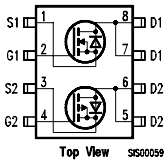
## SIPMOS® Small-Signal-Transistor

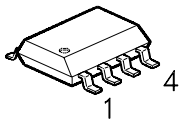
**Product Summary**

| | | 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 |

**Features**

- Dual N- and P -Channel
- Enhancement mode
- Avalanche rated
- Pb-free lead plating;RoHS compliant




VPS05121

| Type | Package | Marking |
|---|---|---|
| BSO 612 CV | PG-DSO-8 | 612CV |

**Maximum Ratings**,at $T_j$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Value | | Unit |
|---|---|---|---|---|
| | | N | P | |
| Continuous drain current | $I_D$ | | | A |
| $T_A$ = 25 °C | | 3 | -2 | |
| $T_A$ = 70 °C | | 2.4 | -1.6 | |
| Pulsed drain current | $I_{D\ puls}$ | 12 | -8 | |
| $T_A$ = 25 °C | | | | |
| Avalanche energy, single pulse | $E_{AS}$ | | | mJ |
| $I_D$ = 3 A, $V_{DD}$ = 25 V, $R_{GS}$ = 25 Ω | | 47 | - | |
| $I_D$ = -2 A, $V_{DD}$ = -25 V, $R_{GS}$ = 25 Ω | | - | 70 | |
| Avalanche energy, periodic limited by $T_{jmax}$ | $E_{AR}$ | 0.2 | 0.2 | |
| Reverse diode d$v$/d$t$, $T_{jmax}$ = 150 °C | d$v$/d$t$ | | | kV/µs |
| $I_S$ = 3 A, $V_{DS}$ = 48 V, d$i$/d$t$ = 200 A/µs | | 6 | - | |
| $I_S$ = -2 A, $V_{DS}$ = -48 V, d$i$/d$t$ = -200 A/µs | | - | 6 | |
| Gate source voltage | $V_{GS}$ | ±20 | ±20 | V |
| Power dissipation | $P_{tot}$ | 2 | 2 | W |
| $T_A$ = 25 °C | | | | |
| Operating and storage temperature | $T_j$ , $T_{stg}$ | -55...+150 | | °C |
| IEC climatic category; DIN IEC 68-1 | | 55/150/56 | | |

## Termal Characteristics

| Parameter | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic Characteristics** | | | | | | |
| Thermal resistance, junction - soldering point | N | $R_{thJS}$ | - | - | 40 | K/W |
| ( Pin 4) | P | | - | - | 40 | |
| SMD version, device on PCB: | | $R_{thJA}$ | | | | |
| @ min. footprint; t ≤ 10 sec. | N | | - | - | 110 | |
| @ 6 cm$^2$ cooling area [1]; t ≤ 10 sec. | N | | - | - | 62.5 | |
| @ min. footprint; t ≤ 10 sec. | P | | - | - | 70 | |
| @ 6 cm$^2$ cooling area [1]; t ≤ 10 sec. | P | | - | - | 62.5 | |
| **Static Characteristics**, at $T_j$ = 25 °C, unless otherwise specified | | | | | | |
| Drain- source breakdown voltage | | $V_{(BR)DSS}$ | | | | V |
| $V_{GS}$ = 0 V, $I_D$ = 250 µA | N | | 60 | - | - | |
| $V_{GS}$ = 0 V, $I_D$ = -250 µA | P | | -60 | - | - | |
| Gate threshold voltage, $V_{GS}$ = $V_{DS}$ | | $V_{GS(th)}$ | | | | |
| $I_D$ = 20 µA | N | | 2.1 | 3 | 4 | |
| $I_D$ = -450 µA | P | | -2.1 | -3 | -4 | |
| Zero gate voltage drain current | | $I_{DSS}$ | | | | µA |
| $V_{DS}$ = 60 V, $V_{GS}$ = 0 V, $T_j$ = 25 °C | N | | - | 0.1 | 1 | |
| $V_{DS}$ = 60 V, $V_{GS}$ = 0 V, $T_j$ = 125 °C | N | | - | 10 | 100 | |
| $V_{DS}$ = -60 V, $V_{GS}$ = 0 V, $T_j$ = 25 °C | P | | - | -0.1 | -1 | |
| $V_{DS}$ = -60 V, $V_{GS}$ = 0 V, $T_j$ = 125 °C | P | | - | -10 | -100 | |
| Gate-source leakage current | | $I_{GSS}$ | | | | nA |
| $V_{GS}$ = 20 V, $V_{DS}$ = 0 V | N | | - | 10 | 100 | |
| $V_{GS}$ = -20 V, $V_{DS}$ = 0 V | P | | - | -10 | -100 | |
| Drain-source on-state resistance | | $R_{DS(on)}$ | | | | Ω |
| $V_{GS}$ = 10 V, $I_D$ = 3 A | N | | - | 0.09 | 0.12 | |
| $V_{GS}$ = -10 V , $I_D$ = -2 A | P | | - | 0.22 | 0.3 | |

[1] Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm $^2$ (one layer, 70 µm thick) copper area for drain connection. PCB is vertical without blown air.

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

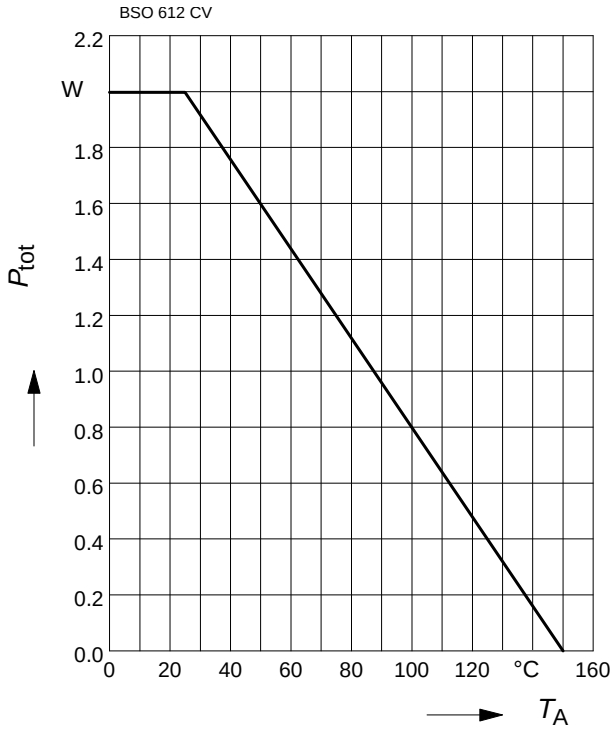
| Parameter | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Characteristics** | | | | | | |
| Transconductance | | $g_{fs}$ | | | | S |
| $V_{DS}$≥2 * $I_D$ * $R_{DS(on)max}$, $I_D$ = 3 A | N | | 2 | 4 | - | |
| $VV_{DS}$≥2 * $I_D$ * $R_{DS(on)max}$,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

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

| Parameter | | Symbol | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Characteristics** | | | | | | |
| Gate to source charge | | $Q_{gs}$ | | | | nC |
| $V_{DD}$ = 48 V, $I_D$ = 3 A | N | | - | 1 | 1.5 | |
| $V_{DD}$ = -48 V, $I_D$ = -2 A | P | | - | 2 | 3 | |
| Gate to drain charge | | $Q_{gd}$ | | | | |
| $V_{DD}$ = 48 V, $I_D$ = 3 A | N | | - | 5.5 | 8.3 | |
| $V_{DD}$ = -48 V, $I_D$ = -2 A | P | | - | 4.5 | 6.8 | |
| Gate charge total | | $Q_g$ | | | | |
| $V_{DD}$ = 48 V, $I_D$ = 3 A, $V_{GS}$ = 0 to 10V | N | | - | 10.3 | 15.5 | |
| $V_{DD}$ = -48 V, $I_D$ = -2 A, $V_{GS}$ = 0 to -10V | P | | - | 10.5 | 16 | |
| Gate plateau voltage | | $V_{(plateau)}$ | | | | V |
| $V_{DD}$ = 48 V, $I_D$ = 3 A | N | | - | 5 | - | |
| $V_{DD}$ = -48 V, $I_D$ = -2 A | P | | - | -4 | - | |
| **Reverse Diode** | | | | | | |
| Inverse diode continuous forward current | N | $I_S$ | - | - | 3 | A |
| $T_A$ = 25 °C | P | | - | - | -2 | |
| Inverse diode direct current,pulsed | N | $I_{SM}$ | - | - | 12 | |
| $T_A$ = 25 °C | P | | - | - | -8 | |
| Inverse diode forward voltage | | $V_{SD}$ | | | | V |
| $V_{GS}$ = 0 V, $I_F$ = $I_S$ | N | | - | 0.9 | 1.2 | |
| $V_{GS}$ = 0 V, $I_F$ = $I_S$ | P | | - | -0.9 | -1.2 | |
| Reverse recovery time | | $t_{rr}$ | | | | ns |
| $V_R$ = 30 V, $I_F$=$I_S$, d$i_F$/d$t$ = 100 A/µs | N | | - | 55 | 85 | |
| $V_R$ = -30 V, $I_F$=$I_S$ , d$i_F$/d$t$ = -100 A/µs | P | | - | 55 | 85 | |
| Reverse recovery charge | | $Q_{rr}$ | | | | nC |
| $V_R$ = 30 V, $I_F$=$I_S$ , d$i_F$/d$t$ = 100 A/µs | N | | - | 90 | 135 | |
| $V_R$ = -30 V, $I_F$=$I_S$, d$i_F$/d$t$ = -100 A/µs | P | | - | 65 | 100 | |

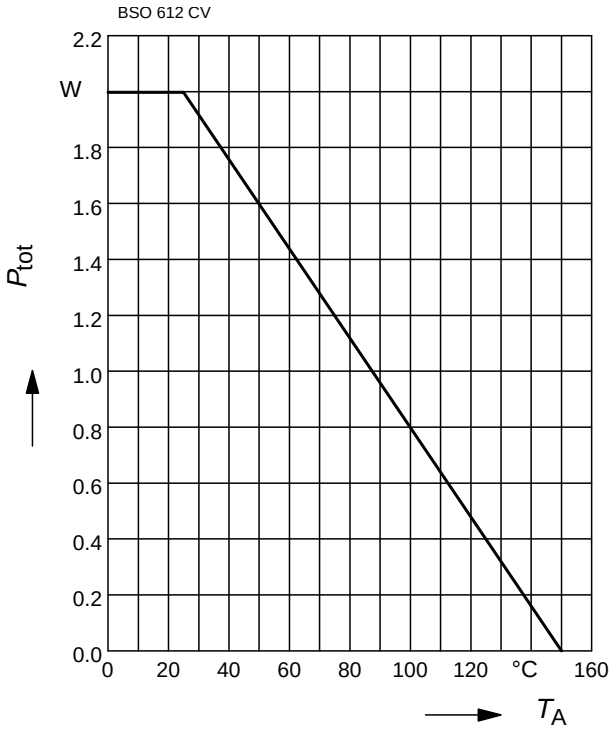
**Power Dissipation** (N-Ch.)

$P_{tot} = f(T_A)$




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

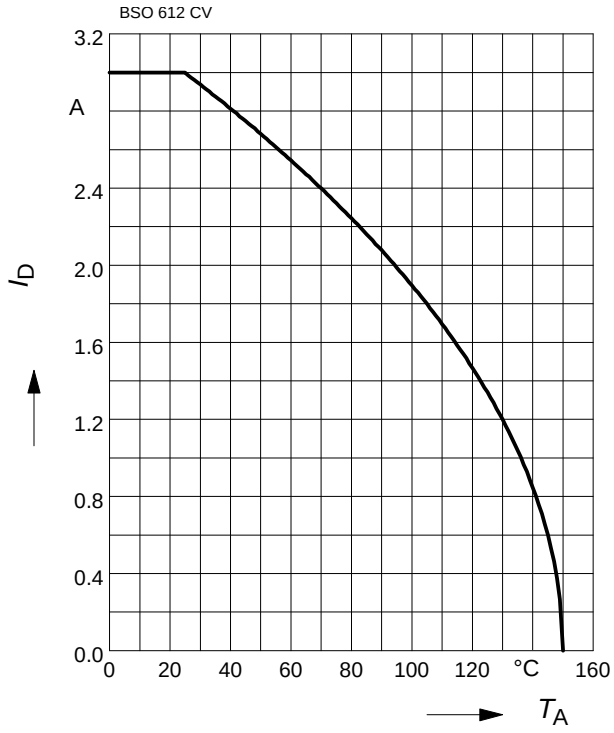
$P_{tot} = f(T_A)$




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

$I_D = f(T_A)$

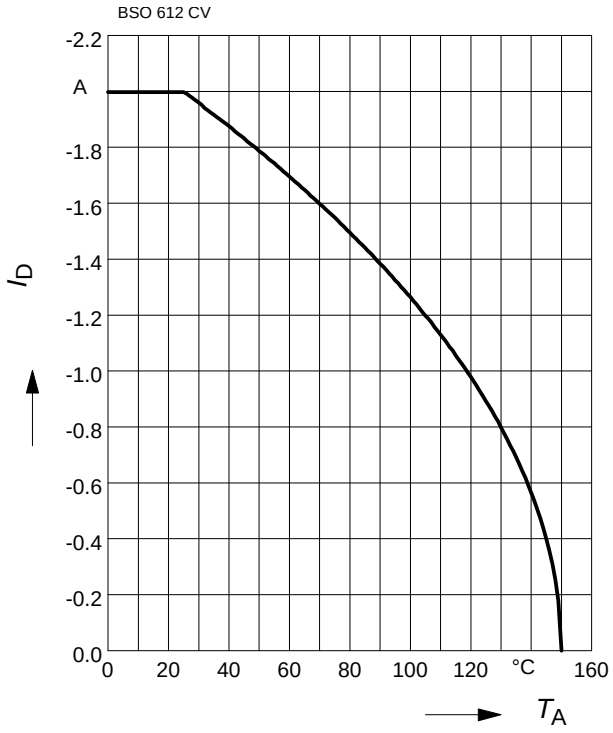
parameter: $V_{GS} \geq 10$ V




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

$I_D = f(T_A)$

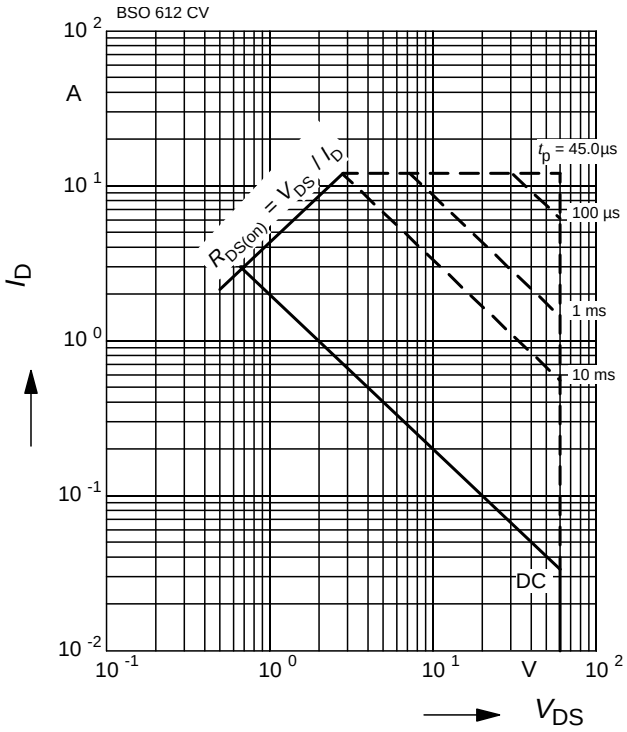
parameter: $V_{GS} \geq -10$ V



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

$I_D = f(V_{DS})$

parameter : $D = 0$ , $T_A = 25$ °C

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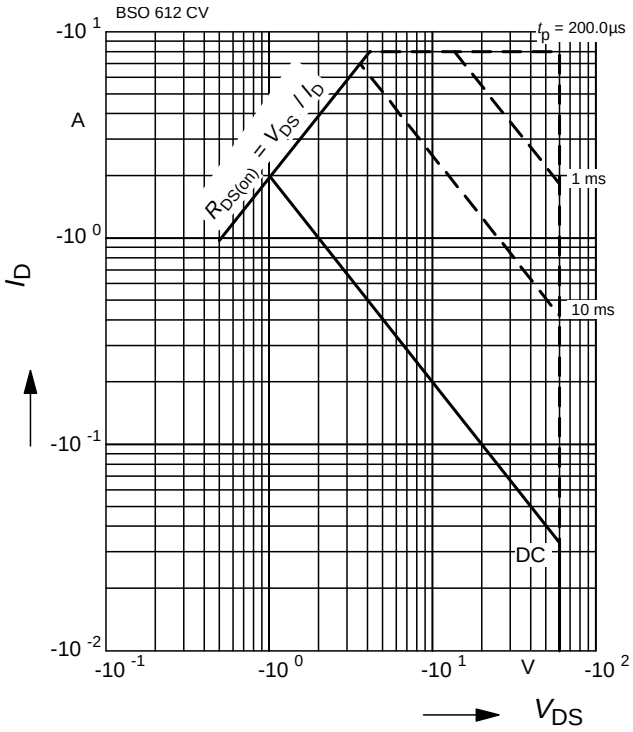
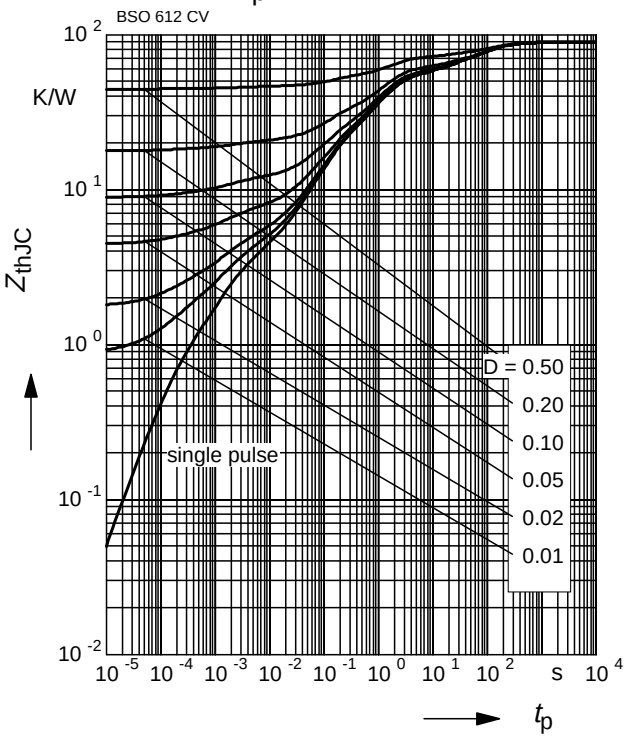



**Transient thermal impedance** (N-Ch.)

$Z_{thJC} = f(t_p)$

parameter : $D = t_p / T$

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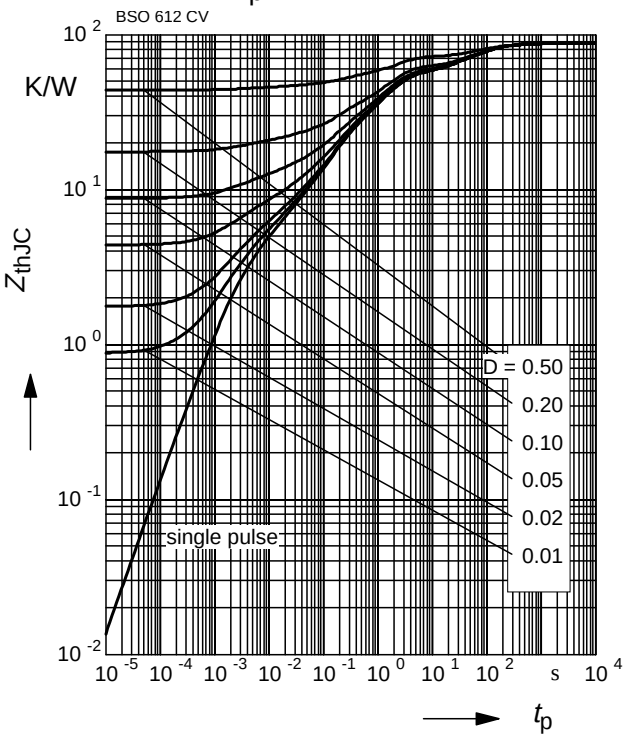
$Z_{thJC} = f(t_p)$

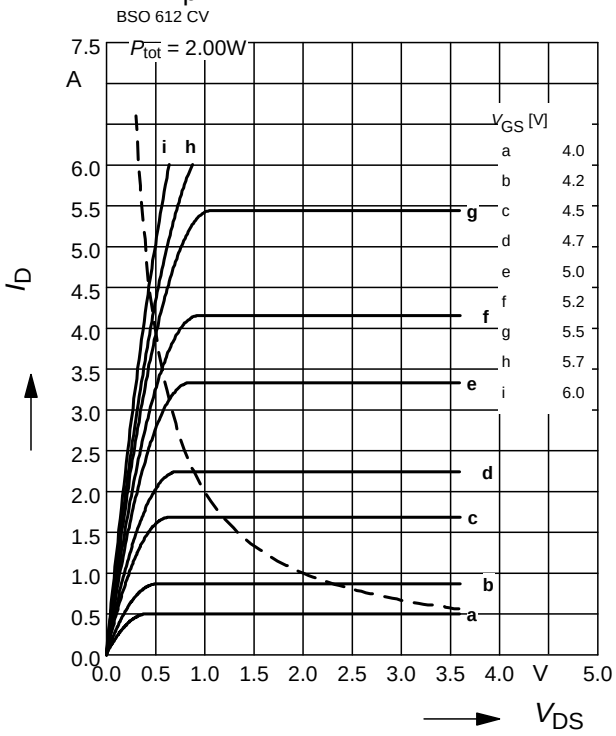
parameter : $D = t_p / T$



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

$I_D = f(V_{DS})$

parameter: $t_p$ = 80 µs

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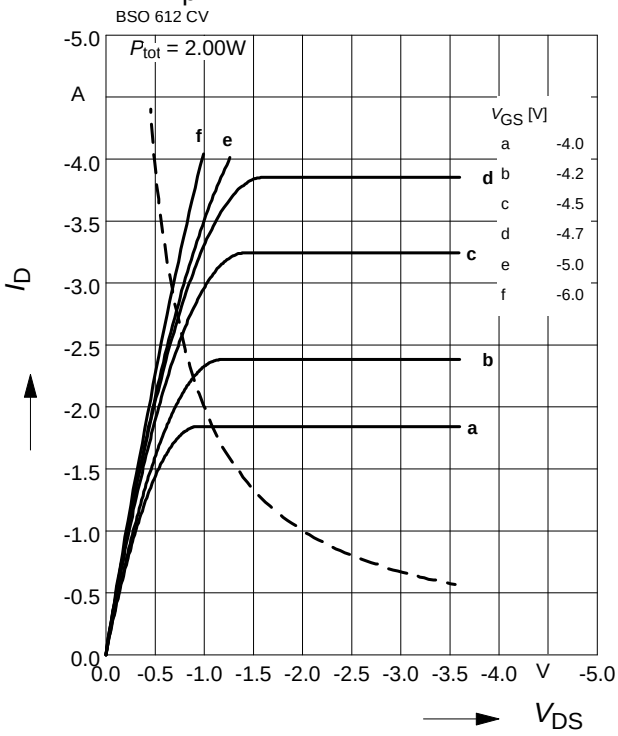
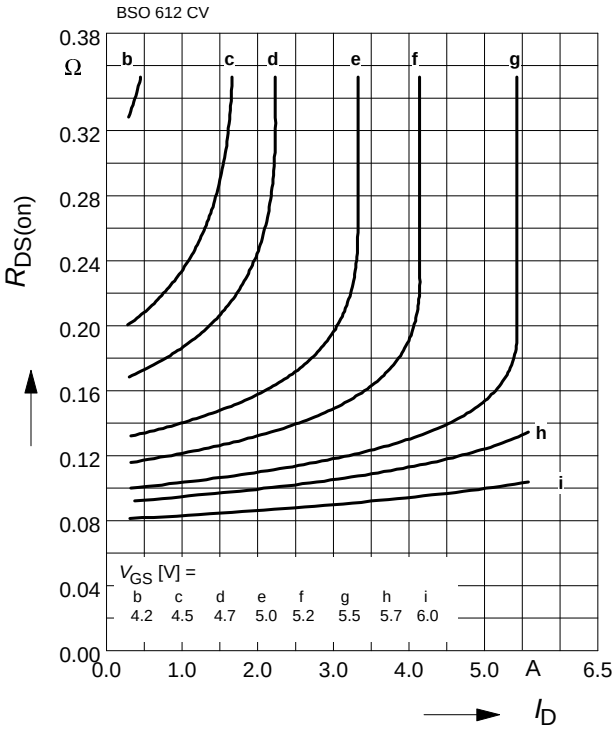



**Typ. drain-source-on-resistance** (N-Ch.)

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

parameter: $V_{GS}$

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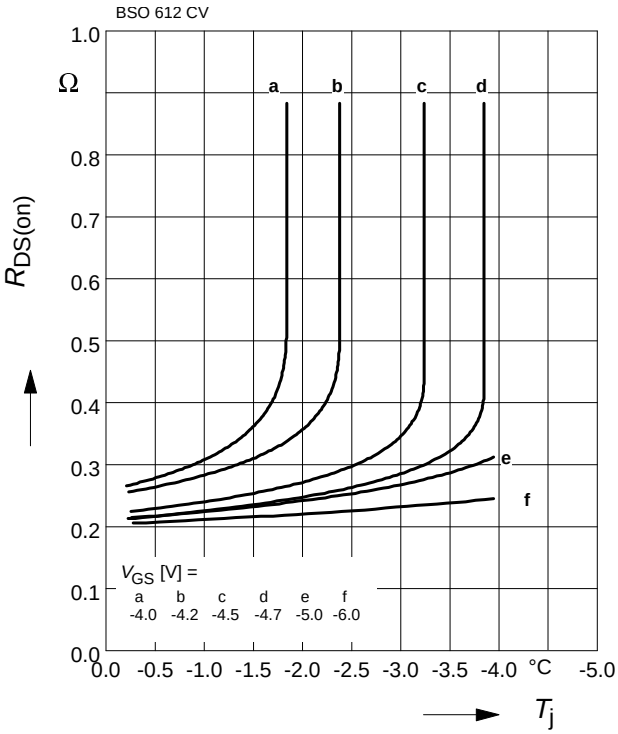
$R_{DS(on)} = f(I_D)$

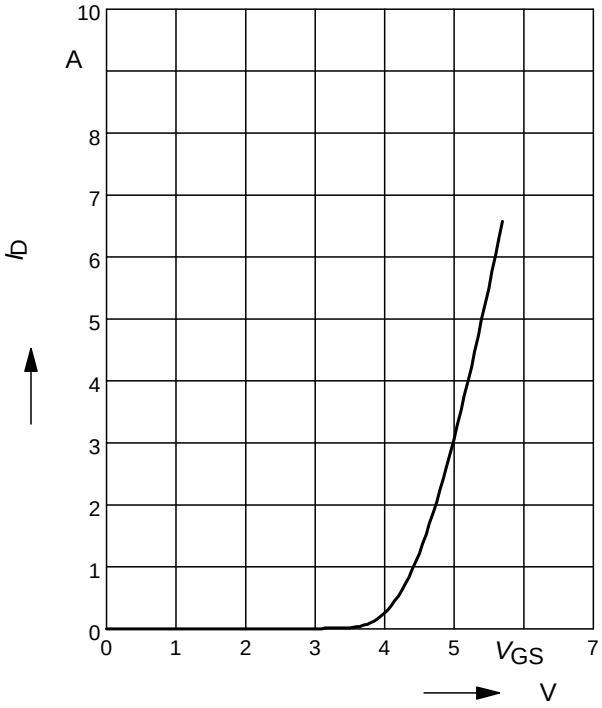
parameter: $V_{GS}$



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

parameter: $t_p$ = 80 µs

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

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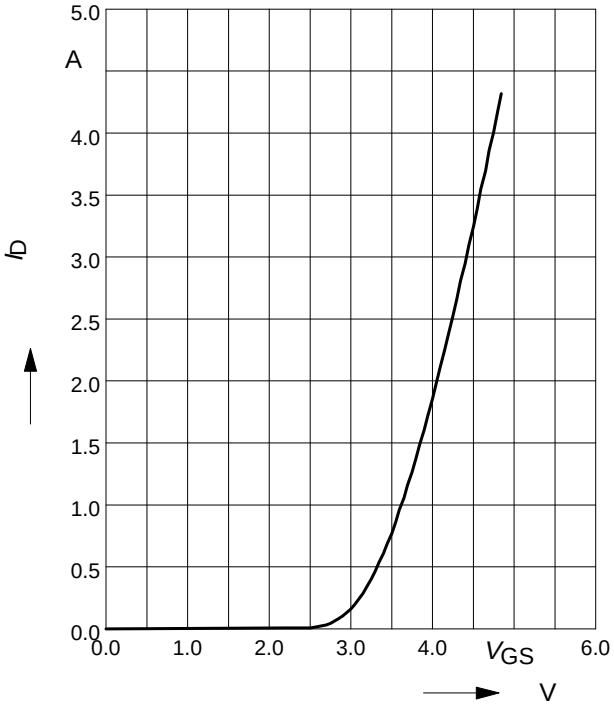
parameter: $t_p$ = 80 µs

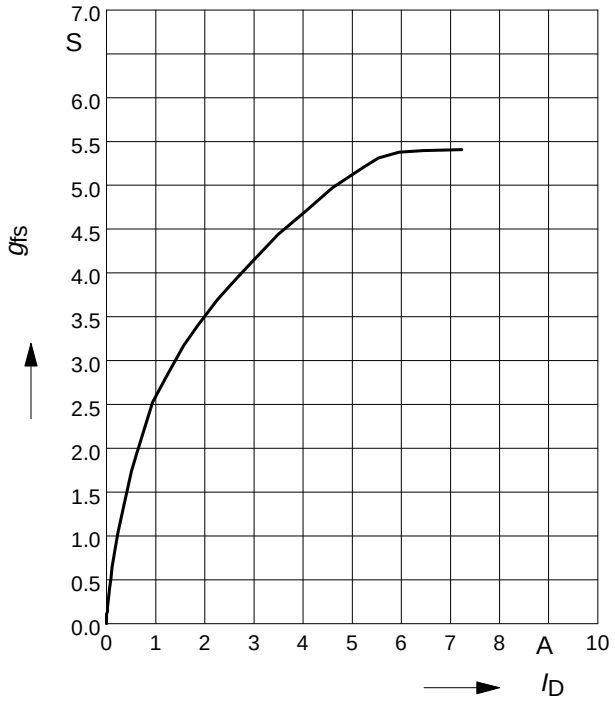
$I_D = f(V_{GS})$, $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$




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

$g_{fs}$ = f($I_D$); $T_j$ = 25 °C

parameter: $g_{fs}$

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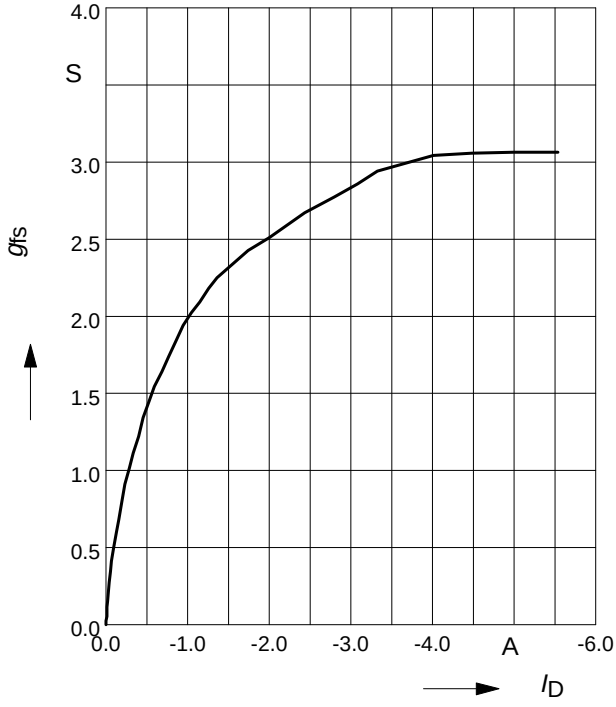
$g_{fs}$ = f($I_D$); $T_j$ = 25 °C

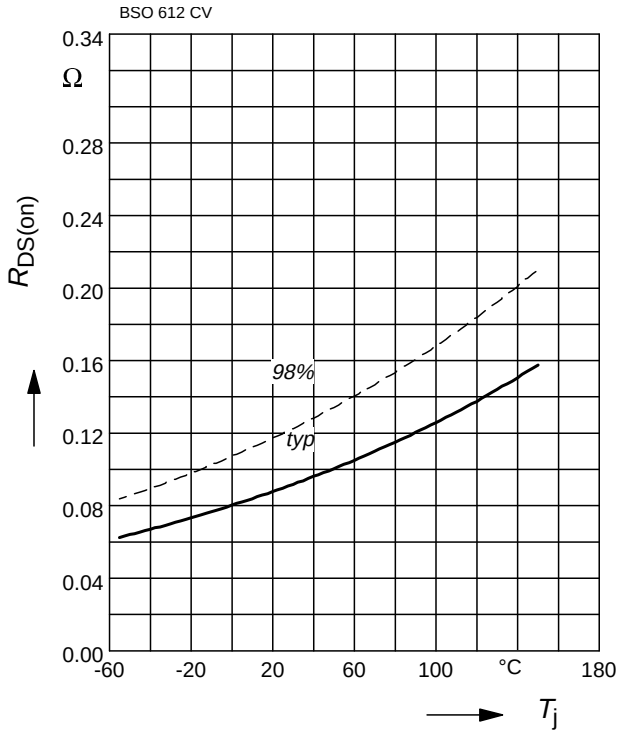
parameter: $g_{fs}$



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

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

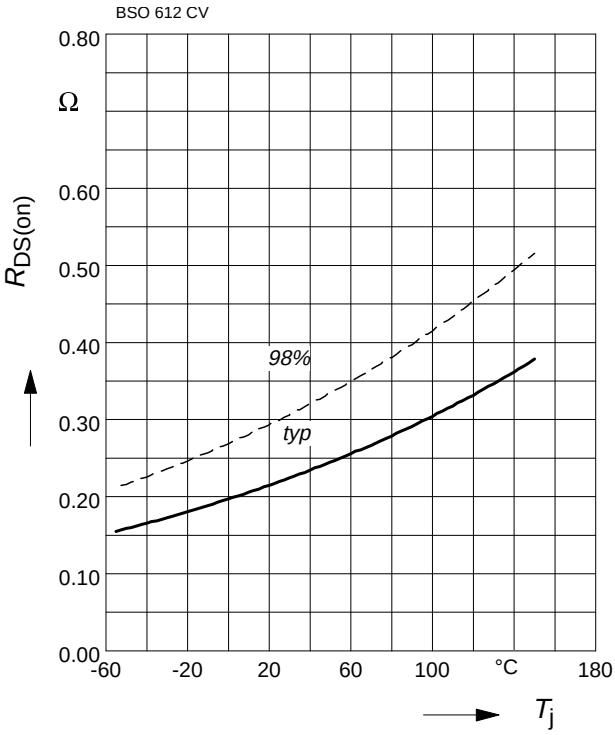
parameter : $I_D$ = 3 A , $V_{GS}$ = 10 V




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

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

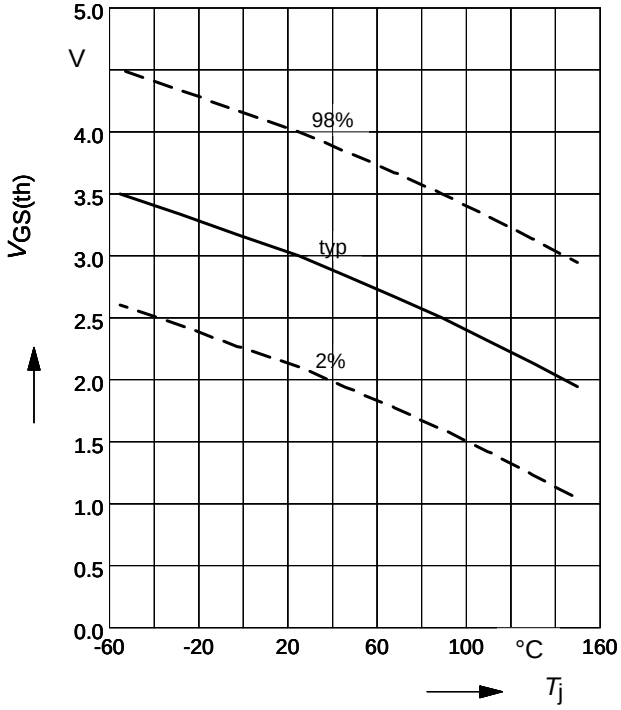
parameter : $I_D$ = -2 A , $V_{GS}$ = -10 V




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

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

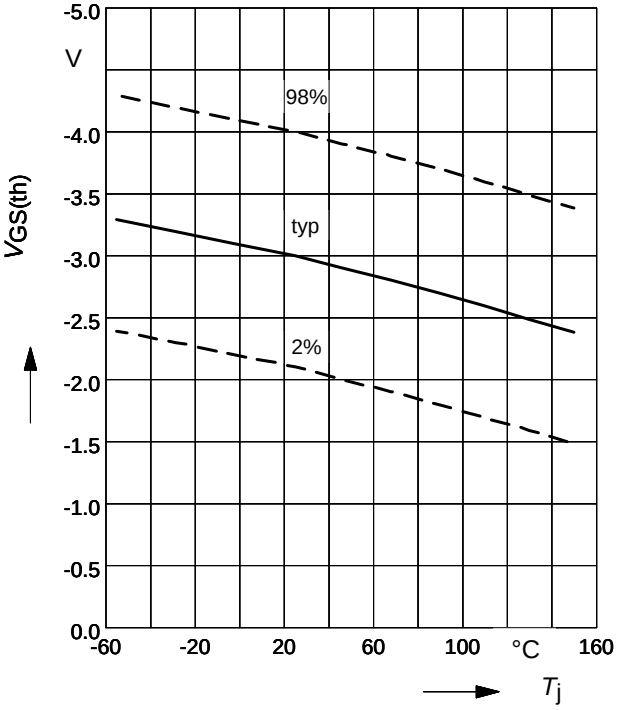
parameter: $V_{GS} = V_{DS}$, $I_D$ = 20 µA




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

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

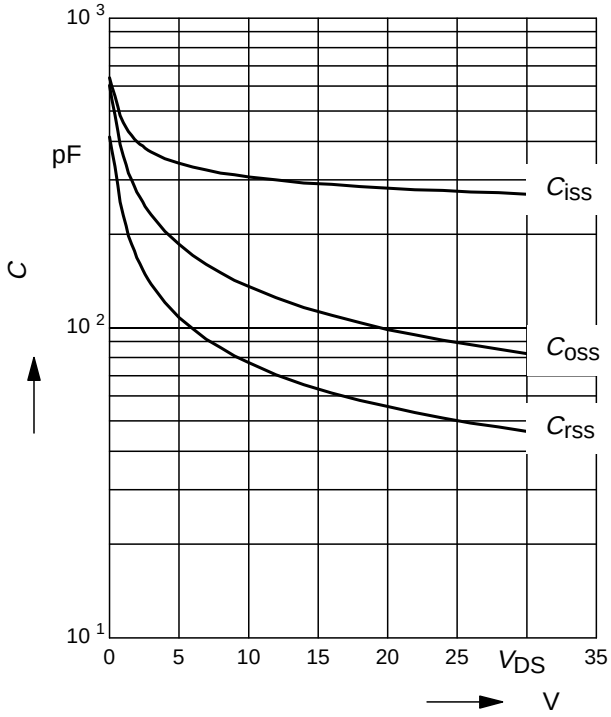
parameter: $V_{GS} = V_{DS}$, $I_D$ = -450 µA



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

$C = f(V_{DS})$

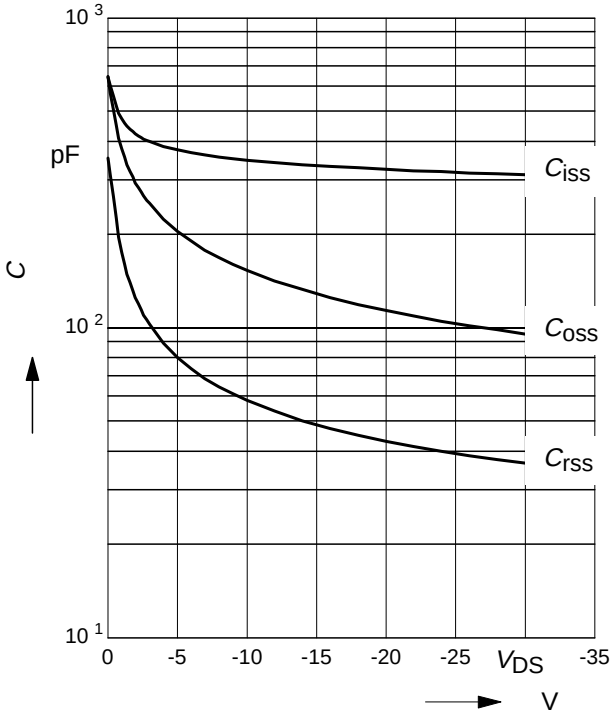
parameter: $V_{GS}$=0 V, $f$=1 MHz




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

$C = f(V_{DS})$

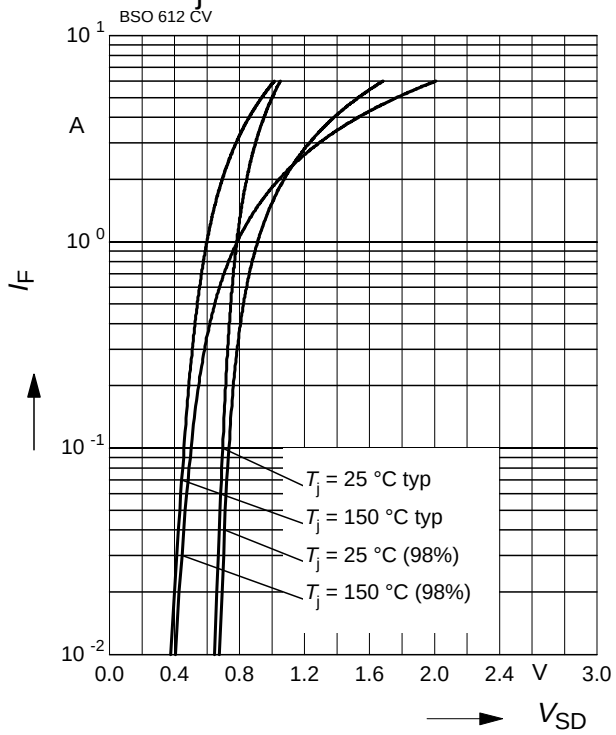
parameter: $V_{GS}$=0 V, $f$=1 MHz




**Forward characteristics of reverse diode**

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

parameter: $T_j$ , tp = 80 µs

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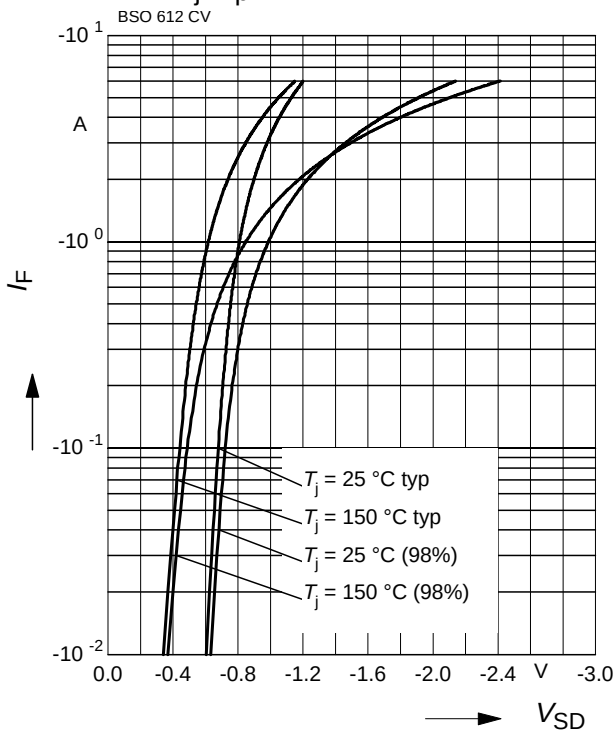
$I_F = f(V_{SD})$, (P-Ch.)

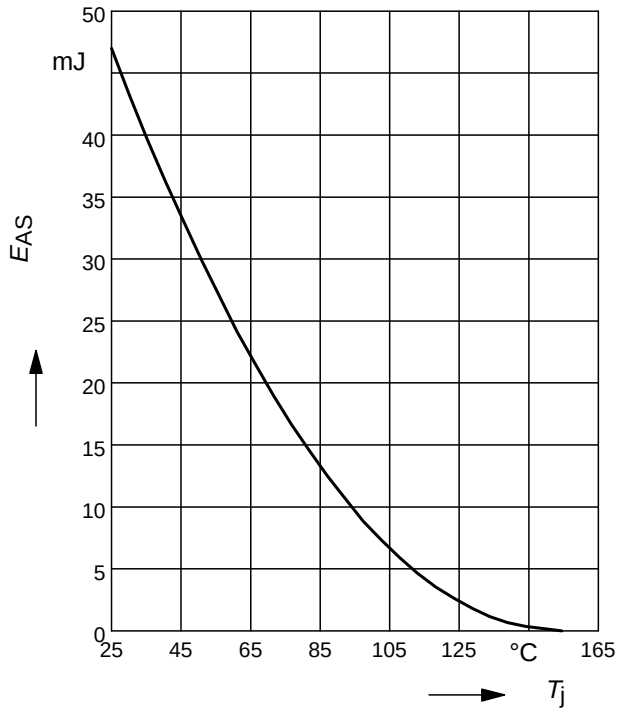
parameter: $T_j$ , $t_p$ = 80 µs



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

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

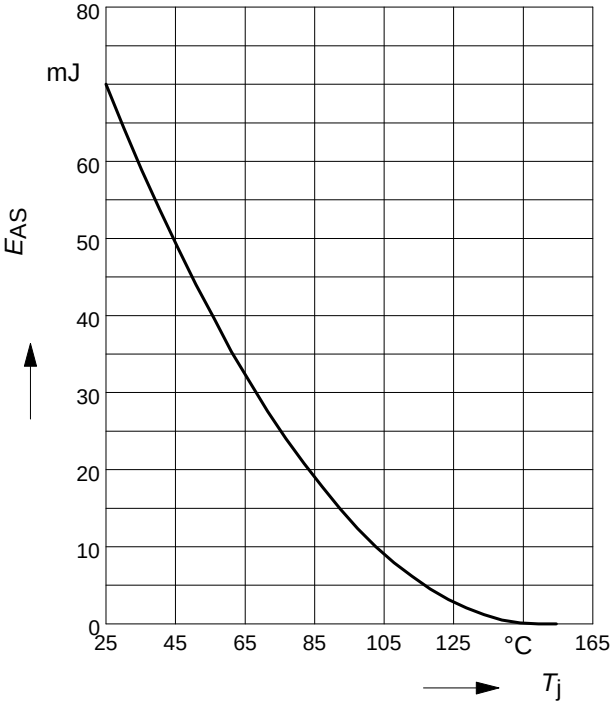
$R_{GS}$ = 25 Ω




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

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

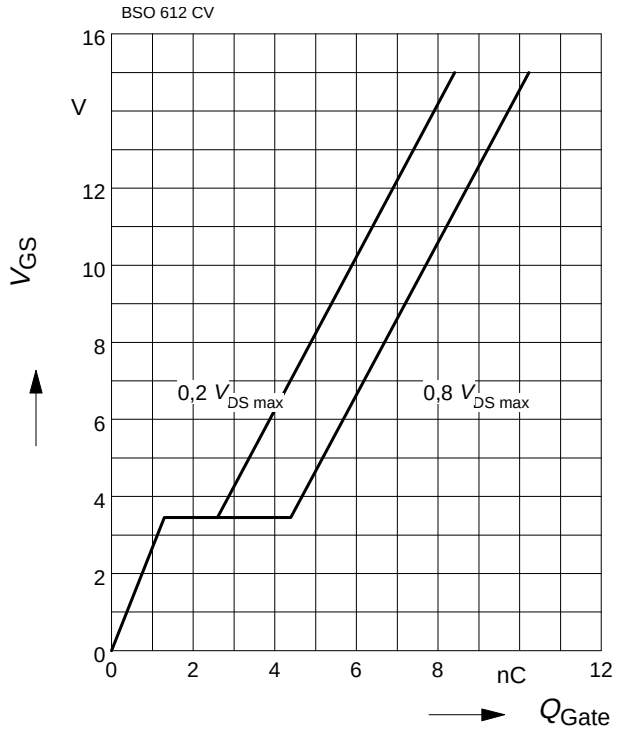
$R_{GS}$ = 25 Ω




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

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

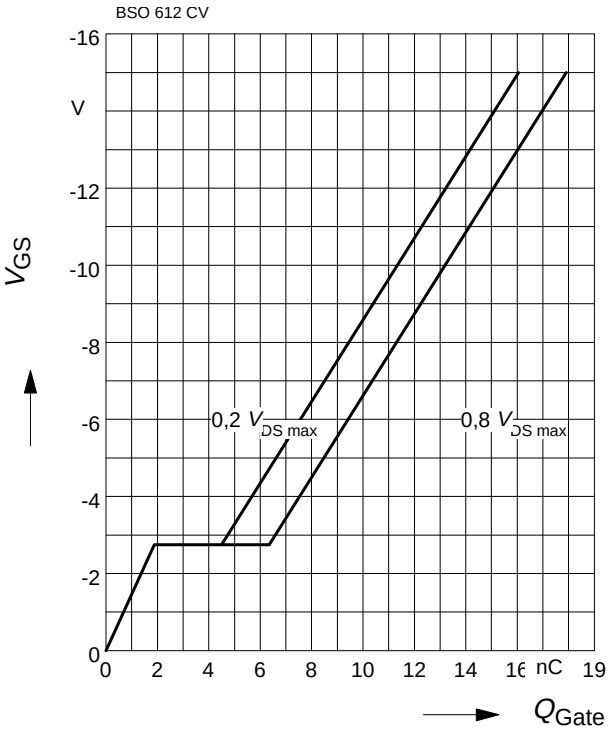
parameter: $I_D$ = 3 A




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

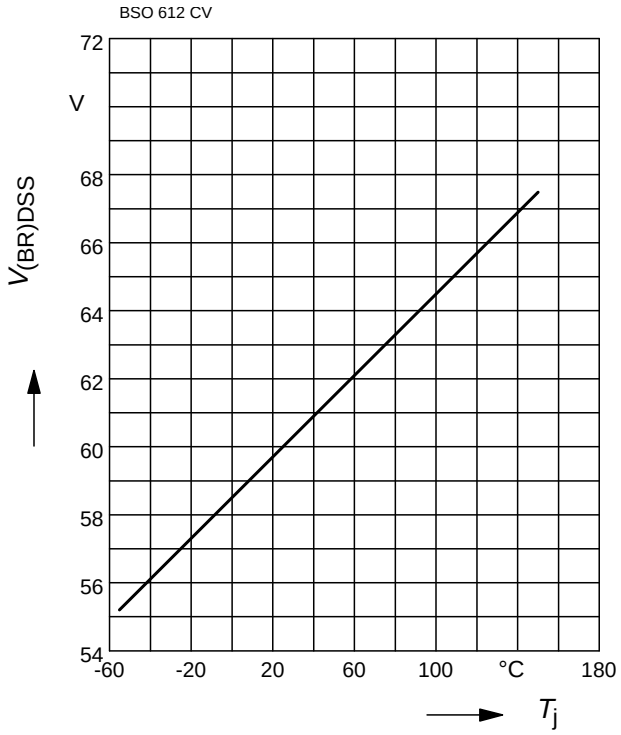
$V_{GS}$ = f ($Q_{Gate}$)

parameter: $I_D$ = -2 A



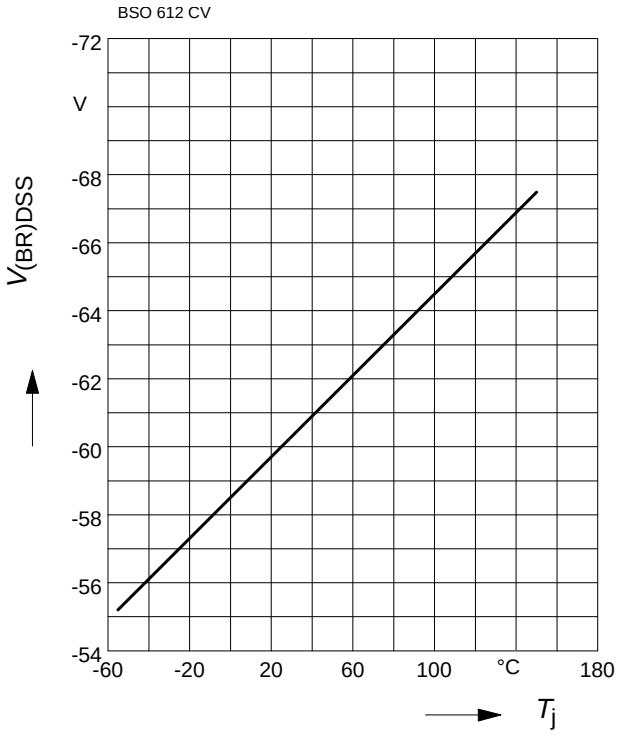
**Drain-source breakdown voltage**

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




**Drain-source breakdown voltage**

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



**Published by**
**Infineon Technologies AG**
**81726 München, Germany**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