

SIPMOS® Small-Signal-Transistor

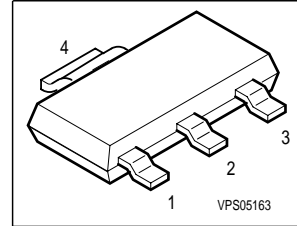
BSP 320S

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	Ω
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/ μs
Gate source voltage	V_{GS}	± 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 ² cooling area ¹⁾		-	-	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	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 $V_{GS} = 10\text{ V}$, $I_D = 2.9\text{ A}$	$R_{DS(on)}$	-	0.09	0.12	Ω

¹ Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm 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.	
Dynamic Characteristics					
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

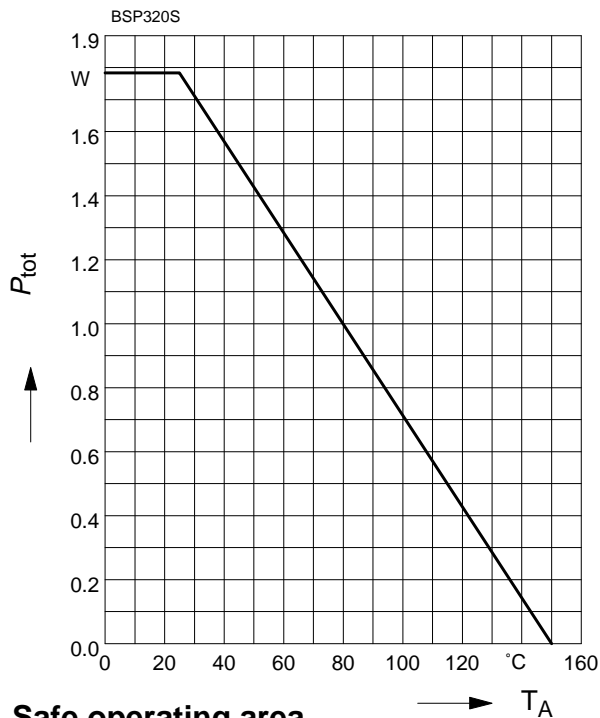
Parameter at $T_j = 25\text{ }^\circ\text{C}$, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Gate charge at threshold $V_{DD} = 40\text{ V}$, $I_D = 0.1\text{ A}$, $V_{GS} = 1\text{ V}$	$Q_{G(th)}$	-	0.25	0.3	nC
Gate charge at $V_{GS}=7\text{V}$ $V_{DD} = 40\text{ V}$, $I_D = 2.9\text{ A}$, $V_{GS} = 0\text{ to }7\text{ V}$	$Q_{g(7)}$	-	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	μC

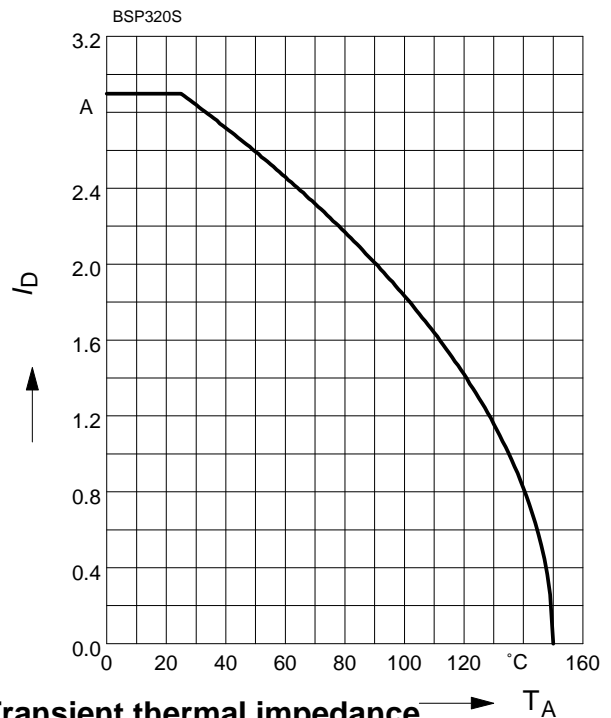
Power Dissipation

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



Drain current

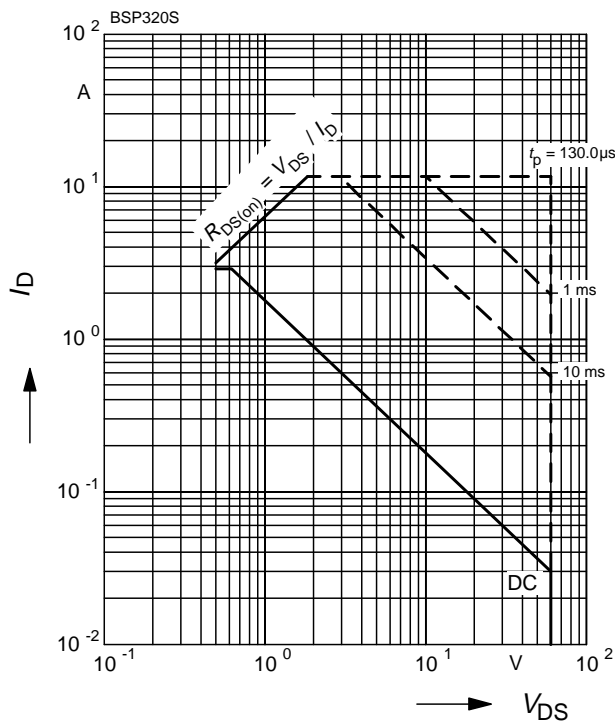
$$I_D = f(T_A)$$



Safe operating area

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

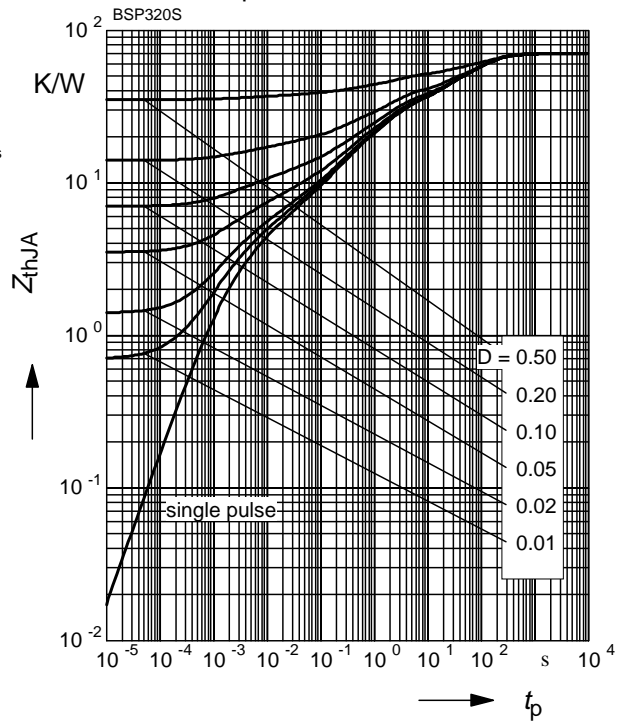
parameter : $D = 0$, $T_A = 25\text{ °C}$



Transient thermal impedance

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

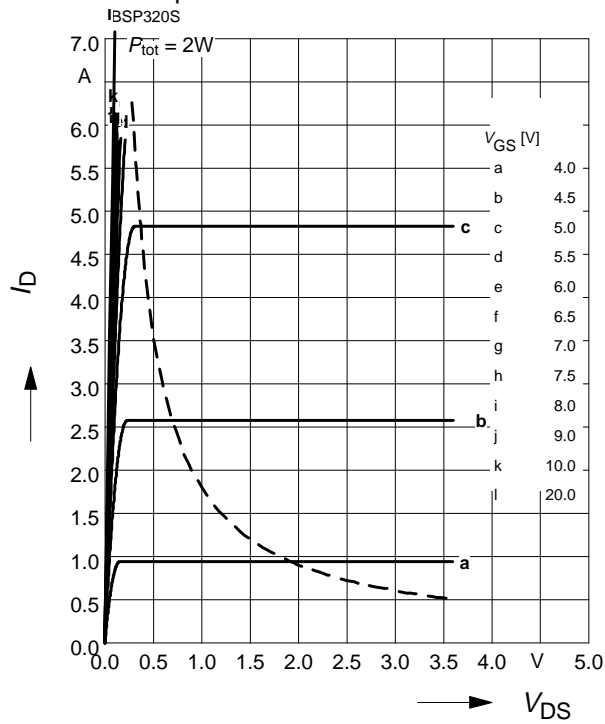
parameter : $D = t_p/T$



Typ. output characteristics

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

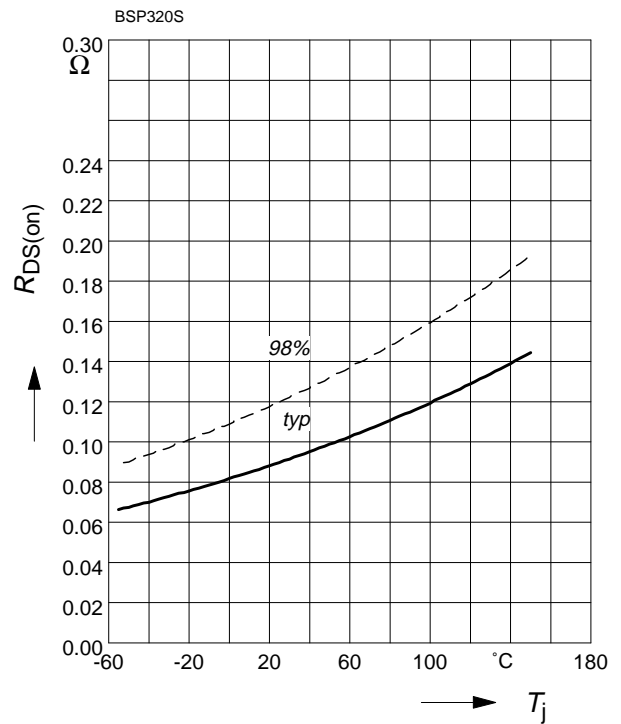
parameter: $t_p = 80 \mu s$



Drain-source on-resistance

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

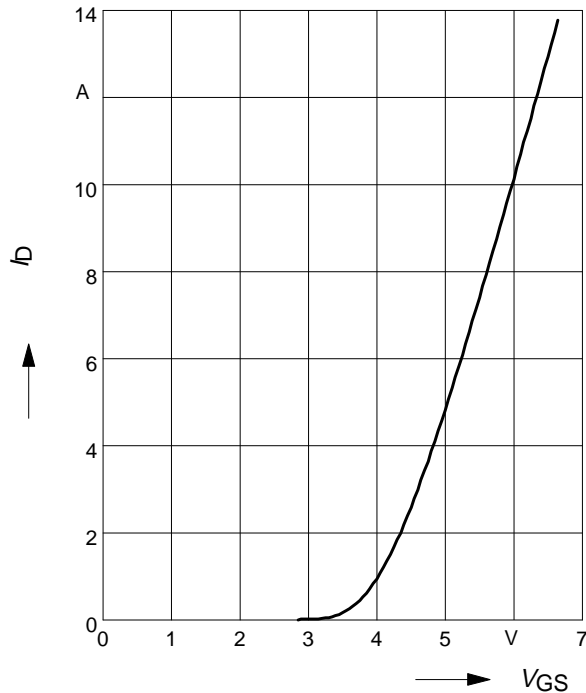
parameter: $I_D = 2.9 A, V_{GS} = 10 V$



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

parameter: $t_p = 80 \mu s$

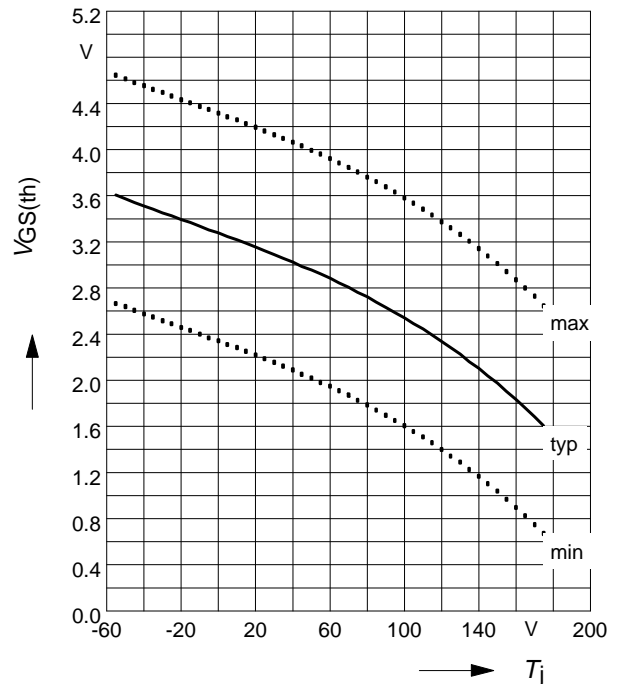
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



Gate threshold voltage

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

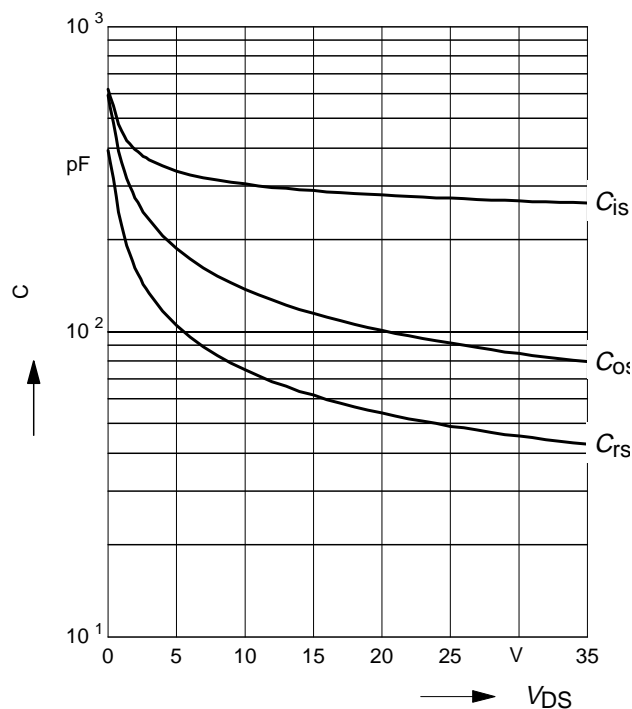
parameter: $V_{GS} = V_{DS}, I_D = 20 \mu A$



Typ. capacitances

$C = f(V_{DS})$

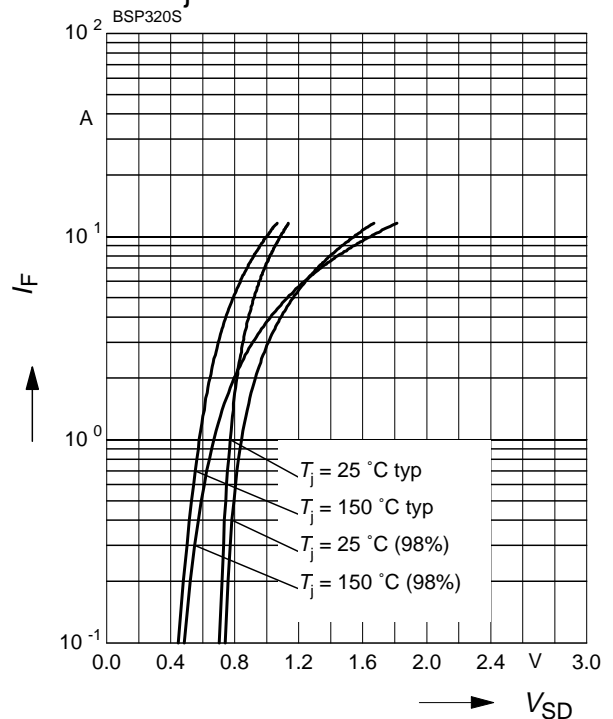
Parameter: $V_{GS} = 0 V, f = 1 MHz$



Forward characteristics of reverse diode

$I_F = f(V_{SD})$

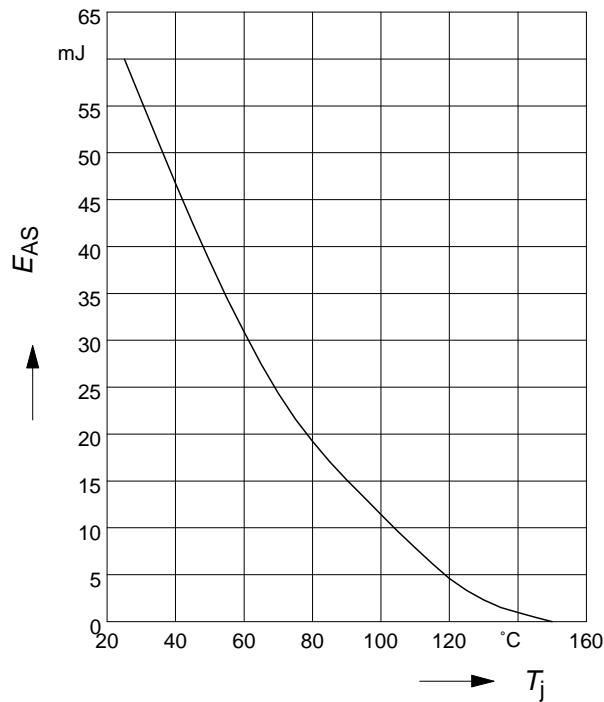
parameter: $T_j, t_p = 80 \mu s$



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

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

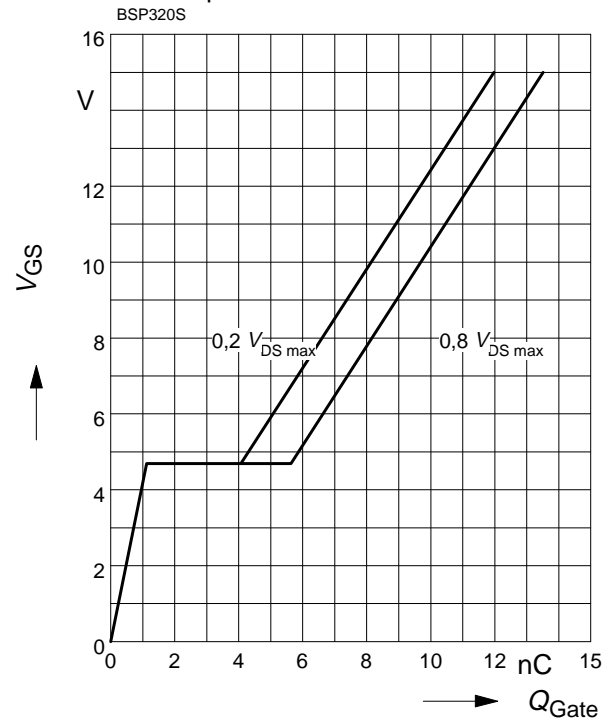
$R_{GS} = 25\ \Omega$



Typ. gate charge

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

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



Drain-source breakdown voltage

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

