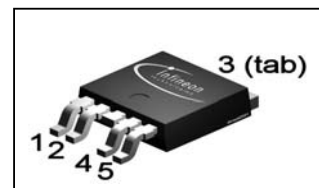


OptiMOS® -P Power-Transistor
Features

- P-Channel
- Enhancement mode
- Logic level
- 175°C operating temperature
- Avalanche rated
- dv/dt rated
- High current rating
- Pb-free lead-plating, RoHS compliant


PG-TO252-5

Product Summary

| | | |
|------------------|-----|------------|
| V_{DS} | -30 | V |
| $R_{DS(on),max}$ | 7 | m Ω |
| I_D | -50 | A |

| Type | Package | Marking | Tape and reel information | Lead Free | Packing |
|-------------|------------|---------|---------------------------|-----------|---------|
| SPD50P03L G | PG-TO252-5 | 50P03L | 1000 pcs / reel | Yes | Non dry |

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

| Parameter | Symbol | Conditions | Value | Unit |
|-------------------------------------|----------------|---|------------|-------------------|
| Continuous drain current | I_D | $T_C=25\text{ }^\circ\text{C}^{(1)}$ | -50 | A |
| | | $T_C=100\text{ }^\circ\text{C}^{(1)}$ | -50 | |
| Pulsed drain current | $I_{D,pulse}$ | $T_C=25\text{ }^\circ\text{C}$ | -200 | |
| Avalanche energy, single pulse | E_{AS} | $I_D=-50\text{ A}$, $R_{GS}=25\text{ }\Omega$ | 256 | mJ |
| Reverse diode dv/dt | dv/dt | $I_D=-50\text{ A}$, $V_{DS}=24\text{ V}$, $di/dt=-200\text{ A}/\mu\text{s}$, $T_{j,max}=175\text{ }^\circ\text{C}$ | -6 | kV/ μs |
| Gate source voltage | V_{GS} | | ± 20 | V |
| Power dissipation | P_{tot} | $T_C=25\text{ }^\circ\text{C}$ | 150 | W |
| Operating and storage temperature | T_j, T_{stg} | | -55...+175 | $^\circ\text{C}$ |
| ESD class HBM | | | 1C | |
| Soldering temperature | | | 260 | |
| IEC climatic category; DIN IEC 68-1 | | | 55/175/56 | |

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

Thermal characteristics

| | | | | | | |
|--|------------|--|---|---|----|-----|
| Thermal resistance, junction - case | R_{thJC} | | - | - | 1 | K/W |
| Thermal resistance, junction - ambient | R_{thJA} | minimal footprint | - | - | 75 | |
| | | 6 cm ² cooling area ²⁾ | - | - | 50 | |

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

| | | | | | | |
|----------------------------------|---------------|---|-----|------|------|---------------|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=-250\text{ }\mu\text{A}$ | -30 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-250\text{ }\mu\text{A}$ | -1 | -1.5 | -2 | |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=-30\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$ | - | -0.1 | -1 | μA |
| | | $V_{DS}=-30\text{ V}, V_{GS}=0\text{ V}, T_j=175\text{ }^\circ\text{C}$ | - | -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 | $R_{DS(on)}$ | $V_{GS}=-4.5\text{ V}, I_D=-30\text{ A}$ | - | 8.5 | 12.5 | m Ω |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=-10\text{ V}, I_D=-50\text{ A}$ | - | 5.7 | 7.0 | |
| Transconductance | g_{fs} | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=-50\text{ A}$ | 47 | 94 | - | S |

¹⁾ Current is limited by bondwire; with an $R_{thJC}=1\text{ K/W}$ the chip is able to carry 123 A.

²⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm 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} | $V_{GS}=0\text{ V}$, $V_{DS}=-25\text{ V}$, $f=1\text{ MHz}$ | - | 4590 | 6880 | pF |
| Output capacitance | C_{oss} | | - | 1220 | 1830 | |
| Reverse transfer capacitance | C_{rss} | | - | 1000 | 1500 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=-15\text{ V}$, $V_{GS}=-10\text{ V}$, $I_D=-1\text{ A}$, $R_G=6\ \Omega$ | - | 14.8 | 22 | ns |
| Rise time | t_r | | - | 21.7 | 32 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 139 | 208 | |
| Fall time | t_f | | - | 104 | 156 | |

Gate Charge Characteristics³⁾

| | | | | | | |
|-----------------------|---------------|---|---|------|------|----|
| Gate to source charge | Q_{gs} | $V_{DD}=-24\text{ V}$, $I_D=-50\text{ A}$ | - | -14 | -19 | nC |
| Gate to drain charge | Q_{gd} | | - | -35 | -53 | |
| Gate charge total | Q_g | $V_{DD}=-24\text{ V}$, $I_D=-50\text{ A}$, $V_{GS}=0\text{ to }-10\text{ V}$ | - | -95 | -126 | |
| Gate plateau voltage | $V_{plateau}$ | $V_{DD}=-24\text{ V}$, $I_D=-50\text{ A}$ | - | -3.0 | - | V |

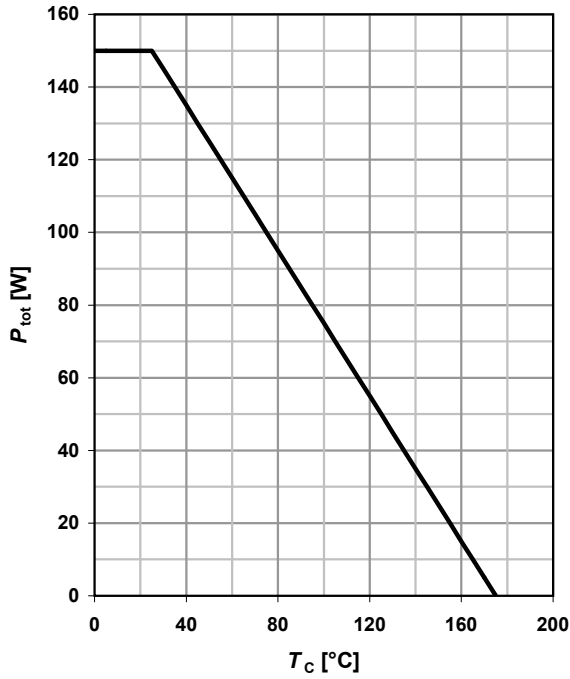
Reverse Diode

| | | | | | | |
|----------------------------------|---------------|---|---|----|-------|----|
| Diode continuous forward current | I_S | $T_C=25\text{ }^\circ\text{C}$ | - | - | -50 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | -200 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}$, $I_F=50\text{ A}$, $T_j=25\text{ }^\circ\text{C}$ | - | -1 | -1.65 | V |
| Reverse recovery time | t_{rr} | $V_R=-15\text{ V}$, $I_F= I_S $, $di_F/dt=100\text{ A}/\mu\text{s}$ | - | 38 | 47 | ns |
| Reverse recovery charge | Q_{rr} | | - | 46 | 57 | nC |

³⁾ See figure 16 for gate charge parameter definition

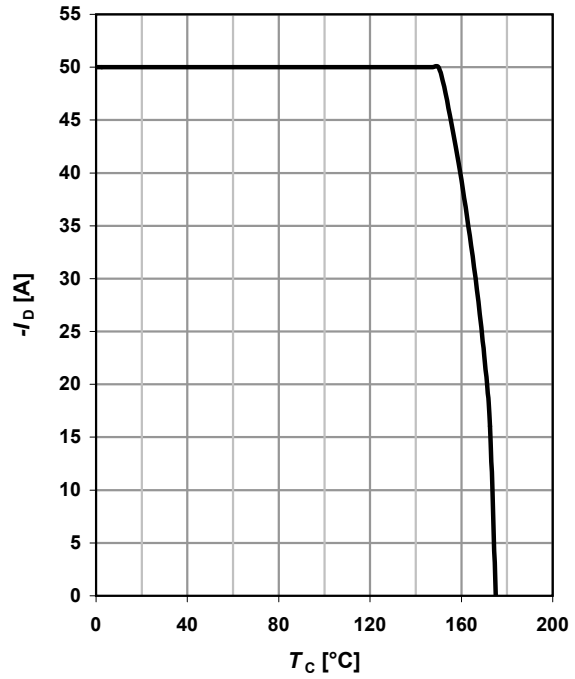
1 Power dissipation

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



2 Drain current

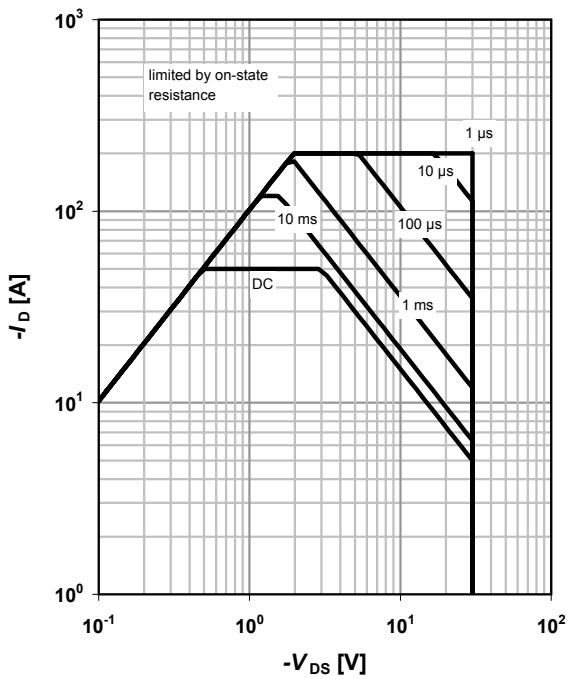
$$I_D = f(T_C); |V_{GS}| \geq 10 \text{ V}$$



3 Safe operating area

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

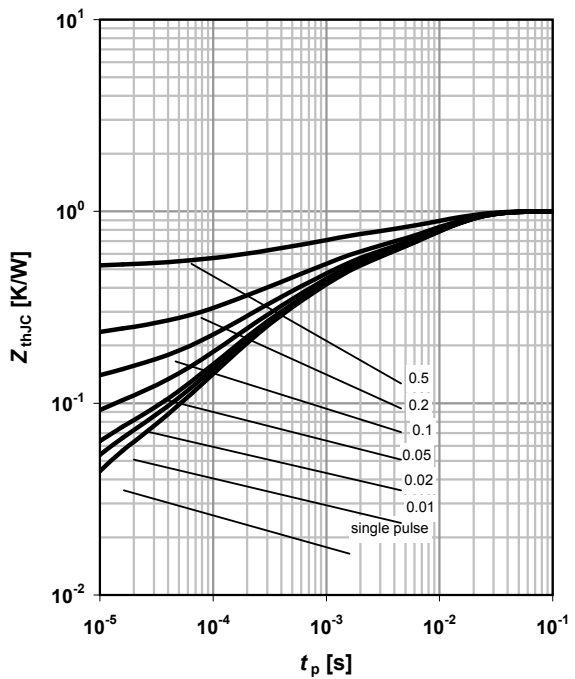
parameter: t_p



4 Max. transient thermal impedance

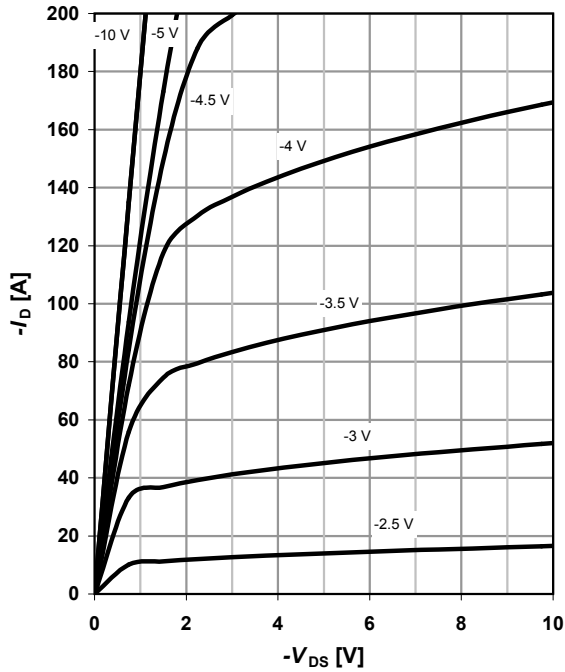
$$Z_{thJC} = f(t_p)$$

parameter: $D = t_p / T$

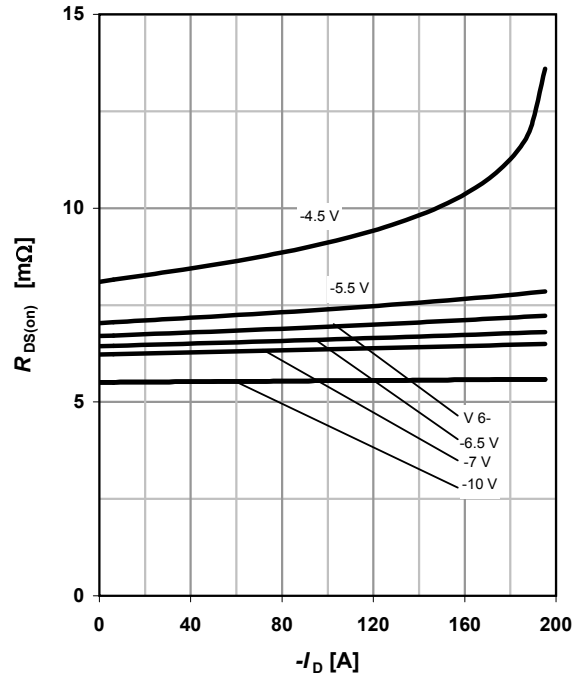


5 Typ. output characteristics

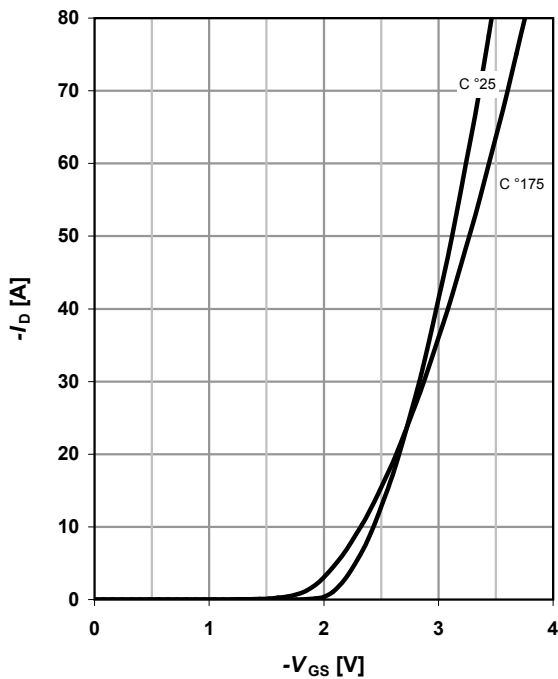
$$I_D = f(V_{DS}); T_j = 25\text{ }^\circ\text{C}$$

 parameter: V_{GS}

6 Typ. drain-source on resistance

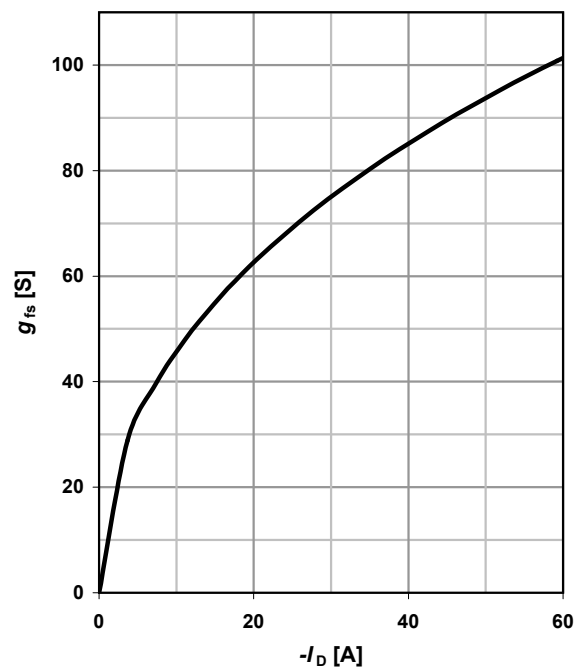
$$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C}$$

 parameter: V_{GS}

7 Typ. transfer characteristics

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

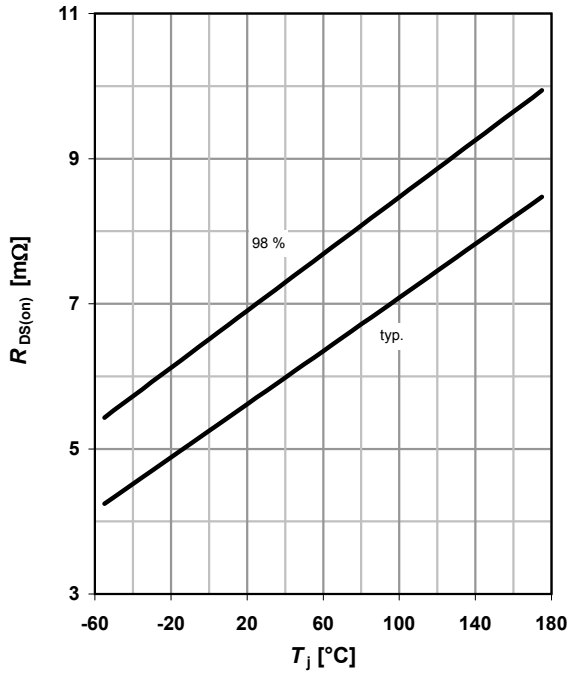
 parameter: T_j

8 Typ. forward transconductance

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



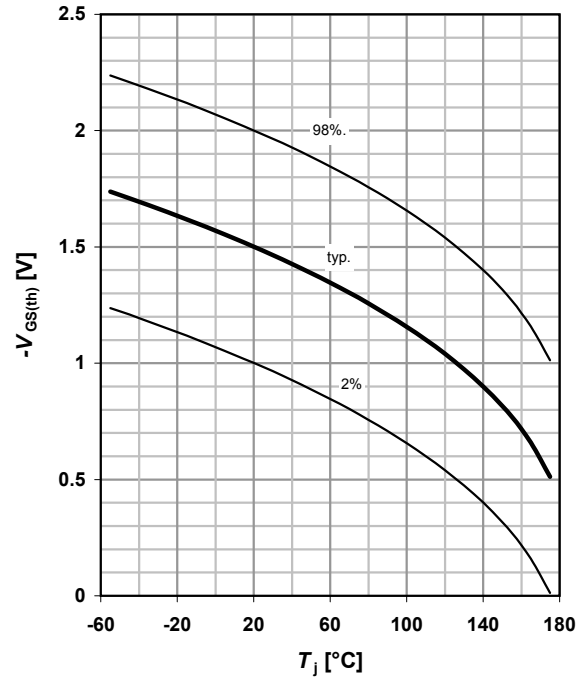
9 Drain-source on-state resistance

$R_{DS(on)} = f(T_j); I_D = -50 \text{ A}; V_{GS} = -10 \text{ V}$



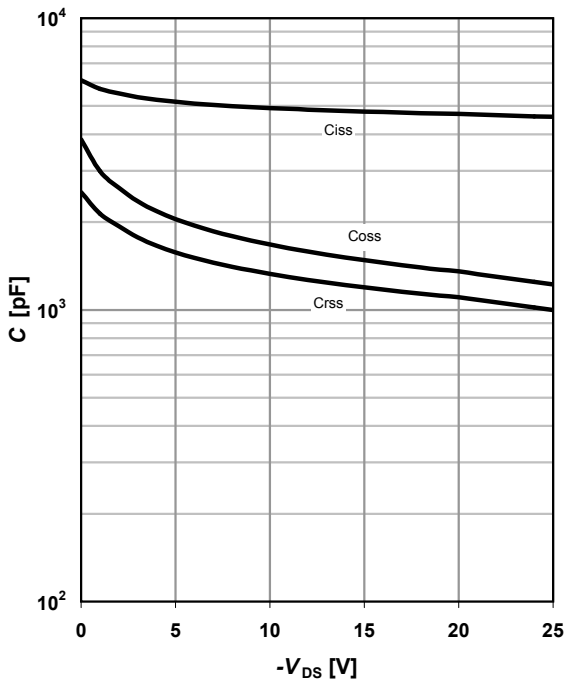
10 Typ. gate threshold voltage

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



11 Typ. capacitances

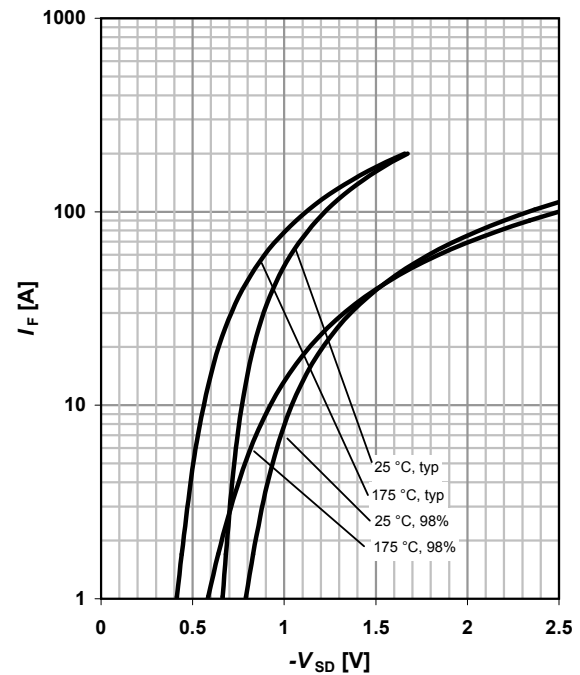
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



12 Forward characteristics of reverse diode

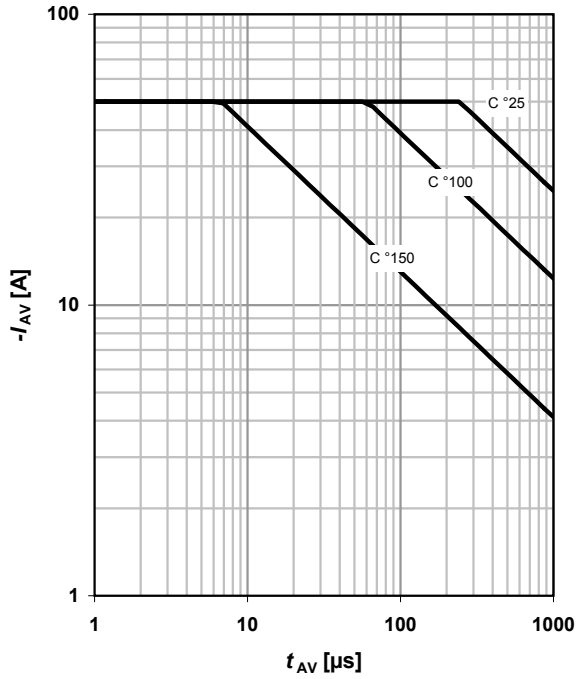
$I_F = f(V_{SD})$

parameter: T_j

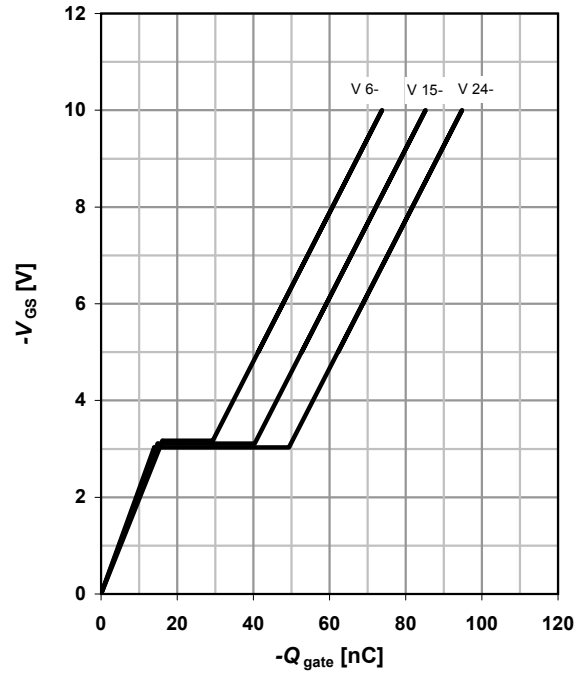


13 Avalanche characteristics

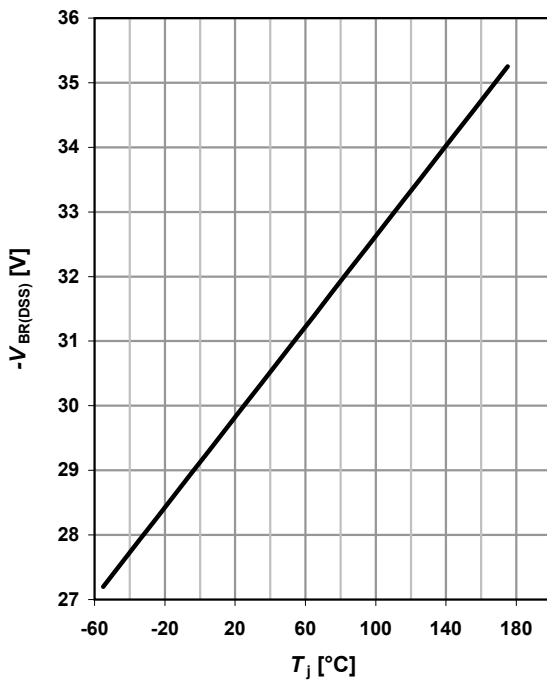
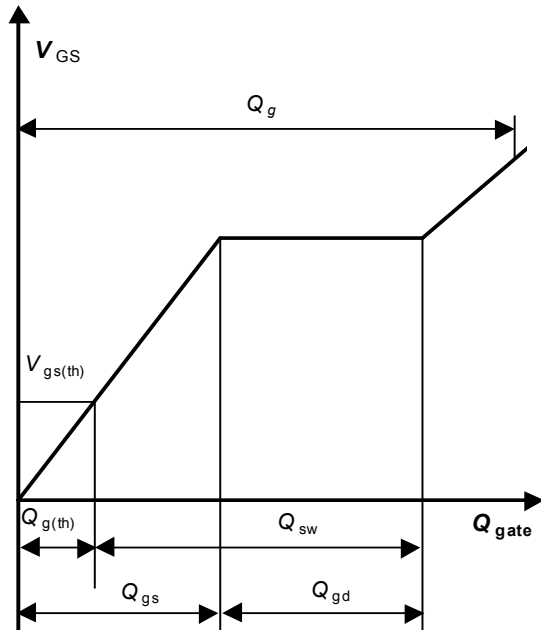
$$I_{AS} = f(t_{AV}); R_{GS} = 25 \Omega$$

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

14 Typ. gate charge

$$V_{GS} = f(Q_{\text{gate}}); I_D = -50 \text{ A pulsed}$$

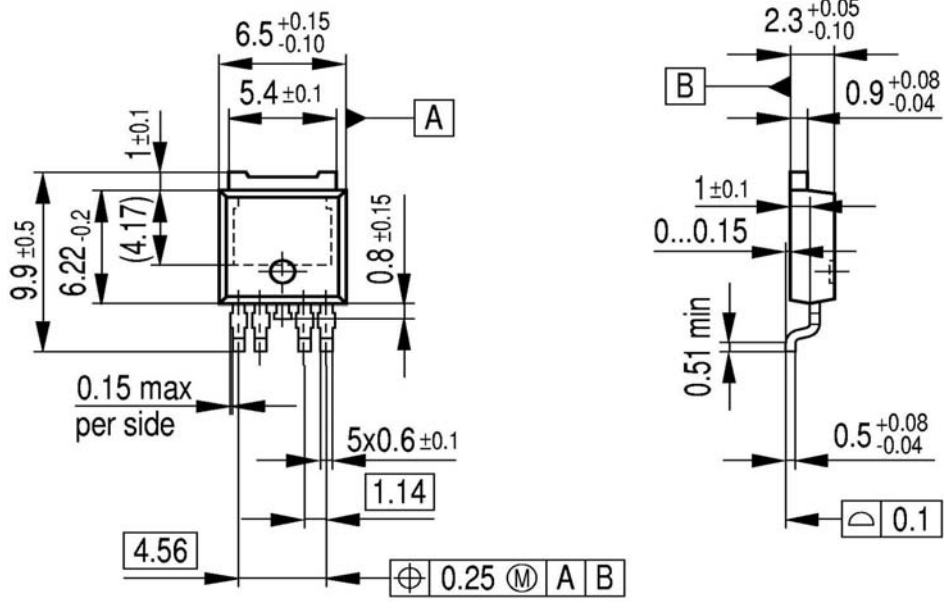
 parameter: V_{DD}

15 Drain-source breakdown voltage

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

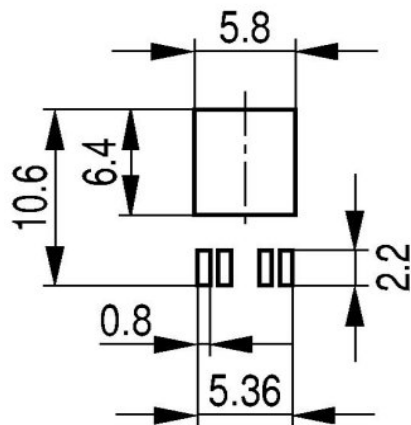

16 Gate charge waveforms


Package Outline

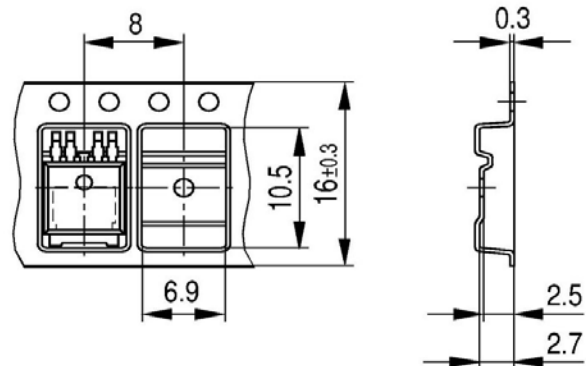
PG-TO252-5: Outline



Footprint



Packaging Tape



Dimensions in mm

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