

## OptiMOS<sup>®</sup>-P Small-Signal-Transistor

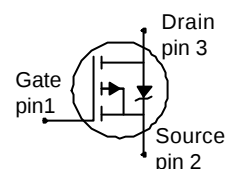
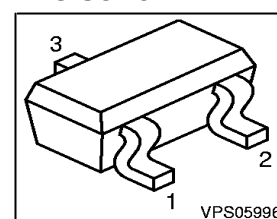
### Feature

- P-Channel
- Enhancement mode
- Super Logic Level (2.5 V rated)
- 150°C operating temperature
- Avalanche rated
- dv/dt rated
- Pb-free lead plating; RoHS compliant

### Product Summary

|              |       |          |
|--------------|-------|----------|
| $V_{DS}$     | -20   | V        |
| $R_{DS(on)}$ | 1.2   | $\Omega$ |
| $I_D$        | -0.39 | A        |

PG-SC-75



| Type      | Package  | Pb-free | Marking |
|-----------|----------|---------|---------|
| BSA 223SP | PG-SC-75 | Yes     | BPs     |

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

| Parameter                                                                                                          | Symbol                   | Value       | Unit              |
|--------------------------------------------------------------------------------------------------------------------|--------------------------|-------------|-------------------|
| Continuous drain current                                                                                           | $I_D$                    |             | A                 |
| $T_A=25^\circ\text{C}$                                                                                             |                          | -0.39       |                   |
| $T_A=70^\circ\text{C}$                                                                                             |                          | -0.31       |                   |
| Pulsed drain current                                                                                               | $I_{D \text{ puls}}$     | -1.56       |                   |
| $T_A=25^\circ\text{C}$                                                                                             |                          |             |                   |
| Avalanche energy, single pulse                                                                                     | $E_{AS}$                 | 1.4         | mJ                |
| $I_D=-0.39 \text{ A}$ , $V_{DD}=-10\text{V}$ , $R_{GS}=25\Omega$                                                   |                          |             |                   |
| Reverse diode dv/dt                                                                                                | dv/dt                    | -6          | kV/ $\mu\text{s}$ |
| $I_S=-0.39\text{A}$ , $V_{DS}=-16\text{V}$ , $di/dt=200\text{A}/\mu\text{s}$ , $T_{j\text{max}}=150^\circ\text{C}$ |                          |             |                   |
| Gate source voltage                                                                                                | $V_{GS}$                 | $\pm 12$    | V                 |
| Power dissipation                                                                                                  | $P_{\text{tot}}$         | 0.25        | W                 |
| $T_A=25^\circ\text{C}$                                                                                             |                          |             |                   |
| Operating and storage temperature                                                                                  | $T_j$ , $T_{\text{stg}}$ | -55... +150 | $^\circ\text{C}$  |
| IEC climatic category; DIN IEC 68-1                                                                                |                          | 55/150/56   |                   |

**Thermal Characteristics**

| Parameter                                      | Symbol     | Values |      |      | Unit |
|------------------------------------------------|------------|--------|------|------|------|
|                                                |            | min.   | typ. | max. |      |
| Characteristics                                |            |        |      |      |      |
| Thermal resistance, junction - soldering point | $R_{thJS}$ | -      | -    | 150  | K/W  |
| Thermal resistance, junction - ambient, leaded | $R_{thJA}$ | -      | -    | 500  |      |

**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>$V_{GS}=0, I_D=-250\mu A$                                                              | $V_{(BR)DSS}$ | -20    | -           | -          | V        |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D=-1.5\mu A$                                                             | $V_{GS(th)}$  | -0.6   | -0.9        | -1.2       |          |
| Zero gate voltage drain current<br>$V_{DS}=-20V, V_{GS}=0, T_j=25^{\circ}C$<br>$V_{DS}=-20V, V_{GS}=0, T_j=150^{\circ}C$ | $I_{DSS}$     | -      | -0.1<br>-10 | -1<br>-100 | $\mu A$  |
| Gate-source leakage current<br>$V_{GS}=-12V, V_{DS}=0$                                                                   | $I_{GSS}$     | -      | -10         | -100       |          |
| Drain-source on-state resistance<br>$V_{GS}=-2.5V, I_D=-0.29A$                                                           | $R_{DS(on)}$  | -      | 1.27        | 2.1        | $\Omega$ |
| Drain-source on-state resistance<br>$V_{GS}=-4.5, I_D=-0.39A$                                                            | $R_{DS(on)}$  | -      | 0.7         | 1.2        |          |

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

| Parameter | Symbol | Conditions | Values |      |      | Unit |
|-----------|--------|------------|--------|------|------|------|
|           |        |            | min.   | typ. | max. |      |

### Dynamic Characteristics

|                              |              |                                                                                       |      |     |     |    |
|------------------------------|--------------|---------------------------------------------------------------------------------------|------|-----|-----|----|
| Transconductance             | $g_{fs}$     | $ V_{DS}  \geq 2 \cdot  I_D  \cdot R_{DS(on)max}$ ,<br>$I_D = -0.31\text{A}$          | 0.35 | 0.7 | -   | S  |
| Input capacitance            | $C_{iss}$    | $V_{GS}=0$ , $V_{DS}=-15\text{V}$ ,<br>$f=1\text{MHz}$                                | -    | 45  | 56  | pF |
| Output capacitance           | $C_{oss}$    |                                                                                       | -    | 21  | 26  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                       | -    | 17  | 22  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=-10\text{V}$ , $V_{GS}=-4.5\text{V}$ ,<br>$I_D=-0.39\text{A}$ , $R_G=6\Omega$ | -    | 3.8 | 5.7 | ns |
| Rise time                    | $t_r$        |                                                                                       | -    | 5   | 7.5 |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                       | -    | 5.1 | 7.6 |    |
| Fall time                    | $t_f$        |                                                                                       | -    | 3.2 | 4.8 |    |

### Gate Charge Characteristics

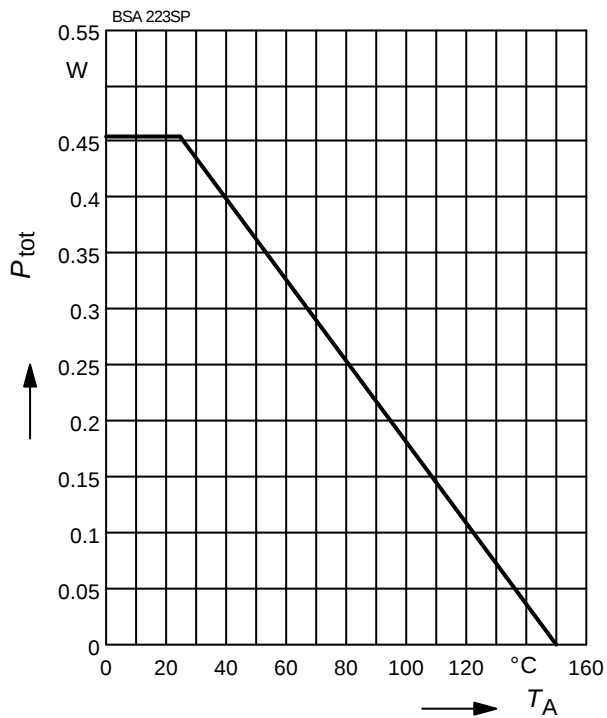
|                       |                 |                                                                              |   |       |       |    |
|-----------------------|-----------------|------------------------------------------------------------------------------|---|-------|-------|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD}=-10\text{V}$ , $I_D=-0.39\text{A}$                                   | - | -0.04 | -0.05 | nC |
| Gate to drain charge  | $Q_{gd}$        |                                                                              | - | -0.4  | -0.5  |    |
| Gate charge total     | $Q_g$           | $V_{DD}=-10\text{V}$ , $I_D=-0.39\text{A}$ ,<br>$V_{GS}=0$ to $-4.5\text{V}$ | - | -0.5  | -0.62 |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD}=-10\text{V}$ , $I_D=-0.39\text{A}$                                   | - | -2.2  | -2.7  | V  |

### Reverse Diode

|                                          |          |                                                                            |   |     |       |    |
|------------------------------------------|----------|----------------------------------------------------------------------------|---|-----|-------|----|
| Inverse diode continuous forward current | $I_S$    | $T_A=25^{\circ}\text{C}$                                                   | - | -   | -0.39 | A  |
| Inv. diode direct current, pulsed        | $I_{SM}$ |                                                                            | - | -   | -1.56 |    |
| Inverse diode forward voltage            | $V_{SD}$ | $V_{GS}=0$ , $I_F=-0.39$                                                   | - | -1  | -1.33 | V  |
| Reverse recovery time                    | $t_{rr}$ | $V_R=-10\text{V}$ , $ I_F  =  I_D $ ,<br>$di_F/dt=100\text{A}/\mu\text{s}$ | - | 7.6 | 9.5   | ns |
| Reverse recovery charge                  | $Q_{rr}$ |                                                                            | - | 1.1 | 1.4   |    |

### 1 Power dissipation

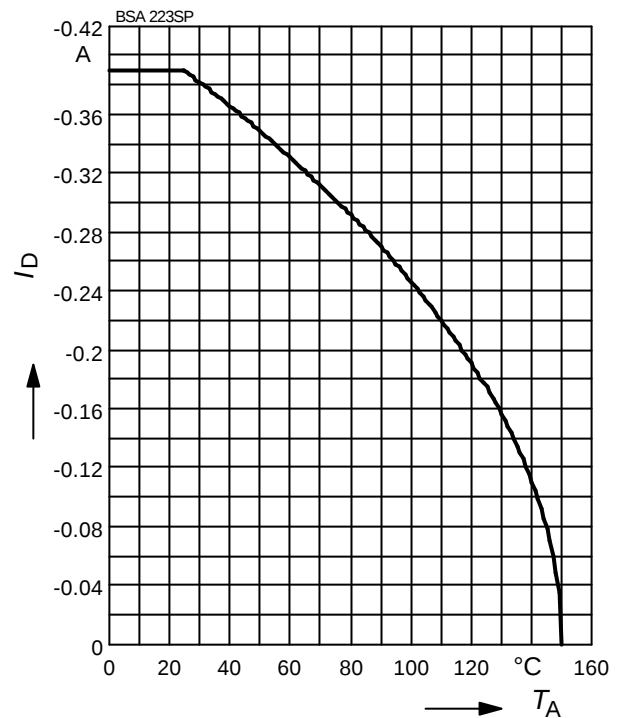
$$P_{\text{tot}} = f(T_A)$$



### 2 Drain current

$$I_D = f(T_A)$$

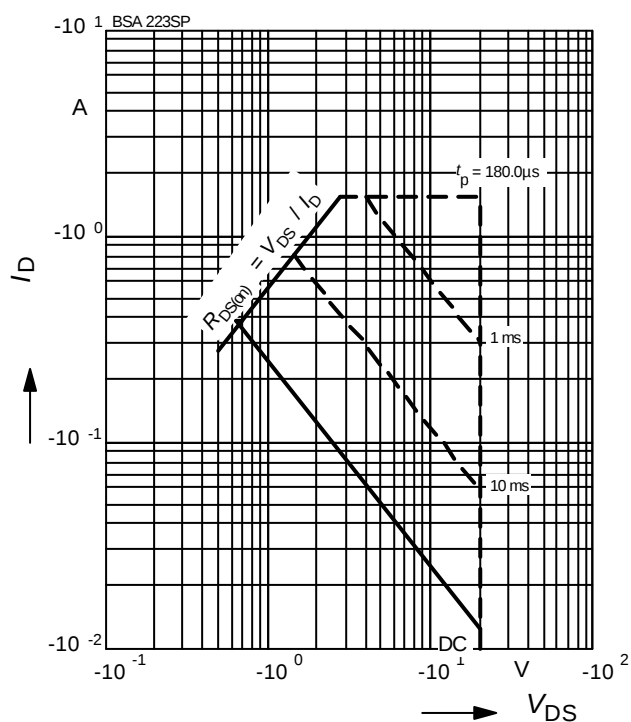
parameter:  $|V_{GS}| \geq 4.5 \text{ V}$



### 3 Safe operating area

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

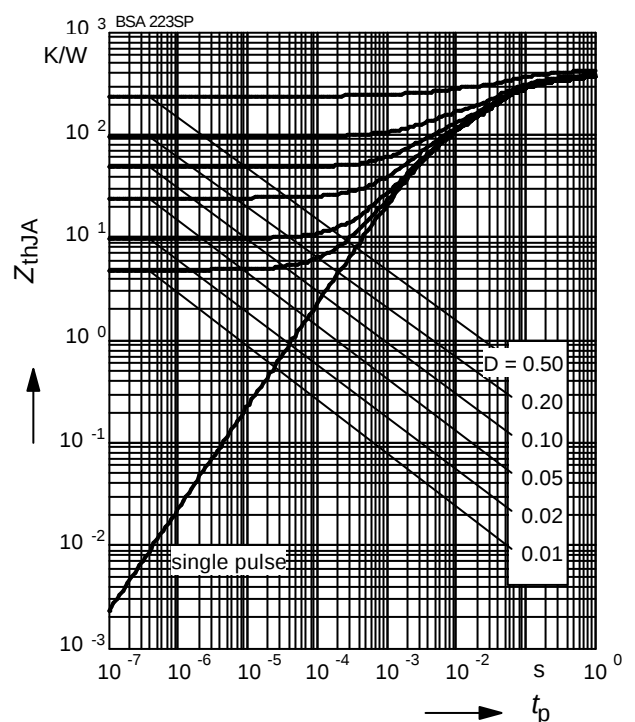
parameter:  $D = 0$ ,  $T_A = 25^\circ\text{C}$



### 4 Transient thermal impedance

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

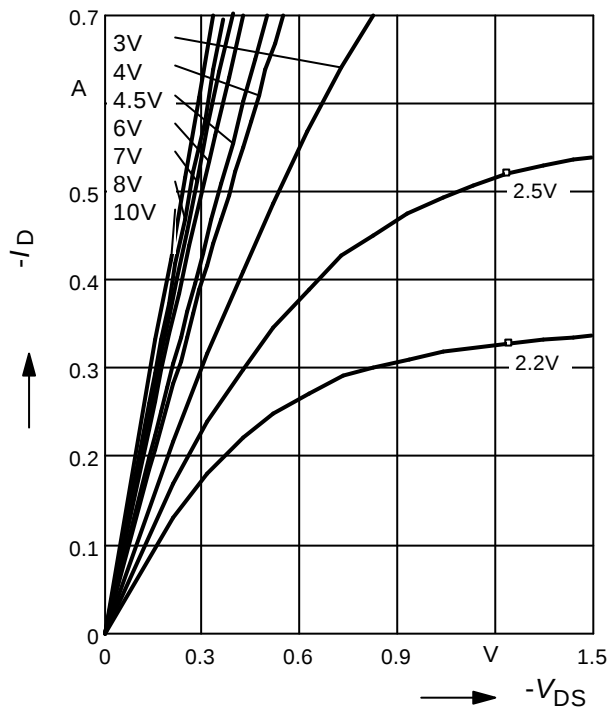
parameter:  $D = t_p/T$



### 5 Typ. output characteristic

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

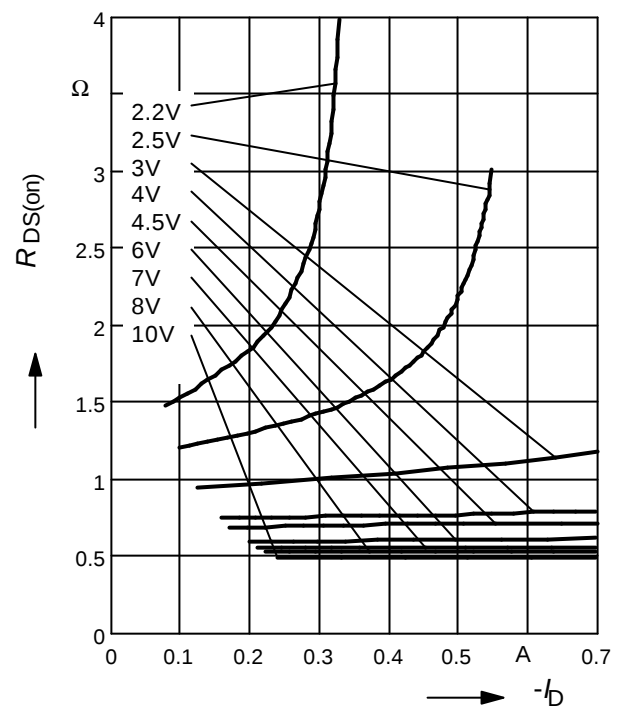
parameter:  $T_j = 25^\circ\text{C}$



### 6 Typ. drain-source on resistance

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

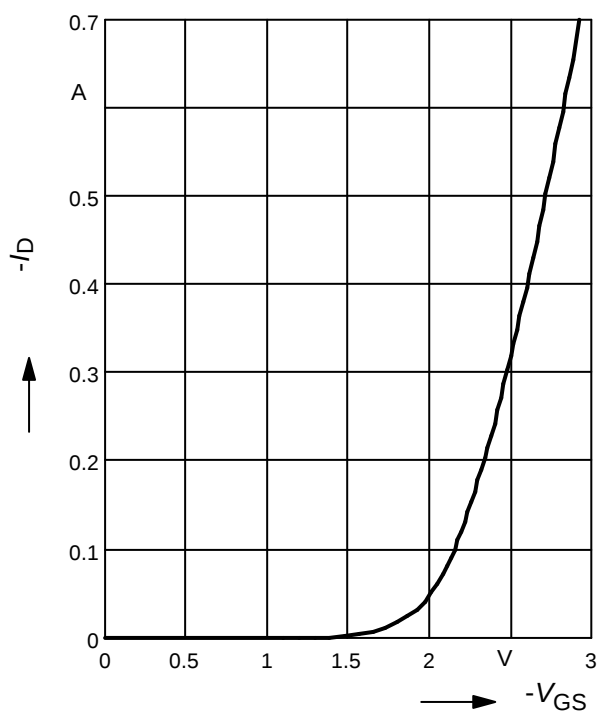
parameter:  $V_{GS}, T_j = 25^\circ\text{C}$



### 7 Typ. transfer characteristics

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

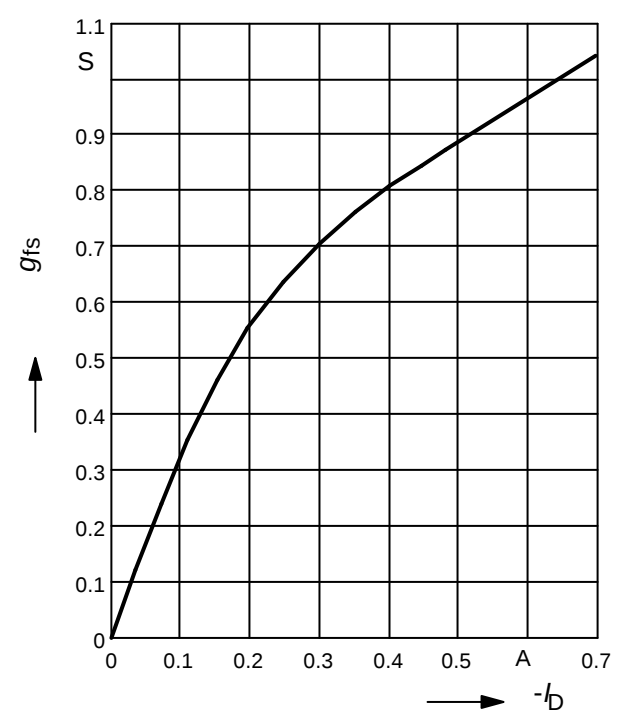
parameter:  $T_j = 25^\circ\text{C}$



### 8 Typ. forward transconductance

$$g_{fs} = f(I_D)$$

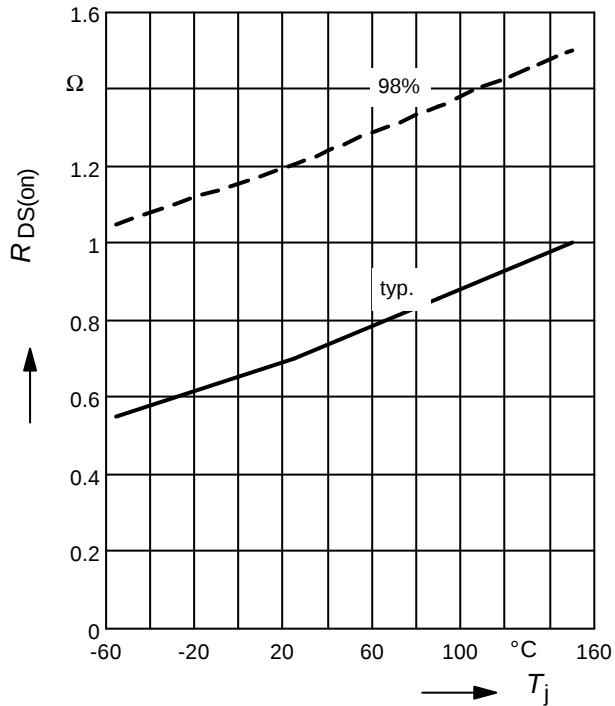
parameter:  $T_j = 25^\circ\text{C}$



### 9 Drain-source on-resistance

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

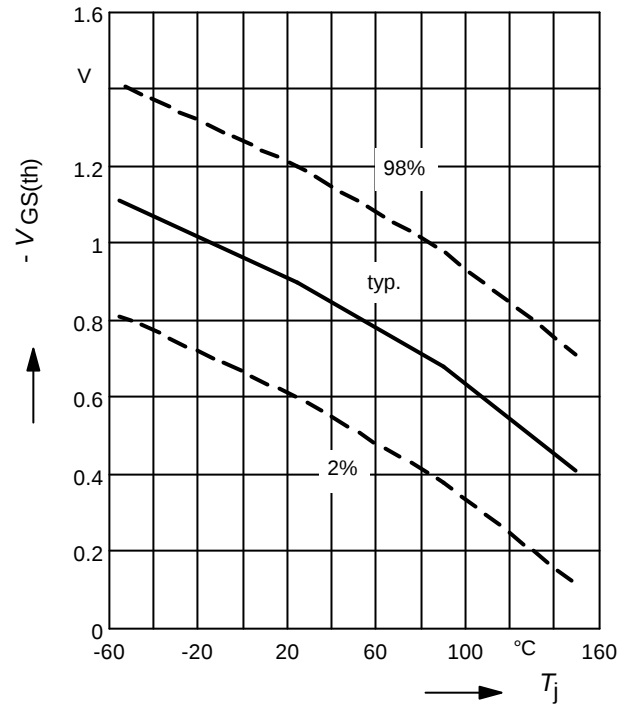
parameter:  $I_D = -0.39$  A,  $V_{GS} = -4.5$  V



### 10 Typ. gate threshold voltage

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

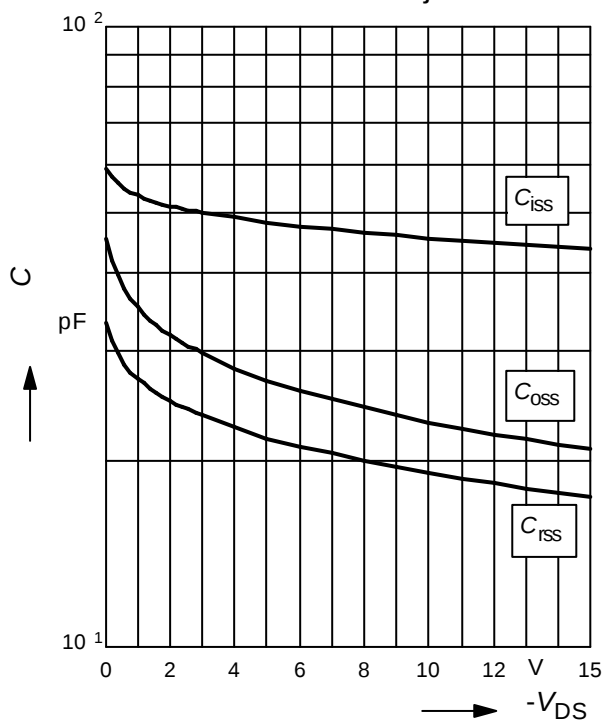
parameter:  $V_{GS} = V_{DS}$



### 11 Typ. capacitances

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

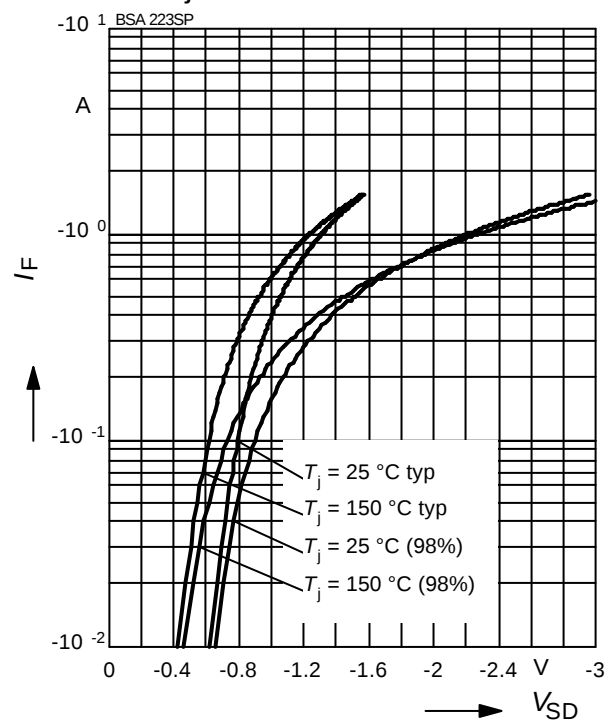
parameter:  $V_{GS}=0$ ,  $f=1$  MHz,  $T_j = 25$  °C



### 12 Forward character. of reverse diode

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

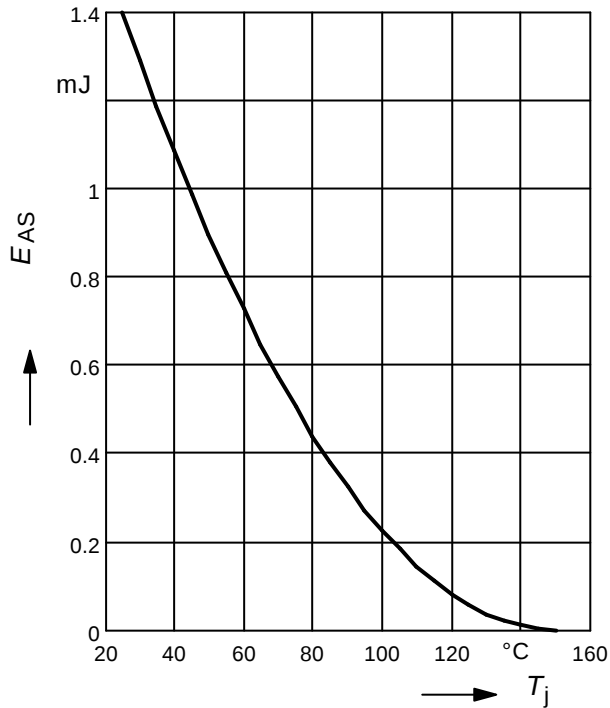
parameter:  $T_j = 25$  °C



**13 Typ. avalanche energy**

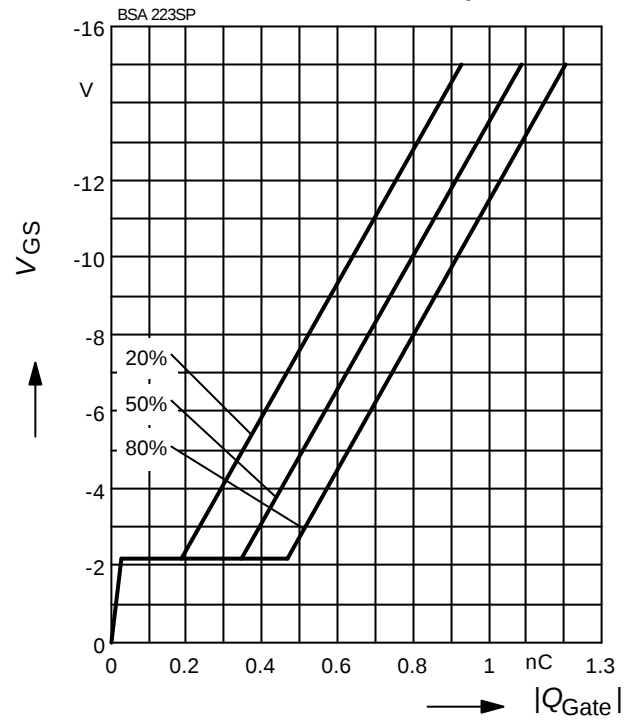
$$E_{AS} = f(T_j), \text{ par.: } I_D = -0.39 \text{ A}$$

$$V_{DD} = -10 \text{ V}, R_{GS} = 25 \Omega$$

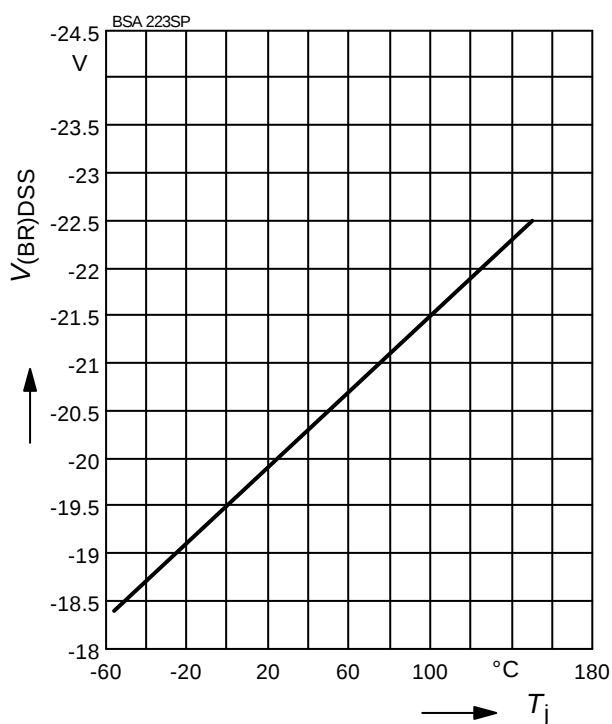

**14 Typ. gate charge**

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

$$\text{parameter: } I_D = -0.39 \text{ A pulsed}, T_j = 25^\circ \text{C}$$


**15 Drain-source breakdown voltage**

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



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