

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

## **Features**

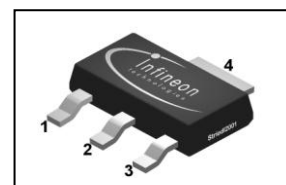
- P-Channel
- Enhancement mode
- Logic level
- Avalanche rated
- Pb-free lead plating; RoHS compliant
- Qualified according to AEC Q101
- Halogen-free according to IEC61249-2-21



Halogen-Free



PG-SOT-223



| Type    | Package    | Tape and Reel Information | Marking | Lead free | Packing |
|---------|------------|---------------------------|---------|-----------|---------|
| BSP322P | PG-SOT-223 | H6327: 1000 pcs/reel      | BSP322P | Yes       | Non dry |

**Maximum ratings**, at  $T_J=25\text{ °C}$ , unless otherwise specified

| Parameter                           | Symbol            | Conditions                                    | Value             | Unit |
|-------------------------------------|-------------------|-----------------------------------------------|-------------------|------|
| Continuous drain current            | $I_D$             | $T_C=25\text{ °C}$                            | 1                 | A    |
|                                     |                   | $T_C=70\text{ °C}$                            | 0.8               |      |
| Pulsed drain current                | $I_{D,pulse}$     | $T_C=25\text{ °C}$                            | 4                 |      |
| Avalanche energy, single pulse      | $E_{AS}$          | $I_D=-1\text{ A}$ , $R_{GS}=25\text{ }\Omega$ | 57                | mJ   |
| Gate source voltage                 | $V_{GS}$          |                                               | $\pm 20$          | V    |
| Power dissipation                   | $P_{tot}$         | $T_C=25\text{ °C}$                            | 1.8               | W    |
| Operating and storage temperature   | $T_J$ , $T_{stg}$ |                                               | -55 ... 150       | °C   |
| ESD Class                           |                   | JESD22-A114-HBM                               | 1A (250V to 500V) |      |
| Soldering temperature               |                   |                                               | 260 °C            |      |
| IEC climatic category; DIN IEC 68-1 |                   |                                               | 55/150/56         |      |

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

### Thermal characteristics

|                                           |            |                                                                |   |   |     |     |
|-------------------------------------------|------------|----------------------------------------------------------------|---|---|-----|-----|
| Thermal resistance,<br>junction - ambient | $R_{thJA}$ | minimal footprint,<br>steady state                             | - | - | 115 | K/W |
|                                           |            | 6 cm <sup>2</sup> cooling area <sup>1)</sup> ,<br>steady state | - | - | 70  |     |

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

#### Static characteristics

|                                  |               |                                                                                     |      |      |      |               |
|----------------------------------|---------------|-------------------------------------------------------------------------------------|------|------|------|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}$ , $I_D=-250\text{ }\mu\text{A}$                                 | -100 | -    | -    | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}$ , $I_D=-380\text{ }\mu\text{A}$                                     | -2.0 | -1.5 | -1.0 |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=-100\text{ V}$ , $V_{GS}=0\text{ V}$ ,<br>$T_j=25\text{ }^{\circ}\text{C}$  | -    | -0.1 | -1   | $\mu\text{A}$ |
|                                  |               | $V_{DS}=-100\text{ V}$ , $V_{GS}=0\text{ V}$ ,<br>$T_j=150\text{ }^{\circ}\text{C}$ | -    | -10  | -100 |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=-20\text{ V}$ , $V_{DS}=0\text{ V}$                                         | -    | -10  | -100 | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=-10\text{ V}$ , $I_D=-1\text{ A}$                                           | -    | 600  | 800  | m $\Omega$    |
|                                  |               | $V_{GS}=-4.5\text{ V}$ ,<br>$I_D=-0.93\text{ A}$                                    | -    | 808  | 1000 |               |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max}$ ,<br>$I_D=-0.8\text{ A}$                             | 0.7  | 1.4  | -    | S             |

<sup>1)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical in still air.

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

**Dynamic characteristics**

|                              |              |                                                                                 |   |      |      |    |
|------------------------------|--------------|---------------------------------------------------------------------------------|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=-25\text{ V},$<br>$f=1\text{ MHz}$                   | - | 280  | 372  | pF |
| Output capacitance           | $C_{oss}$    |                                                                                 | - | 70   | 94   |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                 | - | 34   | 51   |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=-50\text{ V}, V_{GS}=-10\text{ V}, I_D=-1\text{ A},$<br>$R_G=6\ \Omega$ | - | 4.6  | 6.9  | ns |
| Rise time                    | $t_r$        |                                                                                 | - | 4.3  | 6.5  |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                 | - | 21.2 | 31.8 |    |
| Fall time                    | $t_f$        |                                                                                 | - | 8.3  | 12.5 |    |

**Gate Charge Characteristics<sup>2)</sup>**

|                       |               |                                                                              |   |      |      |    |
|-----------------------|---------------|------------------------------------------------------------------------------|---|------|------|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=-80\text{ V}, I_D=-1\text{ A},$<br>$V_{GS}=0\text{ to }-10\text{ V}$ | - | 0.8  | 1.0  | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                                              | - | 4.3  | 6.4  |    |
| Gate charge total     | $Q_g$         |                                                                              | - | 12.4 | 16.5 |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                                              | - | 2.9  | -    | V  |

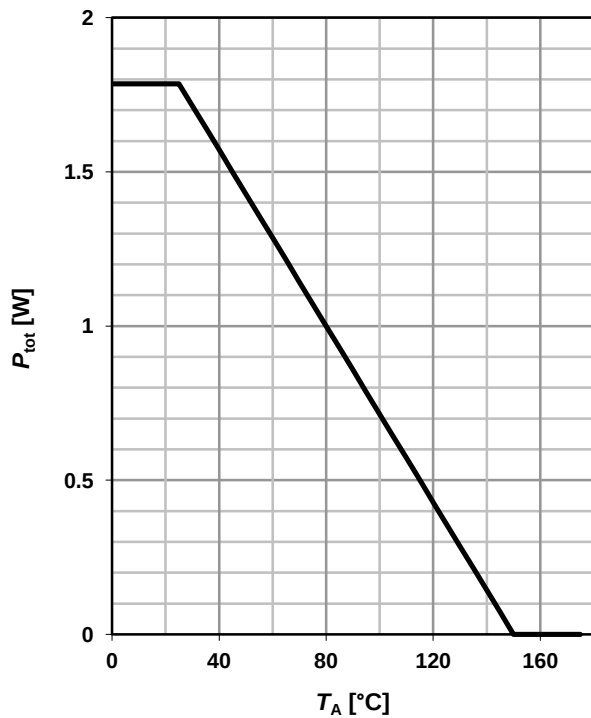
**Reverse Diode**

|                                  |               |                                                                     |   |      |      |    |
|----------------------------------|---------------|---------------------------------------------------------------------|---|------|------|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ °C}$                                                  | - | -    | -1.0 | A  |
| Diode pulse current              | $I_{S,pulse}$ |                                                                     | - | -    | -4.0 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=-1\text{ A},$<br>$T_J=25\text{ °C}$         | - | 0.84 | 1.2  | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=50\text{ V}, I_F= I_S ,$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 47   | -    | ns |
| Reverse recovery charge          | $Q_{rr}$      |                                                                     | - | 84   | -    | nC |

<sup>2)</sup> See figure 16 for gate charge parameter definition

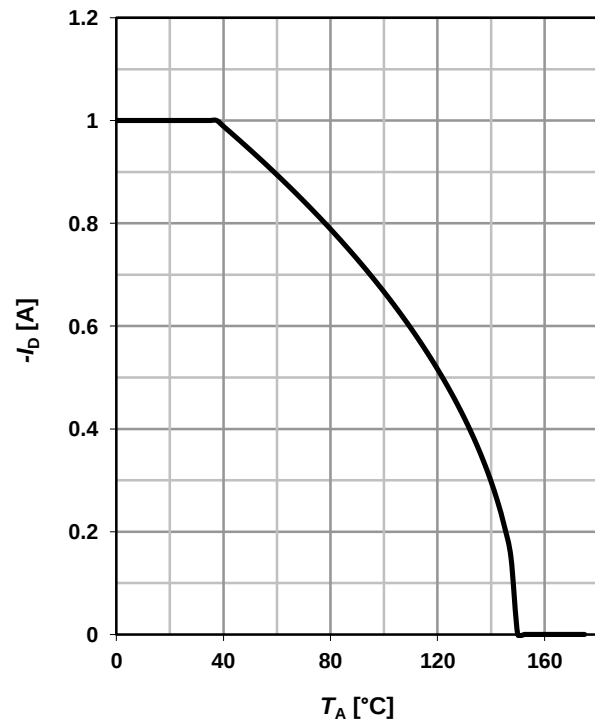
### 1 Power dissipation

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



### 2 Drain current

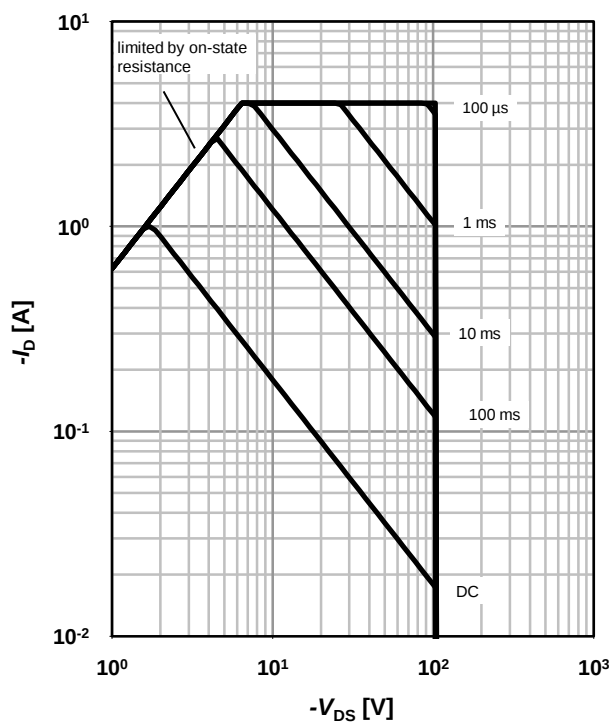
$$I_D = f(T_C); |V_{GS}| \geq 10 \text{ V}$$



### 3 Safe operating area

$$I_D = f(V_{DS}); T_C = 25^\circ\text{C}; D = 0$$

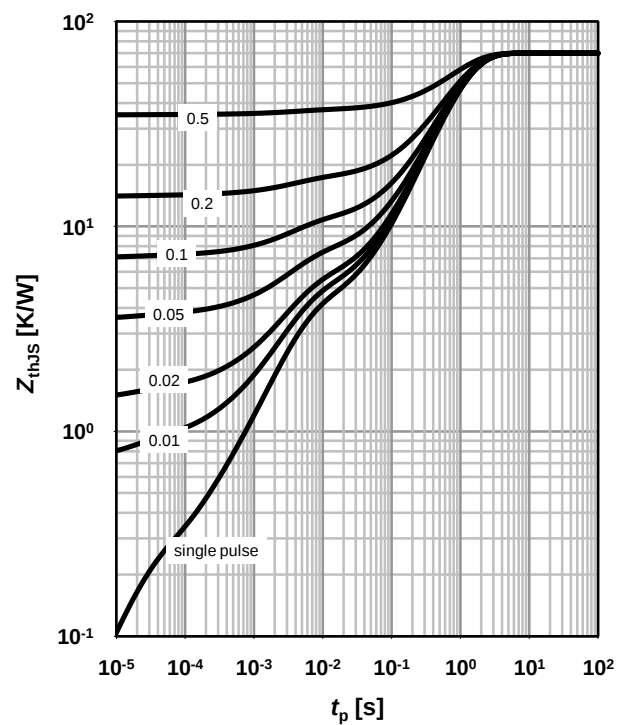
parameter:  $t_p$



### 4 Max. transient thermal impedance

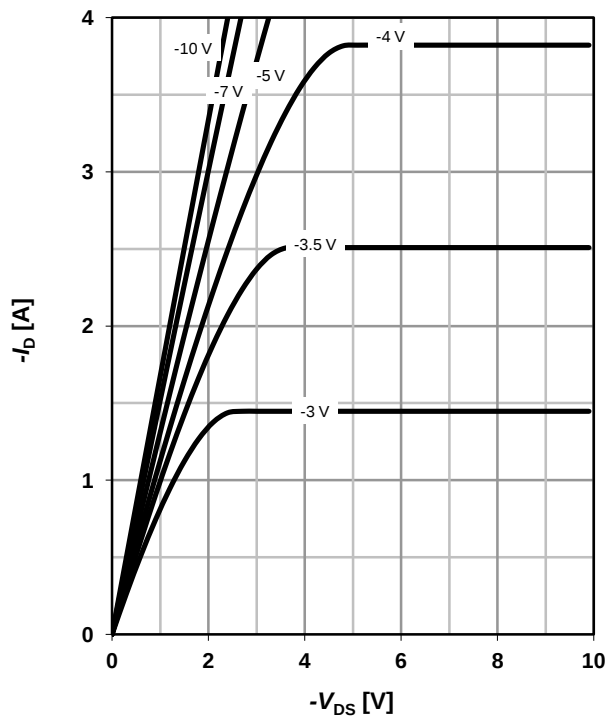
$$Z_{\text{thJC}} = f(t_p)$$

parameter:  $D = t_p/T$



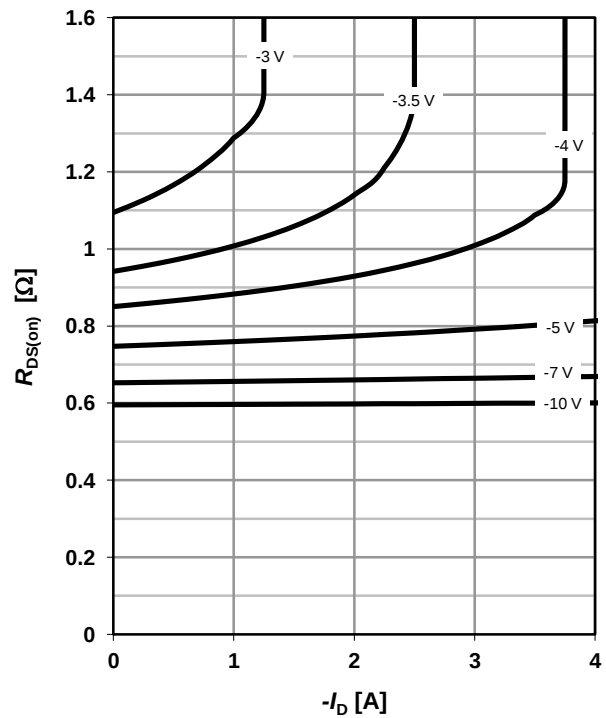
### 5 Typ. output characteristics

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}$ 

parameter:  $V_{GS}$ 


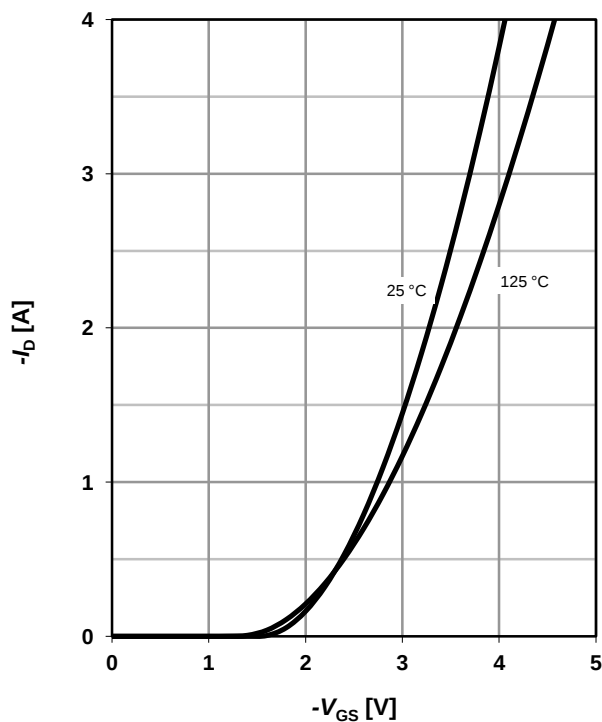
### 6 Typ. drain-source on resistance

 $R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}$ 

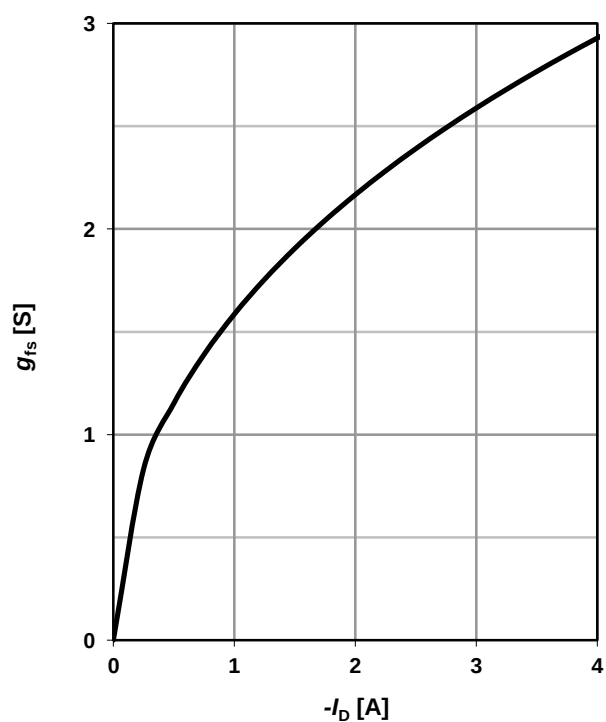
parameter:  $V_{GS}$ 


### 7 Typ. transfer characteristics

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

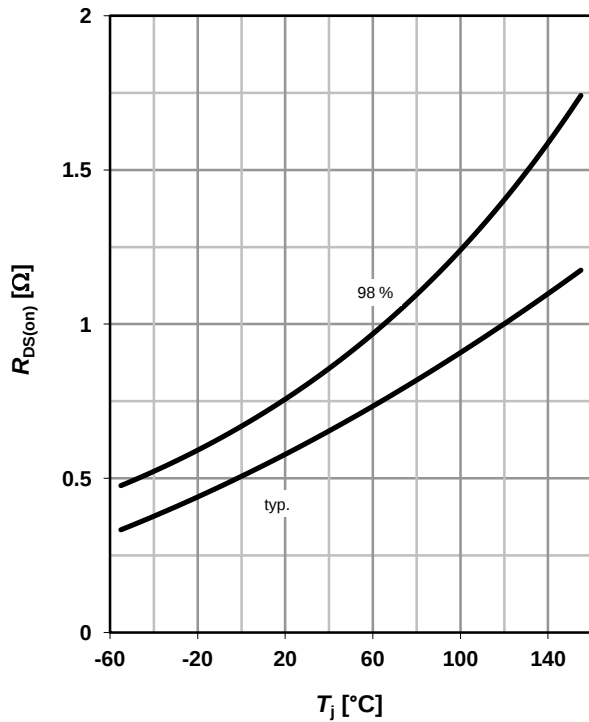
parameter:  $T_j$ 


### 8 Typ. forward transconductance

 $g_{fs} = f(I_D); T_j = 25^\circ\text{C}$ 


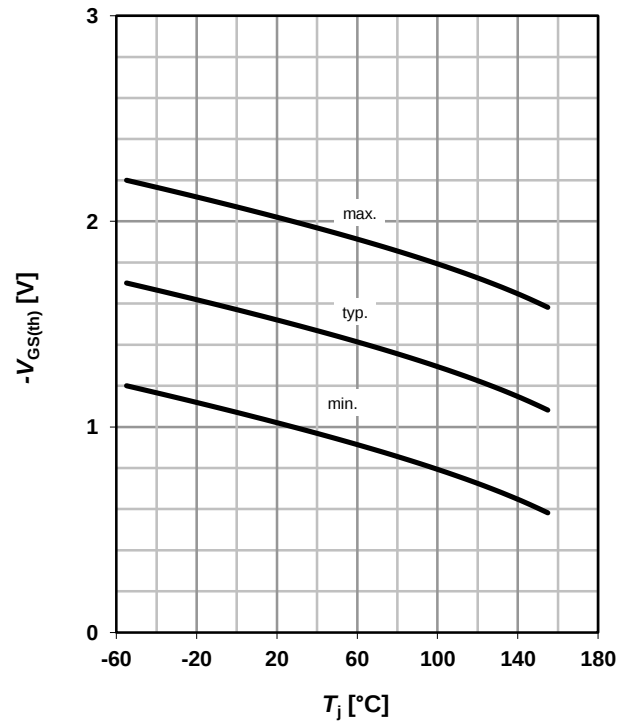
## 9 Drain-source on-state resistance

$$R_{DS(on)} = f(T_j); I_D = -1 \text{ A}; V_{GS} = -10 \text{ V}$$



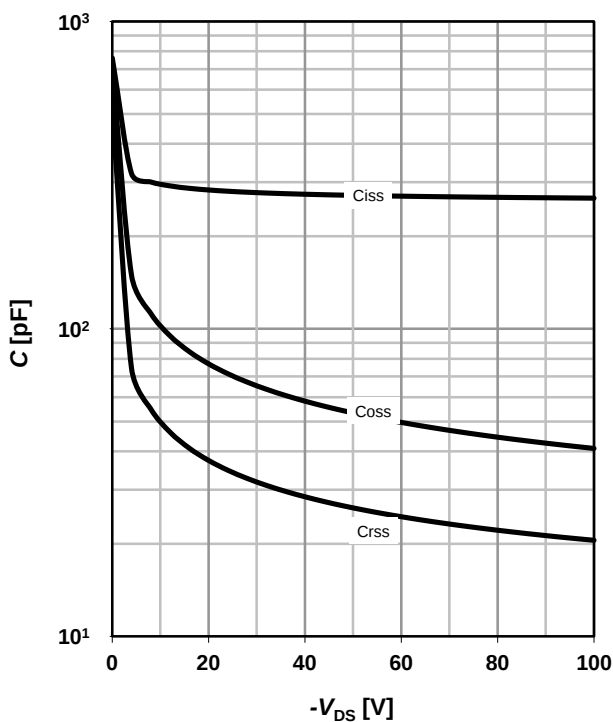
## 10 Typ. gate threshold voltage

$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = -380 \text{ μA}$$



## 11 Typ. capacitances

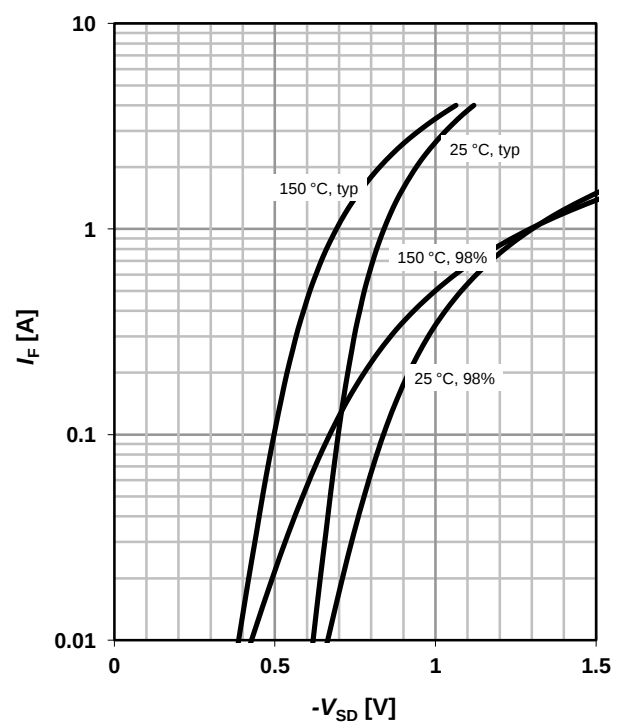
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



## 12 Forward characteristics of reverse diode

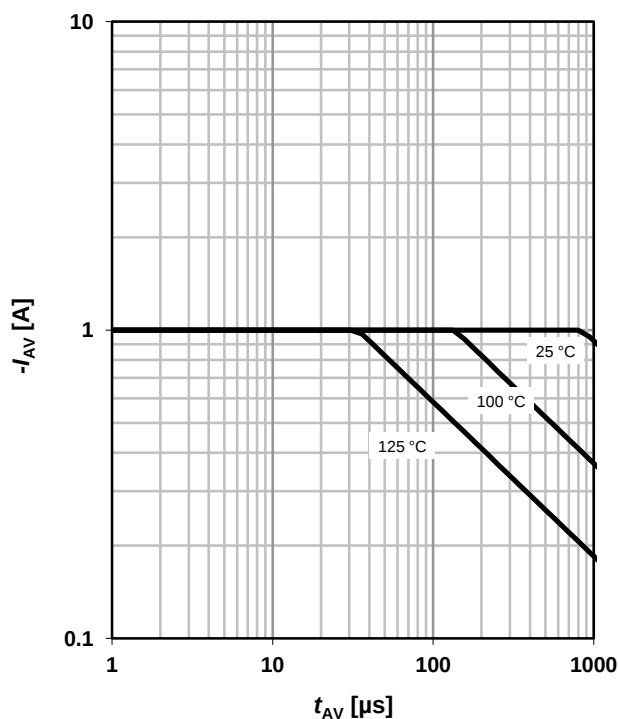
$$I_F = f(V_{SD})$$

parameter:  $T_j$



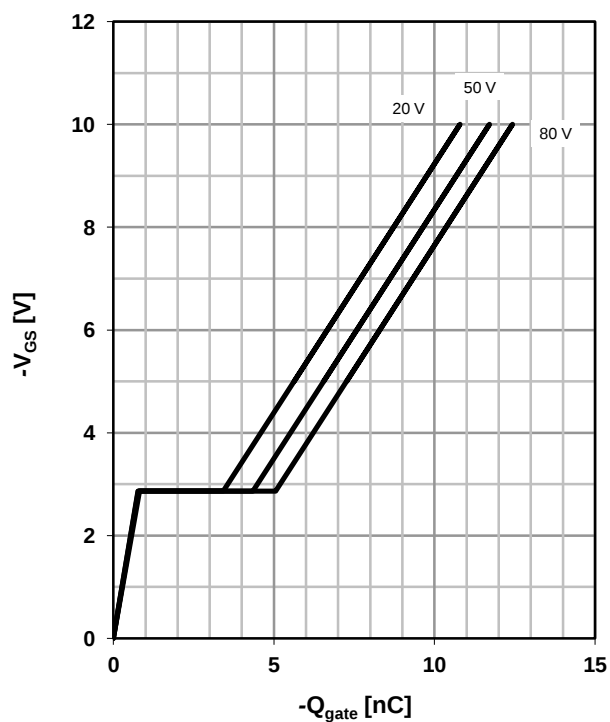
### 13 Avalanche characteristics

 $I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega$ 

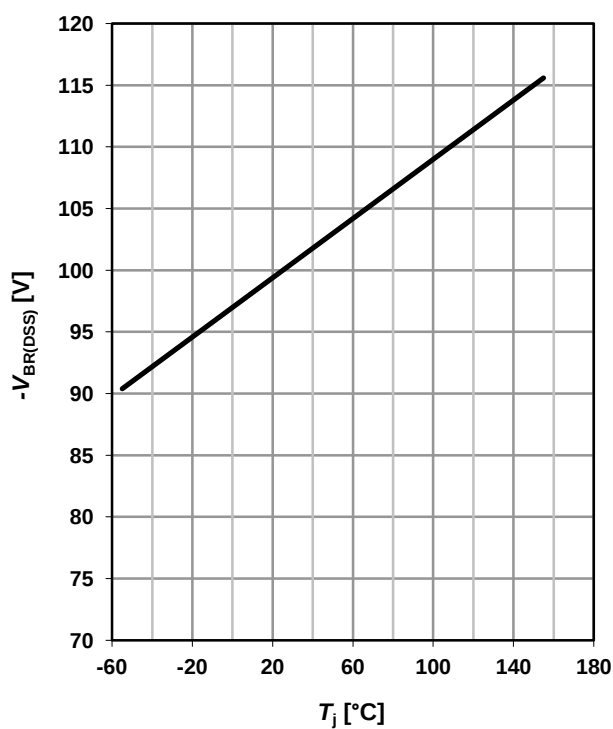
parameter:  $T_{j(\text{start})}$ 


### 14 Typ. gate charge

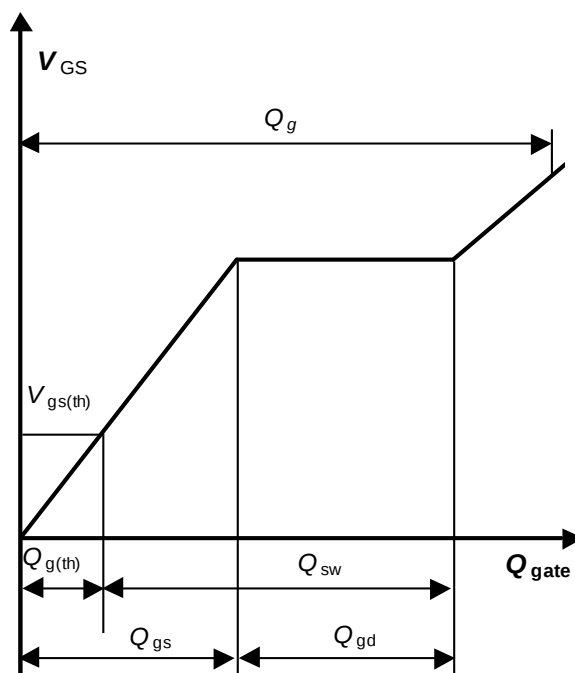
 $V_{GS}=f(Q_{gate}); I_D=-1\ \text{A pulsed}$ 

parameter:  $V_{DD}$ 


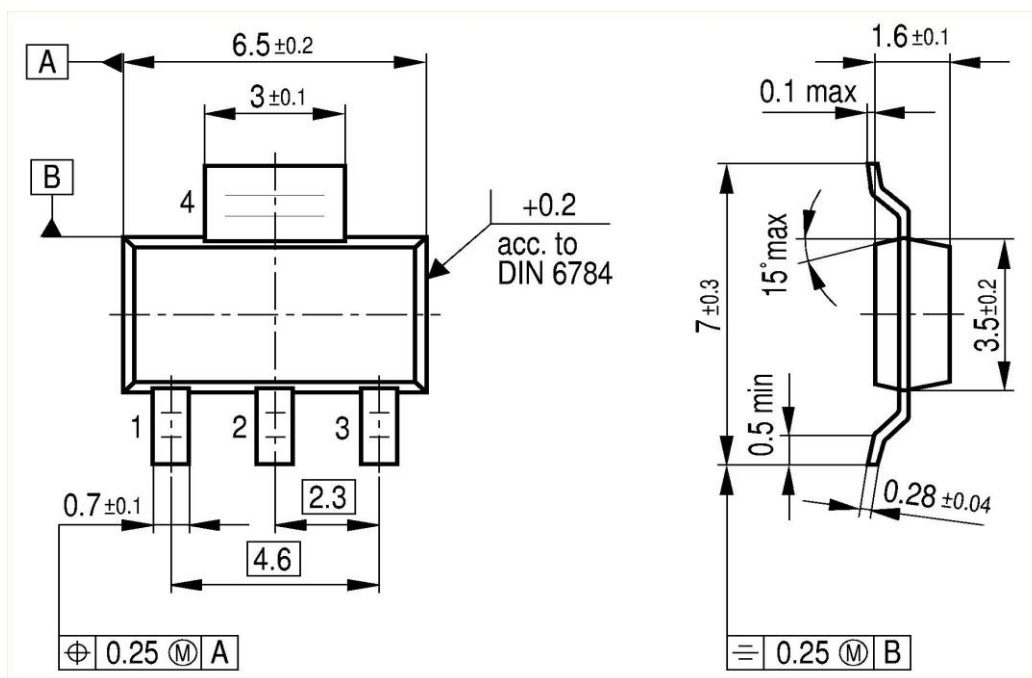
### 15 Drain-source breakdown voltage

 $V_{BR(DSS)}=f(T_j); I_D=-250\ \mu\text{A}$ 


### 16 Gate charge waveforms

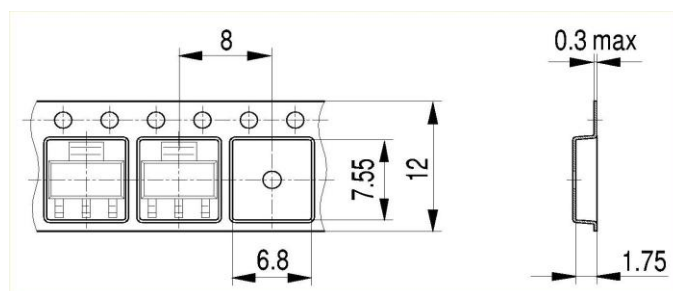
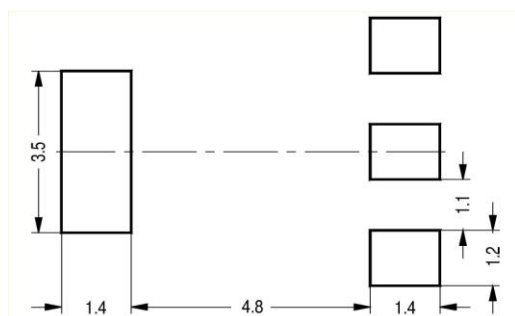


# Package Outline: PG-SOT-223



## Footprint:

## Packaging:



Dimensions in mm

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