

# SIPMOS® Small-Signal-Transistor

## Feature

- P-Channel
- Enhancement mode
- Logic Level
- Avalanche rated
- dv/dt rated
- Pb-free lead plating; RoHS compliant

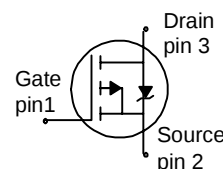
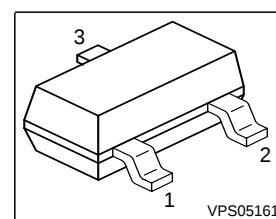


| Type     | Package   | Tape and Reel     | Marking |
|----------|-----------|-------------------|---------|
| BSS 84 P | PG-SOT-23 | L6327:3000pcs/r.  | YBs     |
| BSS 84 P | PG-SOT-23 | L6433:10000pcs/r. | YBs     |

## Product Summary

|              |       |          |
|--------------|-------|----------|
| $V_{DS}$     | -60   | V        |
| $R_{DS(on)}$ | 8     | $\Omega$ |
| $I_D$        | -0.17 | A        |

PG-SOT-23



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

| Parameter                                                                                                                                | Symbol              | Value          | Unit               |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------|--------------------|
| Continuous drain current<br>$T_A=25^{\circ}\text{C}$<br>$T_A=70^{\circ}\text{C}$                                                         | $I_D$               | -0.17<br>-0.14 | A                  |
| Pulsed drain current<br>$T_A=25^{\circ}\text{C}$                                                                                         | $I_{D\text{ puls}}$ | -0.68          |                    |
| Avalanche energy, single pulse<br>$I_D=-0.17\text{ A}$ , $V_{DD}=-25\text{ V}$ , $R_{GS}=25\Omega$                                       | $E_{AS}$            | 2.6            | mJ                 |
| Avalanche energy, periodic limited by $T_{jmax}$                                                                                         | $E_{AR}$            | 0.036          |                    |
| Reverse diode dv/dt<br>$I_S=-0.17\text{ A}$ , $V_{DS}=-48\text{ V}$ , $di/dt=-200\text{ A}/\mu\text{s}$ , $T_{jmax}=150^{\circ}\text{C}$ | dv/dt               | -6             | kV/ $\mu\text{s}$  |
| Gate source voltage                                                                                                                      | $V_{GS}$            | $\pm 20$       | V                  |
| Power dissipation<br>$T_A=25^{\circ}\text{C}$                                                                                            | $P_{tot}$           | 0.36           | 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. |      |
| Characteristics                                           |            |        |      |      |      |
| Thermal resistance, junction - soldering point<br>(Pin 3) | $R_{thJS}$ | -      | -    | 200  | K/W  |
| SMD version, device on PCB:                               | $R_{thJA}$ |        |      |      |      |
| @ min. footprint                                          |            | -      | -    | 350  |      |
| @ 6 cm <sup>2</sup> cooling area <sup>1)</sup>            |            | -      | -    | 300  |      |

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

| Parameter                                                                                                                | Symbol        | Values |             |            | Unit     |
|--------------------------------------------------------------------------------------------------------------------------|---------------|--------|-------------|------------|----------|
|                                                                                                                          |               | min.   | typ.        | max.       |          |
| Static Characteristics                                                                                                   |               |        |             |            |          |
| Drain-source breakdown voltage<br>$V_{GS}=0, I_D=-250\mu A$                                                              | $V_{(BR)DSS}$ | -60    | -           | -          | V        |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D=-20\mu A$                                                              | $V_{GS(th)}$  | -1     | -1.5        | -2         |          |
| Zero gate voltage drain current<br>$V_{DS}=-60V, V_{GS}=0, T_A=25^{\circ}C$<br>$V_{DS}=-60V, V_{GS}=0, T_A=125^{\circ}C$ | $I_{DSS}$     | -<br>- | -0.1<br>-10 | -1<br>-100 | $\mu A$  |
| Gate-source leakage current<br>$V_{GS}=-20V, V_{DS}=0$                                                                   | $I_{GSS}$     | -      | -10         | -100       |          |
| Drain-source on-state resistance<br>$V_{GS}=-4.5V, I_D=-0.14A$                                                           | $R_{DS(on)}$  | -      | 8           | 12         | $\Omega$ |
| Drain-source on-state resistance<br>$V_{GS}=-10V, I_D=-0.17A$                                                            | $R_{DS(on)}$  | -      | 5.8         | 8          |          |

<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  $T_A = 25^\circ\text{C}$ , unless otherwise specified

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

#### Dynamic Characteristics

|                              |              |                                                                                                |       |      |      |    |
|------------------------------|--------------|------------------------------------------------------------------------------------------------|-------|------|------|----|
| Transconductance             | $g_{fs}$     | $V_{DS} \leq 2 \cdot I_D \cdot R_{DS(on)max}$ ,<br>$I_D = -0.14\text{A}$                       | 0.065 | 0.13 | -    | S  |
| Input capacitance            | $C_{iss}$    | $V_{GS} = 0$ , $V_{DS} = -25\text{V}$ ,<br>$f = 1\text{MHz}$                                   | -     | 15   | 19   | pF |
| Output capacitance           | $C_{oss}$    |                                                                                                | -     | 6    | 8    |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                                | -     | 2    | 3    |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD} = -30\text{V}$ , $V_{GS} = -4.5\text{V}$ ,<br>$I_D = -0.14\text{A}$ , $R_G = 25\Omega$ | -     | 6.7  | 10   | ns |
| Rise time                    | $t_r$        |                                                                                                | -     | 16.2 | 24.3 |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                                | -     | 8.6  | 12.9 |    |
| Fall time                    | $t_f$        |                                                                                                | -     | 20.5 | 30.8 |    |

#### Gate Charge Characteristics

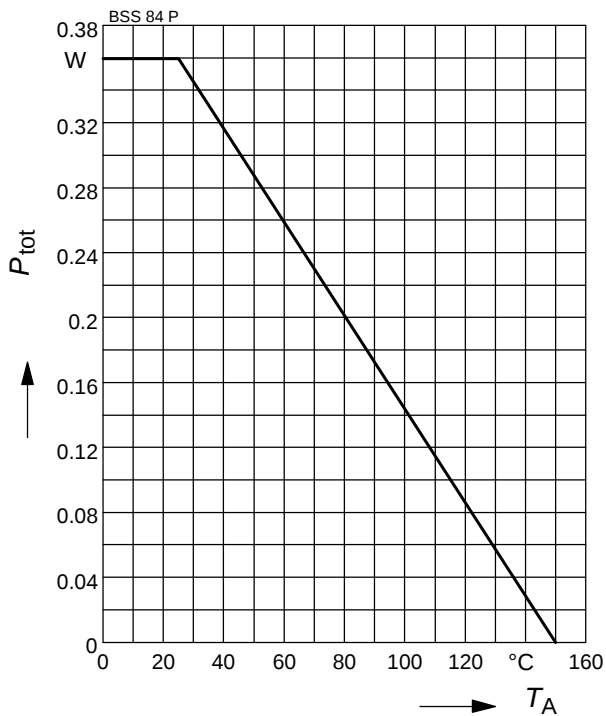
|                       |                 |                                                                                   |   |       |      |    |
|-----------------------|-----------------|-----------------------------------------------------------------------------------|---|-------|------|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD} = -48\text{V}$ , $I_D = -0.17\text{A}$                                    | - | 0.25  | 0.37 | nC |
| Gate to drain charge  | $Q_{gd}$        |                                                                                   | - | 0.3   | 0.45 |    |
| Gate charge total     | $Q_g$           | $V_{DD} = -48\text{V}$ , $I_D = -0.17\text{A}$ ,<br>$V_{GS} = 0$ to $-10\text{V}$ | - | 1     | 1.5  |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD} = -48\text{V}$ , $I_D = -0.17\text{A}$                                    | - | -3.42 | -    | V  |

#### Reverse Diode

|                                          |          |                                                                            |   |       |       |    |
|------------------------------------------|----------|----------------------------------------------------------------------------|---|-------|-------|----|
| Inverse diode continuous forward current | $I_S$    | $T_A = 25^\circ\text{C}$                                                   | - | -     | -0.17 | A  |
| Inv. diode direct current, pulsed        | $I_{SM}$ |                                                                            | - | -     | -0.68 |    |
| Inverse diode forward voltage            | $V_{SD}$ | $V_{GS} = 0$ , $I_F = -0.17\text{A}$                                       | - | -0.93 | -1.24 | V  |
| Reverse recovery time                    | $t_{rr}$ | $V_R = -30\text{V}$ , $I_F = I_S$ ,<br>$di_F/dt = 100\text{A}/\mu\text{s}$ | - | 23    | 34    | ns |
| Reverse recovery charge                  | $Q_{rr}$ |                                                                            | - | 10    | 15    | nC |

### 1 Power dissipation

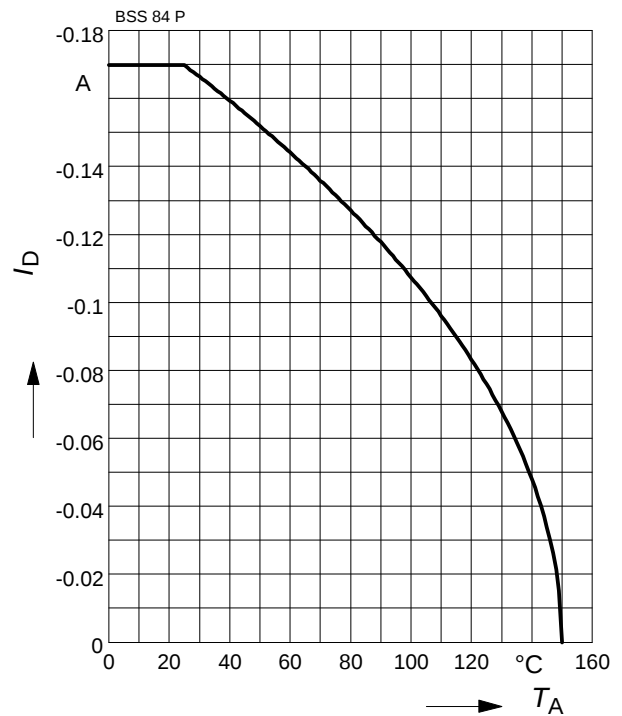
$$P_{\text{tot}} = f(T_A)$$



### 2 Drain current

$$I_D = f(T_A)$$

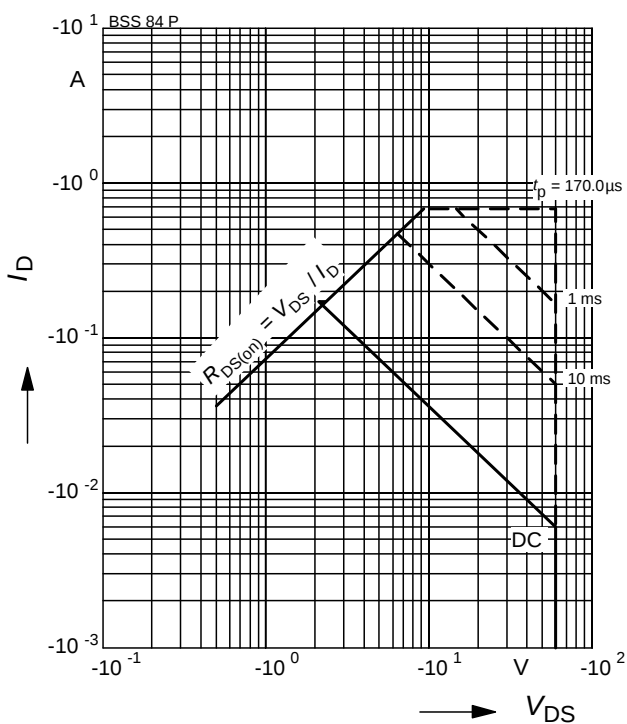
parameter:  $V_{GS} \geq 10$  V



### 3 Safe operating area

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

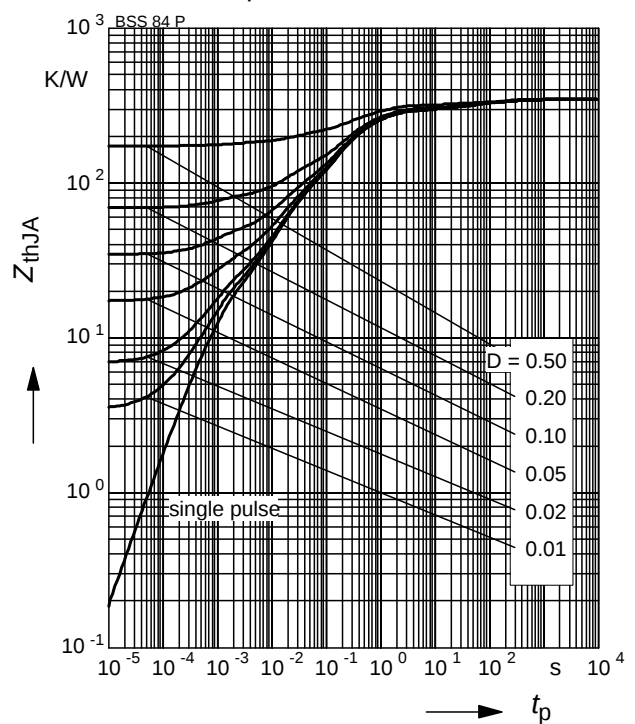
parameter:  $D = 0$ ,  $T_A = 25$  °C



### 4 Transient thermal impedance

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

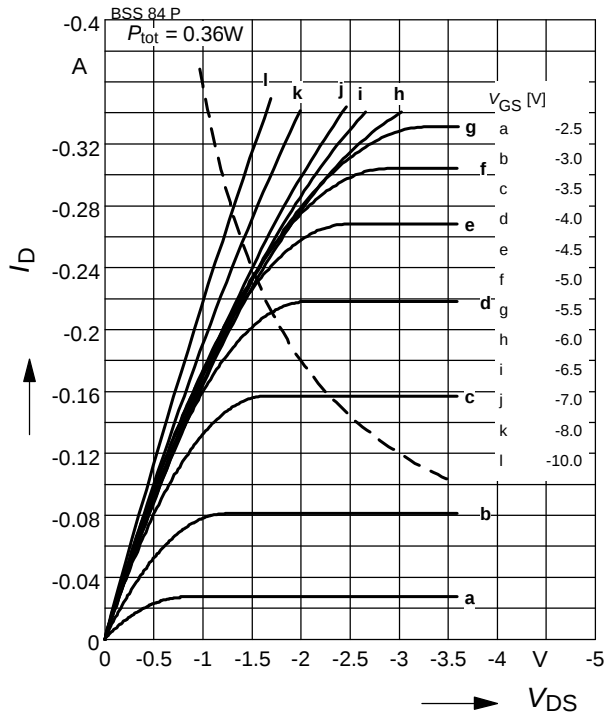
parameter:  $D = t_p/T$



### 5 Typ. output characteristic

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

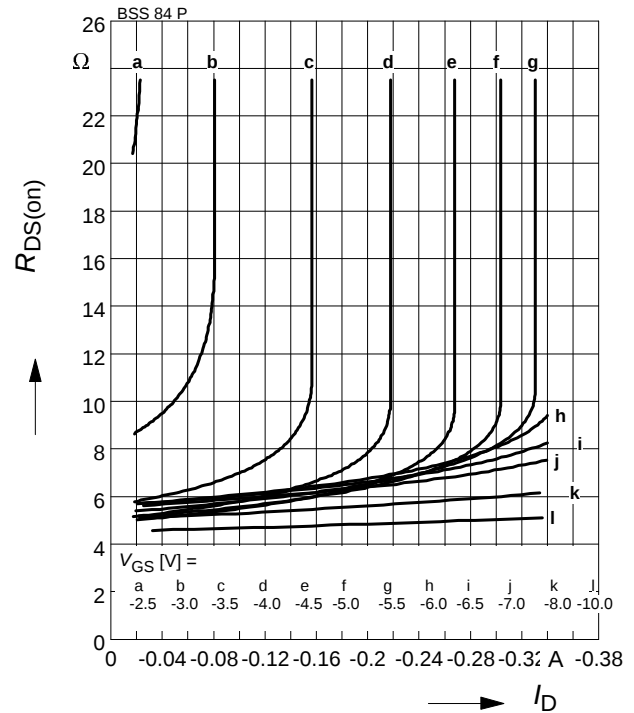
parameter:  $T_j = 25^\circ\text{C}$



### 6 Typ. drain-source on resistance

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

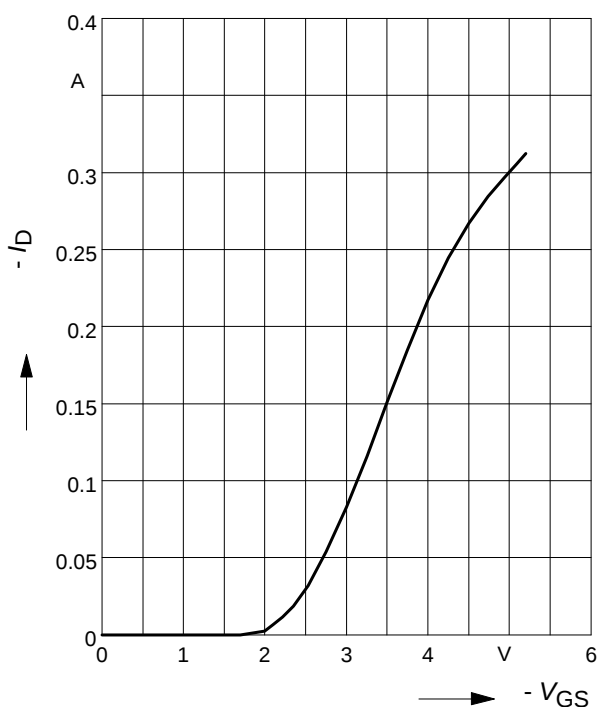
parameter:  $V_{GS}$ ;  $T_j = 25^\circ\text{C}$



### 7 Typ. transfer characteristics

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

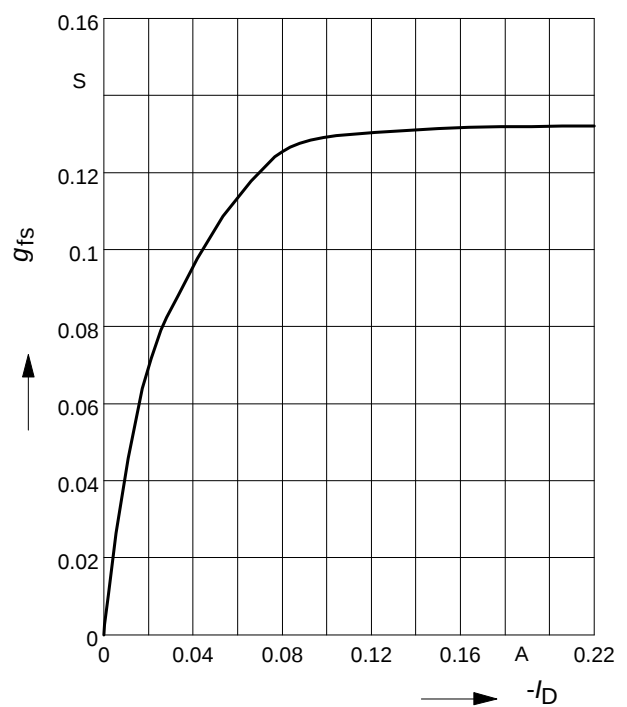
parameter:  $T_j = 25^\circ\text{C}$



### 8 Typ. forward transconductance

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

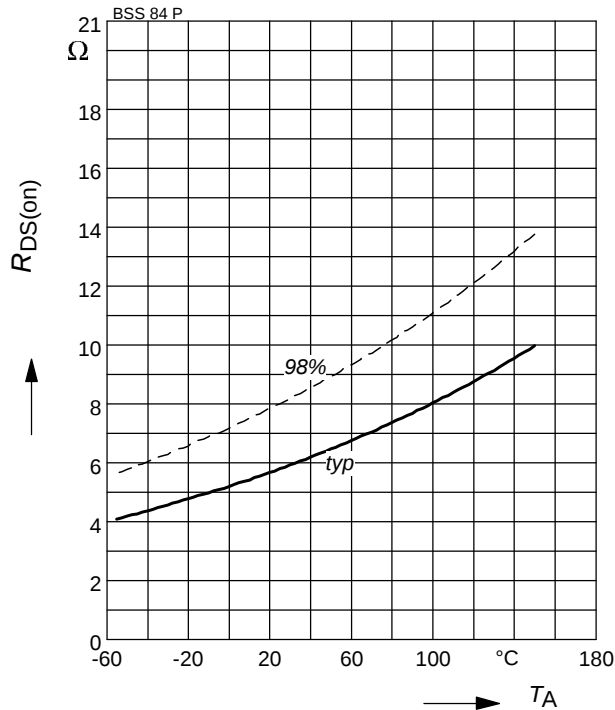
parameter:  $T_j = 25^\circ\text{C}$



### 9 Drain-source on-state resistance

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

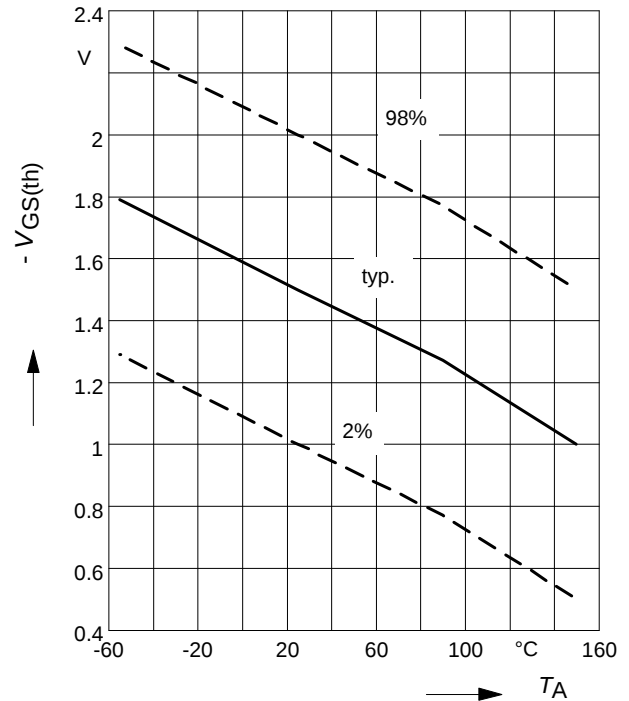
parameter:  $I_D = -0.17 \text{ A}$ ,  $V_{GS} = -10 \text{ V}$



### 10 Typ. gate threshold voltage

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

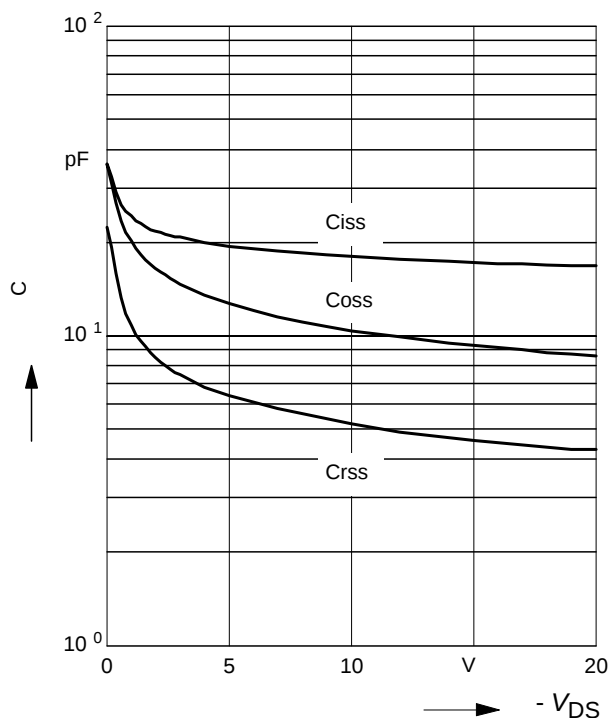
parameter:  $V_{GS} = V_{DS}$



### 11 Typ. capacitances

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

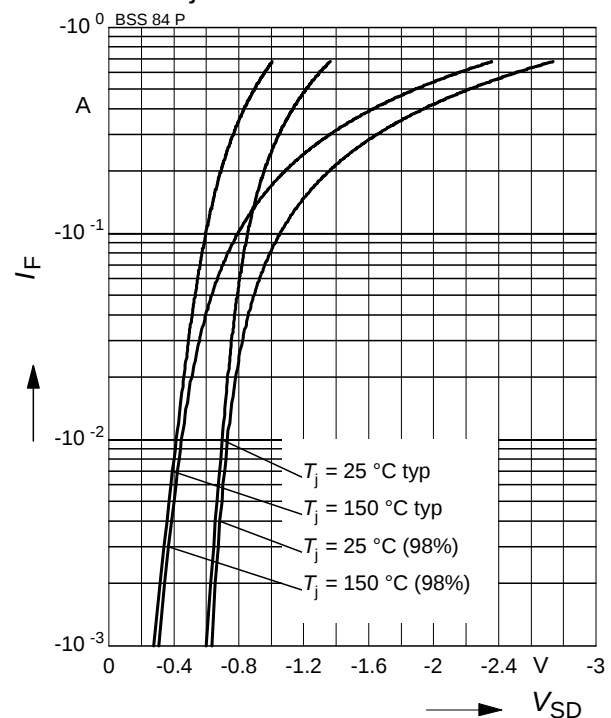
parameter:  $V_{GS}=0$ ,  $f=1 \text{ MHz}$



### 12 Forward character. of reverse diode

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

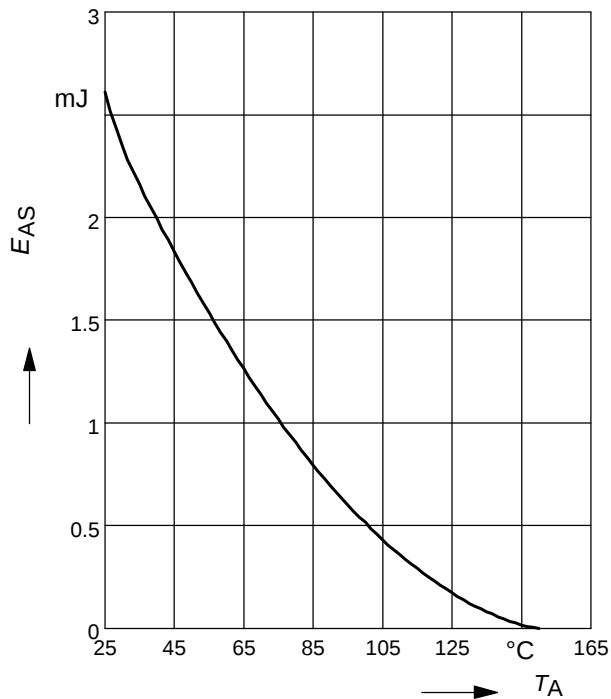
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



### 13 Typ. avalanche energy

$E_{AS} = f(T_A)$ , parameter:

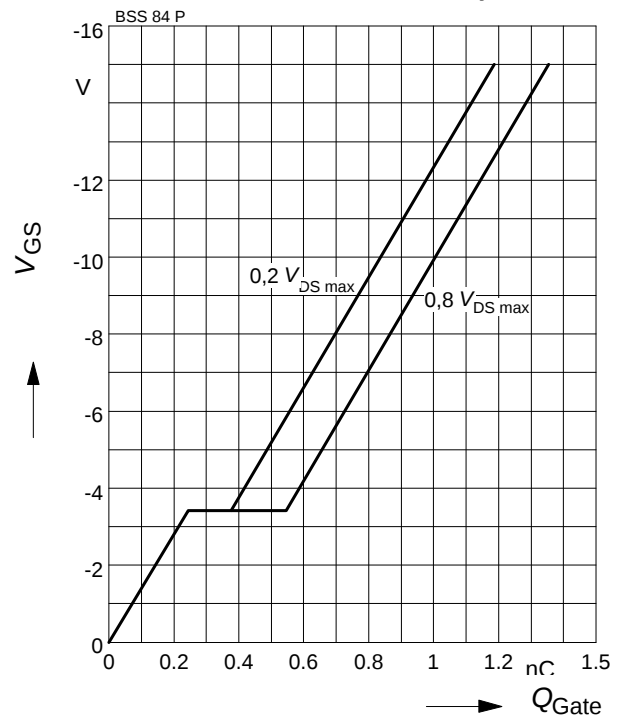
$I_D = -0.17 \text{ A}$ ,  $V_{DD} = -25 \text{ V}$ ,  $R_{GS} = 25 \Omega$



### 14 Typ. gate charge

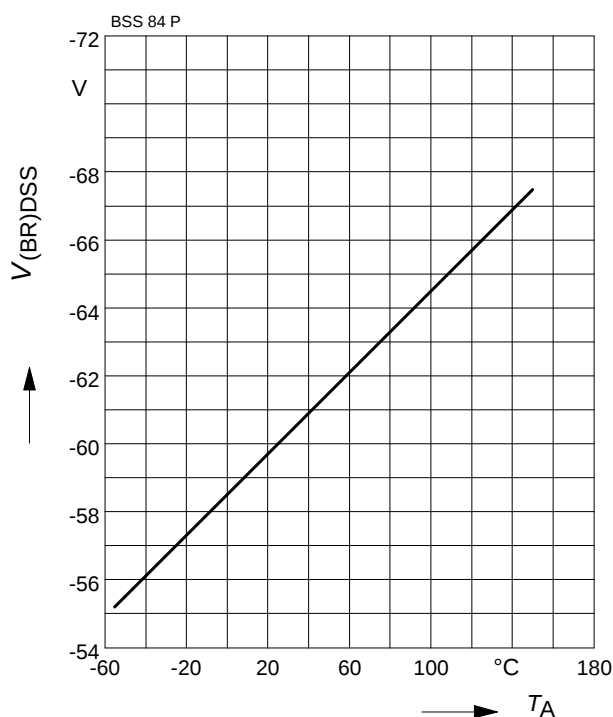
$V_{GS} = f(Q_{Gate})$

parameter:  $I_D = -0.17 \text{ A}$  pulsed;  $T_j = 25 \text{ °C}$



### 15 Drain-source breakdown voltage

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



**Published by**  
**Infineon Technologies AG,**  
**Bereichs Kommunikation**  
**St.-Martin-Strasse 53,**  
**D-81541 München**  
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