

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

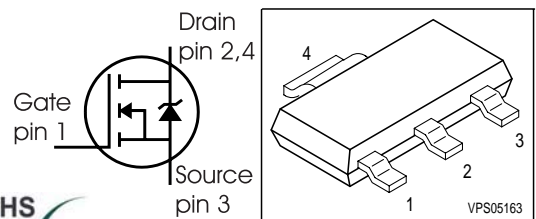
### Feature

- N-Channel
- Enhancement mode
- Logic Level
- dv/dt rated
- Pb-free lead plating; RoHS compliant
- 4.5V rated
- Qualified according to AEC Q101
- Halogen-free according to IEC61249-2-21

### Product Summary

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

PG-SOT223



Type	Package	Tape and Reel Information	Marking	Packaging
BSP89	PG-SOT223	H6327: 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 (JESD22-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 (Pin 4)	$R_{thJS}$	-	-	25	K/W
SMD version, device on PCB: @ min. footprint @ 6 cm <sup>2</sup> cooling area <sup>1)</sup>	$R_{thJA}$	-	-	115 70	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Static Characteristics</b>					
Drain-source breakdown voltage $V_{GS}=0, I_D=250\mu\text{A}$	$V_{(BR)DSS}$	240	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D=108\mu\text{A}$	$V_{GS(th)}$	0.8	1.4	1.8	
Zero gate voltage drain current $V_{DS}=240\text{V}, V_{GS}=0, T_j=25^\circ\text{C}$ $V_{DS}=240\text{V}, V_{GS}=0, T_j=150^\circ\text{C}$	$I_{DSS}$	-	-	0.1 10	$\mu\text{A}$
Gate-source leakage current $V_{GS}=20\text{V}, V_{DS}=0$	$I_{GSS}$	-	-	10	
Drain-source on-state resistance $V_{GS}=4.5\text{V}, I_D=0.32\text{A}$	$R_{DS(on)}$	-	4.9	7.5	$\Omega$
Drain-source on-state resistance $V_{GS}=10\text{V}, I_D=0.35\text{A}$	$R_{DS(on)}$	-	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	$g_{fs}$	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 0.28\text{A}$	0.18	0.36	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$	-	80	140	pF
Output capacitance	$C_{oss}$		-	11.2	16.8	
Reverse transfer capacitance	$C_{rss}$		-	5.2	7.8	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 120\text{V}$ , $V_{GS} = 10\text{V}$ , $I_D = 0.35\text{A}$ , $R_G = 6\Omega$	-	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**

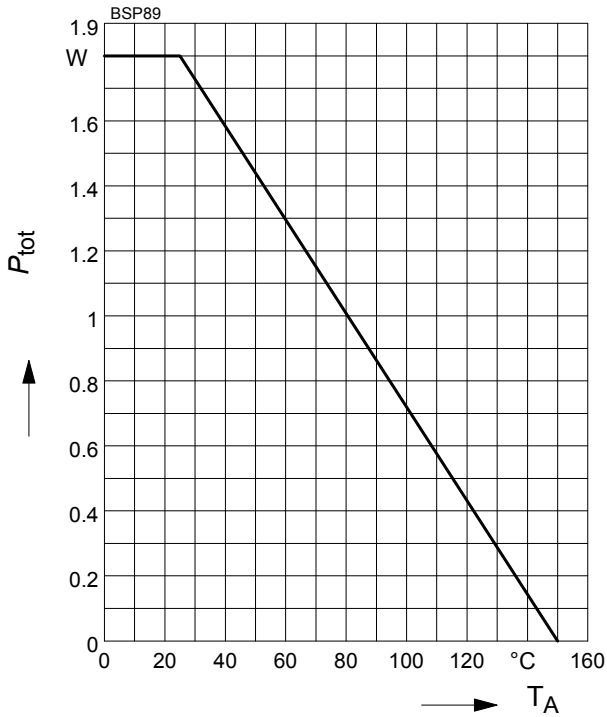
Gate to source charge	$Q_{gs}$	$V_{DD} = 192\text{V}$ , $I_D = 0.35\text{A}$	-	0.2	0.3	nC
Gate to drain charge	$Q_{gd}$		-	2	3	
Gate charge total	$Q_g$	$V_{DD} = 192\text{V}$ , $I_D = 0.35\text{A}$ , $V_{GS} = 0$ to $10\text{V}$	-	4.3	6.4	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 192\text{V}$ , $I_D = 0.35\text{A}$	-	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	$t_{rr}$	$V_R = 120\text{V}$ , $I_F = I_S$ , $di_F/dt = 100\text{A}/\mu\text{s}$	-	67	100	ns
Reverse recovery charge	$Q_{rr}$		-	123	184	nC

### 1 Power dissipation

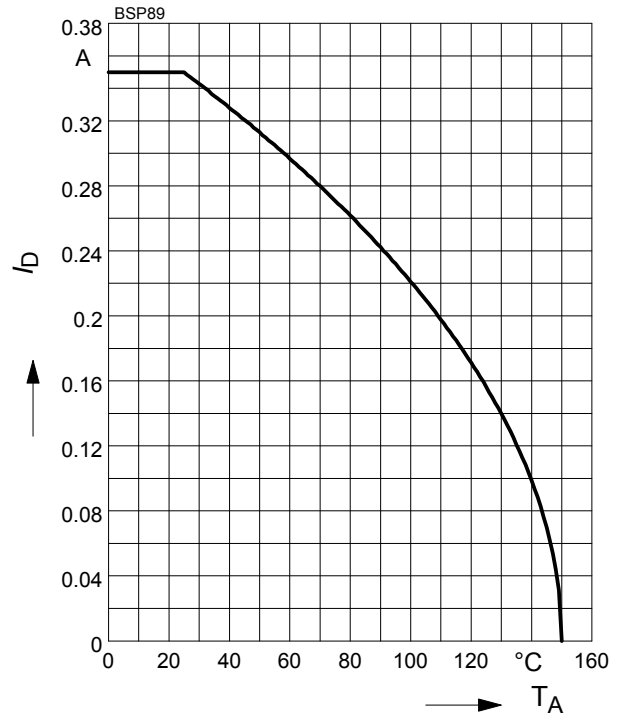
$$P_{tot} = f(T_A)$$



### 2 Drain current

$$I_D = f(T_A)$$

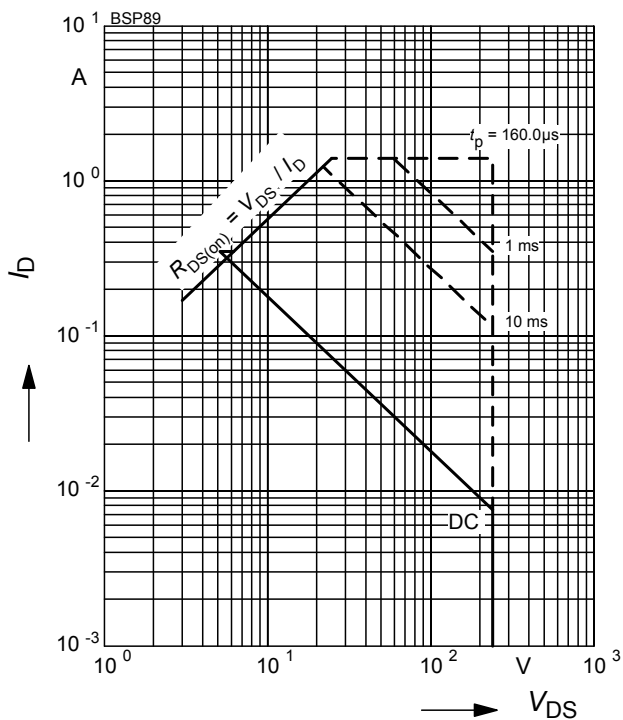
parameter:  $V_{GS} \geq 10 \text{ V}$



### 3 Safe operating area

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

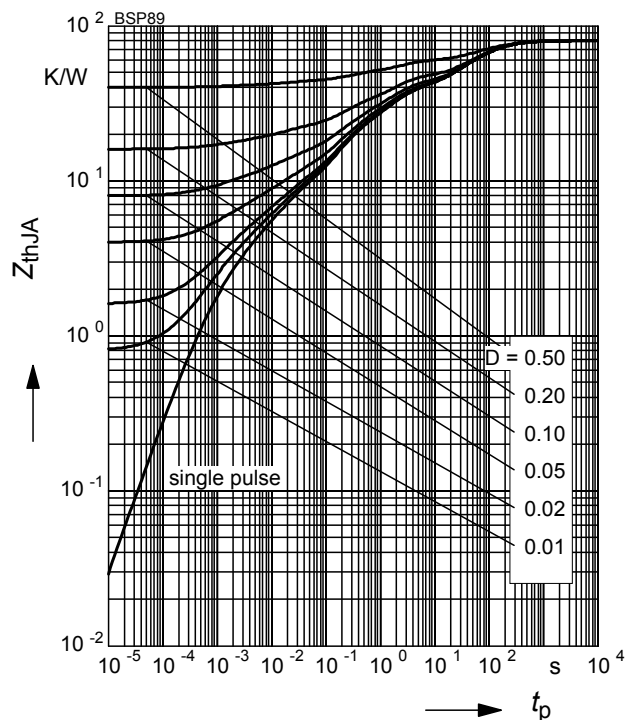
parameter:  $D = 0, T_A = 25 \text{ °C}$



### 4 Transient thermal impedance

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

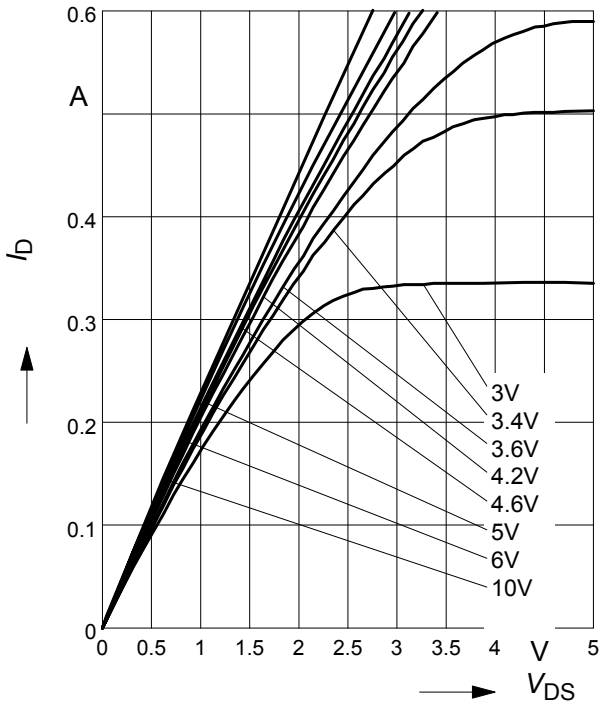
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

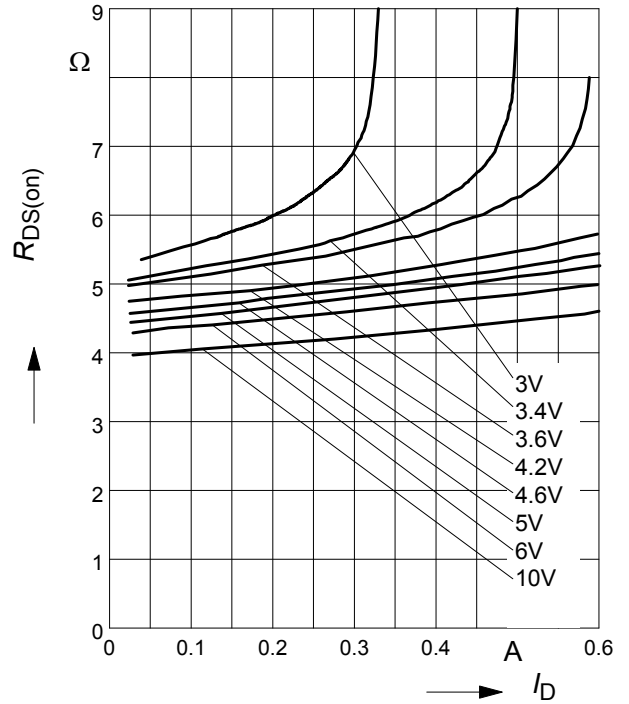
parameter:  $T_j = 25\text{ }^\circ\text{C}$ ,  $V_{GS}$



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

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

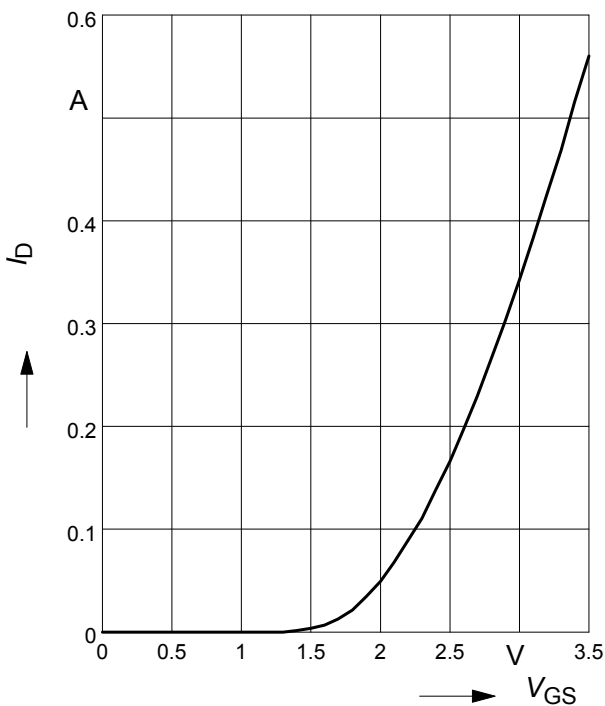
parameter:  $T_j = 25\text{ }^\circ\text{C}$ ,  $V_{GS}$



**7 Typ. transfer characteristics**

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

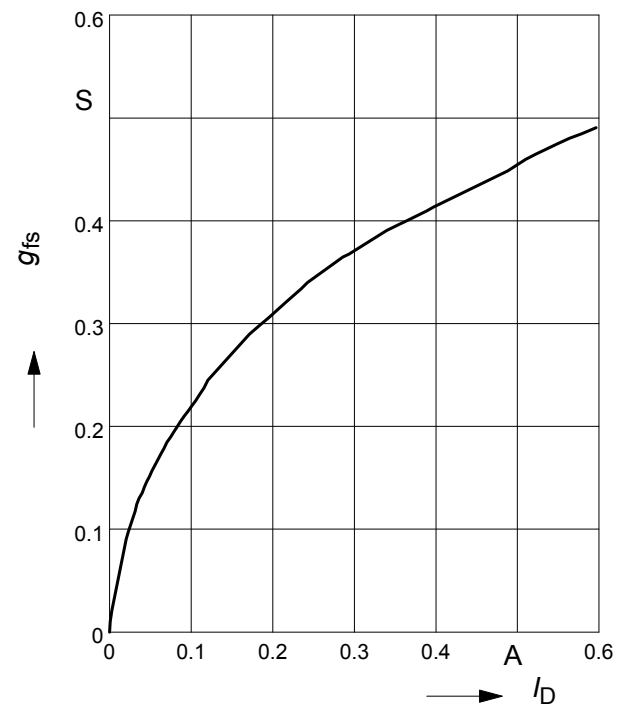
parameter:  $T_j = 25\text{ }^\circ\text{C}$



**8 Typ. forward transconductance**

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

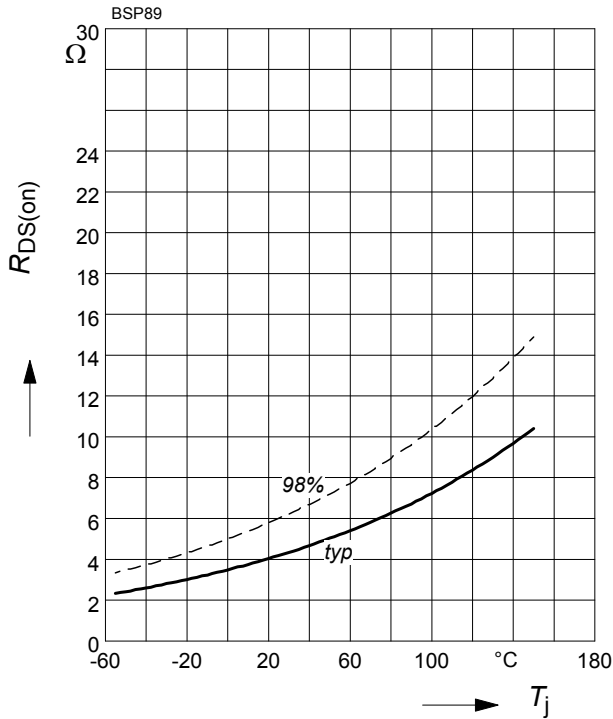
parameter:  $T_j = 25\text{ }^\circ\text{C}$



### 9 Drain-source on-state resistance

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

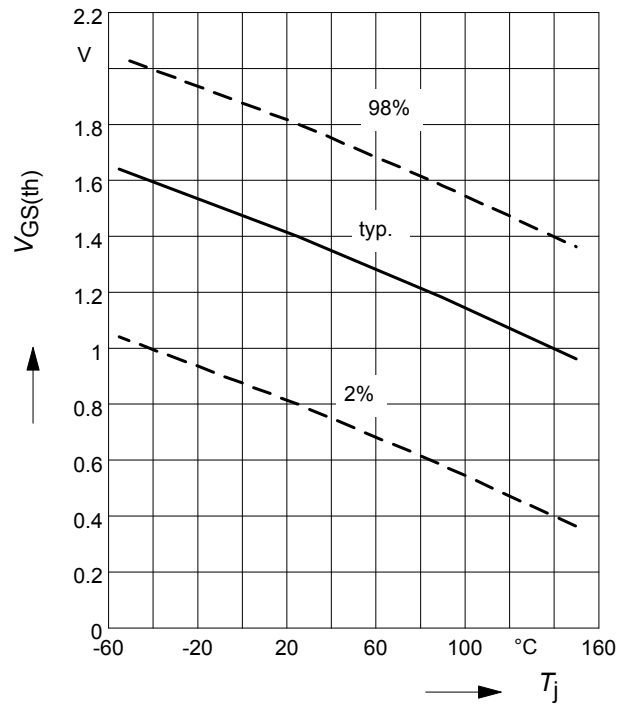
parameter :  $I_D = 0.35 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



### 10 Typ. gate threshold voltage

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

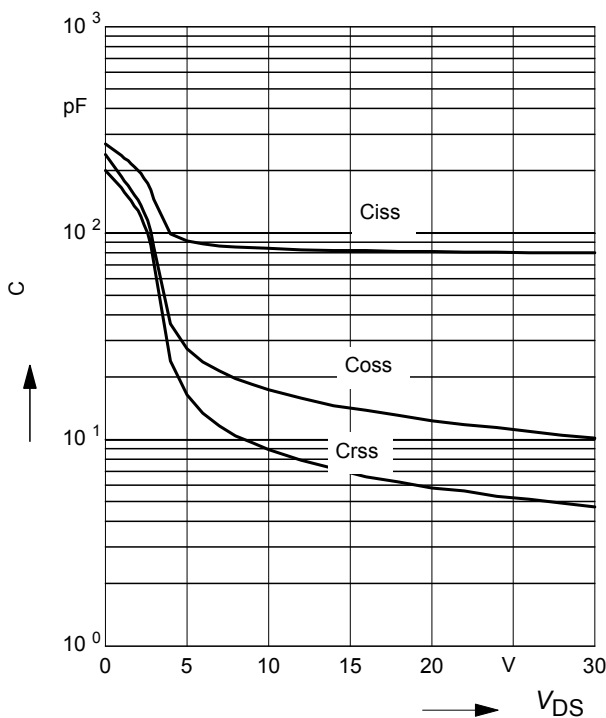
parameter:  $V_{GS} = V_{DS}$ ;  $I_D = 108 \mu\text{A}$



### 11 Typ. capacitances

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

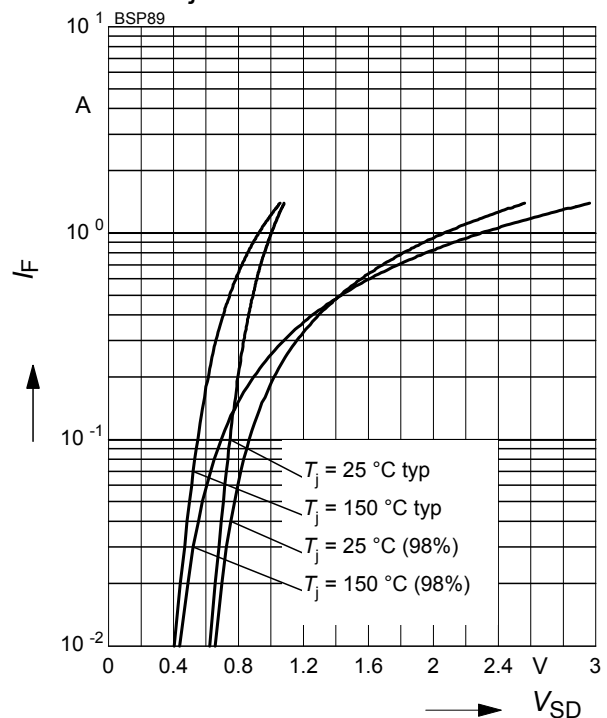
parameter:  $V_{GS}=0$ ,  $f=1 \text{ MHz}$ ,  $T_j = 25 \text{ }^\circ\text{C}$



### 12 Forward character. of reverse diode

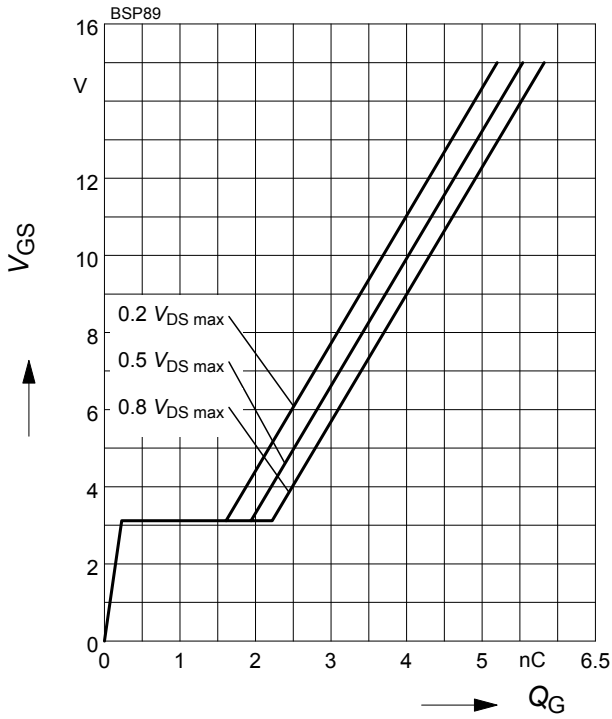
$$I_F = f(V_{SD})$$

parameter:  $T_j$



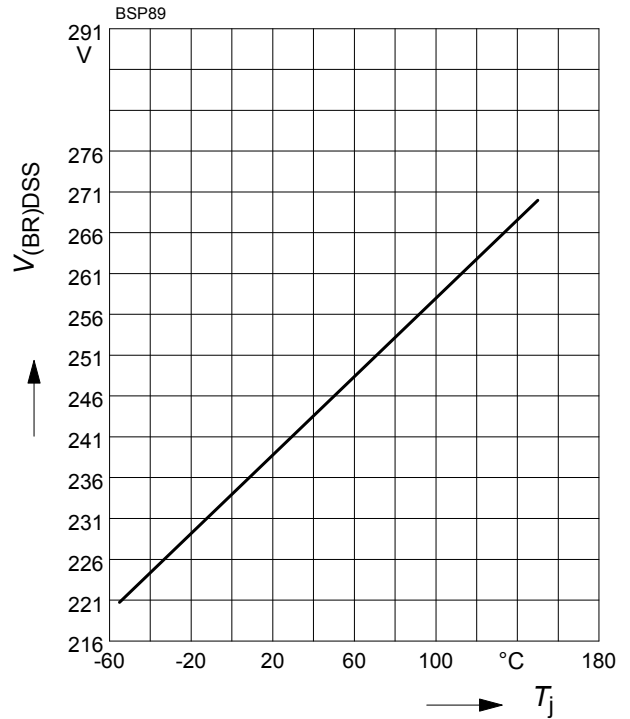
**13 Typ. gate charge**

$V_{GS} = f(Q_G)$ ; parameter:  $V_{DS}$ ,  
 $I_D = 0.35 \text{ A pulsed}$ ,  $T_j = 25 \text{ °C}$



**14 Drain-source breakdown voltage**

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



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