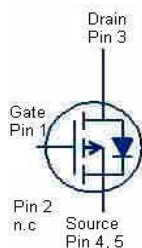
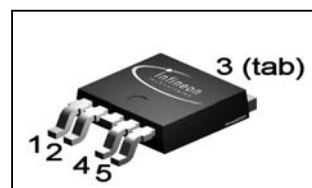


**OptiMOS® -P Power-Transistor**
**Features**

- 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**


| 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  $T_j=25\text{ °C}$ , unless otherwise specified**

| Parameter                           | Symbol            | Conditions                                                                                                      | Value      | Unit              |
|-------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------|------------|-------------------|
| Continuous drain current            | $I_D$             | $T_C=25\text{ °C}^{(1)}$                                                                                        | -50        | A                 |
|                                     |                   | $T_C=100\text{ °C}^{(1)}$                                                                                       | -50        |                   |
|                                     |                   | $T_C=25\text{ °C}$                                                                                              | -200       |                   |
| Pulsed drain current                | $I_{D,pulse}$     | $T_C=25\text{ °C}$                                                                                              | -200       |                   |
| Avalanche energy, single pulse      | $E_{AS}$          | $I_D=-50\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                  | 256        | mJ                |
| Reverse diode $dv/dt$               | $dv/dt$           | $I_D=-50\text{ A}$ , $V_{DS}=24\text{ V}$ ,<br>$di/dt=-200\text{ A}/\mu\text{s}$ ,<br>$T_{j,max}=175\text{ °C}$ | -6         | kV/ $\mu\text{s}$ |
| Gate source voltage                 | $V_{GS}$          |                                                                                                                 | $\pm 20$   | V                 |
| Power dissipation                   | $P_{tot}$         | $T_C=25\text{ °C}$                                                                                              | 150        | W                 |
| Operating and storage temperature   | $T_j$ , $T_{stg}$ |                                                                                                                 | -55...+175 | °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 <sup>2</sup> cooling area <sup>2)</sup> | - | - | 50 |     |

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

#### Static characteristics

|                                  |               |                                                                      |     |      |      |               |
|----------------------------------|---------------|----------------------------------------------------------------------|-----|------|------|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}$ , $I_D=-250\text{ }\mu\text{A}$                  | -30 | -    | -    | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}$ ,<br>$I_D=-250\text{ }\mu\text{A}$                   | -1  | -1.5 | -2   |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=-30\text{ V}$ , $V_{GS}=0\text{ V}$ ,<br>$T_j=25\text{ °C}$  | -   | -0.1 | -1   | $\mu\text{A}$ |
|                                  |               | $V_{DS}=-30\text{ V}$ , $V_{GS}=0\text{ V}$ ,<br>$T_j=175\text{ °C}$ | -   | -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 | $R_{DS(on)}$  | $V_{GS}=-4.5\text{ V}$ ,<br>$I_D=-30\text{ A}$                       | -   | 8.5  | 12.5 | m $\Omega$    |
| 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}$ ,<br>$I_D=-50\text{ A}$               | 47  | 94   | -    | S             |

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

<sup>2)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<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            | $C_{iss}$    | $V_{GS}=0\text{ V},$<br>$V_{DS}=-25\text{ V}, f=1\text{ MHz}$                        | - | 4590 | 6880 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                      | - | 1220 | 1830 |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                      | - | 1000 | 1500 |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=-15\text{ V},$<br>$V_{GS}=-10\text{ V}, I_D=-1\text{ A},$<br>$R_G=6\ \Omega$ | - | 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 Characteristics<sup>3)</sup>**

|                       |               |                                                                               |   |      |      |    |
|-----------------------|---------------|-------------------------------------------------------------------------------|---|------|------|----|
| 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     | $Q_g$         | $V_{DD}=-24\text{ V}, I_D=-50\text{ A},$<br>$V_{GS}=0\text{ to }-10\text{ V}$ | - | -95  | -126 |    |
| Gate plateau voltage  | $V_{plateau}$ | $V_{DD}=-24\text{ V}, I_D=-50\text{ A}$                                       | - | -3.0 | -    | V  |

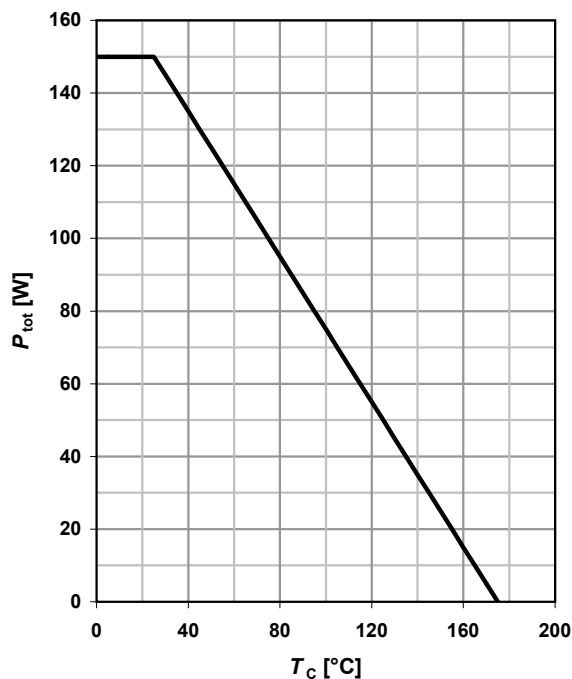
**Reverse Diode**

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

<sup>3)</sup> See figure 16 for gate charge parameter definition

### 1 Power dissipation

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



### 2 Drain current

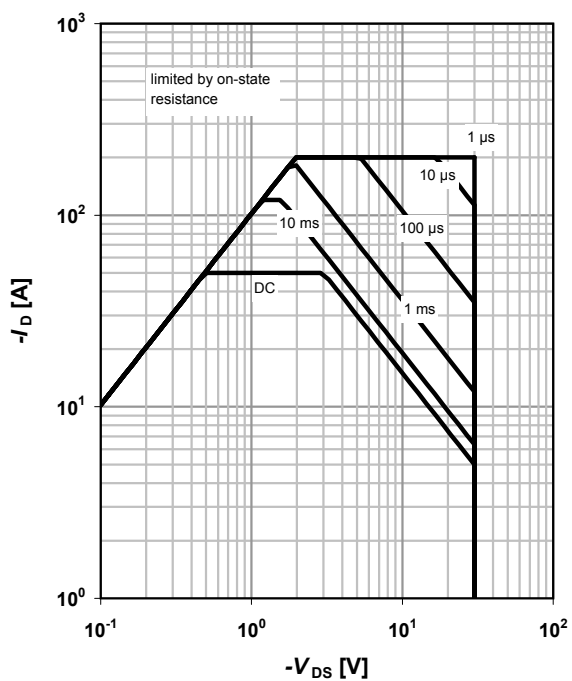
$$I_D = f(T_C); |V_{GS}| \geq 10 \text{ V}$$



### 3 Safe operating area

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

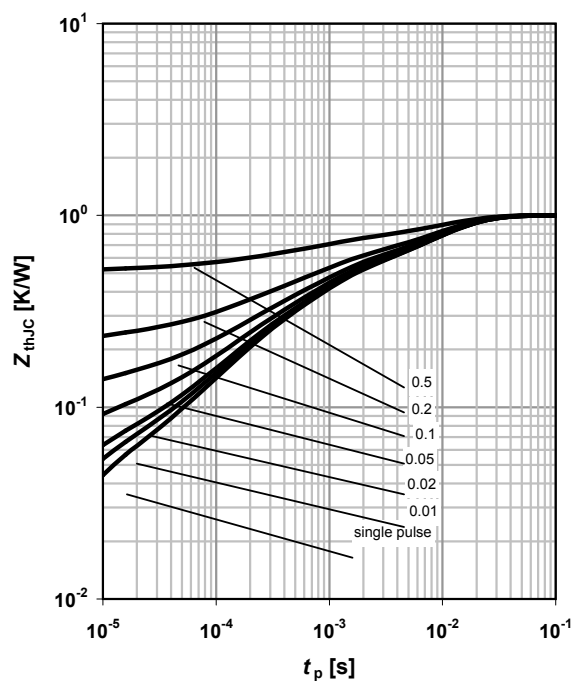
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

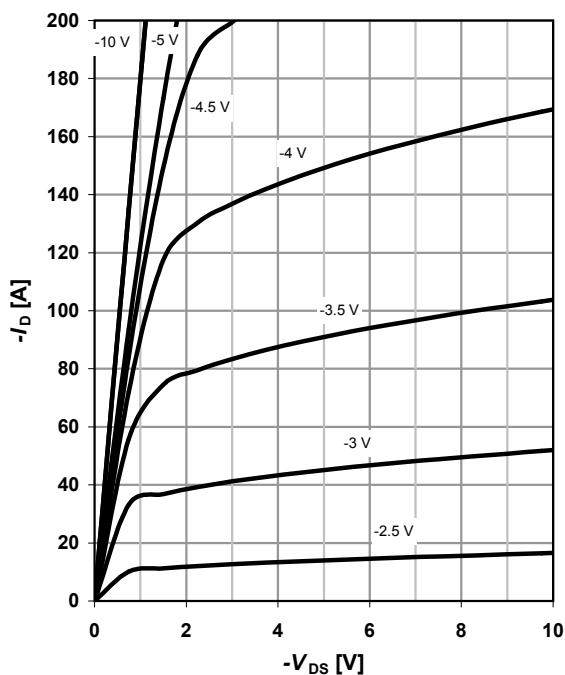
parameter:  $D = t_p/T$



### 5 Typ. output characteristics

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

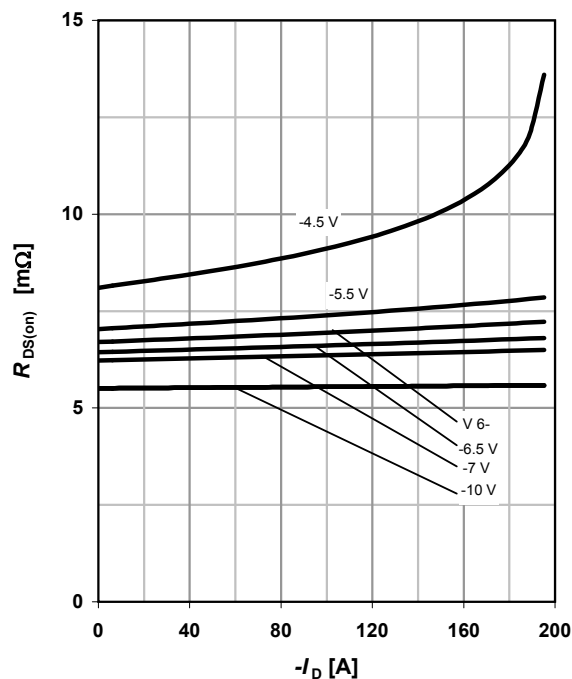
parameter:  $V_{GS}$



### 6 Typ. drain-source on resistance

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

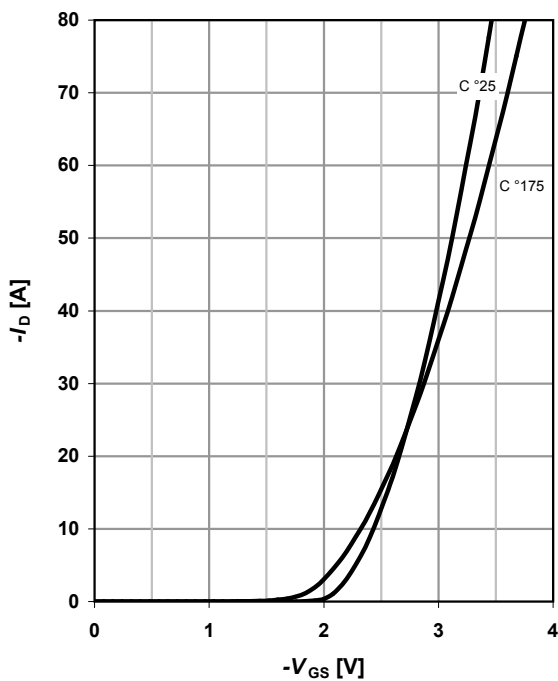
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

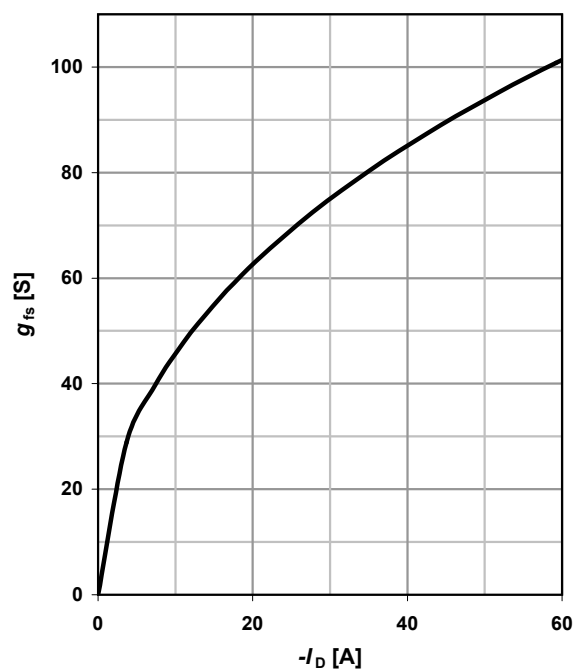
$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$$

parameter:  $T_j$



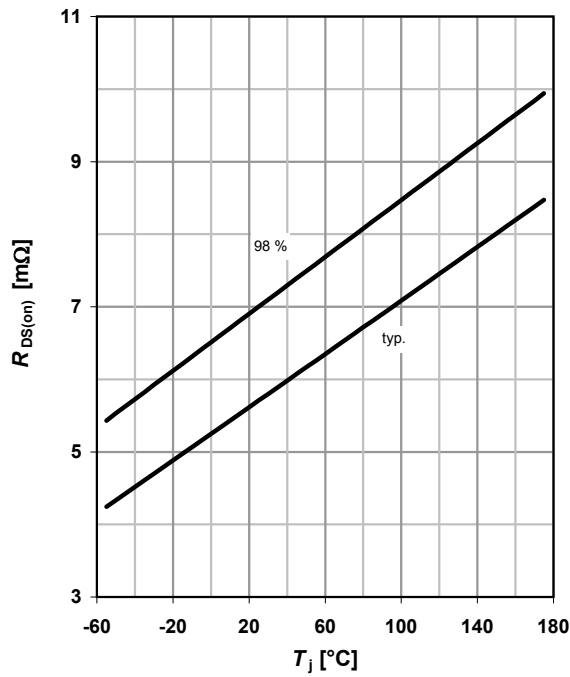
### 8 Typ. forward transconductance

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



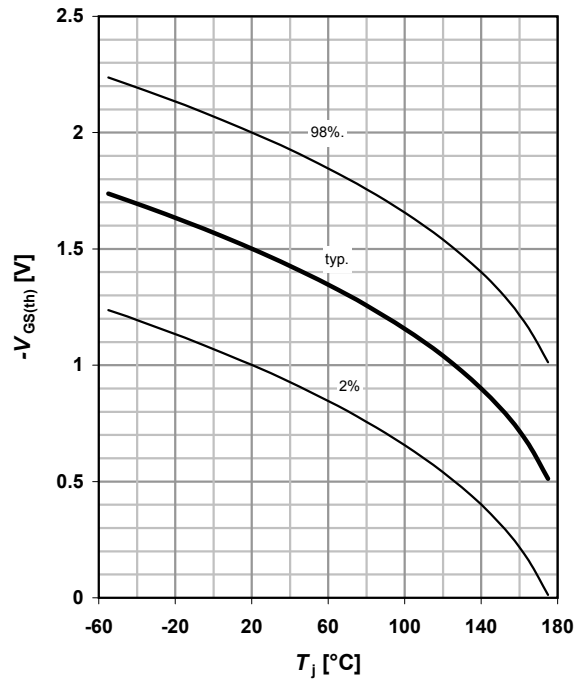
### 9 Drain-source on-state resistance

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



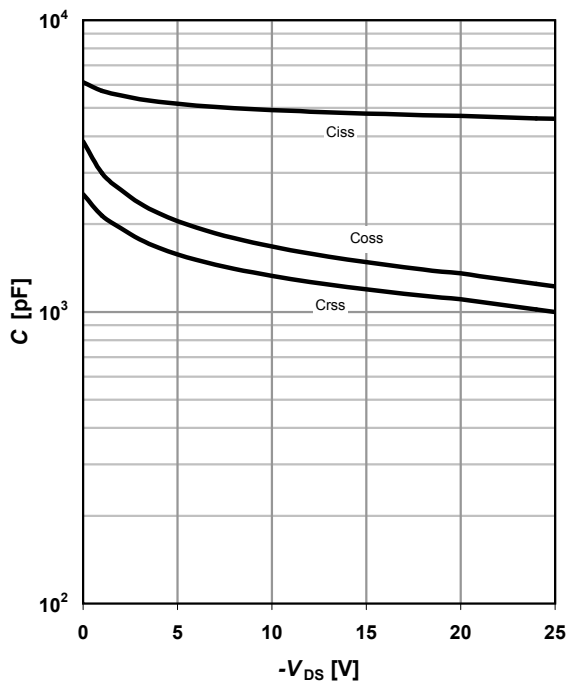
### 10 Typ. gate threshold voltage

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



### 11 Typ. capacitances

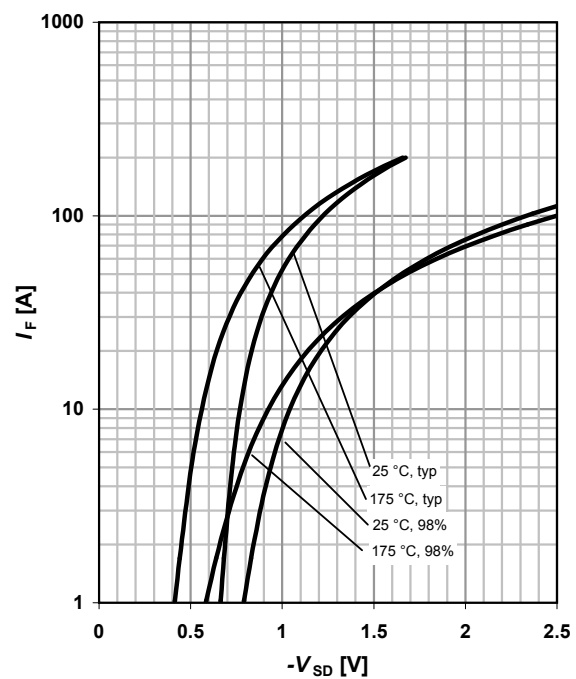
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



### 12 Forward characteristics of reverse diode

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

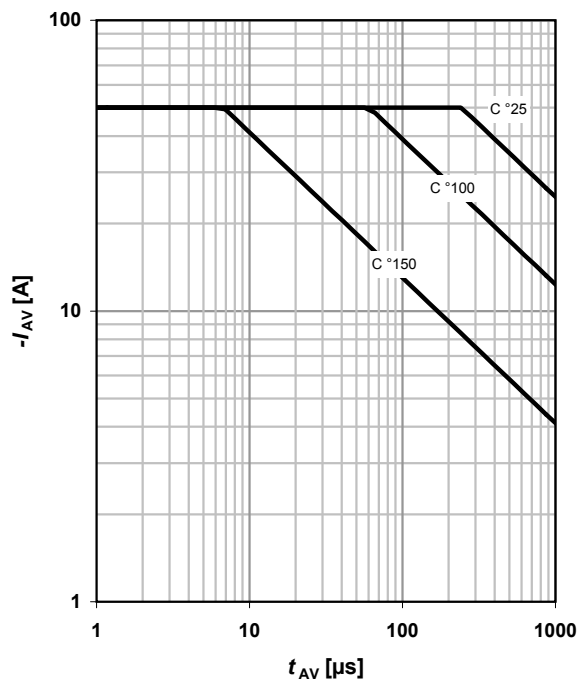
parameter:  $T_j$



### 13 Avalanche characteristics

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

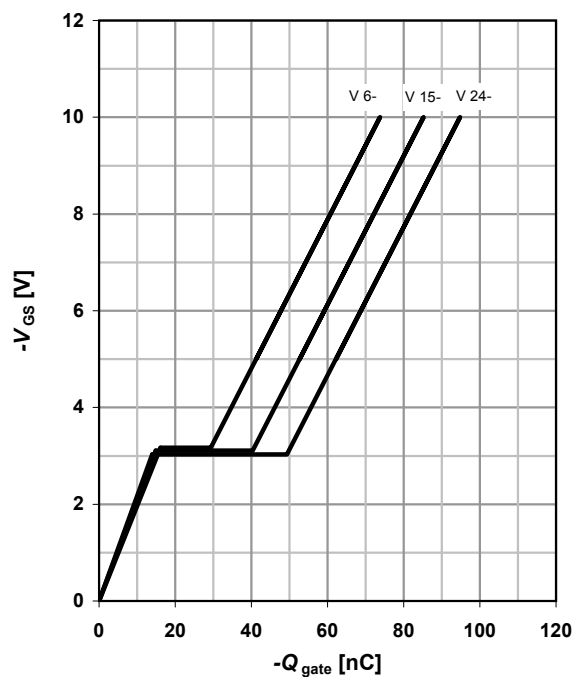
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

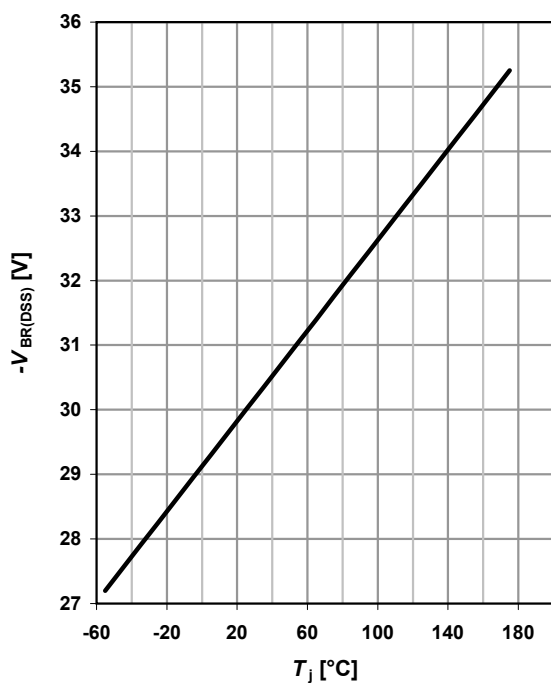
$$V_{GS}=f(Q_{\text{gate}}); I_D=-50\ \text{A pulsed}$$

parameter:  $V_{DD}$

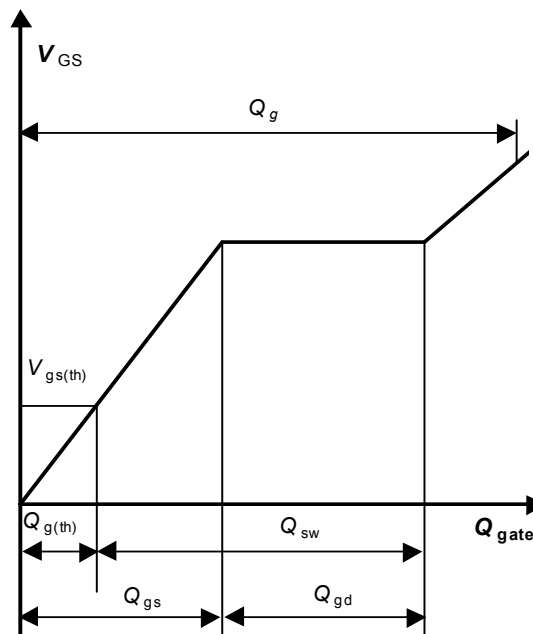


### 15 Drain-source breakdown voltage

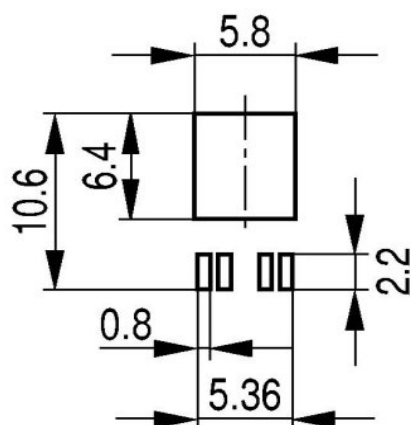
$$V_{BR(DSS)}=f(T_j); I_D=-250\ \mu\text{A}$$



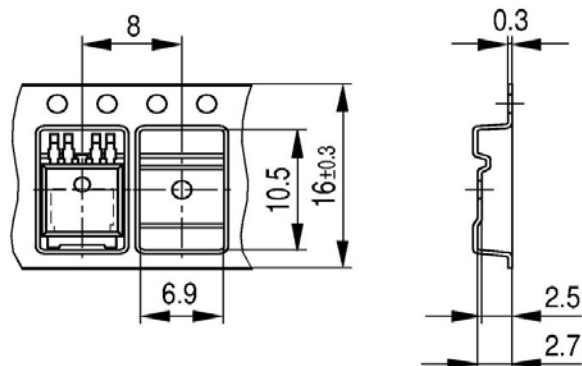
### 16 Gate charge waveforms



## PG-TO252-5: Outline



## Packaging Tape



Dimensions in mm

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