

## Preliminary Data

### SIPMOS® Small-Signal-Transistor

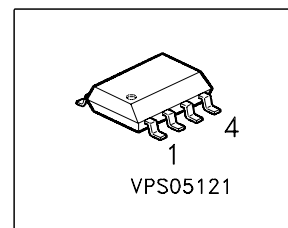
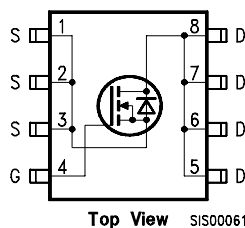
### BSO 302SN

#### Features

- Single N channel
- Enhancement mode
- Avalanche rated
- Logic Level
- $dv/dt$  rated

#### Product Summary

|                                  |              |       |          |
|----------------------------------|--------------|-------|----------|
| Drain source voltage             | $V_{DS}$     | 30    | V        |
| Drain-Source on-state resistance | $R_{DS(on)}$ | 0.013 | $\Omega$ |
| Continuous drain current         | $I_D$        | 9.8   | A        |



| Type      | Package | Ordering Code |
|-----------|---------|---------------|
| BSO 302SN | SO 8    | Q67041-S4029  |

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

| Parameter                                                                                                                                   | Symbol       | Value        | Unit              |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-------------------|
| Continuous drain current<br>$T_C = 25\text{ °C}$                                                                                            | $I_D$        | 9.8          | A                 |
| Pulsed drain current<br>$T_C = 25\text{ °C}$                                                                                                | $I_{Dpulse}$ | 39.2         |                   |
| Avalanche energy, single pulse<br>$I_D = 9.8\text{ A}$ , $V_{DD} = 25\text{ V}$ , $R_{GS} = 25\text{ }\Omega$                               | $E_{AS}$     | 250          | mJ                |
| Avalanche current, periodic limited by $T_{jmax}$                                                                                           | $I_{AR}$     | 9.8          | A                 |
| Avalanche energy, periodic limited by $T_{jmax}$                                                                                            | $E_{AR}$     | 0.2          | mJ                |
| Reverse diode $dv/dt$<br>$I_S = 9.8\text{ A}$ , $V_{DS} = 24\text{ V}$ , $di/dt = 200\text{ A}/\mu\text{s}$ ,<br>$T_{jmax} = 150\text{ °C}$ | $dv/dt$      | 6            | kV/ $\mu\text{s}$ |
| Gate source voltage                                                                                                                         | $V_{GS}$     | $\pm 20$     | V                 |
| Power dissipation<br>$T_C = 25\text{ °C}$                                                                                                   | $P_{tot}$    | 2            | W                 |
| Operating temperature                                                                                                                       | $T_j$        | -55 ... +150 | $\text{°C}$       |
| Storage temperature                                                                                                                         | $T_{stg}$    | -55 ... +150 |                   |
| IEC climatic category; DIN IEC 68-1                                                                                                         |              | 55/150/56    |                   |

## Thermal Characteristics

| Parameter                                                                     | Symbol       | Values |      |      | Unit |
|-------------------------------------------------------------------------------|--------------|--------|------|------|------|
|                                                                               |              | min.   | typ. | max. |      |
| Characteristics                                                               |              |        |      |      |      |
| Thermal resistance, junction - soldering point                                | $R_{thJS}$   | -      | -    | 25   | K/W  |
| Thermal resistance @ 10 sec., min. footprint                                  | $R_{th(JA)}$ | -      | -    | 75   |      |
| Thermal resistance @ 10 sec.,<br>6 cm <sup>2</sup> cooling area <sup>1)</sup> | $R_{th(JA)}$ | -      | -    | 62.5 |      |

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

| Parameter                                                                                                                                                                                                      | Symbol        | Values |                |                | Unit          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|----------------|----------------|---------------|
|                                                                                                                                                                                                                |               | min.   | typ.           | max.           |               |
| Static Characteristics                                                                                                                                                                                         |               |        |                |                |               |
| Drain- source breakdown voltage<br>$V_{GS} = 0\text{ V}$ , $I_D = 0.25\text{ mA}$                                                                                                                              | $V_{(BR)DSS}$ | 30     | -              | -              | V             |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D = 80\text{ }\mu\text{A}$                                                                                                                                     | $V_{GS(th)}$  | 1.2    | 1.6            | 2              |               |
| Zero gate voltage drain current<br>$V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ }^{\circ}\text{C}$<br>$V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ }^{\circ}\text{C}$ | $I_{DSS}$     | -<br>- | 0.1<br>-       | 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            |               |
| Drain-Source on-state resistance<br>$V_{GS} = 4.5\text{ V}$ , $I_D = 8.6\text{ A}$<br>$V_{GS} = 10\text{ V}$ , $I_D = 9.8\text{ A}$                                                                            | $R_{DS(on)}$  | -<br>- | 0.012<br>0.008 | 0.017<br>0.013 | $\Omega$      |

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

**Electrical Characteristics**

| Parameter                                                                                      | Symbol       | Values |      |      | Unit    |
|------------------------------------------------------------------------------------------------|--------------|--------|------|------|---------|
|                                                                                                |              | min.   | typ. | max. |         |
| Characteristics                                                                                |              |        |      |      |         |
| Transconductance<br>$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 8.6$ A              | $g_{fs}$     | 14     | 28   | -    | S       |
| Input capacitance<br>$V_{GS} = 0$ V, $V_{DS} = 25$ V, $f = 1$ MHz                              | $C_{iss}$    | -      | 1630 | 2040 | pF      |
| Output capacitance<br>$V_{GS} = 0$ V, $V_{DS} = 25$ V, $f = 1$ MHz                             | $C_{oss}$    | -      | 710  | 890  |         |
| Reverse transfer capacitance<br>$V_{GS} = 0$ V, $V_{DS} = 25$ V, $f = 1$ MHz                   | $C_{rss}$    | -      | 335  | 420  |         |
| Turn-on delay time<br>$V_{DD} = 15$ V, $V_{GS} = 4.5$ V, $I_D = 8.6$ A,<br>$R_G = 1.6 \Omega$  | $t_{d(on)}$  | -      | 20   | 30   | $\mu$ s |
| Rise time<br>$V_{DD} = 15$ V, $V_{GS} = 4.5$ V, $I_D = 8.6$ A,<br>$R_G = 1.6 \Omega$           | $t_r$        | -      | 120  | 180  |         |
| Turn-off delay time<br>$V_{DD} = 15$ V, $V_{GS} = 4.5$ V, $I_D = 8.6$ A,<br>$R_G = 1.6 \Omega$ | $t_{d(off)}$ | -      | 37   | 55   | $\mu$ s |
| Fall time<br>$V_{DD} = 15$ V, $V_{GS} = 4.5$ V, $I_D = 8.6$ A,<br>$R_G = 1.6 \Omega$           | $t_f$        | -      | 72   | 110  | $\mu$ s |

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

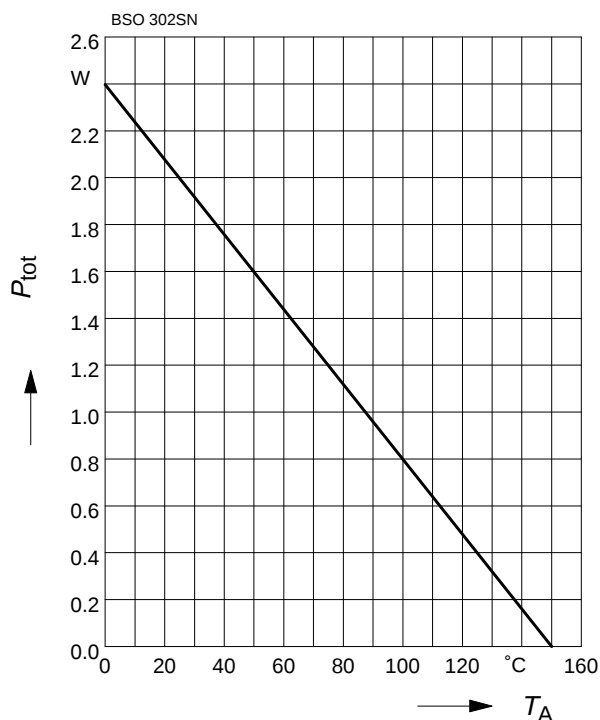
| Parameter<br>at $T_j = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified                                  | Symbol          | Values |      |      | Unit |
|------------------------------------------------------------------------------------------------------------------|-----------------|--------|------|------|------|
|                                                                                                                  |                 | min.   | typ. | max. |      |
| Dynamic Characteristics                                                                                          |                 |        |      |      |      |
| Gate charge at threshold<br>$V_{DD} = 24\text{ V}$ , $I_D \geq 0,1\text{ A}$ , $V_{GS} = 0\text{ to }1\text{ V}$ | $Q_{G(th)}$     | -      | 2    | 3    | nC   |
| Gate charge at $V_{gs}=5V$<br>$V_{DD} = 24\text{ V}$ , $I_D = 9.8\text{ A}$ , $V_{GS} = 0\text{ to }5\text{ V}$  | $Q_{g(5)}$      | -      | 37   | 55   |      |
| Gate charge total<br>$V_{DD} = 15\text{ V}$ , $I_D = 9.8\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$          | $Q_g$           | -      | 60   | 90   | nC   |
| Gate plateau voltage<br>$V_{DD} = 24\text{ V}$ , $I_D = 9.8\text{ A}$                                            | $V_{(plateau)}$ | -      | 2.95 | -    | V    |

**Reverse Diode**

|                                                                                                     |          |   |     |      |               |
|-----------------------------------------------------------------------------------------------------|----------|---|-----|------|---------------|
| Inverse diode continuous forward current<br>$T_C = 25\text{ }^{\circ}\text{C}$                      | $I_S$    | - | -   | 9.8  | A             |
| Inverse diode direct current,pulsed<br>$T_C = 25\text{ }^{\circ}\text{C}$                           | $I_{SM}$ | - | -   | 39.2 |               |
| Inverse diode forward voltage<br>$V_{GS} = 0\text{ V}$ , $I_F = 19.6\text{ A}$                      | $V_{SD}$ | - | 0.9 | 1.6  | V             |
| Reverse recovery time<br>$V_R = 15\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$   | $t_{rr}$ | - | 70  | 105  | ns            |
| Reverse recovery charge<br>$V_R = 15\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ | $Q_{rr}$ | - | 80  | 120  | $\mu\text{C}$ |

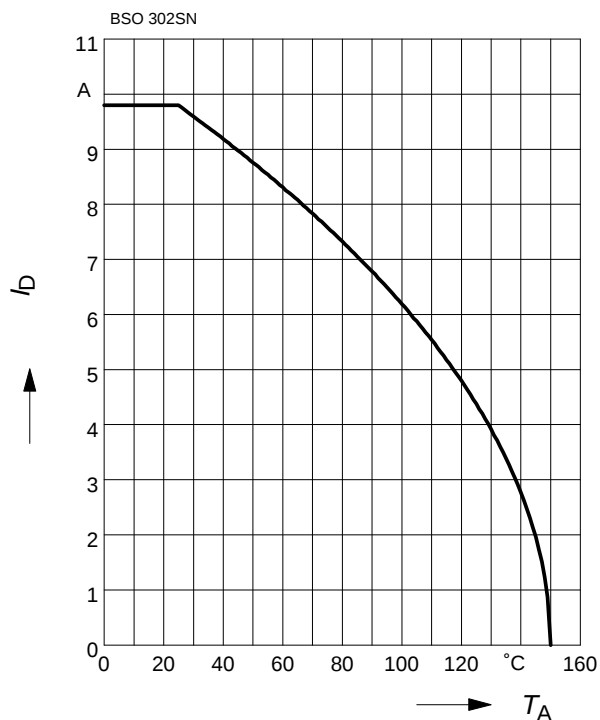
## Power dissipation

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



## Drain current

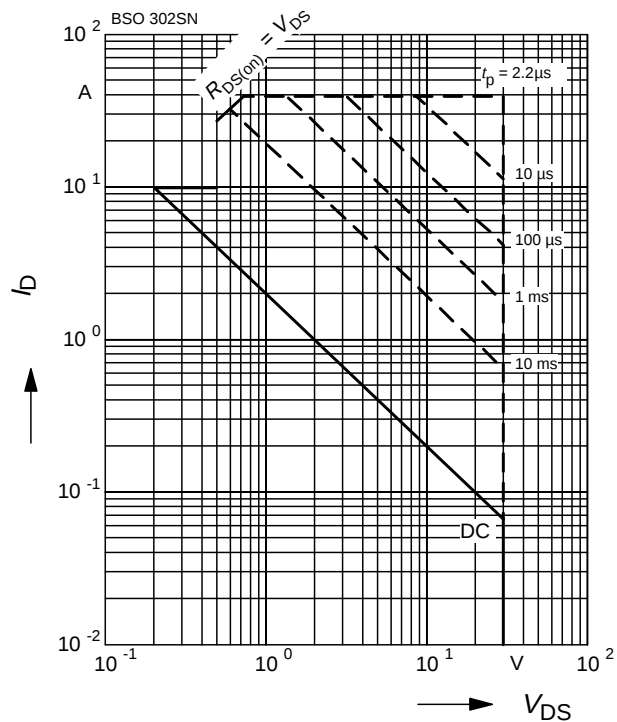
$$I_D = f(T_A)$$



## Safe operating area

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

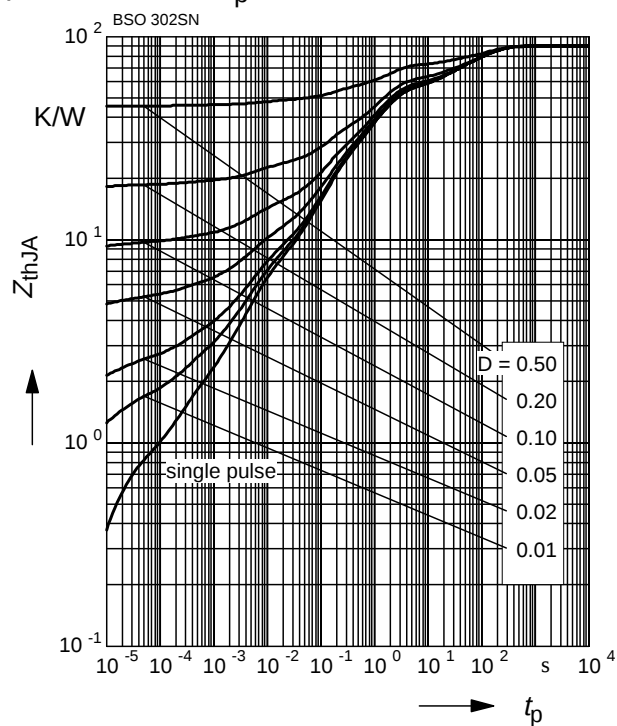
parameter :  $D = 0$ ,  $T_A = 25^\circ\text{C}$



## Transient thermal impedance

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

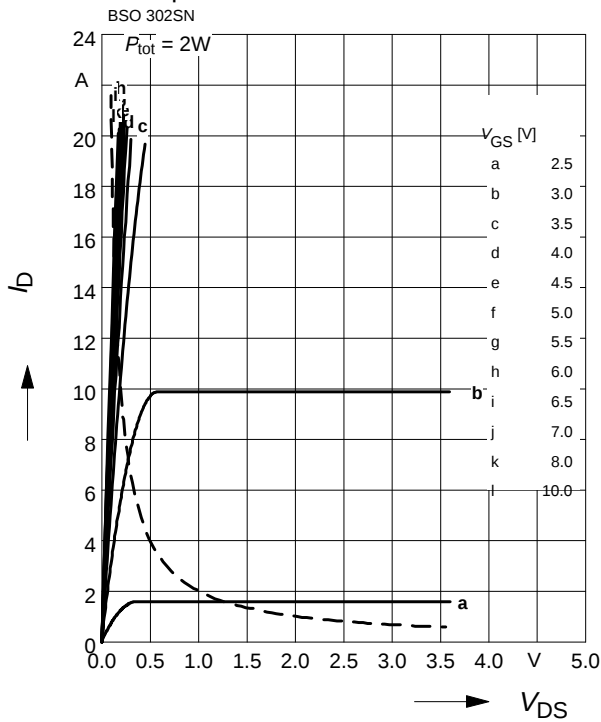
parameter :  $D = t_p/T$



### Typ. output characteristics

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

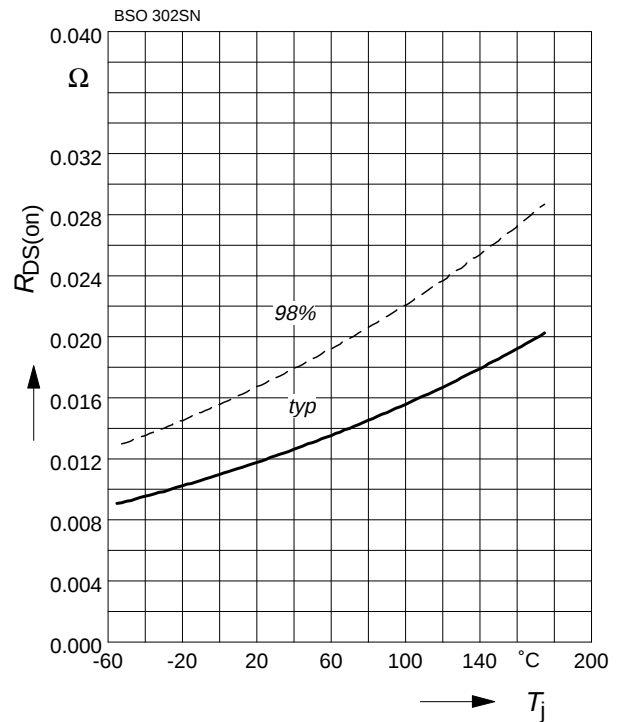
parameter:  $t_p = 80 \mu s$



### Drain-source on-resistance

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

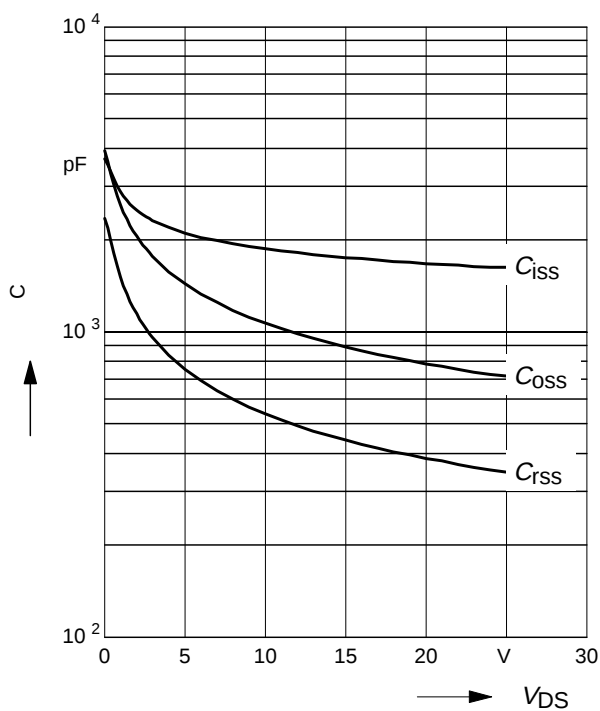
parameter:  $I_D = 8.6 A$ ,  $V_{GS} = 4.5 V$



### Typ. capacitances

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

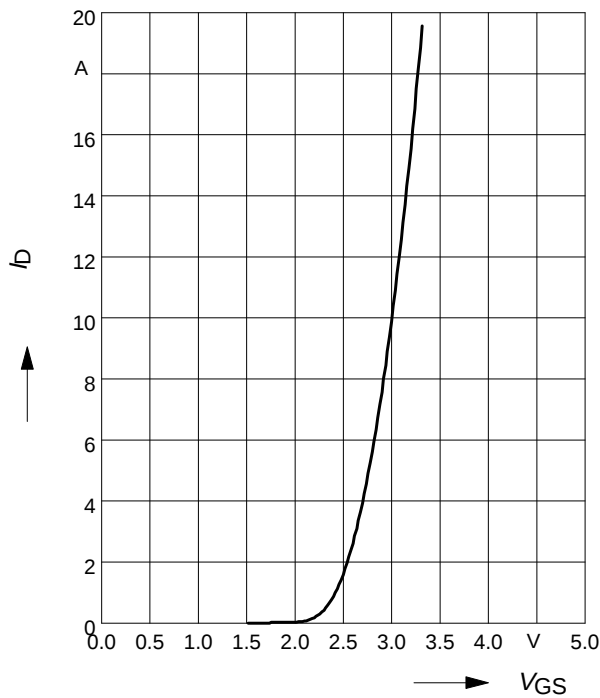
parameter:  $V_{GS} = 0 V$ ,  $f = 1 MHz$



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

parameter:  $t_p = 80 \mu s$

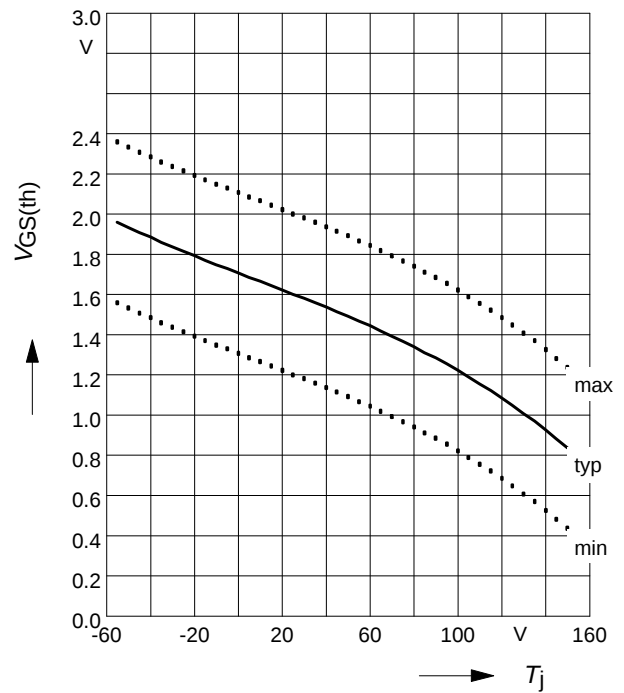
$V_{DS} \geq 2 \times I_D \times R_{DS(on) \max}$



### Gate threshold voltage

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

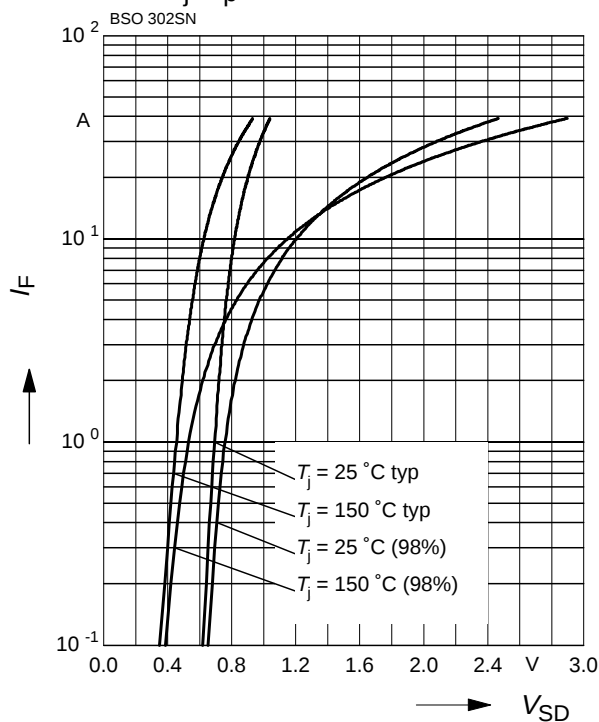
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 80 \mu A$



### Forward characteristics of reverse diode

$I_F = f(V_{SD})$

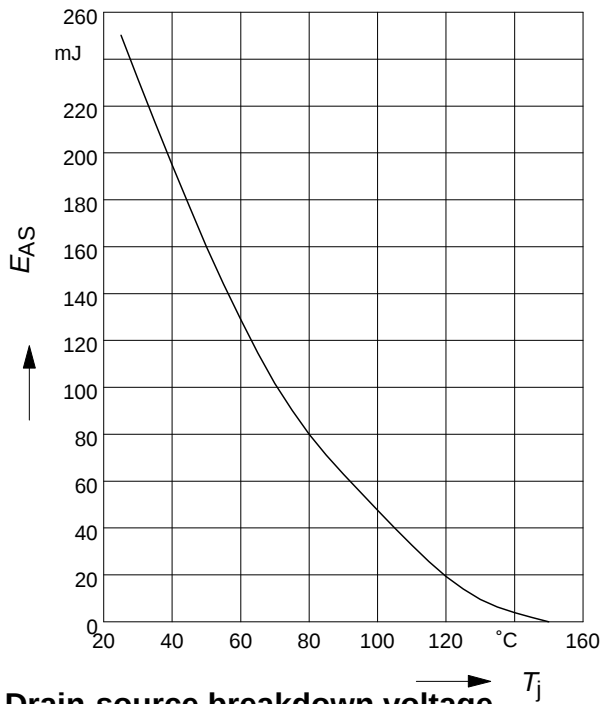
parameter:  $T_j$ ,  $t_p = 80 \mu s$



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

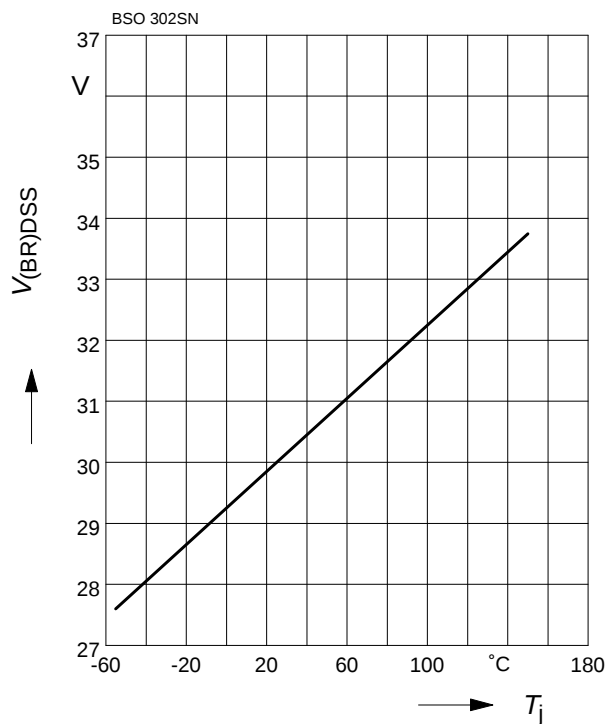
parameter:  $I_D = 9.8 \text{ A}$ ,  $V_{DD} = 25 \text{ V}$

$R_{GS} = 25 \Omega$



### Drain-source breakdown voltage

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



### Typ. gate charge

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

parameter:  $I_{D \text{ puls}} = 9.8 \text{ A}$

