

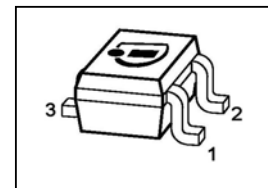
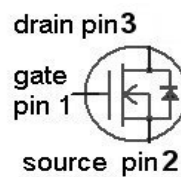
**SIPMOS® Small-Signal-Transistor**
**Features**

- N-channel
- Enhancement mode
- Logic level
- $dv/dt$  rated
- Pb-free lead-plating; RoHS compliant

**Product Summary**

|                  |      |          |
|------------------|------|----------|
| $V_{DS}$         | 60   | V        |
| $R_{DS(on),max}$ | 3.5  | $\Omega$ |
| $I_D$            | 0.28 | A        |

PG-SOT-323



| Type    | Package    | Tape and Reel | Marking |
|---------|------------|---------------|---------|
| BSS138W | PG-SOT-323 | L6327: 3000   | SWs     |
| BSS138W | PG-SOT-323 | L6433: 10000  | SWs     |

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

| Parameter                                | Symbol            | Conditions  | Value       | Unit               |
|--|-------------------|---|-------------|--------------------|
| Continuous drain current                 | $I_D$             | $T_A=25\text{ °C}$  | 0.28        | A                  |
|  |                   | $T_A=70\text{ °C}$  | 0.22        |                    |
| Pulsed drain current                     | $I_{D,pulse}$     | $T_A=25\text{ °C}$  | 1.12        |                    |
| Reverse diode $dv/dt$                    | $dv/dt$           | $I_D=0.28\text{ A}$ , $V_{DS}=48\text{ V}$ ,<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 sensitivity (HBM) as per MIL-STD 883 |                   |   | Class 1     |                    |
| Power dissipation                        | $P_{tot}$         | $T_A=25\text{ °C}$  | 0.50        | W                  |
| Operating and storage temperature        | $T_j$ , $T_{stg}$ |   | -55 ... 150 | $^{\circ}\text{C}$ |
| IEC climatic category; DIN IEC 68-1      |                   |   | 55/150/56   |                    |

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

**Thermal characteristics**

|  |            |  |   |   |     |     |
|--|------------|--|---|---|-----|-----|
| Thermal resistance, junction - minimal footprint | $R_{thJA}$ |  | - | - | 250 | K/W |
|--|------------|--|---|---|-----|-----|

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

|                                  |               |   |      |      |     |               |
|----------------------------------|---------------|---|------|------|-----|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=250\text{ }\mu\text{A}$                 | 60   | -    | -   | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{GS}=V_{DS}, I_D=26\text{ }\mu\text{A}$                      | 0.6  | 1.0  | 1.4 |               |
| Drain-source leakage current     | $I_{D(off)}$  | $V_{DS}=60\text{ V},$<br>$V_{GS}=0\text{ V}, T_j=25\text{ °C}$  | -    | -    | 0.1 | $\mu\text{A}$ |
|                                  |               | $V_{DS}=60\text{ V},$<br>$V_{GS}=0\text{ V}, T_j=150\text{ °C}$ | -    | -    | 5   |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$                         | -    | 1    | 10  | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=4.5\text{ V}, I_D=0.03\text{ A}$                        | -    | 3    | 4.0 | $\Omega$      |
|                                  |               | $V_{GS}=4.5\text{ V}, I_D=0.16\text{ A}$                        | -    | 3.2  | 6   |               |
|                                  |               | $V_{GS}=10\text{ V}, I_D=0.2\text{ A}$                          | -    | 2.1  | 3.5 |               |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max},$<br>$I_D=0.22\text{ A}$          | 0.12 | 0.23 | -   | S             |

| 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>$f=1\text{ MHz}$                   | - | 32  | 43  | pF |
| Output capacitance           | $C_{oss}$    |  | - | 7.2 | 10  |    |
| Reverse transfer capacitance | $C_{rss}$    |  | - | 2.8 | 4.2 |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=30\text{ V}, V_{GS}=10\text{ V},$<br>$I_D=0.2\text{ A}, R_G=6\ \Omega$ | - | 2.2 | 3.3 | ns |
| Rise time                    | $t_r$        |  | - | 3.0 | 4.5 |    |
| Turn-off delay time          | $t_{d(off)}$ |  | - | 6.7 | 10  |    |
| Fall time                    | $t_f$        |  | - | 8.2 | 12  |    |

**Gate Charge Characteristics**

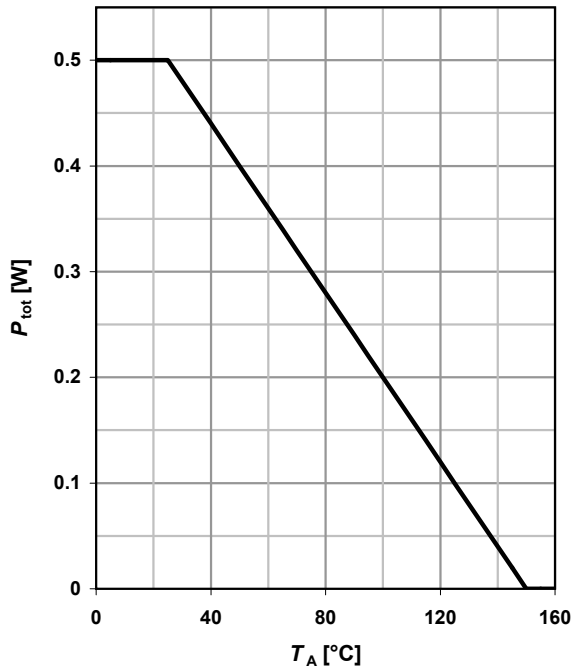
|                       |               |   |   |      |      |    |
|-----------------------|---------------|---|---|------|------|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=48\text{ V}, I_D=0.2\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 0.10 | 0.13 | nC |
| Gate to drain charge  | $Q_{gd}$      |   | - | 0.3  | 0.4  |    |
| Gate charge total     | $Q_g$         |   | - | 1.0  | 1.5  |    |
| Gate plateau voltage  | $V_{plateau}$ |   | - | 3.2  | -    | V  |

**Reverse Diode**

|                                  |               |   |   |      |      |    |
|----------------------------------|---------------|---|---|------|------|----|
| Diode continuous forward current | $I_S$         | $T_A=25\text{ }^\circ\text{C}$  | - | -    | 0.28 | A  |
| Diode pulse current              | $I_{S,pulse}$ |   | - | -    | 1.12 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=0.28\text{ A},$<br>$T_j=25\text{ }^\circ\text{C}$   | - | 0.85 | 1.2  | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=30\text{ V}, I_F=0.28\text{ A},$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 8.3  | 12.4 | ns |
| Reverse recovery charge          | $Q_{rr}$      |   | - | 3.3  | 5    |    |

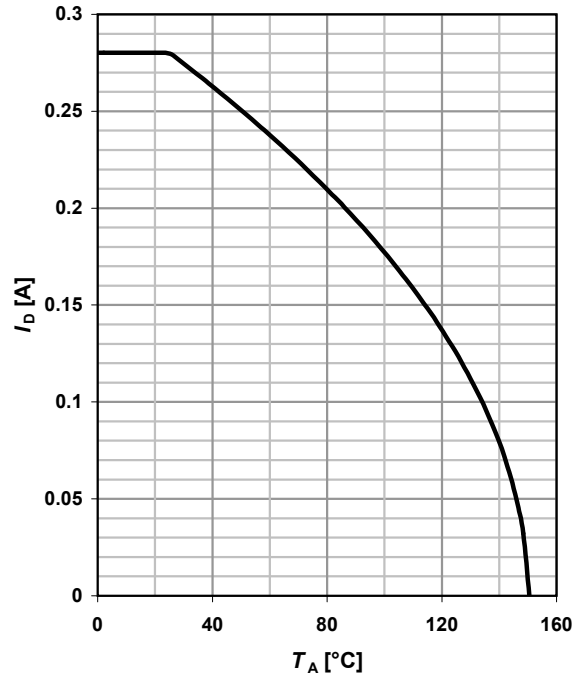
**1 Power dissipation**

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



**2 Drain current**

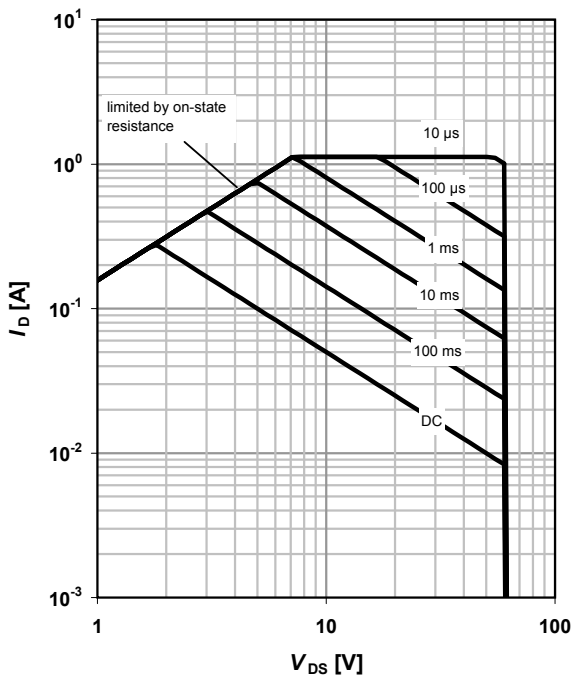
$$I_D = f(T_A); V_{GS} \geq 10 \text{ V}$$



**3 Safe operating area**

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

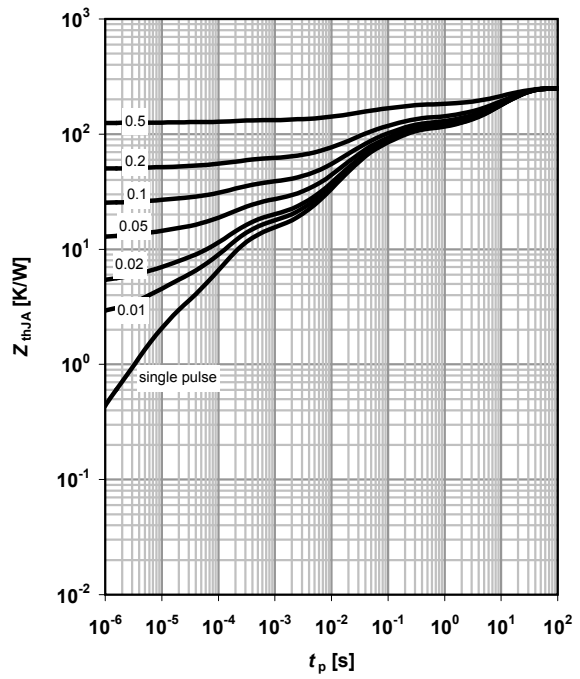
parameter:  $t_p$



**4 Max. transient thermal impedance**

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

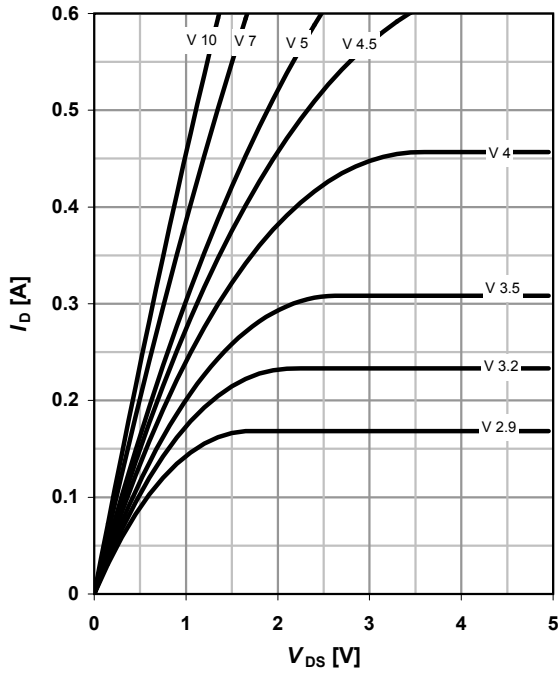
parameter:  $D = t_p / T$



**5 Typ. output characteristics**

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

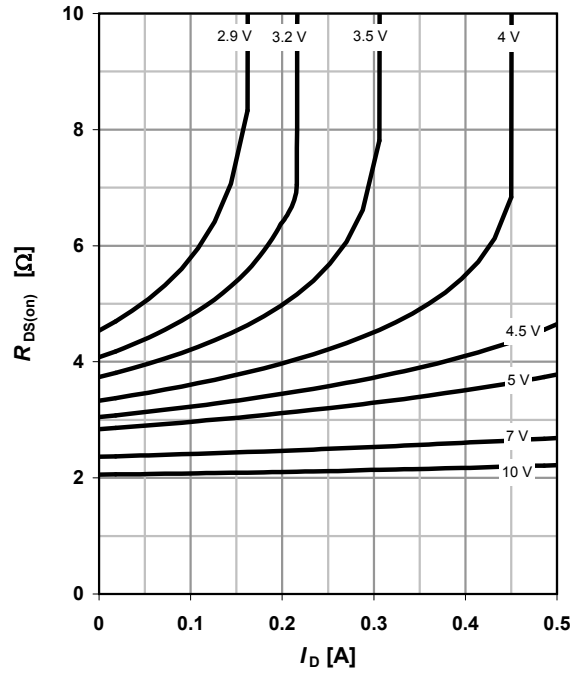
parameter:  $V_{GS}$



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

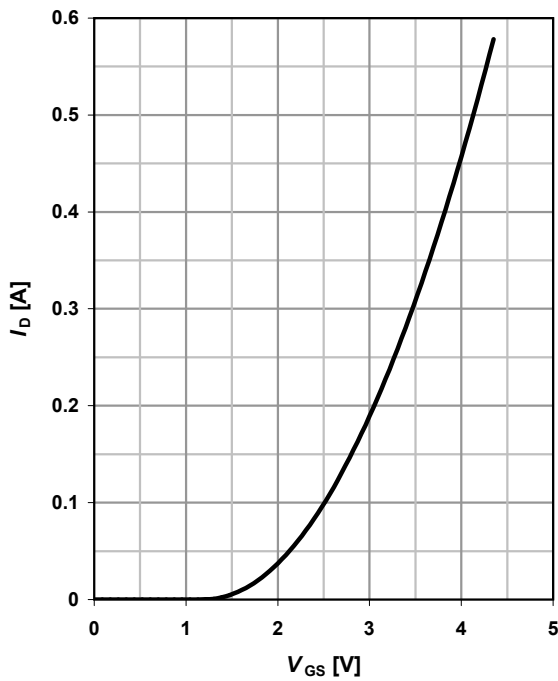
$$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C}$$

parameter:  $V_{GS}$



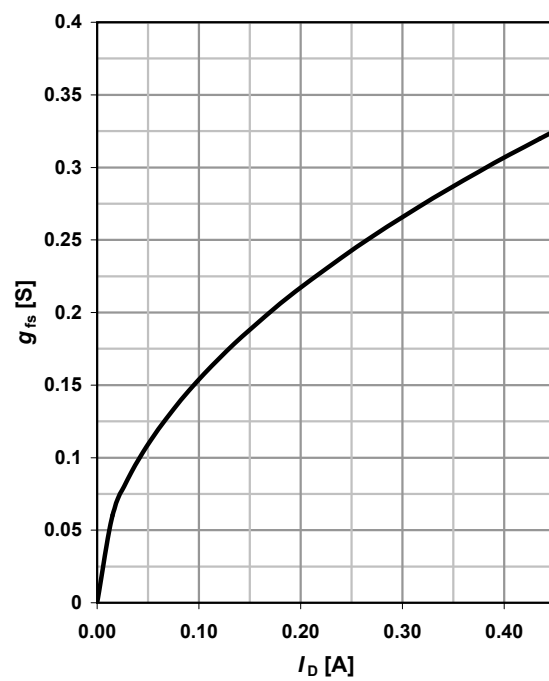
**7 Typ. transfer characteristics**

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



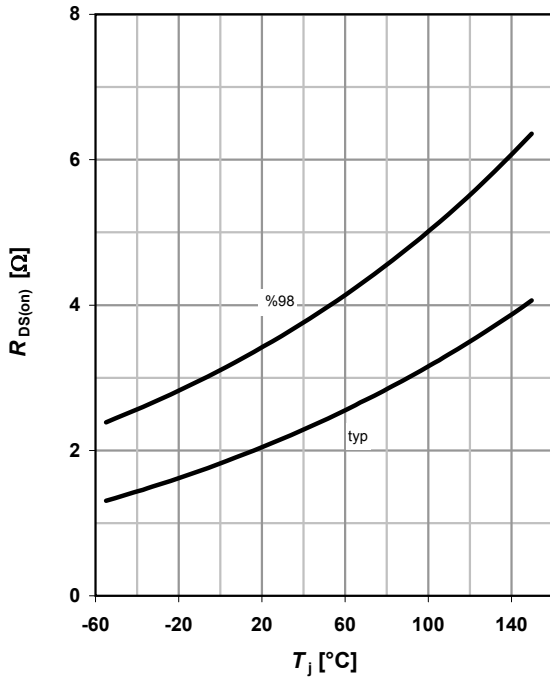
**8 Typ. forward transconductance**

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



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

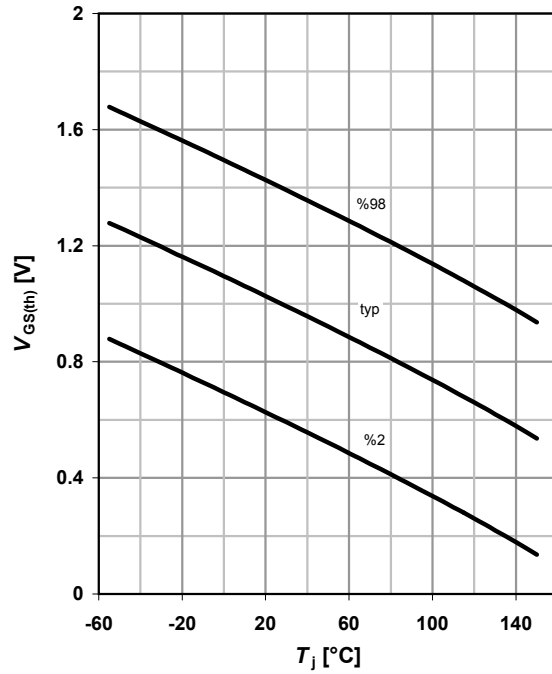
$R_{DS(on)} = f(T_j); I_D = 0.2 \text{ A}; V_{GS} = 10 \text{ V}$



**10 Typ. gate threshold voltage**

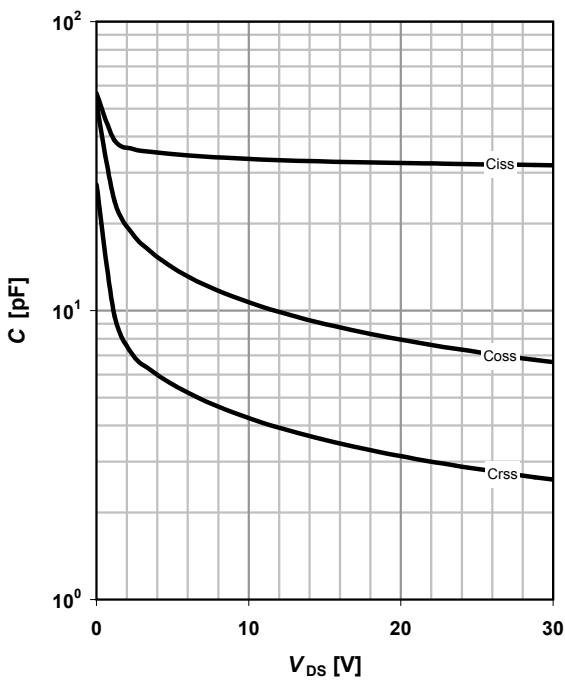
$V_{GS(th)} = f(T_j); V_{DS} = V_{GS}; I_D = 26 \mu\text{A}$

parameter:  $I_D$



**11 Typ. capacitances**

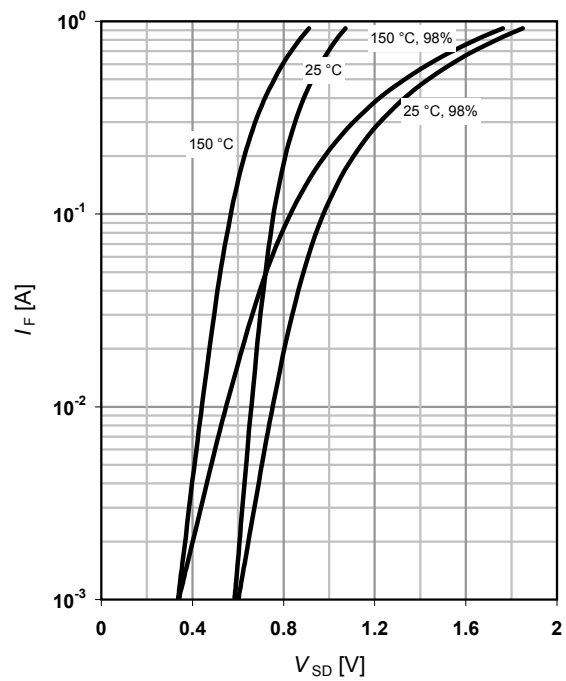
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25^\circ\text{C}$



**12 Forward characteristics of reverse diode**

$I_F = f(V_{SD})$

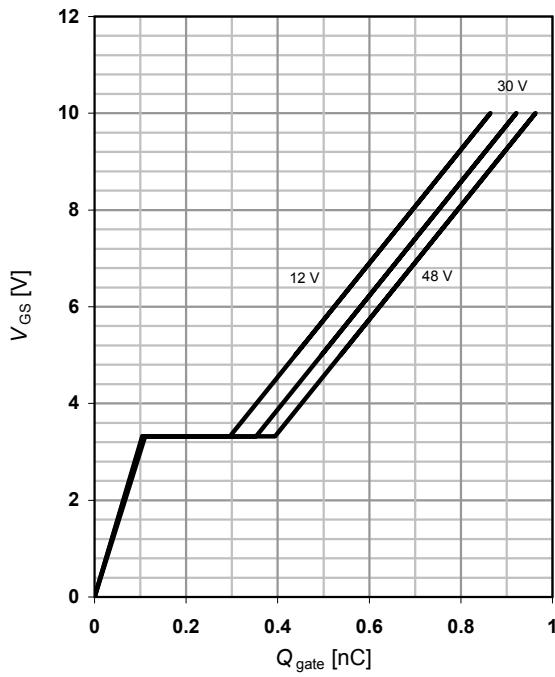
parameter:  $T_j$



**13 Typ. gate charge**

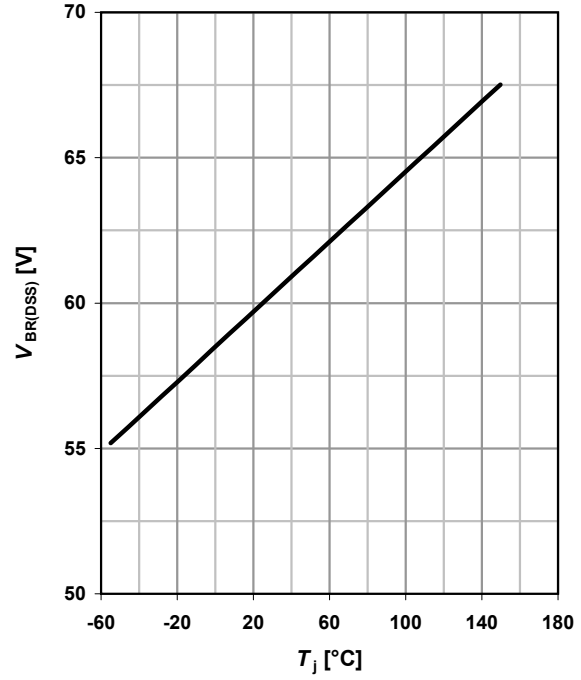
$$V_{GS} = f(Q_{gate}); I_D = 0.2 \text{ A pulsed}$$

parameter:  $V_{DD}$

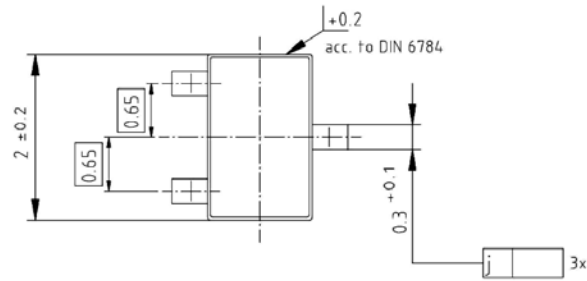
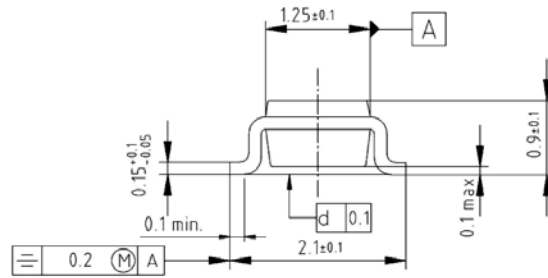


**14 Drain-source breakdown voltage**

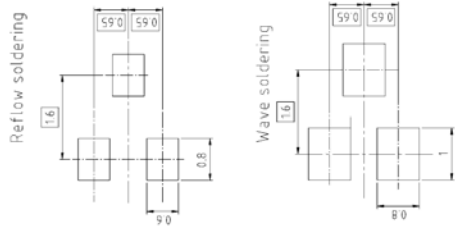
$$V_{BR(DSS)} = f(T_j); I_D = 250 \mu\text{A}$$



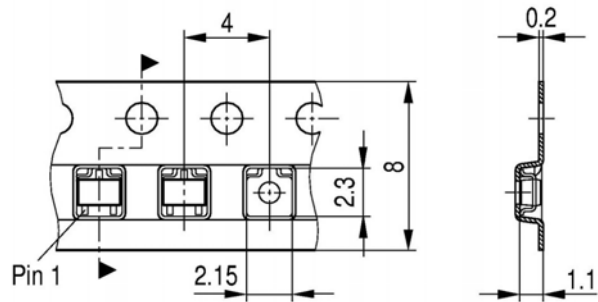
Package Outline:



Footprint:



Packaging:





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