

## OptiMOS™ Small-Signal-Transistor

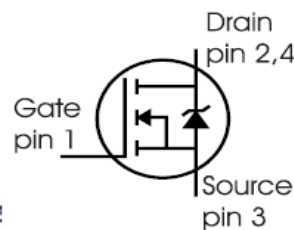
### Features

- N-channel
- Enhancement mode
- Logic level (4.5V rated)
- Avalanche rated
- Qualified according to AEC Q101
- 100% lead-free; RoHS compliant
- Halogen-free according to IEC61249-2-21

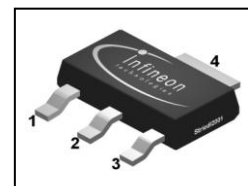


### Product Summary

|                  |                       |              |
|------------------|-----------------------|--------------|
| $V_{DS}$         | 100                   | V            |
| $R_{DS(on),max}$ | $V_{GS}=10\text{ V}$  | 0.6 $\Omega$ |
|                  | $V_{GS}=4.5\text{ V}$ | 0.8          |
| $I_D$            | 1.2                   | A            |



PG-SOT223



| Type    | Package | Tape and Reel Information | Marking | Halogen-Free | Packing |
|---------|---------|---------------------------|---------|--------------|---------|
| BSP296N | SOT223  | H6327: 1000 pcs/ reel     | BSP296N | Yes          | Non dry |

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

| Parameter                           | Symbol            | Conditions                                                                                                     | Value                  | Unit               |
|-------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------|------------------------|--------------------|
| Continuous drain current            | $I_D$             | $T_A=25\text{ °C}$                                                                                             | 1.2                    | A                  |
|                                     |                   | $T_A=70\text{ °C}$                                                                                             | 0.9                    |                    |
| Pulsed drain current                | $I_{D,pulse}$     | $T_A=25\text{ °C}$                                                                                             | 4.6                    |                    |
| Avalanche energy, single pulse      | $E_{AS}$          | $I_D=1.2\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                 | 15.0                   | mJ                 |
| Reverse diode $dv/dt$               | $dv/dt$           | $I_D=1.2\text{ A}$ , $V_{DS}=80\text{ V}$ ,<br>$di/dt=200\text{ A}/\mu\text{s}$ ,<br>$T_{j,max}=150\text{ °C}$ | 6                      | kV/ $\mu\text{s}$  |
| Gate source voltage                 | $V_{GS}$          |                                                                                                                | $\pm 20$               | V                  |
| Power dissipation                   | $P_{tot}$         | $T_A=25\text{ °C}$                                                                                             | 1.8                    | W                  |
| Operating and storage temperature   | $T_J$ , $T_{stg}$ |                                                                                                                | -55 ... 150            | $^{\circ}\text{C}$ |
| ESD Class                           |                   | JESD22-A114 -HBM                                                                                               | 0 (<250V)              |                    |
| Soldering Temperature               |                   |                                                                                                                | 260 $^{\circ}\text{C}$ |                    |
| IEC climatic category; DIN IEC 68-1 |                   |                                                                                                                | 55/150/56              |                    |

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

**Thermal characteristics**

|                                                   |            |                                              |   |   |     |     |
|---------------------------------------------------|------------|----------------------------------------------|---|---|-----|-----|
| Thermal resistance,<br>junction - soldering point | $R_{thJS}$ |                                              | - | - | 25  | K/W |
| Thermal resistance<br>junction - ambient          | $R_{thJA}$ | minimal footprint                            | - | - | 110 |     |
|                                                   |            | 6 cm <sup>2</sup> cooling area <sup>1)</sup> | - | - | 70  |     |

**Electrical characteristics, at  $T_j=25\text{ °C}$ , 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           | $V_{GS(th)}$  | $V_{DS}=V_{GS}\text{ V}, I_D=100\text{ }\mu\text{A}$        | 0.8 | 1.4  | 1.8 |               |
| Drain-source leakage current     | $I_{DSS}$     | $V_{DS}=100\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$  | -   | -    | 0.1 | $\mu\text{A}$ |
|                                  |               | $V_{DS}=100\text{ V}, V_{GS}=0\text{ V}, T_j=150\text{ °C}$ | -   | -    | 10  |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$                     | -   | -    | 10  | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=4.5\text{ V}, I_D=0.95\text{ A}$                    | -   | 371  | 800 | m $\Omega$    |
|                                  |               | $V_{GS}=10\text{ V}, I_D=1.2\text{ A}$                      | -   | 329  | 600 |               |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=0.9\text{ A}$            |     | 2.66 | -   | S             |

<sup>1)</sup> Device on 40mm x 40mm x 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 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>$f=1\text{ MHz}$                               | - | 114.8 | 152.7 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                            | - | 19.7  | 26.3  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                            | - | 9.8   | 14.7  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=50\text{ V}, V_{GS}=10\text{ V},$<br>$I_D=1.2\text{ A}, R_{G,ext}=6\text{ }\Omega$ | - | 3.5   | 5.3   | ns |
| Rise time                    | $t_r$        |                                                                                            | - | 3.8   | 5.7   |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                            | - | 18.4  | 27.6  |    |
| Fall time                    | $t_f$        |                                                                                            | - | 5.2   | 7.8   |    |

#### Gate Charge Characteristics

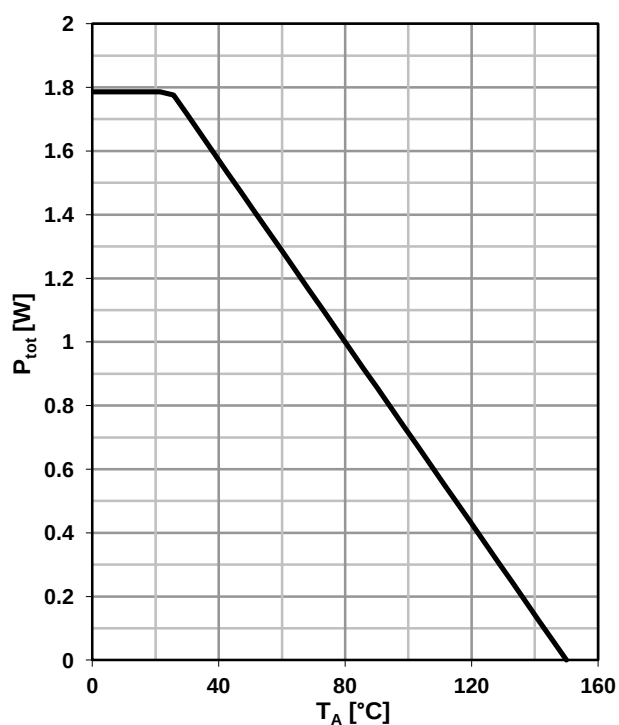
|                       |               |                                                                             |   |      |     |    |
|-----------------------|---------------|-----------------------------------------------------------------------------|---|------|-----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=50\text{ V}, I_D=1.2\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 0.27 | 0.4 | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                                             | - | 1.45 | 2.2 |    |
| Gate charge total     | $Q_g$         |                                                                             | - | 4.5  | 6.7 |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                                             | - | 2.4  | -   | V  |

#### Reverse Diode

|                                  |               |                                                                            |   |      |      |    |
|----------------------------------|---------------|----------------------------------------------------------------------------|---|------|------|----|
| Diode continuous forward current | $I_S$         | $T_A=25\text{ }^\circ\text{C}$                                             | - | -    | 1.2  | A  |
| Diode pulse current              | $I_{S,pulse}$ |                                                                            | - | -    | 4.6  |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=1.2\text{ A},$<br>$T_j=25\text{ }^\circ\text{C}$   | - | 0.85 | 1.1  | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=50\text{ V}, I_F=1.2\text{ A},$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 27   | 40.5 | ns |
| Reverse recovery charge          | $Q_{rr}$      |                                                                            | - | 30   | 45   | nC |

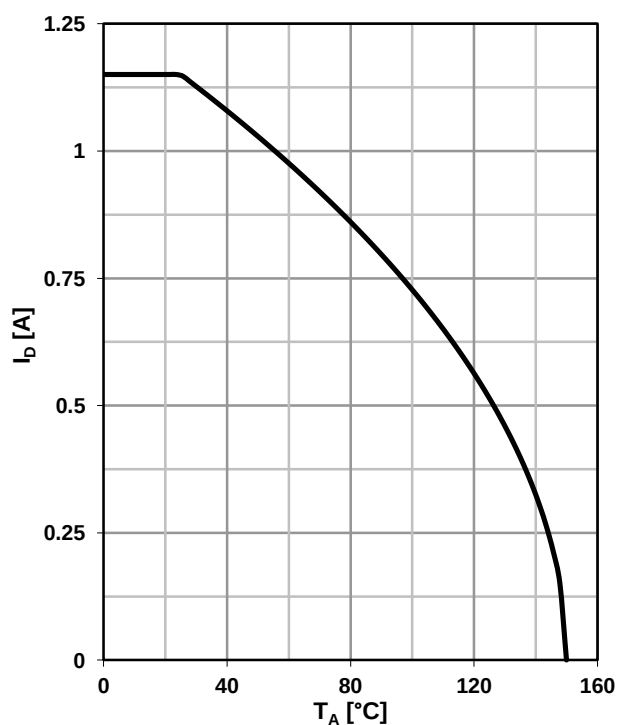
## 1 Power dissipation

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



## 2 Drain current

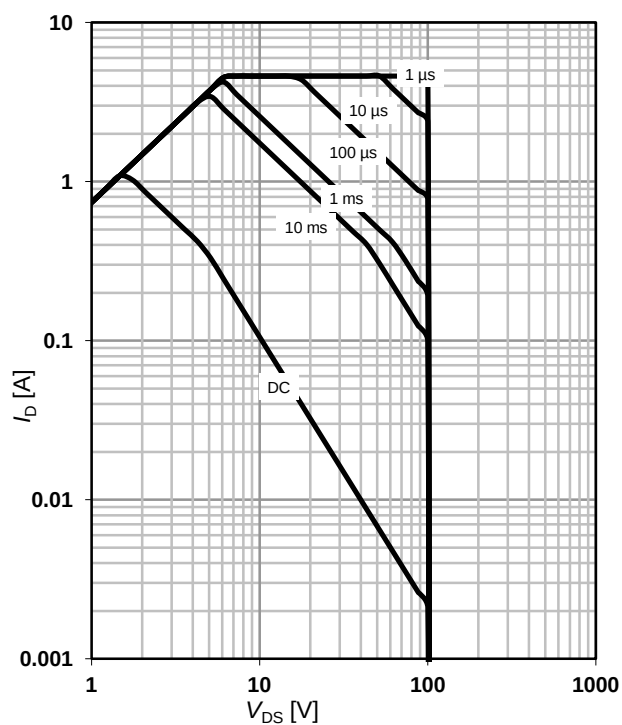
$$I_D = f(T_A); V_{GS} \geq 10 \text{ V}$$



## 3 Safe operating area

$$I_D = f(V_{DS}); T_A = 25 \text{ °C}; D = 0$$

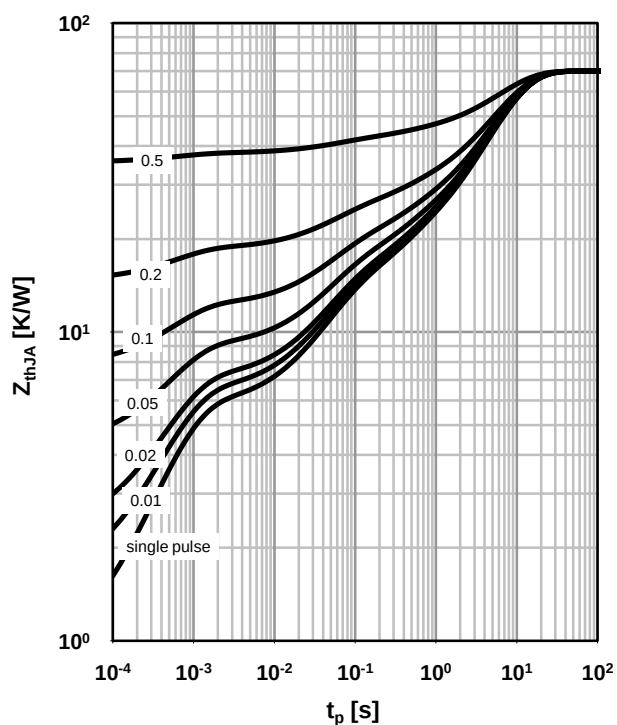
parameter:  $t_p$



## 4 Max. transient thermal impedance

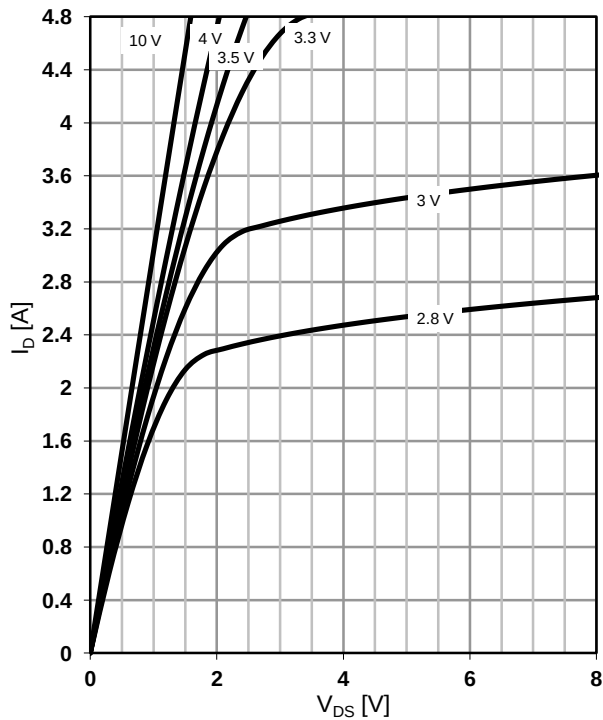
$$Z_{thJA} = f(t_p)$$

parameter:  $D = t_p/T$



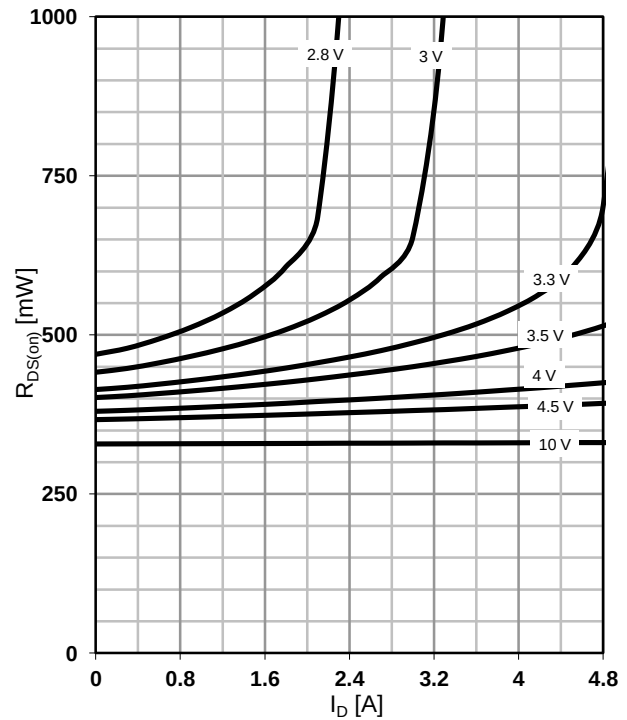
## 5 Typ. output characteristics

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

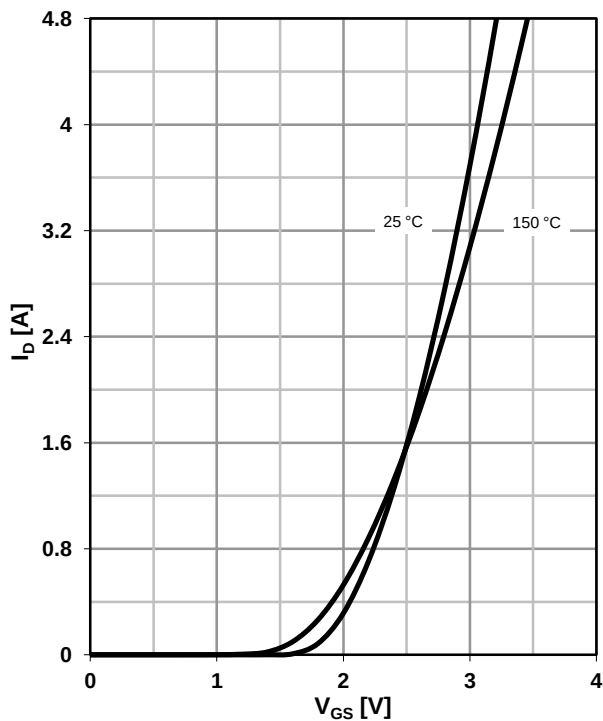
parameter:  $V_{GS}$ 


## 6 Typ. drain-source on resistance

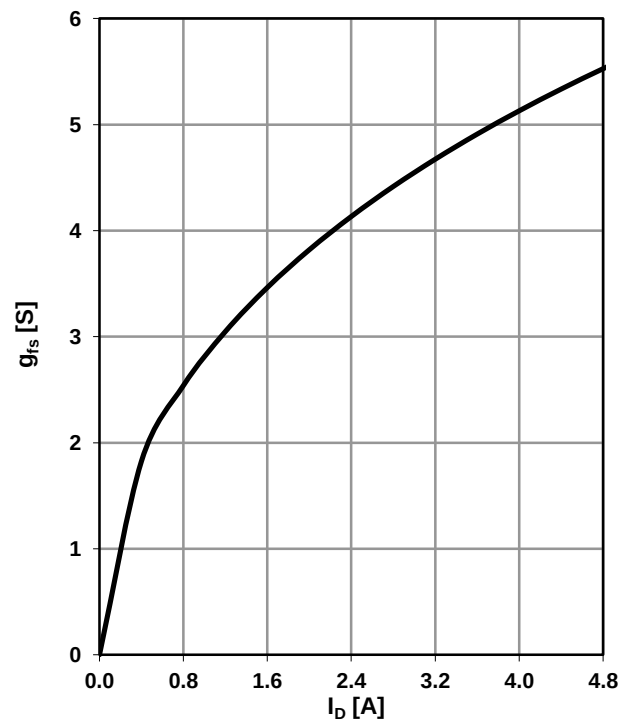
 $R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}$ 

parameter:  $V_{GS}$ 


## 7 Typ. transfer characteristics

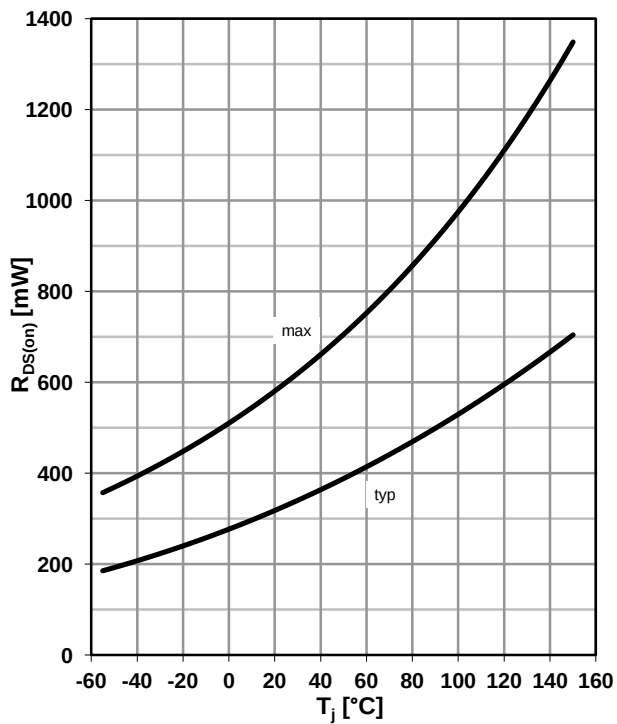
 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$ 


## 8 Typ. forward transconductance

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


## 9 Drain-source on-state resistance

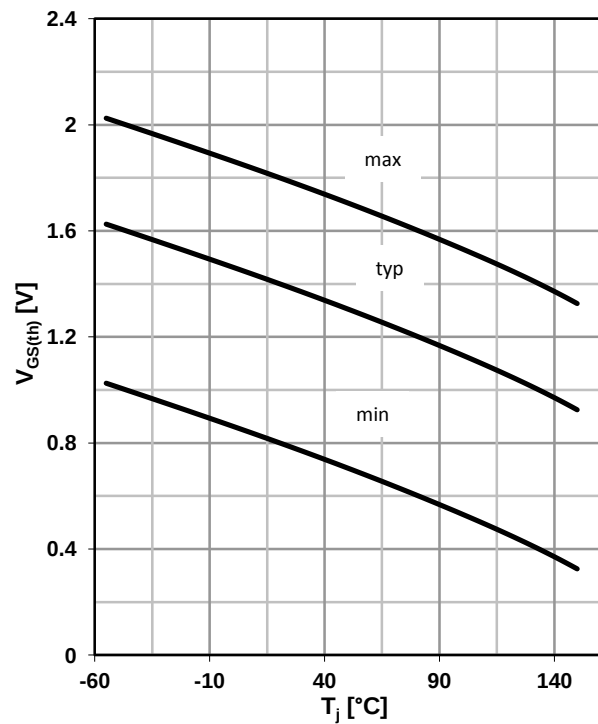
$$R_{DS(on)} = f(T_j); I_D = 1.2 \text{ A}; V_{GS} = 10 \text{ V}$$



## 10 Typ. gate threshold voltage

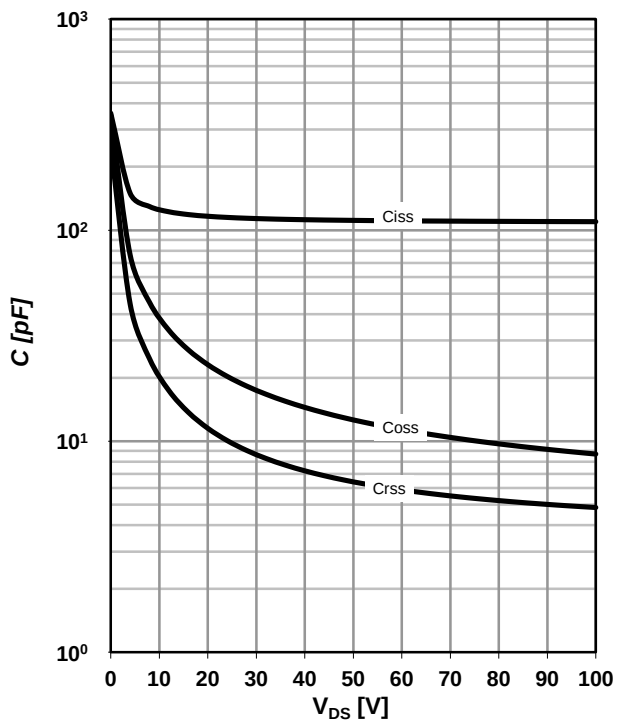
$$V_{GS(th)} = f(T_j); V_{DS} = V_{GS}; I_D = 100 \mu\text{A}$$

parameter:  $I_D$



## 11 Typ. capacitances

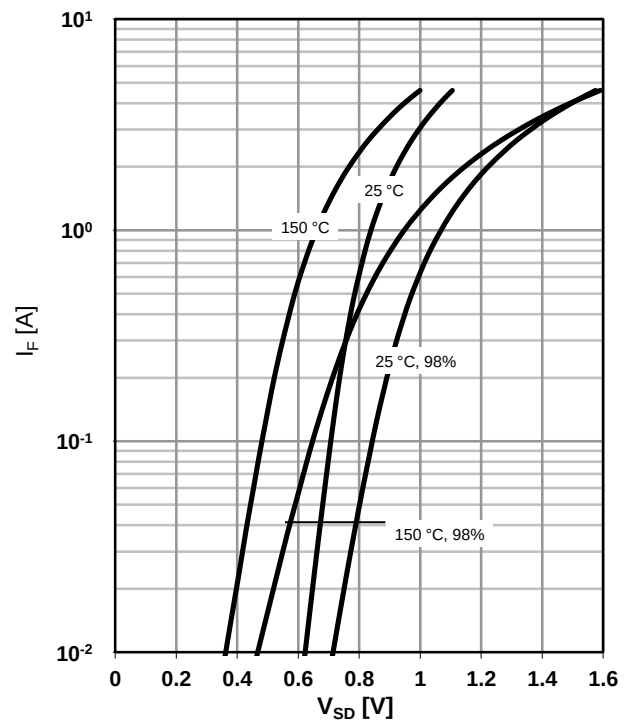
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25^\circ\text{C}$$



## 12 Forward characteristics of reverse diode

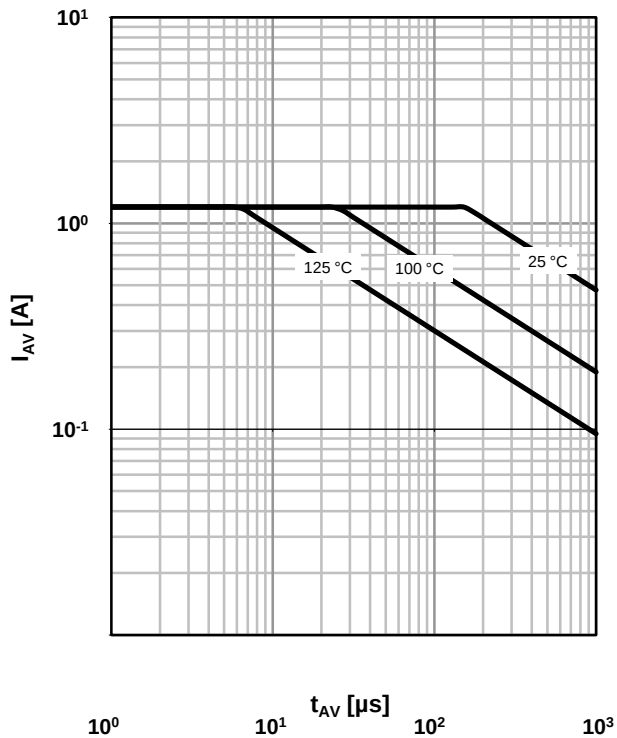
$$I_F = f(V_{SD})$$

parameter:  $T_j$

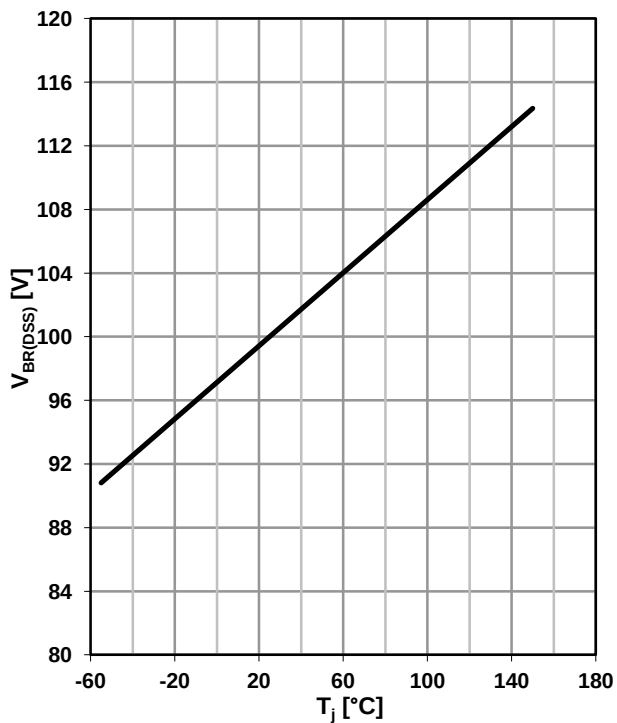


### 13 Avalanche characteristics

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

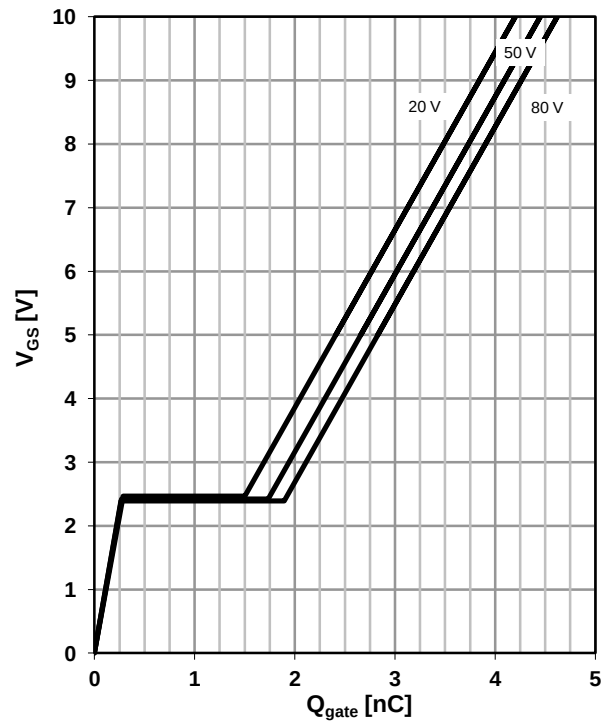
parameter:  $T_{j(start)}$ 


### 15 Drain-source breakdown voltage

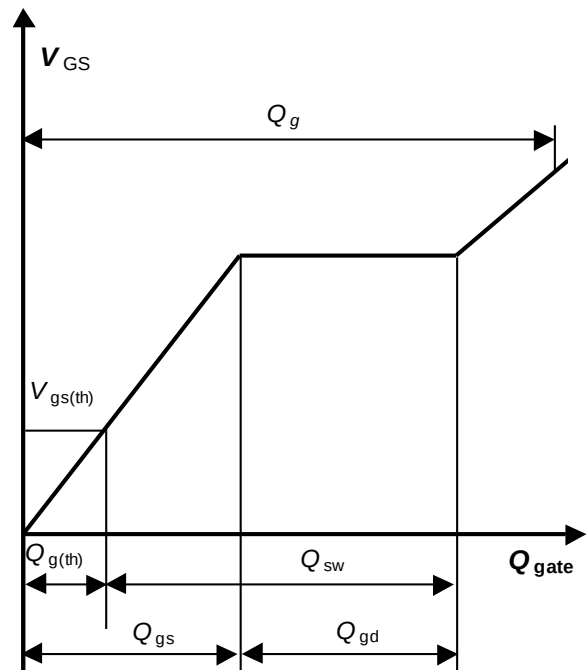
 $V_{BR(DSS)}=f(T_j); I_D=250\ \mu A$ 


### 14 Typ. gate charge

 $V_{GS}=f(Q_{gate}); I_D=1.2\ A\ pulsed$ 

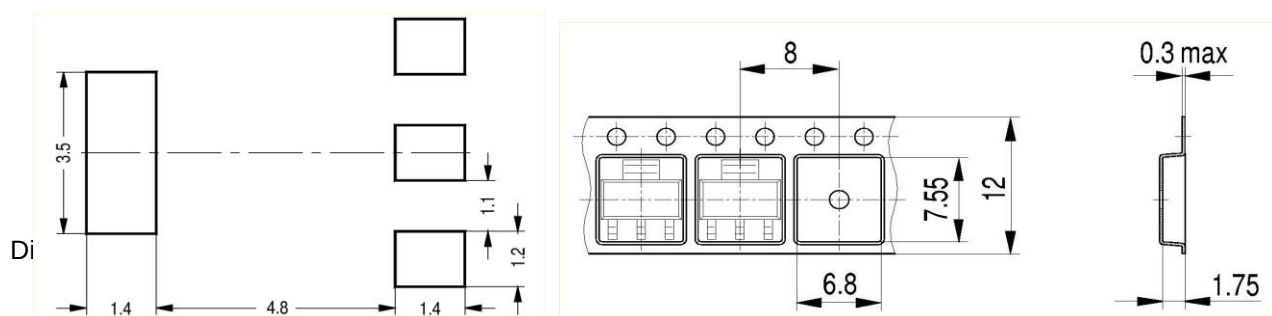
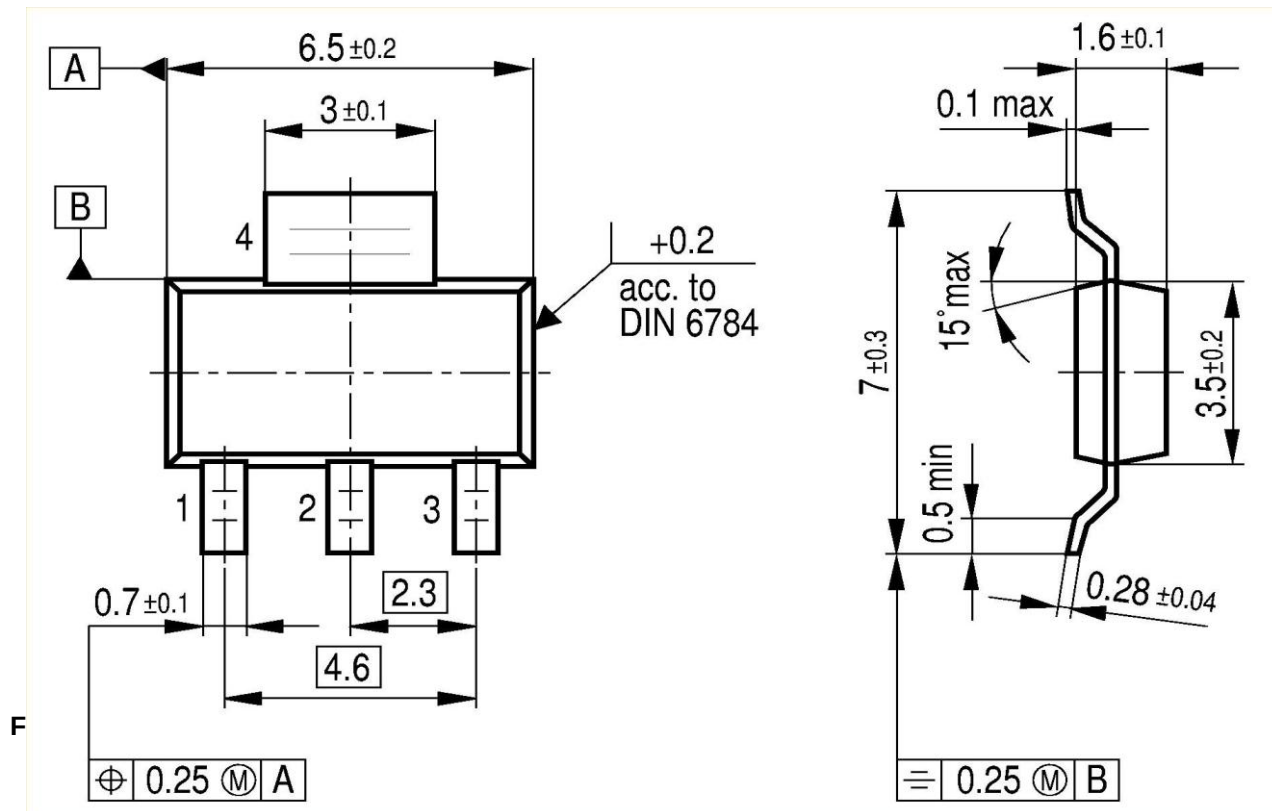
parameter:  $V_{DD}$ 


### 16 Gate charge waveforms



## SOT223

## Package Outline:



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