

SIPMOS® Small-Signal-Transistor

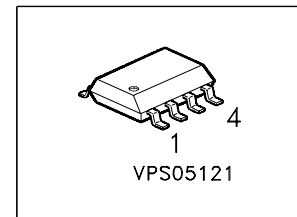
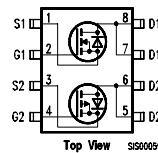
Features

- Dual N- and P -Channel
- Enhancement mode
- Logic Level
- Avalanche rated
- dv/dt rated

Product Summary

		N	P	
Drain source voltage	V_{DS}	20	-20	V
Drain-Source on-state resistance	$R_{DS(on)}$	0.1	0.1	Ω
Continuous drain current	I_D	3.7	-3.7	A

Type	Package	Ordering Code
BSO 215 C	SO 8	Q67041-S4025



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

Parameter	Symbol	Value		Unit
		N	P	
Continuous drain current $T_A = 25\text{ °C}$ $T_A = 70\text{ °C}$	I_D	3.7 3	-3.7 -3	A
Pulsed drain current $T_A = 25\text{ °C}$	$I_{D\text{ puls}}$	14.8	-14.8	
Avalanche energy, single pulse $I_D = 3\text{ A}$, $V_{DD} = 15\text{ V}$, $R_{GS} = 25\ \Omega$ $I_D = -3.7\text{ A}$, $V_{DD} = -15\text{ V}$, $R_{GS} = 25\ \Omega$	E_{AS}	26 -	- 68	mJ
Avalanche energy, periodic limited by T_{jmax}	E_{AR}	0.2	0.2	
Reverse diode dv/dt, $T_{jmax} = 150\text{ °C}$ $I_S = 3\text{ A}$, $V_{DS} = 16\text{ V}$, $di/dt = 200\text{ A}/\mu\text{s}$ $I_S = -2.7\text{ A}$, $V_{DS} = -16\text{ V}$, $di/dt = -200\text{ A}/\mu\text{s}$	dv/dt	6 -	- 6	kV/ μs
Gate source voltage	V_{GS}	± 20	± 20	V
Power dissipation $T_A = 25\text{ °C}$	P_{tot}	2	2	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.	

Dynamic Characteristics

Thermal resistance, junction - soldering point	N	R_{thJS}	-	-	40	K/W
	P		-	-	40	
SMD version, device on PCB: @ min. footprint; $t \leq 10$ sec. @ 6 cm ² cooling area ¹⁾ ; $t \leq 10$ sec. @ min. footprint; $t \leq 10$ sec. @ 6 cm ² cooling area ¹⁾ ; $t \leq 10$ sec.	N	R_{thJA}	-	-	110	
	N		-	-	62.5	
	P		-	-	100	
	P		-	-	62.5	

Static Characteristics, at $T_j = 25$ °C, unless otherwise specified

Drain- source breakdown voltage $V_{GS} = 0$ V, $I_D = 250$ μ A $V_{GS} = 0$ V, $I_D = -250$ μ A	N	$V_{(BR)DSS}$	20	-	-	V
	P		-20	-	-	
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 10$ μ A $I_D = -450$ μ A	N	$V_{GS(th)}$	1.2	1.5	2	
	P		-1	-1.5	-2	
Zero gate voltage drain current $V_{DS} = 20$ V, $V_{GS} = 0$ V, $T_j = 25$ °C $V_{DS} = 20$ V, $V_{GS} = 0$ V, $T_j = 125$ °C $V_{DS} = -20$ V, $V_{GS} = 0$ V, $T_j = 25$ °C $V_{DS} = -20$ V, $V_{GS} = 0$ V, $T_j = 125$ °C	N	I_{DSS}	-	0.1	1	μ A
	N		-	10	100	
	P		-	-0.1	-1	
	P		-	-10	-100	
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$ V $V_{GS} = -20$ V, $V_{DS} = 0$ V	N	I_{GSS}	-	10	100	nA
	P		-	-10	-100	
Drain-Source on-state resistance $V_{GS} = 4.5$ V, $I_D = 3$ A $V_{GS} = -4.5$ V, $I_D = -3$ A	N	$R_{DS(on)}$	-	0.1	0.15	Ω
	P		-	0.1	0.15	
Drain-Source on-state resistance $V_{GS} = 10$ V, $I_D = 3.7$ A $V_{GS} = -10$ V, $I_D = -3.7$ A	N	$R_{DS(on)}$	-	0.05	0.1	Ω
	P		-	0.06	0.1	

¹Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 μ m thick) copper area for drain connection. PCB is vertical without blown air.

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

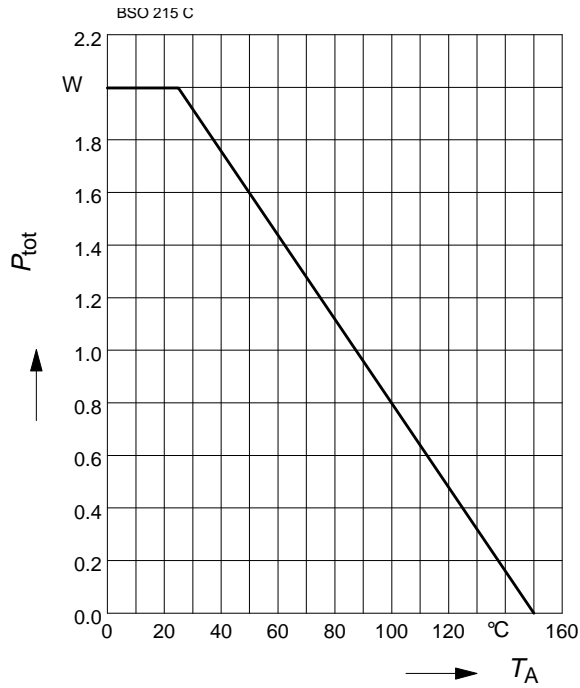
Parameter	Symbol	Values			Unit	
		min.	typ.	max.		
Characteristics						
Transconductance		g_{fs}				S
$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 3\text{ A}$	N		2.1	4.4	-	
$V_{VDS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = -3\text{ A}$	P		2.6	5.2	-	
Input capacitance		C_{iss}				pF
$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	N		-	197	246	
$V_{GS} = 0\text{ V}$, $V_{DS} = -25\text{ V}$, $f = 1\text{ MHz}$	P		-	380	475	
Output capacitance		C_{oss}				
$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	N		-	109	136	
$V_{GS} = 0\text{ V}$, $V_{DS} = -25\text{ V}$, $f = 1\text{ MHz}$	P		-	290	360	
Reverse transfer capacitance		C_{rss}				
$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	N		-	59	74	
$V_{GS} = 0\text{ V}$, $V_{DS} = -25\text{ V}$, $f = 1\text{ MHz}$	P		-	103	128	
Turn-on delay time		$t_{d(on)}$				ns
$V_{DD} = 10\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 3\text{ A}$, $R_G = 33\text{ }\Omega$	N		-	15	22.5	
$V_{DD} = -10$, $V_{GS} = -4.5\text{ V}$, $I_D = -3\text{ A}$, $R_G = 13\text{ }\Omega$	P		-	24	36	
Rise time		t_r				
$V_{DD} = 10\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 3\text{ A}$, $R_G = 33\text{ }\Omega$	N		-	88	132	
$V_{DD} = -10$, $V_{GS} = -4.5\text{ V}$, $I_D = -3\text{ A}$, $R_G = 13\text{ }\Omega$	P		-	236	354	
Turn-off delay time		$t_{d(off)}$				
$V_{DD} = 10\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 3\text{ A}$, $R_G = 33\text{ }\Omega$	N		-	12.3	18.5	
$V_{DD} = -10$, $V_{GS} = -4.5\text{ V}$, $I_D = -3\text{ A}$, $R_G = 13\text{ }\Omega$	P		-	87	130	
Fall time		t_f				
$V_{DD} = 10\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 3\text{ A}$, $R_G = 33\text{ }\Omega$	N		-	17.1	25.7	
$V_{DD} = -10\text{ V}$, $V_{GS} = -4.5\text{ V}$, $I_D = -3\text{ A}$, $R_G = 13\text{ }\Omega$	P		-	168	252	

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

Parameter	Symbol	Values			Unit	
		min.	typ.	max.		
Characteristics						
Gate to source charge $V_{DD} = 16, I_D = 3.7\text{ A}$ $V_{DD} = -16, I_D = -3.7\text{ A}$	N P	Q_{gs}	- -	1.3 1.9	2 2.9	nC
Gate to drain charge $V_{DD} = 16, I_D = 3.7\text{ A}$ $V_{DD} = -16, I_D = -3.7\text{ A}$	N P	Q_{gd}	- -	3 4.4	4.5 6.6	
Gate charge total $V_{DD} = 16, I_D = 3.7\text{ A}, V_{GS} = 0\text{ to }10\text{ V}$ $V_{DD} = -16, I_D = -3.7\text{ A}, V_{GS} = 0\text{ to }-10\text{ V}$	N P	Q_g	- -	7.7 13.2	11.5 19.8	
Gate plateau voltage $V_{DD} = 16, I_D = 3.7\text{ A}$ $V_{DD} = -16, I_D = -3.7\text{ A}$	N P	$V_{(\text{plateau})}$	- -	3.5 2.8	- -	V
Reverse Diode						
Inverse diode continuous forward current $T_A = 25\text{ }^\circ\text{C}$	N P	I_S	- -	- -	3.7 -3.7	A
Inverse diode direct current, pulsed $T_A = 25\text{ }^\circ\text{C}$	N P	I_{SM}	- -	- -	14.8 -14.8	
Inverse diode forward voltage $V_{GS} = 0\text{ V}, I_F = I_S$ $V_{GS} = 0\text{ V}, I_F = I_S$	N P	V_{SD}	- -	0.84 -0.82	1.1 -1	V
Reverse recovery time $V_R = 10\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = -10\text{ V}, I_F = I_S, di_F/dt = -100\text{ A}/\mu\text{s}$	N P	t_{rr}	- -	46.5 137	70 205	ns
Reverse recovery charge $V_R = 10\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = -10\text{ V}, I_F = I_S, di_F/dt = -100\text{ A}/\mu\text{s}$	N P	Q_{rr}	- -	18.4 80	27.6 120	μC

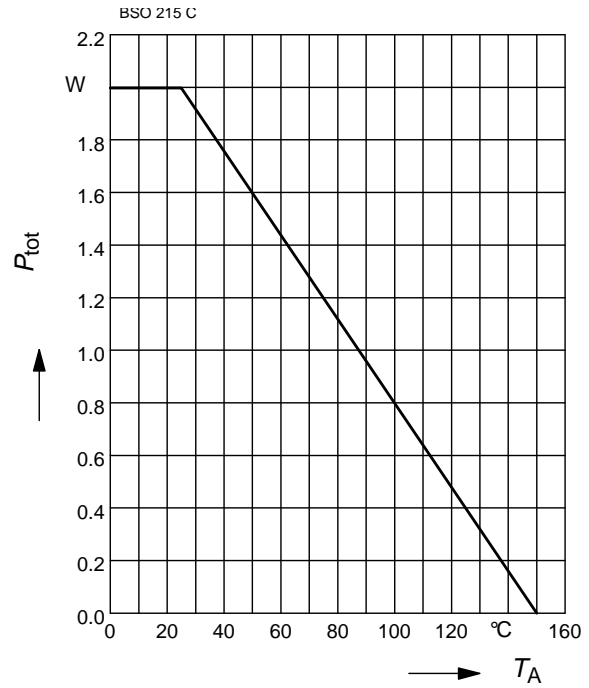
Power Dissipation (N-Ch.)

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



Power Dissipation (P-Ch.)

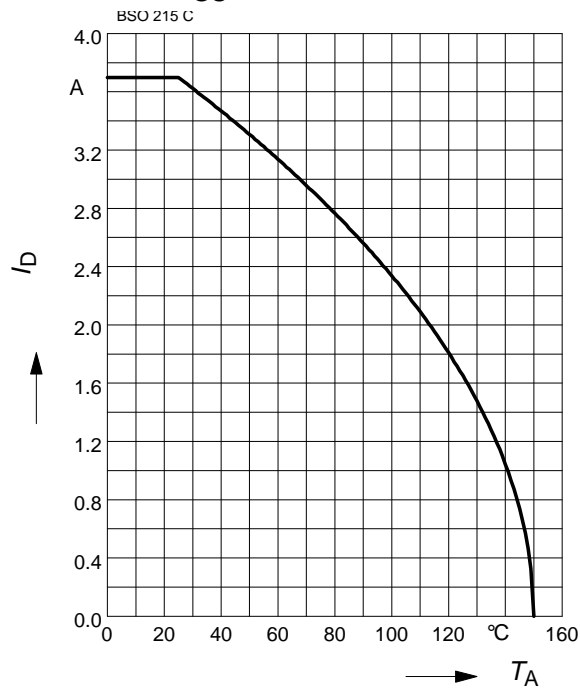
$$P_{\text{tot}} = f(T_A)$$



Drain current (N-Ch.)

$$I_D = f(T_A)$$

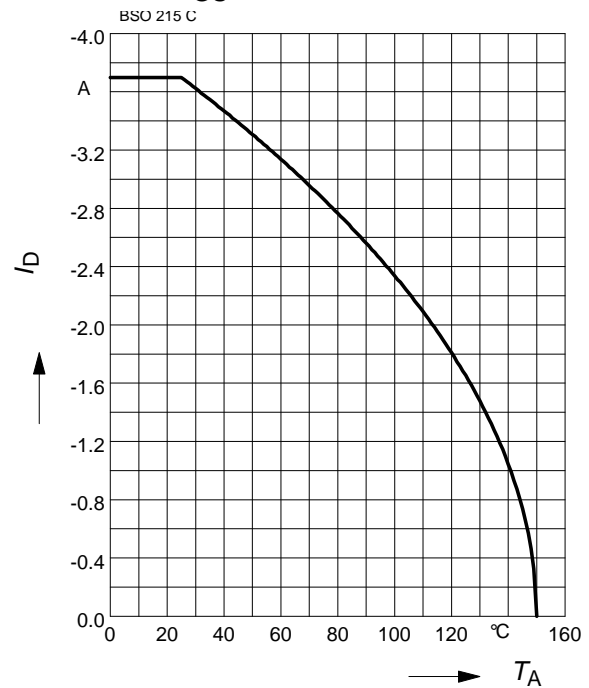
parameter: $V_{GS} \geq 10 \text{ V}$



Drain current (P-Ch.)

$$I_D = f(T_A)$$

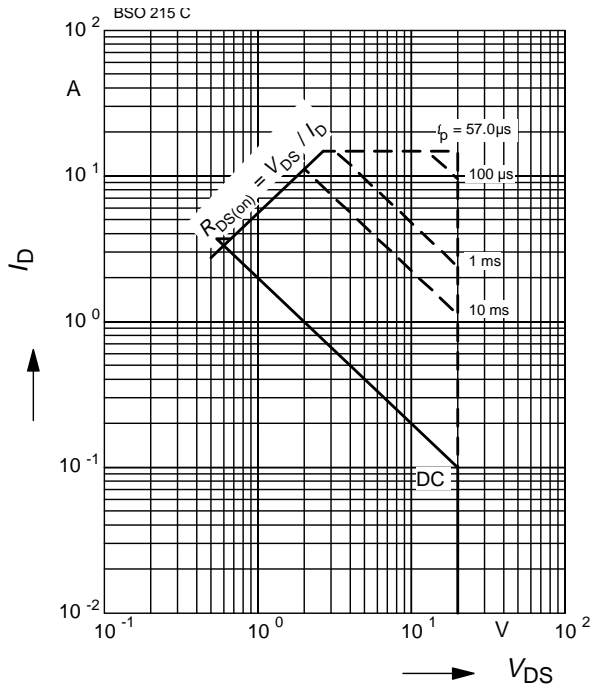
parameter: $V_{GS} \geq -10 \text{ V}$



Safe operating area (N-Ch.)

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

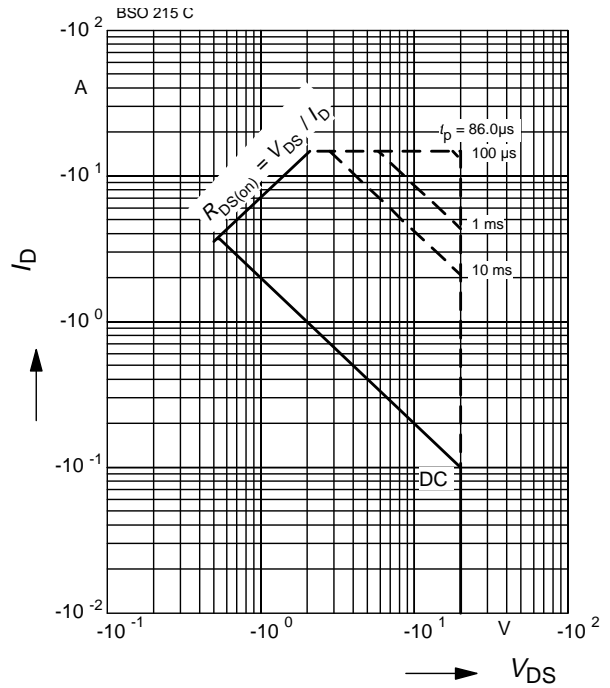
parameter : $D = 0, T_A = 25^\circ\text{C}$



Safe operating area (P-Ch.)

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

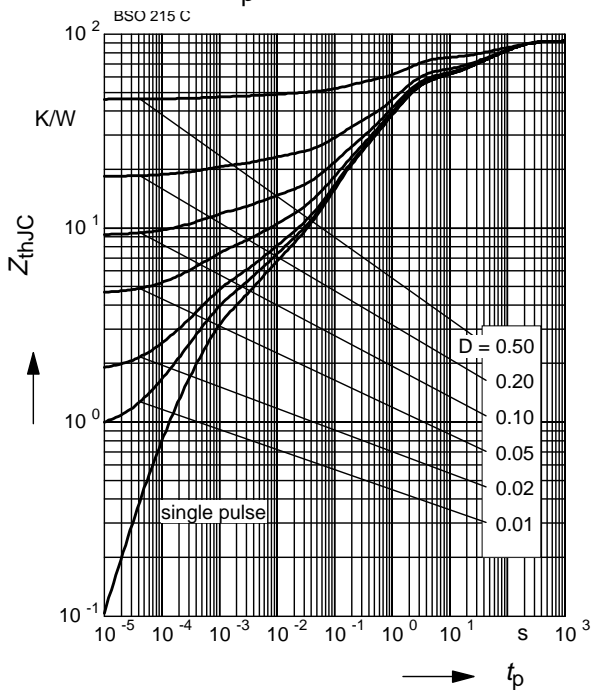
parameter : $D = 0, T_A = 25^\circ\text{C}$



Transient thermal impedance (N-Ch.)

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

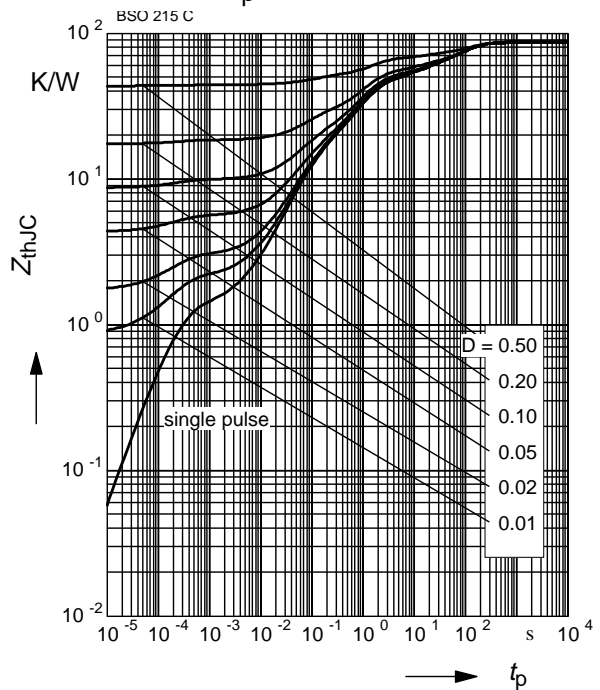
parameter : $D = t_p/T$



Transient thermal impedance (P-Ch.)

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

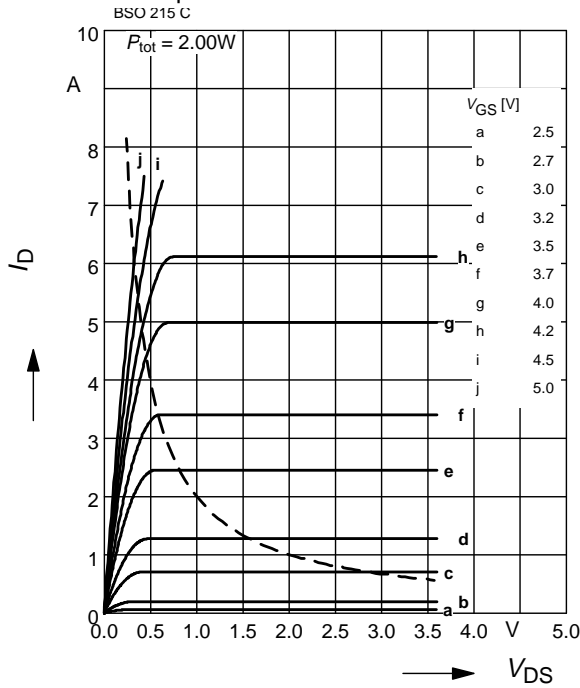
parameter : $D = t_p/T$



Typ. output characteristics (N-Ch.)

$I_D = f(V_{DS})$

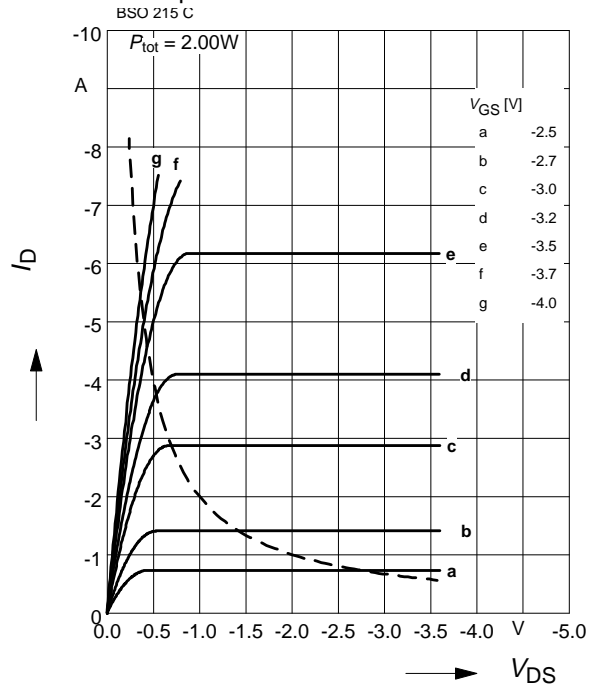
parameter: $t_p = 80 \mu s$



Typ. output characteristics (P-Ch.)

$I_D = f(V_{DS})$

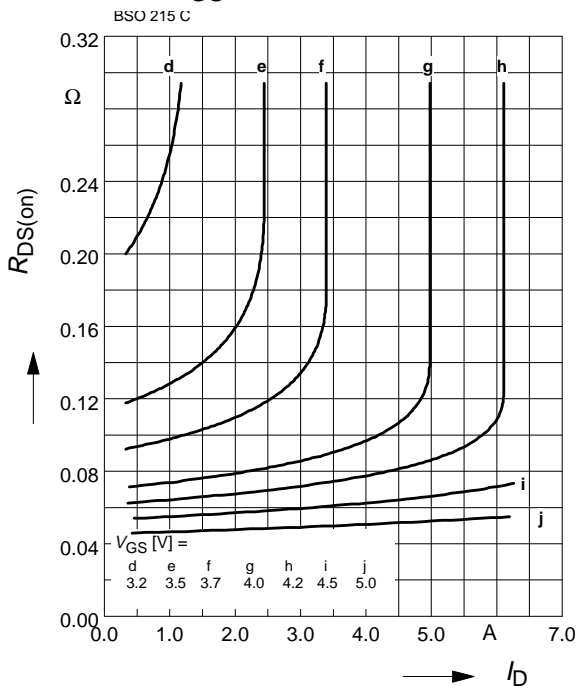
parameter: $t_p = 80 \mu s$



Typ. drain-source-on-resistance (N-Ch.)

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

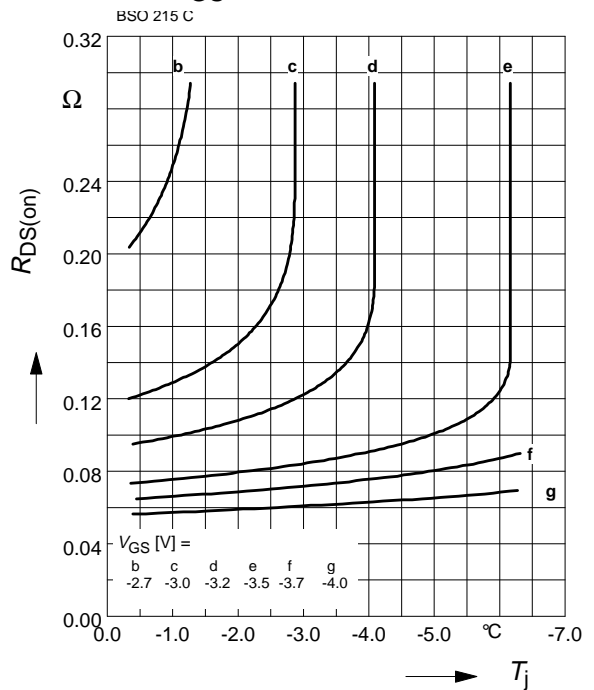
parameter: V_{GS}



Typ. drain-source-on-resistance (P-Ch.)

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

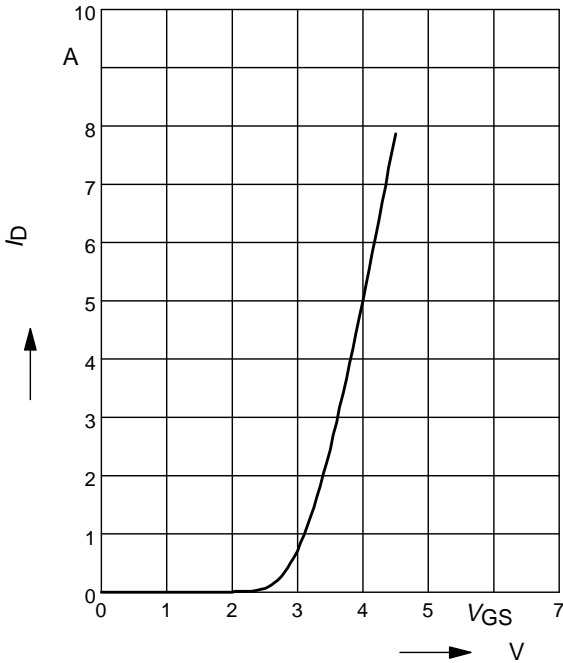
parameter: V_{GS}



Typ. transfer characteristics (N-Ch.)

parameter: $t_p = 80 \mu s$

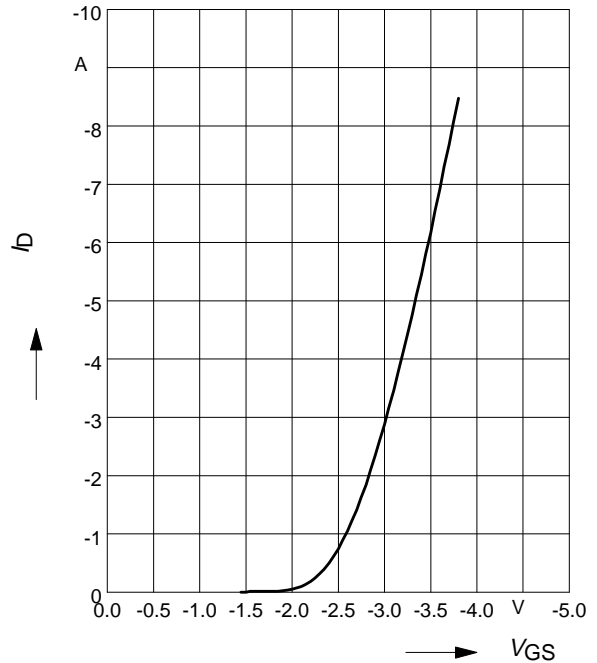
$$I_D = f(V_{GS}), V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$



Typ. transfer characteristics (P-Ch.)

parameter: $t_p = 80 \mu s$

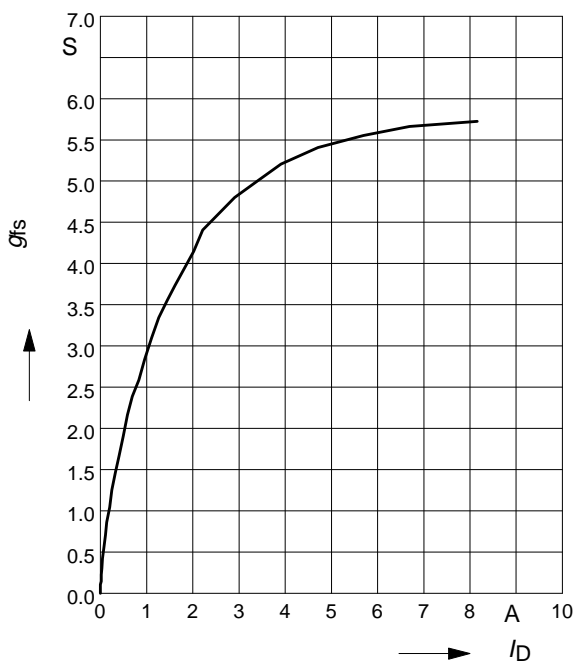
$$I_D = f(V_{GS}), V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$



Typ. forward transconductance (N-Ch.)

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

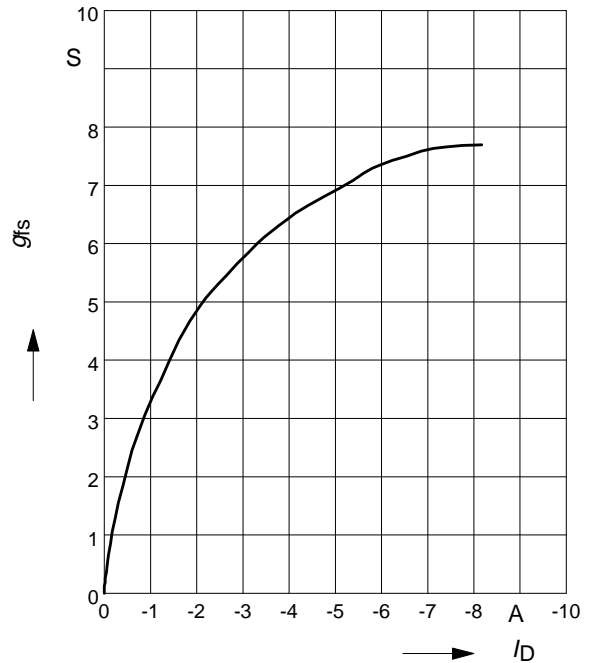
parameter: g_{fs}



Typ. forward transconductance (P-Ch.)

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

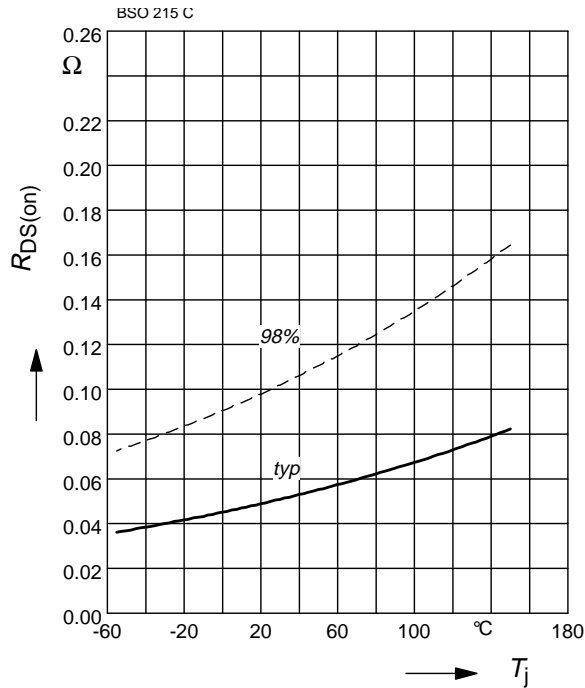
parameter: g_{fs}



Drain-source on-resistance (N-Ch.)

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

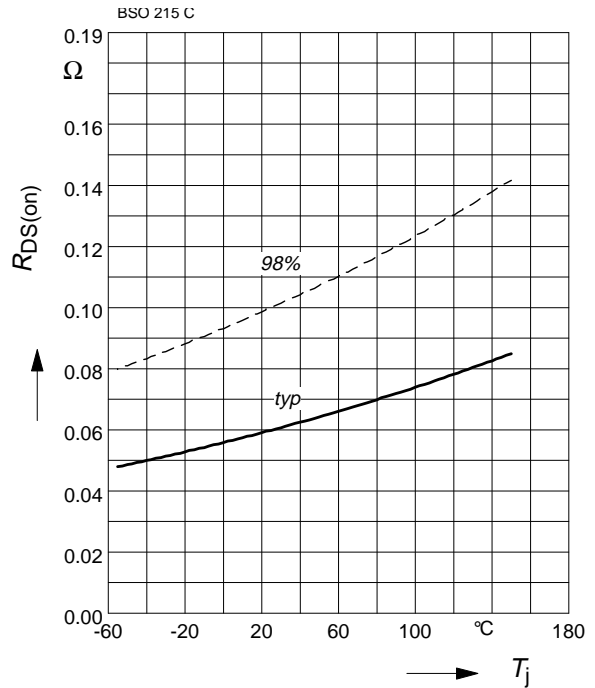
parameter : $I_D = 3.7 \text{ A}$, $V_{GS} = 10 \text{ V}$



Drain-source on-resistance (P-Ch.)

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

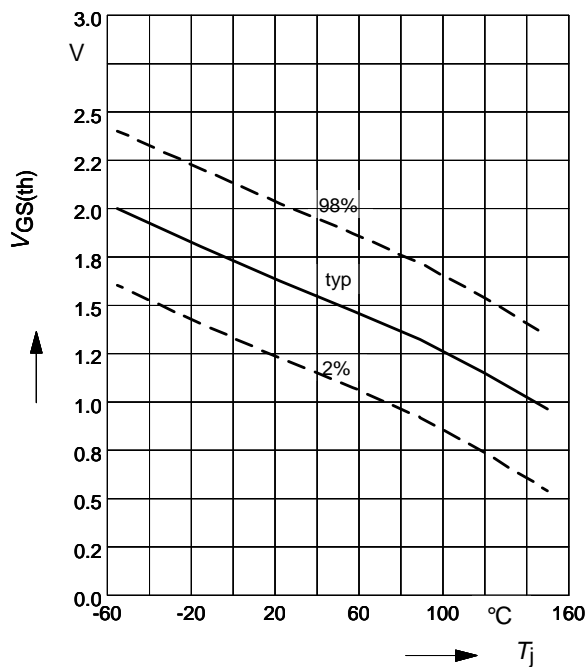
parameter : $I_D = -3.7 \text{ A}$, $V_{GS} = -10 \text{ V}$



Gate threshold voltage (N-Ch.)

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

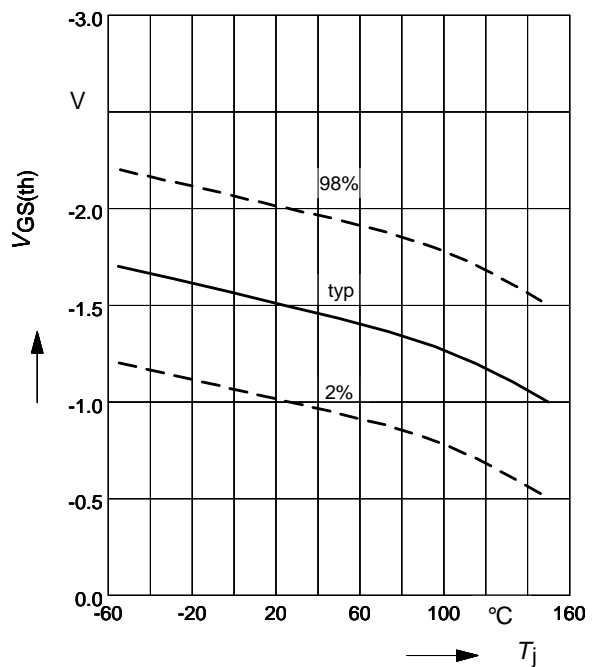
parameter: $V_{GS} = V_{DS}$, $I_D = 10 \mu\text{A}$



Gate threshold voltage (P-Ch.)

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

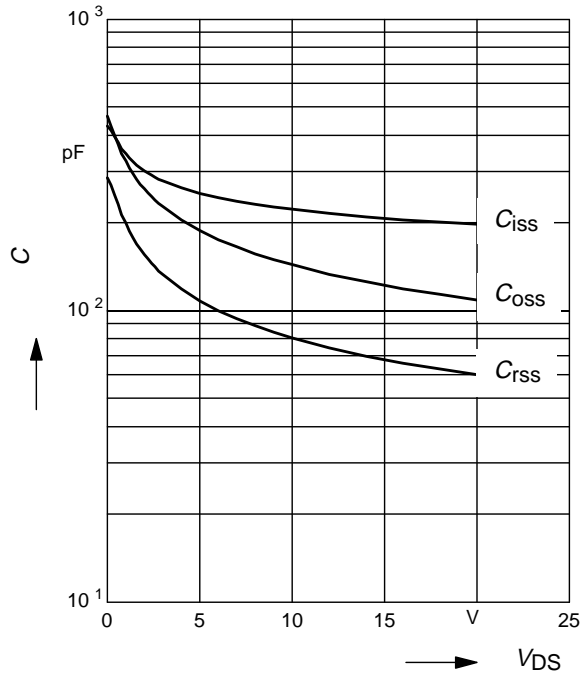
parameter: $V_{GS} = V_{DS}$, $I_D = -450 \mu\text{A}$



Typ. capacitances (N-Ch.)

$C = f(V_{DS})$

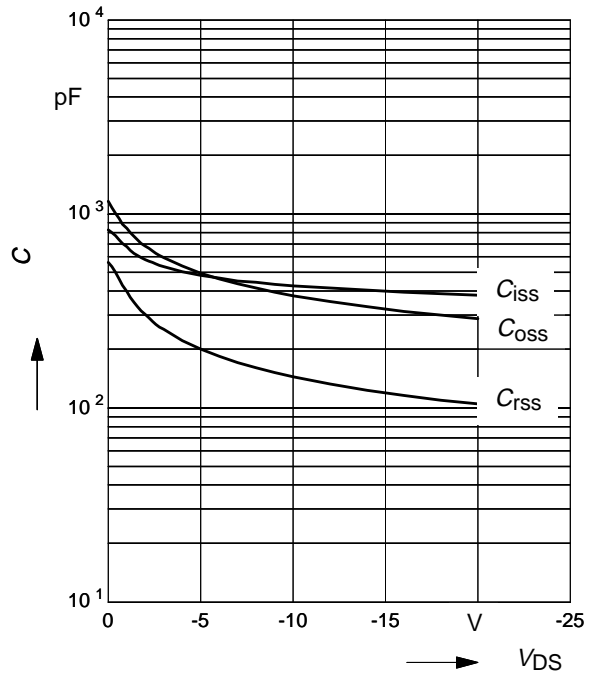
parameter: $V_{GS}=0\text{ V}$, $f=1\text{ MHz}$



Typ. capacitances (P-Ch.)

$C = f(V_{DS})$

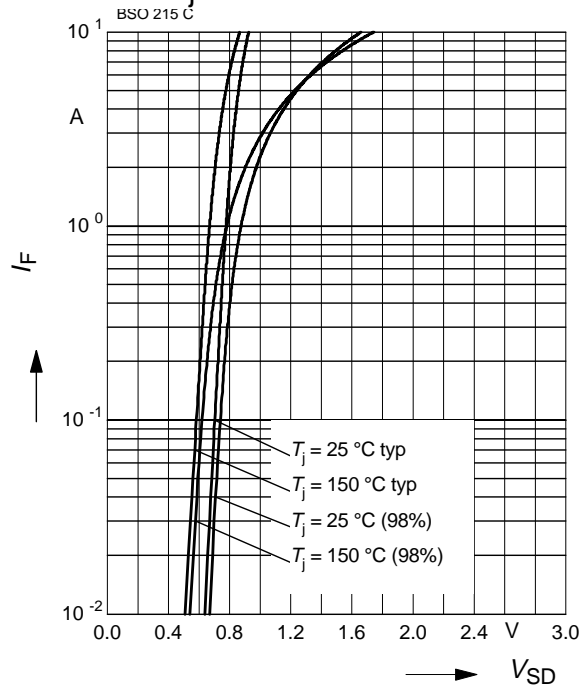
parameter: $V_{GS}=0\text{ V}$, $f=1\text{ MHz}$



Forward characteristics of reverse diode

$I_F = f(V_{SD})$, (N-Ch.)

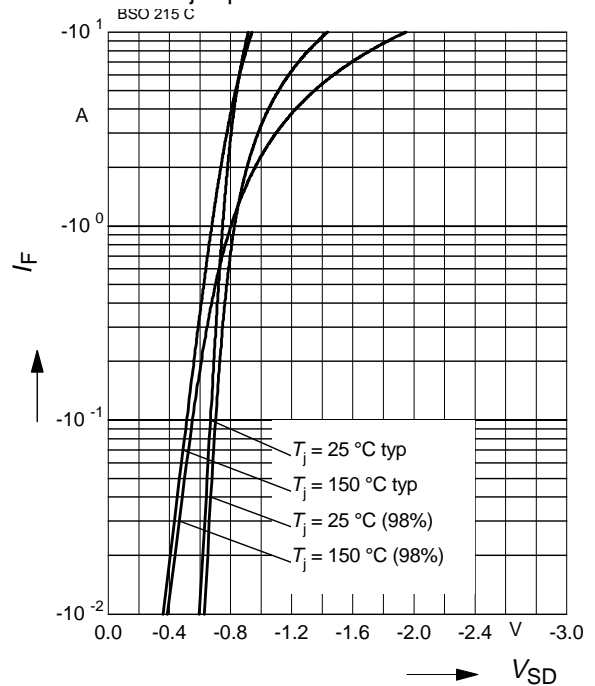
parameter: T_j , $t_p = 80\ \mu\text{s}$



Forward characteristics of reverse diode

$I_F = f(V_{SD})$, (P-Ch.)

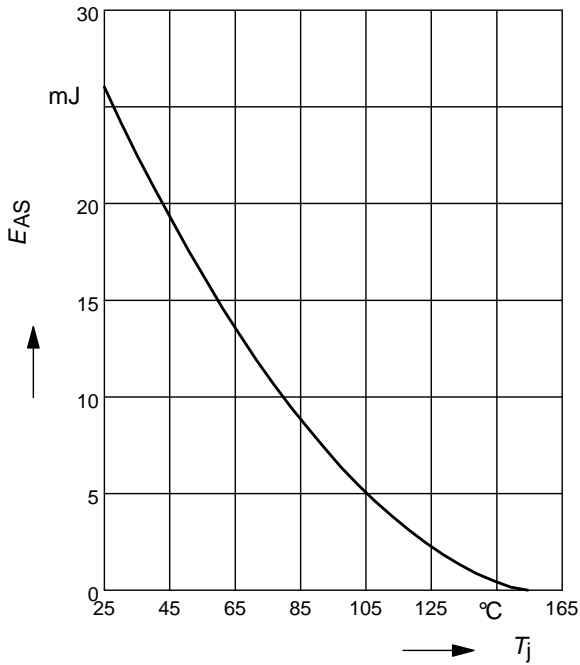
parameter: T_j , $t_p = 80\ \mu\text{s}$



Avalanche Energy $E_{AS} = f(T_j)$ (N-Ch.)

parameter: $I_D = 3\text{ A}$, $V_{DD} = 15\text{ V}$

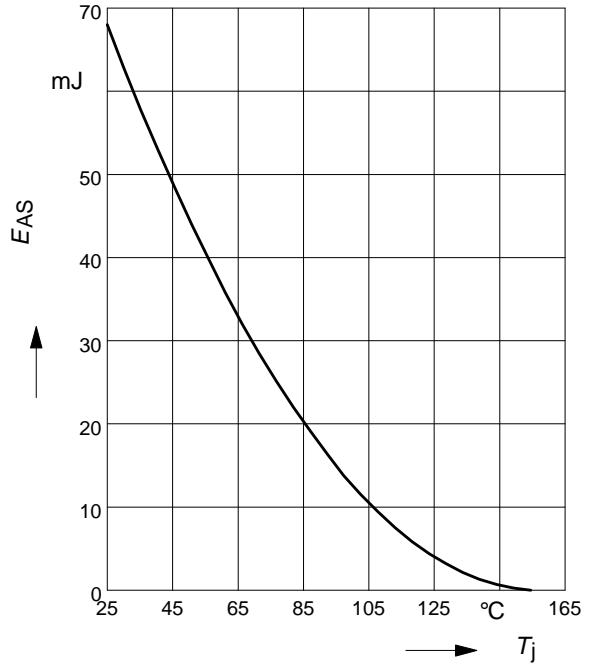
$R_{GS} = 25\ \Omega$



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

parameter: $I_D = -3.7\text{ A}$, $V_{DD} = -15\text{ V}$

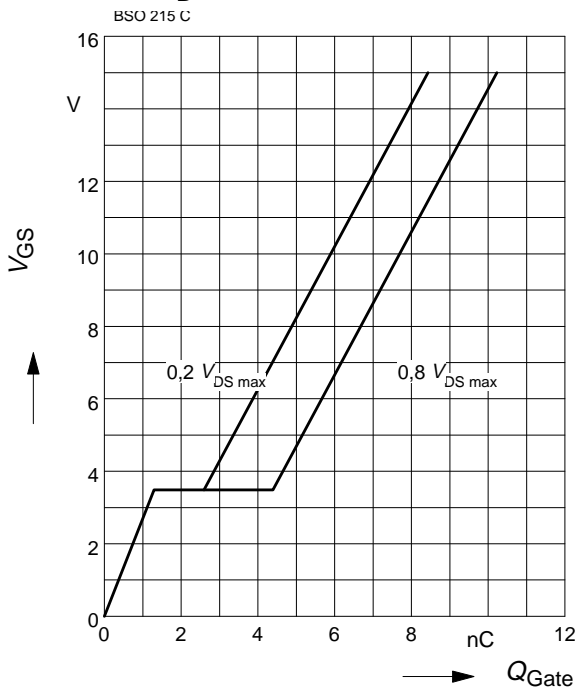
$R_{GS} = 25\ \Omega$



Typ. gate charge (N-Ch.)

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

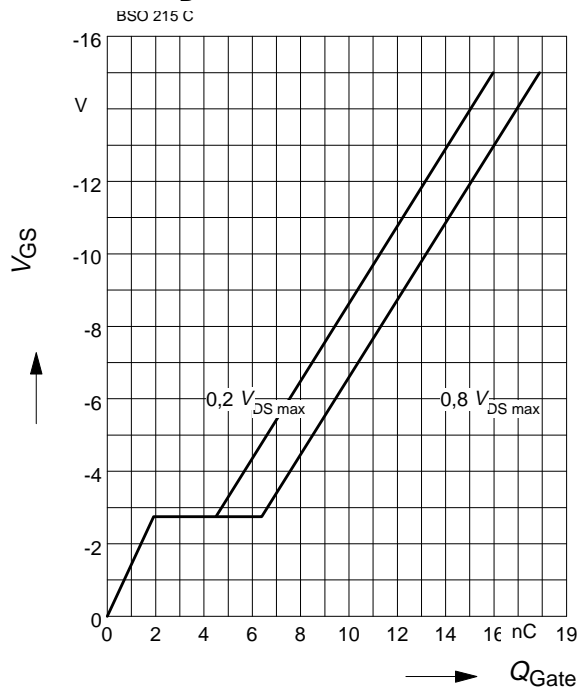
parameter: $I_D = 3.7\text{ A}$



Typ. gate charge (P-Ch.)

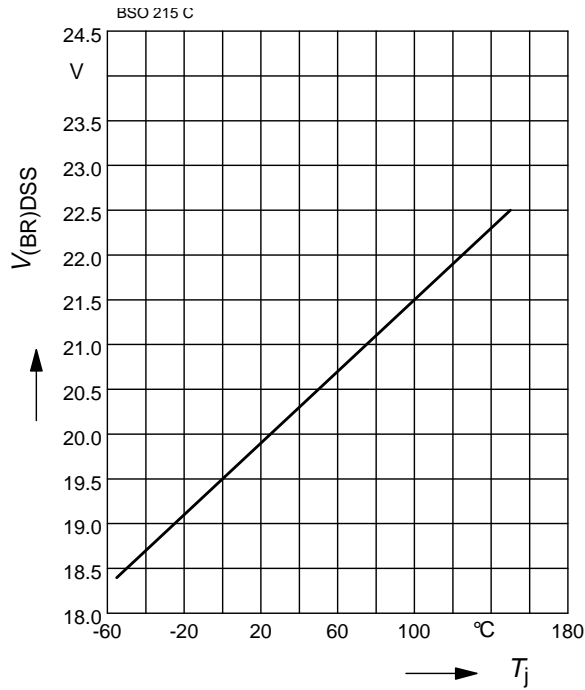
$V_{GS} = f(Q_{Gate})$

parameter: $I_D = -3.7\text{ A}$



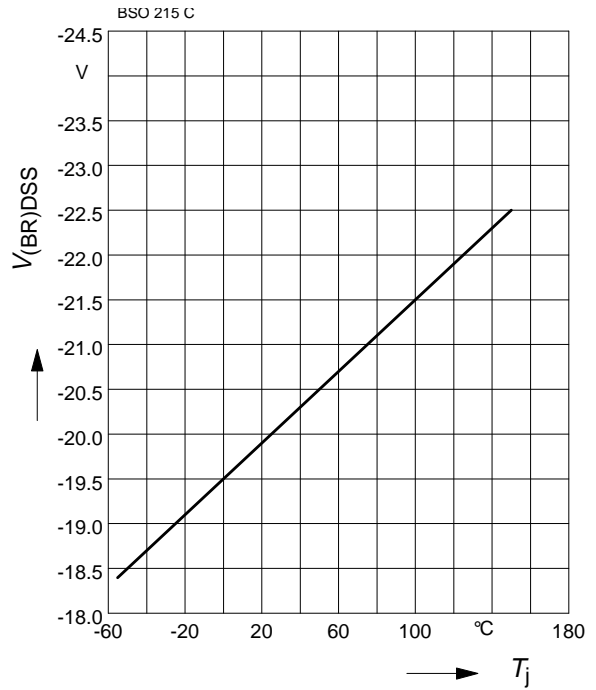
Drain-source breakdown voltage

$$V_{(BR)DSS} = f(T_j), \text{ (N-Ch.)}$$



Drain-source breakdown voltage

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



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