

## SIPMOS® Small-Signal-Transistor

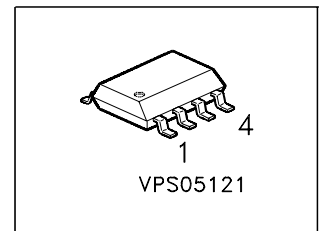
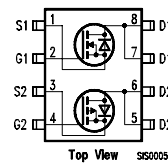
### Features

- 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	$\Omega$
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 $T_{jmax}$	$E_{AR}$	0.2	0.2	
Reverse diode dv/dt, $T_{jmax} = 150\text{ °C}$ $I_S = 3\text{ A}$ , $V_{DS} = 48\text{ V}$ , $di/dt = 200\text{ A}/\mu\text{s}$ $I_S = -2\text{ A}$ , $V_{DS} = -48\text{ V}$ , $di/dt = -200\text{ A}/\mu\text{s}$	dv/dt	6 -	- 6	kV/ $\mu\text{s}$
Gate source voltage	$V_{GS}$	$\pm 20$	$\pm 20$	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 <sup>2</sup> cooling area 1); $t \leq 10$ sec. @ min. footprint; $t \leq 10$ sec. @ 6 cm <sup>2</sup> 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, $I_D = 250$ $\mu$ A $V_{GS} = 0$ V, $I_D = -250$ $\mu$ A	N	$V_{(BR)DSS}$	60	-	-	V
	P		-60	-	-	
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 20$ $\mu$ A $I_D = -450$ $\mu$ 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	$\mu$ 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	$\Omega$
	P		-	0.22	0.3	

<sup>1</sup>Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu$ m thick) copper area for drain connection. PCB is vertical without blown air.

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

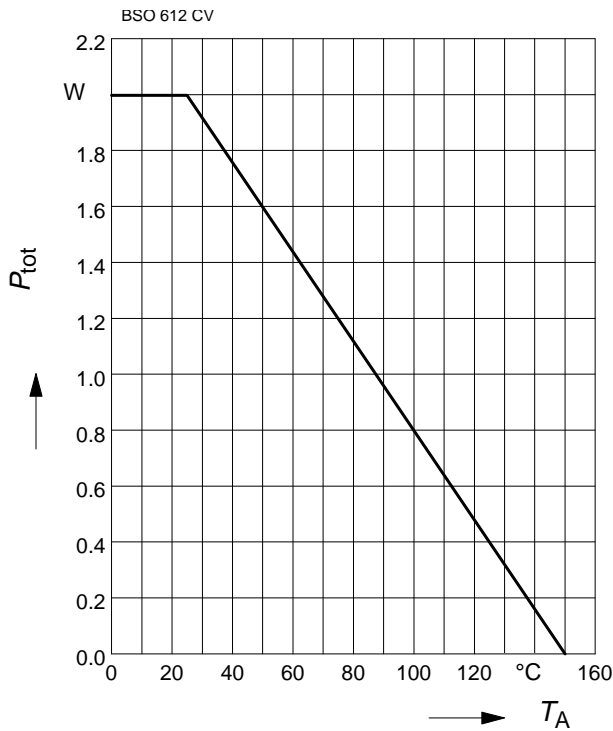
Parameter	Symbol	Values			Unit	
		min.	typ.	max.		
<b>Characteristics</b>						
Transconductance		$g_{fs}$				S
$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 3\text{ A}$	N		2	4	-	
$V_{V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}}$ , $I_D = -2\text{ A}$	P		1.2	2.4	-	
Input capacitance		$C_{iss}$				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.		
<b>Characteristics</b>						
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
<b>Reverse Diode</b>						
Inverse diode continuous forward current $T_A = 25\text{ °C}$	N P	$I_S$	- -	- -	3 -2	A
Inverse diode direct current, pulsed $T_A = 25\text{ °C}$	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	$\mu\text{C}$

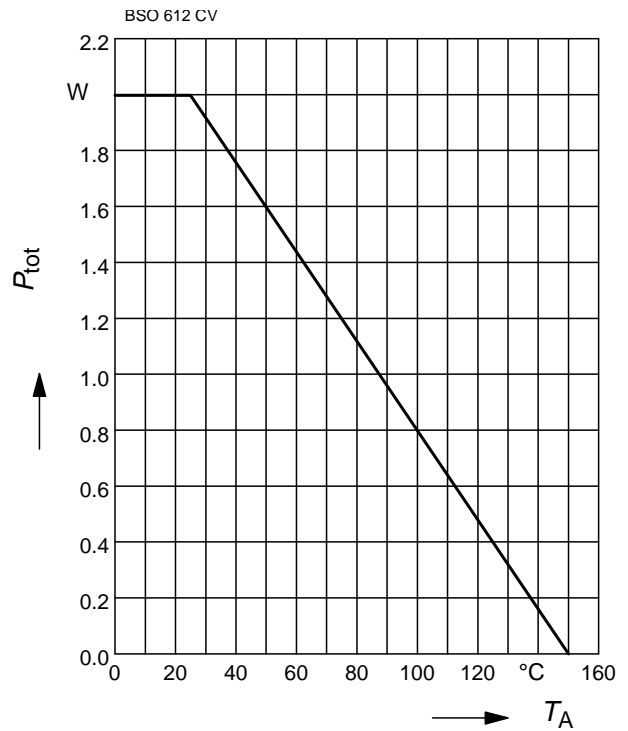
**Power Dissipation (N-Ch.)**

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



**Power Dissipation (P-Ch.)**

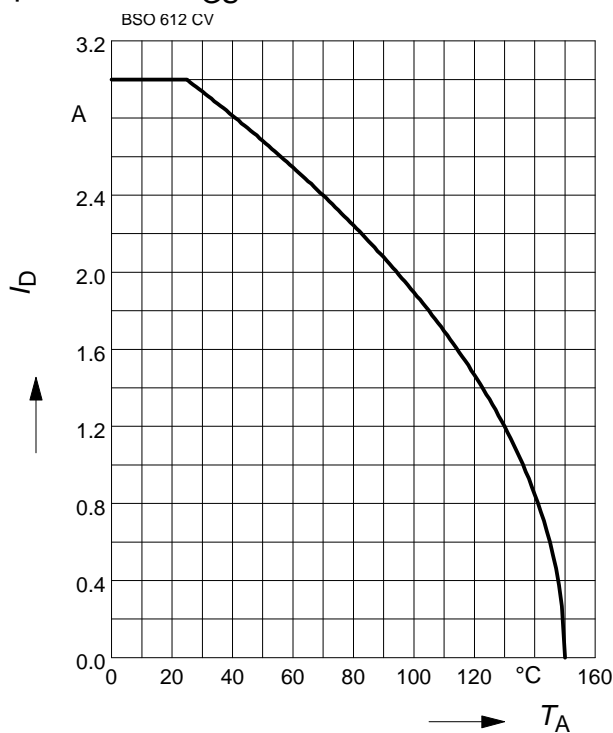
$$P_{\text{tot}} = f(T_A)$$



**Drain current (N-Ch.)**

$$I_D = f(T_A)$$

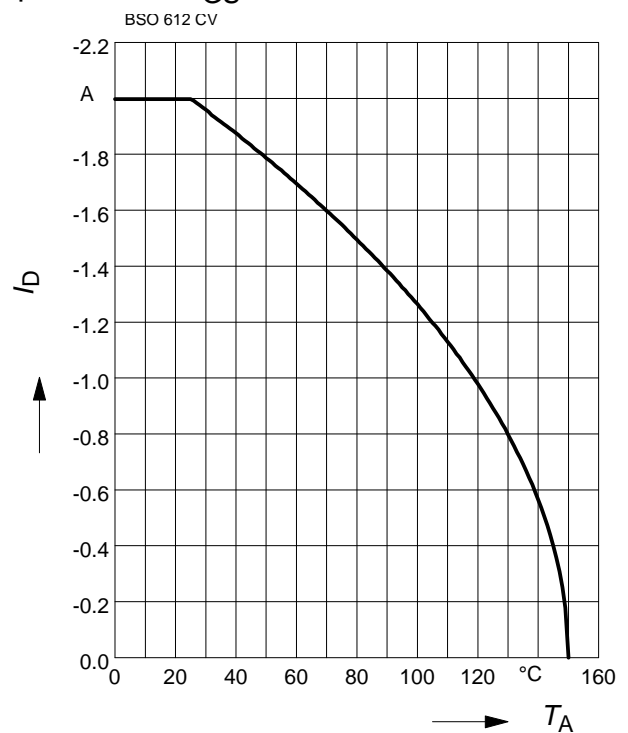
parameter:  $V_{GS} \geq 10 \text{ V}$



**Drain current (P-Ch.)**

$$I_D = f(T_A)$$

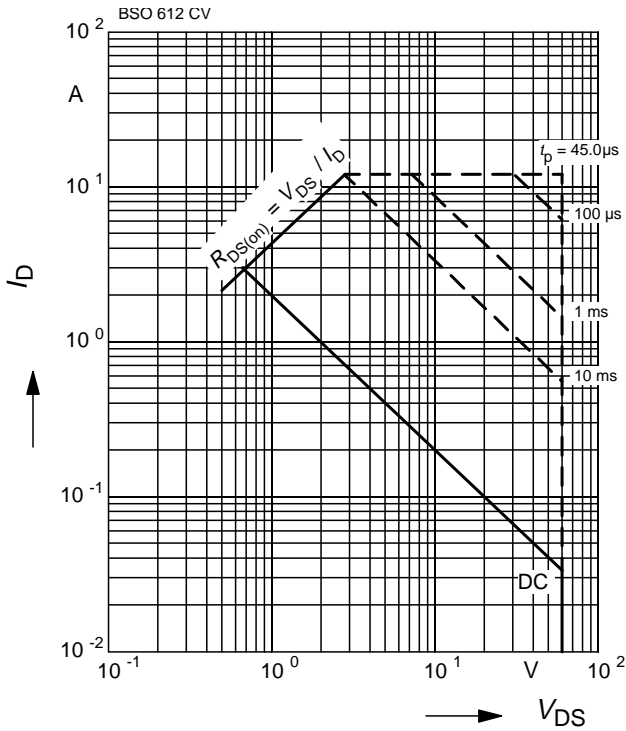
parameter:  $V_{GS} \geq -10 \text{ V}$



**Safe operating area (N-Ch.)**

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

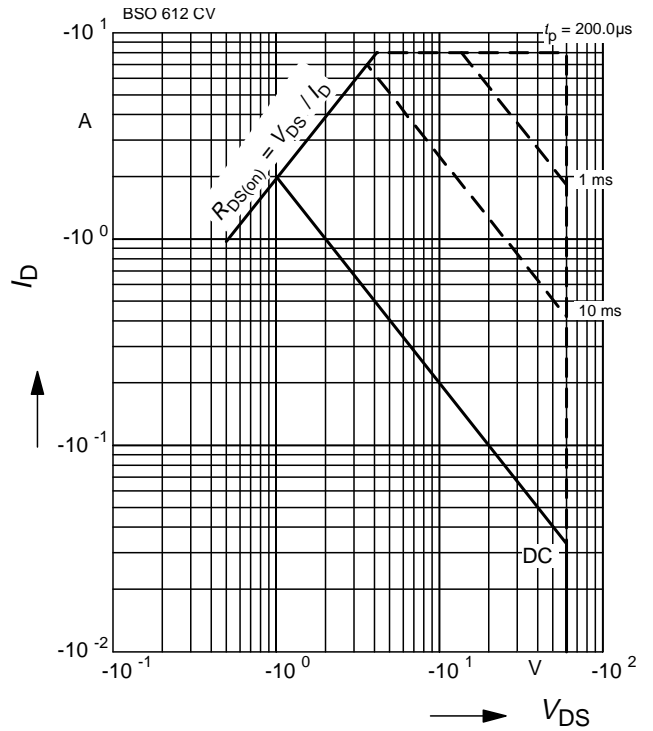
parameter :  $D = 0, T_A = 25\text{ }^\circ\text{C}$



**Safe operating area (P-Ch.)**

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

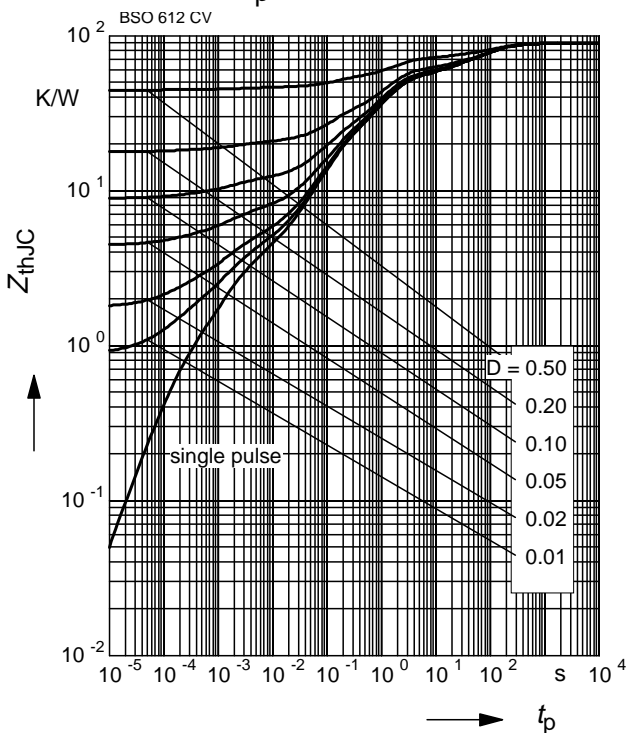
parameter :  $D = 0, T_A = 25\text{ }^\circ\text{C}$



**Transient thermal impedance (N-Ch.)**

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

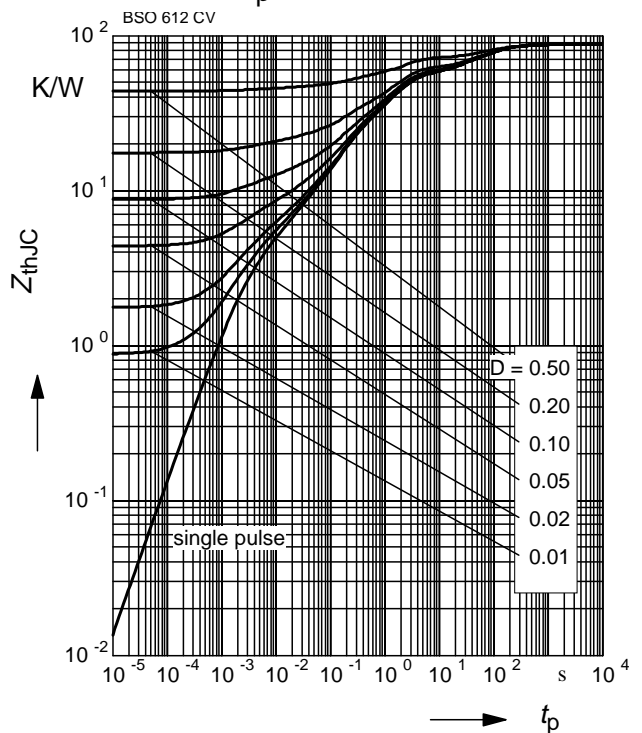
parameter :  $D = t_p/T$



**Transient thermal impedance (P-Ch.)**

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

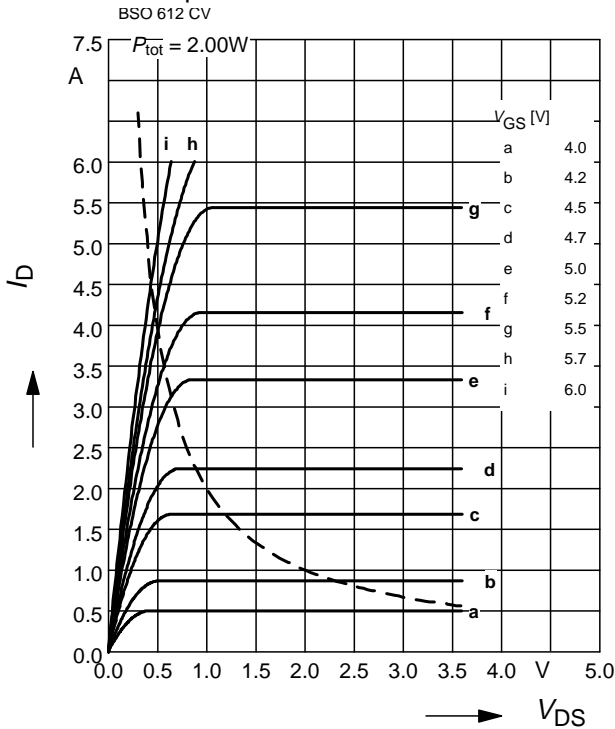
parameter :  $D = t_p/T$



**Typ. output characteristics (N-Ch.)**

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

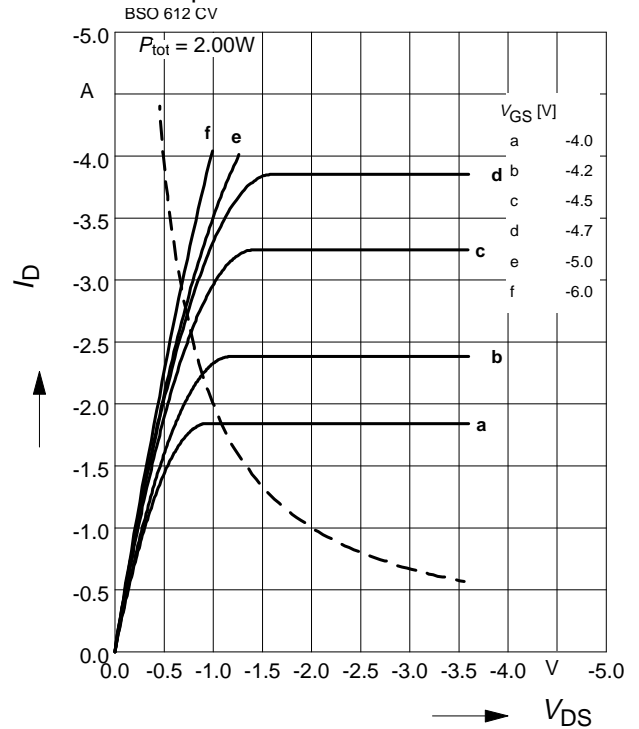
parameter:  $t_p = 80 \mu s$



**Typ. output characteristics (P-Ch.)**

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

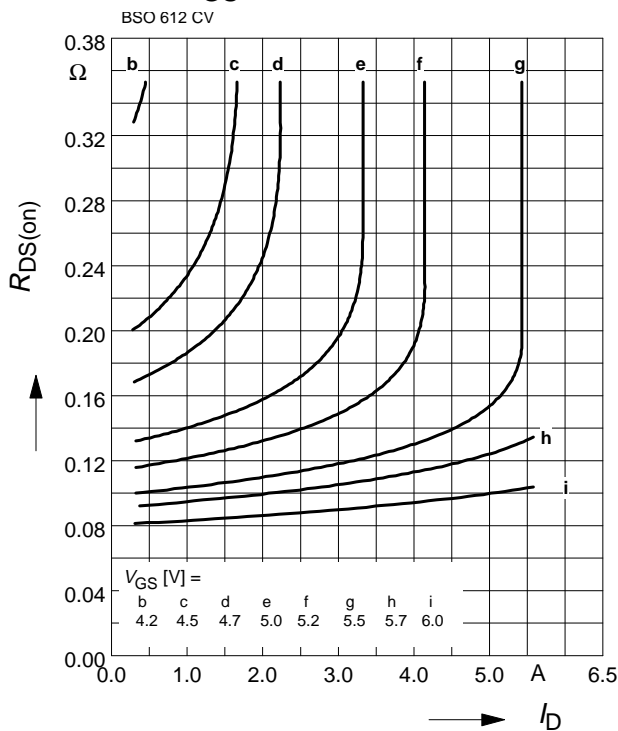
parameter:  $t_p = 80 \mu s$



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

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

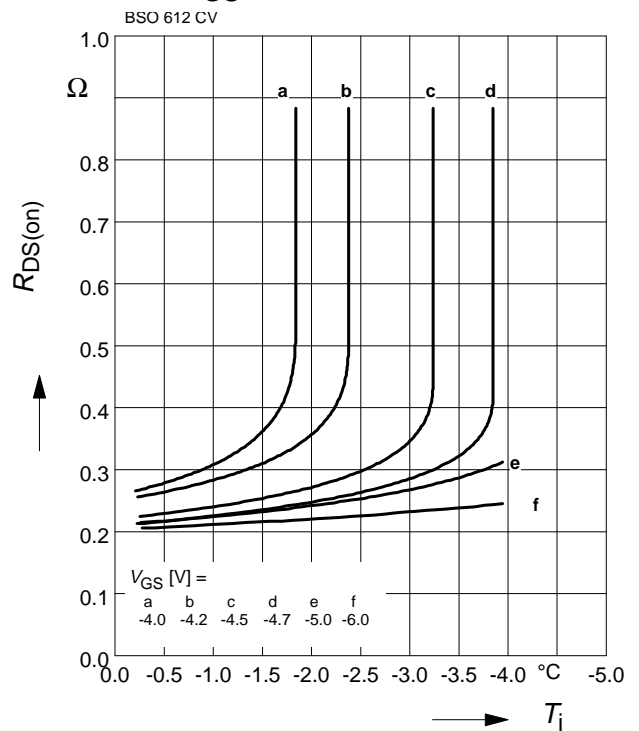
parameter:  $V_{GS}$



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

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

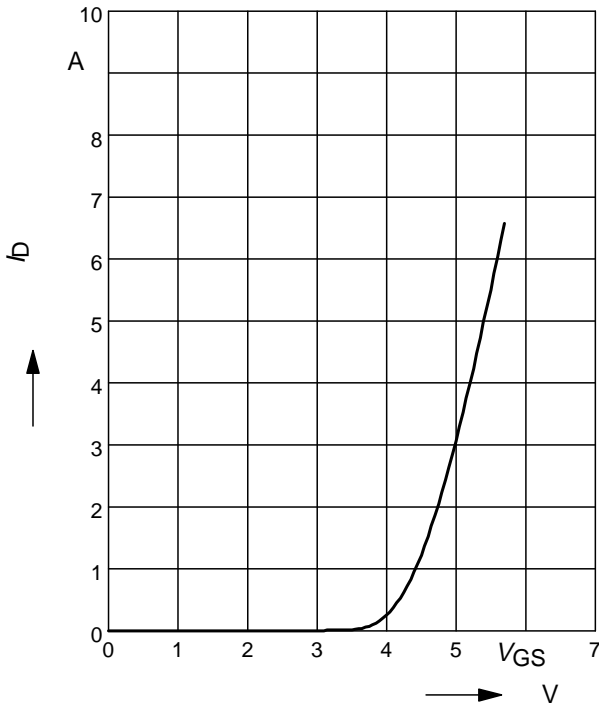
parameter:  $V_{GS}$



**Typ. transfer characteristics (N-Ch.)**

parameter:  $t_p = 80 \mu s$

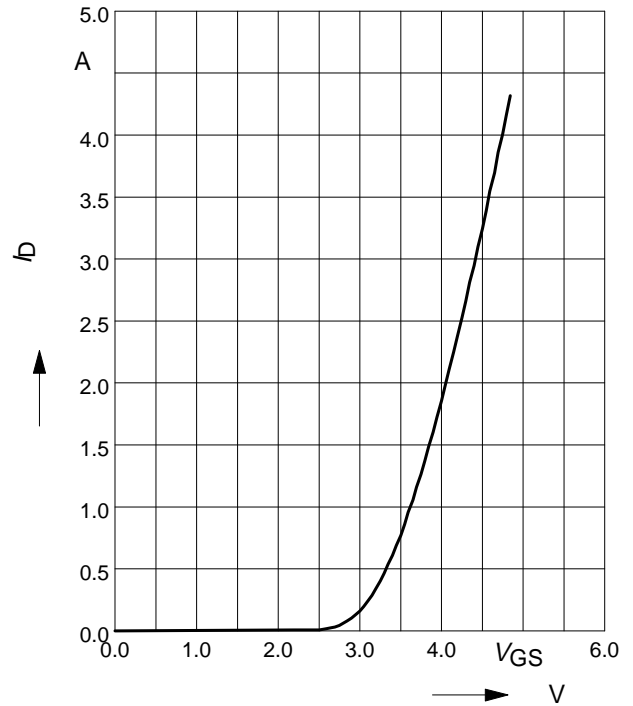
$$I_D = f(V_{GS}), V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$



**Typ. transfer characteristics (P-Ch.)**

parameter:  $t_p = 80 \mu s$

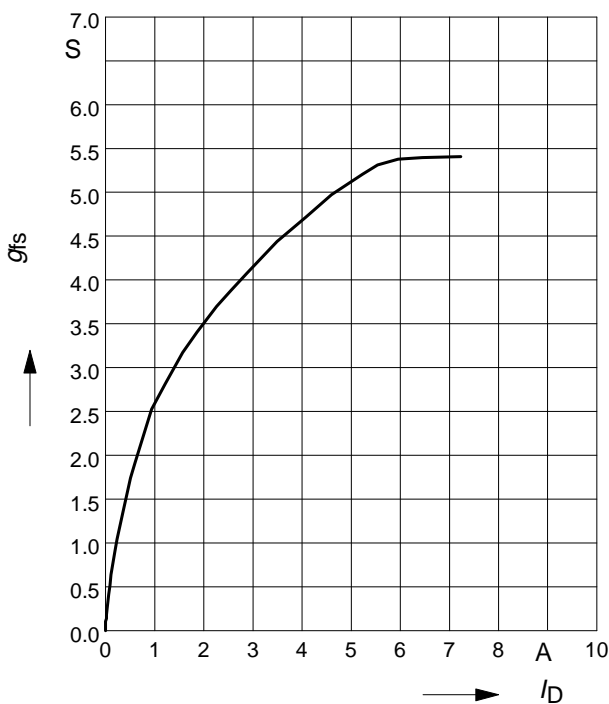
$$I_D = f(V_{GS}), V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$



**Typ. forward transconductance (N-Ch.)**

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

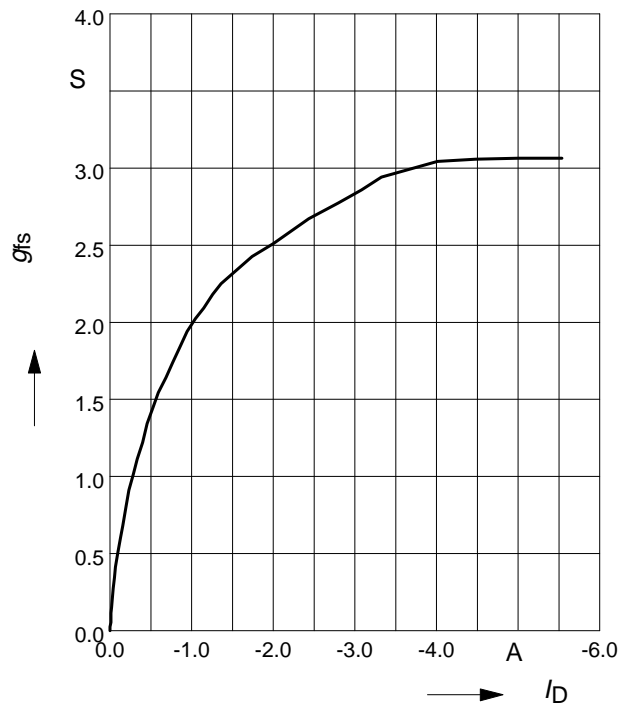
parameter:  $g_{fs}$



**Typ. forward transconductance (P-Ch.)**

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

parameter:  $g_{fs}$

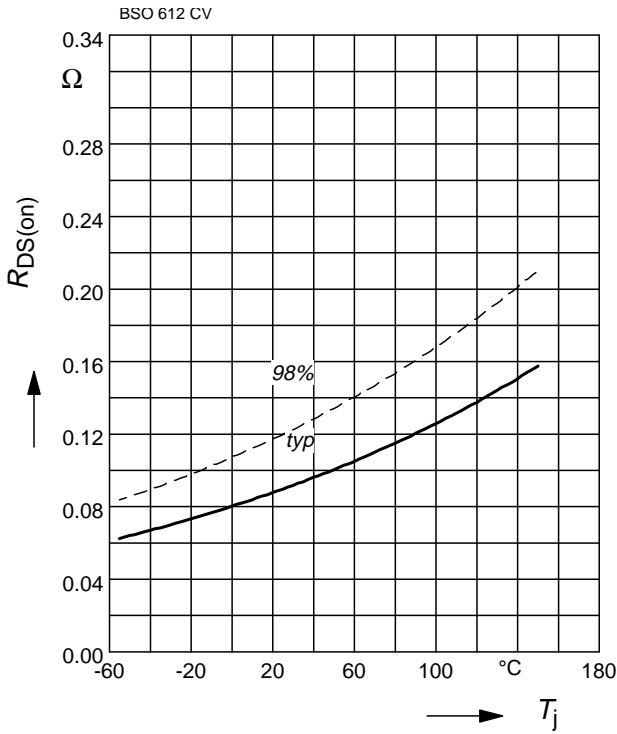




**Drain-source on-resistance (N-Ch.)**

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

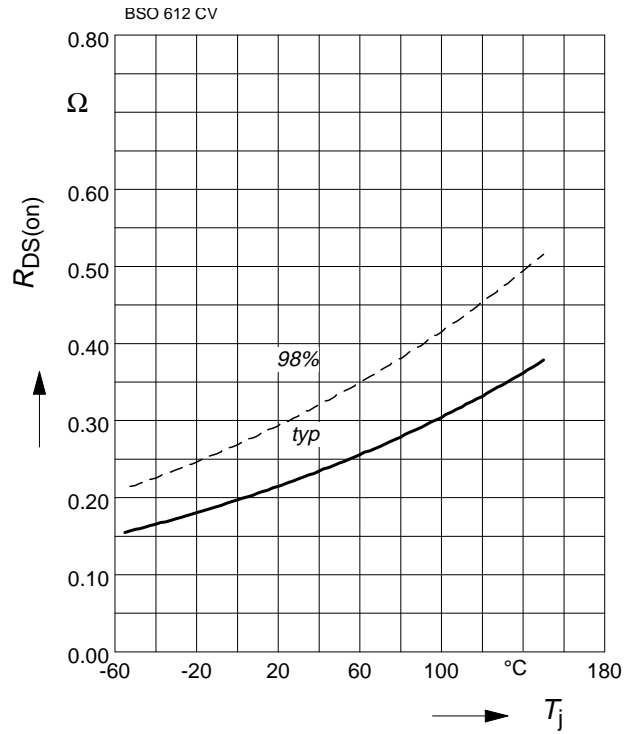
parameter :  $I_D = 3 \text{ A}$  ,  $V_{GS} = 10 \text{ V}$



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

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

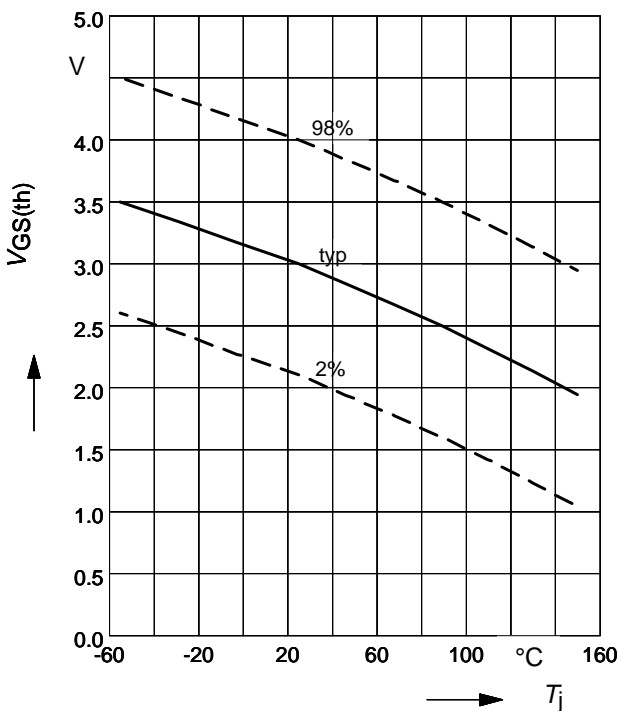
parameter :  $I_D = -2 \text{ A}$  ,  $V_{GS} = -10 \text{ V}$



**Gate threshold voltage (N-Ch.)**

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

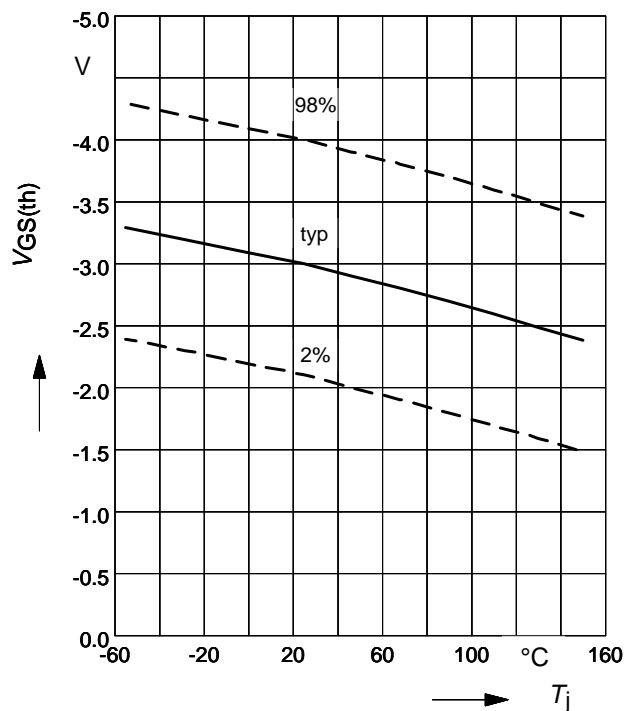
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 20 \mu\text{A}$



**Gate threshold voltage (P-Ch.)**

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

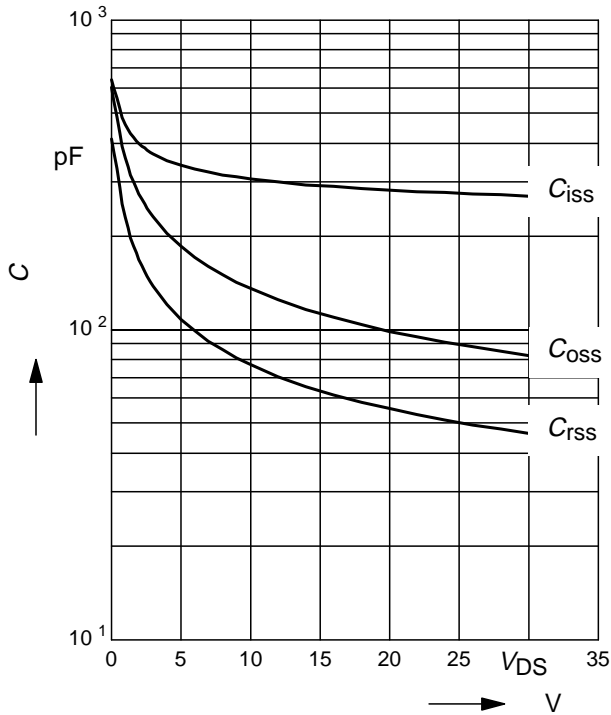
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = -450 \mu\text{A}$



**Typ. capacitances (N-Ch.)**

$C = f(V_{DS})$

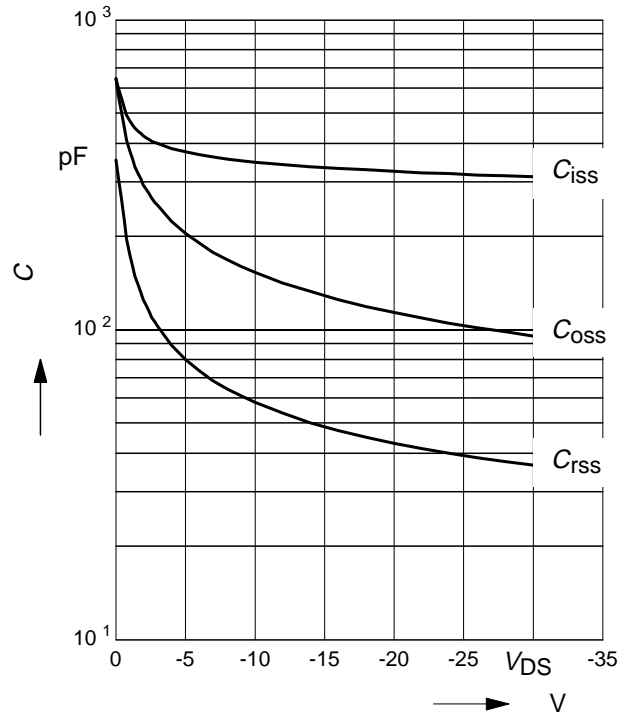
parameter:  $V_{GS}=0\text{ V}$ ,  $f=1\text{ MHz}$



**Typ. capacitances (P-Ch.)**

$C = f(V_{DS})$

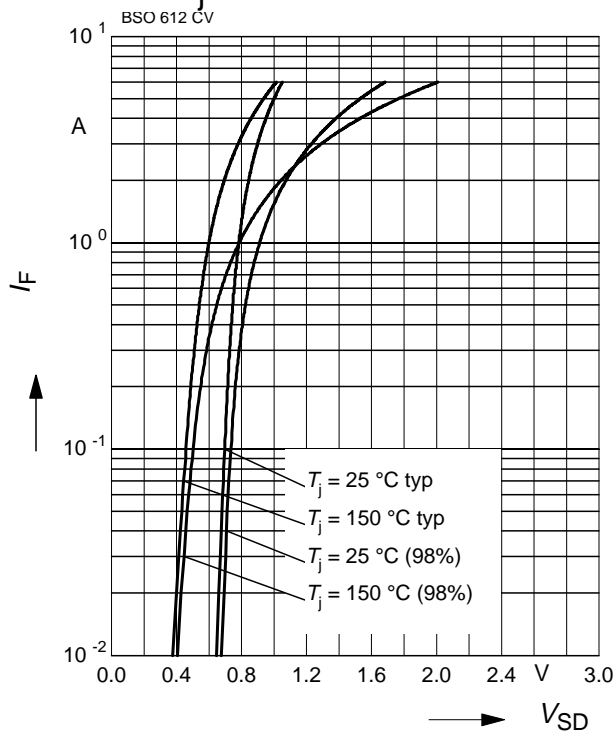
parameter:  $V_{GS}=0\text{ V}$ ,  $f=1\text{ MHz}$



**Forward characteristics of reverse diode**

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

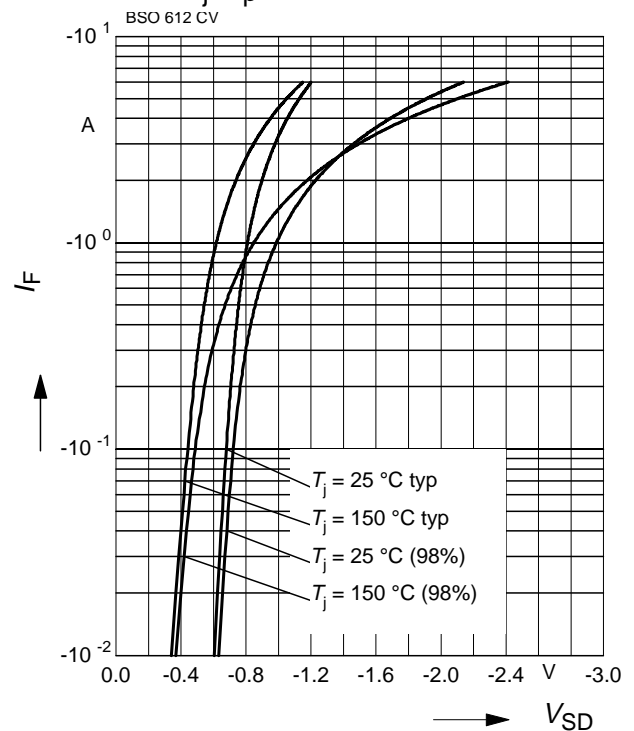
parameter:  $T_j$ ,  $t_p = 80\ \mu\text{s}$



**Forward characteristics of reverse diode**

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

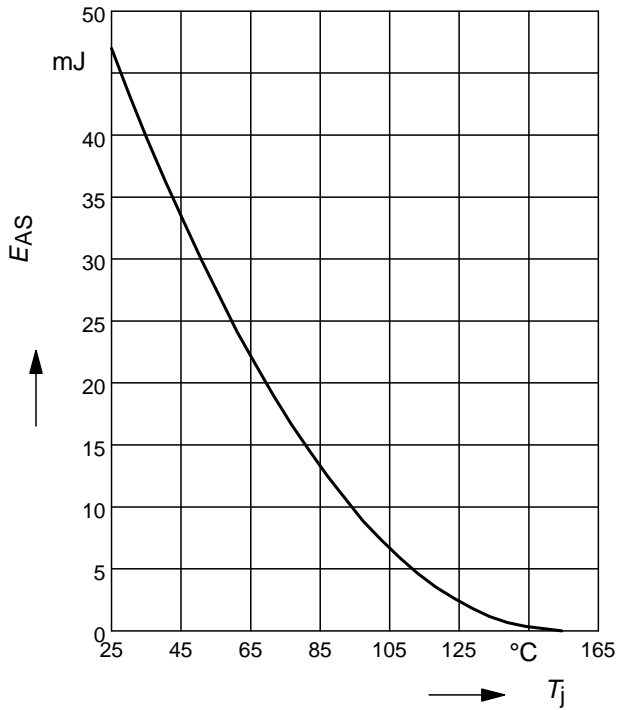
parameter:  $T_j$ ,  $t_p = 80\ \mu\text{s}$



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

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

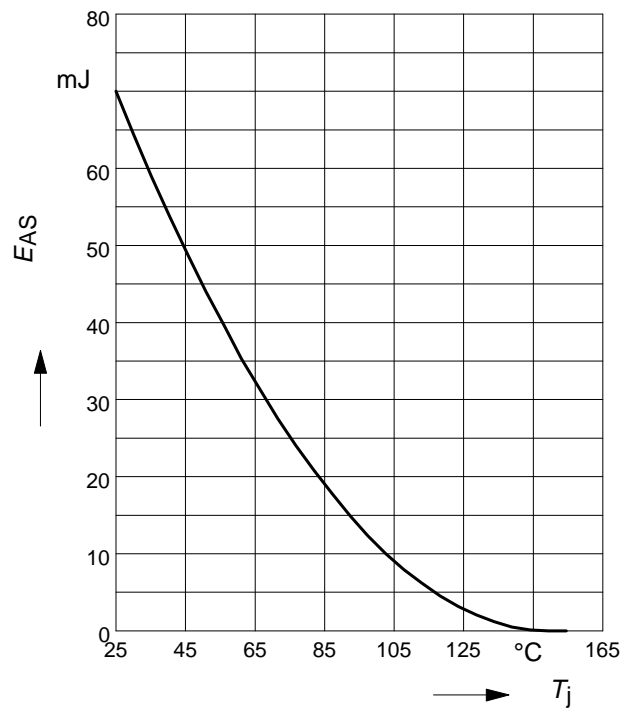
$R_{GS} = 25\ \Omega$



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

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

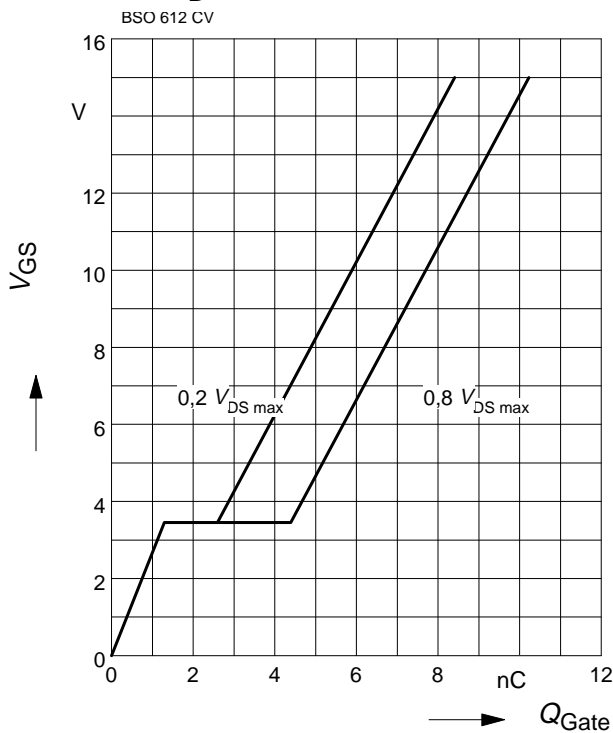
$R_{GS} = 25\ \Omega$



**Typ. gate charge (N-Ch.)**

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

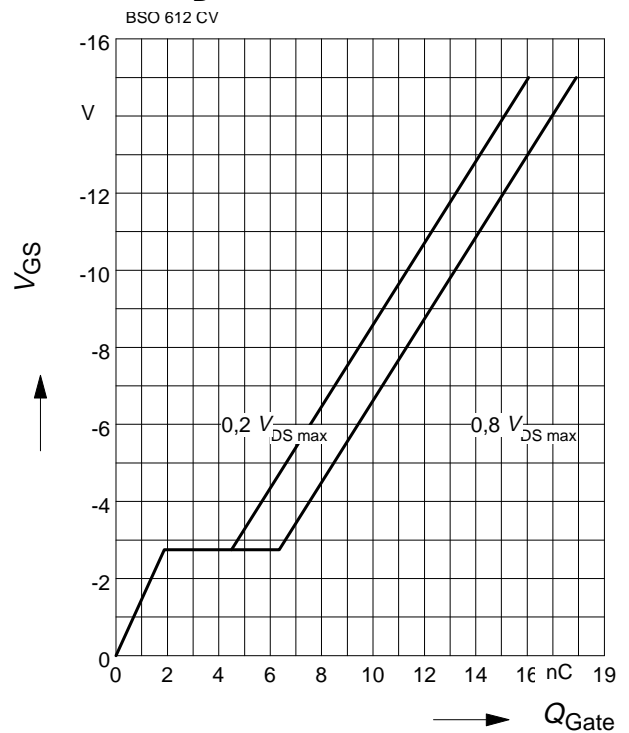
parameter:  $I_D = 3\text{ A}$



**Typ. gate charge (P-Ch.)**

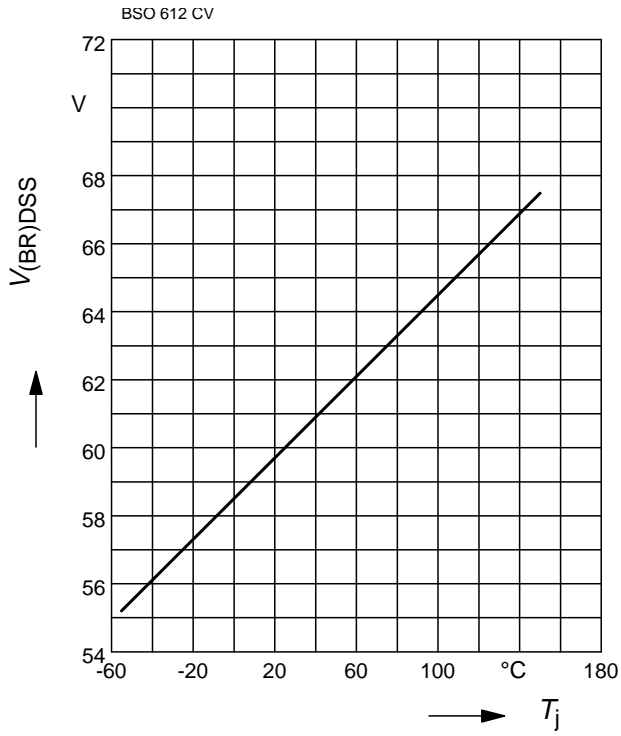
$V_{GS} = f(Q_{Gate})$

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



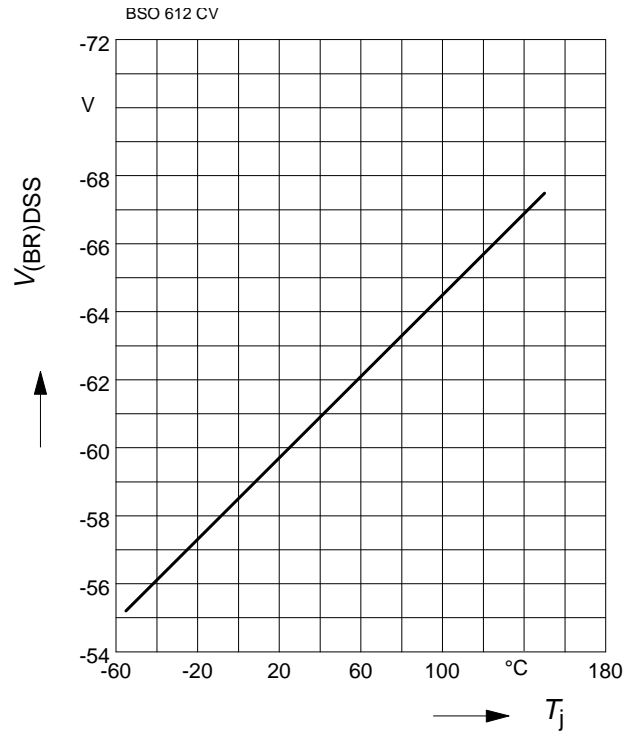
**Drain-source breakdown voltage**

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



**Drain-source breakdown voltage**

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



**Published by**  
**Infineon Technologies AG,**  
**Bereichs Kommunikation**  
**St.-Martin-Strasse 53,**  
**D-81541 München**  
**© Infineon Technologies AG 1999**  
**All Rights Reserved.**

**Attention please!**

The information herein is given to describe certain components and shall not be considered as warranted characteristics.

Terms of delivery and rights to technical change reserved.

We hereby disclaim any and all warranties, including but not limited to warranties of non-infringement, regarding circuits, descriptions and charts stated herein.

Infineon Technologies is an approved CECC manufacturer.

**Information**

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office in Germany or our Infineon Technologies Representatives worldwide (see address list).

**Warnings**

Due to technical requirements components may contain dangerous substances.

For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.