

## SIPMOS<sup>®</sup> Small-Signal-Transistor

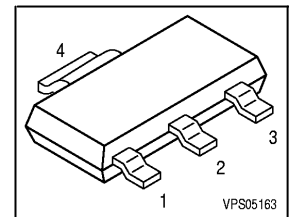
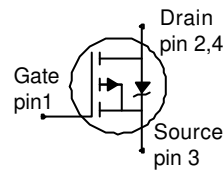
### Feature

- P-Channel
- Enhancement mode
- Avalanche rated
- $dv/dt$  rated
- Ideal for fast switching buck converter
- Pb-free lead plating; RoHS compliant
- Qualified according to AEC Q101
- Halogen-free according to IEC 61249-2-21

### Product Summary

$V_{DS}$	-60	V
$R_{DS(on)}$	0.13	$\Omega$
$I_D$	-2.9	A

PG-SOT223



Type	Package	Tape and reel	Packaging	Marking
BSP613P	PG-SOT223	H6327: 1000pcs/r.	Non Dry	BSP613P

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

Parameter	Symbol	Value	Unit
Continuous drain current	$I_D$	-2.9	A
$T_A=25\text{ °C}$		-2.9	
$T_A=70\text{ °C}$		-2.3	
Pulsed drain current	$I_{D\text{ puls}}$	-11.6	
$T_A=25\text{ °C}$			
Avalanche energy, single pulse	$E_{AS}$	150	mJ
$I_D=2.9\text{ A}$ , $V_{DD}=-25\text{ V}$ , $R_{GS}=25\Omega$			
Avalanche energy, periodic limited by $T_{jmax}$	$E_{AR}$	0.18	
Reverse diode $dv/dt$	$dv/dt$	6	kV/ $\mu\text{s}$
$I_S=2.9\text{ A}$ , $V_{DS}=-48\text{ V}$ , $di/dt=-200\text{ A}/\mu\text{s}$ , $T_{jmax}=150\text{ °C}$			
Gate source voltage	$V_{GS}$	$\pm 20$	V
Power dissipation	$P_{tot}$	1.8	W
$T_A=25\text{ °C}$			
Operating and storage temperature	$T_j, T_{stg}$	-55... +150	$\text{°C}$
IEC climatic category; DIN IEC 68-1		55/150/56	
ESD Class JESD22-A114-HBM		Class 1c	

**Thermal Characteristics**

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Characteristics</b>					
Thermal resistance, junction - soldering point (Pin 4)	$R_{thJS}$	-	-	19	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$	-	100	-	
SMD version, device on PCB: @ min. footprint @ 6 cm <sup>2</sup> cooling area <sup>1)</sup>	$R_{thJA}$	-	-	100 70	

**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 $V_{GS}=0, I_D=-250\mu\text{A}$	$V_{(BR)DSS}$	-60	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D=-1\text{mA}$	$V_{GS(th)}$	-2.1	-3	-4	
Zero gate voltage drain current $V_{DS}=-60\text{V}, V_{GS}=0, T_j=25^\circ\text{C}$ $V_{DS}=-60\text{V}, V_{GS}=0, T_j=125^\circ\text{C}$	$I_{DSS}$	-	-0.1 -10	-1 -100	$\mu\text{A}$
Gate-source leakage current $V_{GS}=-20\text{V}, V_{DS}=0$	$I_{GSS}$	-	-10	-100	
Drain-source on-state resistance $V_{GS}=-10\text{V}, I_D=2.9\text{A}$	$R_{DS(on)}$	-	0.11	0.13	$\Omega$

<sup>1)</sup> Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  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 *  I_D  * R_{DS(on)max}$ , $I_D = 2.9\text{A}$	2.7	5.4	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0, V_{DS} = -25\text{V}$ , $f = 1\text{MHz}$	-	715	875	pF
Output capacitance	$C_{oss}$		-	230	295	
Reverse transfer capacitance	$C_{rss}$		-	90	120	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -30\text{V}, V_{GS} = -10\text{V}$ , $I_D = 2.9\text{A}, R_G = 2.7\Omega$	-	6.7	17	ns
Rise time	$t_r$		-	9	18	
Turn-off delay time	$t_{d(off)}$		-	26	52	
Fall time	$t_f$		-	7	19	

**Gate Charge Characteristics**

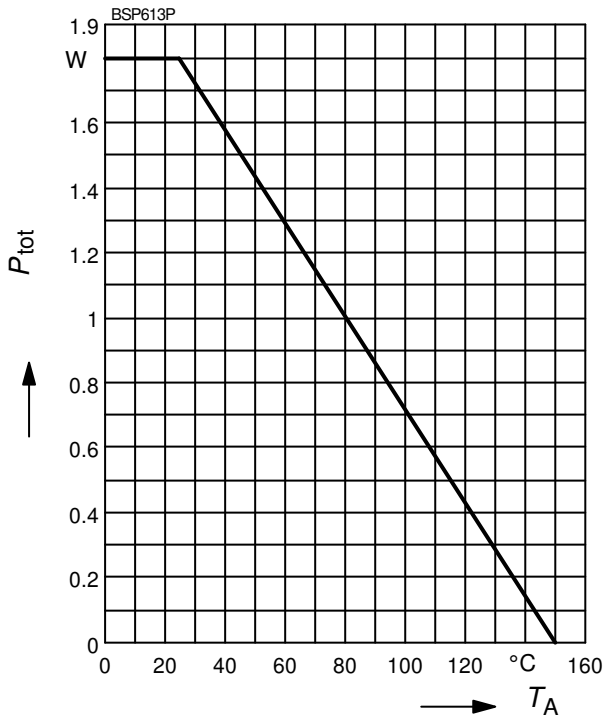
Gate to source charge	$Q_{gs}$	$V_{DD} = -48\text{V}, I_D = 2.9\text{A}$	-	2.5	3.8	nC
Gate to drain charge	$Q_{gd}$		-	8.9	14.3	
Gate charge total	$Q_g$	$V_{DD} = -48\text{V}, I_D = 2.9\text{A}$ , $V_{GS} = 0 \text{ to } -10\text{V}$	-	22	33	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = -48\text{V}, I_D = 2.9\text{A}$	-	-3.9	-	V

**Reverse Diode**

Inverse diode continuous forward current	$I_S$	$T_A = 25\text{ }^\circ\text{C}$	-	-	-2.9	A
Inv. diode direct current, pulsed	$I_{SM}$		-	-	-11.6	
Inverse diode forward voltage	$V_{SD}$	$V_{GS} = 0\text{V},  I_F  =  I_S $	-	-0.8	-1.1	V
Reverse recovery time	$t_{rr}$	$V_R = -30\text{V},  I_F  =  I_S $ , $di_F/dt = 100\text{A}/\mu\text{s}$	-	37.2	79	ns
Reverse recovery charge	$Q_{rr}$		-	59.8	112	

### 1 Power Dissipation

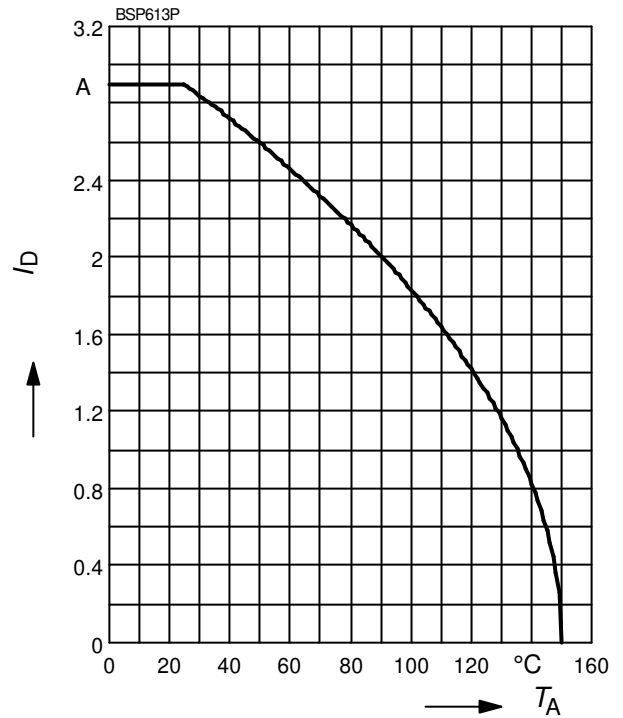
$$P_{tot} = f(T_A)$$



### 2 Drain current

$$I_D = f(T_A)$$

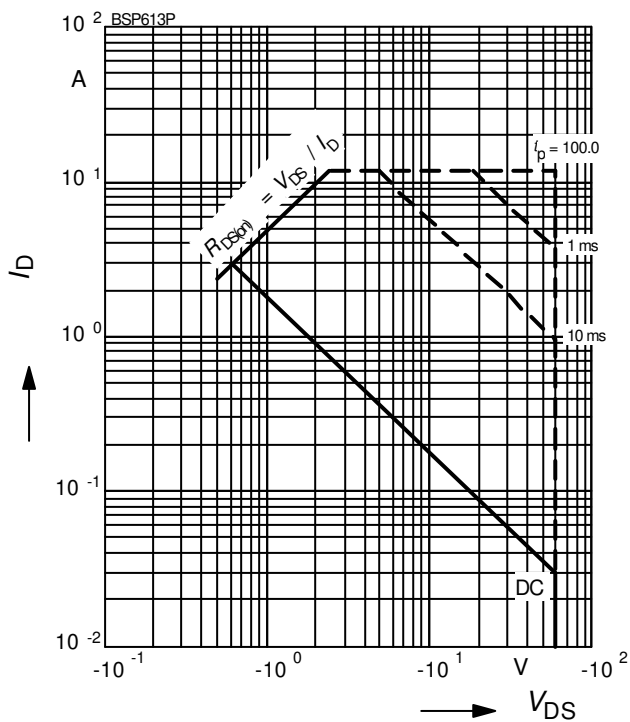
parameter:  $V_{GS} \geq 10 \text{ V}$



### 3 Safe operating area

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

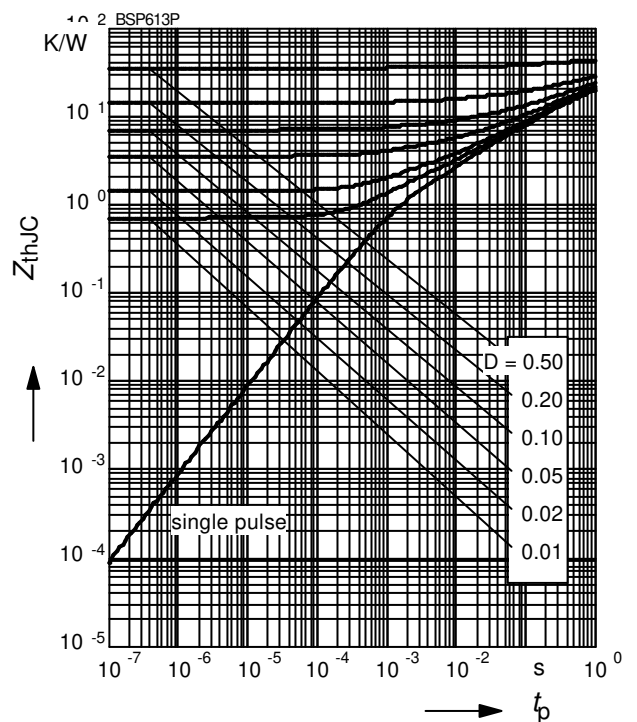
parameter:  $D = 0$ ,  $T_A = 25 \text{ °C}$



### 4 Transient thermal impedance

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

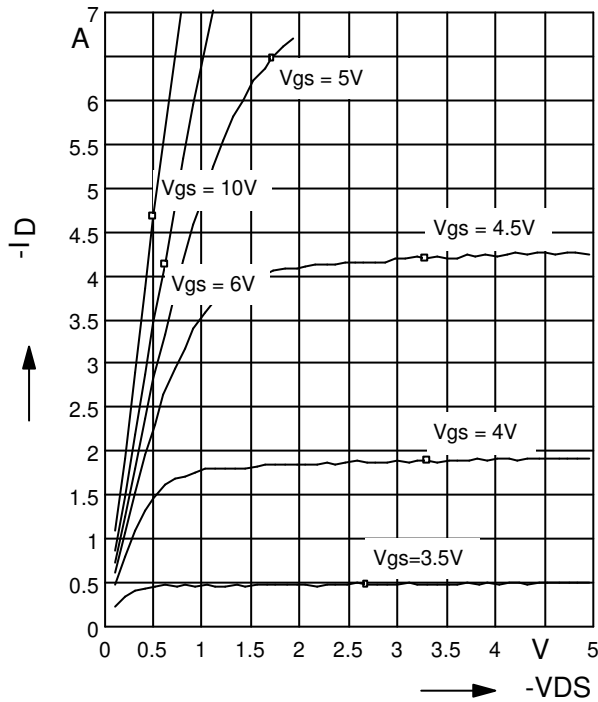
parameter:  $D = t_p / T$



**5 Typ. output characteristic**

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

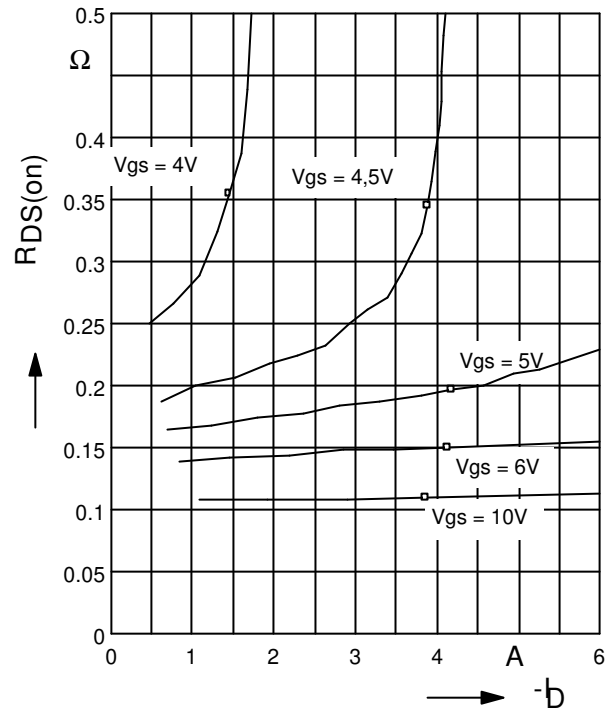
parameter:  $T_j = 25^\circ\text{C}$



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

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

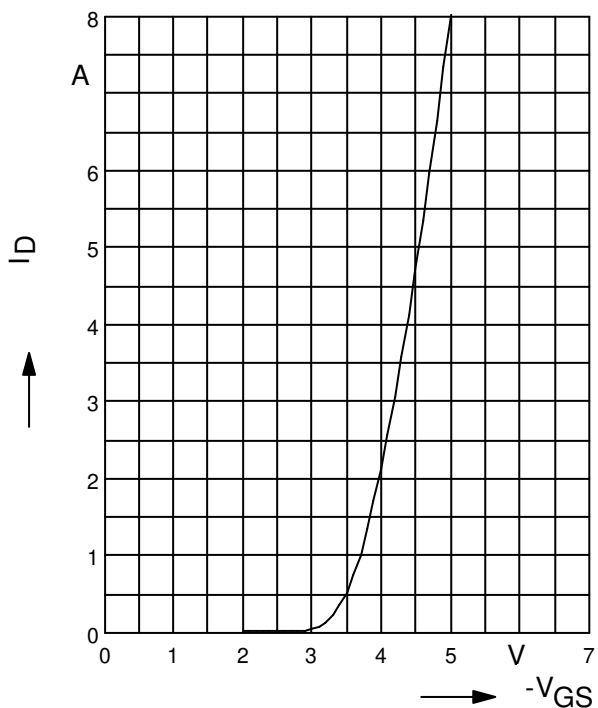
parameter:  $V_{GS}; T_j = 25^\circ\text{C}$



**7 Typ. transfer characteristics**

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

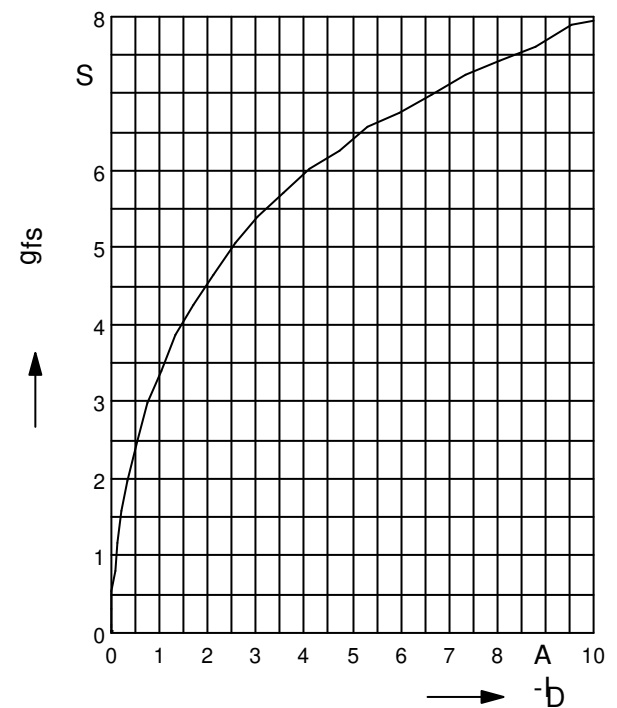
parameter:  $T_j = 25^\circ\text{C}$



**8 Typ. forward transconductance**

$$g_{fs} = f(I_D)$$

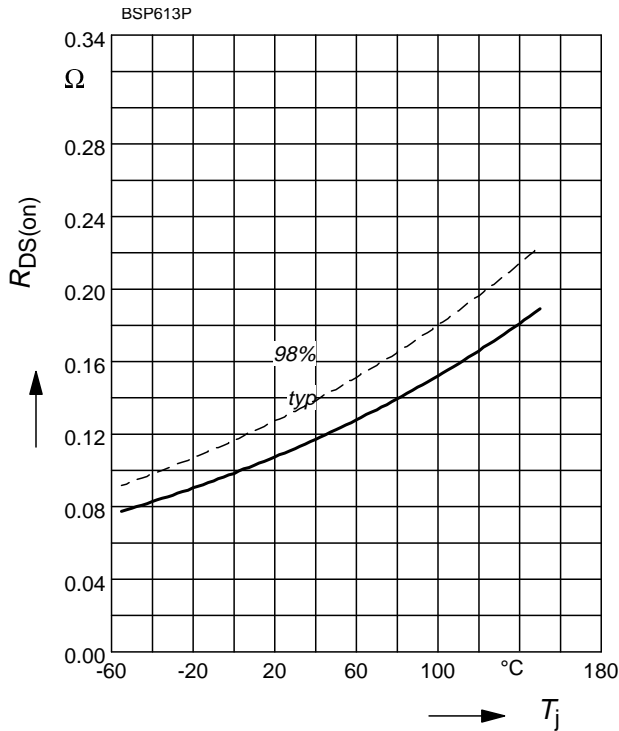
parameter:  $T_j = 25^\circ\text{C}$



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

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

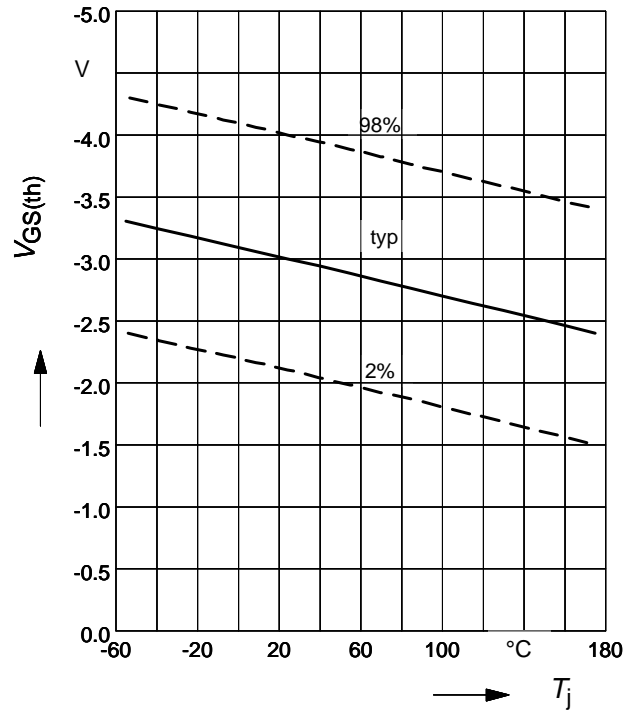
parameter:  $I_D = -2.9\text{ A}$ ,  $V_{GS} = -10\text{ V}$



**10 Gate threshold voltage**

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

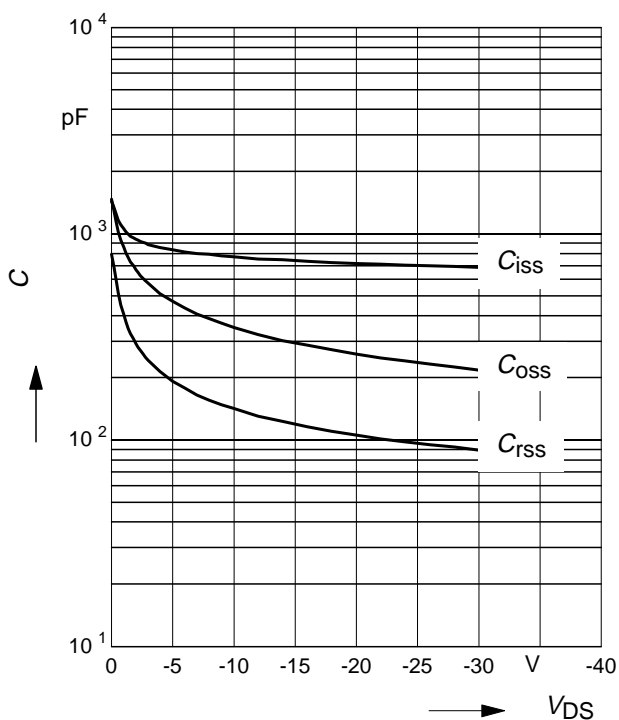
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = -1\text{ mA}$



**11 Typ. capacitances**

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

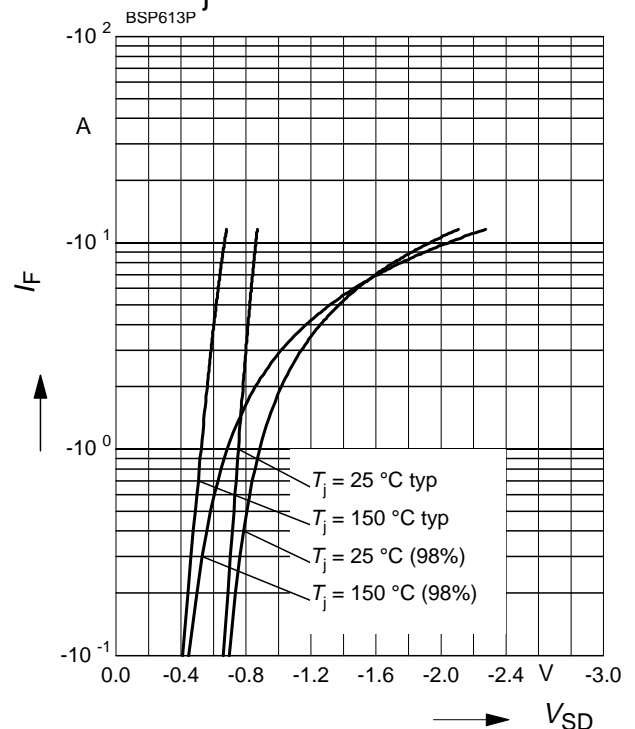
parameter:  $V_{GS} = 0\text{ V}$ ,  $f = 1\text{ MHz}$



**12 Forward characteristics of reverse diode**

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

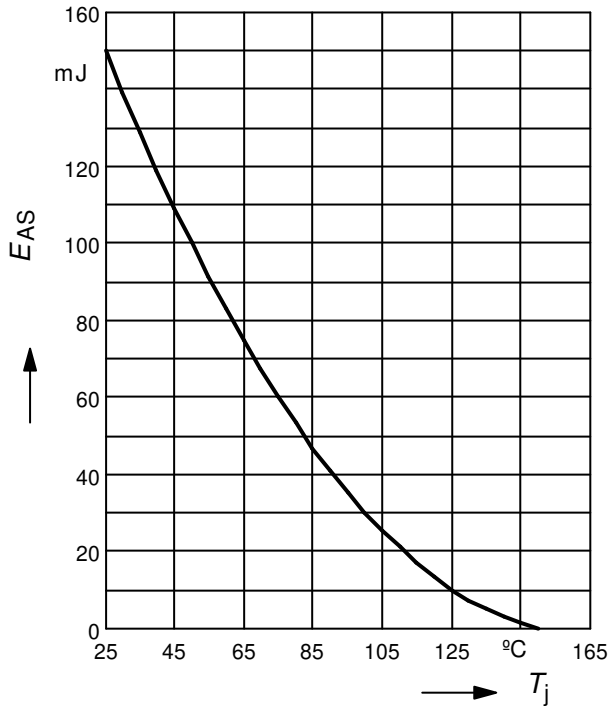
parameter:  $T_j$ ,  $t_p = 80\text{ }\mu\text{s}$



**13 Typ. avalanche energy**

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

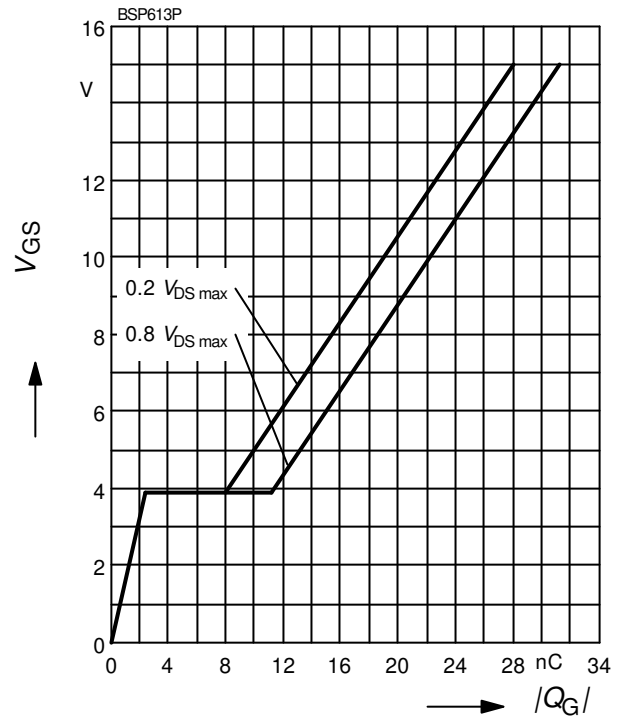
par.:  $I_D = 2.9 \text{ A}$  ,  $V_{DD} = -25 \text{ V}$  ,  $R_{GS} = 25 \Omega$



**14 Typ. gate charge**

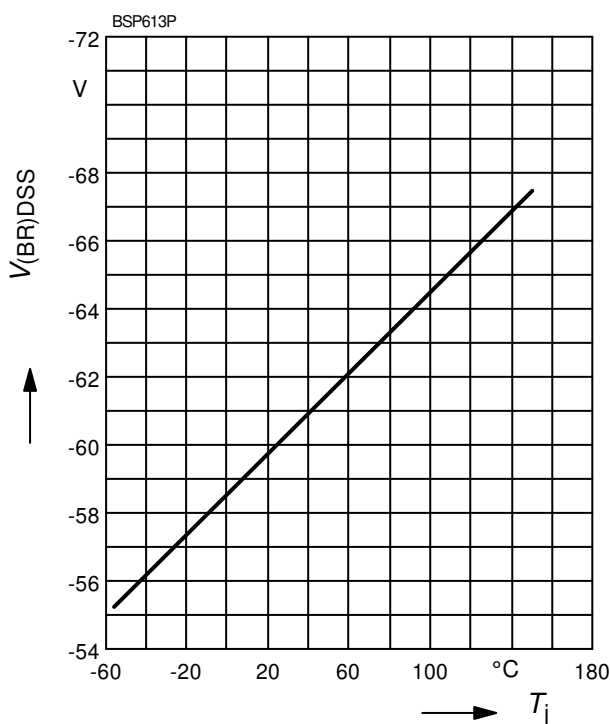
$$V_{GS} = f(Q_G), \text{ parameter: } V_{DS}; T_j = 25 \text{ }^\circ\text{C}$$

$I_D = 2.9 \text{ A}$  pulsed;



**15 Drain-source breakdown voltage**

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



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