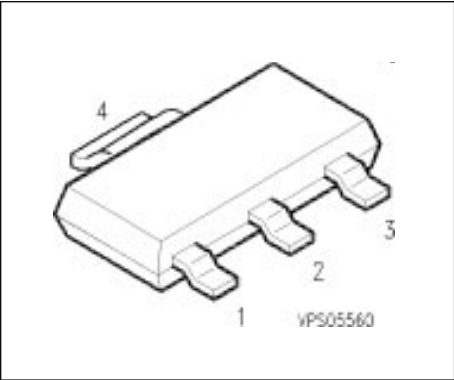


**SIPMOS® Small-Signal Transistor**

- N channel
- Enhancement mode
- Logic Level
- $V_{GS(th)} = 0.8...2.0V$



| Pin 1 | Pin 2 | Pin 3 | Pin 4 |
|-------|-------|-------|-------|
| G     | D     | S     | D     |

| Type   | $V_{DS}$      | $I_D$  | $R_{DS(on)}$              | Package | Marking |
|--------|---------------|--------|---------------------------|---------|---------|
| BSP 89 | 240 V         | 0.36 A | 6 $\Omega$                | SOT-223 | BSP 89  |
| Type   | Ordering Code |        | Tape and Reel Information |         |         |
| BSP 89 | Q67000-S652   |        | E6327                     |         |         |

**Maximum Ratings**

| Parameter                                                     | Symbol      | Values   | Unit |
|---------------------------------------------------------------|-------------|----------|------|
| Drain source voltage                                          | $V_{DS}$    | 240      | V    |
| Drain-gate voltage<br>$R_{GS} = 20 \text{ k}\Omega$           | $V_{DGR}$   | 240      |      |
| Gate source voltage                                           | $V_{GS}$    | $\pm 14$ |      |
| Gate-source peak voltage, aperiodic                           | $V_{gs}$    | $\pm 20$ |      |
| Continuous drain current<br>$T_A = 29 \text{ }^\circ\text{C}$ | $I_D$       | 0.36     | A    |
| DC drain current, pulsed<br>$T_A = 25 \text{ }^\circ\text{C}$ | $I_{Dpuls}$ | 1.44     |      |
| Power dissipation<br>$T_A = 25 \text{ }^\circ\text{C}$        | $P_{tot}$   | 1.7      | W    |

## Maximum Ratings

| Parameter                                                  | Symbol     | Values        | Unit |
|------------------------------------------------------------|------------|---------------|------|
| Chip or operating temperature                              | $T_j$      | -55 ... + 150 | °C   |
| Storage temperature                                        | $T_{stg}$  | -55 ... + 150 |      |
| Thermal resistance, chip to ambient air                    | $R_{thJA}$ | ≤ 72          | K/W  |
| Thermal resistance, junction-soldering point <sup>1)</sup> | $R_{thJS}$ | ≤ 12          |      |
| DIN humidity category, DIN 40 040                          |            | E             |      |
| IEC climatic category, DIN IEC 68-1                        |            | 55 / 150 / 56 |      |

1) Transistor on epoxy pcb 40 mm x 40 mm x 1,5 mm with 6 cm<sup>2</sup> copper area for drain connection

## 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>$V_{GS} = 0 \text{ V}$ , $I_D = 0.25 \text{ mA}$ , $T_j = 25^\circ\text{C}$                                                                                                                                                                  | $V_{(BR)DSS}$ | 240         | -              | -               | V  |
| Gate threshold voltage<br>$V_{GS} = V_{DS}$ , $I_D = 1 \text{ mA}$                                                                                                                                                                                                              | $V_{GS(th)}$  | 0.8         | 1.5            | 2               |    |
| Zero gate voltage drain current<br>$V_{DS} = 240 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $T_j = 25^\circ\text{C}$<br>$V_{DS} = 240 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $T_j = 125^\circ\text{C}$<br>$V_{DS} = 60 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $T_j = 25^\circ\text{C}$ | $I_{DSS}$     | -<br>-<br>- | 0.1<br>10<br>- | 1<br>100<br>0.2 | μA |
| 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>$V_{GS} = 10 \text{ V}$ , $I_D = 0.36 \text{ A}$<br>$V_{GS} = 4.5 \text{ V}$ , $I_D = 0.36 \text{ A}$                                                                                                                                       | $R_{DS(on)}$  | -<br>-      | 3.5<br>4       | 6<br>10         | Ω  |

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

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

### Dynamic Characteristics

|                                                                                                                           |              |      |      |     |    |
|---------------------------------------------------------------------------------------------------------------------------|--------------|------|------|-----|----|
| Transconductance<br>$V_{DS} \geq 2 * I_D * R_{DS(on)max}$ , $I_D = 0.36 \text{ A}$                                        | $g_{fs}$     | 0.14 | 0.36 | -   | S  |
| Input capacitance<br>$V_{GS} = 0 \text{ V}$ , $V_{DS} = 25 \text{ V}$ , $f = 1 \text{ MHz}$                               | $C_{iss}$    | -    | 80   | 110 | pF |
| Output capacitance<br>$V_{GS} = 0 \text{ V}$ , $V_{DS} = 25 \text{ V}$ , $f = 1 \text{ MHz}$                              | $C_{oss}$    | -    | 15   | 25  |    |
| Reverse transfer capacitance<br>$V_{GS} = 0 \text{ V}$ , $V_{DS} = 25 \text{ V}$ , $f = 1 \text{ MHz}$                    | $C_{rss}$    | -    | 8    | 12  |    |
| Turn-on delay time<br>$V_{DD} = 30 \text{ V}$ , $V_{GS} = 10 \text{ V}$ , $I_D = 0.28 \text{ A}$<br>$R_{GS} = 50 \Omega$  | $t_{d(on)}$  | -    | 5    | 8   | ns |
| Rise time<br>$V_{DD} = 30 \text{ V}$ , $V_{GS} = 10 \text{ V}$ , $I_D = 0.28 \text{ A}$<br>$R_{GS} = 50 \Omega$           | $t_r$        | -    | 10   | 15  |    |
| Turn-off delay time<br>$V_{DD} = 30 \text{ V}$ , $V_{GS} = 10 \text{ V}$ , $I_D = 0.28 \text{ A}$<br>$R_{GS} = 50 \Omega$ | $t_{d(off)}$ | -    | 30   | 40  |    |
| Fall time<br>$V_{DD} = 30 \text{ V}$ , $V_{GS} = 10 \text{ V}$ , $I_D = 0.28 \text{ A}$<br>$R_{GS} = 50 \Omega$           | $t_f$        | -    | 20   | 27  |    |

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

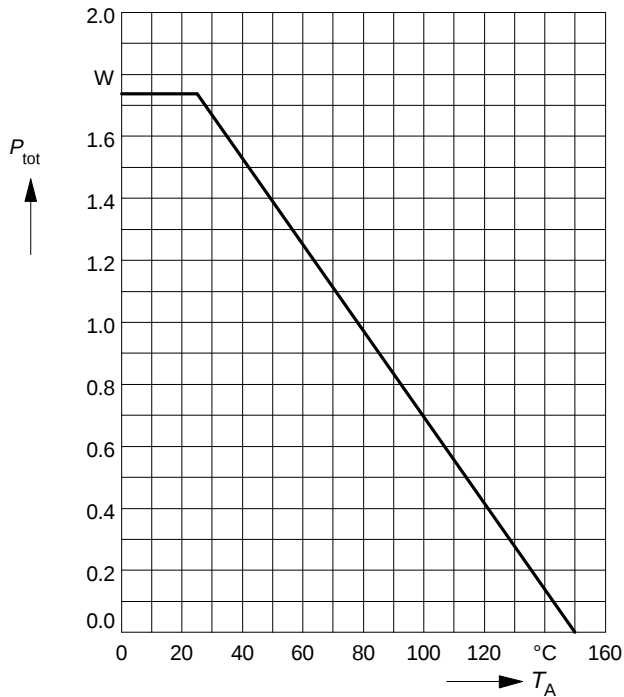
| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

## Reverse Diode

|                                                                                                           |          |   |     |      |   |
|-----------------------------------------------------------------------------------------------------------|----------|---|-----|------|---|
| Inverse diode continuous forward current<br>$T_A = 25^\circ\text{C}$                                      | $I_S$    | - | -   | 0.36 | A |
| Inverse diode direct current,pulsed<br>$T_A = 25^\circ\text{C}$                                           | $I_{SM}$ | - | -   | 1.44 |   |
| Inverse diode forward voltage<br>$V_{GS} = 0\text{ V}$ , $I_F = 0.72\text{ A}$ , $T_j = 25^\circ\text{C}$ | $V_{SD}$ | - | 1.1 | 1.4  | V |

## Power dissipation

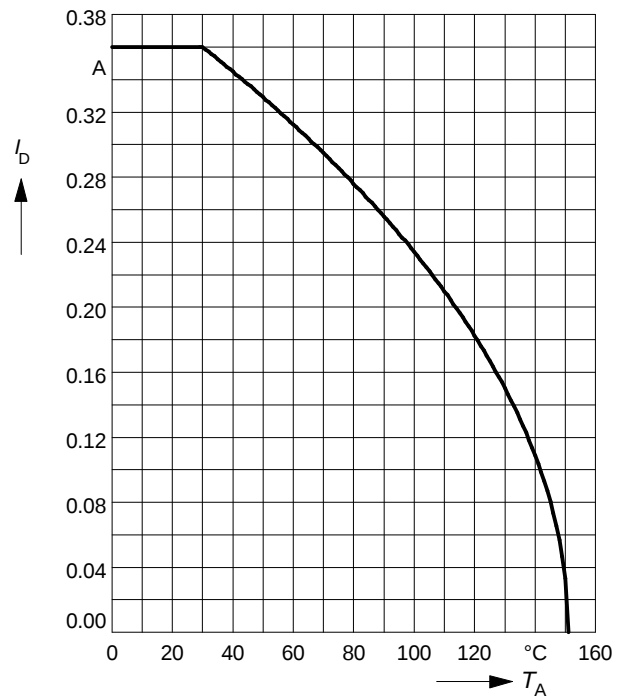
$$P_{\text{tot}} = f(T_A)$$



## Drain current

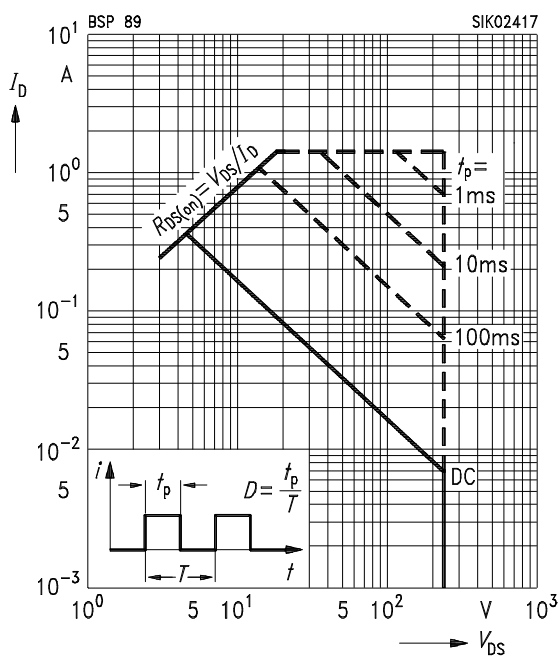
$$I_D = f(T_A)$$

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



## Safe operating area $I_D = f(V_{DS})$

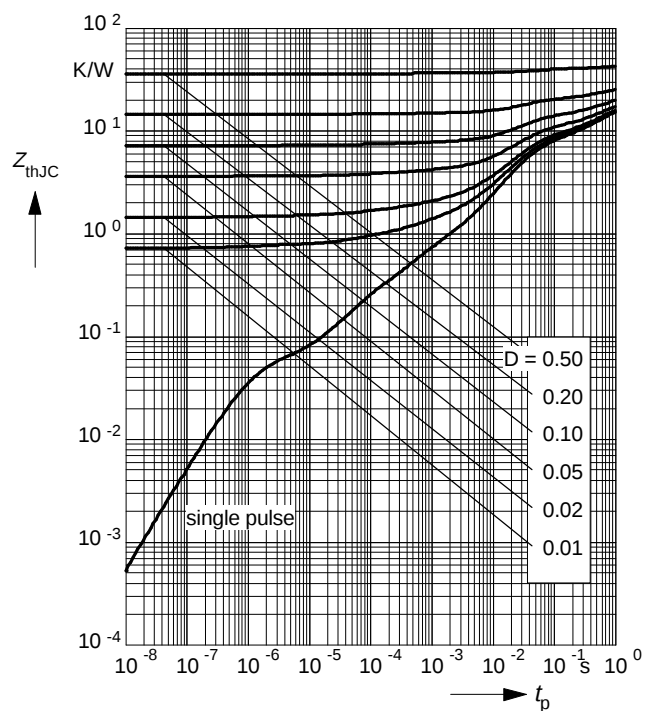
parameter:  $D = 0$ ,  $T_C = 25^\circ\text{C}$



## Transient thermal impedance

$$Z_{\text{th JA}} = f(t_p)$$

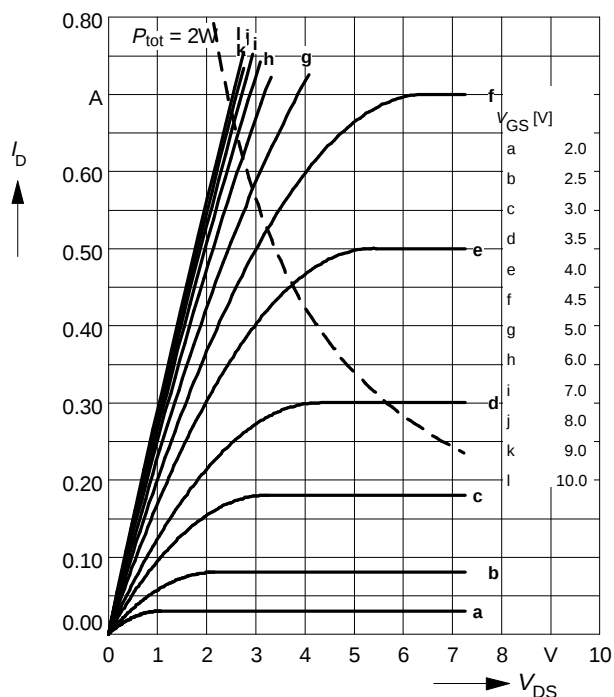
parameter:  $D = t_p / T$



## Typ. output characteristics

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

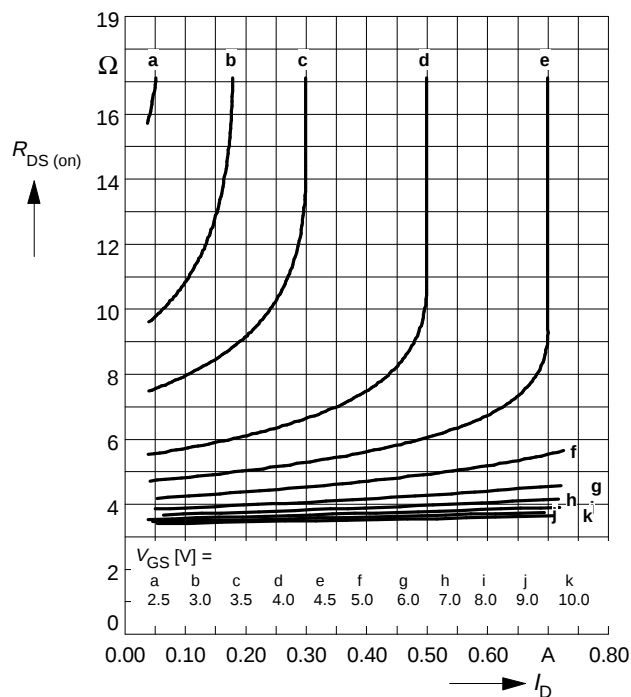
parameter:  $t_p = 80 \mu s$



## Typ. drain-source on-resistance

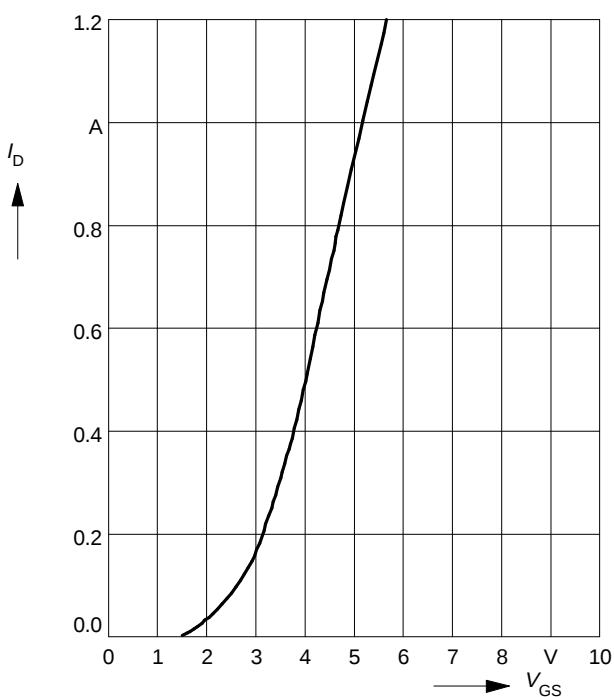
$$R_{DS(on)} = f(I_D)$$

parameter:  $t_p = 80 \mu s, T_j = 25^\circ C$



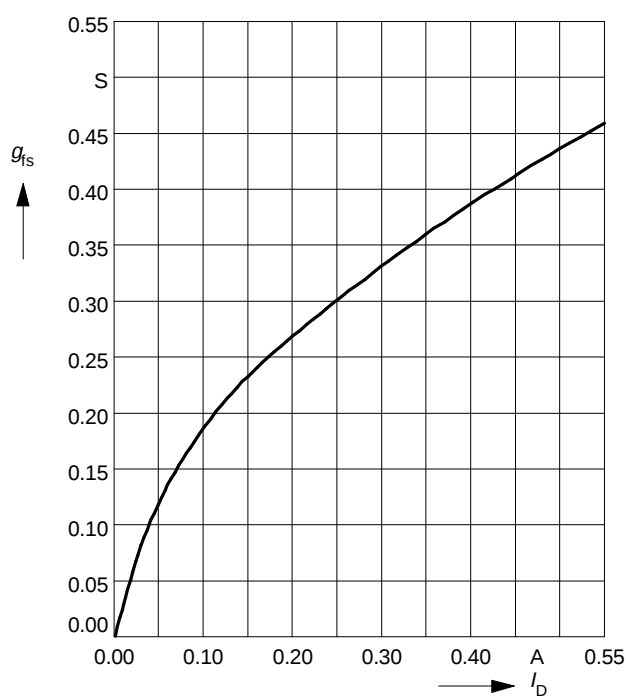
## Typ. transfer characteristics $I_D = f(V_{GS})$

parameter:  $t_p = 80 \mu s$



## Typ. forward transconductance $g_{fs} = f(I_D)$

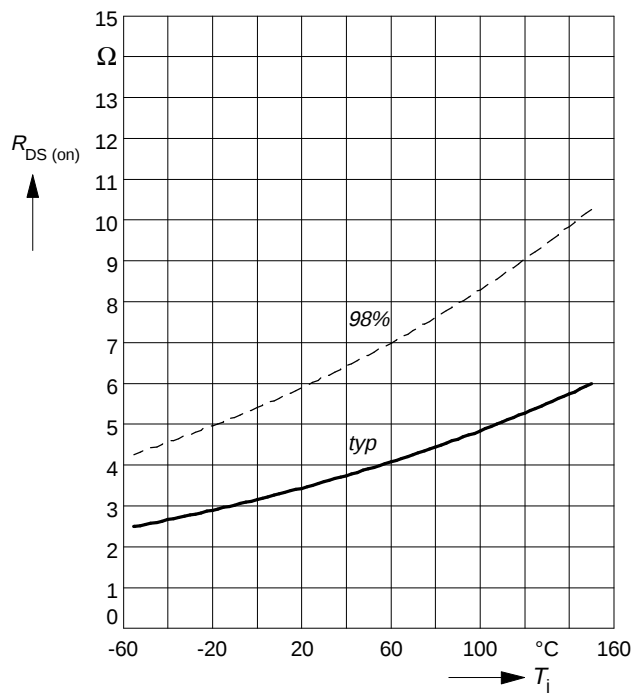
parameter:  $t_p = 80 \mu s$



## Drain-source on-resistance

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

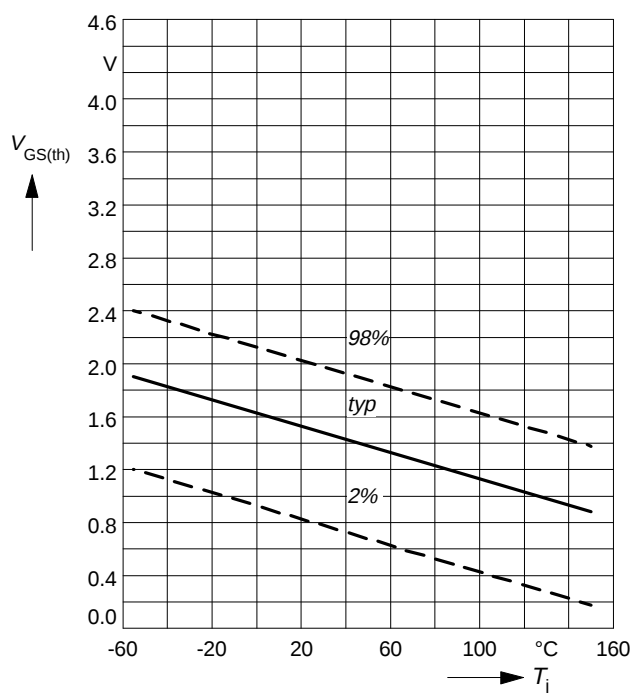
parameter:  $I_D = 0.36 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



## Gate threshold voltage

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

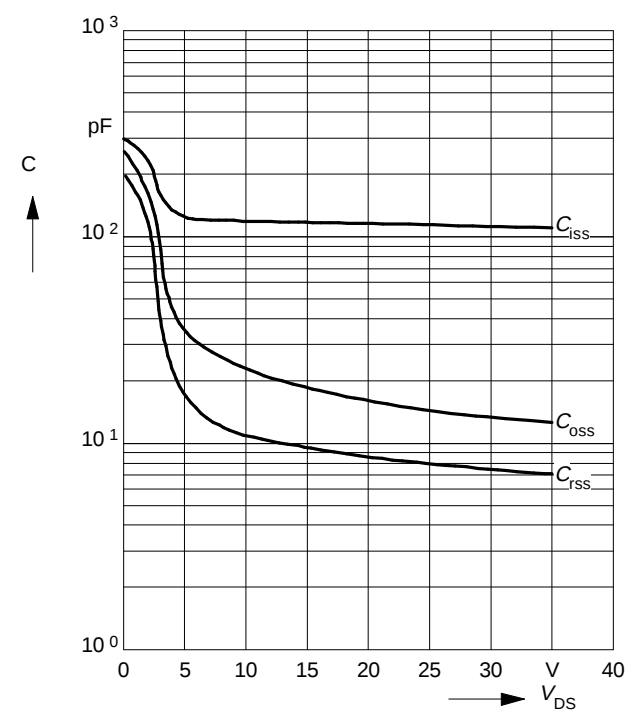
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 1 \text{ mA}$



## Typ. capacitances

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

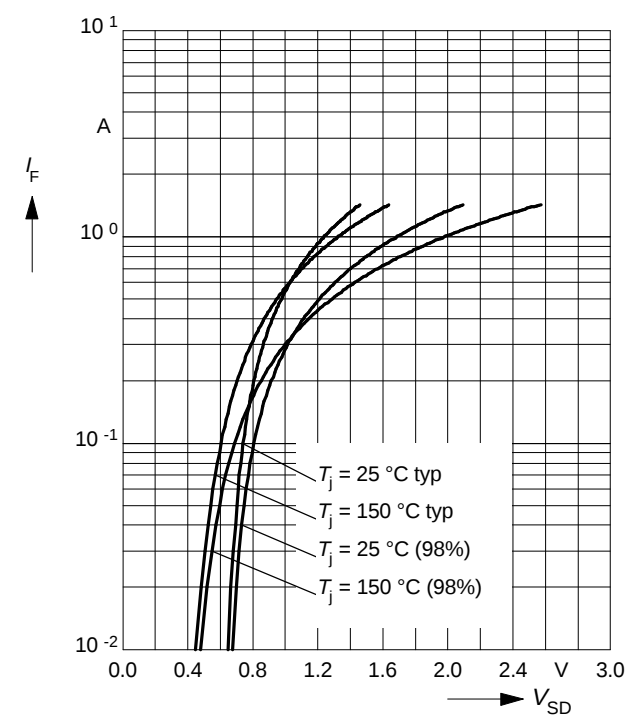
parameter:  $V_{GS} = 0 \text{ V}$ ,  $f = 1 \text{ MHz}$



## Forward characteristics of reverse diode

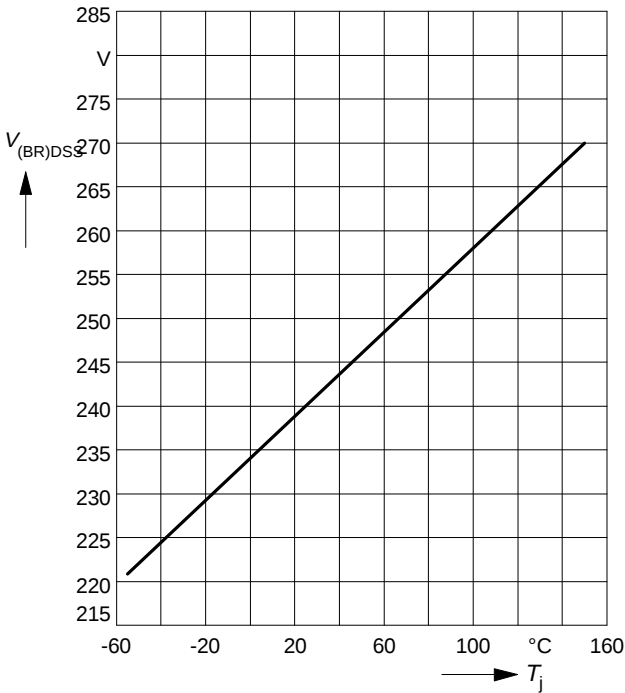
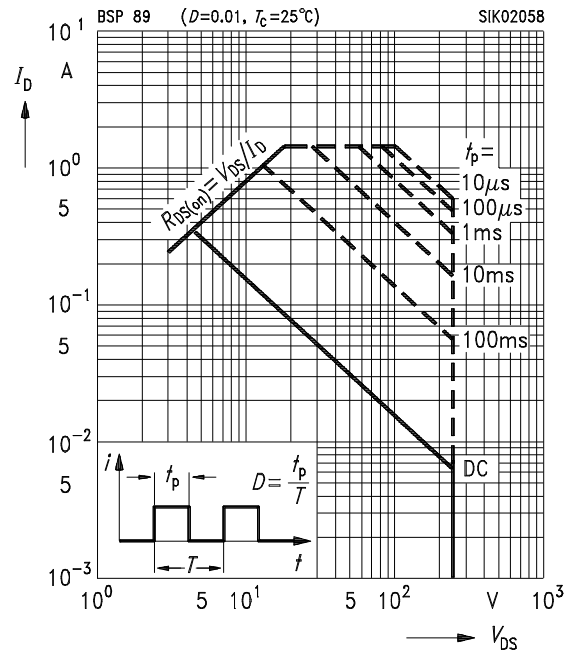
$$I_F = f(V_{SD})$$

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



**Drain-source breakdown voltage**

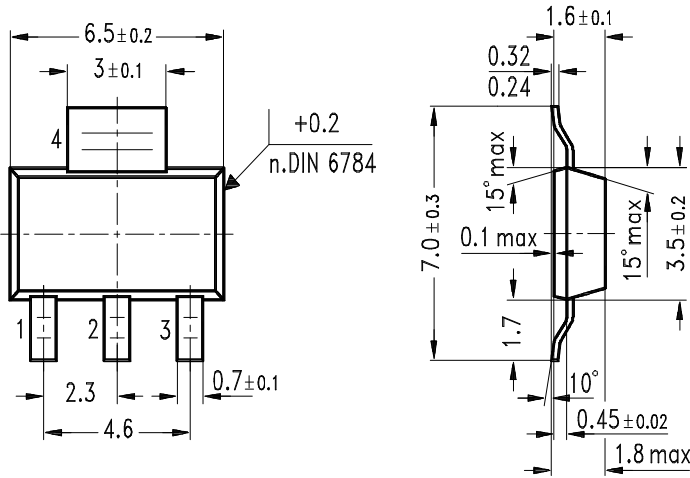
$$V_{(BR)DSS} = f(T_j)$$

**Safe operating area  $I_D = f(V_{DS})$** parameter :  $D = 0.01$ ,  $T_C = 25^\circ\text{C}$ 

**Package outlines**

SOT-223

Dimensions in mm



GPS05560