

SIPMOS® Small-Signal-Transistor

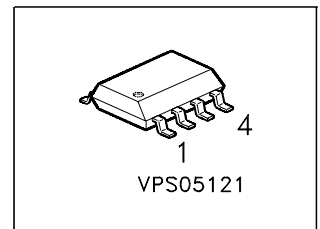
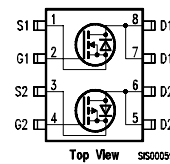
Features

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

Product Summary

		N	P	
Drain source voltage	V_{DS}	60	-60	V
Drain-Source on-state resistance	$R_{DS(on)}$	0.12	0.3	Ω
Continuous drain current	I_D	3	-2	A

Type	Package	Ordering Code
BSO 612 CV	SO 8	Q67041-S4015



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 2.4	-2 -1.6	A
Pulsed drain current $T_A = 25\text{ °C}$	$I_{D\text{ puls}}$	12	-8	
Avalanche energy, single pulse $I_D = 3\text{ A}$, $V_{DD} = 25\text{ V}$, $R_{GS} = 25\text{ }\Omega$ $I_D = -2\text{ A}$, $V_{DD} = -25\text{ V}$, $R_{GS} = 25\text{ }\Omega$	E_{AS}	47 -	- 70	mJ
Avalanche energy, periodic limited by $T_{j\text{max}}$	E_{AR}	0.2	0.2	
Reverse diode dv/dt , $T_{j\text{max}} = 150\text{ °C}$ $I_S = 3\text{ A}$, $V_{DS} = 48\text{ V}$, $dI/dt = 200\text{ A}/\mu\text{s}$ $I_S = -2\text{ A}$, $V_{DS} = -48\text{ V}$, $dI/dt = -200\text{ A}/\mu\text{s}$	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 (Pin 4)	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		-	-	70	
	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	$V_{(BR)DSS}$	60	-	-	V
	P		-60	-	-	
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 20$ μ A $I_D = -450$ μ A	N	$V_{GS(th)}$	2.1	3	4	
	P		-2.1	-3	-4	
Zero gate voltage drain current $V_{DS} = 60$ V, $V_{GS} = 0$ V, $T_j = 25$ °C $V_{DS} = 60$ V, $V_{GS} = 0$ V, $T_j = 125$ °C $V_{DS} = -60$ V, $V_{GS} = 0$ V, $T_j = 25$ °C $V_{DS} = -60$ 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 $V_{GS} = 10$ V, $I_D = 3$ A $V_{GS} = -10$ V, $I_D = -2$ A	N	$R_{DS(on)}$	-	0.09	0.12	Ω
	P		-	0.22	0.3	

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

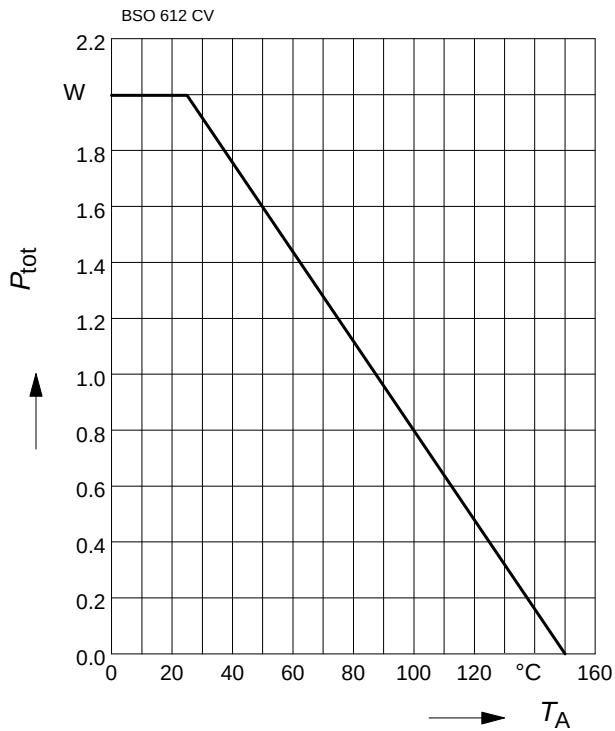
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Characteristics						
Transconductance		g_{fs}				S
$V_{DS} \geq 2 * I_D * R_{DS(on)max}, I_D = 3\text{ A}$	N		2	4	-	
$V_{V_{DS} \geq 2 * I_D * R_{DS(on)max}, I_D = -2\text{ A}}$	P		1.2	2.4	-	
Input capacitance		C_{iss}				pF
$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	N		-	275	340	
$V_{GS} = 0\text{ V}, V_{DS} = -25\text{ V}, f = 1\text{ MHz}$	P		-	320	400	
Output capacitance		C_{oss}				
$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	N		-	90	115	
$V_{GS} = 0\text{ V}, V_{DS} = -25\text{ V}, f = 1\text{ MHz}$	P		-	105	130	
Reverse transfer capacitance		C_{rss}				
$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	N		-	50	65	
$V_{GS} = 0\text{ V}, V_{DS} = -25\text{ V}, f = 1\text{ MHz}$	P		-	40	50	
Turn-on delay time		$t_{d(on)}$				ns
$V_{DD} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}, R_G = 33\text{ }\Omega$	N		-	12	18	
$V_{DD} = -30\text{ V}, V_{GS} = -10\text{ V}, I_D = -2\text{ A}, R_G = 27\text{ }\Omega$	P		-	15	23	
Rise time		t_r				
$V_{DD} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}, R_G = 33\text{ }\Omega$	N		-	35	55	
$V_{DD} = -30\text{ V}, V_{GS} = -10\text{ V}, I_D = -2\text{ A}, R_G = 27\text{ }\Omega$	P		-	60	90	
Turn-off delay time		$t_{d(off)}$				
$V_{DD} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}, R_G = 33\text{ }\Omega$	N		-	25	40	
$V_{DD} = -30\text{ V}, V_{GS} = -10\text{ V}, I_D = -2\text{ A}, R_G = 27\text{ }\Omega$	P		-	145	220	
Fall time		t_f				
$V_{DD} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 3\text{ A}, R_G = 33\text{ }\Omega$	N		-	30	45	
$V_{DD} = -30\text{ V}, V_{GS} = -10\text{ V}, I_D = -2\text{ A}, R_G = 27\text{ }\Omega$	P		-	95	140	

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

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Characteristics						
Gate to source charge $V_{DD} = 48\text{ V}$, $I_D = 3\text{ A}$ $V_{DD} = -48\text{ V}$, $I_D = -2\text{ A}$	N P	Q_{gs}	- -	1 2	1.5 3	nC
Gate to drain charge $V_{DD} = 48\text{ V}$, $I_D = 3\text{ A}$ $V_{DD} = -48\text{ V}$, $I_D = -2\text{ A}$	N P	Q_{gd}	- -	5.5 4.5	8.3 6.8	
Gate charge total $V_{DD} = 48\text{ V}$, $I_D = 3\text{ A}$, $V_{GS} = 0\text{ to }10\text{V}$ $V_{DD} = -48\text{ V}$, $I_D = -2\text{ A}$, $V_{GS} = 0\text{ to }-10\text{V}$	N P	Q_g	- -	10.3 10.5	15.5 16	
Gate plateau voltage $V_{DD} = 48\text{ V}$, $I_D = 3\text{ A}$ $V_{DD} = -48\text{ V}$, $I_D = -2\text{ A}$	N P	$V_{(\text{plateau})}$	- -	5 -4	- -	V
Reverse Diode						
Inverse diode continuous forward current $T_A = 25\text{ }^{\circ}\text{C}$	N P	I_S	- -	- -	3 -2	A
Inverse diode direct current,pulsed $T_A = 25\text{ }^{\circ}\text{C}$	N P	I_{SM}	- -	- -	12 -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}	- -	0.9 -0.9	1.2 -1.2	V
Reverse recovery time $V_R = 30\text{ V}$, $I_F{=}I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = -30\text{ V}$, $I_F{=}I_S$, $di_F/dt = -100\text{ A}/\mu\text{s}$	N P	t_{rr}	- -	55 55	85 85	ns
Reverse recovery charge $V_R = 30\text{ V}$, $I_F{=}I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = -30\text{ V}$, $I_F{=}I_S$, $di_F/dt = -100\text{ A}/\mu\text{s}$	N P	Q_{rr}	- -	90 65	135 100	nC

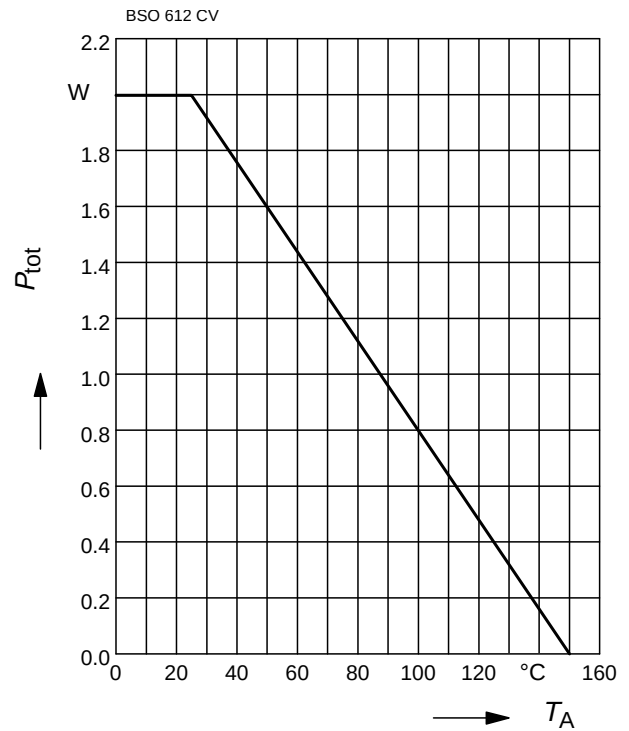
Power Dissipation (N-Ch.)

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



Power Dissipation (P-Ch.)

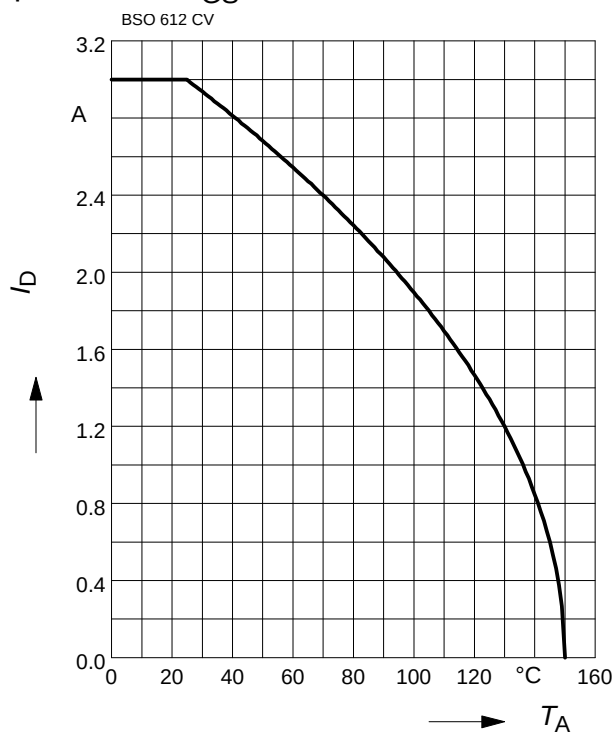
$$P_{\text{tot}} = f(T_A)$$



Drain current (N-Ch.)

$$I_D = f(T_A)$$

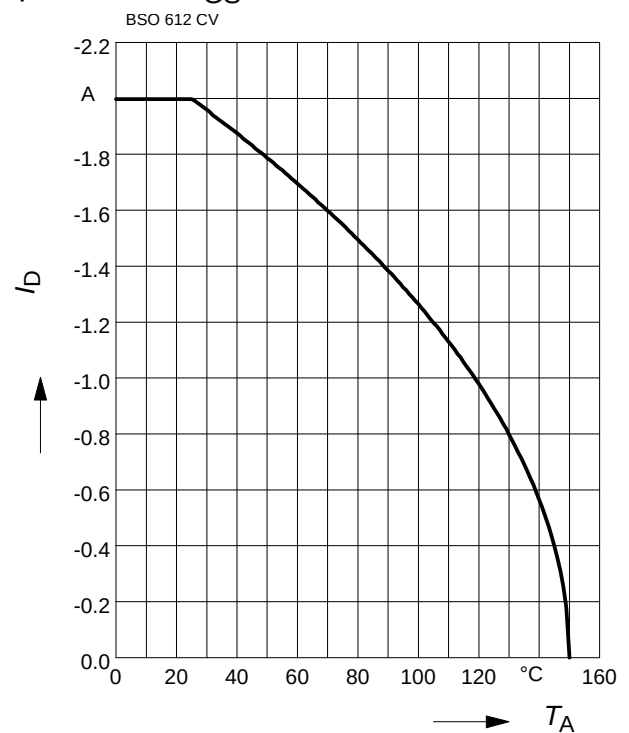
parameter: $V_{GS} \geq 10 \text{ V}$



Drain current (P-Ch.)

$$I_D = f(T_A)$$

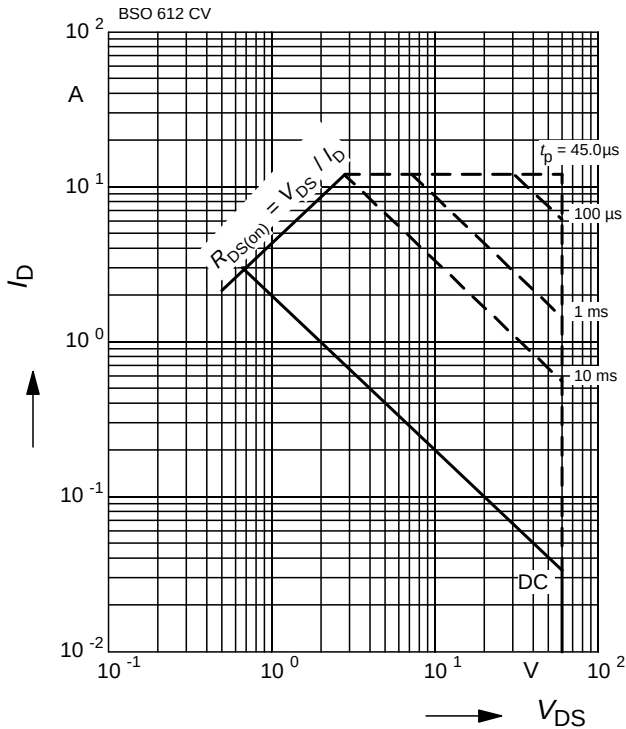
parameter: $V_{GS} \geq -10 \text{ V}$



Safe operating area (N-Ch.)

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

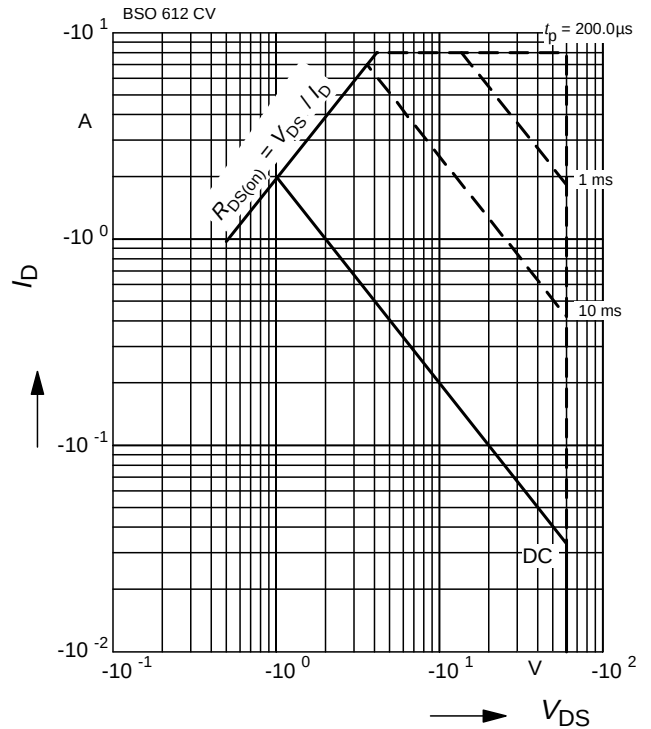
parameter : $D = 0$, $T_A = 25^\circ\text{C}$



Safe operating area (P-Ch.)

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

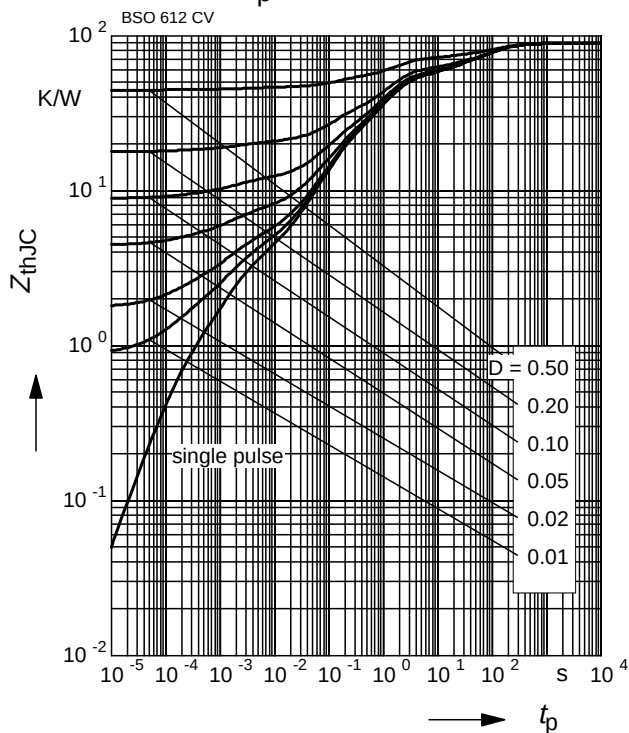
parameter : $D = 0$, $T_A = 25^\circ\text{C}$



Transient thermal impedance (N-Ch.)

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

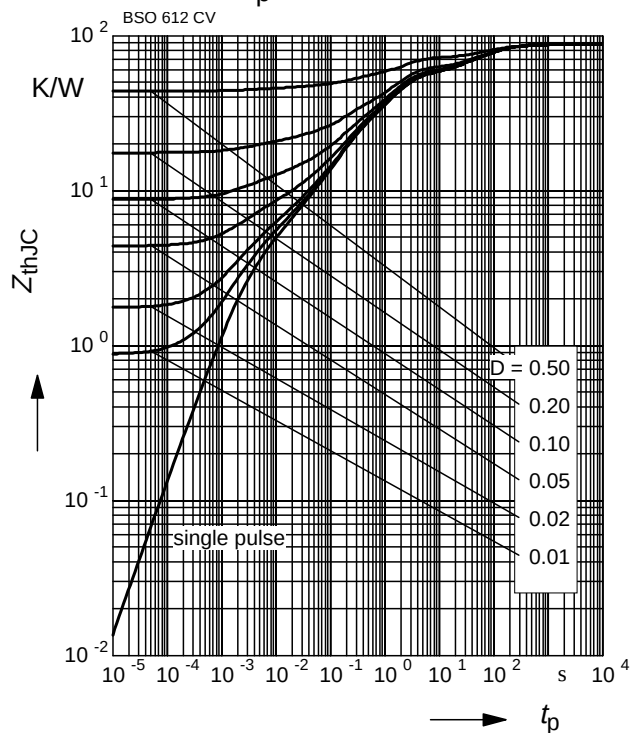
parameter : $D = t_p/T$



Transient thermal impedance (P-Ch.)

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

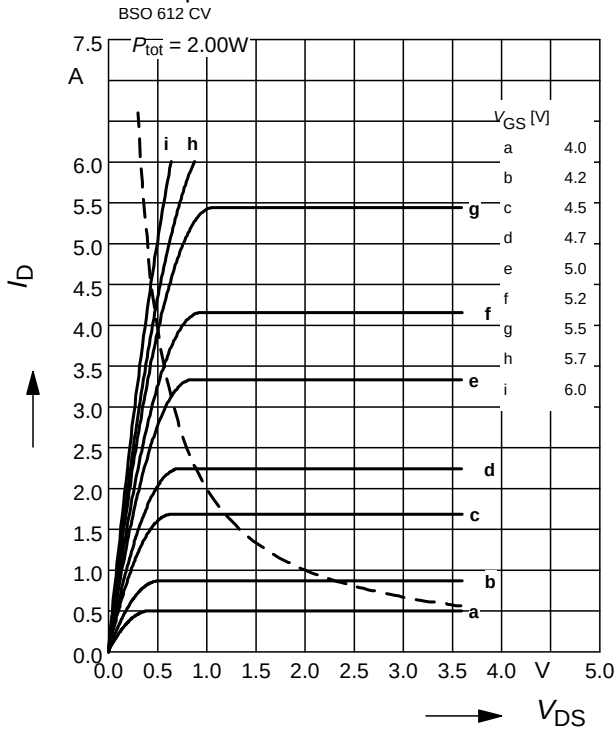
parameter : $D = t_p/T$



Typ. output characteristics (N-Ch.)

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

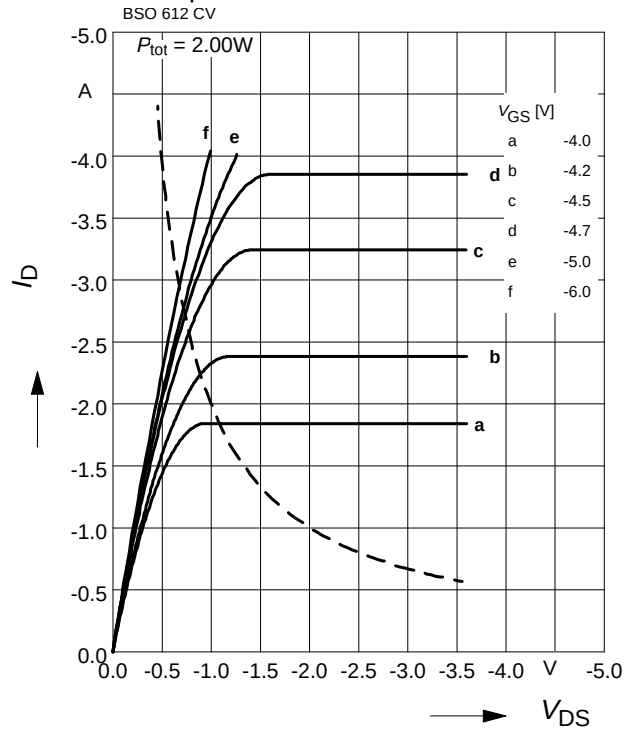
parameter: $t_p = 80 \mu s$



Typ. output characteristics (P-Ch.)

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

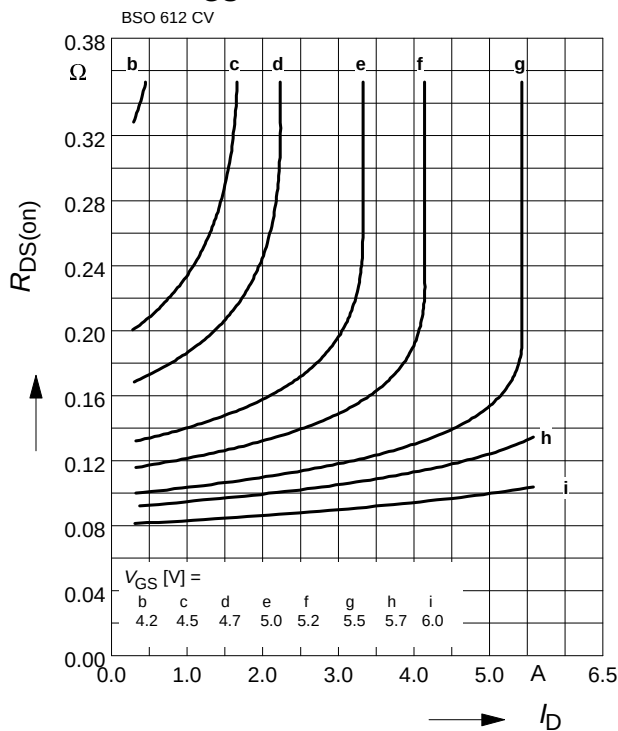
parameter: $t_p = 80 \mu s$



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

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

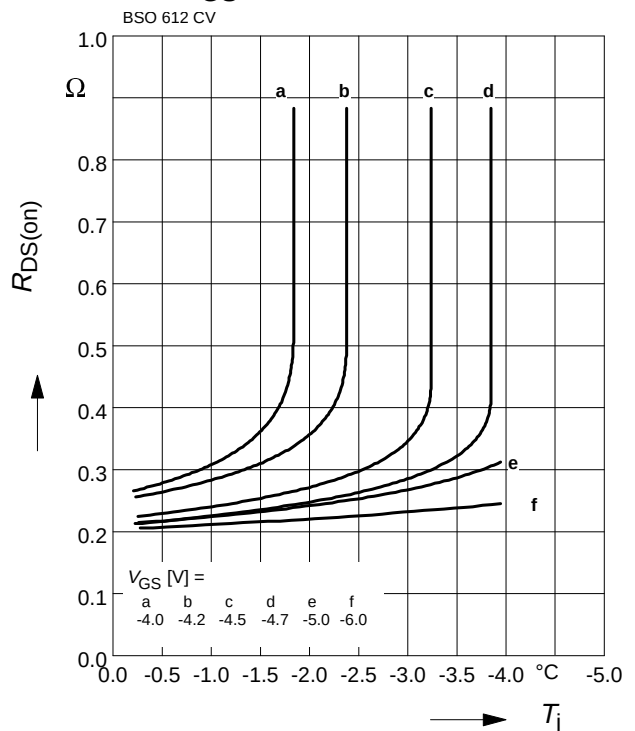
parameter: V_{GS}



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

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

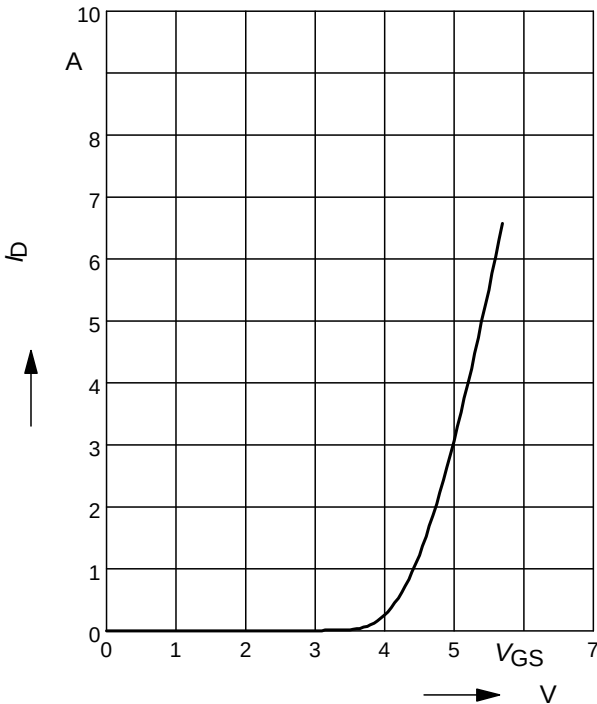
parameter: V_{GS}



Typ. transfer characteristics (N-Ch.)

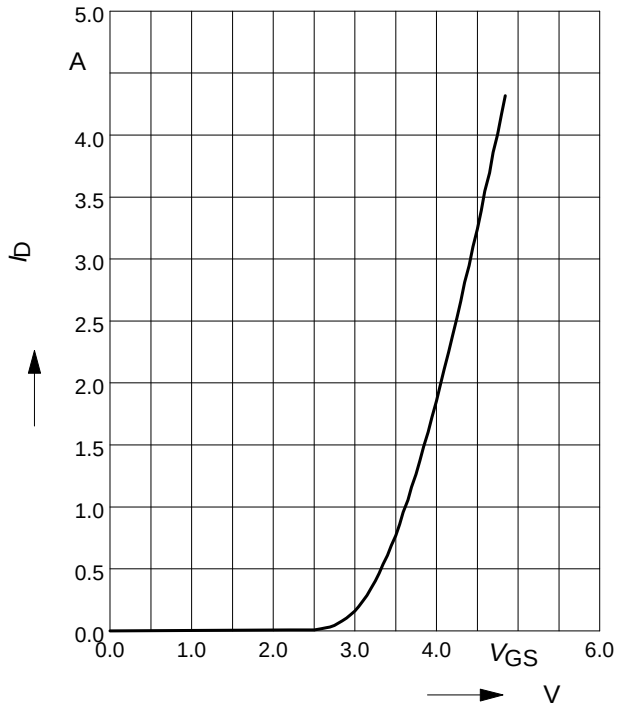
parameter: $t_p = 80 \mu s$

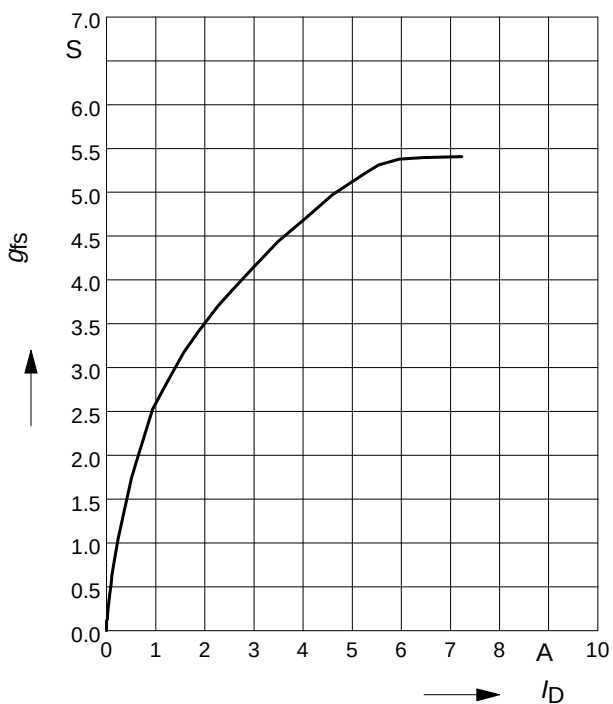
$$I_D = f(V_{GS}), V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$

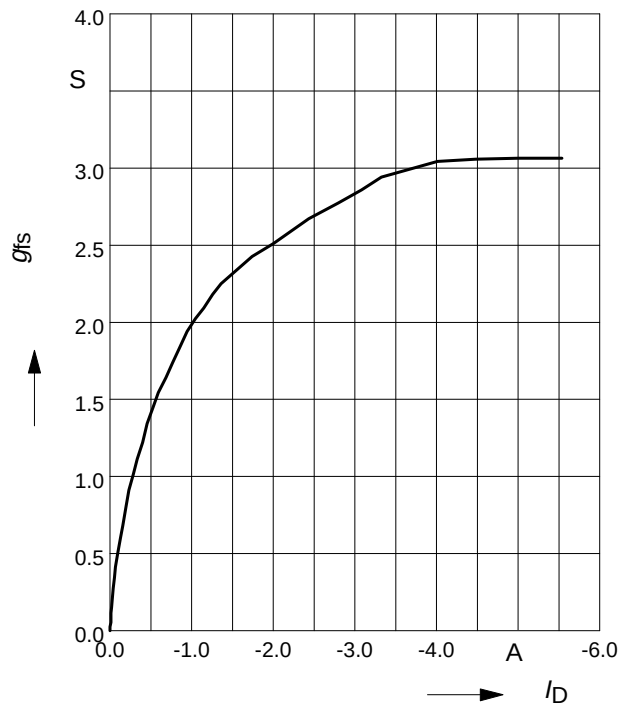

Typ. transfer characteristics (P-Ch.)

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

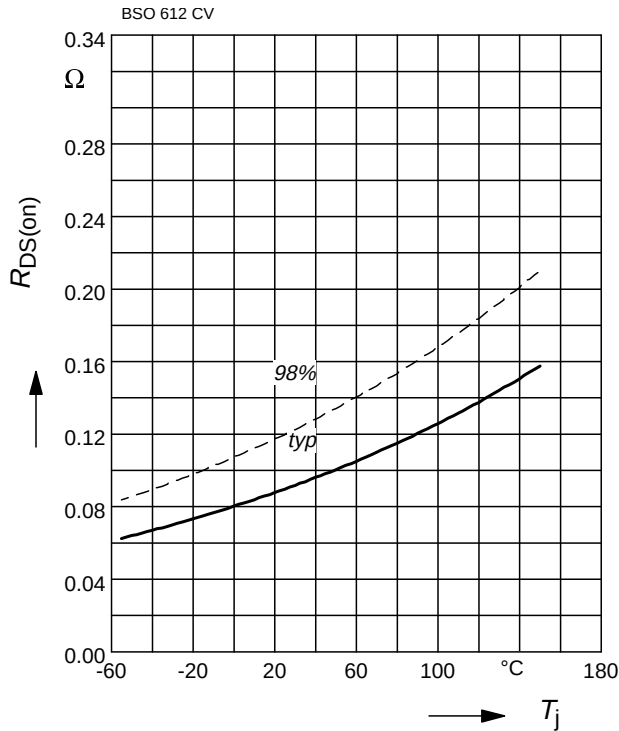
parameter: g_{fs}

Typ. forward transconductance (P-Ch.)
 $g_{fs} = f(I_D); T_j = 25^\circ C$

parameter: g_{fs}


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

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

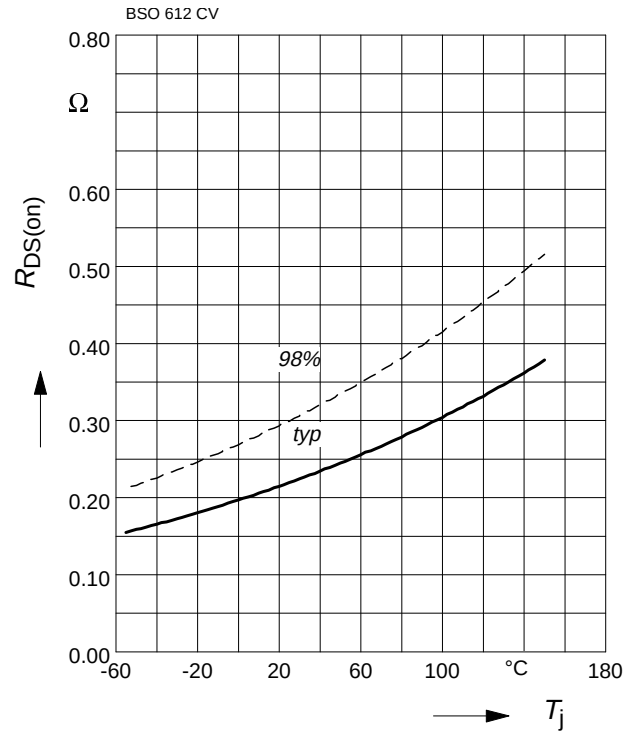
parameter: $I_D = 3\text{ A}$, $V_{GS} = 10\text{ V}$



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

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

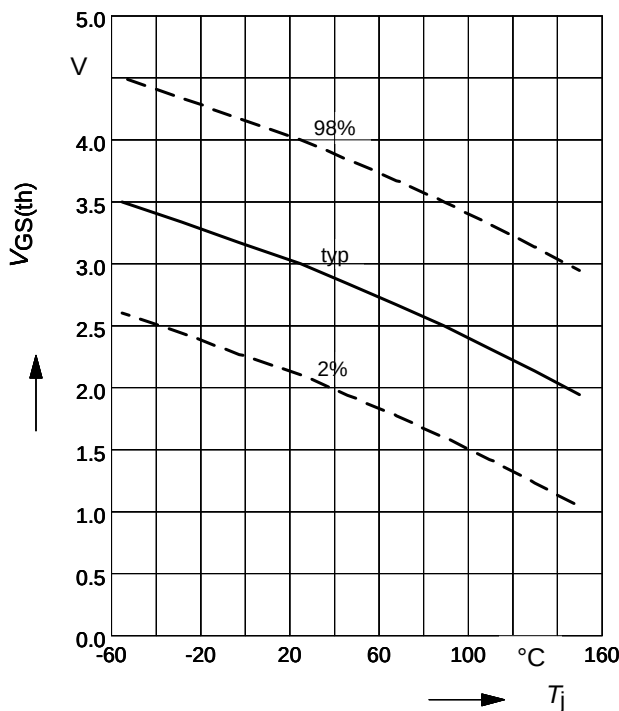
parameter: $I_D = -2\text{ A}$, $V_{GS} = -10\text{ V}$



Gate threshold voltage (N-Ch.)

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

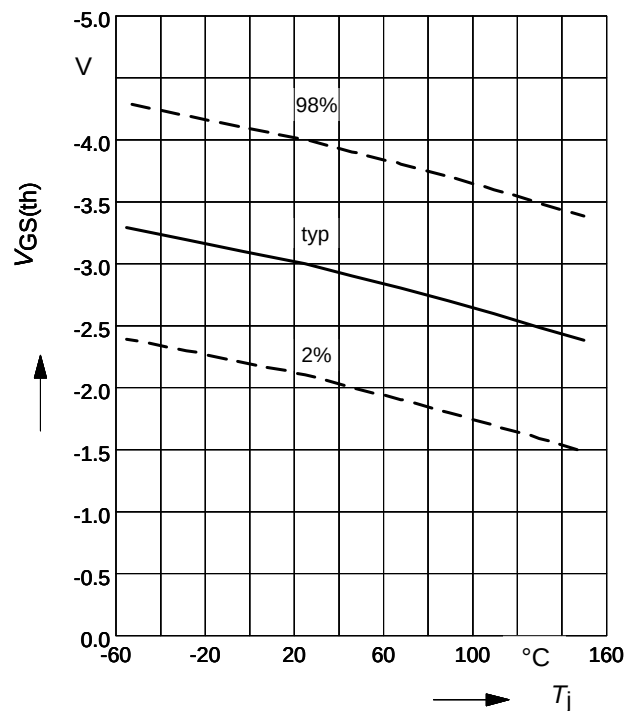
parameter: $V_{GS} = V_{DS}$, $I_D = 20\text{ }\mu\text{A}$



Gate threshold voltage (P-Ch.)

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

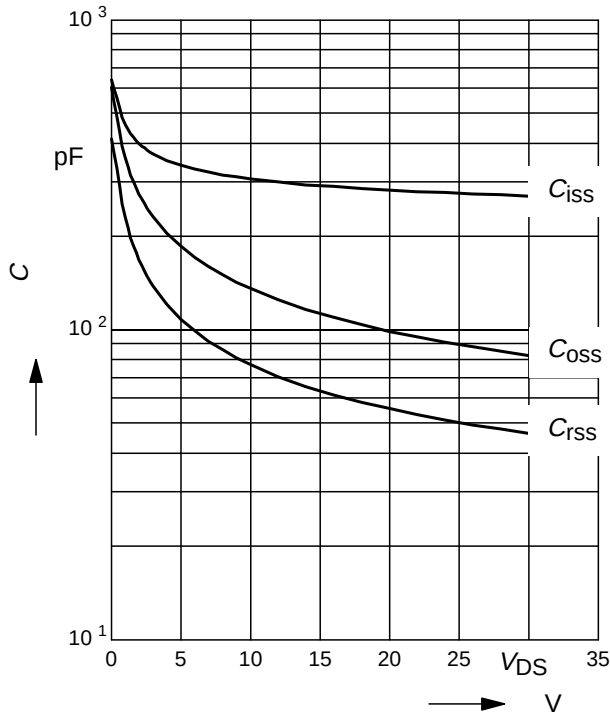
parameter: $V_{GS} = V_{DS}$, $I_D = -450\text{ }\mu\text{A}$



Typ. capacitances (N-Ch.)

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

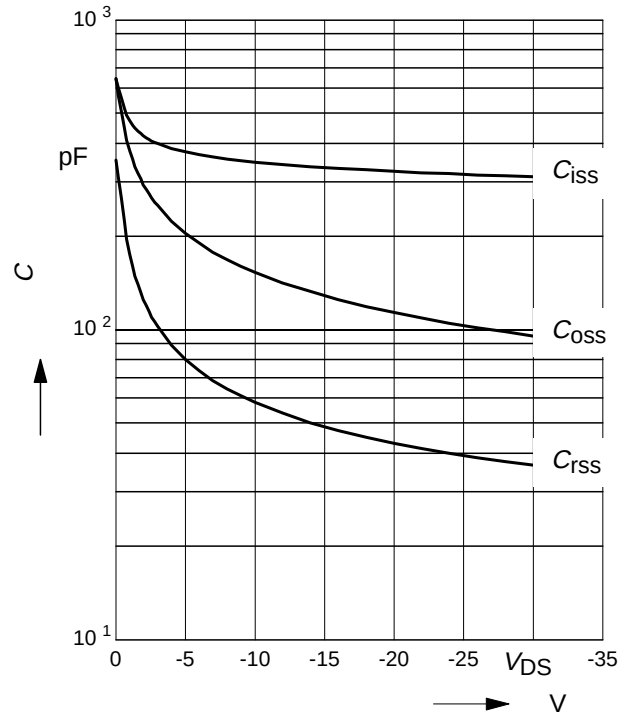
parameter: $V_{GS}=0\text{ V}$, $f=1\text{ MHz}$



Typ. capacitances (P-Ch.)

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

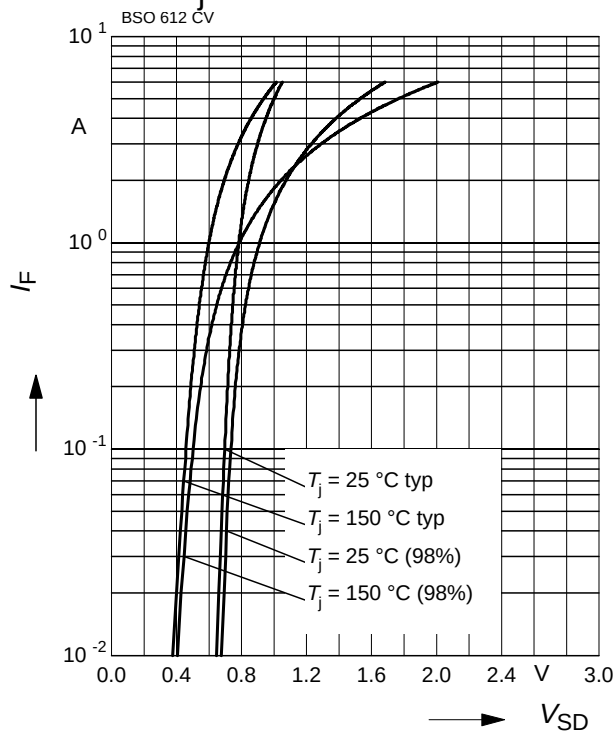
parameter: $V_{GS}=0\text{ V}$, $f=1\text{ MHz}$



Forward characteristics of reverse diode

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

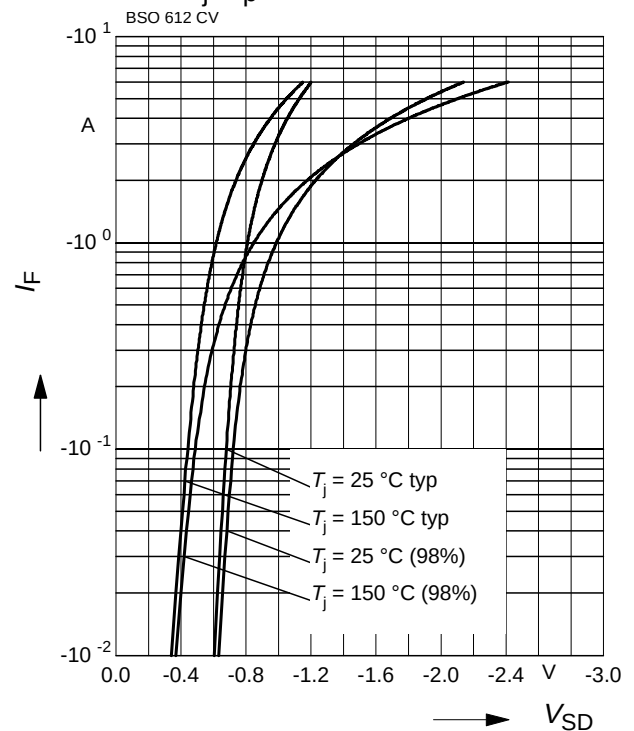
parameter: T_j , $t_p = 80\text{ }\mu\text{s}$



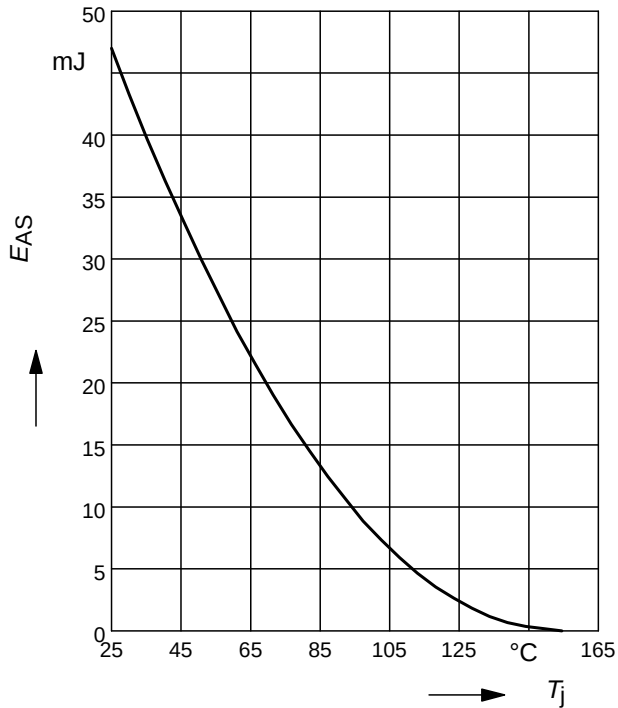
Forward characteristics of reverse diode

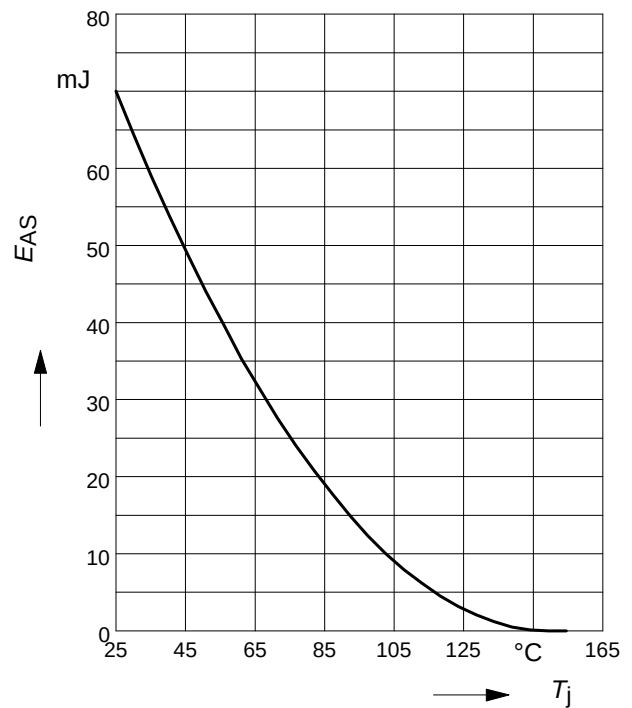
$$I_F = f(V_{SD}), (\text{P-Ch.})$$

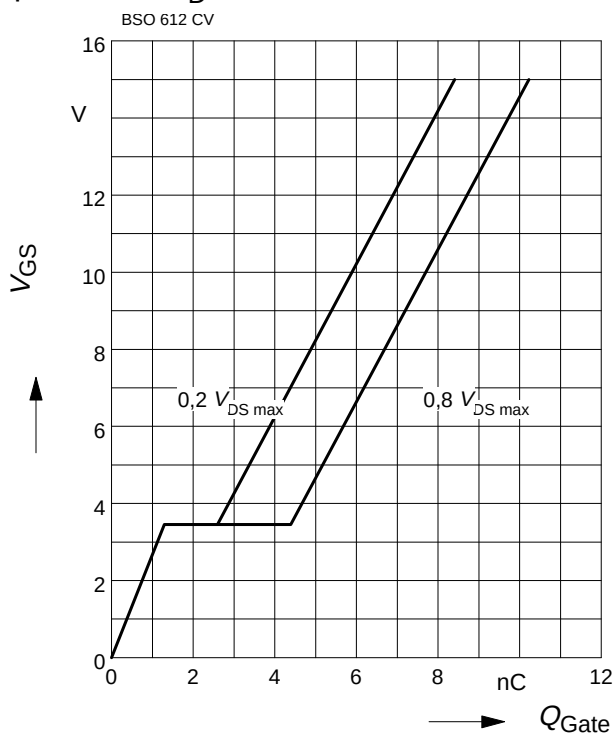
parameter: T_j , $t_p = 80\text{ }\mu\text{s}$

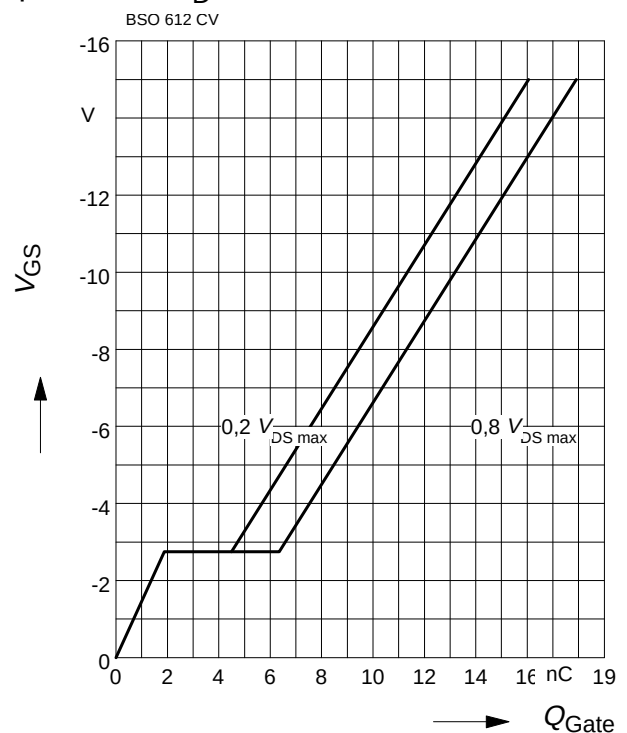


Avalanche Energy $E_{AS} = f(T_j)$ (N-Ch.)

parameter: $I_D = 3\text{ A}$, $V_{DD} = 25\text{ V}$
 $R_{GS} = 25\ \Omega$

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

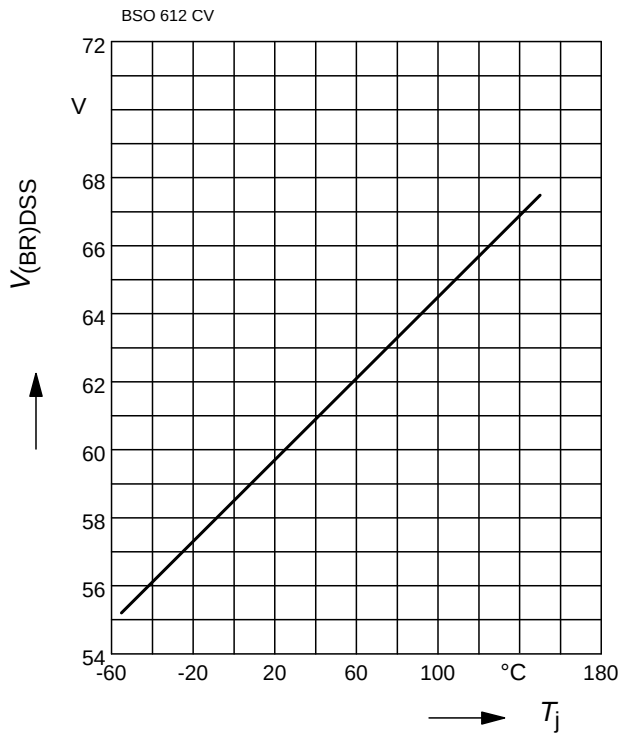
parameter: $I_D = -2\text{ A}$, $V_{DD} = -25\text{ V}$
 $R_{GS} = 25\ \Omega$

Typ. gate charge (N-Ch.)
 $V_{GS} = f(Q_{Gate})$

parameter: $I_D = 3\text{ A}$

Typ. gate charge (P-Ch.)
 $V_{GS} = f(Q_{Gate})$

parameter: $I_D = -2\text{ A}$


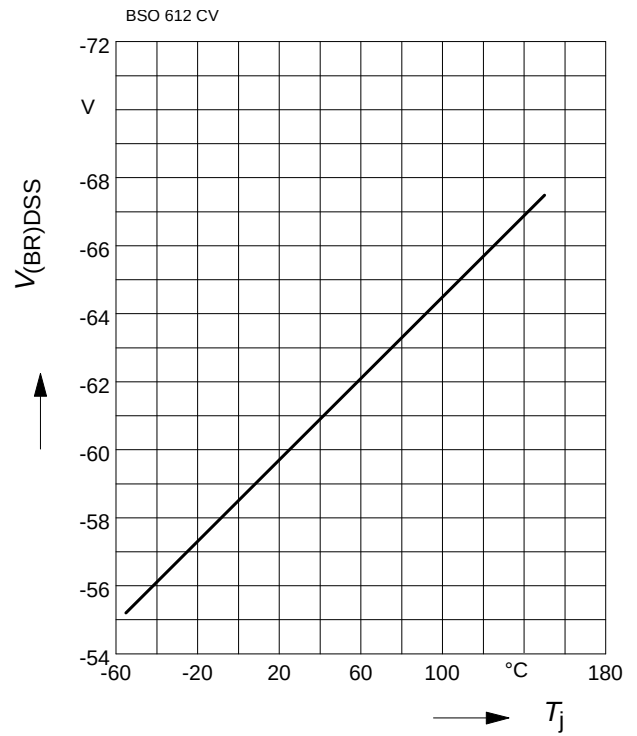
Drain-source breakdown voltage

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



Drain-source breakdown voltage

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



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