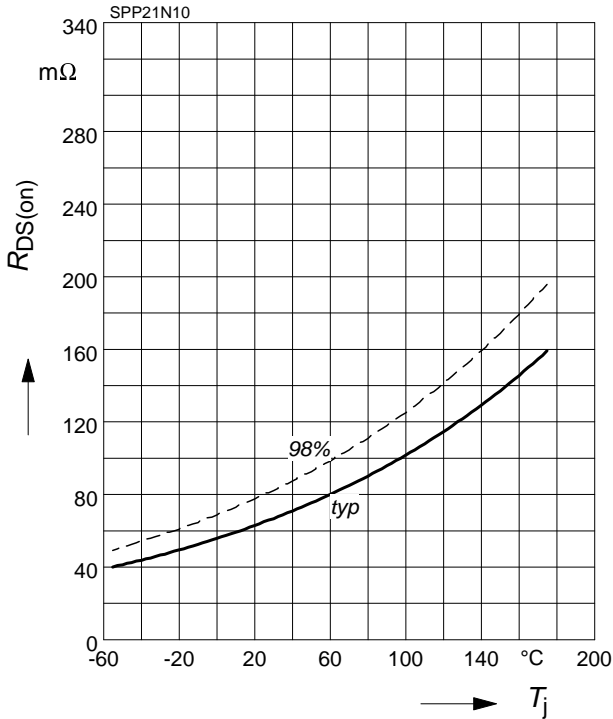
parameter:  $g_{fs}$



**9 Drain-source on-state resistance**

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

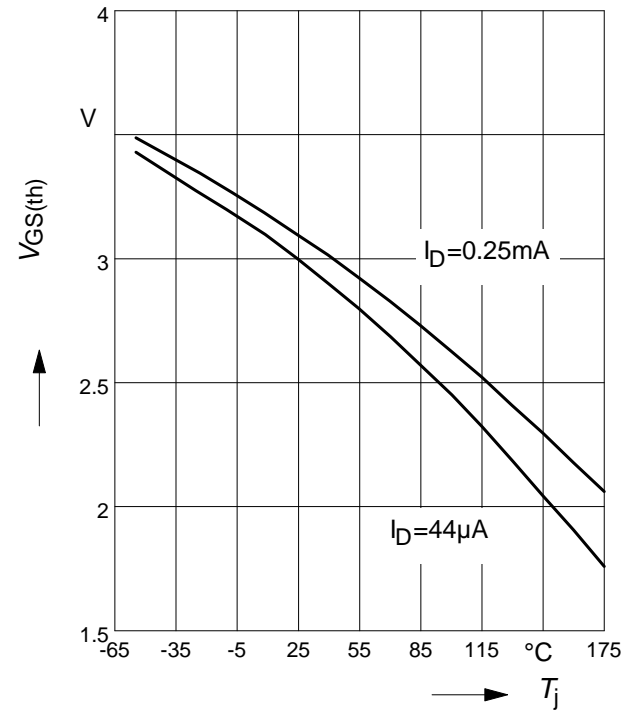
parameter :  $I_D = 15.0 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



**10 Typ. gate threshold voltage**

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

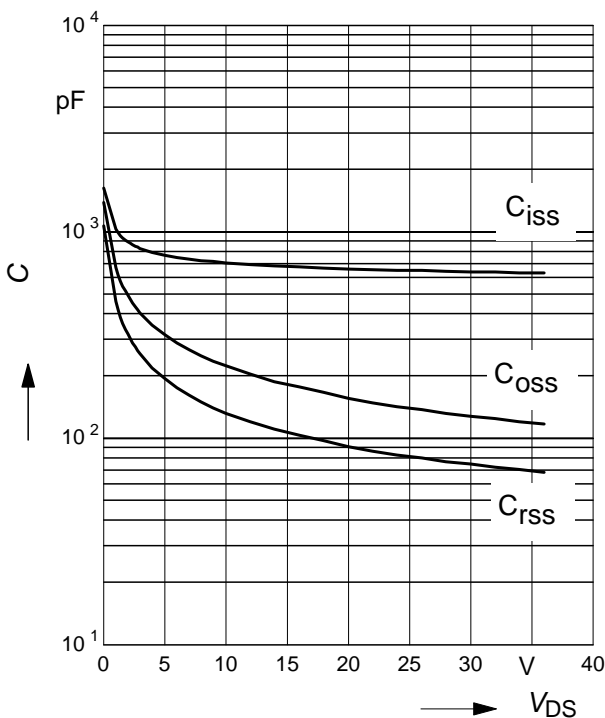
parameter:  $V_{GS} = V_{DS}$



**11 Typ. capacitances**

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

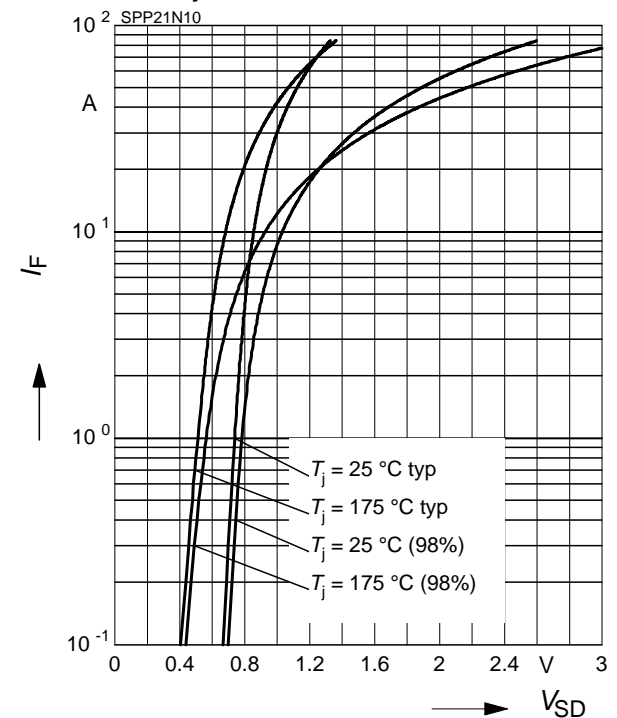
parameter:  $V_{GS} = 0 \text{ V}$ ,  $f = 1 \text{ MHz}$



**12 Forward character. of reverse diode**

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

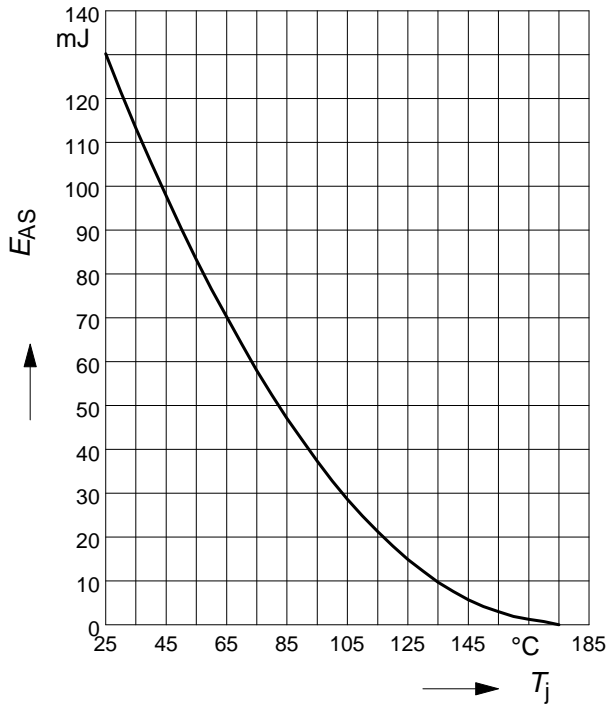
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



**13 Typ. avalanche energy**

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

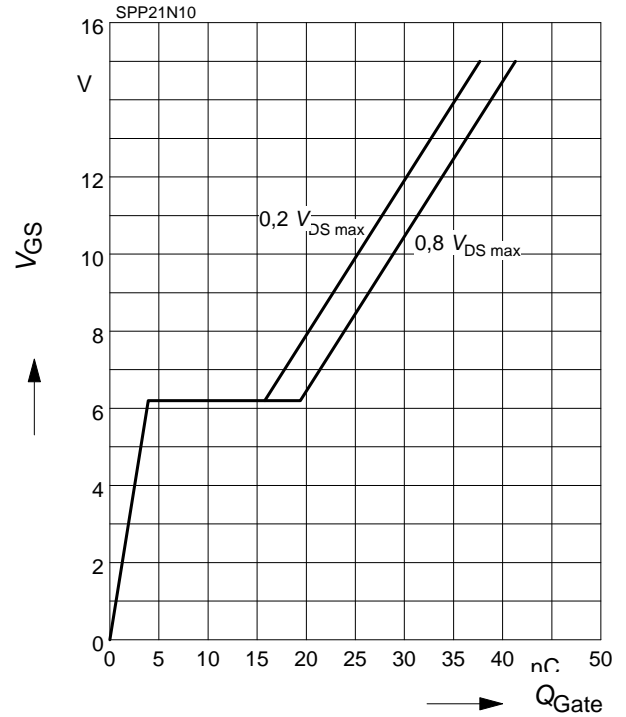
par.:  $I_D = 21 \text{ A}$  ,  $V_{DD} = 25 \text{ V}$ ,  $R_{GS} = 25 \Omega$



**14 Typ. gate charge**

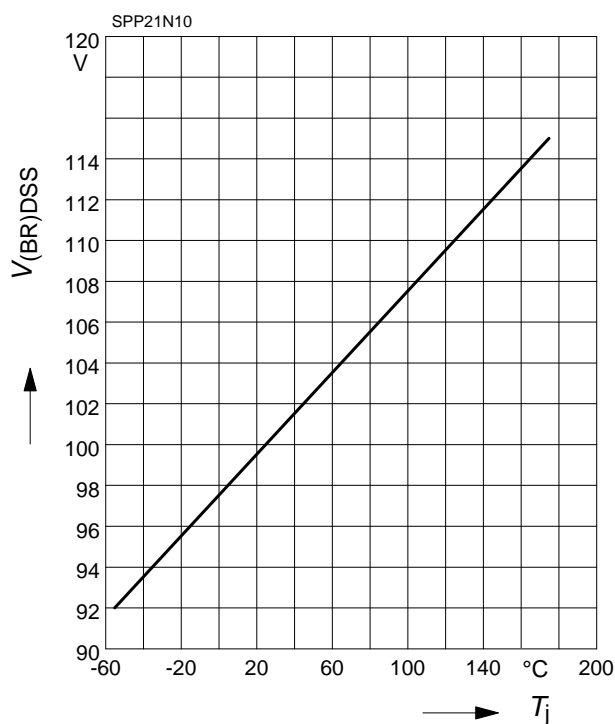
$$V_{GS} = f(Q_{Gate})$$

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



**15 Drain-source breakdown voltage**

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



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