

SIPMOS® Small-Signal-Transistor

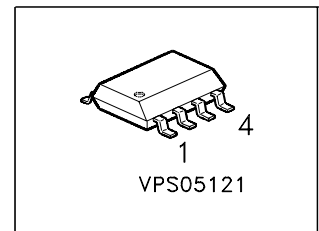
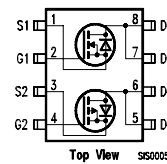
Features

- 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 $T_j = 25\text{ }^\circ\text{C}$, unless otherwise specified

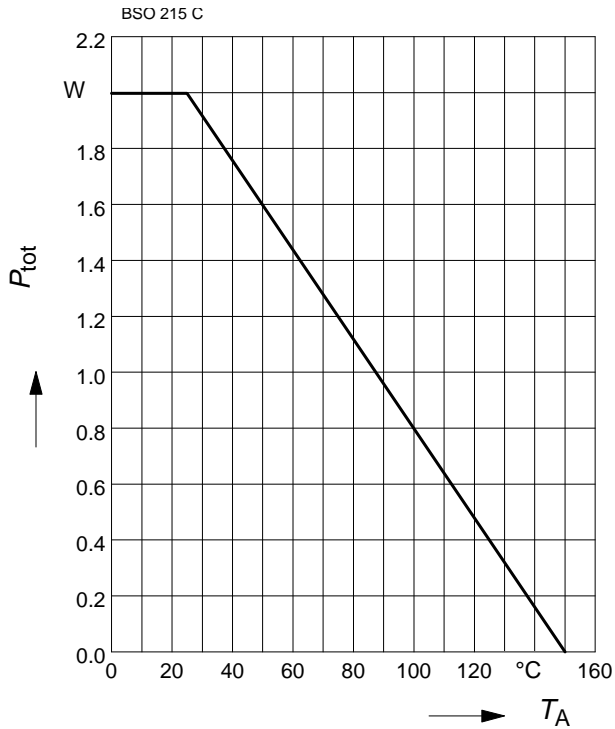
| Parameter | Symbol | Values | | | Unit | |
|---|--------|--------------|------|------|------|----|
| | | min. | typ. | max. | | |
| Characteristics | | | | | | |
| Transconductance | | g_{fs} | | | | S |
| $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 3\text{ A}$ | N | | 2.1 | 4.4 | - | |
| $V_{V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}}$, $I_D = -3\text{ A}$ | 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 $T_j = 25\text{ °C}$, 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 | $V_{(plateau)}$ | - - | 3.5 2.8 | - - | V |
| Reverse Diode | | | | | | |
| Inverse diode continuous forward current $T_A = 25\text{ °C}$ | N P | I_S | - - | - - | 3.7 -3.7 | A |
| Inverse diode direct current, pulsed $T_A = 25\text{ °C}$ | 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 |

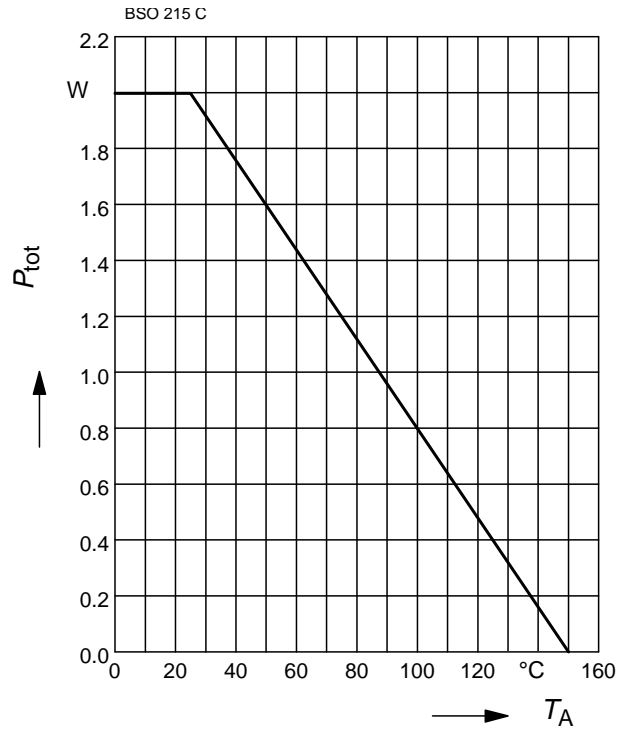
Power Dissipation (N-Ch.)

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



Power Dissipation (P-Ch.)

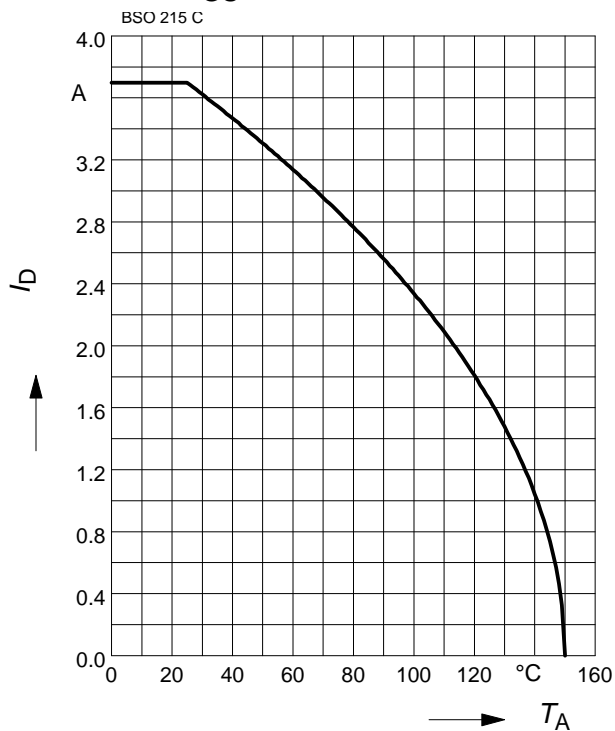
$$P_{\text{tot}} = f(T_A)$$



Drain current (N-Ch.)

$$I_D = f(T_A)$$

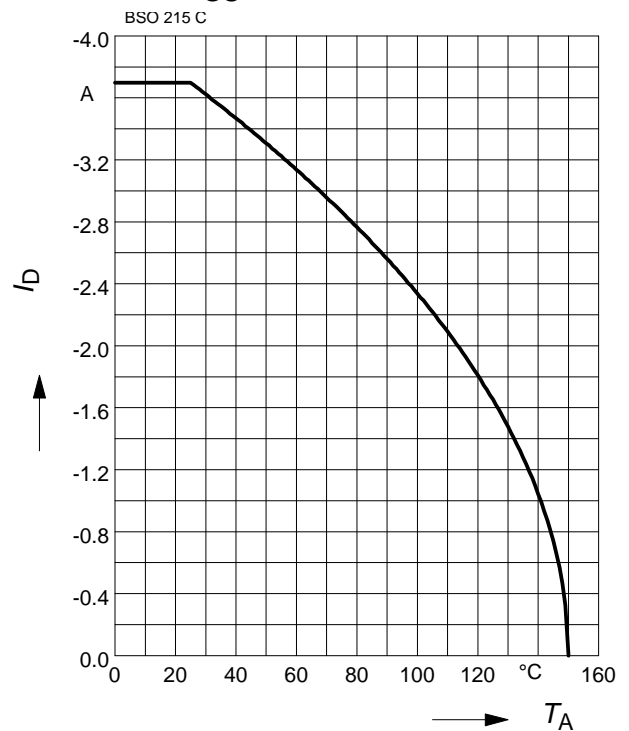
parameter: $V_{GS} \geq 10 \text{ V}$



Drain current (P-Ch.)

$$I_D = f(T_A)$$

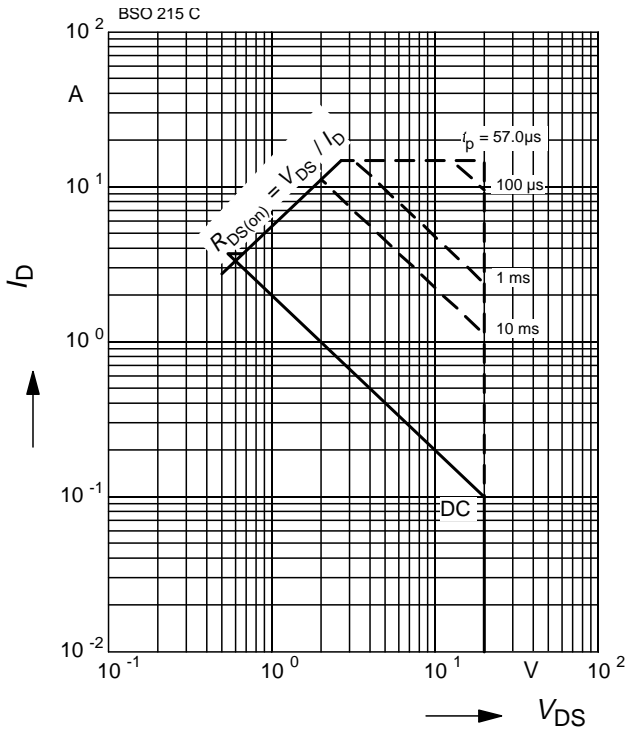
parameter: $V_{GS} \geq -10 \text{ V}$



Safe operating area (N-Ch.)

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

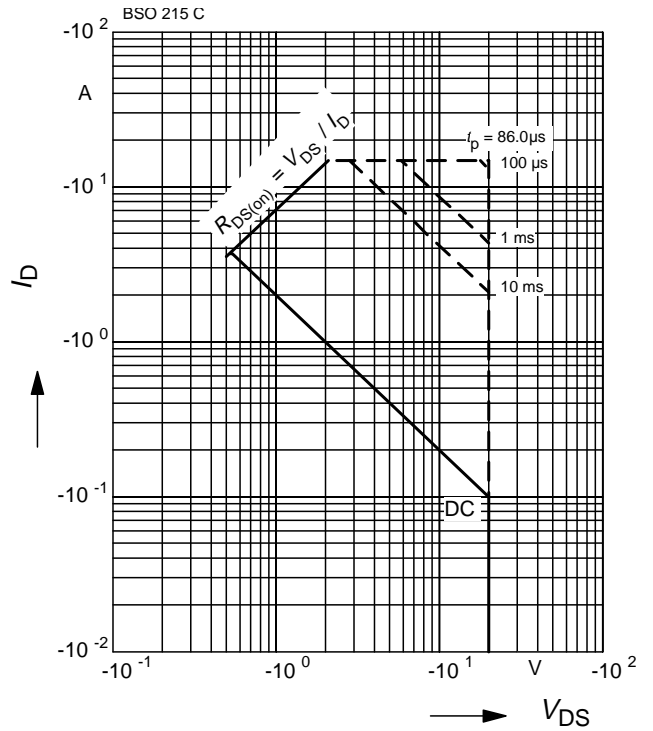
parameter : $D = 0$, $T_A = 25\text{ }^\circ\text{C}$



Safe operating area (P-Ch.)

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

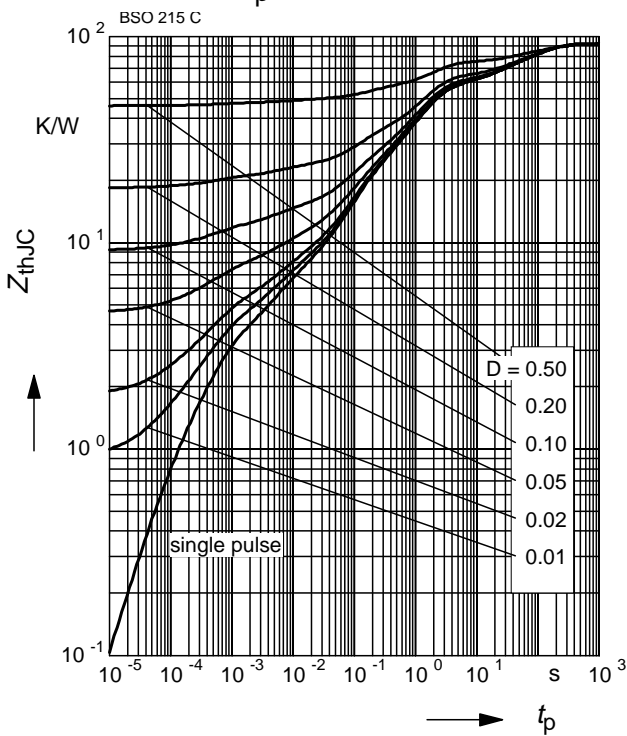
parameter : $D = 0$, $T_A = 25\text{ }^\circ\text{C}$



Transient thermal impedance (N-Ch.)

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

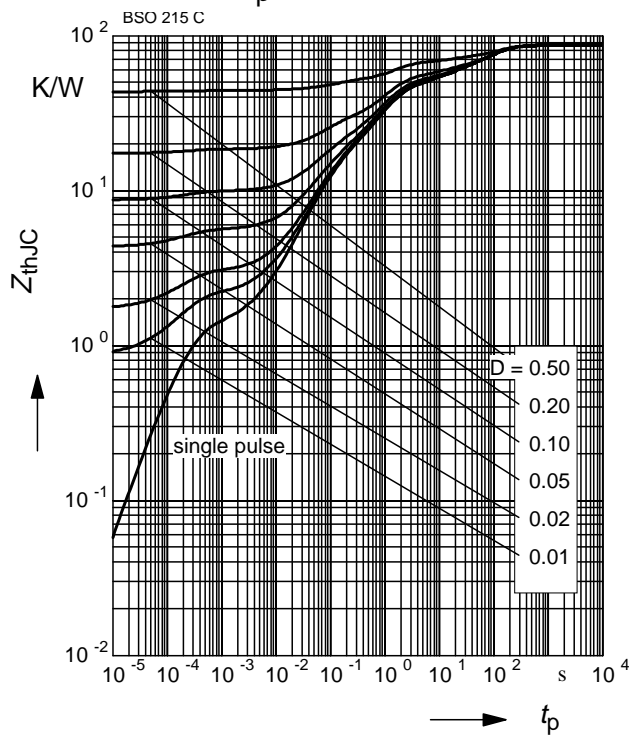
parameter : $D = t_p/T$



Transient thermal impedance (P-Ch.)

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

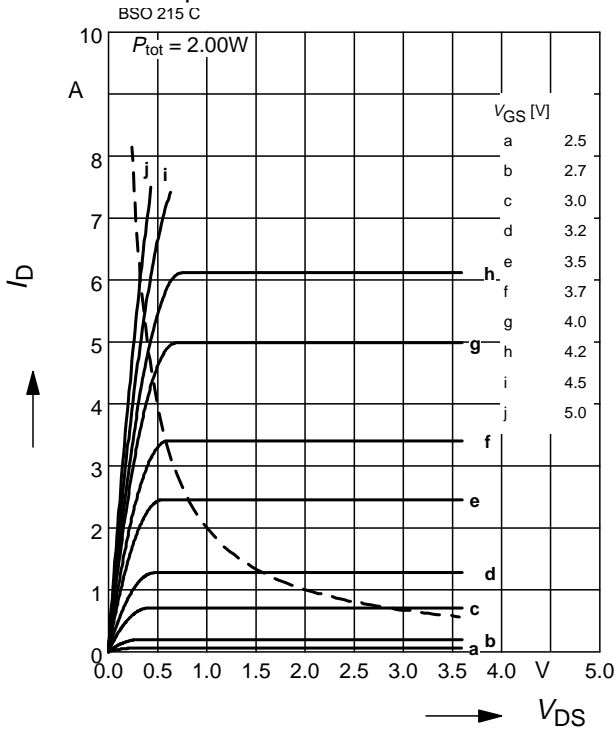
parameter : $D = t_p/T$



Typ. output characteristics (N-Ch.)

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

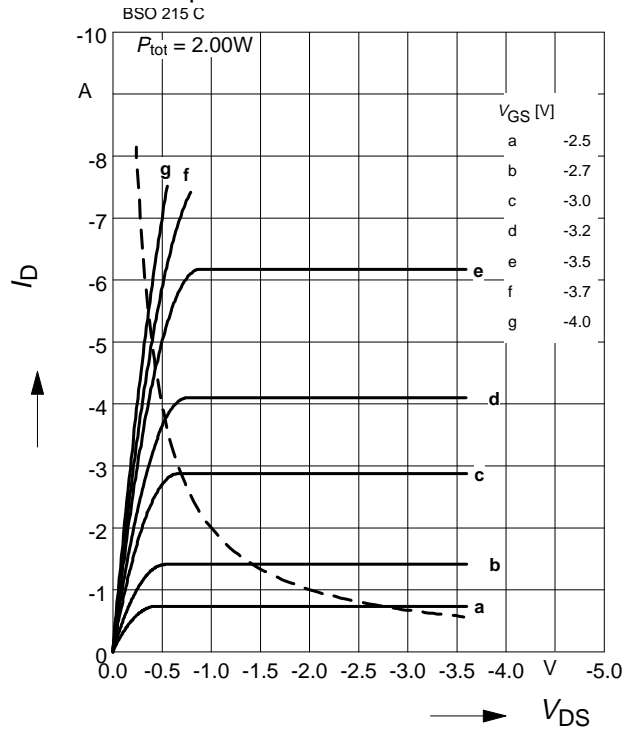
parameter: $t_p = 80 \mu s$



Typ. output characteristics (P-Ch.)

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

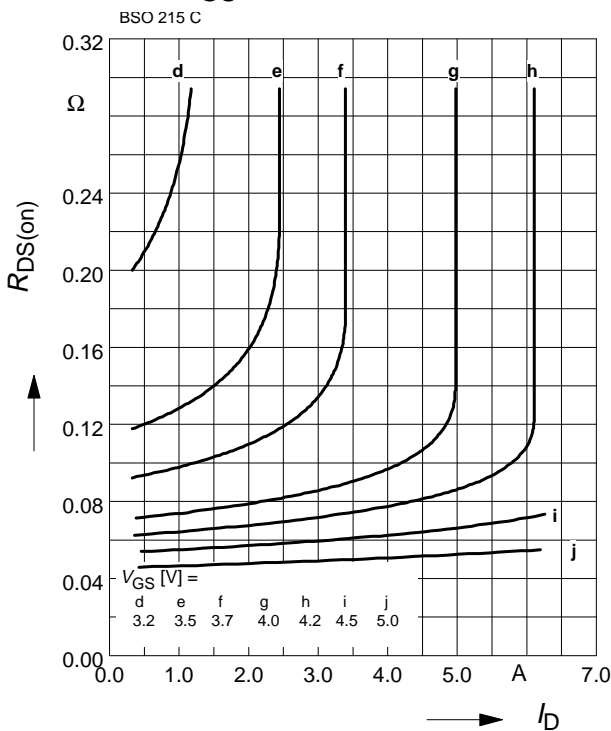
parameter: $t_p = 80 \mu s$



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

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

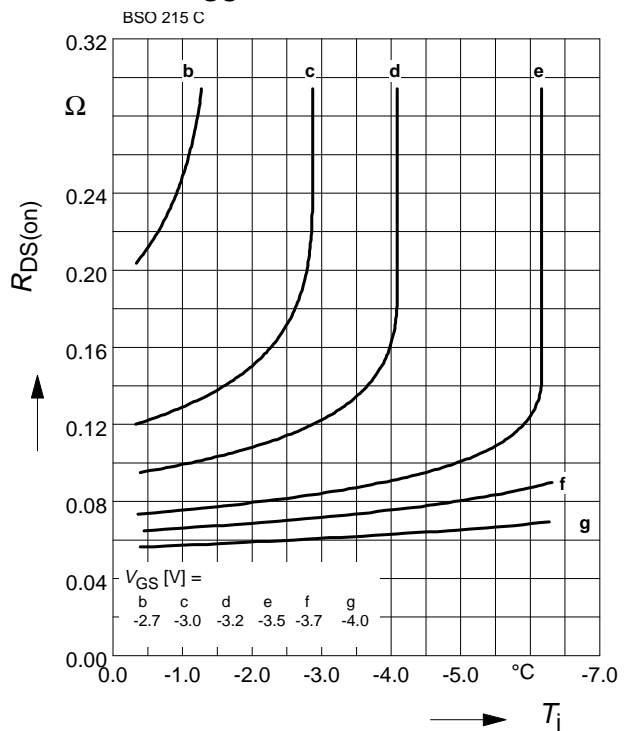
parameter: V_{GS}



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

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

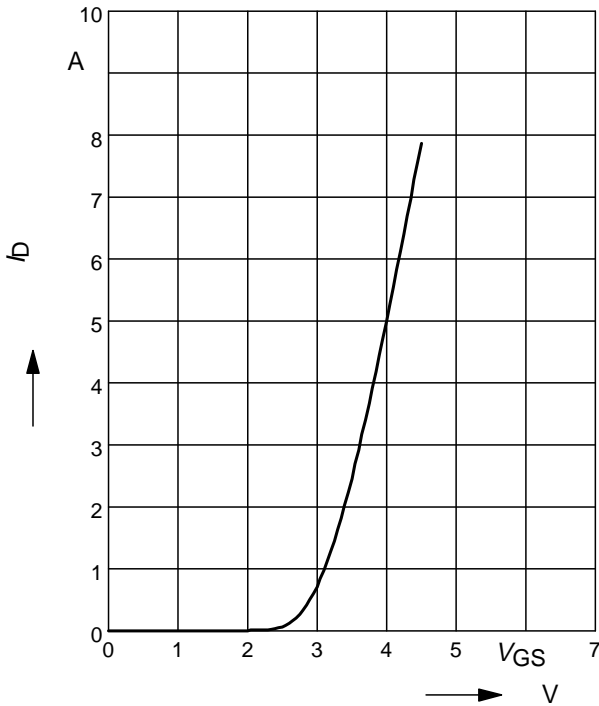
parameter: V_{GS}



Typ. transfer characteristics (N-Ch.)

parameter: $t_p = 80 \mu s$

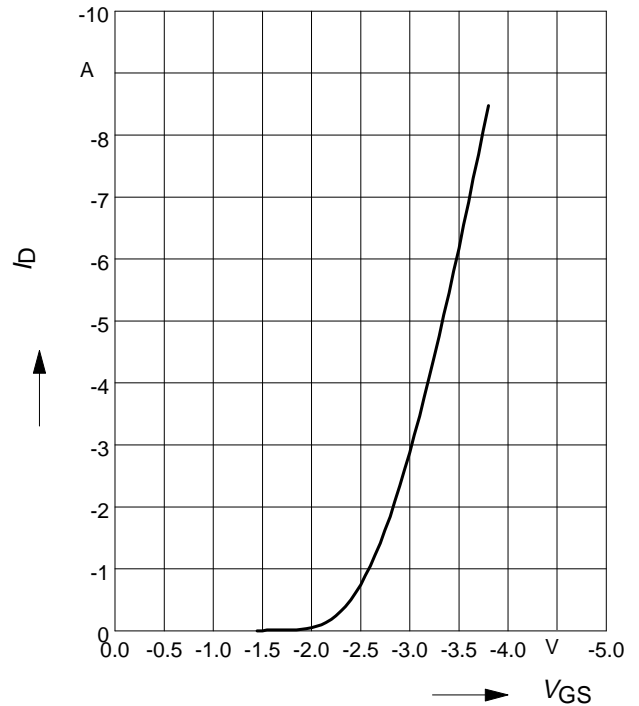
$$I_D = f(V_{GS}), V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$



Typ. transfer characteristics (P-Ch.)

parameter: $t_p = 80 \mu s$

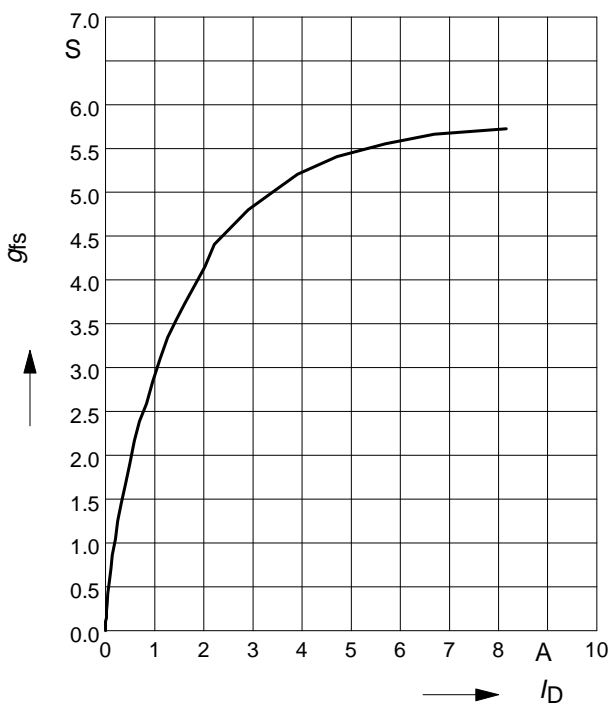
$$I_D = f(V_{GS}), V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$



Typ. forward transconductance (N-Ch.)

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

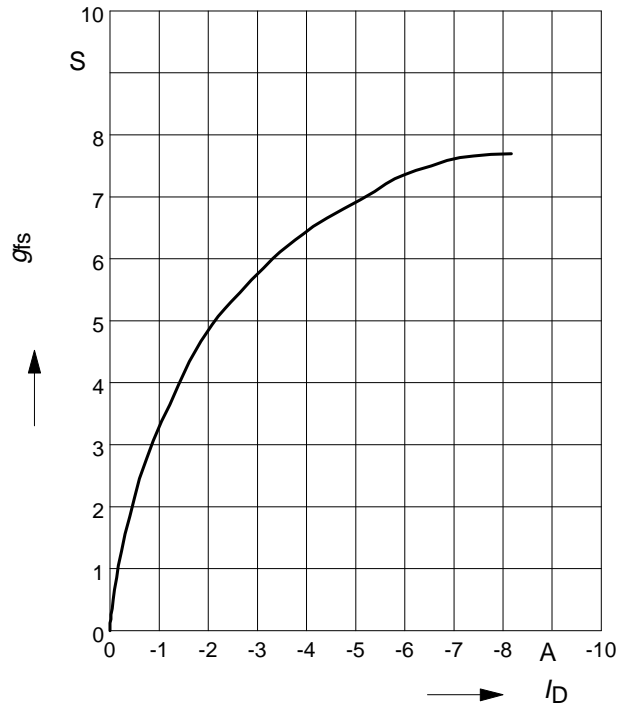
parameter: g_{fs}



Typ. forward transconductance (P-Ch.)

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

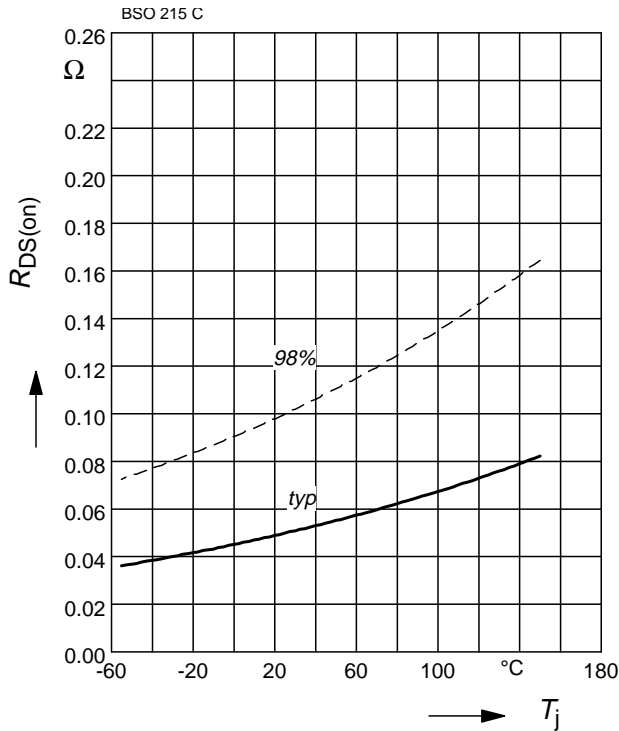
parameter: g_{fs}



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

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

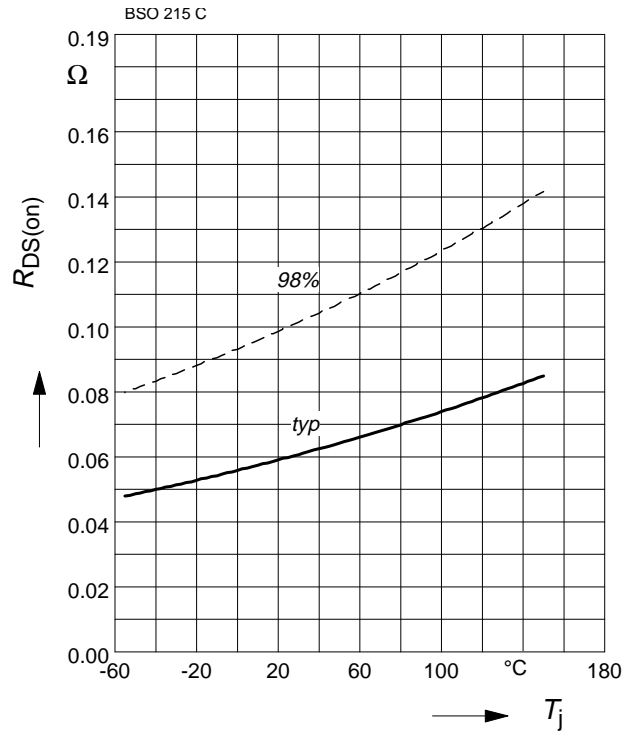
parameter : $I_D = 3.7 \text{ A}$, $V_{GS} = 10 \text{ V}$



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

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

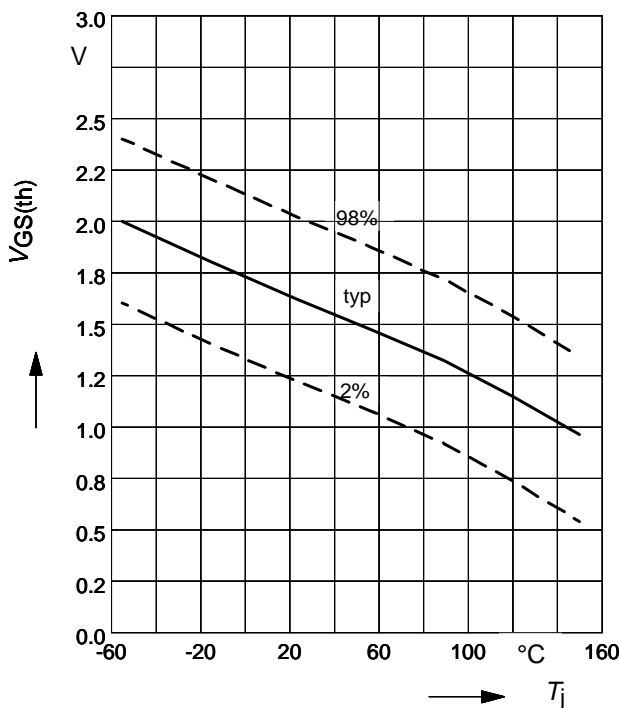
parameter : $I_D = -3.7 \text{ A}$, $V_{GS} = -10 \text{ V}$



Gate threshold voltage (N-Ch.)

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

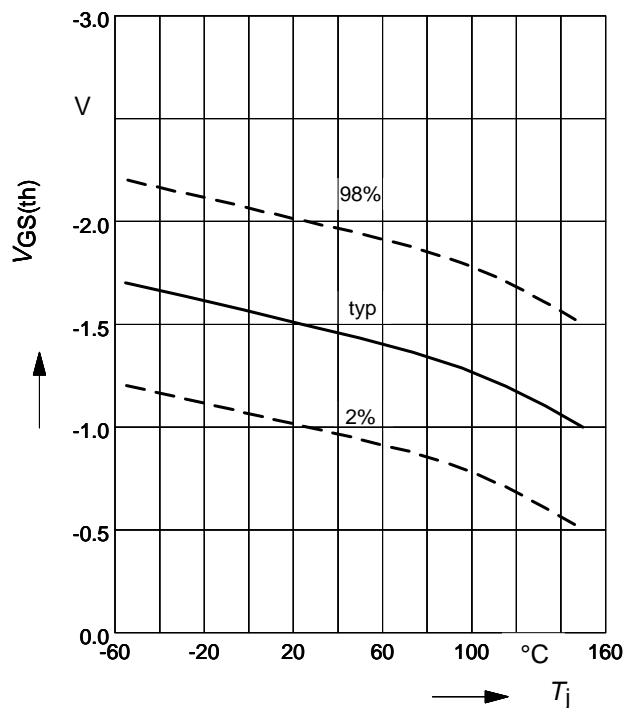
parameter: $V_{GS} = V_{DS}$, $I_D = 10 \mu\text{A}$



Gate threshold voltage (P-Ch.)

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

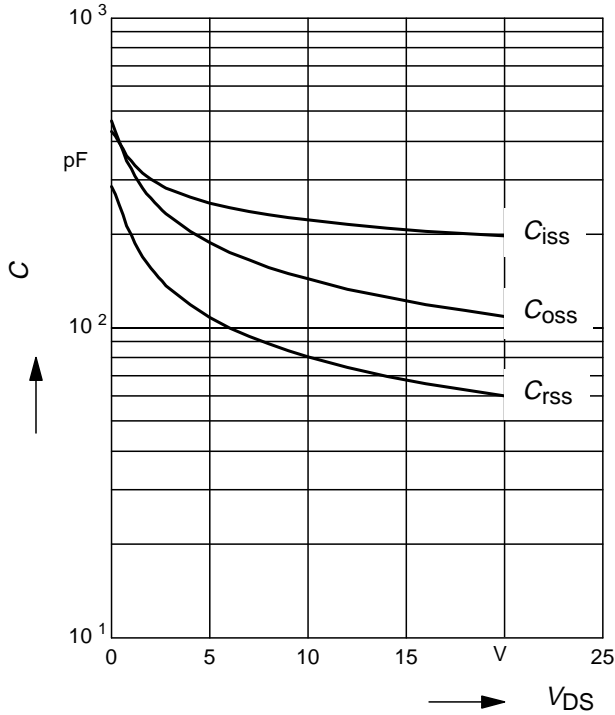
parameter: $V_{GS} = V_{DS}$, $I_D = -450 \mu\text{A}$



Typ. capacitances (N-Ch.)

$C = f(V_{DS})$

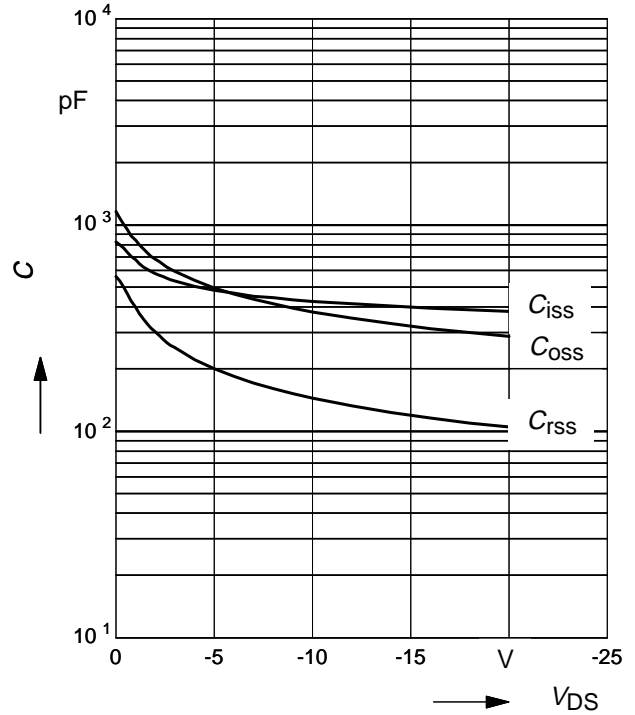
parameter: $V_{GS}=0\text{ V}$, $f=1\text{ MHz}$



Typ. capacitances (P-Ch.)

$C = f(V_{DS})$

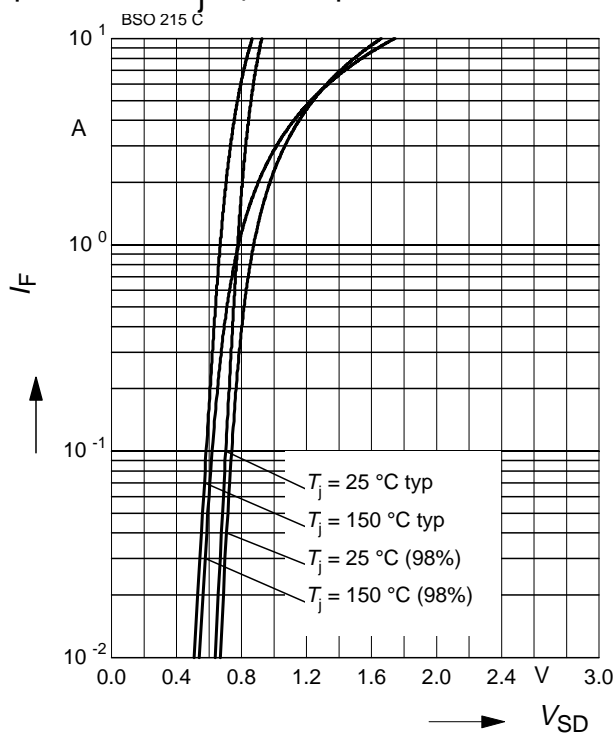
parameter: $V_{GS}=0\text{ V}$, $f=1\text{ MHz}$



Forward characteristics of reverse diode

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

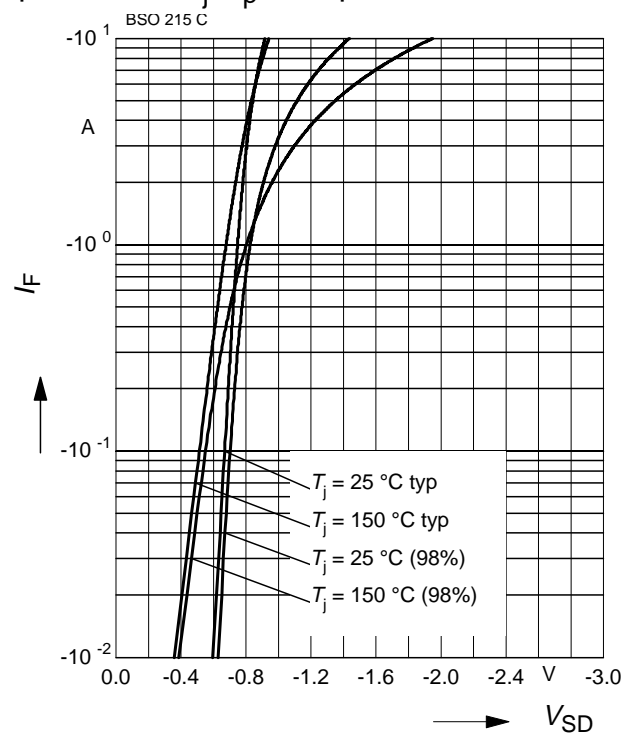
parameter: T_j , $t_p = 80\ \mu\text{s}$



Forward characteristics of reverse diode

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

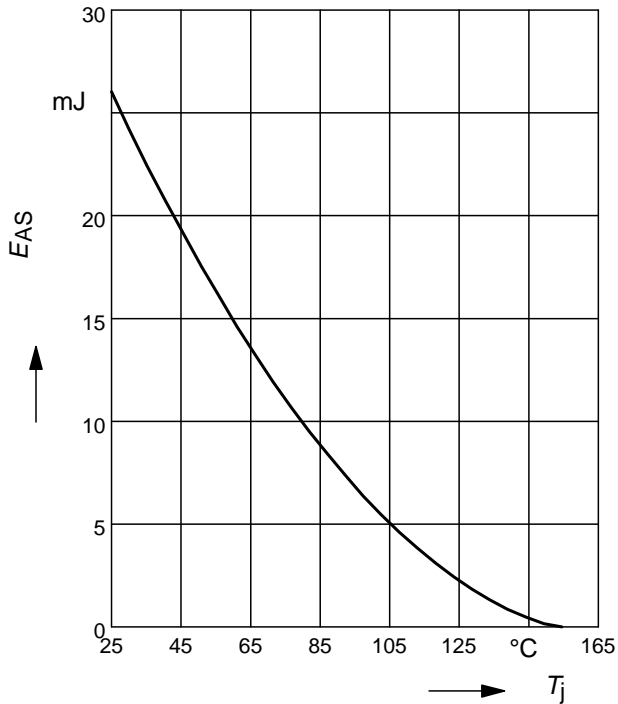
parameter: T_j , $t_p = 80\ \mu\text{s}$



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

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

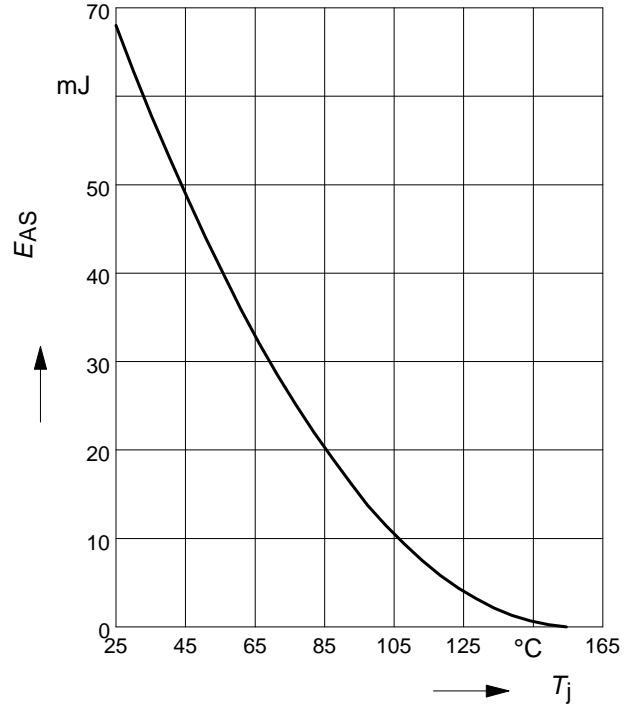
$R_{GS} = 25 \Omega$



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

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

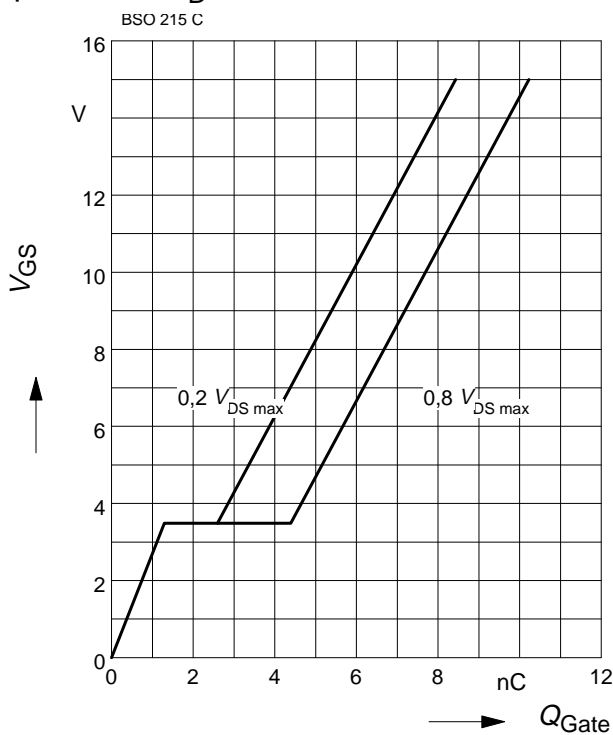
$R_{GS} = 25 \Omega$



Typ. gate charge (N-Ch.)

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

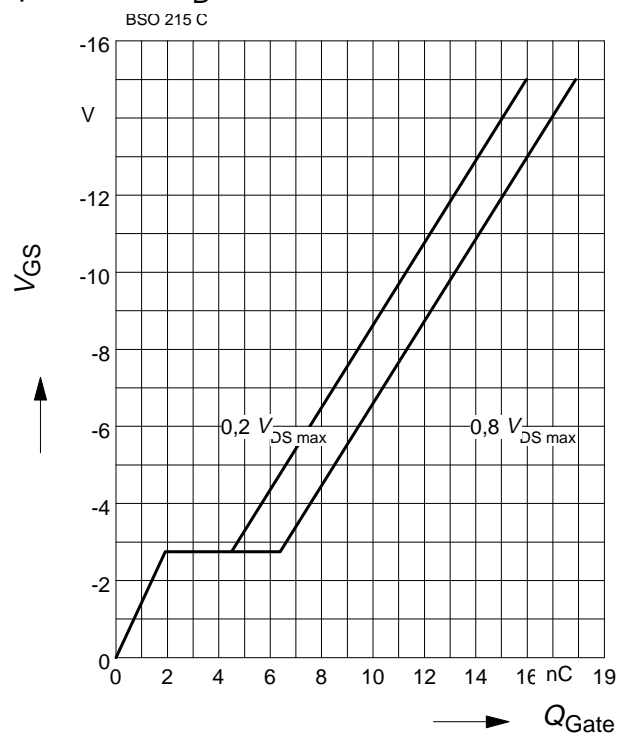
parameter: $I_D = 3.7 \text{ A}$



Typ. gate charge (P-Ch.)

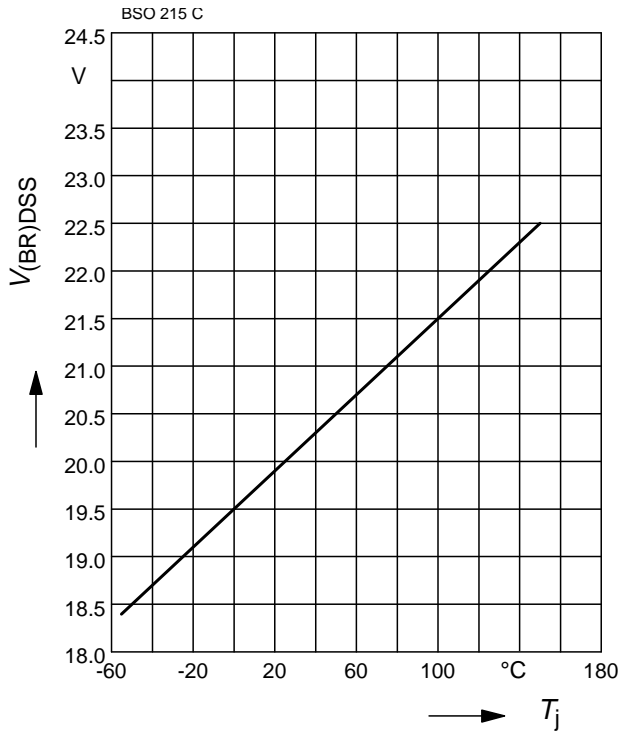
$V_{GS} = f(Q_{Gate})$

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



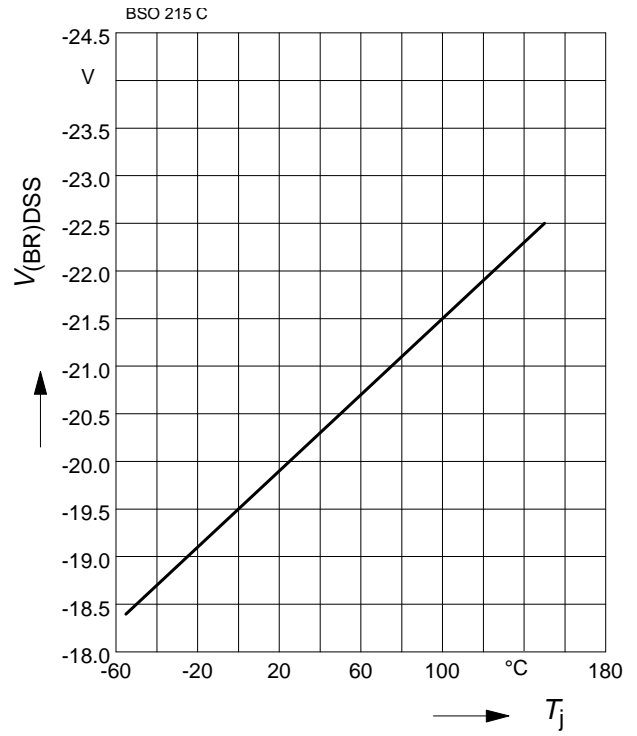
Drain-source breakdown voltage

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



Drain-source breakdown voltage

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



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