

## SIPMOS<sup>®</sup> Small-Signal-Transistor

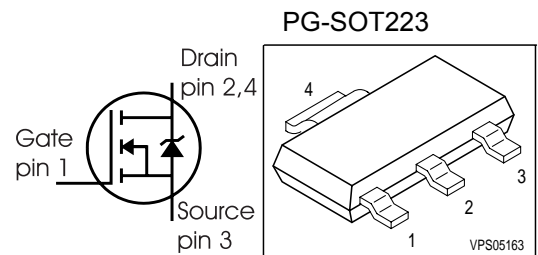
### Feature

- N-Channel
- Enhancement mode
- Logic Level
- dv/dt rated
- Pb-free lead plating; RoHS compliant
- 4.5V rated
- Qualified according to AEC Q101



### Product Summary

|              |      |          |
|--------------|------|----------|
| $V_{DS}$     | 240  | V        |
| $R_{DS(on)}$ | 6    | $\Omega$ |
| $I_D$        | 0.35 | A        |



| Type  | Package   | Tape and Reel Information | Marking | Packaging |
|-------|-----------|---------------------------|---------|-----------|
| BSP89 | PG-SOT223 | L6327: 1000 pcs/reel      | BSP89   | Non dry   |

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

| Parameter  | Symbol              | Value             | Unit              |
|--|---------------------|-------------------|-------------------|
| Continuous drain current   | $I_D$               |                   | A                 |
| $T_A=25\text{ }^\circ\text{C}$   |                     | 0.35              |                   |
| $T_A=70\text{ }^\circ\text{C}$   |                     | 0.28              |                   |
| Pulsed drain current   | $I_{D\text{ puls}}$ | 1.4               |                   |
| $T_A=25\text{ }^\circ\text{C}$   |                     |                   |                   |
| Reverse diode dv/dt  | dv/dt               | 6                 | kV/ $\mu\text{s}$ |
| $I_S=0.35\text{A}$ , $V_{DS}=192\text{V}$ , $di/dt=200\text{A}/\mu\text{s}$ , $T_{jmax}=150\text{ }^\circ\text{C}$ |                     |                   |                   |
| Gate source voltage  | $V_{GS}$            | $\pm 20$          | V                 |
| ESD class (JEDEC22-A114-HBM)   |                     | 1A (>250V, <500V) |                   |
| Power dissipation  | $P_{tot}$           | 1.8               | W                 |
| $T_A=25\text{ }^\circ\text{C}$   |                     |                   |                   |
| 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.      |      |
| <b>Characteristics</b>  |            |        |      |           |      |
| Thermal resistance, junction - soldering point<br>(Pin 4)   | $R_{thJS}$ | -      | -    | 25        | K/W  |
| SMD version, device on PCB:<br>@ min. footprint<br>@ 6 cm <sup>2</sup> cooling area <sup>1)</sup> | $R_{thJA}$ | -      | -    | 115<br>70 |      |

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

| Parameter  | Symbol        | Values |      |           | Unit          |
|--|---------------|--------|------|-----------|---------------|
|  |               | min.   | typ. | max.      |               |
| <b>Static Characteristics</b>  |               |        |      |           |               |
| Drain-source breakdown voltage<br>$V_{GS}=0, I_D=250\mu\text{A}$   | $V_{(BR)DSS}$ | 240    | -    | -         | V             |
| Gate threshold voltage, $V_{GS} = V_{DS}$<br>$I_D=108\mu\text{A}$  | $V_{GS(th)}$  | 0.8    | 1.4  | 1.8       |               |
| Zero gate voltage drain current<br>$V_{DS}=240\text{V}, V_{GS}=0, T_j=25^\circ\text{C}$<br>$V_{DS}=240\text{V}, V_{GS}=0, T_j=150^\circ\text{C}$ | $I_{DSS}$     | -      | -    | 0.1<br>10 | $\mu\text{A}$ |
| Gate-source leakage current<br>$V_{GS}=20\text{V}, V_{DS}=0$   | $I_{GSS}$     | -      | -    | 10        |               |
| Drain-source on-state resistance<br>$V_{GS}=4.5\text{V}, I_D=0.32\text{A}$   | $R_{DS(on)}$  | -      | 4.9  | 7.5       | $\Omega$      |
| Drain-source on-state resistance<br>$V_{GS}=10\text{V}, I_D=0.35\text{A}$  | $R_{DS(on)}$  | -      | 4.2  | 6         |               |

<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  $T_j = 25\text{ }^\circ\text{C}$ , 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>$I_D = 0.28\text{A}$                    | 0.18 | 0.36 | -    | S  |
| Input capacitance            | $C_{iss}$    | $V_{GS} = 0$ , $V_{DS} = 25\text{V}$ ,<br>$f = 1\text{MHz}$                                | -    | 80   | 140  | pF |
| Output capacitance           | $C_{oss}$    |  | -    | 11.2 | 16.8 |    |
| Reverse transfer capacitance | $C_{rss}$    |  | -    | 5.2  | 7.8  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD} = 120\text{V}$ , $V_{GS} = 10\text{V}$ ,<br>$I_D = 0.35\text{A}$ , $R_G = 6\Omega$ | -    | 4    | 6    | ns |
| Rise time                    | $t_r$        |  | -    | 3.5  | 5.3  |    |
| Turn-off delay time          | $t_{d(off)}$ |  | -    | 15.9 | 23.8 |    |
| Fall time                    | $t_f$        |  | -    | 18.4 | 27.6 |    |

**Gate Charge Characteristics**

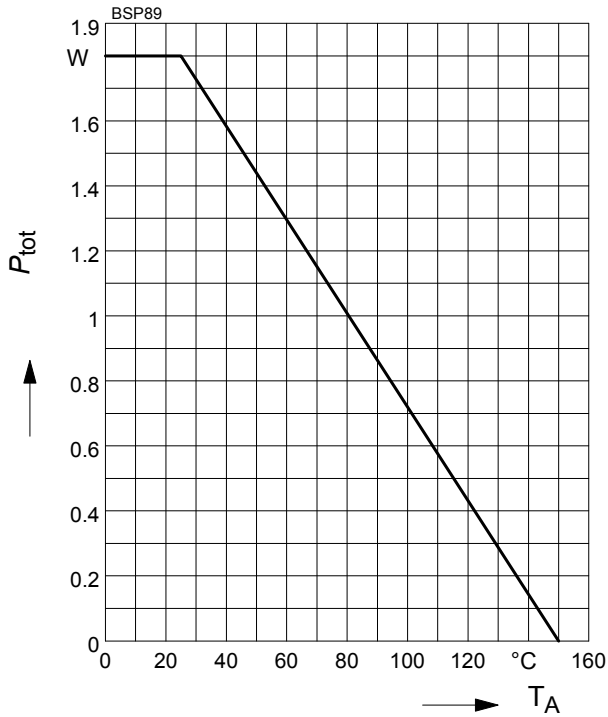
|                       |                 |   |   |     |     |    |
|-----------------------|-----------------|---|---|-----|-----|----|
| Gate to source charge | $Q_{gs}$        | $V_{DD} = 192\text{V}$ , $I_D = 0.35\text{A}$                                   | - | 0.2 | 0.3 | nC |
| Gate to drain charge  | $Q_{gd}$        |   | - | 2   | 3   |    |
| Gate charge total     | $Q_g$           | $V_{DD} = 192\text{V}$ , $I_D = 0.35\text{A}$ ,<br>$V_{GS} = 0$ to $10\text{V}$ | - | 4.3 | 6.4 |    |
| Gate plateau voltage  | $V_{(plateau)}$ | $V_{DD} = 192\text{V}$ , $I_D = 0.35\text{A}$                                   | - | 3.1 | -   | V  |

**Reverse Diode**

|  |          |  |   |      |      |    |
|--|----------|--|---|------|------|----|
| Inverse diode continuous forward current | $I_S$    | $T_A = 25\text{ }^\circ\text{C}$   | - | -    | 0.35 | A  |
| Inv. diode direct current, pulsed        | $I_{SM}$ |  | - | -    | 1.4  |    |
| Inverse diode forward voltage            | $V_{SD}$ | $V_{GS} = 0$ , $I_F = I_S$   | - | 0.85 | 1.2  | V  |
| Reverse recovery time                    | $t_{rr}$ | $V_R = 120\text{V}$ , $I_F = I_S$ ,<br>$di_F/dt = 100\text{A}/\mu\text{s}$ | - | 67   | 100  | ns |
| Reverse recovery charge                  | $Q_{rr}$ |  | - | 123  | 184  | nC |

### 1 Power dissipation

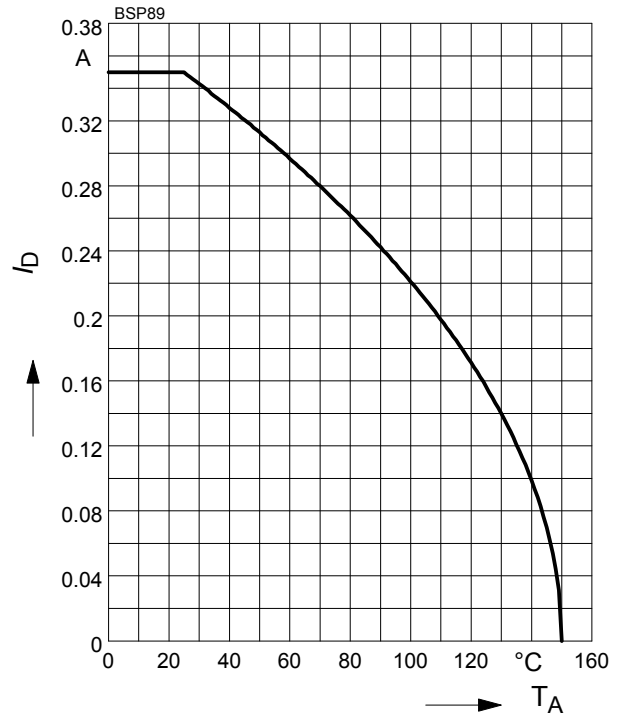
$$P_{tot} = f(T_A)$$



### 2 Drain current

$$I_D = f(T_A)$$

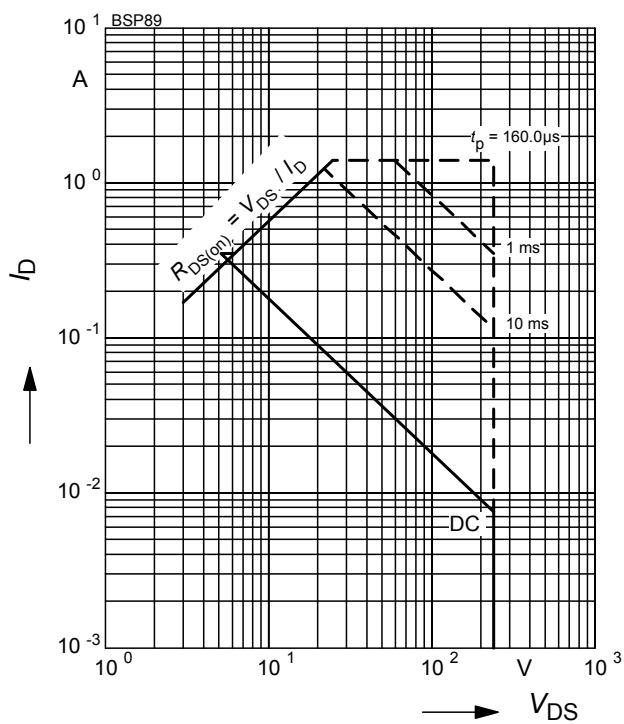
parameter:  $V_{GS} \geq 10 \text{ V}$



### 3 Safe operating area

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

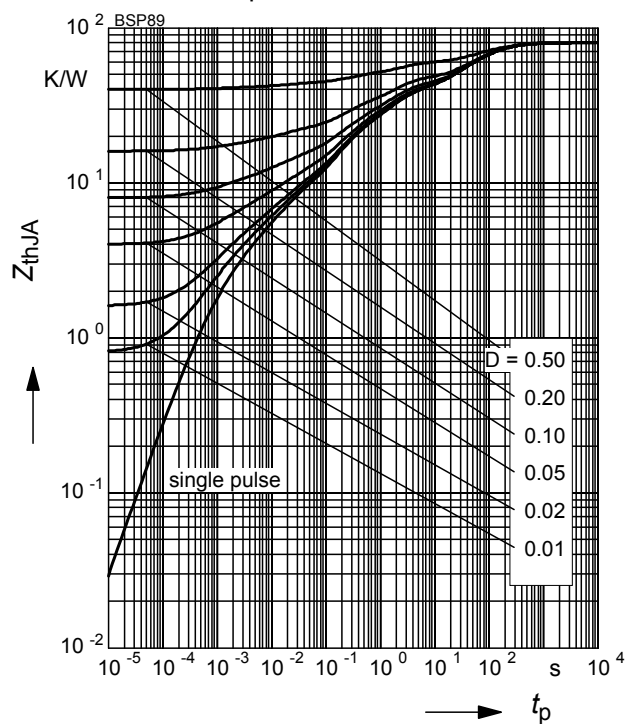
parameter:  $D = 0, T_A = 25 \text{ °C}$



### 4 Transient thermal impedance

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

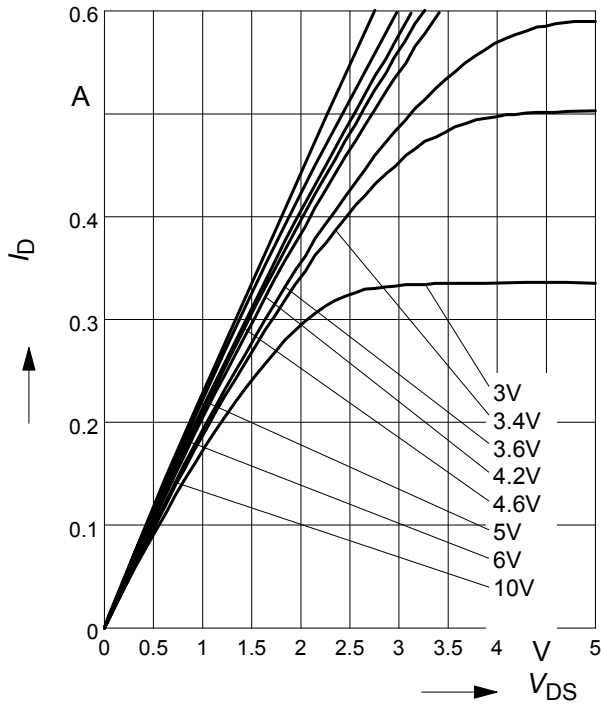
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

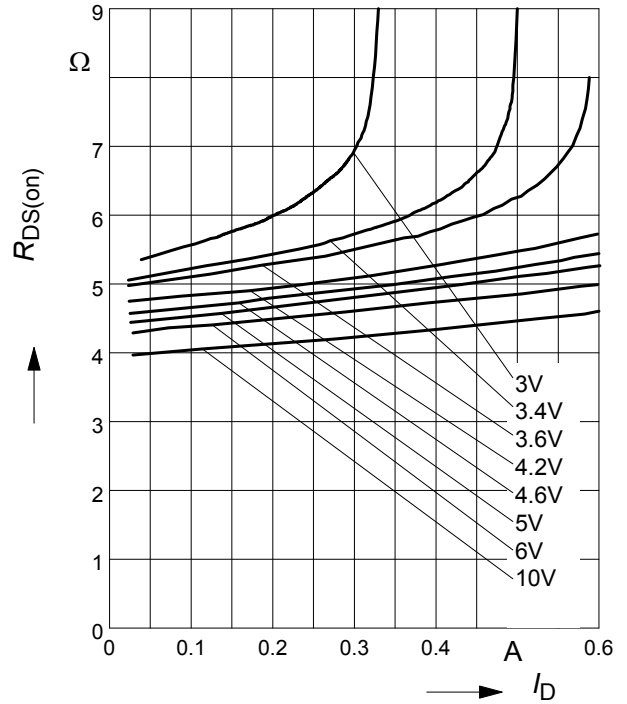
parameter:  $T_j = 25\text{ }^\circ\text{C}$ ,  $V_{GS}$



**6 Typ. drain-source on resistance**

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

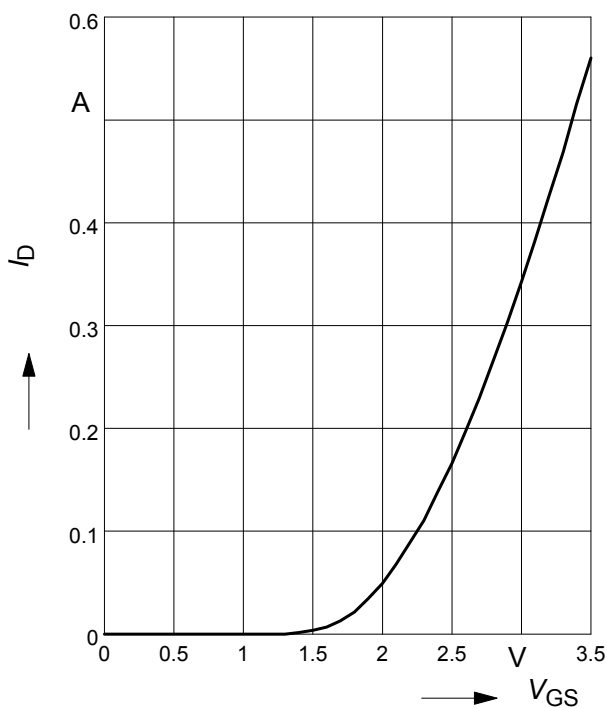
parameter:  $T_j = 25\text{ }^\circ\text{C}$ ,  $V_{GS}$



**7 Typ. transfer characteristics**

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

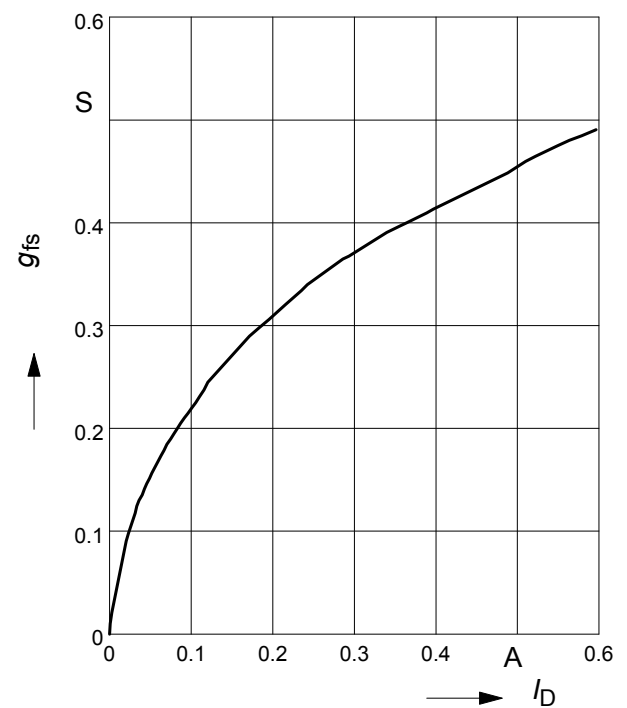
parameter:  $T_j = 25\text{ }^\circ\text{C}$



**8 Typ. forward transconductance**

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

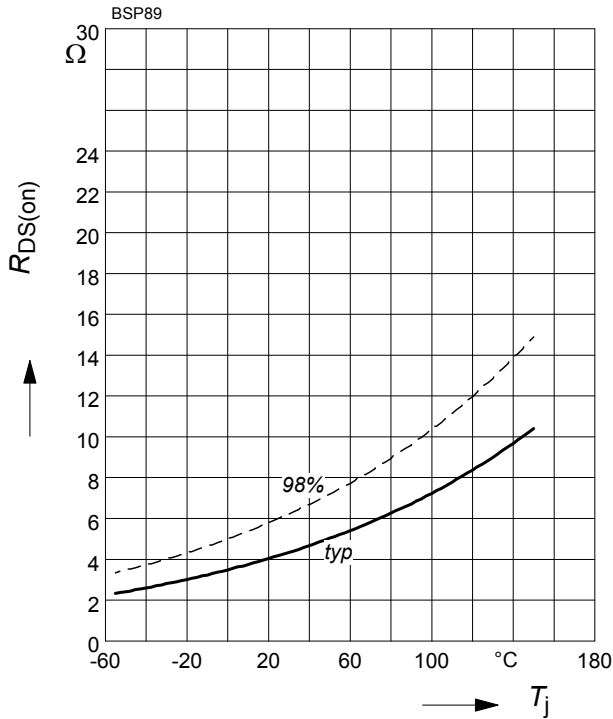
parameter:  $T_j = 25\text{ }^\circ\text{C}$



### 9 Drain-source on-state resistance

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

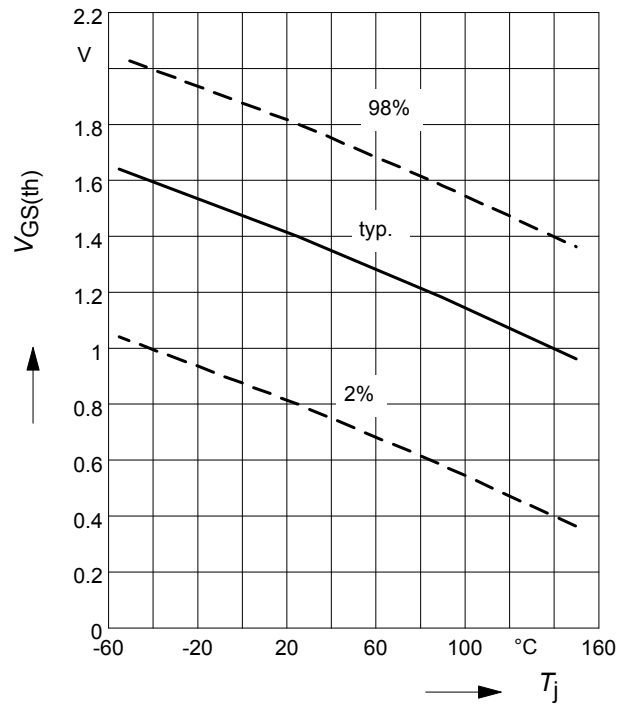
parameter :  $I_D = 0.35 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



### 10 Typ. gate threshold voltage

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

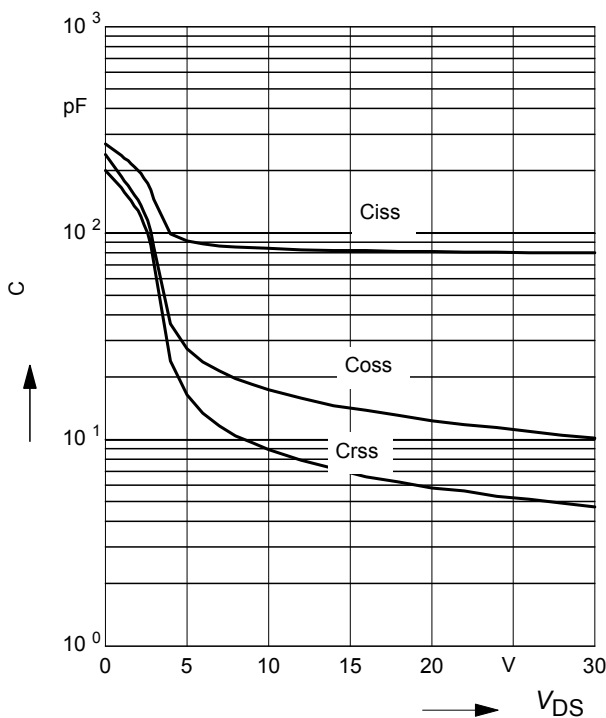
parameter:  $V_{GS} = V_{DS}$ ;  $I_D = 108 \mu\text{A}$



### 11 Typ. capacitances

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

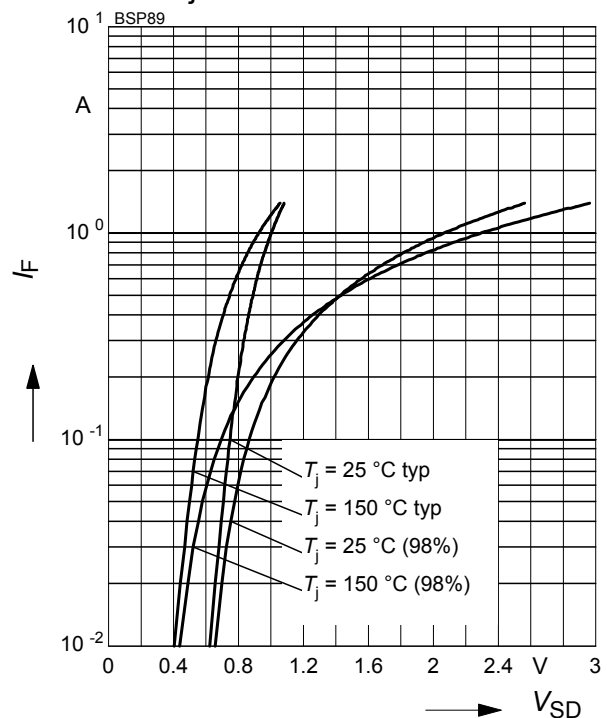
parameter:  $V_{GS}=0$ ,  $f=1 \text{ MHz}$ ,  $T_j = 25 \text{ }^\circ\text{C}$



### 12 Forward character. of reverse diode

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

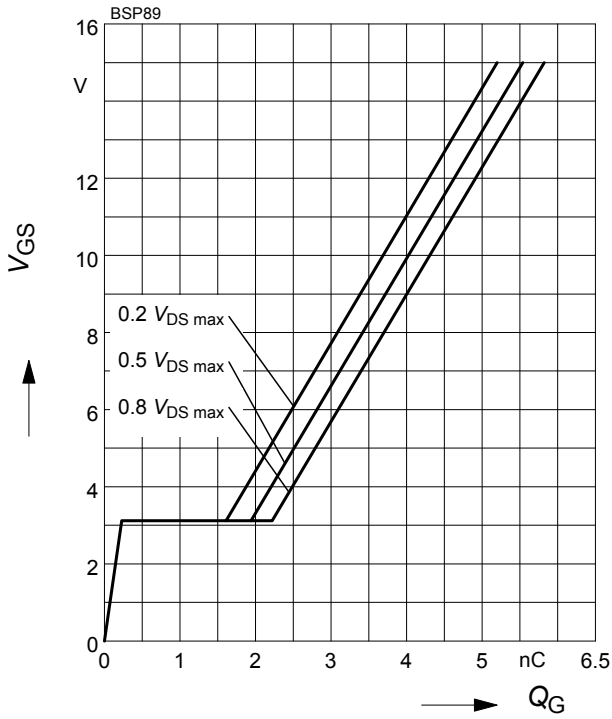
parameter:  $T_j$



**13 Typ. gate charge**

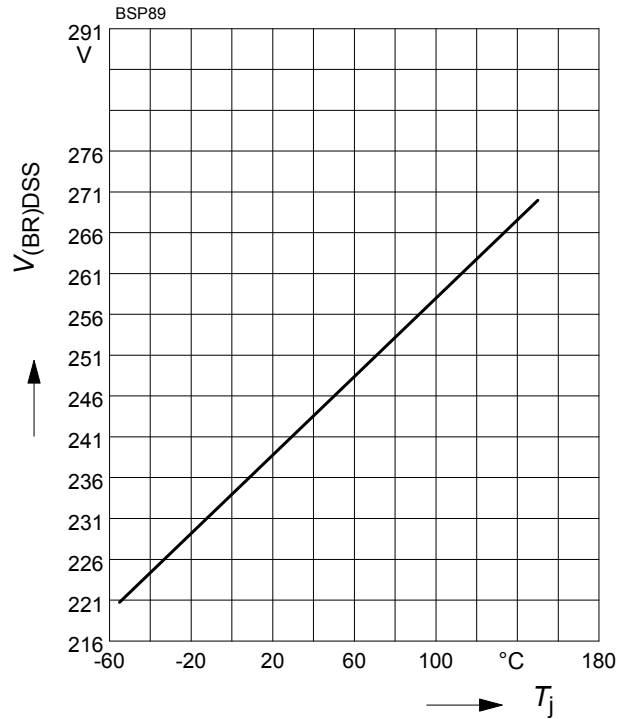
$V_{GS} = f(Q_G)$ ; parameter:  $V_{DS}$ ,

$I_D = 0.35$  A pulsed,  $T_j = 25$  °C



**14 Drain-source breakdown voltage**

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



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