

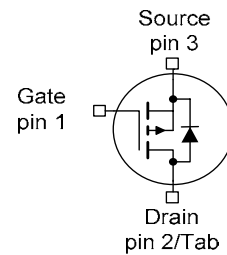
**OptiMOS<sup>®</sup> -P2 Power-Transistor**

**Features**

- P-channel - Normal Level - Enhancement mode
- AEC qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green package (RoHS compliant)
- 100% Avalanche tested

**Product Summary**

|              |     |    |
|--------------|-----|----|
| $V_{DS}$     | -30 | V  |
| $R_{DS(on)}$ | 4.5 | mΩ |
| $I_D$        | -90 | A  |

**PG-TO252-3-11**


| Type          | Package       | Marking |
|---------------|---------------|---------|
| IPD90P03P4-04 | PG-TO252-3-11 | 4P0304  |

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

| Parameter                              | Symbol         | Conditions   | Value        | Unit |
|--|----------------|--|--------------|------|
| Continuous drain current <sup>1)</sup> | $I_D$          | $T_C=25\text{ °C}$ ,<br>$V_{GS}=-10\text{V}$       | -90          | A    |
|  |                | $T_C=100\text{ °C}$ ,<br>$V_{GS}=-10\text{V}^{2)}$ | -90          |      |
| Pulsed drain current <sup>2)</sup>     | $I_{D,pulse}$  | $T_C=25\text{ °C}$                                 | -360         |      |
| Avalanche energy, single pulse         | $E_{AS}$       | $I_D=-45\text{A}$                                  | 370          | mJ   |
| Avalanche current, single pulse        | $I_{AS}$       | -  | -90          | A    |
| Gate source voltage                    | $V_{GS}$       | -  | ±20          | V    |
| Power dissipation                      | $P_{tot}$      | $T_C=25\text{ °C}$                                 | 137          | W    |
| Operating and storage temperature      | $T_j, T_{stg}$ | -  | -55 ... +175 | °C   |
| IEC climatic category; DIN IEC 68-1    | -              | -  | 55/175/56    |      |

| Parameter                                   | Symbol     | Conditions                                   | Values |      |      | Unit |
|---|------------|--|--------|------|------|------|
|   |            |  | min.   | typ. | max. |      |
| <b>Thermal characteristics<sup>2)</sup></b> |            |  |        |      |      |      |
| Thermal resistance, junction - case         | $R_{thJC}$ | -  | -      | -    | 1.1  | K/W  |
| SMD version, device on PCB                  | $R_{thJA}$ | minimal footprint                            | -      | -    | 62   |      |
|   |            | 6 cm <sup>2</sup> cooling area <sup>3)</sup> | -      | -    | 40   |      |

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

**Static characteristics**

|                                  |               |  |      |       |      |            |
|----------------------------------|---------------|--|------|-------|------|------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=-1mA$                                | -30  | -     | -    | V          |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=-253\mu A$                       | -2.0 | -3.0  | -4.0 |            |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=-24V, V_{GS}=0V, T_j=25^\circ\text{C}$       | -    | -0.05 | -1   | $\mu A$    |
|                                  |               | $V_{DS}=-24V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$ | -    | -20   | -200 |            |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=-20V, V_{DS}=0V$                             | -    | -     | -100 | nA         |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=-10V, I_D=-90A$                              | -    | 3.6   | 4.5  | m $\Omega$ |

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

**Dynamic characteristics<sup>2)</sup>**

|                              |              |   |   |      |       |    |
|------------------------------|--------------|---|---|------|-------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0V, V_{DS}=-25V,$<br>$f=1MHz$                         | - | 7900 | 10300 | pF |
| Output capacitance           | $C_{oss}$    |   | - | 2340 | 3040  |    |
| Reverse transfer capacitance | $C_{rss}$    |   | - | 50   | 100   |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=-15V,$<br>$V_{GS}=-10V, I_D=-90A,$<br>$R_G=3.5\Omega$ | - | 35   | -     | ns |
| Rise time                    | $t_r$        |   | - | 10   | -     |    |
| Turn-off delay time          | $t_{d(off)}$ |   | - | 70   | -     |    |
| Fall time                    | $t_f$        |   | - | 20   | -     |    |

**Gate Charge Characteristics<sup>2)</sup>**

|                       |               |  |   |      |     |    |
|-----------------------|---------------|--|---|------|-----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=-24V, I_D=-90A,$<br>$V_{GS}=0$ to $-10V$ | - | 42   | 55  | nC |
| Gate to drain charge  | $Q_{gd}$      |  | - | 10   | 20  |    |
| Gate charge total     | $Q_g$         |  | - | 100  | 130 |    |
| Gate plateau voltage  | $V_{plateau}$ |  | - | -5.3 | -   | V  |

**Reverse Diode**

|  |               |  |   |    |      |    |
|--|---------------|--|---|----|------|----|
| Diode continuous forward current <sup>2)</sup> | $I_S$         | $T_C=25^\circ C$                               | - | -  | -90  | A  |
| Diode pulse current <sup>2)</sup>              | $I_{S,pulse}$ |  | - | -  | -360 |    |
| Diode forward voltage                          | $V_{SD}$      | $V_{GS}=0V, I_F=-90A,$<br>$T_j=25^\circ C$     | - | -  | -1.3 | V  |
| Reverse recovery time <sup>2)</sup>            | $t_{rr}$      | $V_R=-15V, I_F=-50A,$<br>$di_F/dt=-100A/\mu s$ | - | 50 | -    | ns |
| Reverse recovery charge <sup>2)</sup>          | $Q_{rr}$      |  | - | 70 | -    | nC |

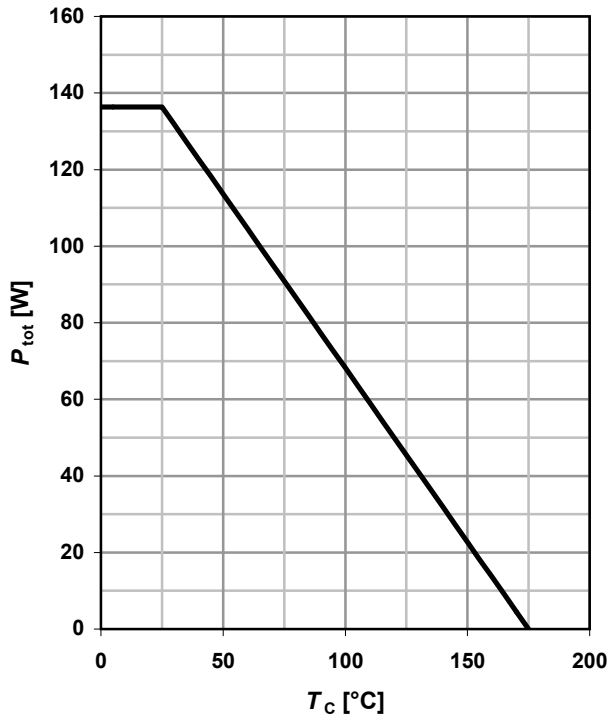
<sup>1)</sup> Current is limited by bondwire; with an  $R_{thJC} = 1.1K/W$  the chip is able to carry -143A at 25°C.

<sup>2)</sup> Defined by design. Not subject to production test.

<sup>3)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 μm thick) copper area for drain connection. PCB is vertical in still air.

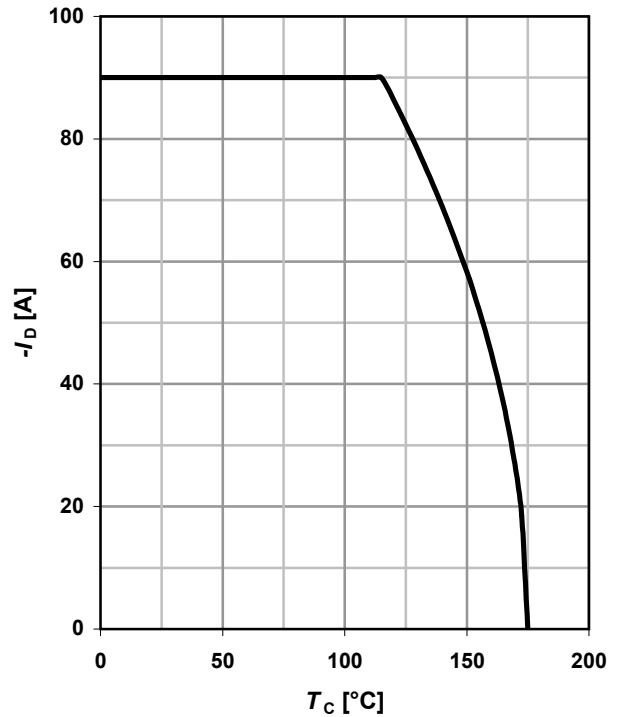
### 1 Power dissipation

$$P_{\text{tot}} = f(T_C); V_{\text{GS}} \leq -6\text{V}$$



### 2 Drain current

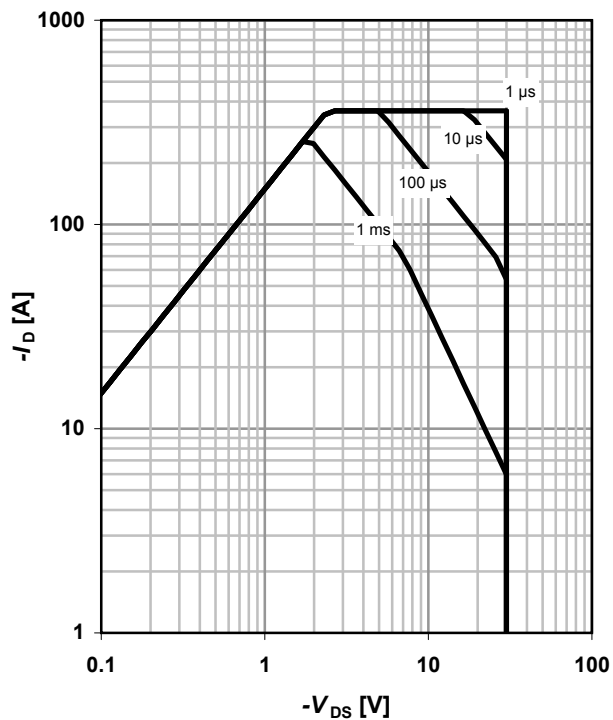
$$I_D = f(T_C); V_{\text{GS}} \leq -6\text{V}$$



### 3 Safe operating area

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

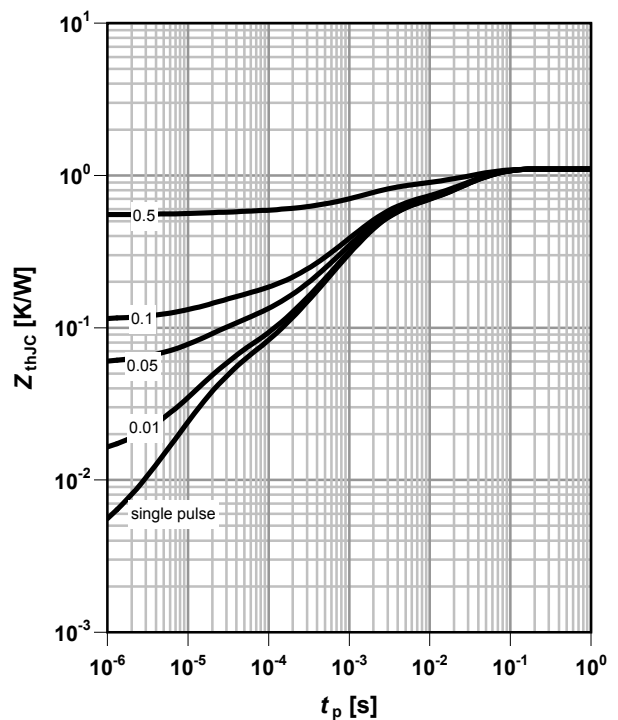
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

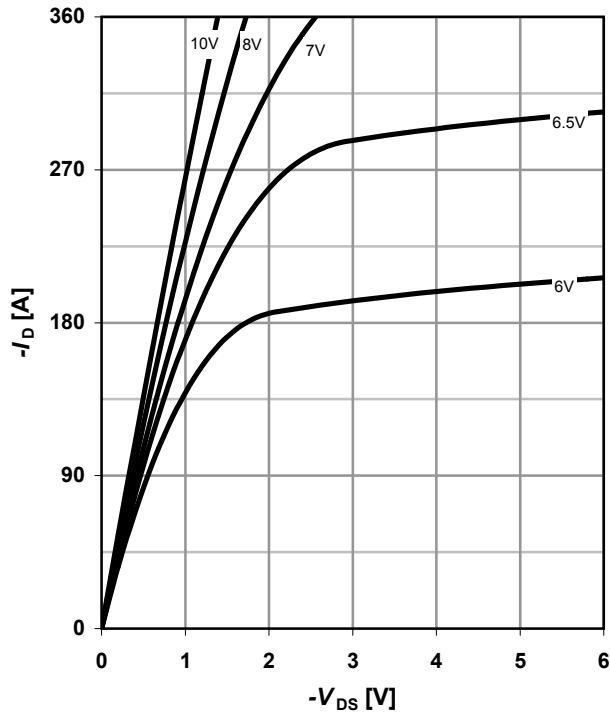
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

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

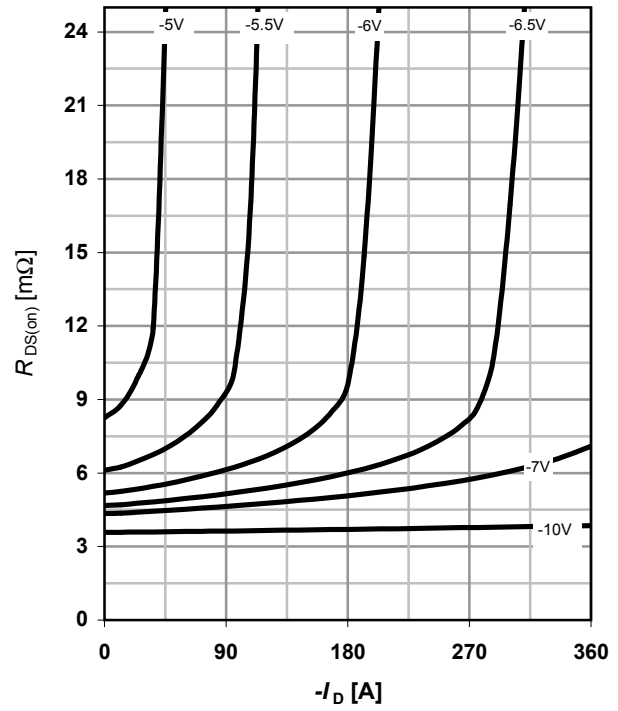
parameter:  $V_{GS}$



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

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

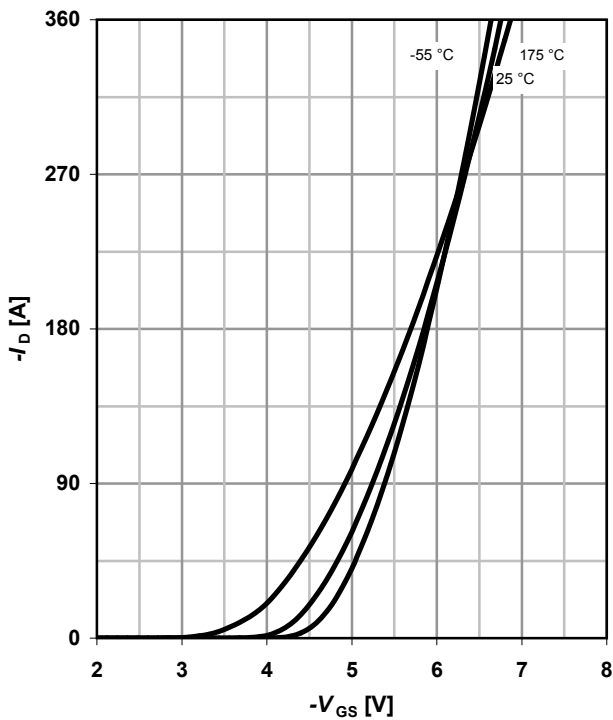
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

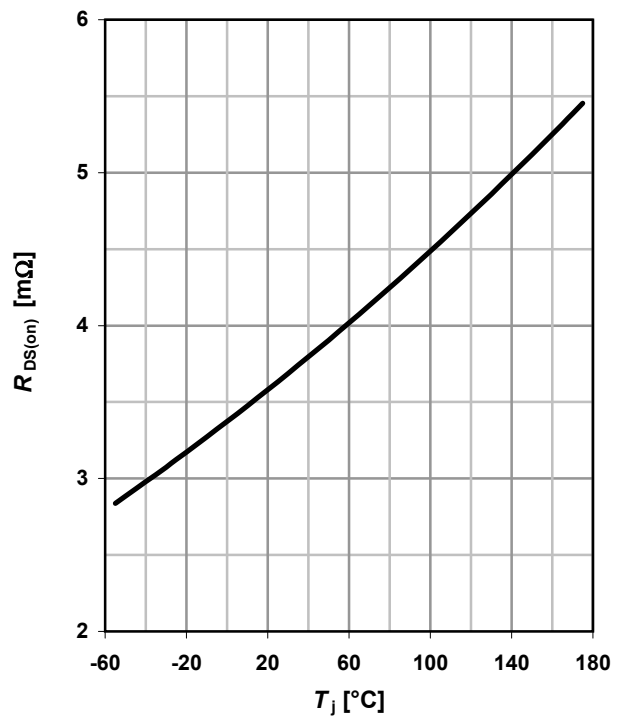
$I_D = f(V_{GS}); V_{DS} = -6\text{V}$

parameter:  $T_j$



**8 Typ. drain-source on-state resistance**

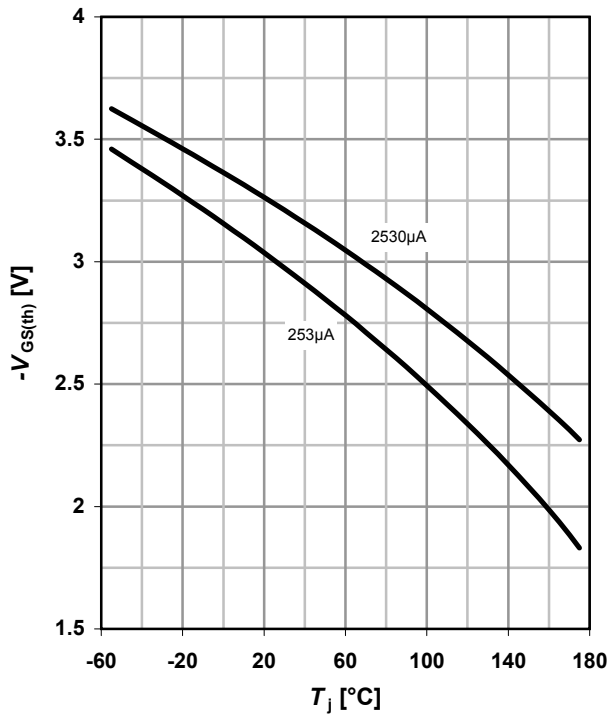
$R_{DS(on)} = f(T_j); I_D = -90\text{ A}; V_{GS} = -10\text{ V}$



### 9 Typ. gate threshold voltage

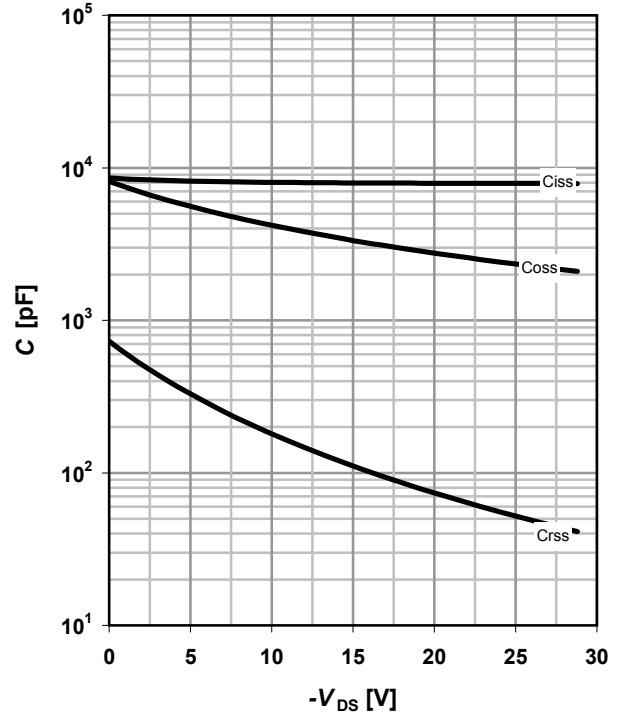
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $-I_D$



### 10 Typ. capacitances

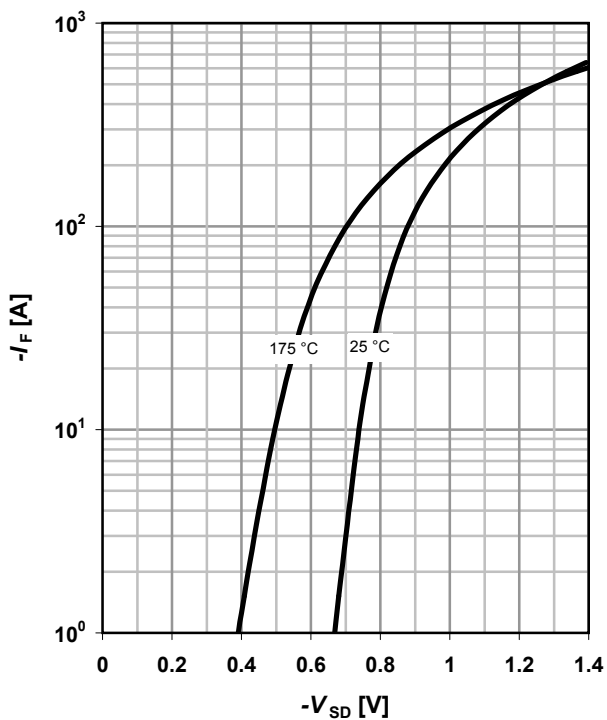
$$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$$



### 11 Typical forward diode characteristics

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

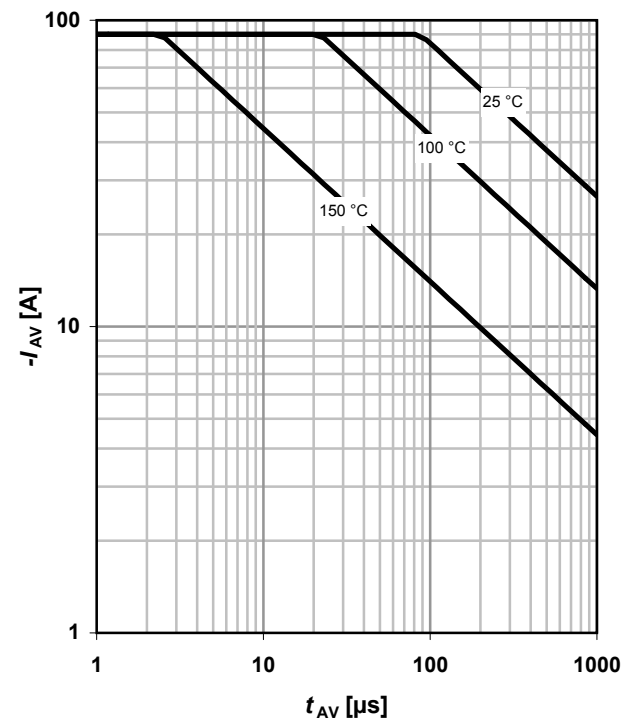
parameter:  $T_j$



### 12 Avalanche characteristics

$$I_{AS} = f(t_{AV})$$

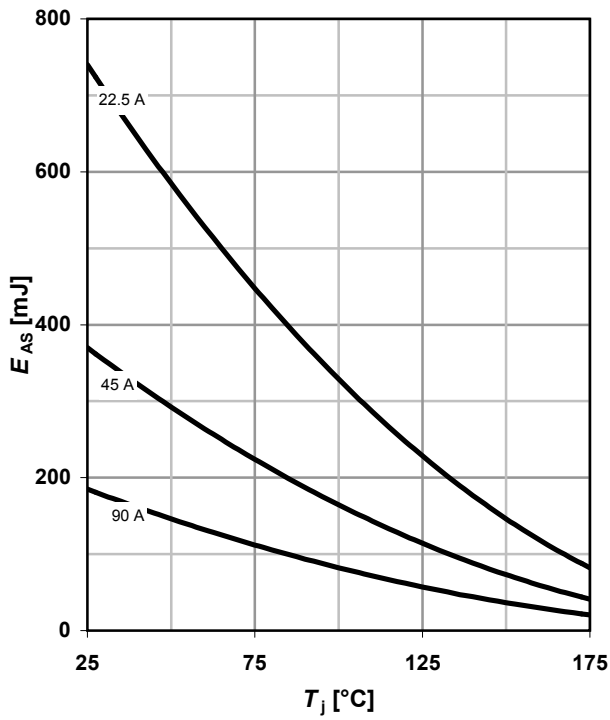
parameter:  $T_{j(start)}$



**13 Avalanche energy**

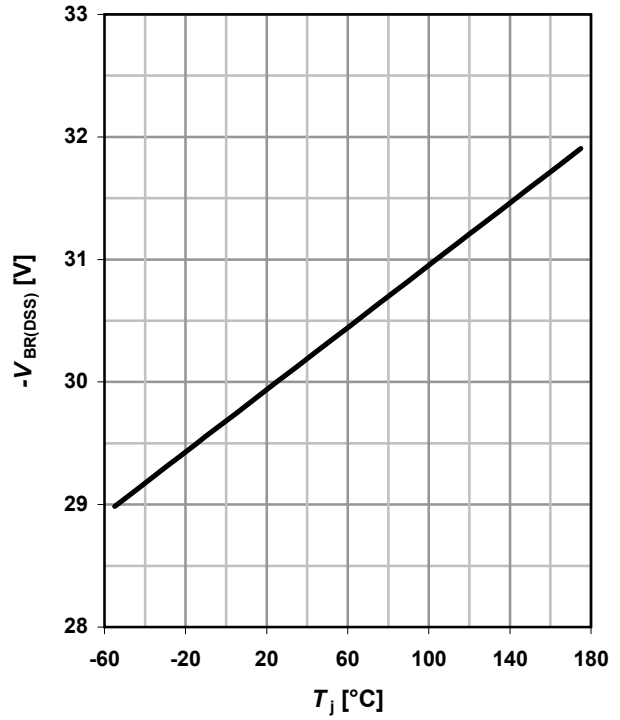
$$E_{AS} = f(T_j)$$

parameter:  $I_D$



**14 Drain-source breakdown voltage**

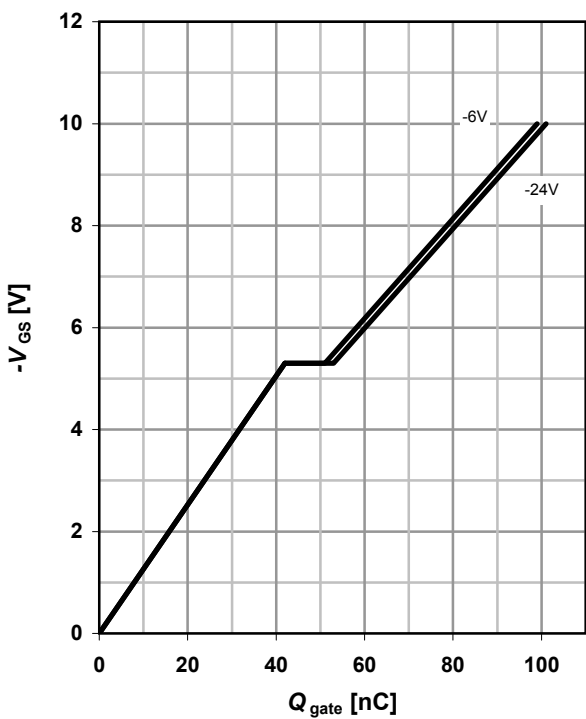
$$V_{BR(DSS)} = f(T_j); I_D = -1 \text{ mA}$$



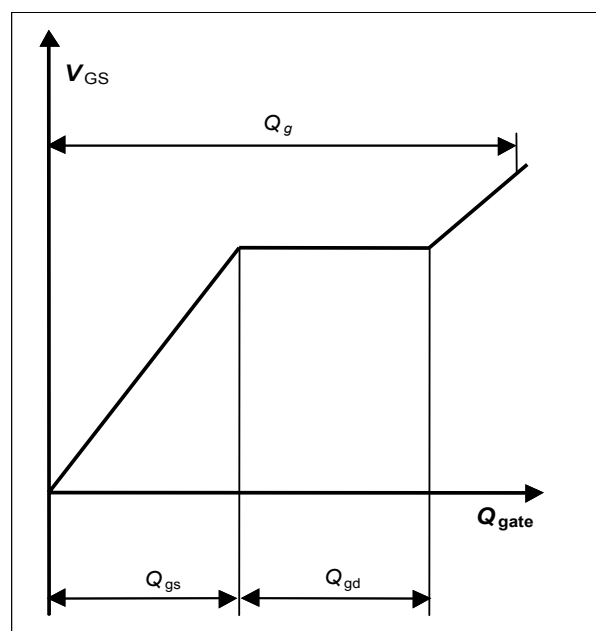
**15 Typ. gate charge**

$$V_{GS} = f(Q_{gate}); I_D = -90 \text{ A pulsed}$$

parameter:  $V_{DD}$



**16 Gate charge waveforms**



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Revision History

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| Version | Date | Changes |
|---------|------|---------|
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