

**SIPMOS® Power-Transistor**
**Features**

- P-Channel
- Enhancement mode
- Avalanche rated
- $dv/dt$  rated
- 175°C operating temperature
- Pb-free lead plating; RoHS compliant
- ° Halogen-free according to IEC61249-2-21
- ° Qualified according to AEC Q101

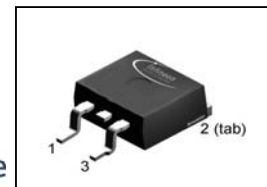


Halogen-Free

**Product Summary**

|                  |       |          |
|------------------|-------|----------|
| $V_{DS}$         | -60   | V        |
| $R_{DS(on),max}$ | 0.13  | $\Omega$ |
| $I_D$            | -18.6 | A        |

PG-TO263-3



| Type       | Package    | Tape and reel information | Marking | Lead free | Packing |
|------------|------------|---------------------------|---------|-----------|---------|
| SPB18P06PG | PG-TO263-3 | 1000 pcs / reel           | 18P06P  | Yes       | Non dry |

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

| Parameter                                        | Symbol            | Conditions                                                                                                       | Value          | Unit              |
|--------------------------------------------------|-------------------|------------------------------------------------------------------------------------------------------------------|----------------|-------------------|
|                                                  |                   |                                                                                                                  | steady state   |                   |
| Continuous drain current                         | $I_D$             | $T_A=25\text{ °C}$                                                                                               | -18.7          | A                 |
|                                                  |                   | $T_A=100\text{ °C}$                                                                                              | -13.2          |                   |
| Pulsed drain current                             | $I_{D,pulse}$     | $T_A=25\text{ °C}$                                                                                               | -74.8          |                   |
| Avalanche energy, single pulse                   | $E_{AS}$          | $I_D=18.7\text{ A}$ , $R_{GS}=25\text{ }\Omega$                                                                  | 151            | mJ                |
| Avalanche energy, periodic limited by $T_{jmax}$ | $E_{AR}$          |                                                                                                                  | 8              |                   |
| Reverse diode $dv/dt$                            | $dv/dt$           | $I_D=18.7\text{ A}$ , $V_{DS}=48\text{ V}$ ,<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                                | $P_{tot}$         | $T_A=25\text{ °C}$                                                                                               | 81.1           | W                 |
| Operating and storage temperature                | $T_j$ , $T_{stg}$ |                                                                                                                  | "-55 ... +175" | °C                |
| ESD class                                        |                   |                                                                                                                  |                |                   |
| Soldering temperature                            |                   |                                                                                                                  | 260 °C         |                   |
| IEC climatic category; DIN IEC 68-1              |                   |                                                                                                                  | 55/175/56      |                   |

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

**Thermal characteristics**

|                                                   |            |                                              |   |   |      |     |
|---------------------------------------------------|------------|----------------------------------------------|---|---|------|-----|
| Thermal resistance,<br>junction - case            | $R_{thJC}$ |                                              | - | - | 1.85 | K/W |
| Thermal resistance,<br>junction - ambient, leaded | $R_{thJA}$ |                                              | - | - | 62   |     |
| SMD version, device on PCB:                       | $R_{thJA}$ | minimal footprint                            | - | - | 62   | K/W |
|                                                   |            | 6 cm <sup>2</sup> cooling area <sup>1)</sup> | - | - | 40   |     |

**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           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=-1000\text{ }\mu\text{A}$                             | -2.1 | 3    | -4   |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=-60\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^{\circ}\text{C}$  | -    | -0.1 | -1   | $\mu\text{A}$ |
|                                  |               | $V_{DS}=-60\text{ V}, V_{GS}=0\text{ V}, T_j=150\text{ }^{\circ}\text{C}$ | -    | -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 | $R_{DS(on)}$  | $V_{GS}=-10\text{ V}, I_D=-13.2\text{ A}$                                 | -    | 101  | 130  | m $\Omega$    |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=-13.2\text{ A}$                        | 5    | 10   | -    | S             |

<sup>1)</sup> Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. FCB is vertical without blown air.

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

**Dynamic characteristics**

|                              |              |                                                                                      |   |     |      |    |
|------------------------------|--------------|--------------------------------------------------------------------------------------|---|-----|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=-25\text{ V},$<br>$f=1\text{ MHz}$                        | - | 690 | 860  | pF |
| Output capacitance           | $C_{oss}$    |                                                                                      | - | 230 | 290  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                      | - | 95  | 120  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=-30\text{ V}, V_{GS}=-10\text{ V}, I_D=-13.2\text{ A},$<br>$R_G=2.7\ \Omega$ | - | 12  | 18   | ns |
| Rise time                    | $t_r$        |                                                                                      | - | 5.8 | 8.7  |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                      | - | 25  | 37   |    |
| Fall time                    | $t_f$        |                                                                                      | - | 11  | 16.5 |    |

**Gate Charge Characteristics**

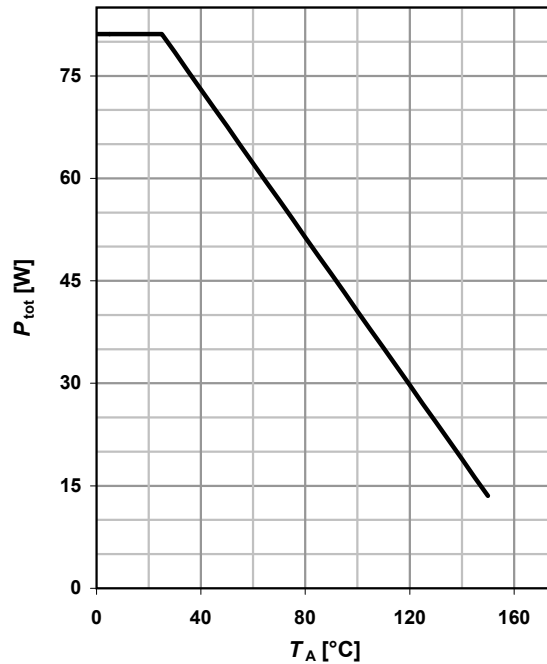
|                       |               |                                                                            |   |       |      |    |
|-----------------------|---------------|----------------------------------------------------------------------------|---|-------|------|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=-48\text{ V}, I_D=-18.6\text{ A}, V_{GS}=0\text{ to }-10\text{ V}$ | - | -4.1  | -5.5 | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                                            | - | -11   | -17  |    |
| Gate charge total     | $Q_g$         |                                                                            | - | -21   | -28  |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                                            | - | -5.94 | -    | V  |

**Reverse Diode**

|                                  |               |                                                                     |   |       |       |    |
|----------------------------------|---------------|---------------------------------------------------------------------|---|-------|-------|----|
| Diode continuous forward current | $I_S$         | $T_A=25\text{ °C}$                                                  | - | -     | -18.6 | A  |
| Diode pulse current              | $I_{S,pulse}$ |                                                                     | - | -     | -74.8 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=18.6\text{ A},$<br>$T_j=25\text{ °C}$       | - | -0.99 | -1.33 | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=30\text{ V}, I_F= I_S ,$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 70    | 105   | ns |
| Reverse recovery charge          | $Q_{rr}$      |                                                                     | - | 139   | 208   | nC |

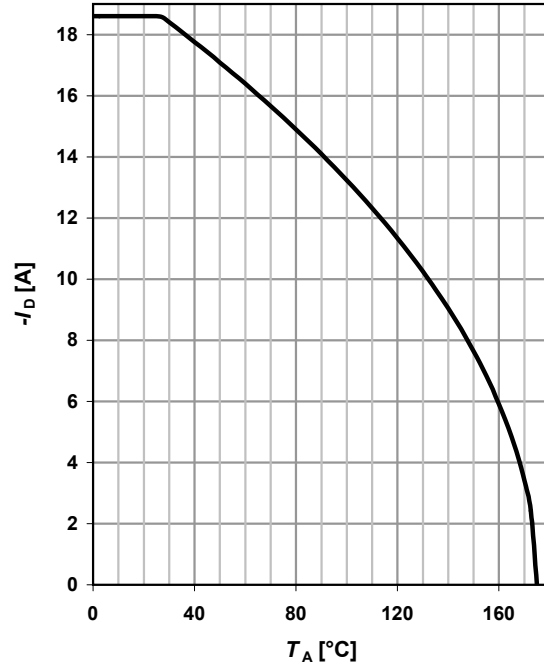
### 1 Power dissipation

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



### 2 Drain current

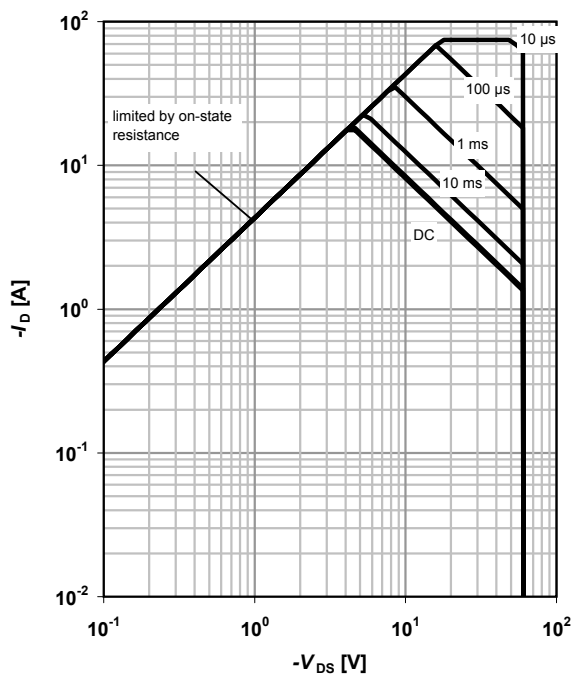
$$I_D = f(T_A); |V_{GS}| \geq 10 \text{ V}$$



### 3 Safe operating area

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

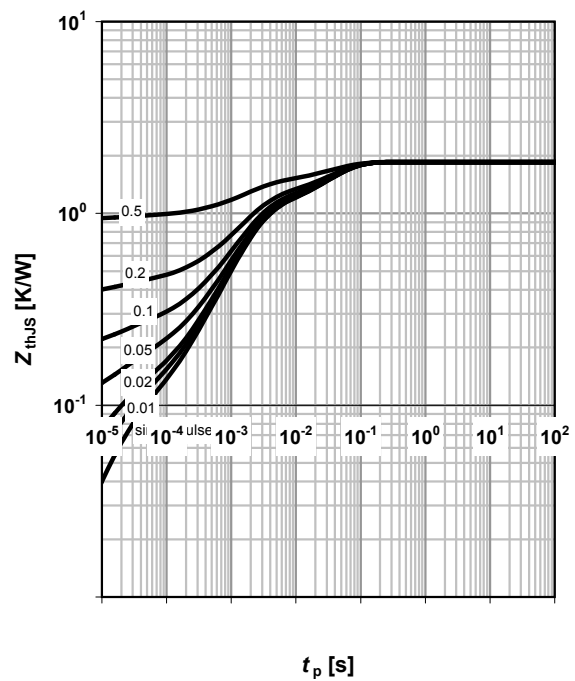
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

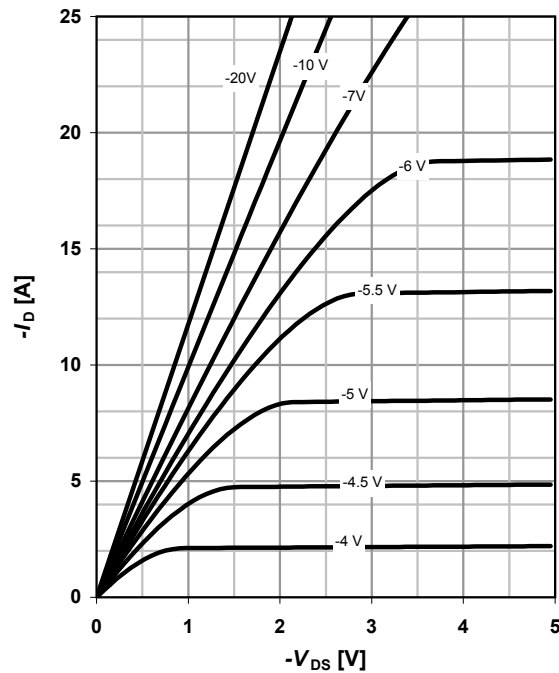
parameter:  $D = t_p / T$



### 5 Typ. output characteristics

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

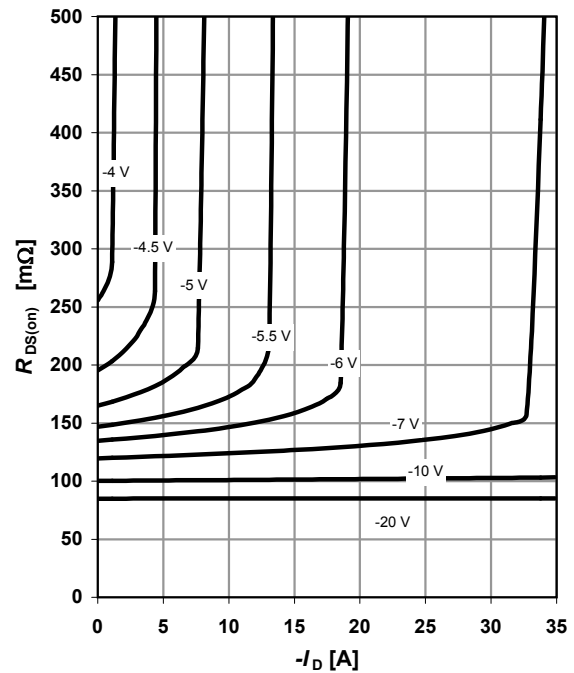
parameter:  $V_{GS}$



### 6 Typ. drain-source on resistance

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

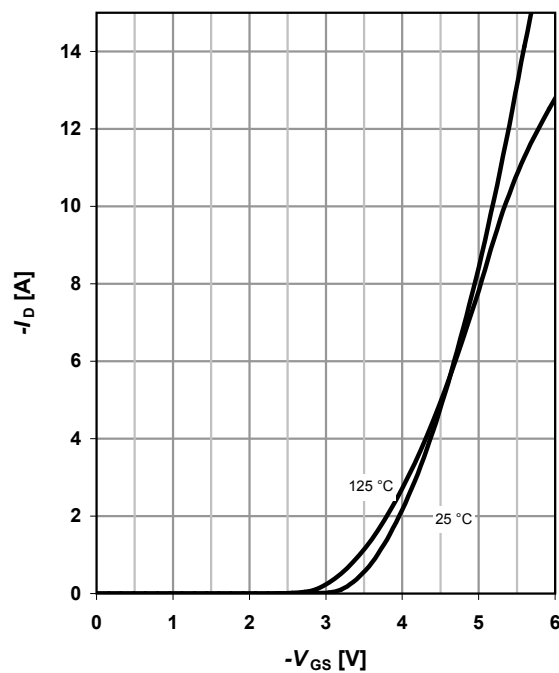
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

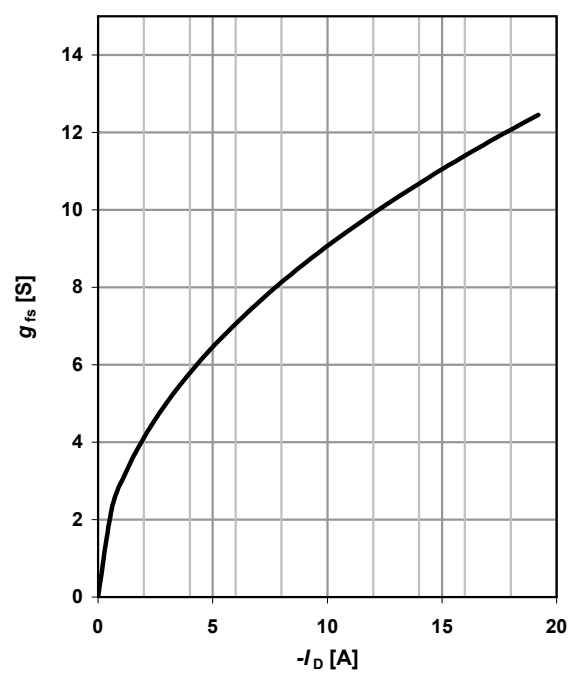
$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$$

parameter:  $T_j$



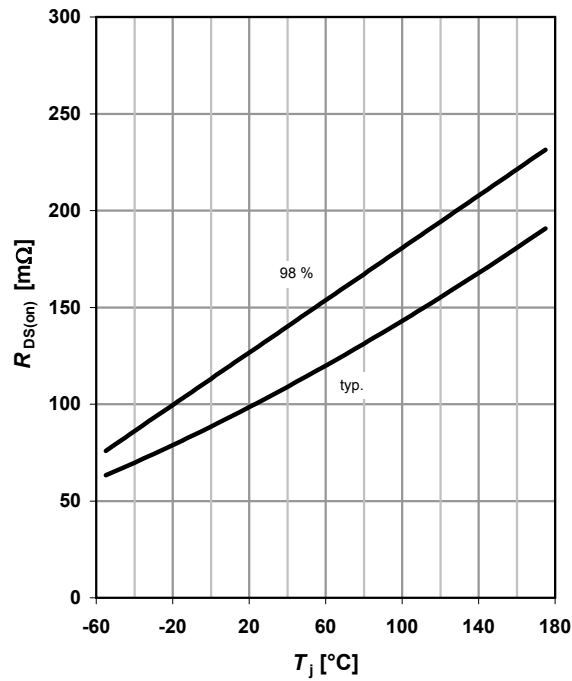
### 8 Typ. forward transconductance

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



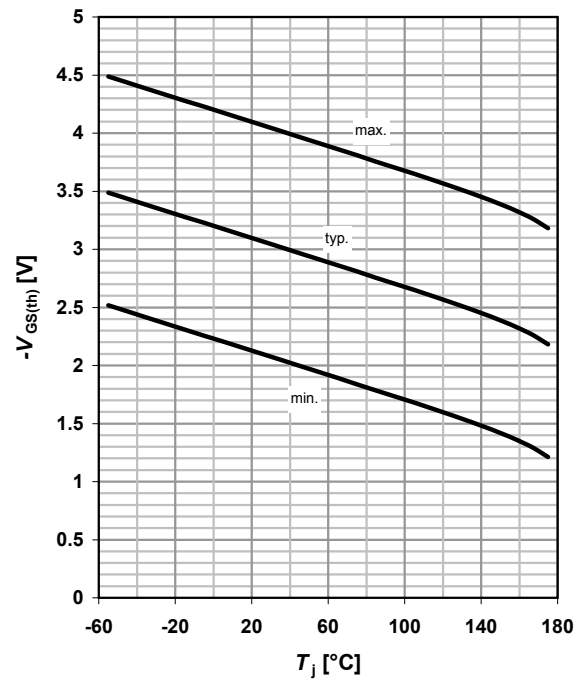
### 9 Drain-source on-state resistance

$$R_{DS(on)} = f(T_j); I_D = -13.2 \text{ A}; V_{GS} = -10 \text{ V}$$



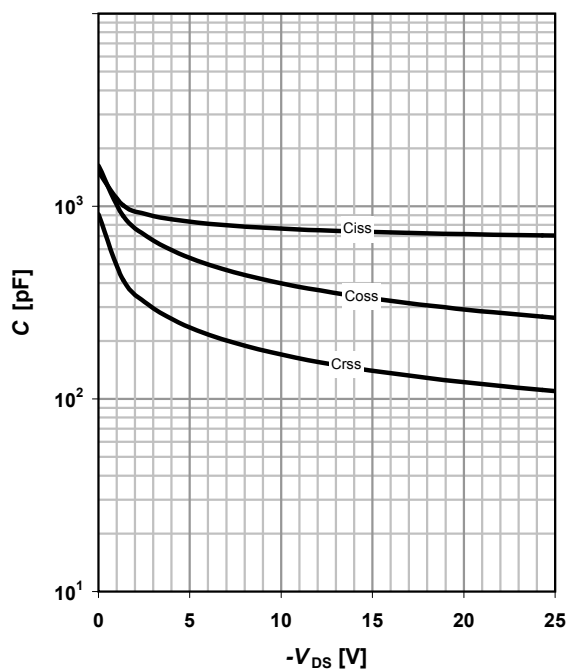
### 10 Typ. gate threshold voltage

$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = -1000 \text{ μA}$$



### 11 Typ. capacitances

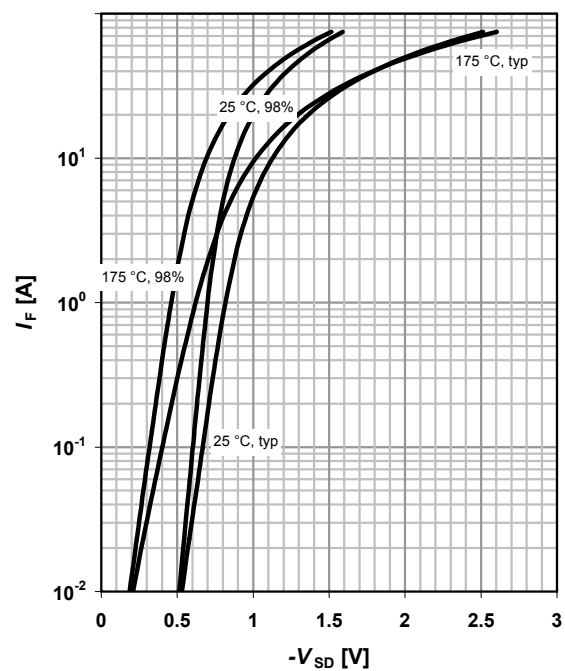
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



### 12 Forward characteristics of reverse diode

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

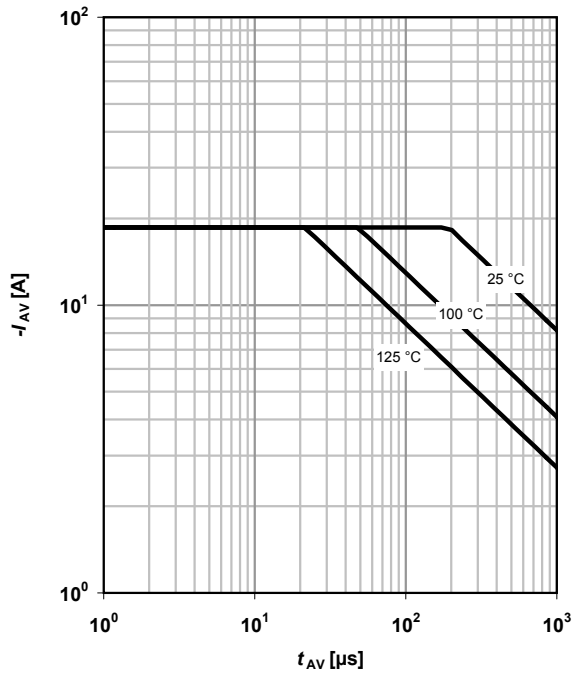
parameter:  $T_j$



### 13 Avalanche characteristics

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

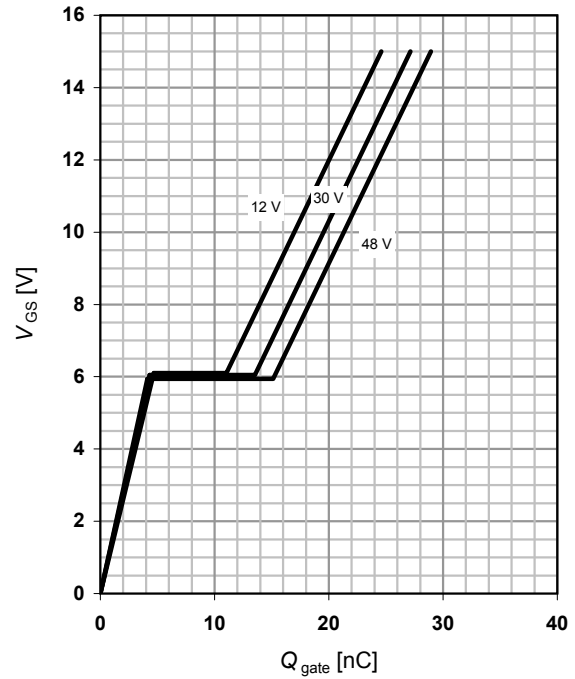
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

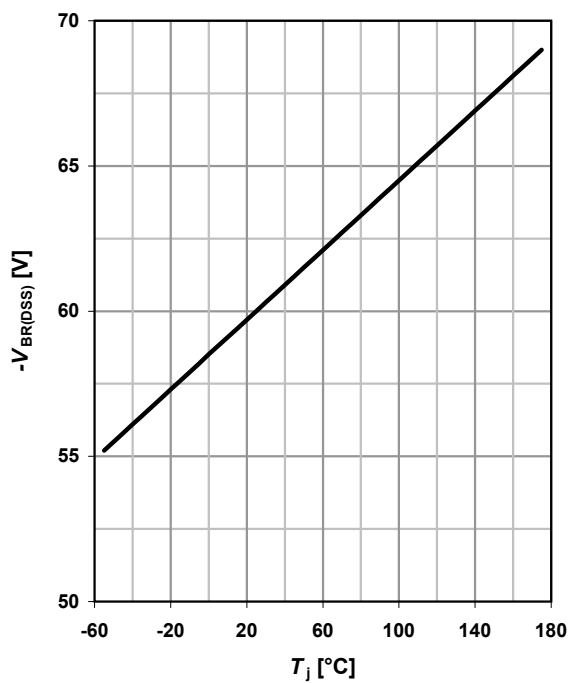
$$V_{GS}=f(Q_{\text{gate}}); I_D=-18.6\ \text{A pulsed}$$

parameter:  $V_{DD}$



### 15 Drain-source breakdown voltage

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



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