

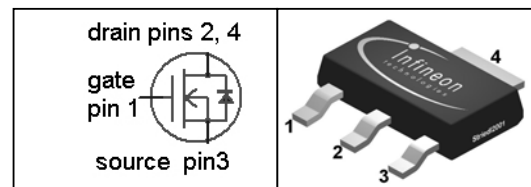
**SIPMOS® Small-Signal-Transistor**
**Features**

- N-channel
- Depletion mode
- $dv/dt$  rated
- Available with  $V_{GS(th)}$  indicator on reel
- Pb-free lead plating; RoHS compliant
- Qualified according to AEC Q101


**Product Summary**

|                  |      |          |
|------------------|------|----------|
| $V_{DS}$         | 600  | V        |
| $R_{DS(on),max}$ | 60   | $\Omega$ |
| $I_{DSS,min}$    | 0.02 | A        |

PG-SOT223



| Type   | Package  | Tape and Reel Information                     | Marking | Packaging |
|--------|----------|---|---------|-----------|
| BSP135 | PG-SOT22 | L6327: 1000 pcs/reel                          | BSP135  | Non dry   |
| BSP135 | PG-SOT22 | L6906: 1000 pcs/reel in $V_{GS(th)}$ bands 1) | BSP135  | Non dry   |

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

| Parameter                           | Symbol            | Conditions  | Value             | Unit               |
|-------------------------------------|-------------------|---|-------------------|--------------------|
| Continuous drain current            | $I_D$             | $T_A=25\text{ °C}$  | 0.12              | A                  |
|                                     |                   | $T_A=70\text{ °C}$  | 0.10              |                    |
| Pulsed drain current                | $I_{D,pulse}$     | $T_A=25\text{ °C}$  | 0.48              |                    |
| Reverse diode $dv/dt$               | $dv/dt$           | $I_D=0.12\text{ A}$ , $V_{DS}=20\text{ V}$ ,<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                  |
| ESD Class<br>(JESD22-A114-HBM)      |                   |   | 1A (>250V, <500V) |                    |
| Power dissipation                   | $P_{tot}$         | $T_A=25\text{ °C}$  | 1.8               | W                  |
| Operating and storage temperature   | $T_j$ , $T_{stg}$ |   | -55 ... 150       | $^{\circ}\text{C}$ |
| IEC climatic category; DIN IEC 68-1 |                   |   | 55/150/56         |                    |

1) see table on next page and diagram 11

| Parameter  | Symbol     | Conditions                                   | Values |      |      | Unit |
|--|------------|--|--------|------|------|------|
|  |            |  | min.   | typ. | max. |      |
| <b>Thermal characteristics</b>                         |            |  |        |      |      |      |
| Thermal resistance, junction - soldering point (pin 4) | $R_{thJS}$ |  | -      | -    | 25   | K/W  |
| SMD version, device on PCB                             | $R_{thJA}$ | minimal footprint                            | -      | -    | 115  |      |
|  |            | 6 cm <sup>2</sup> cooling area <sup>2)</sup> | -      | -    | 70   |      |

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

**Static characteristics**

|                                  |               |  |      |      |     |               |
|----------------------------------|---------------|--|------|------|-----|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=-3\text{ V}, I_D=250\text{ }\mu\text{A}$                         | 600  | -    | -   | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=3\text{ V}, I_D=94\text{ }\mu\text{A}$                           | -2.1 | -1.4 | -1  |               |
| Drain-source cutoff current      | $I_{D(off)}$  | $V_{DS}=600\text{ V}, V_{GS}=-3\text{ V}, T_j=25\text{ }^\circ\text{C}$  | -    | -    | 0.1 | $\mu\text{A}$ |
|                                  |               | $V_{DS}=600\text{ V}, V_{GS}=-3\text{ V}, T_j=125\text{ }^\circ\text{C}$ | -    | -    | 10  |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$                                  | -    | -    | 100 | nA            |
| On-state drain current           | $I_{DSS}$     | $V_{GS}=0\text{ V}, V_{DS}=10\text{ V}$                                  | 20   | -    | -   | mA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=0\text{ V}, I_D=0.01\text{ A}$                                   | -    | 30   | 60  | $\Omega$      |
|                                  |               | $V_{GS}=10\text{ V}, I_D=0.12\text{ A}$                                  | -    | 25   | 45  |               |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=0.1\text{ A}$                         | 0.08 | 0.16 | -   | S             |

**Threshold voltage  $V_{GS(th)}$  sorted in bands<sup>3)</sup>**

|   |              |  |       |   |       |   |
|---|--------------|--|-------|---|-------|---|
| J | $V_{GS(th)}$ | $V_{DS}=3\text{ V}, I_D=94\text{ }\mu\text{A}$ | -1.2  | - | -1    | V |
| K |              |  | -1.35 | - | -1.15 |   |
| L |              |  | -1.5  | - | -1.3  |   |
| M |              |  | -1.65 | - | -1.45 |   |
| N |              |  | -1.8  | - | -1.6  |   |

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

<sup>3)</sup> Each reel contains transistors out of one band whose identifying letter is printed on the reel label. A specific band cannot be ordered separately.

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

**Dynamic characteristics**

|                              |              |   |   |     |     |    |
|------------------------------|--------------|---|---|-----|-----|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=-3\text{ V}, V_{DS}=25\text{ V},$<br>$f=1\text{ MHz}$                               | - | 98  | 146 | pF |
| Output capacitance           | $C_{oss}$    |   | - | 8.5 | 13  |    |
| Reverse transfer capacitance | $C_{rss}$    |   | - | 3.4 | 5.1 |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=300\text{ V},$<br>$V_{GS}=-3\dots 5\text{ V},$<br>$I_D=0.1\text{ A}, R_G=6\ \Omega$ | - | 5.4 | 8.1 | ns |
| Rise time                    | $t_r$        |   | - | 5.6 | 8.4 |    |
| Turn-off delay time          | $t_{d(off)}$ |   | - | 28  | 42  |    |
| Fall time                    | $t_f$        |   | - | 182 | 273 |    |

**Gate Charge Characteristics**

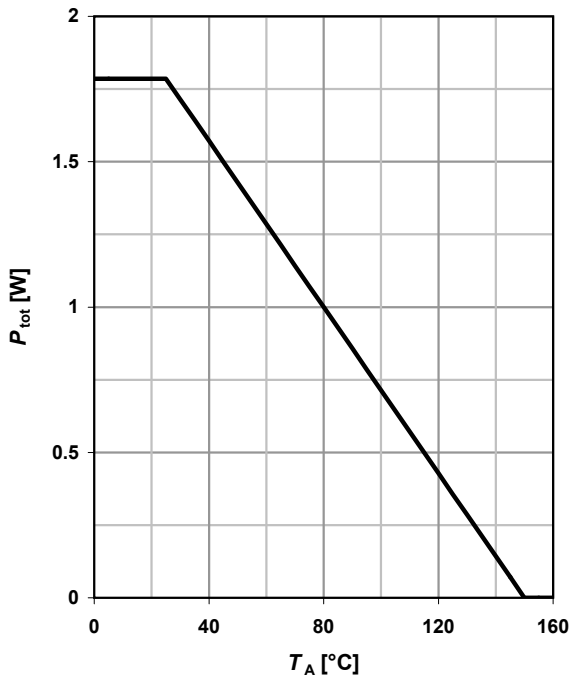
|                       |               |  |   |      |      |    |
|-----------------------|---------------|--|---|------|------|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=400\text{ V}, I_D=0.1\text{ A},$<br>$V_{GS}=-3\text{ to }5\text{ V}$ | - | 0.24 | 0.36 | nC |
| Gate to drain charge  | $Q_{gd}$      |  | - | 2.0  | 3.0  |    |
| Gate charge total     | $Q_g$         |  | - | 3.7  | 4.9  |    |
| Gate plateau voltage  | $V_{plateau}$ |  | - | 0.20 | -    | V  |

**Reverse Diode**

|                                  |               |   |   |      |      |    |
|----------------------------------|---------------|---|---|------|------|----|
| Diode continuous forward current | $I_S$         | $T_A=25\text{ }^\circ\text{C}$  | - | -    | 0.12 | A  |
| Diode pulse current              | $I_{S,pulse}$ |   | - | -    | 0.48 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=-3\text{ V}, I_F=0.12\text{ A},$<br>$T_j=25\text{ }^\circ\text{C}$  | - | 0.78 | 1.2  | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=300\text{ V}, I_F=0.1\text{ A},$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 87   | 130  | ns |
| Reverse recovery charge          | $Q_{rr}$      |   | - | 70   | 104  |    |

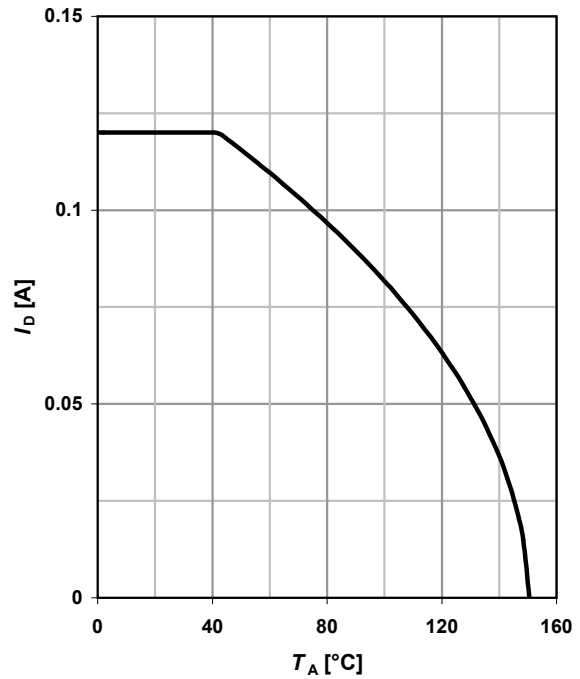
**1 Power dissipation**

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



**2 Drain current**

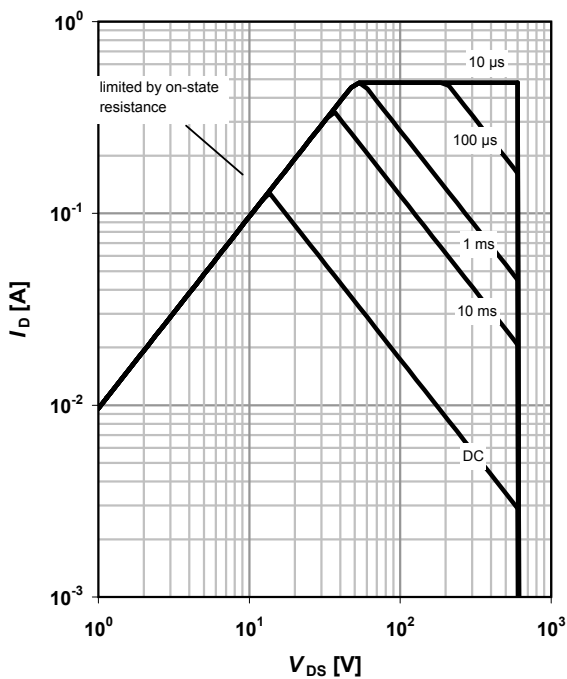
$$I_D = f(T_A); V_{GS} \geq 10 \text{ V}$$



**3 Safe operating area**

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

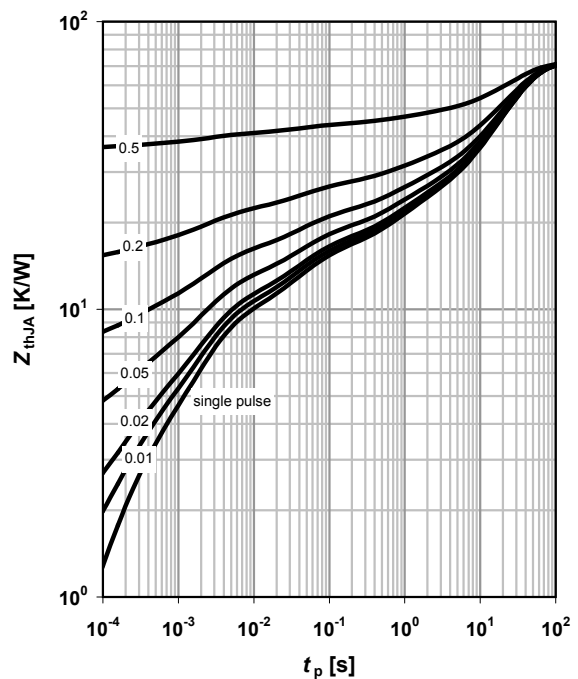
parameter:  $t_p$



**4 Max. transient thermal impedance**

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

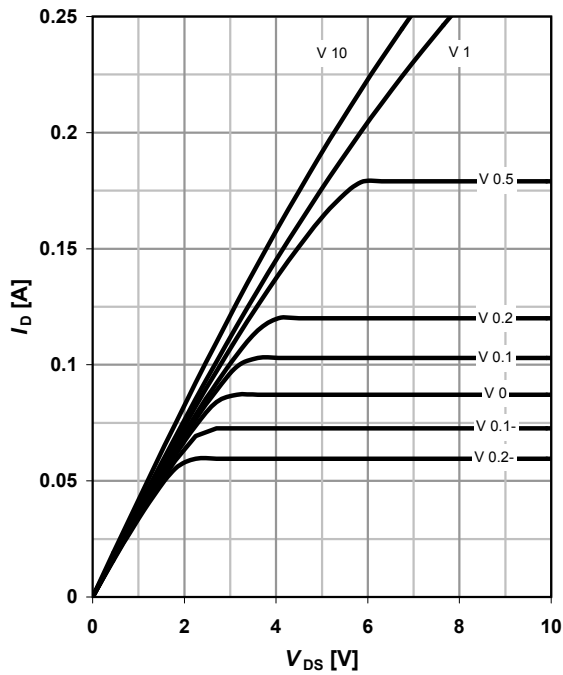
parameter:  $D = t_p / T$



**5 Typ. output characteristics**

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

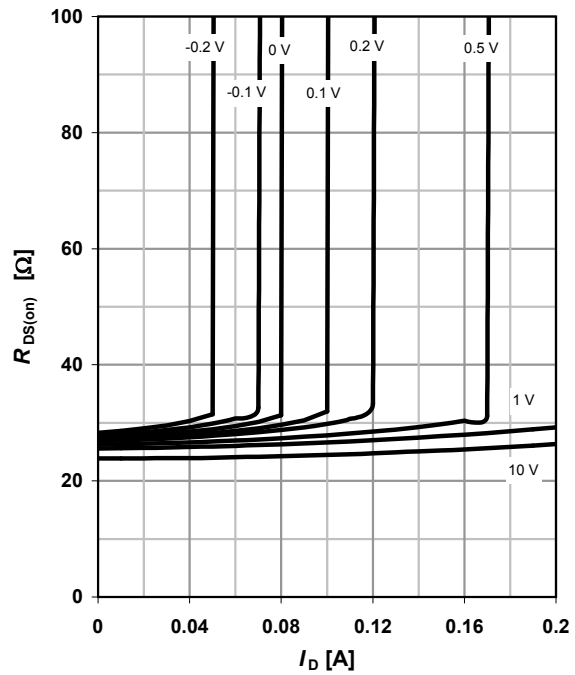
parameter:  $V_{GS}$



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

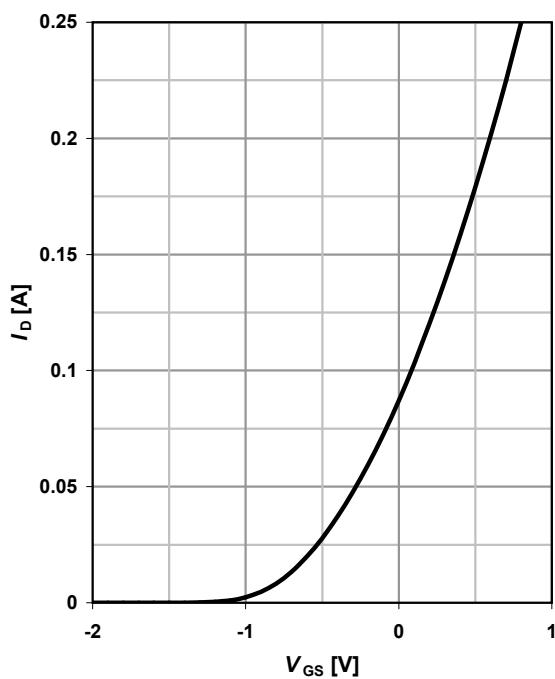
$$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C}$$

parameter:  $V_{GS}$



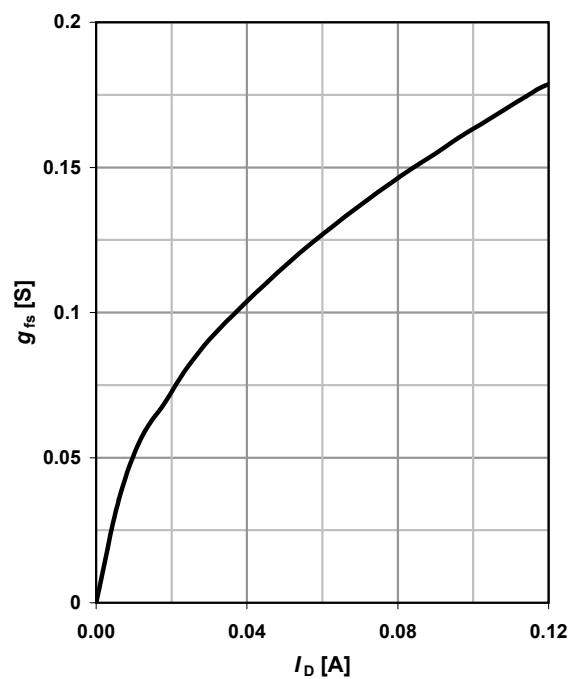
**7 Typ. transfer characteristics**

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



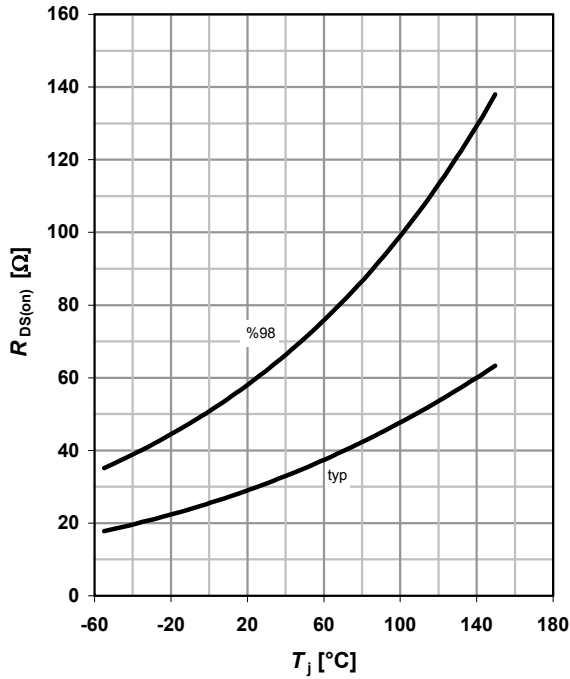
**8 Typ. forward transconductance**

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



**9 Drain-source on-state resistance**

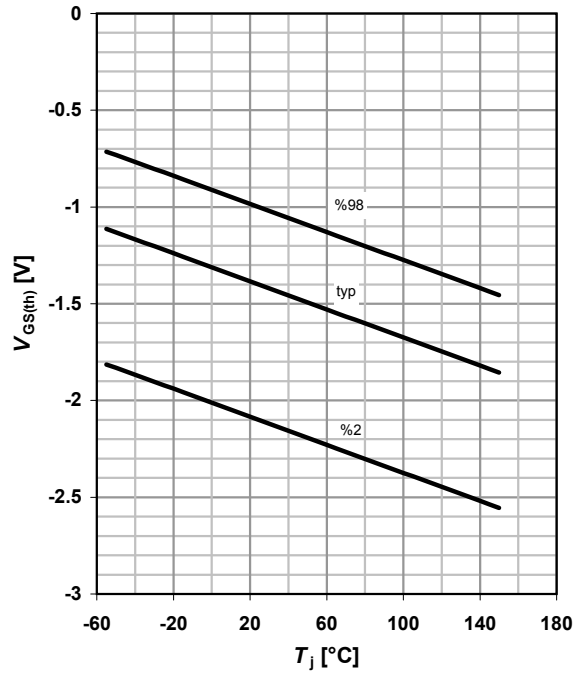
$$R_{DS(on)} = f(T_j); I_D = 0.01 \text{ A}; V_{GS} = 0 \text{ V}$$



**10 Typ. gate threshold voltage**

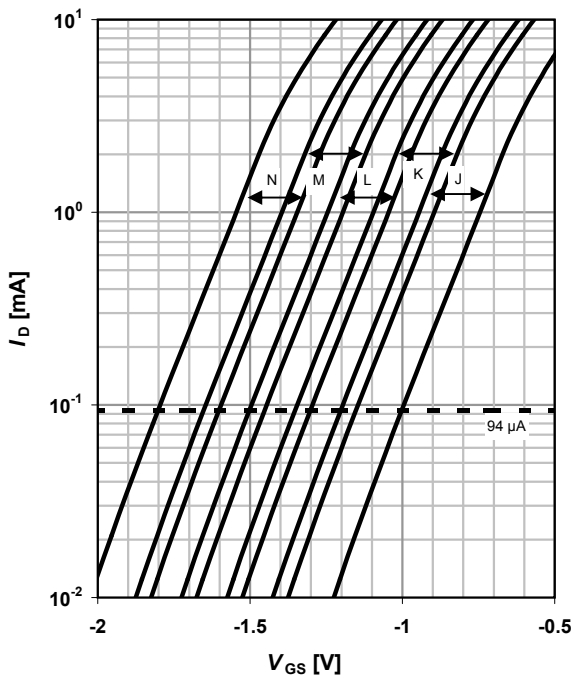
$$V_{GS(th)} = f(T_j); V_{DS} = 3 \text{ V}; I_D = 94 \mu\text{A}$$

parameter:  $I_D$



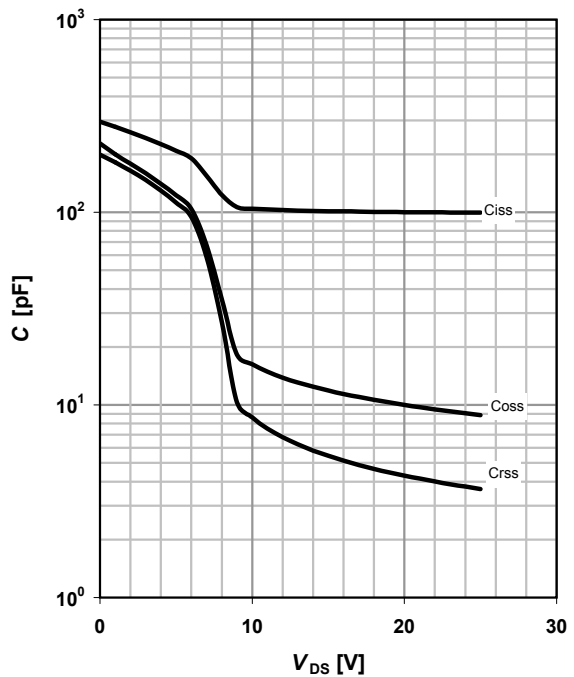
**11 Threshold voltage bands**

$$I_D = f(V_{GS}); V_{DS} = 3 \text{ V}; T_j = 25 \text{ °C}$$



**12 Typ. capacitances**

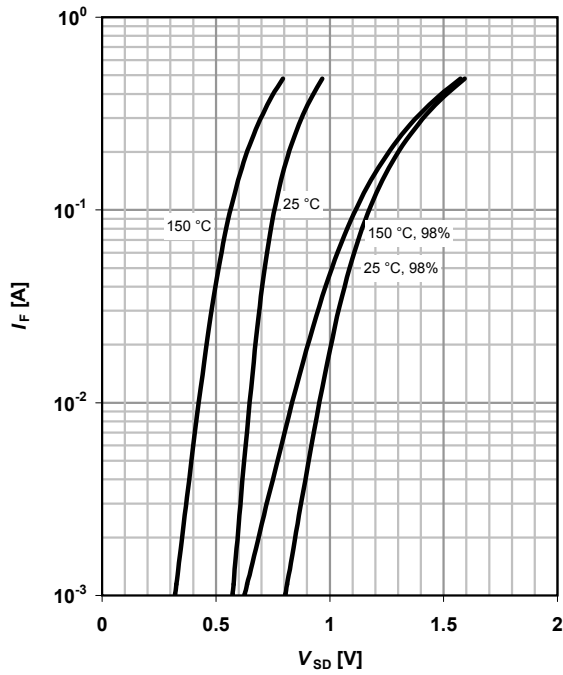
$$C = f(V_{DS}); V_{GS} = -3 \text{ V}; f = 1 \text{ MHz}$$



**13 Forward characteristics of reverse diode**

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

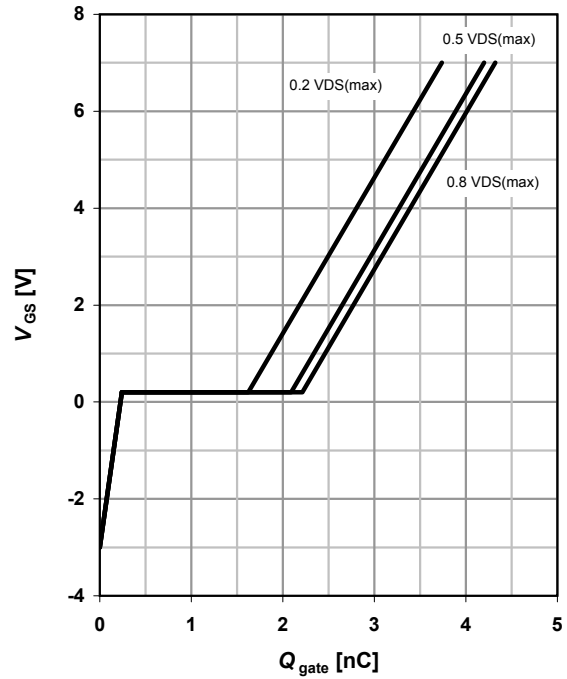
parameter:  $T_j$



**15 Typ. gate charge**

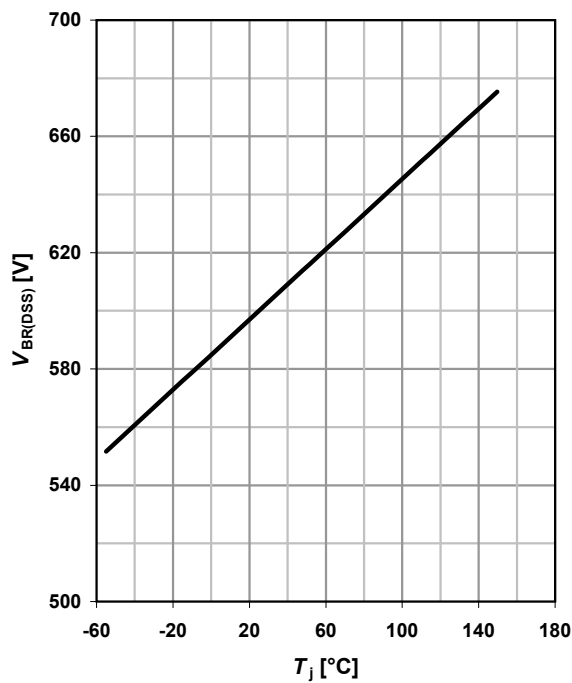
$$V_{GS} = f(Q_{gate}); I_D = 0.1 \text{ A pulsed}$$

parameter:  $V_{DD}$

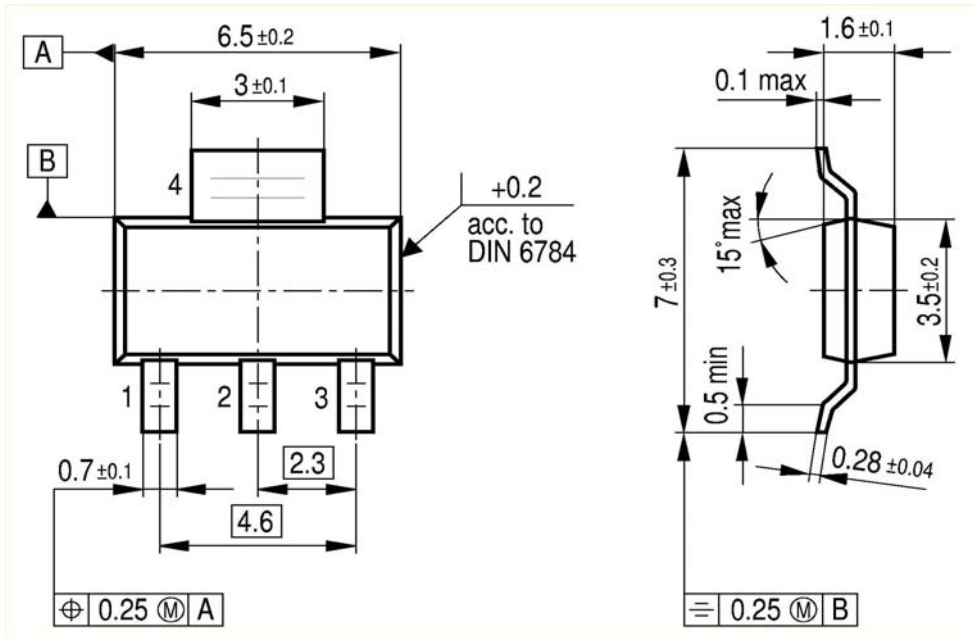


**16 Drain-source breakdown voltage**

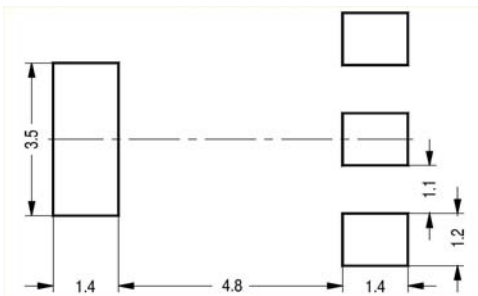
$$V_{BR(DSS)} = f(T_j); I_D = 250 \mu\text{A}$$



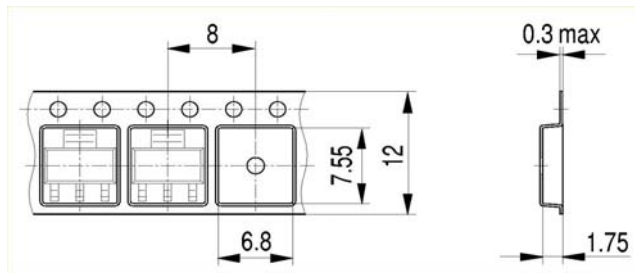
Package Outline:



Footprint:



Packaging:



Dimensions in mm



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