

## OptiMOS<sup>®</sup>-P Small-Signal-Transistor

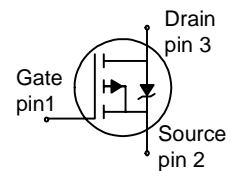
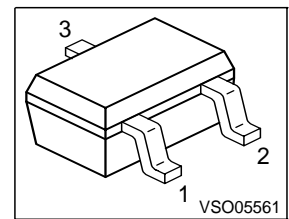
### Feature

- P-Channel
- Enhancement mode
- Super Logic Level (2.5 V rated)
- 150°C operating temperature
- Avalanche rated
- dv/dt rated

### Product Summary

$V_{DS}$	-20	V
$R_{DS(on)}$	550	mΩ
$I_D$	-0.58	A

SOT-323



Type	Package	Ordering Code	Marking
BSS 209PW	SOT-323	Q67042-S4074	X3s

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

Parameter	Symbol	Value	Unit
Continuous drain current	$I_D$		A
$T_A=25\text{ °C}$		-0.58	
$T_A=70\text{ °C}$		-0.46	
Pulsed drain current	$I_{D\text{ puls}}$	-2.3	
$T_A=25\text{ °C}$			
Avalanche energy, single pulse	$E_{AS}$	3.5	mJ
$I_D=-0.58\text{ A}$ , $V_{DD}=-10\text{ V}$ , $R_{GS}=25\text{ Ω}$			
Reverse diode dv/dt	dv/dt	-6	kV/μs
$I_S=-0.58\text{ A}$ , $V_{DS}=-16\text{ V}$ , $di/dt=200\text{ A/μs}$ , $T_{jmax}=150\text{ °C}$			
Gate source voltage	$V_{GS}$	±12	V
Power dissipation	$P_{tot}$	0.52	W
$T_A=25\text{ °C}$			
Operating and storage temperature	$T_j, T_{stg}$	-55... +150	°C
IEC climatic category; DIN IEC 68-1		55/150/56	

**Thermal Characteristics**

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Characteristics</b>					
Thermal resistance, junction - soldering point	$R_{thJS}$	-	-	120	K/W
SMD version, device on PCB:	$R_{thJA}$				
@ min. footprint		-	-	240	
@ 6 cm <sup>2</sup> cooling area <sup>1)</sup>		-	-	160	

**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 $V_{GS}=0V, I_D=-250\mu A$	$V_{(BR)DSS}$	-20	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D=-3.5\mu A$	$V_{GS(th)}$	-0.6	-0.9	-1.2	
Zero gate voltage drain current $V_{DS}=-20V, V_{GS}=0, T_j=25^\circ C$ $V_{DS}=-20V, V_{GS}=0, T_j=150^\circ C$	$I_{DSS}$	-	-0.1	-1	$\mu A$
Gate-source leakage current $V_{GS}=-12V, V_{DS}=0$	$I_{GSS}$	-	-10	-100	
Drain-source on-state resistance $V_{GS}=-2.5V, I_D=-0.46A$	$R_{DS(on)}$	-	563	900	$m\Omega$
Drain-source on-state resistance $V_{GS}=-4.5, I_D=-0.58A$	$R_{DS(on)}$	-	369	550	

<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;  $t \leq 10$  sec.

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 *  I_D  * R_{DS(on)max}$ $I_D = -0.46\text{A}$	0.87	1.74	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0, V_{DS} = -15\text{V},$ $f = 1\text{MHz}$	-	89.9	-	pF
Output capacitance	$C_{oss}$		-	40.1	-	
Reverse transfer capacitance	$C_{rss}$		-	31.5	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -10\text{V}, V_{GS} = -4.5\text{V},$ $I_D = -0.58\text{A}, R_G = 6\Omega$	-	4.4	6.6	ns
Rise time	$t_r$		-	5.8	8.7	
Turn-off delay time	$t_{d(off)}$		-	7.6	11.4	
Fall time	$t_f$		-	4.5	6.7	

**Gate Charge Characteristics**

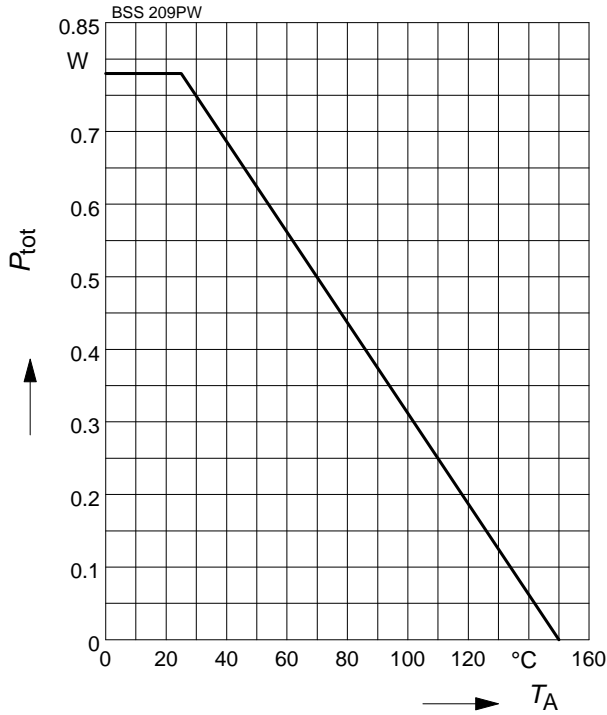
Gate to source charge	$Q_{gs}$	$V_{DD} = -10\text{V}, I_D = -0.58\text{A}$	-	-0.12	-0.17	nC
Gate to drain charge	$Q_{gd}$		-	-0.74	-1.1	
Gate charge total	$Q_g$	$V_{DD} = -10\text{V}, I_D = -0.58\text{A},$ $V_{GS} = 0 \text{ to } -4.5\text{V}$	-	-0.92	-1.38	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = -10\text{V}, I_D = -0.58\text{A}$	-	-1.7	-	V

**Reverse Diode**

Inverse diode continuous forward current	$I_S$	$T_A = 25\text{ }^\circ\text{C}$	-	-	-0.5	A
Inverse diode direct current, pulsed	$I_{SM}$		-	-	-2.3	
Inverse diode forward voltage	$V_{SD}$	$V_{GS} = 0,  I_F  =  I_D $	-	-1.3	-0.88	V
Reverse recovery time	$t_{rr}$	$V_R = -10\text{V},  I_F  =  I_D ,$ $di_F/dt = 100\text{A}/\mu\text{s}$	-	9	11.2	ns
Reverse recovery charge	$Q_{rr}$		-	1.27	1.59	nC

### 1 Power dissipation

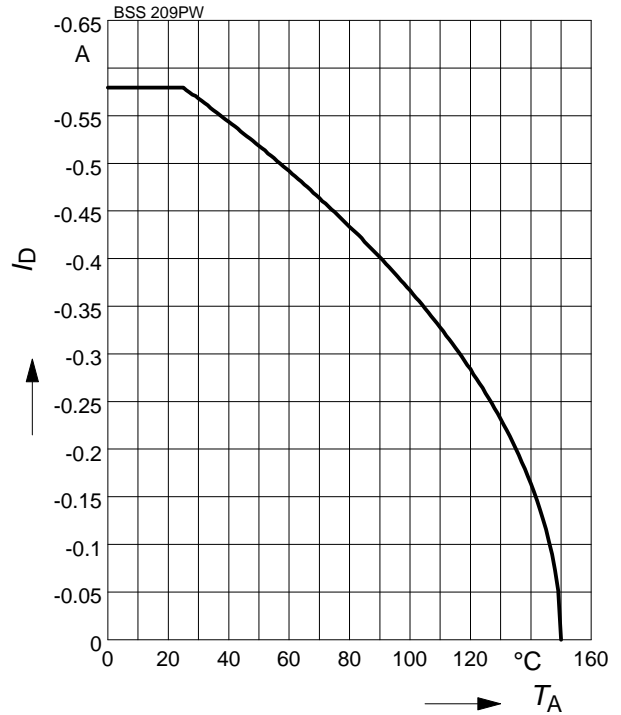
$$P_{tot} = f(T_A)$$



### 2 Drain current

$$I_D = f(T_A)$$

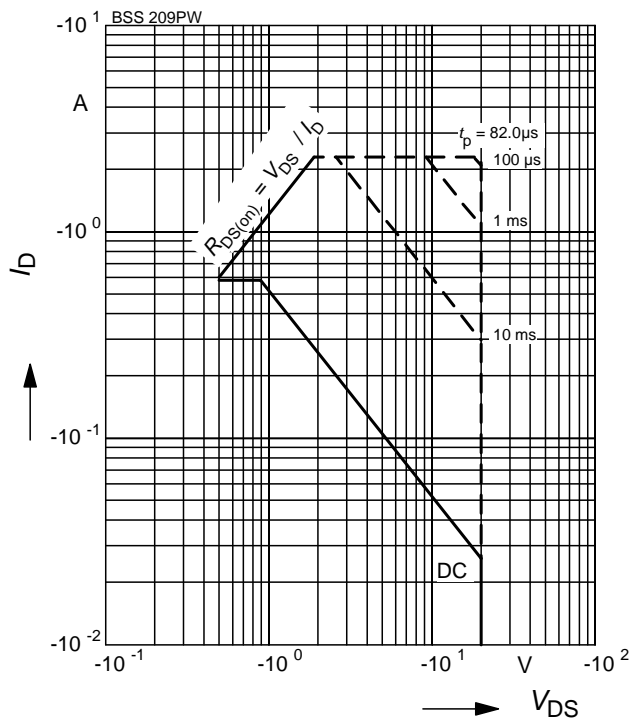
parameter:  $|V_{GS}| \geq 4.5 \text{ V}$



### 3 Safe operating area

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

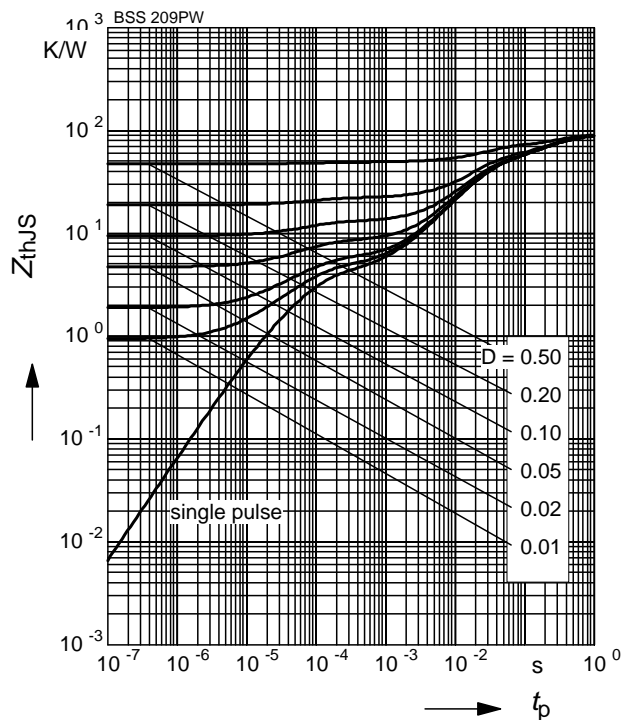
parameter:  $D = 0, T_A = 25 \text{ °C}$



### 4 Transient thermal impedance

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

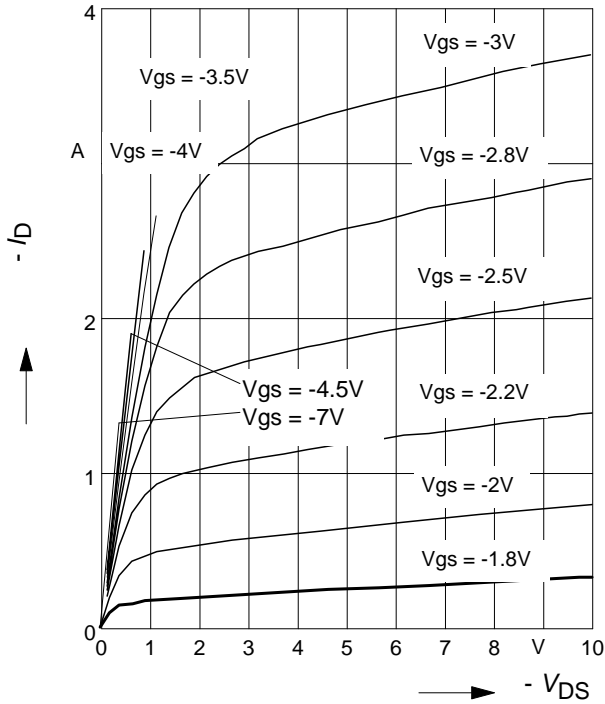
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

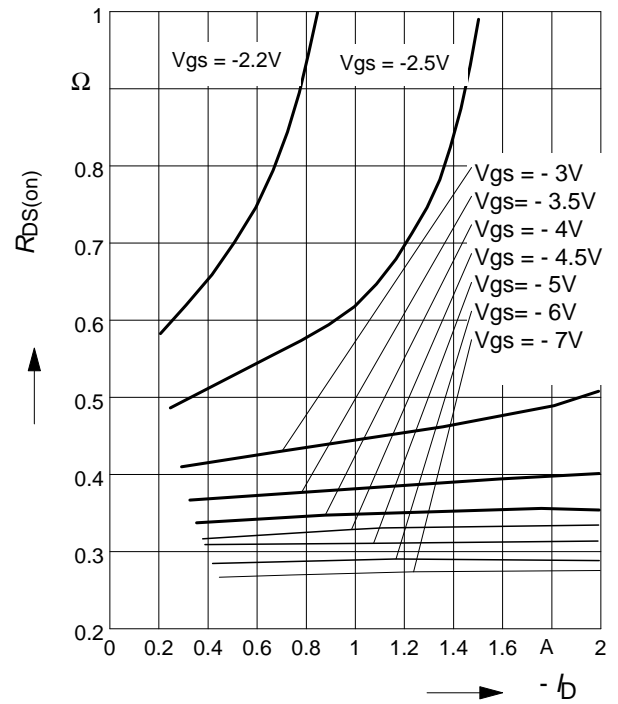
parameter:  $t_p = 80 \mu\text{s}$



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

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

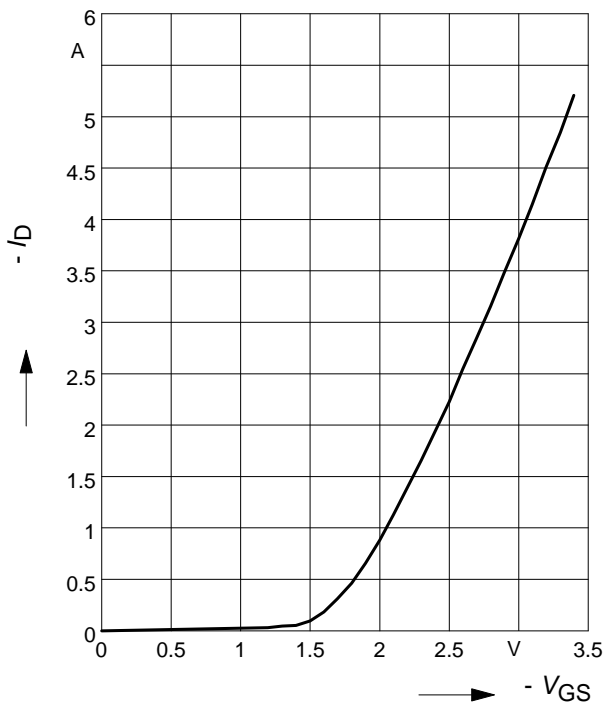
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

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

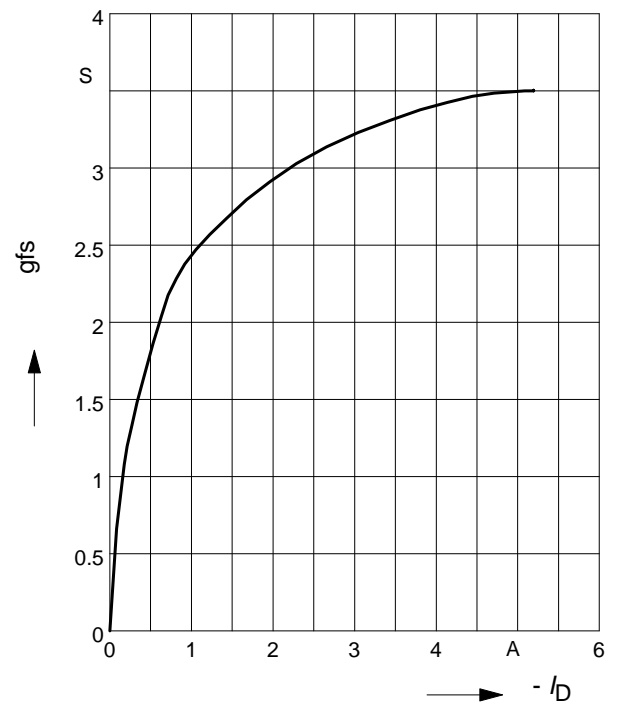
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

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

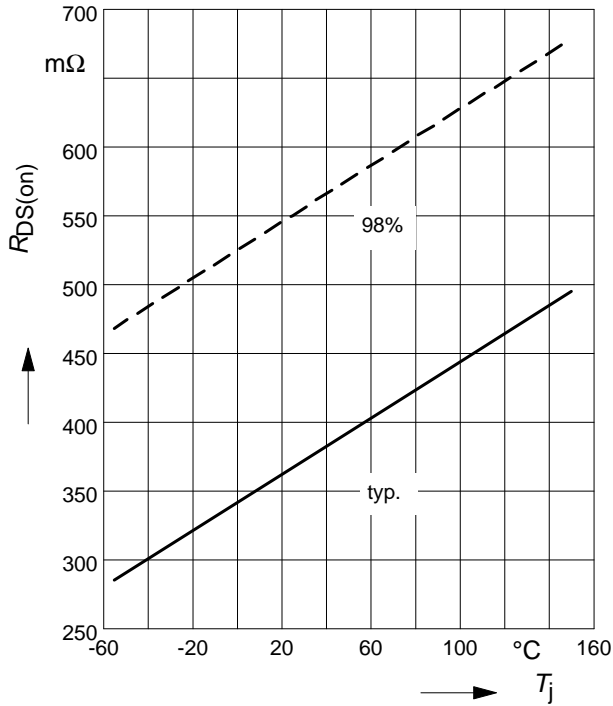
parameter:  $t_p = 80 \mu\text{s}$



**9 Drain-source on-resistance**

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

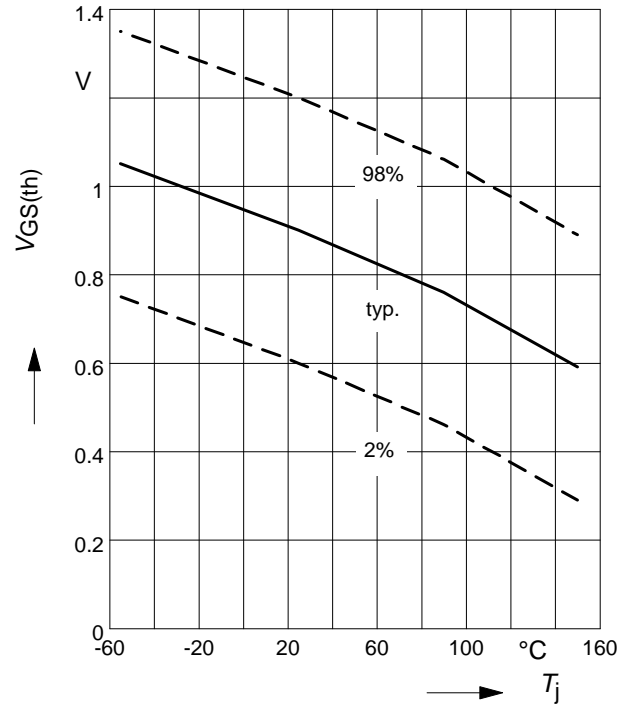
parameter:  $I_D = -0.58 \text{ A}$ ,  $V_{GS} = -4.5 \text{ V}$



**10 Gate threshold voltage**

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

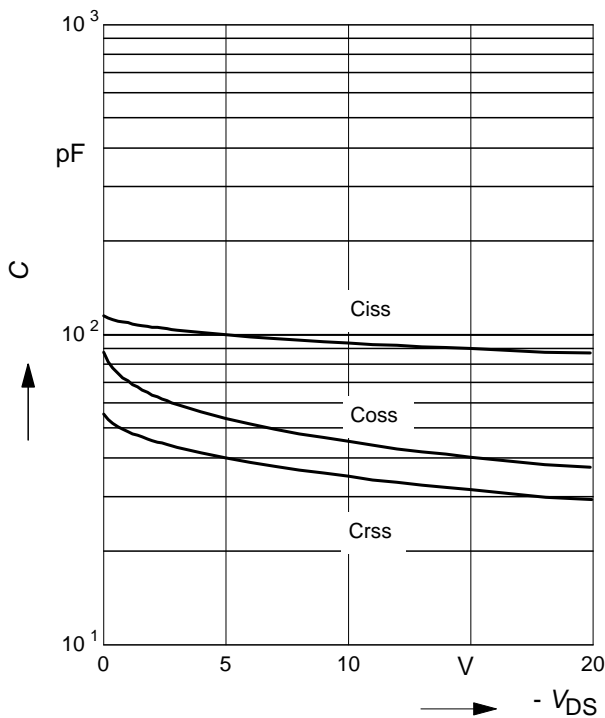
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = -3.5 \mu\text{A}$



**11 Typ. capacitances**

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

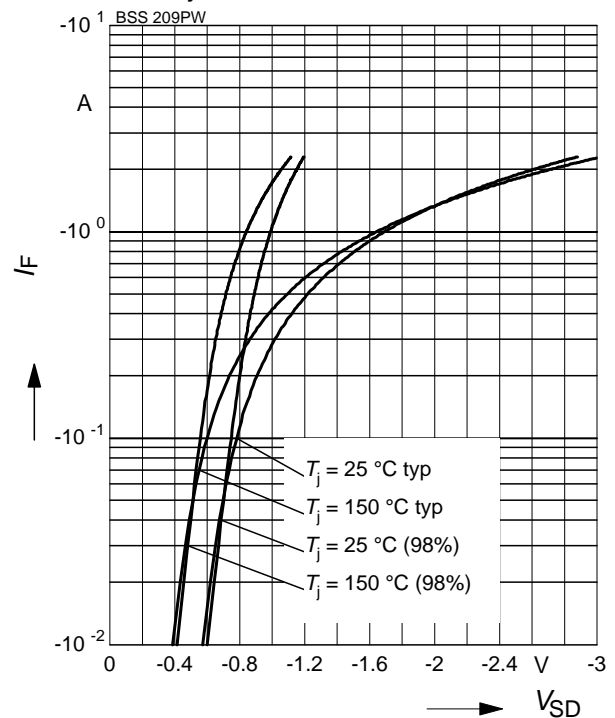
parameter:  $V_{GS}=0$ ,  $f=1 \text{ MHz}$



**12 Forward character. of reverse diode**

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

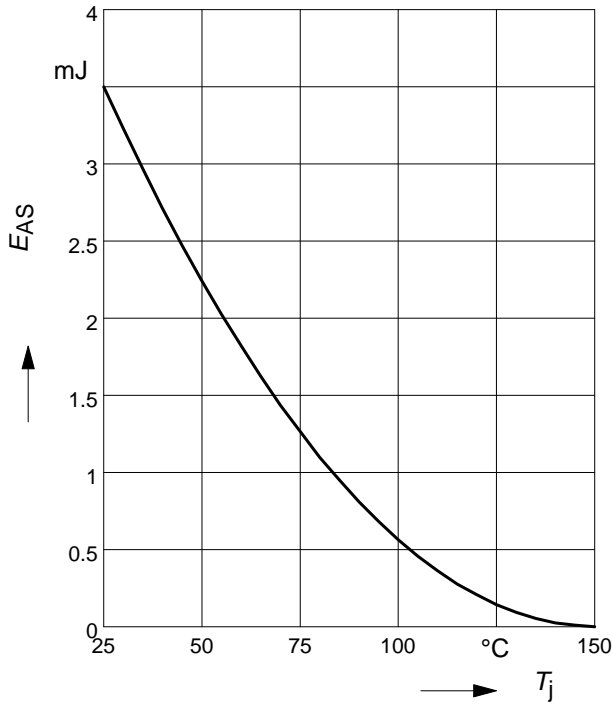
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



**13 Typ. avalanche energy**

$$E_{AS} = f(T_j), \text{ par.: } I_D = -0.58 \text{ A}$$

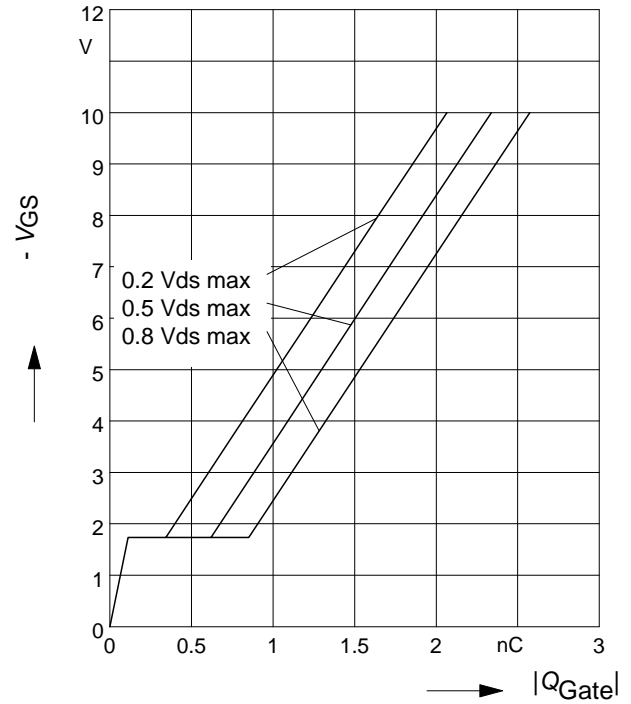
$$V_{DD} = -10 \text{ V}, R_{GS} = 25 \Omega$$



**14 Typ. gate charge**

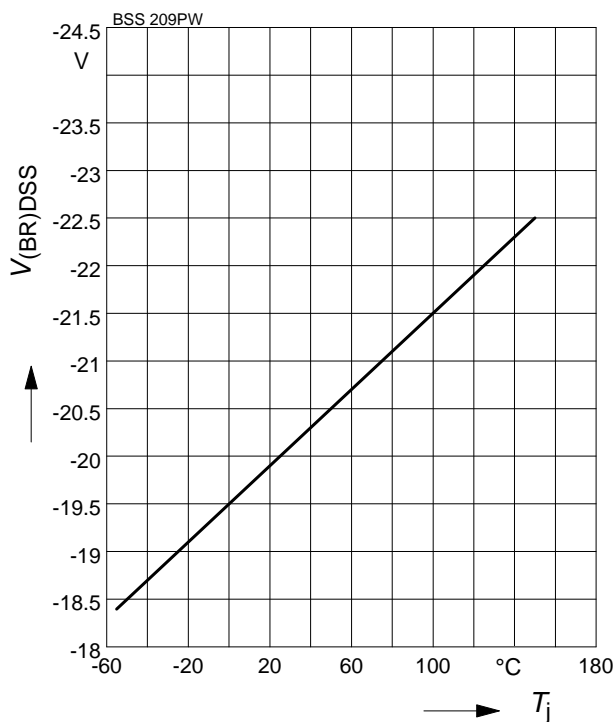
$$|V_{GS}| = f(Q_{Gate})$$

parameter:  $I_D = -0.58 \text{ A}$  pulsed



**15 Drain-source breakdown voltage**

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



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