

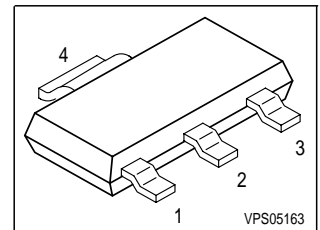
SIPMOS® Small-Signal-Transistor

Features

- P-Channel
- Enhancement mode
- Avalanche rated
- dv/dt rated

Product Summary

Drain source voltage	V_{DS}	-60	V
Drain-source on-state resistance	$R_{DS(on)}$	0.13	Ω
Continuous drain current	I_D	-2.9	A



Type	Package	Ordering Code
BSP613P	SOT-223	Q67040-S4190

Pin 1	Pin 2/4	PIN 3
G	D	S

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

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

Thermal Characteristics

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

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain- source breakdown voltage $V_{GS} = 0\text{ V}$, $I_D = -250\text{ }\mu\text{A}$	$V_{(BR)DSS}$	-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 $V_{DS} = -60\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 25\text{ °C}$ $V_{DS} = -60\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 125\text{ °C}$	I_{DSS}	-	-0.1 -10	-1 -100	μA
Gate-source leakage current $V_{GS} = -20\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	-	-10	-100	nA
Drain-source on-state resistance $V_{GS} = -10\text{ V}$, $I_D = -2.9\text{ A}$	$R_{DS(on)}$	-	0.11	0.13	Ω

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Transconductance $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = -2.9\text{ A}$	g_{fs}	2.3	4.6	-	S
Input capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = -25\text{ V}$, $f = 1\text{ MHz}$	C_{iss}	-	700	875	pF
Output capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = -25\text{ V}$, $f = 1\text{ MHz}$	C_{oss}	-	235	295	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = -25\text{ V}$, $f = 1\text{ MHz}$	C_{rss}	-	95	120	
Turn-on delay time $V_{DD} = -30\text{ V}$, $V_{GS} = -10\text{ V}$, $I_D = -2.9\text{ A}$, $R_G = 2.7\ \Omega$	$t_{d(on)}$	-	11.5	17	ns
Rise time $V_{DD} = -30\text{ V}$, $V_{GS} = -10\text{ V}$, $I_D = -2.9\text{ A}$, $R_G = 2.7\ \Omega$	t_r	-	12	18	
Turn-off delay time $V_{DD} = -30\text{ V}$, $V_{GS} = -10\text{ V}$, $I_D = -2.9\text{ A}$, $R_G = 2.7\ \Omega$	$t_{d(off)}$	-	35	52	
Fall time $V_{DD} = -30\text{ V}$, $V_{GS} = -10\text{ V}$, $I_D = -2.9\text{ A}$, $R_G = 2.7\ \Omega$	t_f	-	13	19	

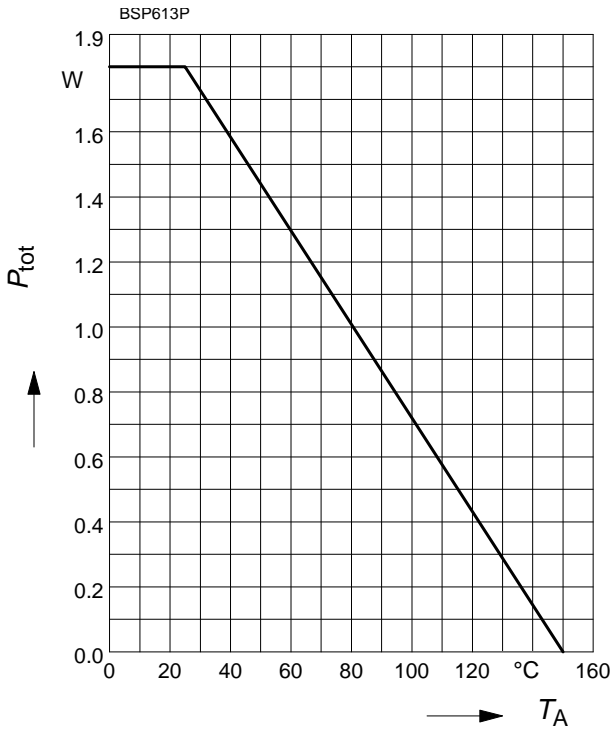
Electrical Characteristics, at $T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Gate to source charge $V_{DD} = -48\text{ V}, I_D = -2.9\text{ A}$	Q_{gs}	-	1.7	2.6	nC
Gate to drain charge $V_{DD} = -48\text{ V}, I_D = -2.9\text{ A}$	Q_{gd}	-	9.5	14.3	
Gate charge total $V_{DD} = -48\text{ V}, I_D = -2.9\text{ A}, V_{GS} = 0\text{ to }-10\text{ V}$	Q_g	-	22	33	
Gate plateau voltage $V_{DD} = -48\text{ V}, I_D = -2.9\text{ A}$	$V_{(plateau)}$	-	-3.7	-	V

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Inverse diode continuous forward current $T_A = 25\text{ °C}$	I_S	-	-	-2.9	A
Inverse diode direct current,pulsed $T_A = 25\text{ °C}$	I_{SM}	-	-	-11.6	
Inverse diode forward voltage $V_{GS} = 0\text{ V}, I_F = -2.9\text{ A}$	V_{SD}	-	-0.8	-1.1	V
Reverse recovery time $V_R = -30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$	t_{rr}	-	46.6	79	ns
Reverse recovery charge $V_R = -30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$	Q_{rr}	-	75	112	nC

Power Dissipation

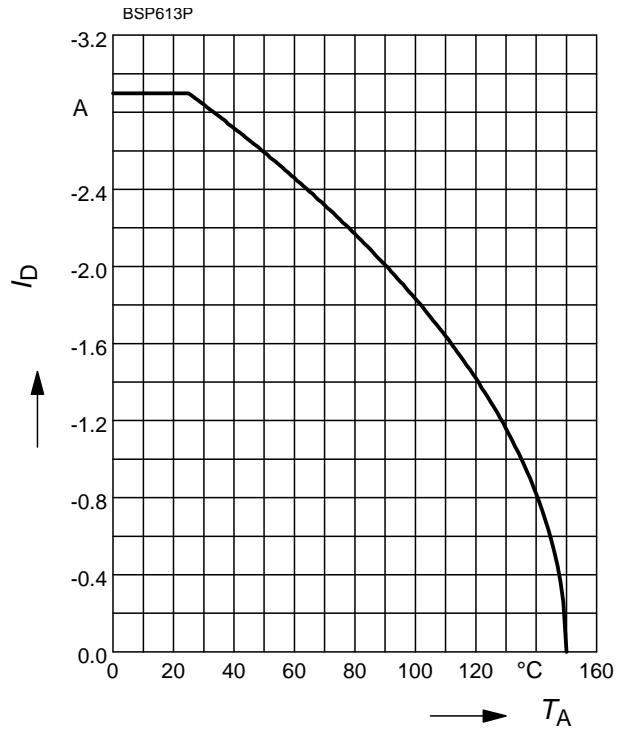
$$P_{tot} = f(T_A)$$



Drain current

$$I_D = f(T_A)$$

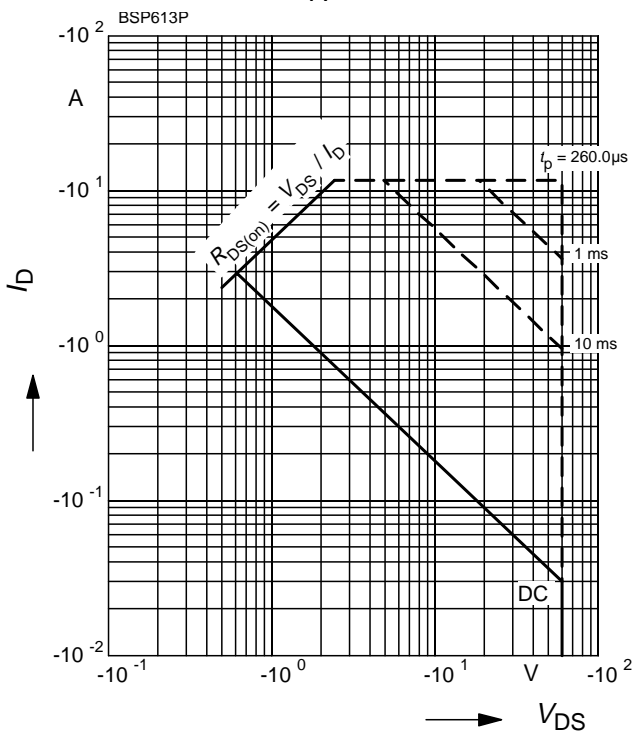
parameter: $V_{GS} \geq 10 \text{ V}$



Safe operating area

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

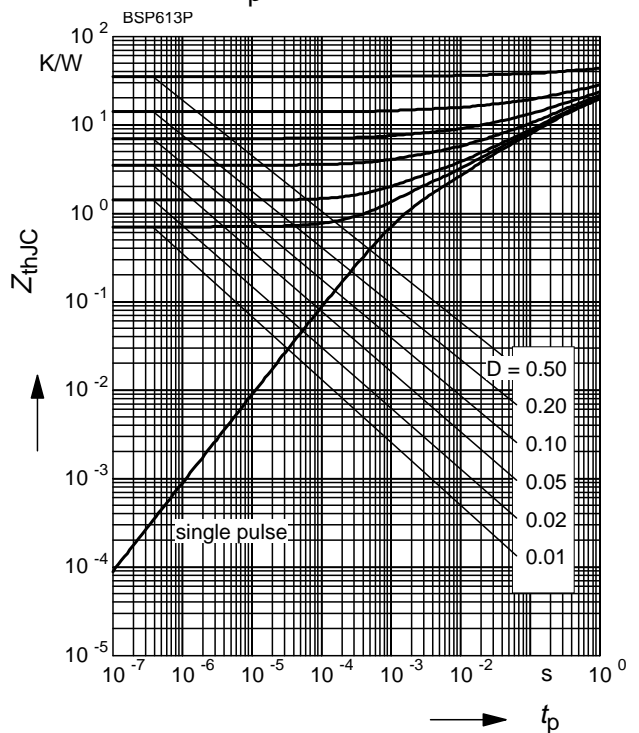
parameter: $D = 0, T_A = 25 \text{ °C}$



Transient thermal impedance

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

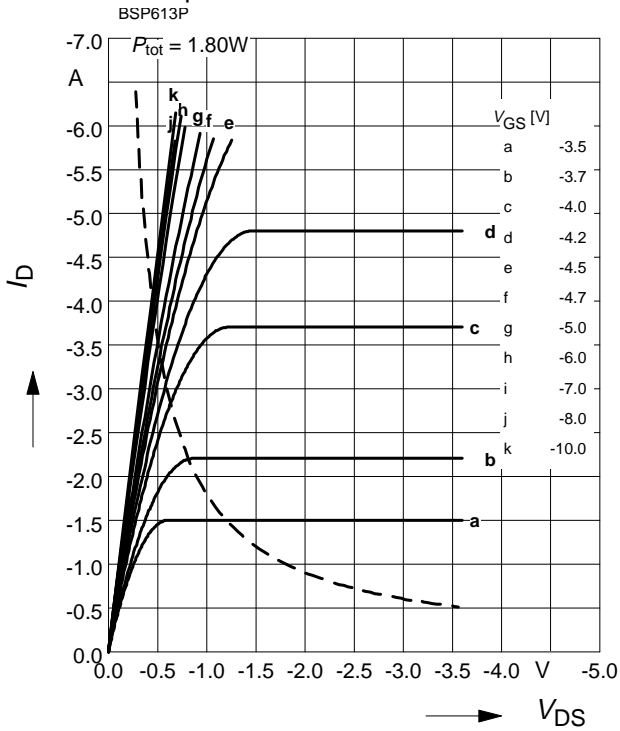
parameter: $D = t_p / T$



Typ. output characteristic

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

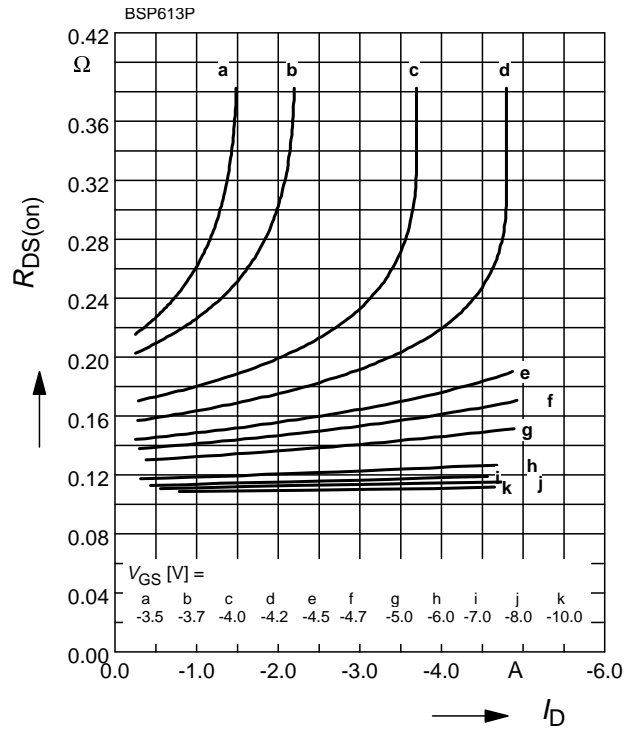
parameter: $t_p = 80 \mu\text{s}$



Typ. drain-source-on-resistance

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

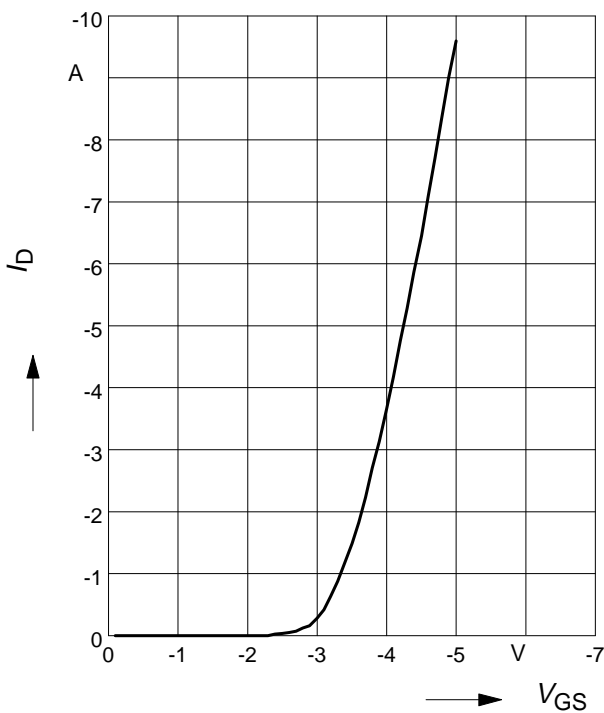
parameter: V_{GS}



Typ. transfer characteristics $I_D = f(V_{GS})$

$V_{DS} \geq 2 \times I_D \times R_{DS(\text{on})\text{max}}$

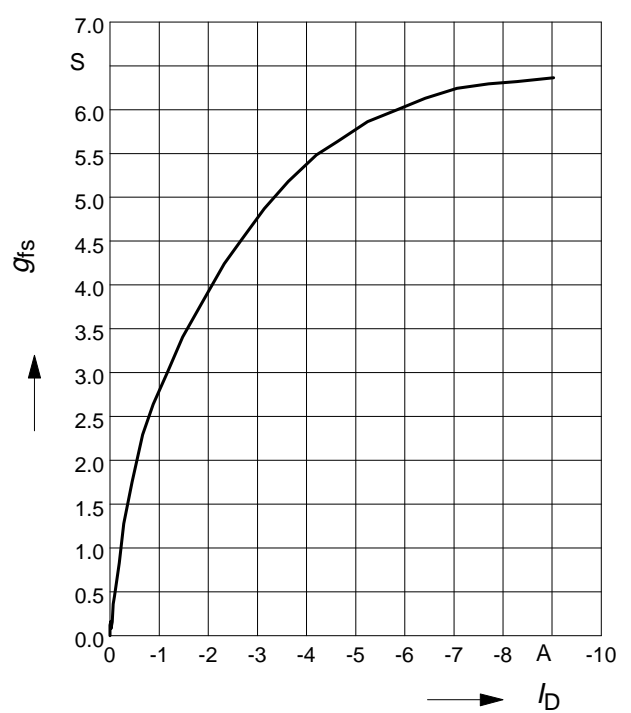
parameter: $t_p = 80 \mu\text{s}$



Typ. forward transconductance

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

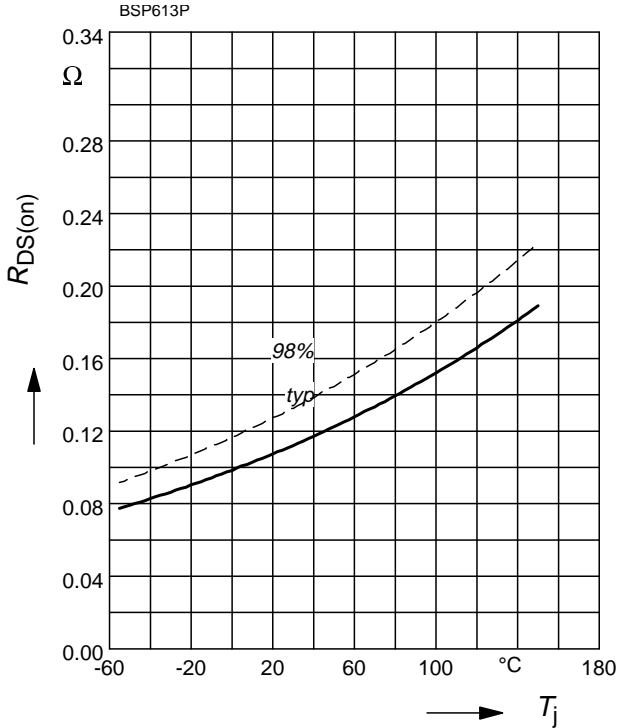
parameter: g_{fs}



Drain-source on-state resistance

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

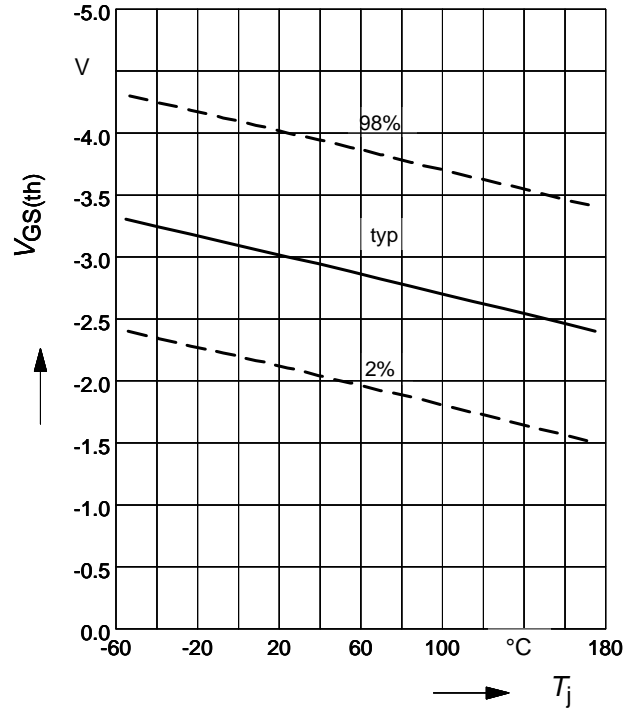
parameter: $I_D = -2.9 \text{ A}$, $V_{GS} = -10 \text{ V}$



Gate threshold voltage

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

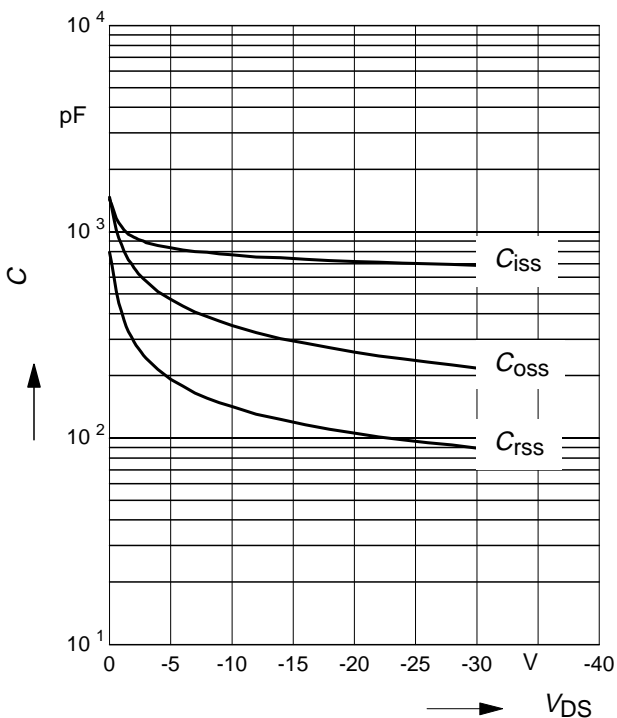
parameter: $V_{GS} = V_{DS}$, $I_D = -1 \text{ mA}$



Typ. capacitances

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

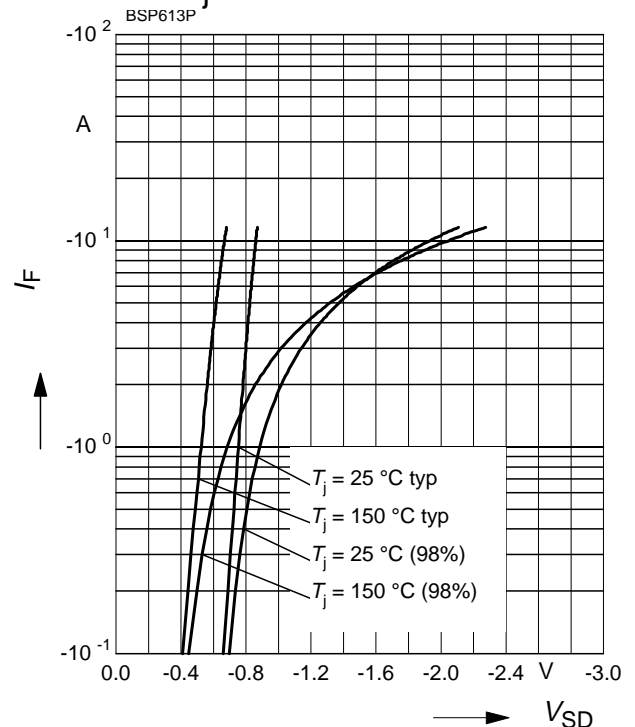
parameter: $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$



Forward characteristics of reverse diode

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

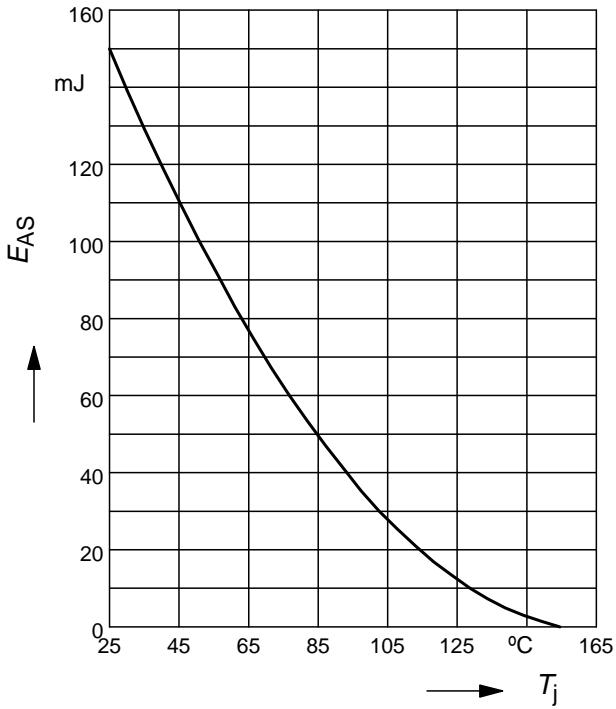
parameter: T_j , $t_p = 80 \mu\text{s}$



Avalanche energy

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

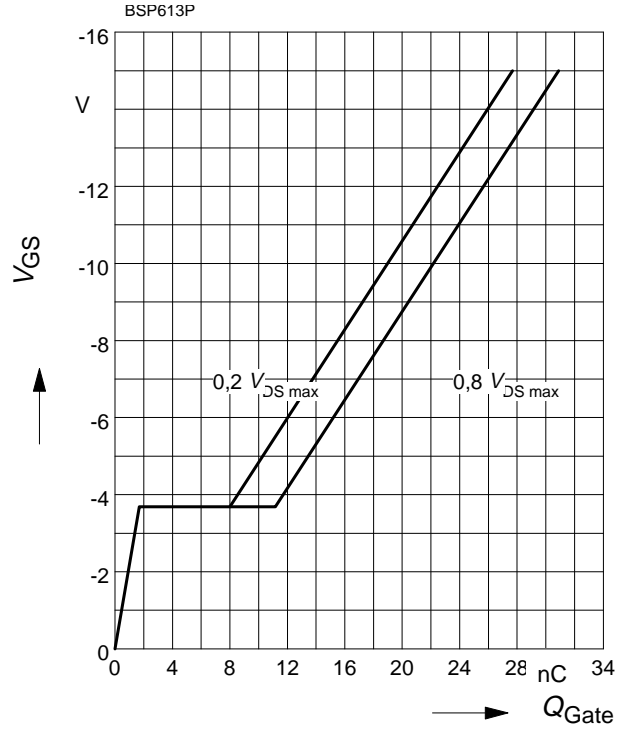
para.: $I_D = -2.9 \text{ A}$, $V_{DD} = -25 \text{ V}$, $R_{GS} = 25 \text{ } \Omega$



Typ. gate charge

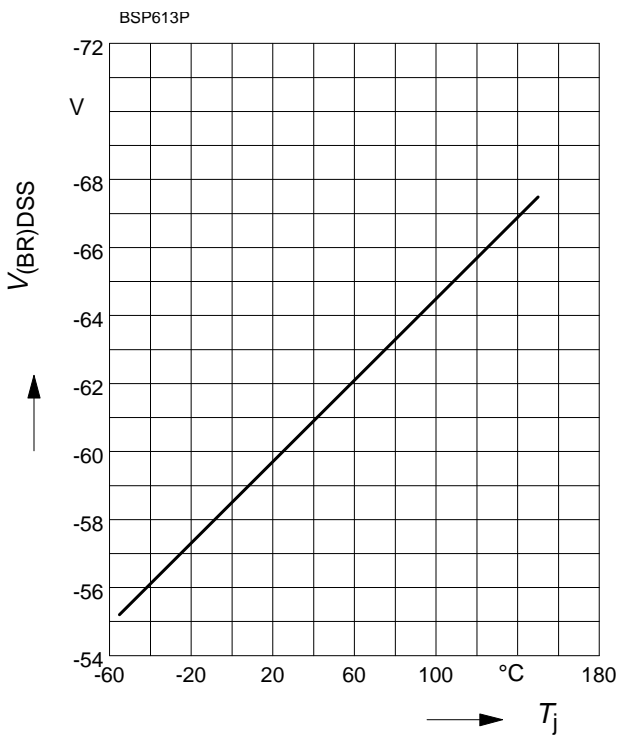
$$V_{GS} = f(Q_{Gate})$$

parameter: $I_D = -2.9 \text{ A}$ pulsed



Drain-source breakdown voltage

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



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