

## Preliminary Data

### SIPMOS® Small-Signal-Transistor

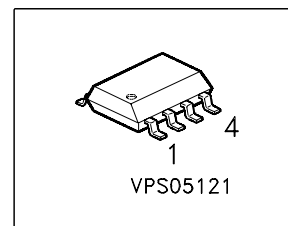
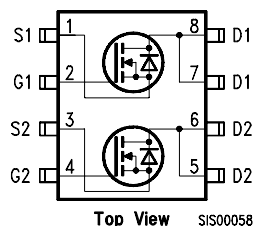
### BSO 615NV

#### Features

- Dual N Channel
- Enhancement mode
- Avalanche rated
- $dv/dt$  rated

#### Product Summary

|                                  |              |      |          |
|----------------------------------|--------------|------|----------|
| Drain source voltage             | $V_{DS}$     | 60   | V        |
| Drain-Source on-state resistance | $R_{DS(on)}$ | 0.12 | $\Omega$ |
| Continuous drain current         | $I_D$        | 3.1  | A        |



| Type      | Package | Ordering Code |
|-----------|---------|---------------|
| BSO 615NV | SO 8    | Q67041-S2844  |

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

| Parameter                                                                                                                                       | Symbol       | Value        | Unit              |
|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-------------------|
| Continuous drain current, <i>one channel active</i>                                                                                             | $I_D$        | 3.1          | A                 |
| Pulsed drain current, <i>one channel active</i><br>$T_A = 25^\circ\text{C}$                                                                     | $I_{Dpulse}$ | 12.4         |                   |
| Avalanche energy, single pulse<br>$I_D = 3.1\text{ A}$ , $V_{DD} = 25\text{ V}$ , $R_{GS} = 25\ \Omega$                                         | $E_{AS}$     | 60           | mJ                |
| Avalanche current, periodic limited by $T_{jmax}$                                                                                               | $I_{AR}$     | 3.1          | A                 |
| Avalanche energy, periodic limited by $T_{jmax}$                                                                                                | $E_{AR}$     | 0.2          | mJ                |
| Reverse diode $dv/dt$<br>$I_S = 3.1\text{ A}$ , $V_{DS} = 20\text{ V}$ , $di/dt = 200\text{ A}/\mu\text{s}$ ,<br>$T_{jmax} = 150^\circ\text{C}$ | $dv/dt$      | 6            | kV/ $\mu\text{s}$ |
| Gate source voltage                                                                                                                             | $V_{GS}$     | $\pm 20$     | V                 |
| Power dissipation, <i>one channel active</i><br>$T_A = 25^\circ\text{C}$                                                                        | $P_{tot}$    | 2            | W                 |
| Operating temperature                                                                                                                           | $T_j$        | -55 ... +150 | $^\circ\text{C}$  |
| 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                                | $R_{thJS}$   | -      | -    | 35   | K/W  |
| Thermal resistance @ 10 sec., min. footprint                                  | $R_{th(JA)}$ | -      | -    | 100  |      |
| 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>$V_{GS} = 0\text{ V}$ , $I_D = 0.25\text{ mA}$                                                                                                                              | $V_{(BR)DSS}$ | 60     | -         | -        | V             |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D = 20\text{ }\mu\text{A}$                                                                                                                                     | $V_{GS(th)}$  | 2.1    | 3         | 4        |               |
| Zero gate voltage drain current<br>$V_{DS} = 60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ }^{\circ}\text{C}$<br>$V_{DS} = 60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ }^{\circ}\text{C}$ | $I_{DSS}$     | -<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>$V_{GS} = 10\text{ V}$ , $I_D = 3.1\text{ A}$                                                                                                                              | $R_{DS(on)}$  | -      | 0.09      | 0.12     | $\Omega$      |

<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>$V_{DS} \leq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 3.1$ A            | $g_{fs}$     | 2.5    | 5.8  | -    | S    |
| Input capacitance<br>$V_{GS} = 0$ V, $V_{DS} = 25$ V, $f = 1$ MHz                            | $C_{iss}$    | -      | 275  | 340  | pF   |
| Output capacitance<br>$V_{GS} = 0$ V, $V_{DS} = 25$ V, $f = 1$ MHz                           | $C_{oss}$    | -      | 90   | 120  |      |
| Reverse transfer capacitance<br>$V_{GS} = 0$ V, $V_{DS} = 25$ V, $f = 1$ MHz                 | $C_{rss}$    | -      | 50   | 65   |      |
| Turn-on delay time<br>$V_{DD} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.1$ A,<br>$R_G = 33 \Omega$  | $t_{d(on)}$  | -      | 11   | 17   | ns   |
| Rise time<br>$V_{DD} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.1$ A,<br>$R_G = 33 \Omega$           | $t_r$        | -      | 25   | 40   |      |
| Turn-off delay time<br>$V_{DD} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.1$ A,<br>$R_G = 33 \Omega$ | $t_{d(off)}$ | -      | 25   | 40   |      |
| Fall time<br>$V_{DD} = 30$ V, $V_{GS} = 10$ V, $I_D = 3.1$ A,<br>$R_G = 33 \Omega$           | $t_f$        | -      | 35   | 55   |      |

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

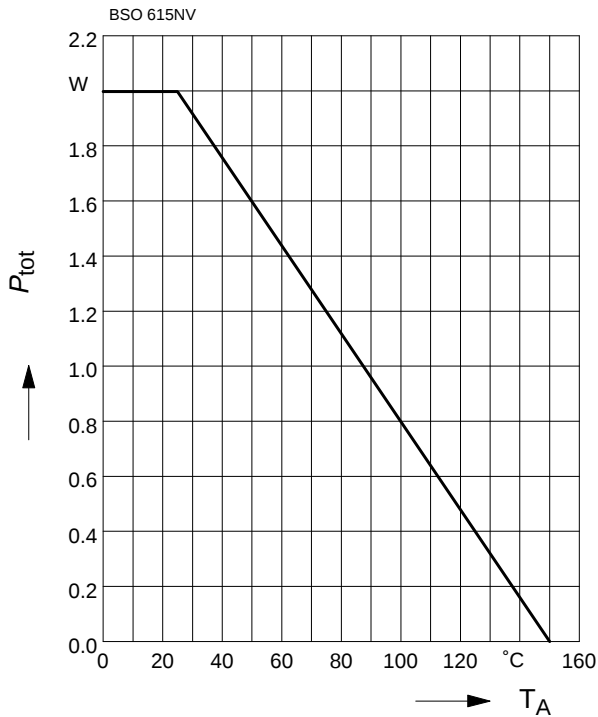
| Parameter<br>at $T_j = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified                                 | Symbol          | Values |      |      | Unit |
|-----------------------------------------------------------------------------------------------------------------|-----------------|--------|------|------|------|
|                                                                                                                 |                 | min.   | typ. | max. |      |
| Dynamic Characteristics                                                                                         |                 |        |      |      |      |
| Gate charge at threshold<br>$V_{DD} = 40\text{ V}$ , $I_D = 0.1\text{ A}$ , $V_{GS} = 1\text{ V}$               | $Q_{G(th)}$     | -      | 0.25 | 0.3  | nC   |
| Gate charge at $V_{gs}=7V$<br>$V_{DD} = 40\text{ V}$ , $I_D = 3.1\text{ A}$ , $V_{GS} = 0\text{ to }7\text{ V}$ | $Q_{g(7)}$      | -      | 7.4  | 9.3  | nC   |
| Gate charge total<br>$V_{DD} = 40\text{ V}$ , $I_D = 3.1\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$         | $Q_g$           | -      | 9.7  | 12   |      |
| Gate plateau voltage<br>$V_{DD} = 40\text{ V}$ , $I_D = 3.1\text{ A}$                                           | $V_{(plateau)}$ | -      | 4.7  | -    | V    |

**Reverse Diode**

|                                                                                                     |          |   |      |      |               |
|-----------------------------------------------------------------------------------------------------|----------|---|------|------|---------------|
| Inverse diode continuous forward current<br>$T_A = 25^\circ\text{C}$                                | $I_S$    | - | -    | 3.1  | A             |
| Inverse diode direct current,pulsed<br>$T_A = 25^\circ\text{C}$                                     | $I_{SM}$ | - | -    | 12.4 |               |
| Inverse diode forward voltage<br>$V_{GS} = 0\text{ V}$ , $I_F = 6.2\text{ A}$                       | $V_{SD}$ | - | 0.95 | 1.2  | V             |
| Reverse recovery time<br>$V_R = 30\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$   | $t_{rr}$ | - | 45   | 56   | ns            |
| Reverse recovery charge<br>$V_R = 30\text{ V}$ , $I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ | $Q_{rr}$ | - | 0.08 | 0.12 | $\mu\text{C}$ |

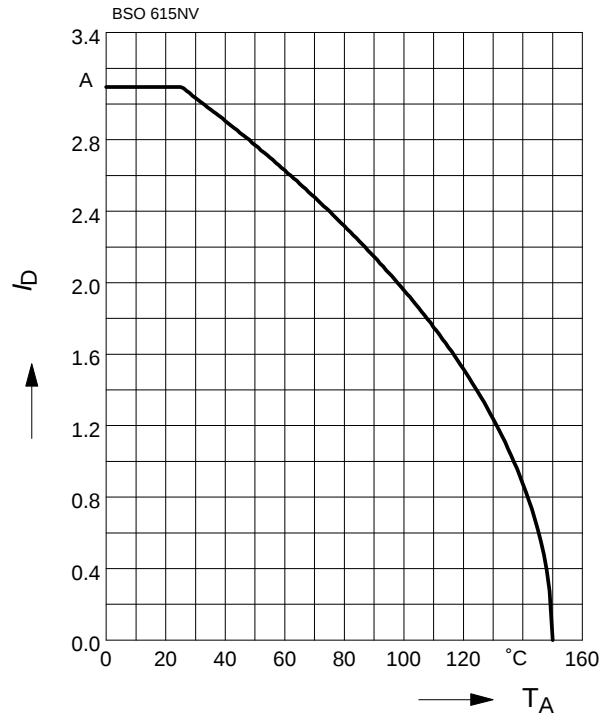
## Power Dissipation

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



## Drain current

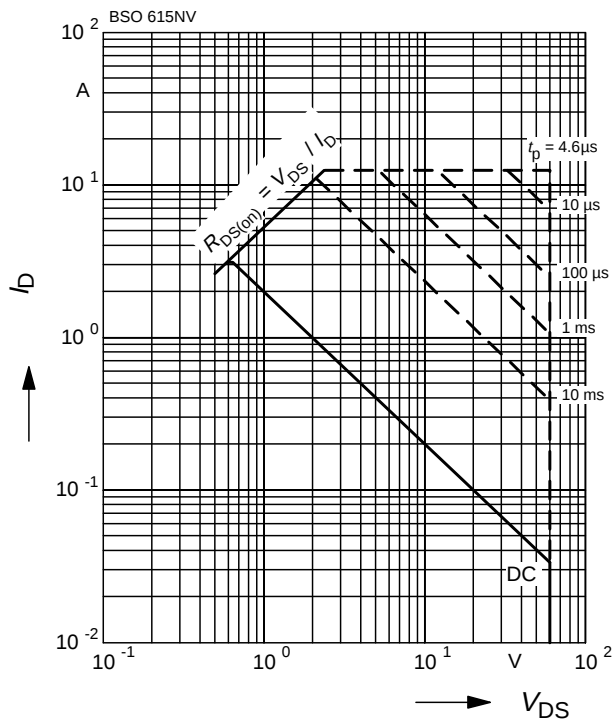
$$I_D = f(T_A)$$



## Safe operating area

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

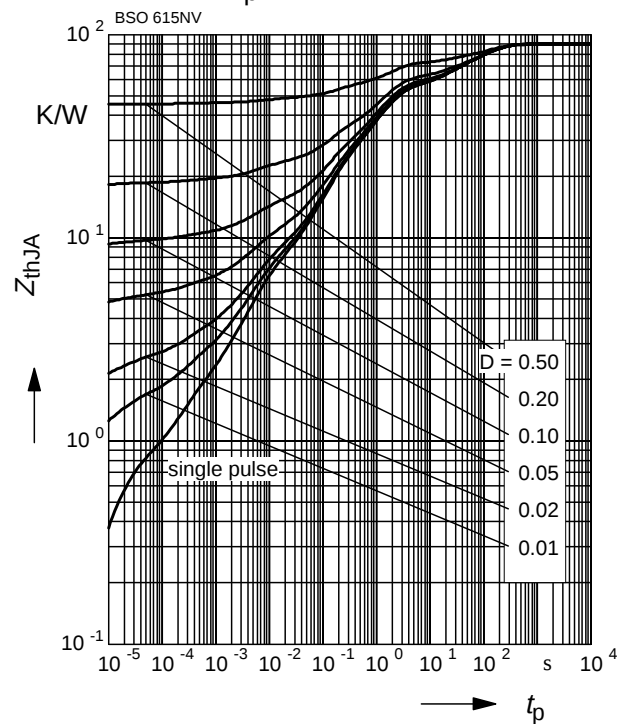
parameter :  $D = 0$ ,  $T_A = 25^{\circ}\text{C}$



## Transient thermal impedance

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

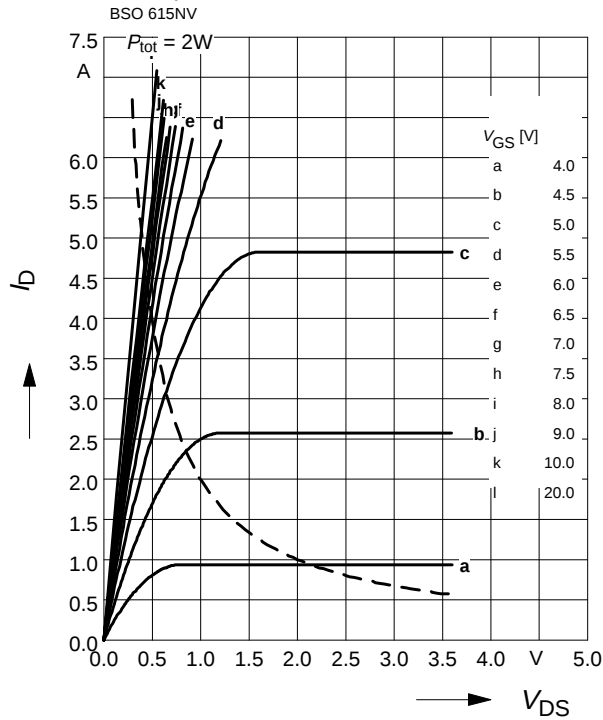
parameter :  $D = t_p / T$



### Typ. output characteristics

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

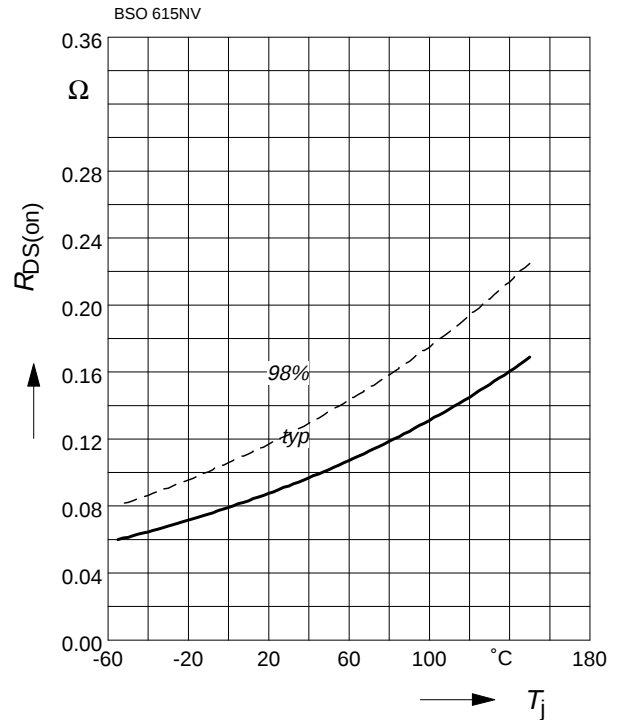
parameter:  $t_p = 80 \mu s$



### Drain-source on-resistance

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

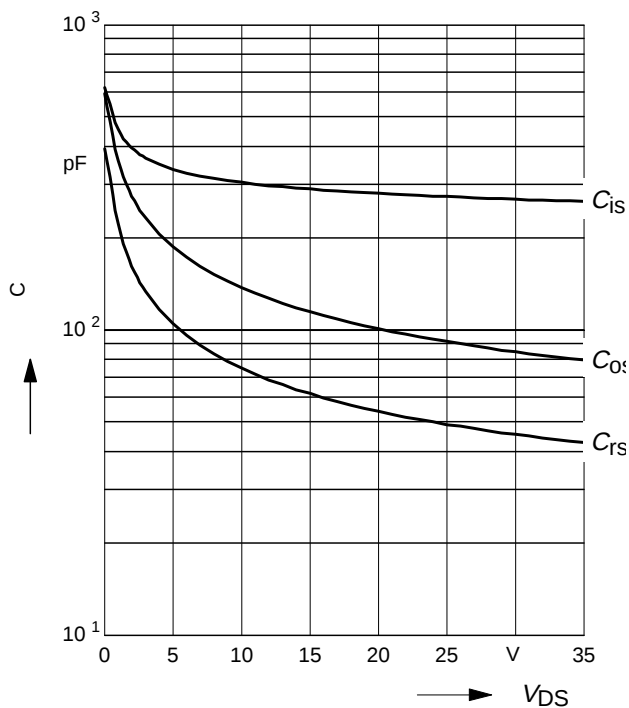
parameter:  $I_D = 3.1 A$ ,  $V_{GS} = 10 V$



### Typ. capacitances

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

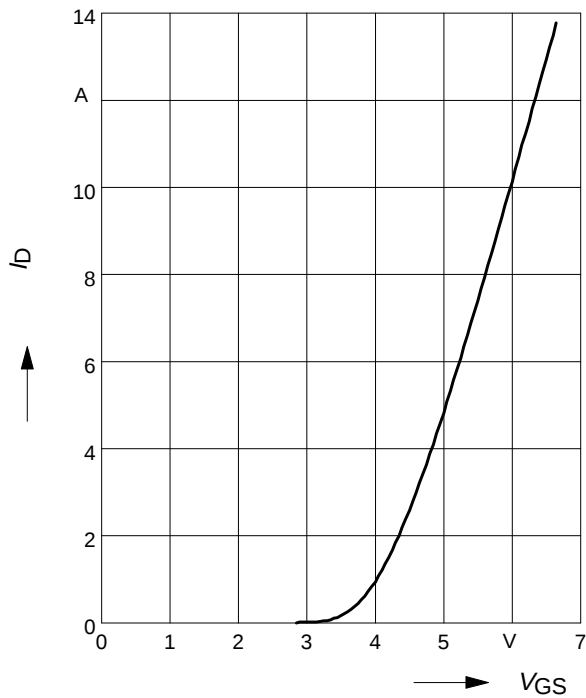
parameter:  $V_{GS} = 0 V$ ,  $f = 1 MHz$



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

parameter:  $t_p = 80 \mu s$

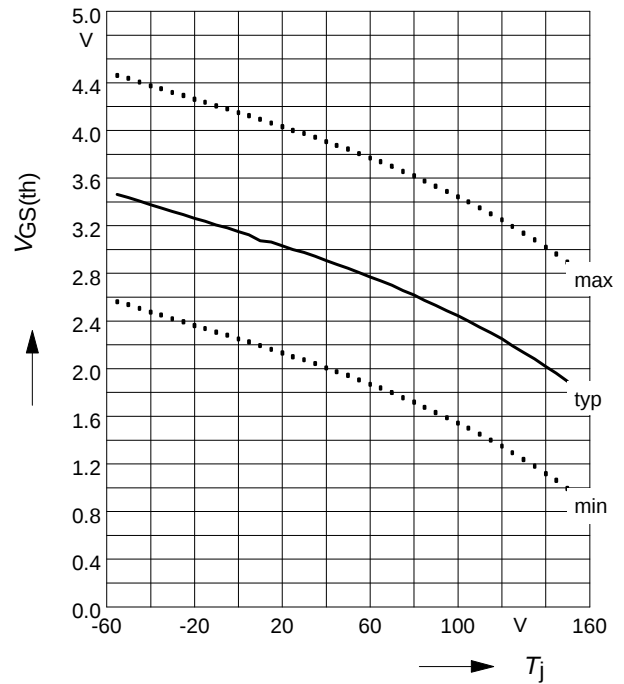
$V_{DS} \geq 2 \times I_D \times R_{DS(on) \max}$



### Gate threshold voltage

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

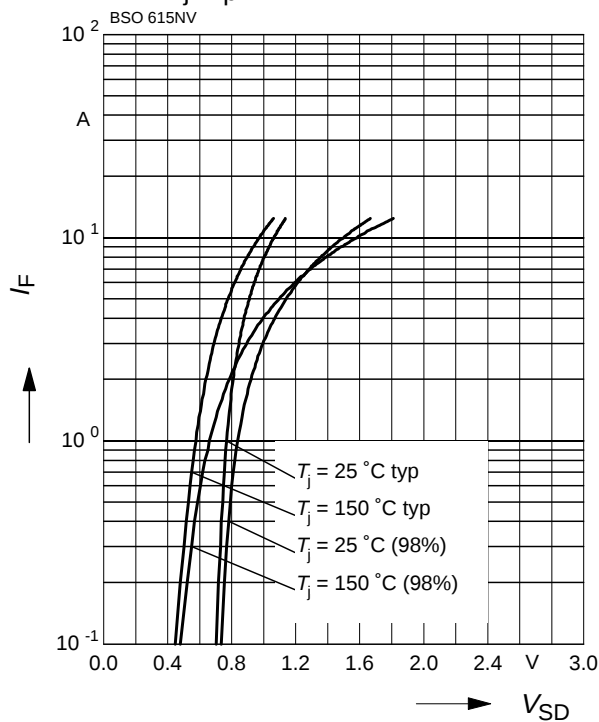
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 20 \mu A$



### Forward characteristics of reverse diode

$I_F = f(V_{SD})$

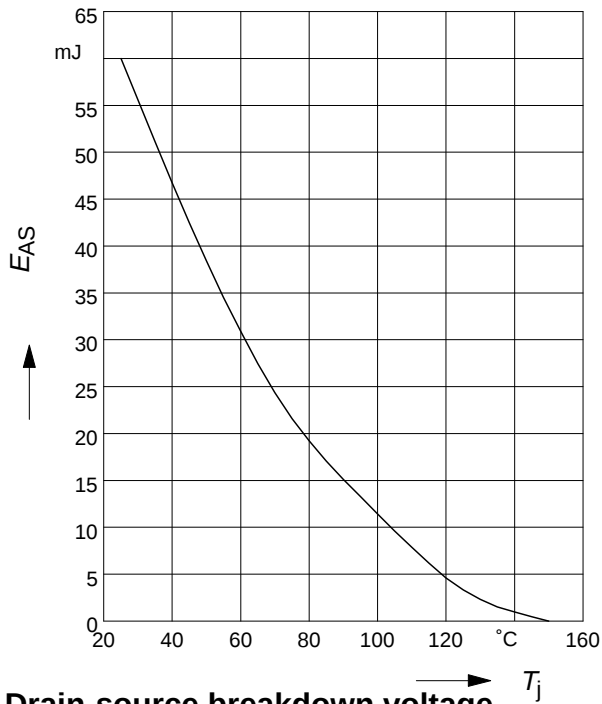
parameter:  $T_j$ ,  $t_p = 80 \mu s$



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

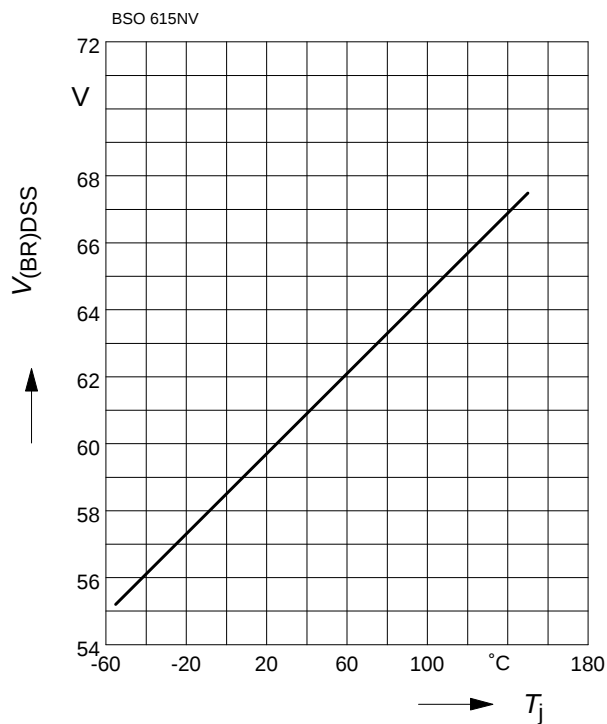
parameter:  $I_D = 3.1 \text{ A}$ ,  $V_{DD} = 25 \text{ V}$

$R_{GS} = 25 \Omega$



### Drain-source breakdown voltage $V_{(BR)DSS} = f(T_j)$

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



### Typ. gate charge

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

parameter:  $I_{D \text{ puls}} = 3.1 \text{ A}$

