

## SIPMOS® Small-Signal-Transistor

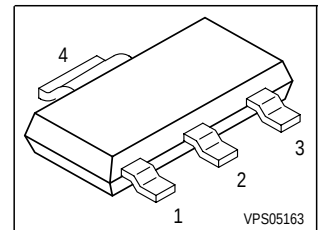
### Features

- P-Channel
- Enhancement mode
- Avalanche rated
- Logic Level
- dv/dt rated
- Pb-free lead plating; RoHS compliant
- Qualified according to AEC Q101
- Halogen-free according to IEC61249-2-21

### Product Summary

|                                  |              |       |          |
|----------------------------------|--------------|-------|----------|
| Drain source voltage             | $V_{DS}$     | -60   | V        |
| Drain-Source on-state resistance | $R_{DS(on)}$ | 0.8   | $\Omega$ |
| Continuous drain current         | $I_D$        | -1.17 | A        |

| Pin 1 | Pin2/4 | PIN 3 |
|-------|--------|-------|
| G     | D      | S     |



Halogen-Free



| Type    | Package   | Tape and Reel Information | Marking | Packaging |
|---------|-----------|---------------------------|---------|-----------|
| BSP315P | PG-SOT223 | H6327: 1000 pcs/reel      | BSP315P | Non dry   |

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

| Parameter                                                                                                                                    | Symbol             | Value          | Unit               |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------|--------------------|
| Continuous drain current<br>$T_A = 25\text{ °C}$<br>$T_A = 70\text{ °C}$                                                                     | $I_D$              | -1.17<br>-0.94 | A                  |
| Pulsed drain current<br>$T_A = 25\text{ °C}$                                                                                                 | $I_D \text{ puls}$ | -4.68          |                    |
| Avalanche energy, single pulse<br>$I_D = -1.17\text{ A}$ , $V_{DD} = -25\text{ V}$ , $R_{GS} = 25\text{ }\Omega$                             | $E_{AS}$           | 24             | mJ                 |
| Avalanche energy, periodic limited by $T_{jmax}$                                                                                             | $E_{AR}$           | 0.18           |                    |
| Reverse diode dv/dt<br>$I_S = -1.17\text{ A}$ , $V_{DS} = -48\text{ V}$ , $dI/dt = 200\text{ A}/\mu\text{s}$ ,<br>$T_{jmax} = 150\text{ °C}$ | dv/dt              | 6              | kV/ $\mu\text{s}$  |
| Gate source voltage                                                                                                                          | $V_{GS}$           | $\pm 20$       | V                  |
| Power dissipation<br>$T_A = 25\text{ °C}$                                                                                                    | $P_{tot}$          | 1.8            | W                  |
| Operating and storage temperature                                                                                                            | $T_j$ , $T_{stg}$  | -55...+150     | $^{\circ}\text{C}$ |
| IEC climatic category; DIN IEC 68-1                                                                                                          |                    | 55/150/56      |                    |
| ESD Class; JESD22-A114-HBM                                                                                                                   |                    | Class 0        |                    |

**Thermal Characteristics**

| Parameter                                                 | Symbol     | Values |      |      | Unit |
|-----------------------------------------------------------|------------|--------|------|------|------|
|                                                           |            | min.   | typ. | max. |      |
| Characteristics                                           |            |        |      |      |      |
| Thermal resistance, junction - soldering point<br>(Pin 4) | $R_{thJS}$ | -      | -    | 25   | K/W  |
| SMD version, device on PCB:                               | $R_{thJA}$ |        |      |      | K/W  |
| @ min. footprint                                          |            | -      | -    | 115  |      |
| @ 6 cm <sup>2</sup> cooling area <sup>1)</sup>            |            | -      | -    | 70   |      |

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

| Parameter                                                                                                                                                                                                        | Symbol        | Values |             |            | Unit          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|-------------|------------|---------------|
|                                                                                                                                                                                                                  |               | min.   | typ.        | max.       |               |
| Static Characteristics                                                                                                                                                                                           |               |        |             |            |               |
| Drain- source breakdown voltage<br>$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$                                                                                                                       | $V_{(BR)DSS}$ | -60    | -           | -          | V             |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D = -160\text{ }\mu\text{A}$                                                                                                                                     | $V_{GS(th)}$  | -1     | -1.5        | -2         |               |
| Zero gate voltage drain current<br>$V_{DS} = -60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ }^{\circ}\text{C}$<br>$V_{DS} = -60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 125\text{ }^{\circ}\text{C}$ | $I_{DSS}$     | -<br>- | -0.1<br>-10 | -1<br>-100 | $\mu\text{A}$ |
| Gate-source leakage current<br>$V_{GS} = -20\text{ V}$ , $V_{DS} = 0\text{ V}$                                                                                                                                   | $I_{GSS}$     | -      | -10         | -100       | nA            |
| Drain-Source on-state resistance<br>$V_{GS} = -4.5\text{ V}$ , $I_D = -0.89\text{ A}$                                                                                                                            | $R_{DS(on)}$  | -      | 0.8         | 1.4        | $\Omega$      |
| Drain-Source on-state resistance<br>$V_{GS} = -10\text{ V}$ , $I_D = -1.17\text{ A}$                                                                                                                             | $R_{DS(on)}$  | -      | 0.5         | 0.8        | $\Omega$      |

<sup>1)</sup>Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  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. |      |
| Dynamic Characteristics                                                                            |              |        |      |      |      |
| Transconductance<br>$V_{DS} \leq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = -0.89$ A                | $g_{fs}$     | 0.7    | 1.4  | -    | S    |
| Input capacitance<br>$V_{GS} = 0$ V, $V_{DS} = -25$ V, $f = 1$ MHz                                 | $C_{iss}$    | -      | 130  | 160  | pF   |
| Output capacitance<br>$V_{GS} = 0$ V, $V_{DS} = -25$ V, $f = 1$ MHz                                | $C_{oss}$    | -      | 40   | 50   |      |
| Reverse transfer capacitance<br>$V_{GS} = 0$ V, $V_{DS} = -25$ V, $f = 1$ MHz                      | $C_{rss}$    | -      | 17   | 21   |      |
| Turn-on delay time<br>$V_{DD} = -30$ V, $V_{GS} = -4.5$ V, $I_D = -0.89$ A,<br>$R_G = 18\ \Omega$  | $t_{d(on)}$  | -      | 24   | 36   | ns   |
| Rise time<br>$V_{DD} = -30$ V, $V_{GS} = -4.5$ V, $I_D = -0.89$ A,<br>$R_G = 18\ \Omega$           | $t_r$        | -      | 9    | 14   |      |
| Turn-off delay time<br>$V_{DD} = -30$ V, $V_{GS} = -4.5$ V, $I_D = -0.89$ A,<br>$R_G = 18\ \Omega$ | $t_{d(off)}$ | -      | 32   | 48   |      |
| Fall time<br>$V_{DD} = -30$ V, $V_{GS} = -4.5$ V, $I_D = -0.89$ A,<br>$R_G = 18\ \Omega$           | $t_f$        | -      | 19   | 28   |      |

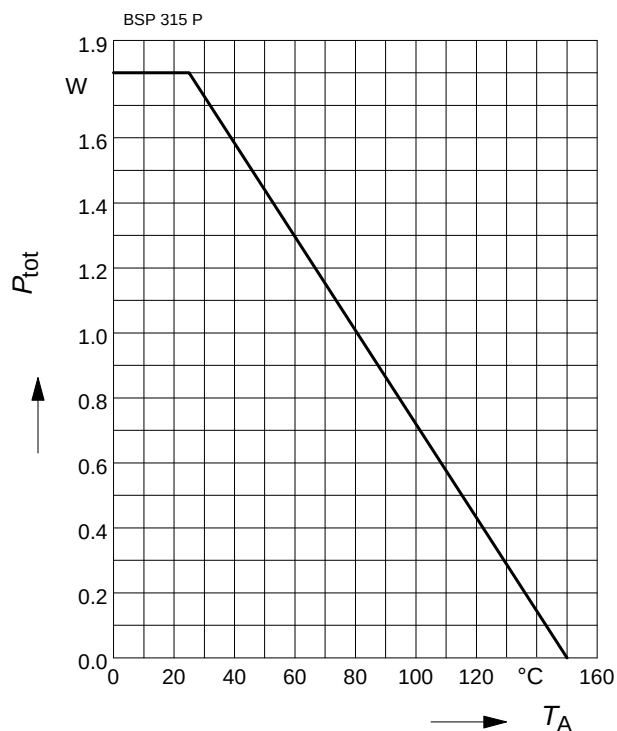
**Electrical Characteristics, at  $T_j = 25\text{ °C}$ , unless otherwise specified**

| Parameter                                                                                                   | Symbol          | Values |       |      | Unit |
|-------------------------------------------------------------------------------------------------------------|-----------------|--------|-------|------|------|
|                                                                                                             |                 | min.   | typ.  | max. |      |
| Dynamic Characteristics                                                                                     |                 |        |       |      |      |
| Gate to source charge<br>$V_{DD} = -48\text{ V}$ , $I_D = -1.17\text{ A}$                                   | $Q_{gs}$        | -      | 0.7   | 1.1  | nC   |
| Gate to drain charge<br>$V_{DD} = -48\text{ V}$ , $I_D = -1.17\text{ A}$                                    | $Q_{gd}$        | -      | 1.8   | 2.6  |      |
| Gate charge total<br>$V_{DD} = -48\text{ V}$ , $I_D = -1.17\text{ A}$ , $V_{GS} = 0\text{ to }-10\text{ V}$ | $Q_g$           | -      | 5.2   | 7.8  |      |
| Gate plateau voltage<br>$V_{DD} = -48\text{ V}$ , $I_D = -1.17\text{ A}$                                    | $V_{(plateau)}$ | -      | -3.14 | -    | V    |

| Parameter                                                                                            | Symbol   | Values |       |       | Unit          |
|------------------------------------------------------------------------------------------------------|----------|--------|-------|-------|---------------|
|                                                                                                      |          | min.   | typ.  | max.  |               |
| Reverse Diode                                                                                        |          |        |       |       |               |
| Inverse diode continuous forward current<br>$T_A = 25\text{ }^{\circ}\text{C}$                       | $I_S$    | -      | -     | -1.17 | A             |
| Inverse diode direct current,pulsed<br>$T_A = 25\text{ }^{\circ}\text{C}$                            | $I_{SM}$ | -      | -     | -4.68 |               |
| Inverse diode forward voltage<br>$V_{GS} = 0\text{ V}$ , $I_F = -1.17\text{ A}$                      | $V_{SD}$ | -      | -0.97 | -1.3  | V             |
| Reverse recovery time<br>$V_R = -30\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$   | $t_{rr}$ | -      | 30.5  | 46    | ns            |
| Reverse recovery charge<br>$V_R = -30\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ | $Q_{rr}$ | -      | 36    | 54    | $\mu\text{C}$ |

## Power Dissipation

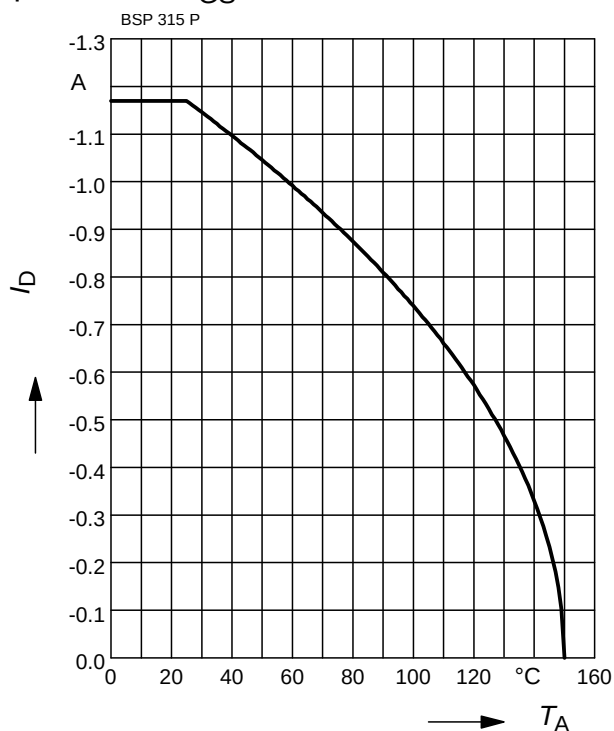
$$P_{\text{tot}} = f(T_A)$$



## Drain current

$$I_D = f(T_A)$$

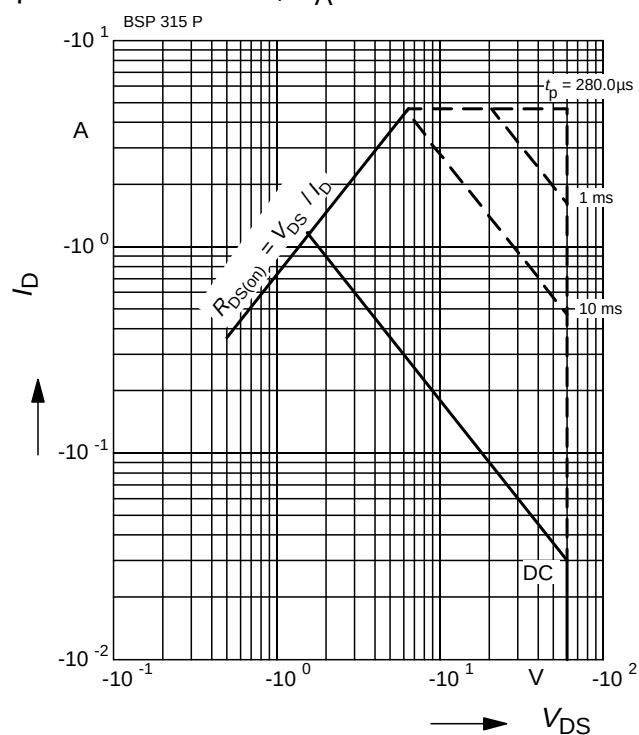
parameter :  $V_{GS} \geq -10\text{V}$



## Safe operating area

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

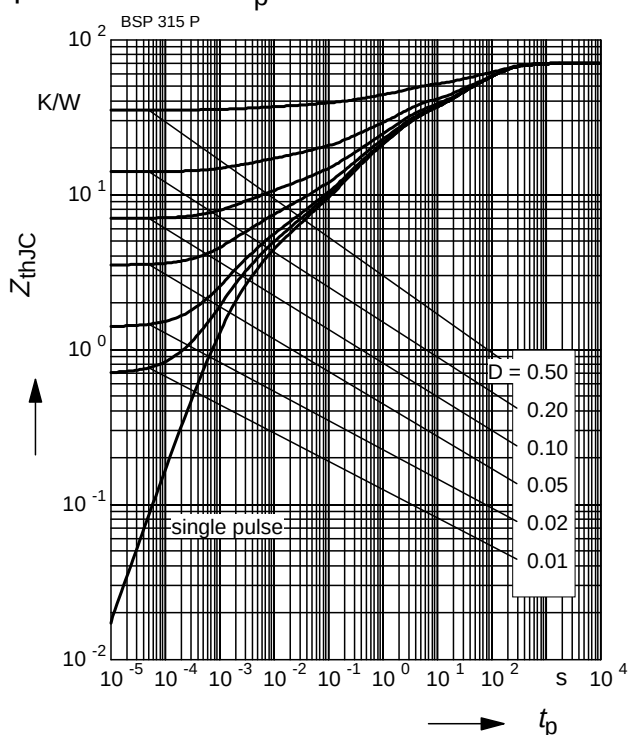
parameter :  $D = 0$ ,  $T_A = 25^{\circ}\text{C}$



## Transient thermal impedance

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

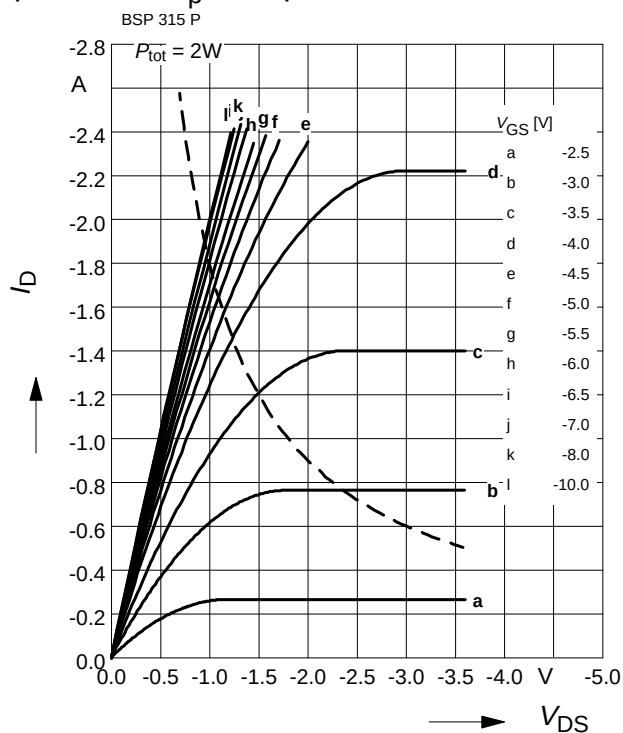
parameter :  $D = t_p / T$



**Typ. output characteristics**

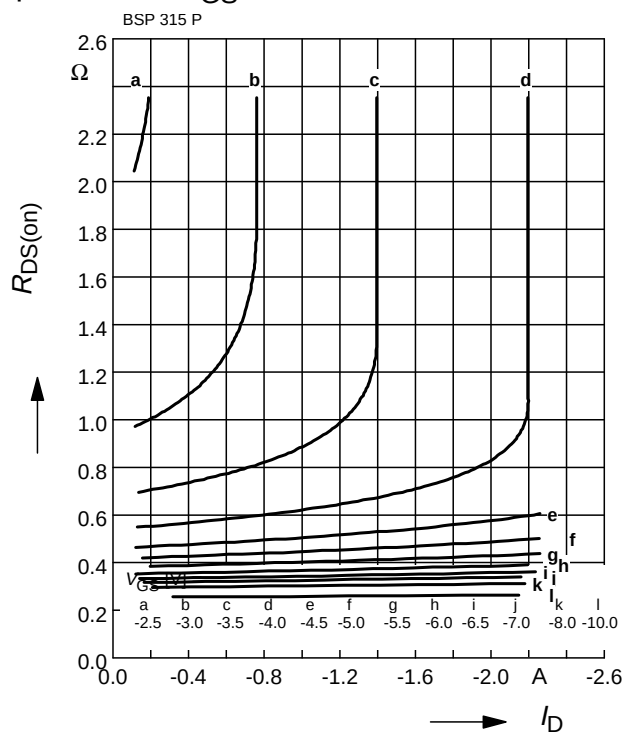
$$I_D = f(V_{DS})$$

parameter:  $t_p = 80 \mu s$


**Typ. drain-source-on-resistance**

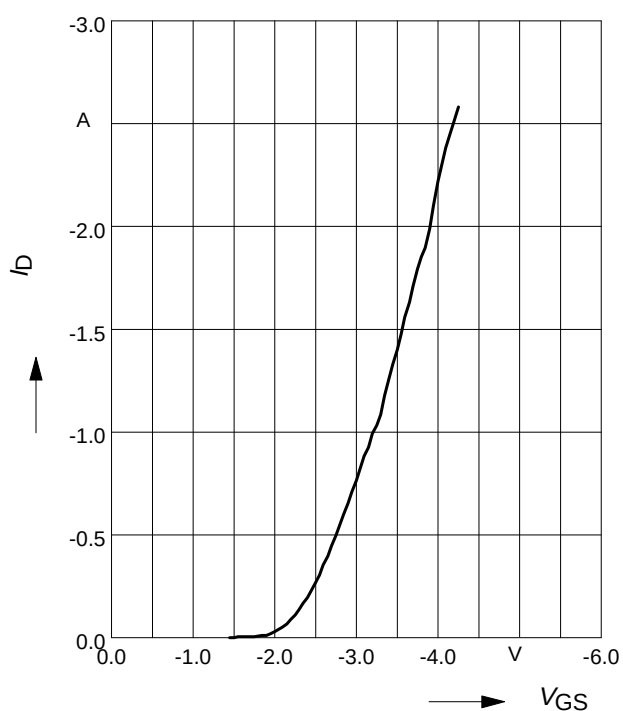
$$R_{DS(on)} = f(I_D)$$

parameter:  $V_{GS}$


**Typ. transfer characteristics  $I_D = f(V_{GS})$** 

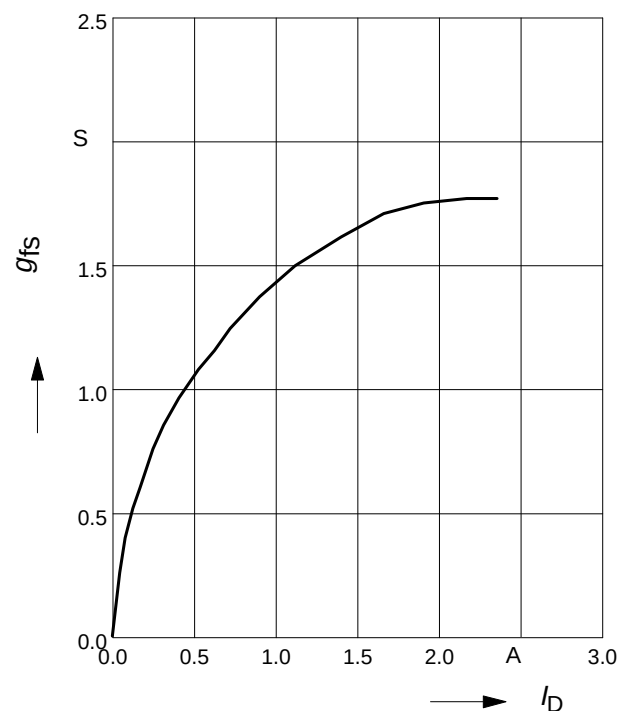
$$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$

parameter:  $t_p = 80 \mu s$


**Typ. forward transconductance**

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

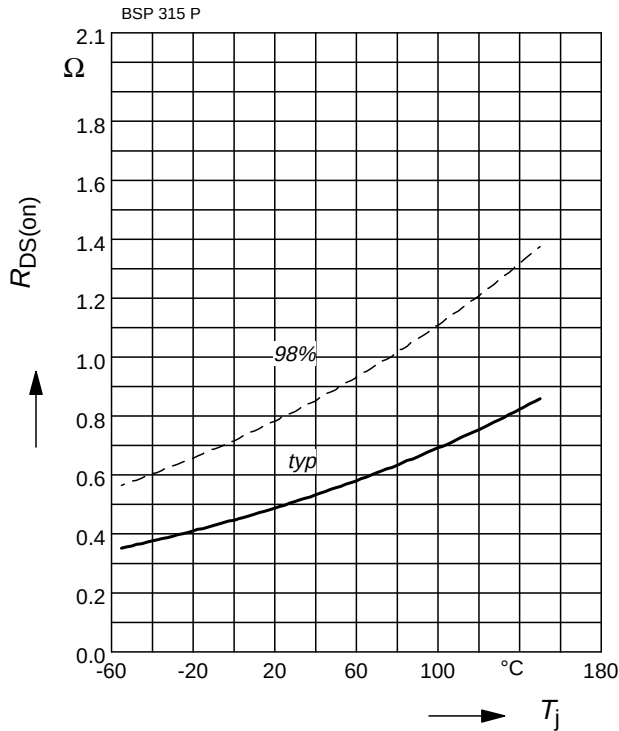
parameter:  $g_{fs}$



### Drain-source on-resistance

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

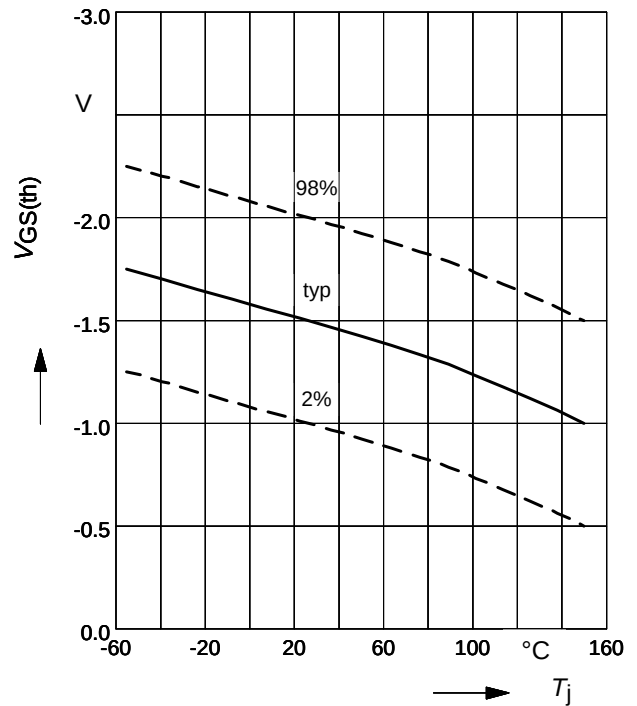
parameter:  $I_D = -1.17$  A,  $V_{GS} = -10$  V



### Gate threshold voltage

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

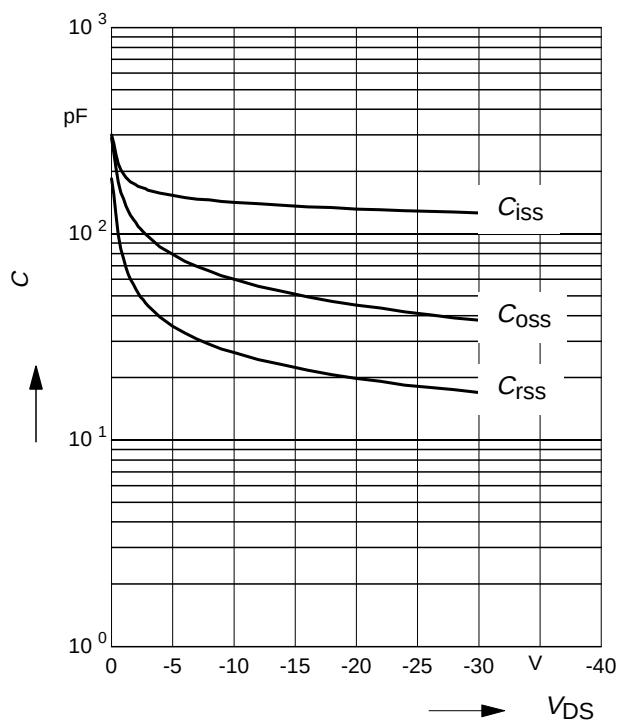
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = -160$   $\mu$ A



### Typ. capacitances

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

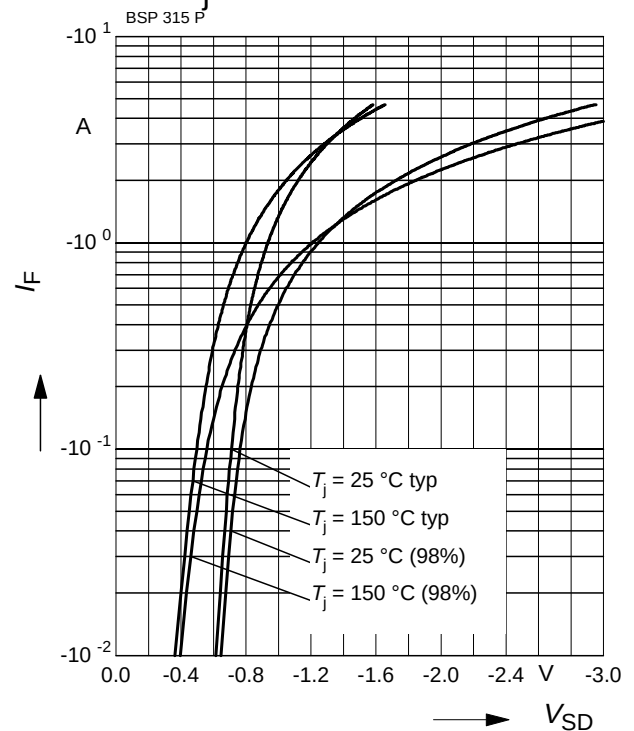
Parameter:  $V_{GS} = 0$  V,  $f = 1$  MHz



### Forward characteristics of reverse diode

$$I_F = f(V_{SD})$$

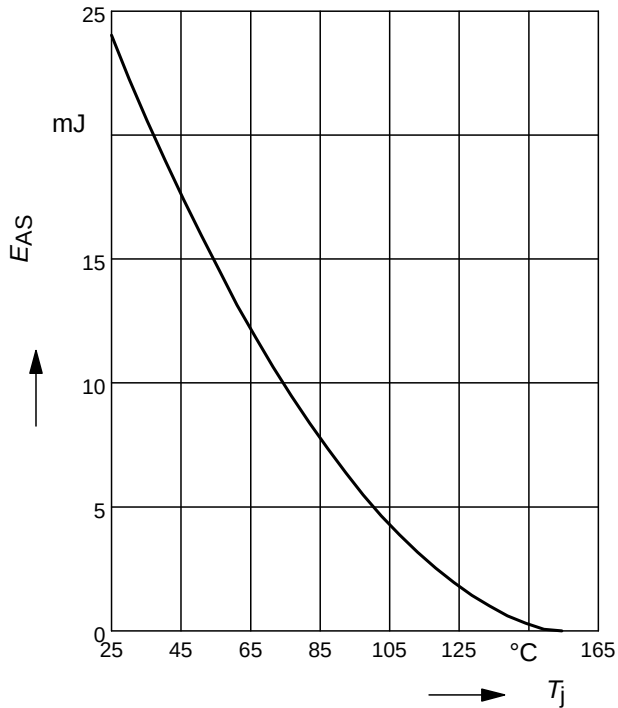
parameter:  $T_j$ ,  $t_p = 80$   $\mu$ s



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

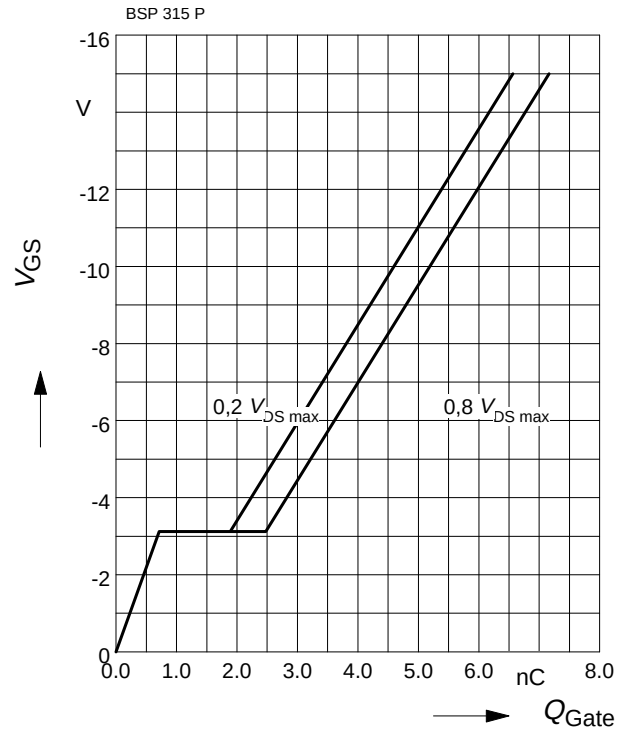
parameter:  $I_D = -1.17\text{ A}$  ,  $V_{DD} = -25\text{ V}$

$R_{GS} = 25\ \Omega$

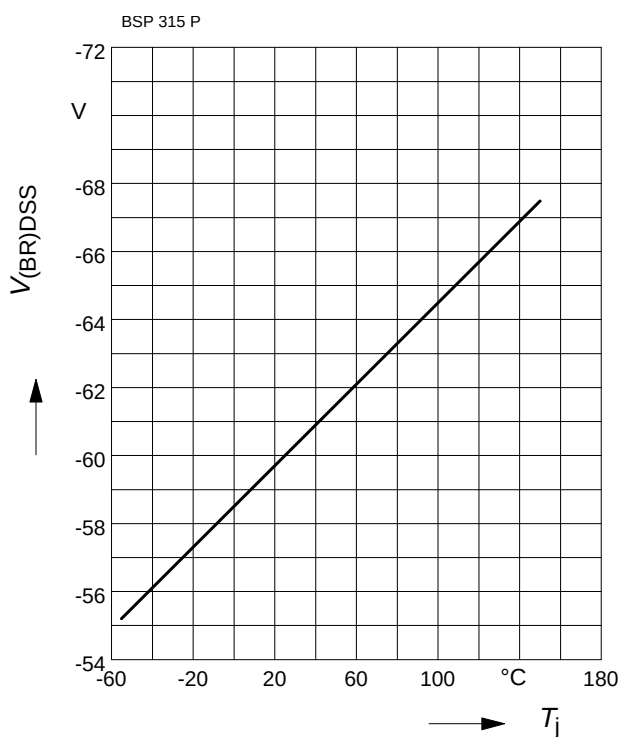

**Typ. gate charge**

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

parameter:  $I_D = -1.17\text{ A}$  pulsed


**Drain-source breakdown voltage**

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





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