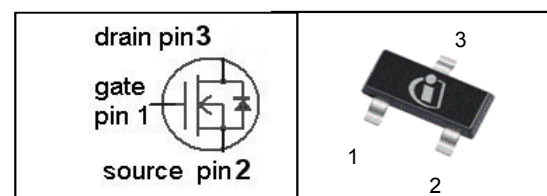


OptiMOS™ Small-Signal-Transistor
Features

- N-channel
- Enhancement mode
- Logic level
- Avalanche rated
- fast switching
- Pb-free lead-plating; RoHS compliant
- Halogen-free according to IEC61249-2-21


Product Summary

| | | |
|------------------|-----------------------|------------|
| V_{DS} | 60 | V |
| $R_{DS(on),max}$ | $V_{GS}=10\text{ V}$ | 3 Ω |
| | $V_{GS}=4.5\text{ V}$ | 4 |
| I_D | 0.3 | A |

PG-SOT23


| Type | Package | Tape and Reel Information | Marking | HalogenFree | Packing |
|--------|-----------|---------------------------|---------|-------------|---------|
| 2N7002 | PG-SOT-23 | H6327: 3000 pcs/reel | 72s | Yes | Non Dry |

| Parameter | Symbol | Conditions | Value | Unit |
|-------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------|-----------------|--------------------|
| Continuous drain current | I_D | $T_A=25\text{ °C}$ | 0.30 | A |
| | | $T_A=70\text{ °C}$ | 0.24 | |
| Pulsed drain current | $I_{D,pulse}$ | $T_A=25\text{ °C}$ | 1.2 | |
| Avalanche energy, single pulse | E_{AS} | $I_D=0.3\text{ A}$, $R_{GS}=25\ \Omega$ | 1.3 | mJ |
| Reverse diode dv/dt | dv/dt | $I_D=0.3\text{ A}$, $V_{DS}=48\text{ V}$, $di/dt=200\text{ A}/\mu\text{s}$, $T_{j,max}=150\text{ °C}$ | 6 | kV/ μs |
| Gate source voltage | V_{GS} | | ± 20 | V |
| ESD class | | JESD22-A114 (HBM) | class 0 (<250V) | |
| Power dissipation | $P_{tot}^{(2)}$ | $T_A=25\text{ °C}$ | 0.5 | 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⁾ J-STD20 and JESD22

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

Thermal characteristics

| | | | | | | |
|-----------------------------------------------------------------|------------|--|---|---|-----|-----|
| Thermal resistance, junction - minimal footprint ⁽²⁾ | R_{thJA} | | - | - | 250 | K/W |
|-----------------------------------------------------------------|------------|--|---|---|-----|-----|

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

| | | | | | | |
|----------------------------------|---------------|------------------------------------------------------------------------|-----|------|-----|---------------|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=250\text{ }\mu\text{A}$ | 60 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\text{ }\mu\text{A}$ | 1.5 | 2.1 | 2.5 | |
| Drain-source leakage current | $I_{D(off)}$ | $V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$ | - | - | 0.1 | μA |
| | | $V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=150\text{ }^\circ\text{C}$ | - | - | 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 | $R_{DS(on)}$ | $V_{GS}=4.5\text{ V}, I_D=0.25\text{ A}$ | - | 2.0 | 4 | Ω |
| | | $V_{GS}=10\text{ V}, I_D=0.5\text{ A}$ | - | 1.6 | 3 | |
| Transconductance | g_{fs} | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=0.24\text{ A}$ | 0.2 | 0.36 | - | S |

⁽²⁾ Performed on a 40x40mm² FR4 PCB with both sided Cu sense-force traces, each 1mm wide, 70 μm thick and 20mm long.

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

Dynamic characteristics

| | | | | | | |
|------------------------------|--------------|--------------------------------------------------------------------------------|---|-----|-----|----|
| Input capacitance | C_{iss} | $V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$ | - | 13 | 20 | pF |
| Output capacitance | C_{oss} | | - | 4.1 | 6 | |
| Reverse transfer capacitance | C_{rss} | | - | 2.0 | 3 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=30\text{ V}, V_{GS}=10\text{ V},$ $I_D=0.5\text{ A}, R_G=6\ \Omega$ | - | 3.0 | 4.5 | ns |
| Rise time | t_r | | - | 3.3 | 5 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 5.5 | 9 | |
| Fall time | t_f | | - | 3.1 | 5 | |

Gate Charge Characteristics

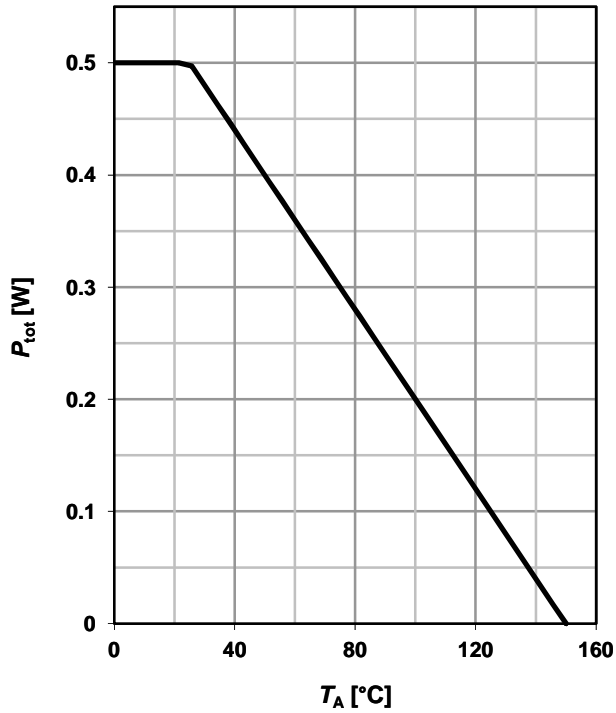
| | | | | | | |
|-----------------------|---------------|-----------------------------------------------------------------------------|---|------|-----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=48\text{ V}, I_D=0.5\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 0.05 | 0.1 | nC |
| Gate to drain charge | Q_{gd} | | - | 0.2 | 0.4 | |
| Gate charge total | Q_g | | - | 0.4 | 0.6 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 4.0 | - | V |

Reverse Diode

| | | | | | | |
|----------------------------------|---------------|----------------------------------------------------------------------------|---|------|-----|----|
| Diode continuous forward current | I_S | $T_A=25\text{ }^\circ\text{C}$ | - | - | 0.3 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 1.2 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=0.5\text{ A},$ $T_J=25\text{ }^\circ\text{C}$ | - | 0.96 | 1.2 | V |
| Reverse recovery time | t_{rr} | $V_R=30\text{ V}, I_F=0.5\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$ | - | 8.5 | 13 | ns |
| Reverse recovery charge | Q_{rr} | | - | 2.4 | 4 | nC |

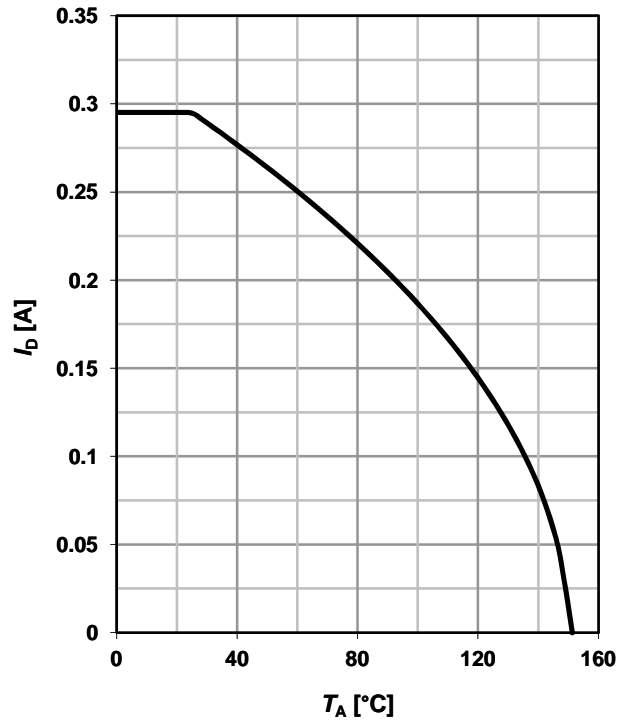
1 Power dissipation

$P_{tot}=f(T_A)$



2 Drain current

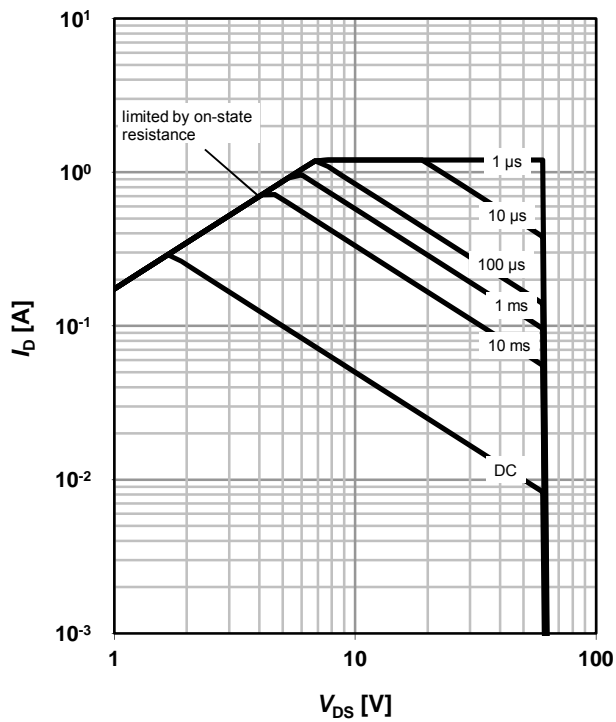
$I_D=f(T_A); V_{GS} \geq 10\text{ V}$



3 Safe operating area

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

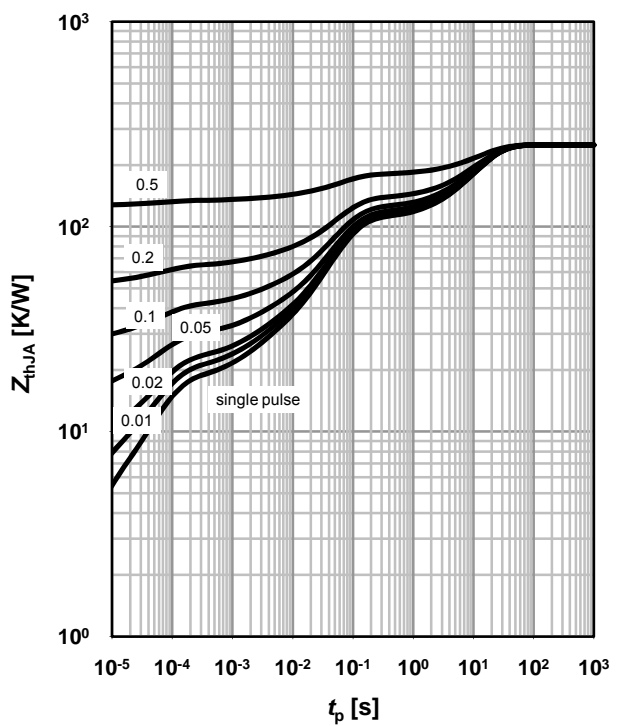
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJA}=f(t_p)$

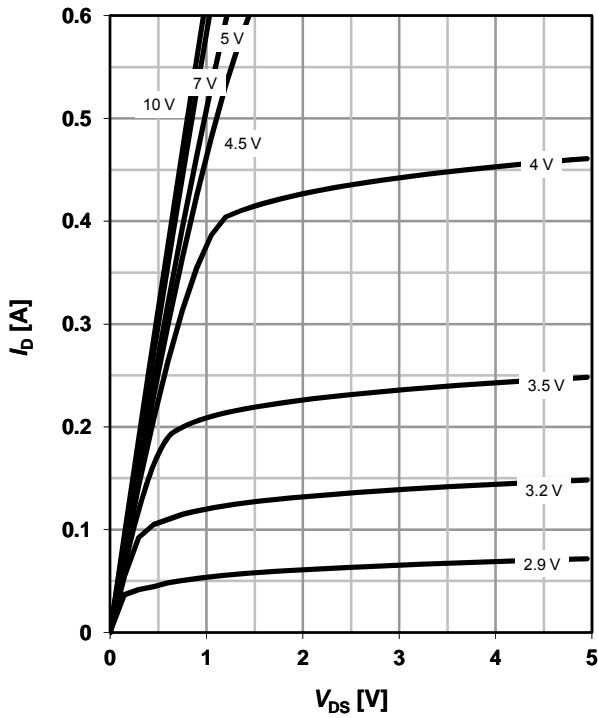
parameter: $D=t_p/T$



5 Typ. output characteristics

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

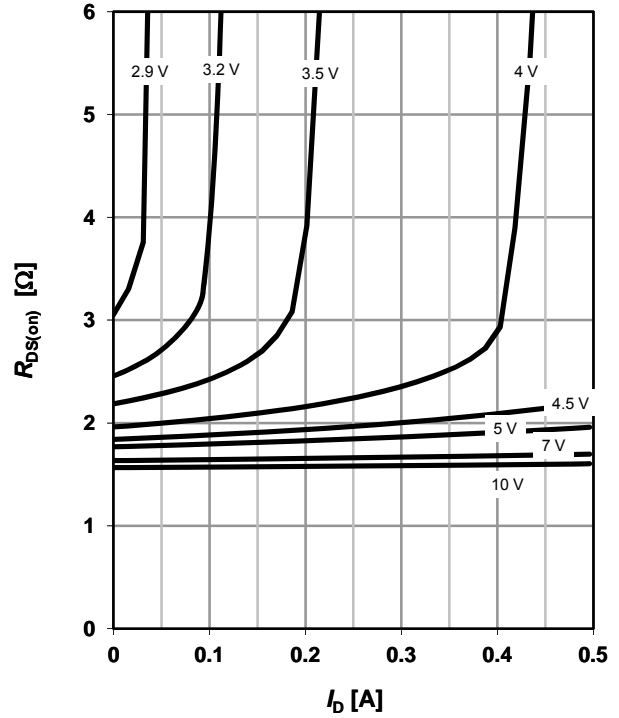
parameter: V_{GS}



6 Typ. drain-source on resistance

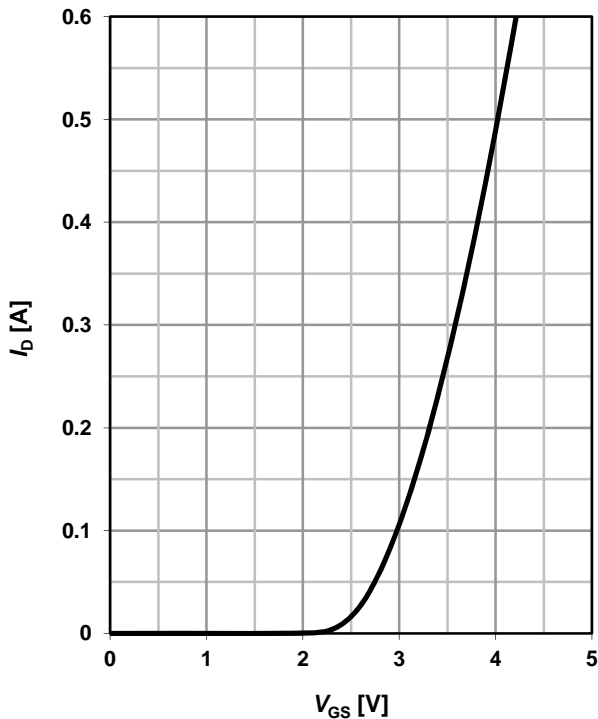
$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C}$

parameter: V_{GS}



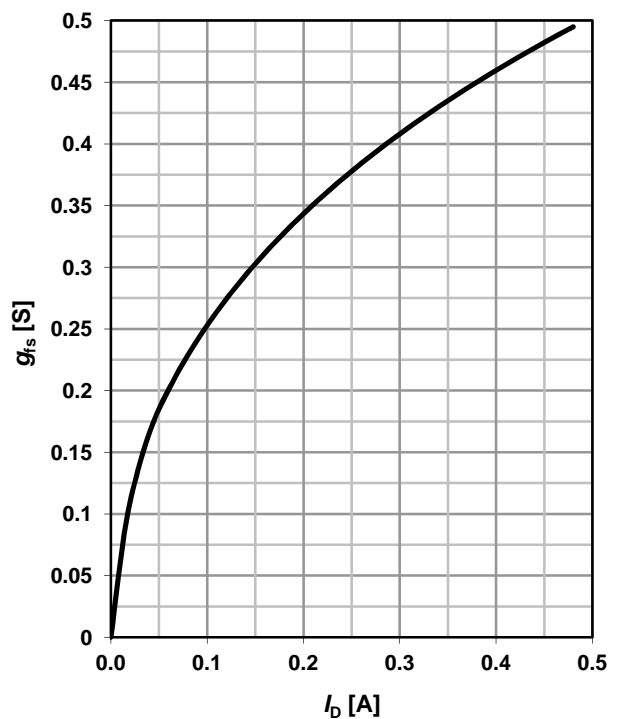
7 Typ. transfer characteristics

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



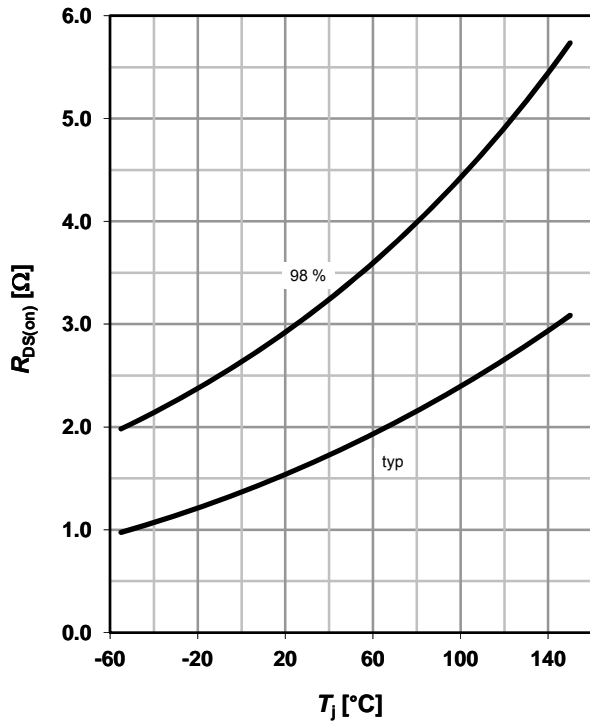
8 Typ. forward transconductance

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



9 Drain-source on-state resistance

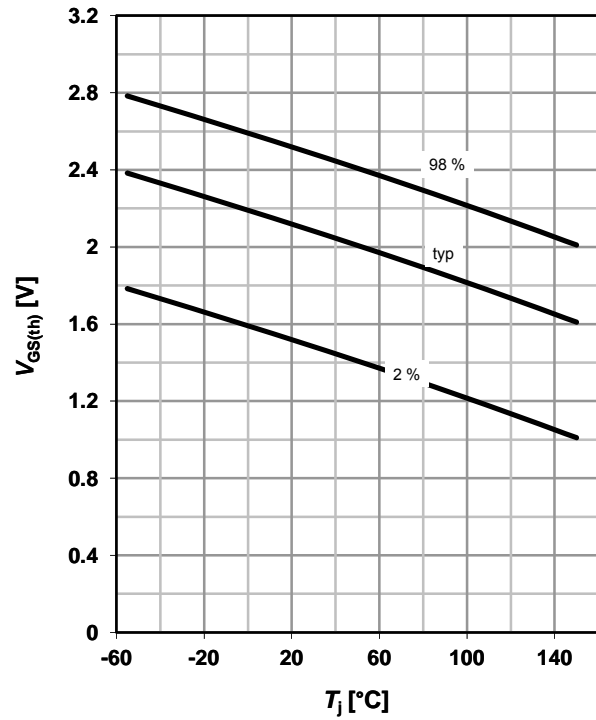
$R_{DS(on)}=f(T_j); I_D=0.3\text{ A}; V_{GS}=10\text{ V}$



10 Typ. gate threshold voltage

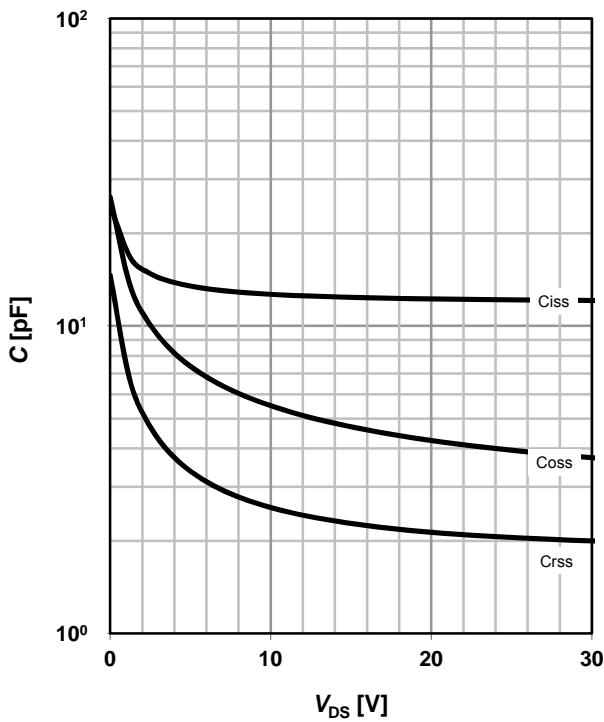
$V_{GS(th)}=f(T_j); V_{DS}=V_{GS}; I_D=250\ \mu\text{A}$

parameter: I_D



11 Typ. capacitances

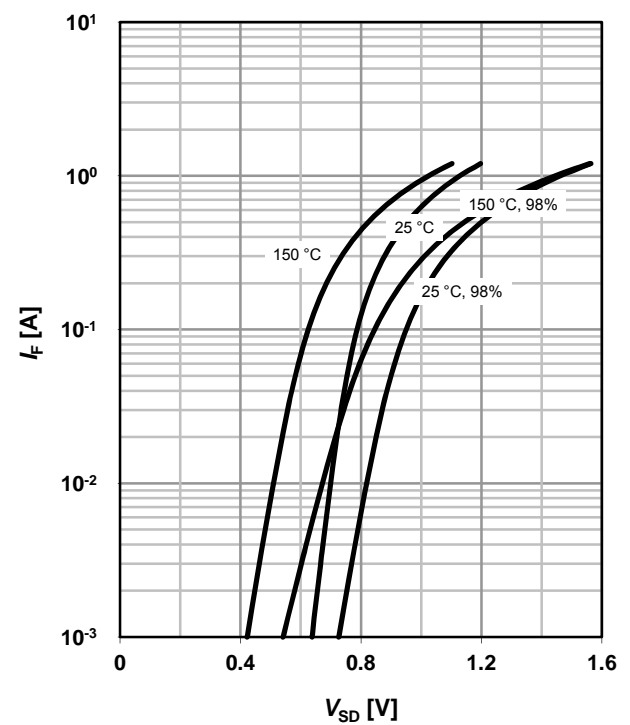
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}; T_j=25^\circ\text{C}$



12 Forward characteristics of reverse diode

$I_F=f(V_{SD})$

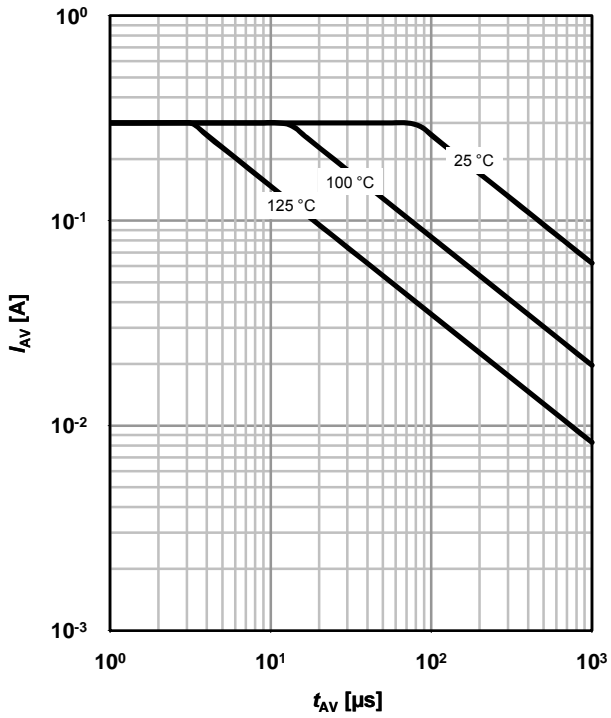
parameter: T_j



13 Avalanche characteristics

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

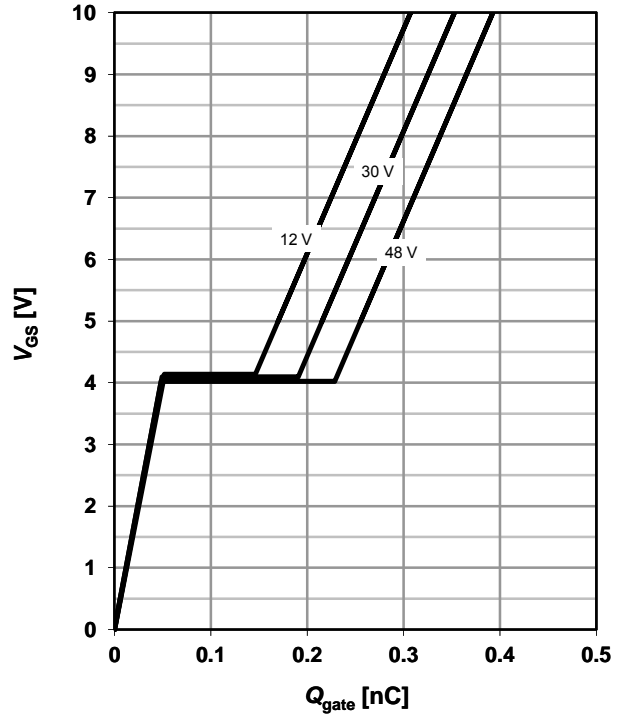
parameter: $T_{j(\text{start})}$



14 Typ. gate charge

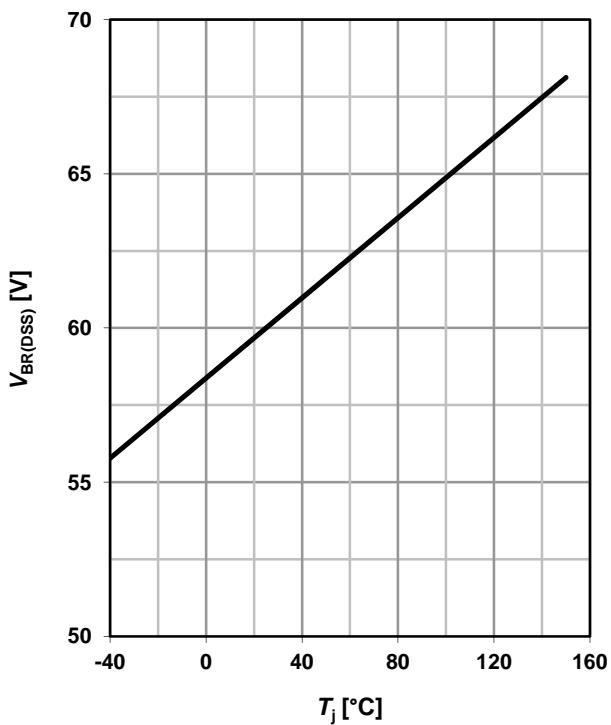
$V_{GS}=f(Q_{\text{gate}}); I_D=0.5\text{ A pulsed}$

parameter: V_{DD}

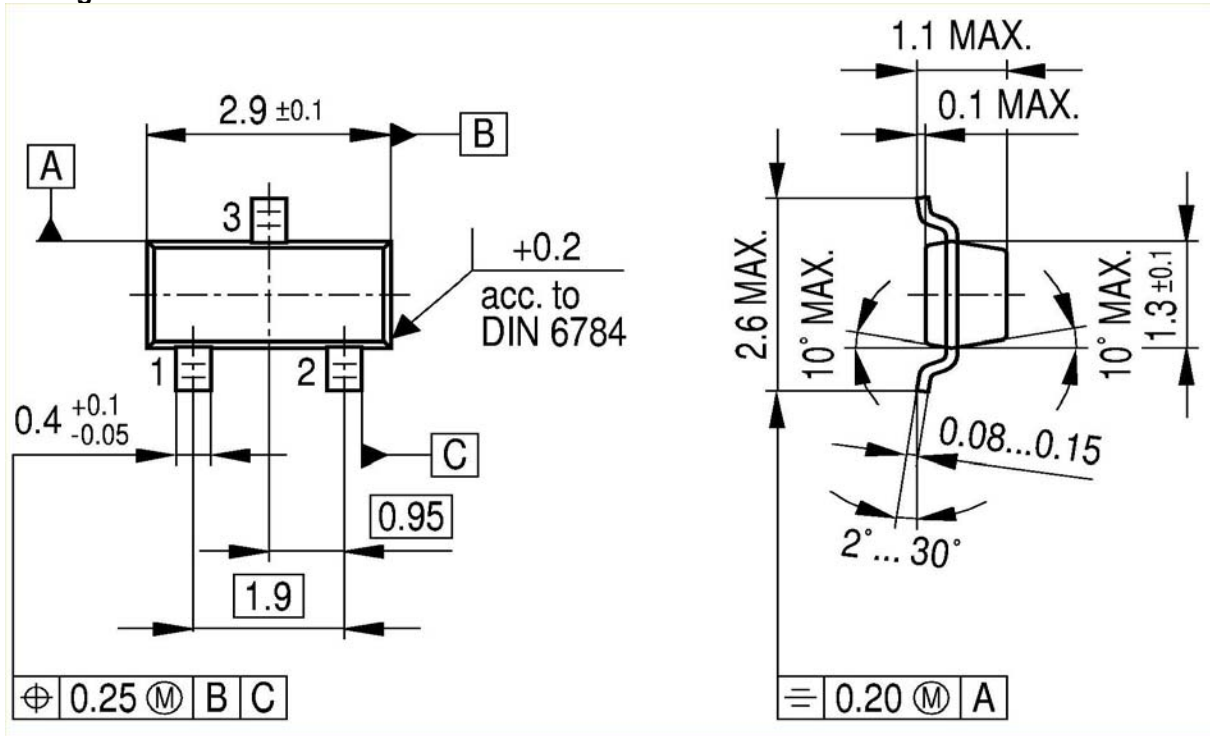


15 Drain-source breakdown voltage

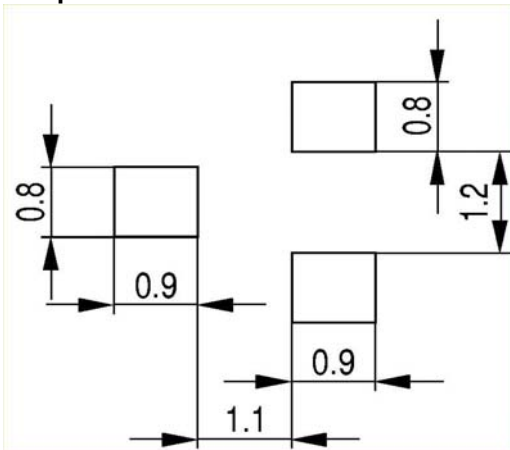
$V_{BR(DSS)}=f(T_j); I_D=250\ \mu\text{A}$



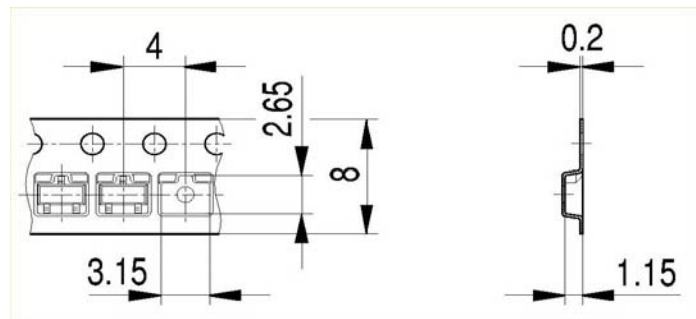
Package Outline:



Footprint:



Packing:



Dimensions in mm

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