

## SIPMOS® Small-Signal-Transistor

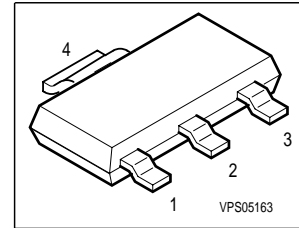
## BSP 320S

### Features

- N channel
- Enhancement mode
- Avalanche rated
- $dv/dt$  rated

### Product Summary

Drain source voltage	$V_{DS}$	60	V
Drain-Source on-state resistance	$R_{DS(on)}$	0.12	$\Omega$
Continuous drain current	$I_D$	2.9	A



Type	Package	Ordering Code
BSP320S	SOT-223	Q67000-S4001

Pin 1	Pin 2/4	Pin 3
G	D	S

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

Parameter	Symbol	Value	Unit
Continuous drain current	$I_D$	2.9	A
Pulsed drain current $T_A = 25\text{ }^\circ\text{C}$	$I_{Dpulse}$	11.6	
Avalanche energy, single pulse $I_D = 2.9\text{ A}$ , $V_{DD} = 25\text{ V}$ , $R_{GS} = 25\text{ }\Omega$	$E_{AS}$	60	mJ
Avalanche current, periodic limited by $T_{jmax}$	$I_{AR}$	2.9	A
Avalanche energy, periodic limited by $T_{jmax}$	$E_{AR}$	0.18	mJ
Reverse diode $dv/dt$ $I_S = 2.9\text{ A}$ , $V_{DS} = 20\text{ V}$ , $di/dt = 200\text{ A}/\mu\text{s}$ , $T_{jmax} = 150\text{ }^\circ\text{C}$	$dv/dt$	6	kV/ $\mu\text{s}$
Gate source voltage	$V_{GS}$	$\pm 20$	V
Power dissipation $T_A = 25\text{ }^\circ\text{C}$	$P_{tot}$	1.8	W
Operating temperature	$T_j$	-55 ... +150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55 ... +150	
IEC climatic category; DIN IEC 68-1		55/150/56	

**Electrical Characteristics**

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
at $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified					

**Thermal Characteristics**

Thermal resistance, junction - soldering point (Pin 4)	$R_{thJS}$	-	17	-	K/W
SMD version, device on PCB:	$R_{thJA}$				K/W
@ min. footprint		-	110	-	
@ 6 cm <sup>2</sup> cooling area <sup>1)</sup>		-	-	70	

**Static Characteristics**

Drain- source breakdown voltage $V_{GS} = 0\text{ V}$ , $I_D = 0.25\text{ mA}$	$V_{(BR)DSS}$	60	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 20\text{ }\mu\text{A}$	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current $V_{DS} = 60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$ $V_{DS} = 60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$	$I_{DSS}$	-	0.1	1	$\mu\text{A}$
Gate-source leakage current $V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$	$I_{GSS}$	-	10	100	nA
Drain-Source on-state resistance $V_{GS} = 10\text{ V}$ , $I_D = 2.9\text{ A}$	$R_{DS(on)}$	-	0.09	0.12	$\Omega$

<sup>1</sup> Device on 50mm\*50mm\*1.5mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical without blown air.

**Electrical Characteristics**

Parameter at $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
<b>Dynamic Characteristics</b>					
Transconductance $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 2.9\text{ A}$	$g_{fs}$	2.5	5.8	-	S
Input capacitance $V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$	$C_{iss}$	-	275	340	pF
Output capacitance $V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$	$C_{oss}$	-	90	120	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$	$C_{rss}$	-	50	65	
Turn-on delay time $V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 2.9\text{ A}$ , $R_G = 33\text{ }\Omega$	$t_{d(on)}$	-	11	17	ns
Rise time $V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 2.9\text{ A}$ , $R_G = 33\text{ }\Omega$	$t_r$	-	25	40	
Turn-off delay time $V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 2.9\text{ A}$ , $R_G = 33\text{ }\Omega$	$t_{d(off)}$	-	25	40	
Fall time $V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 2.9\text{ A}$ , $R_G = 33\text{ }\Omega$	$t_f$	-	35	55	

**Electrical Characteristics**

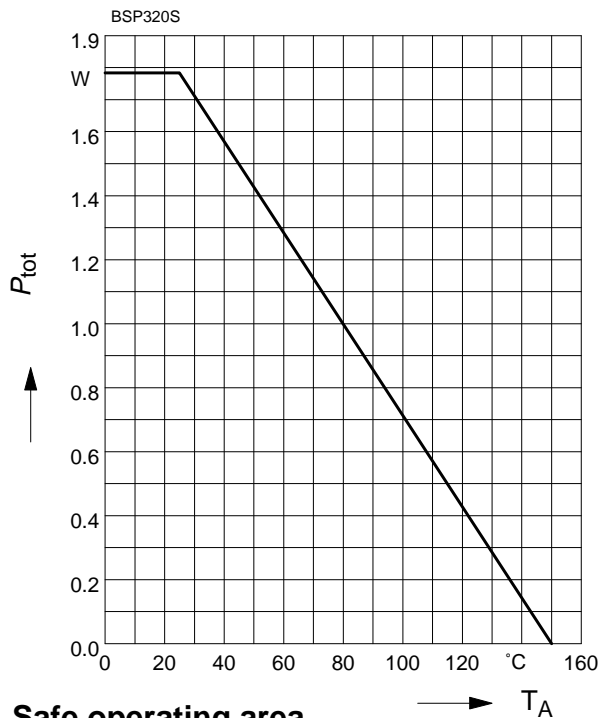
Parameter at $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
<b>Dynamic Characteristics</b>					
Gate charge at threshold $V_{DD} = 40\text{ V}$ , $I_D = 0.1\text{ A}$ , $V_{GS} = 1\text{ V}$	$Q_{G(th)}$	-	0.25	0.3	nC
Gate charge at $V_{GS}=7\text{V}$ $V_{DD} = 40\text{ V}$ , $I_D = 2.9\text{ A}$ , $V_{GS} = 0\text{ to }7\text{ V}$	$Q_{g(7)}$	-	7.4	9.3	nC
Gate charge total $V_{DD} = 40\text{ V}$ , $I_D = 2.9\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$	$Q_g$	-	9.7	12	
Gate plateau voltage $V_{DD} = 40\text{ V}$ , $I_D = 2.9\text{ A}$	$V_{(plateau)}$	-	4.7	-	V

**Reverse Diode**

Inverse diode continuous forward current $T_A = 25\text{ }^\circ\text{C}$	$I_S$	-	-	2.9	A
Inverse diode direct current,pulsed $T_A = 25\text{ }^\circ\text{C}$	$I_{SM}$	-	-	11.6	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$ , $I_F = 5.8\text{ A}$	$V_{SD}$	-	0.95	1.2	V
Reverse recovery time $V_R = 30\text{ V}$ , $I_F=I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$	$t_{rr}$	-	45	56	ns
Reverse recovery charge $V_R = 30\text{ V}$ , $I_F=I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$	$Q_{rr}$	-	0.08	0.12	$\mu\text{C}$

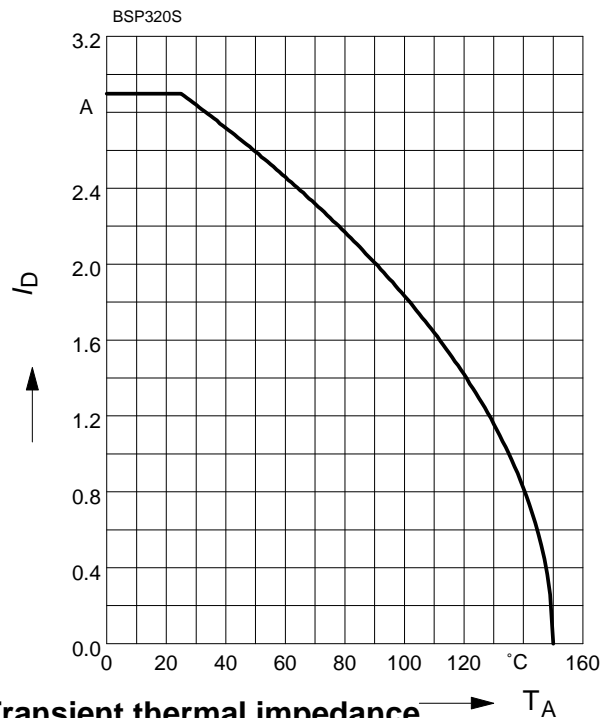
**Power Dissipation**

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



**Drain current**

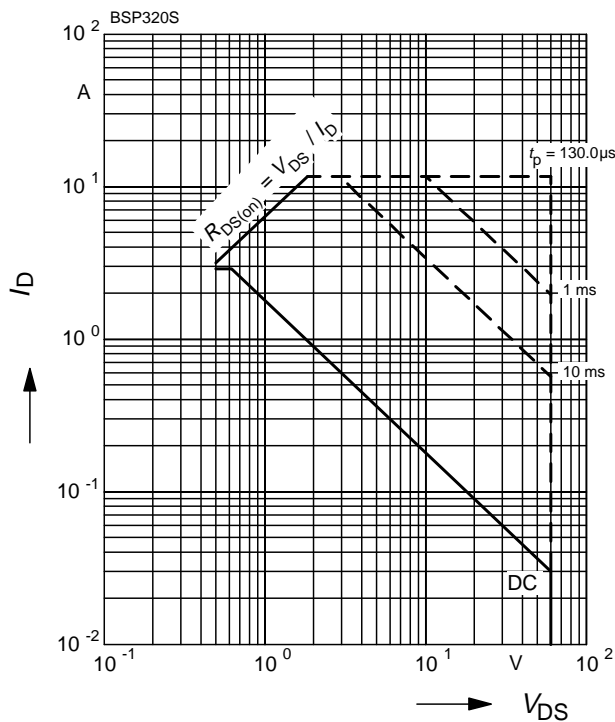
$$I_D = f(T_A)$$



**Safe operating area**

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

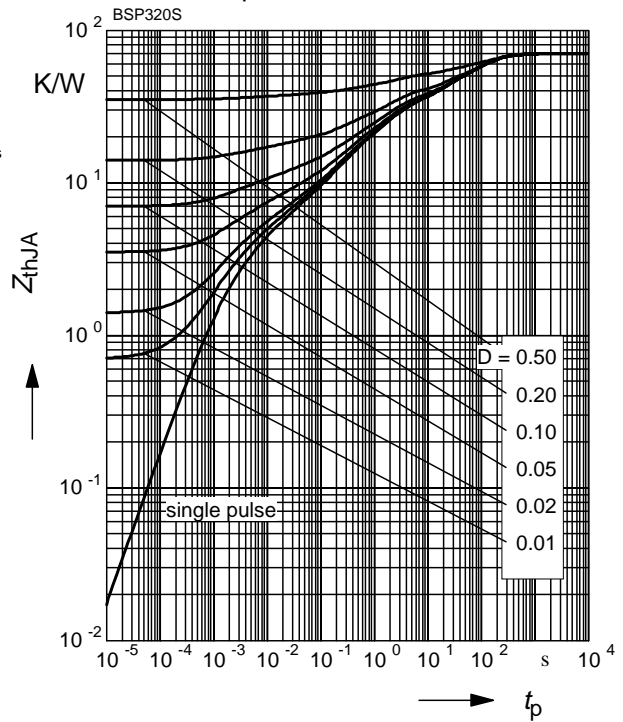
parameter :  $D = 0$  ,  $T_A = 25\text{ }^\circ\text{C}$



**Transient thermal impedance**

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

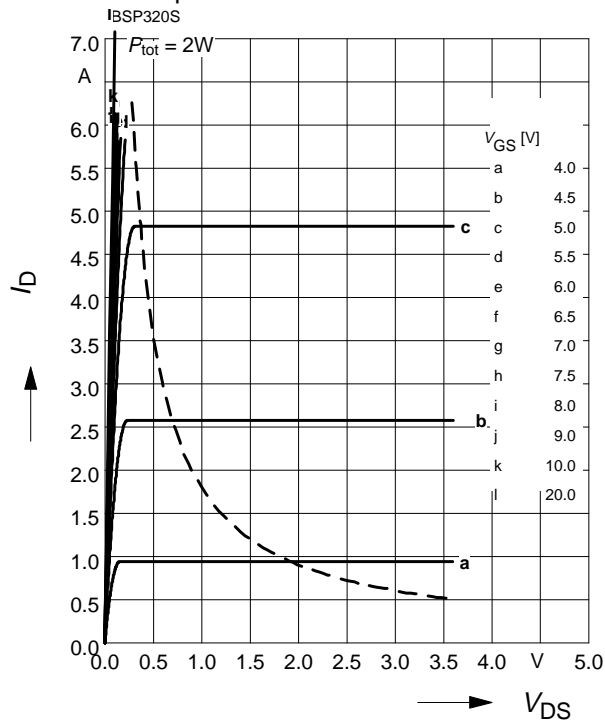
parameter :  $D = t_p / T$



**Typ. output characteristics**

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

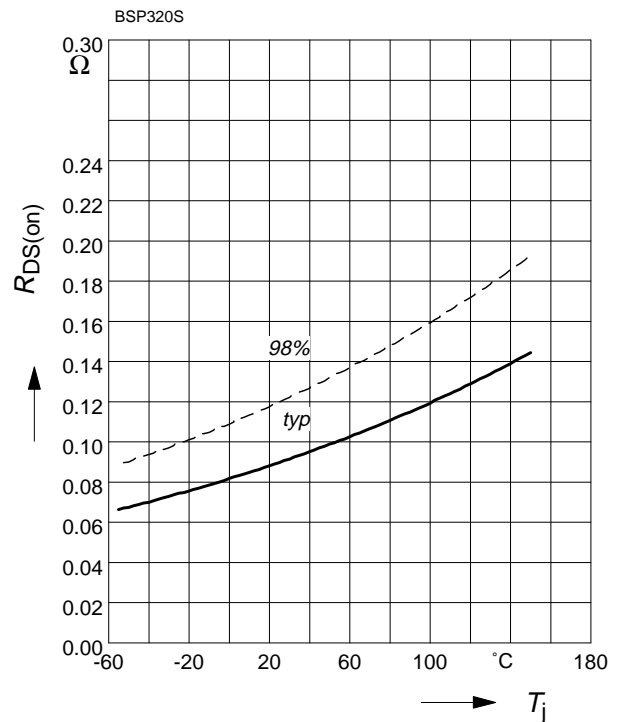
parameter:  $t_p = 80 \mu s$



**Drain-source on-resistance**

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

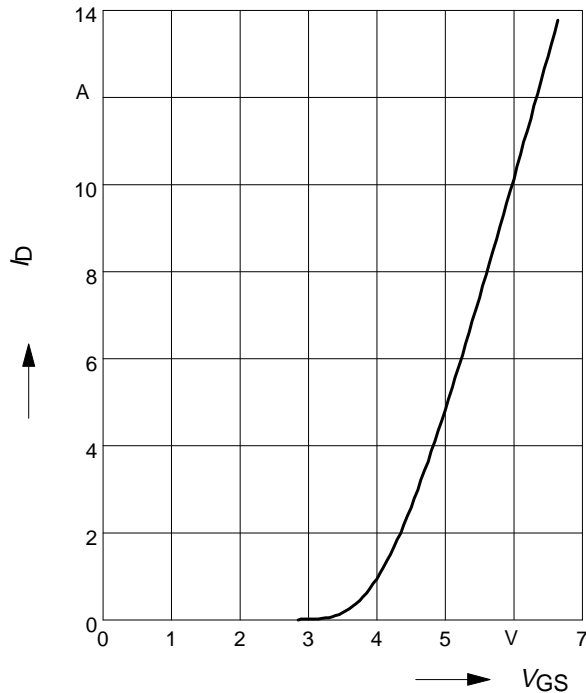
parameter:  $I_D = 2.9 A, V_{GS} = 10 V$



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

parameter:  $t_p = 80 \mu s$

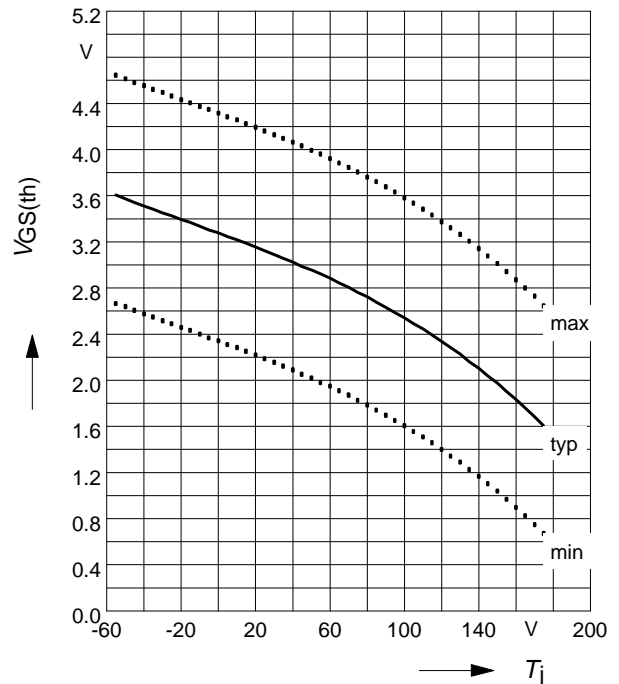
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



**Gate threshold voltage**

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

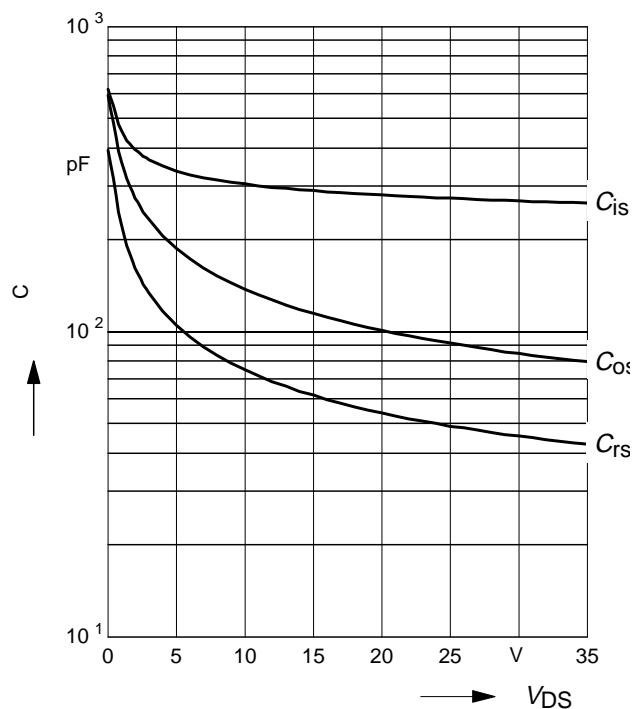
parameter:  $V_{GS} = V_{DS}, I_D = 20 \mu A$



**Typ. capacitances**

$C = f(V_{DS})$

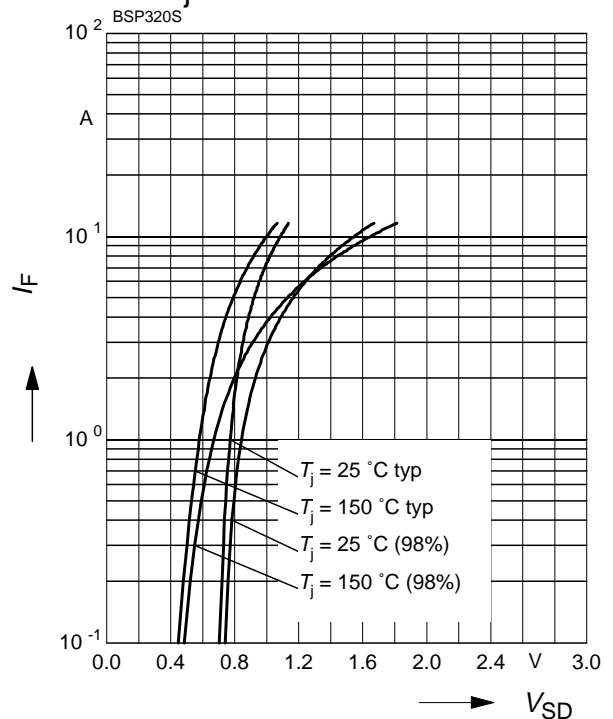
Parameter:  $V_{GS}=0 V, f=1 MHz$



**Forward characteristics of reverse diode**

$I_F = f(V_{SD})$

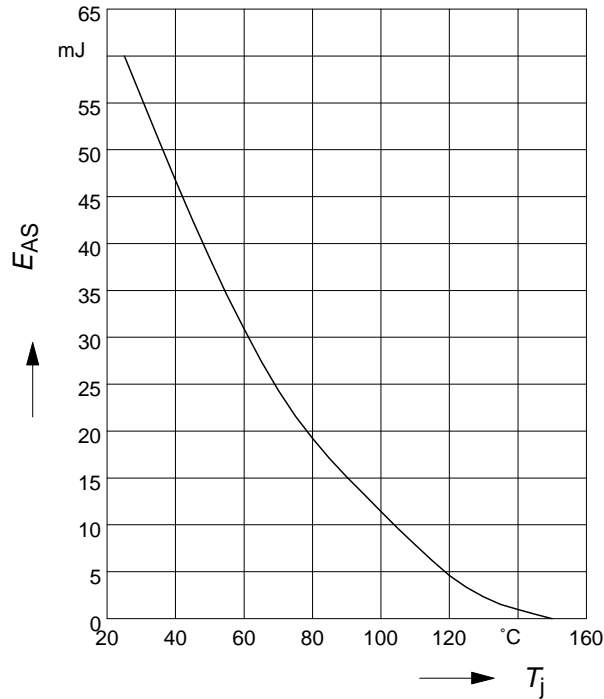
parameter:  $T_j, t_p = 80 \mu s$



**Avalanche Energy  $E_{AS} = f(T_j)$**

parameter:  $I_D = 2.9\text{ A}$ ,  $V_{DD} = 25\text{ V}$

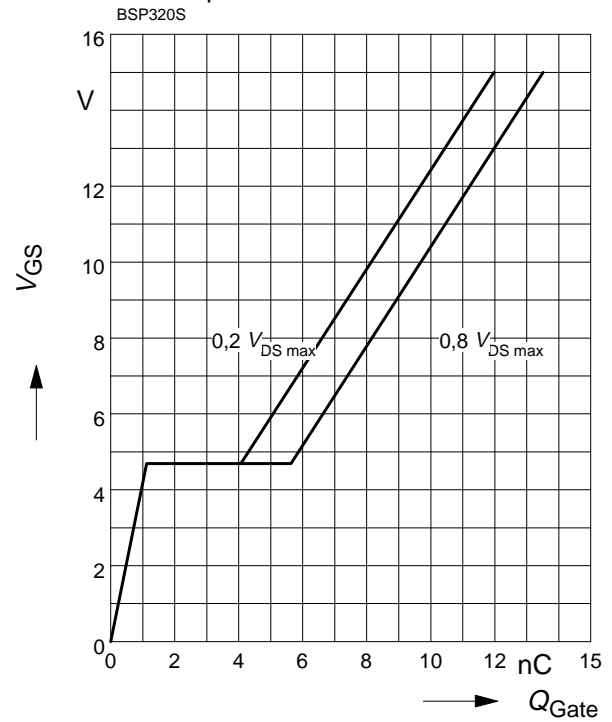
$R_{GS} = 25\ \Omega$



**Typ. gate charge**

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

parameter:  $I_{D\text{ puls}} = 2.9\text{ A}$



**Drain-source breakdown voltage**

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

