

## OptiMOS<sup>®</sup> -T Power-Transistor



### Product Summary

|                  |     |    |
|------------------|-----|----|
| $V_{DS}$         | 55  | V  |
| $R_{DS(on),max}$ | 7.4 | mΩ |
| $I_D$            | 90  | A  |

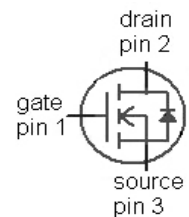
### Features

- N-channel - Logic Level - Enhancement mode
- Automotive AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green package (RoHS compliant)
- Ultra low  $R_{DS(on)}$
- 100% Avalanche tested

PG-TO252-3-11



| Type           | Package       | Marking |
|----------------|---------------|---------|
| IPD90N06S3L-07 | PG-TO252-3-11 | QN06L07 |



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

| Parameter                                     | Symbol            | Conditions                                          | Value        | Unit |
|-----------------------------------------------|-------------------|-----------------------------------------------------|--------------|------|
| Continuous drain current                      | $I_D$             | $T_C=25\text{ °C}$ , $V_{GS}=10\text{ V}$           | 90           | A    |
|                                               |                   | $T_C=100\text{ °C}$ ,<br>$V_{GS}=10\text{ V}^{(2)}$ | 64           |      |
| Pulsed drain current <sup>(1)</sup>           | $I_{D,pulse}$     | $T_C=25\text{ °C}$                                  | 360          |      |
| Avalanche energy, single pulse <sup>(1)</sup> | $E_{AS}$          | $I_D=45\text{ A}$                                   | 210          | mJ   |
| Avalanche current, single pulse               | $I_{AS}$          |                                                     | 90           | A    |
| Gate source voltage <sup>(2)</sup>            | $V_{GS}$          |                                                     | ±16          | V    |
| Power dissipation                             | $P_{tot}$         | $T_C=25\text{ °C}$                                  | 107          | 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. |      |

### Thermal characteristics<sup>1)</sup>

|                                     |            |                                              |   |   |     |     |
|-------------------------------------|------------|----------------------------------------------|---|---|-----|-----|
| Thermal resistance, junction - case | $R_{thJC}$ |                                              | - | - | 1.4 | 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 $T_j=25\text{ °C}$ , unless otherwise specified

#### Static characteristics

|                                  |               |                                                                          |     |      |      |               |
|----------------------------------|---------------|--------------------------------------------------------------------------|-----|------|------|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$                                  | 55  | -    | -    | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}$ , $I_D=55\text{ }\mu\text{A}$                            | 1.2 | 1.7  | 2.2  |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=55\text{ V}$ , $V_{GS}=0\text{ V}$ ,<br>$T_j=25\text{ °C}$       | -   | 0.01 | 1    | $\mu\text{A}$ |
|                                  |               | $V_{DS}=55\text{ V}$ , $V_{GS}=0\text{ V}$ ,<br>$T_j=125\text{ °C}^{2)}$ | -   | 1    | 100  |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=16\text{ V}$ , $V_{DS}=0\text{ V}$                               | -   | 1    | 100  | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=5\text{ V}$ , $I_D=29\text{ A}$                                  | -   | 11.0 | 13.7 | m $\Omega$    |
|                                  |               | $V_{GS}=10\text{ V}$ , $I_D=43\text{ A}$                                 | -   | 6.0  | 7.4  |               |

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

### Dynamic characteristics<sup>1)</sup>

|                              |              |                                                                                        |   |      |      |    |
|------------------------------|--------------|----------------------------------------------------------------------------------------|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$<br>$f=1\text{ MHz}$                           | - | 6500 | 7480 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                        | - | 810  | 1220 |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                        | - | 780  | 1170 |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=27.5\text{ V},$<br>$V_{GS}=10\text{ V}, I_D=80\text{ A},$<br>$R_G=5.1\ \Omega$ | - | 17   | -    | ns |
| Rise time                    | $t_r$        |                                                                                        | - | 42   | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                        | - | 43   | -    |    |
| Fall time                    | $t_f$        |                                                                                        | - | 44   | -    |    |

### Gate Charge Characteristics<sup>1)</sup>

|                       |               |                                                                            |   |     |     |    |
|-----------------------|---------------|----------------------------------------------------------------------------|---|-----|-----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=11\text{ V}, I_D=50\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 32  | 42  | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                                            | - | 19  | 28  |    |
| Gate charge total     | $Q_g$         |                                                                            | - | 90  | 110 |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                                            | - | 4.8 | -   | V  |

### Reverse Diode

|                                                |               |                                                                             |     |     |     |    |
|------------------------------------------------|---------------|-----------------------------------------------------------------------------|-----|-----|-----|----|
| Diode continuous forward current <sup>1)</sup> | $I_S$         | $T_C=25\text{ °C}$                                                          | -   | -   | 90  | A  |
| Diode pulse current <sup>1)</sup>              | $I_{S,pulse}$ |                                                                             | -   | -   | 360 |    |
| Diode forward voltage                          | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=80\text{ A},$<br>$T_j=25\text{ °C}$                 | 0.6 | 0.9 | 1.3 | V  |
| Reverse recovery time <sup>1)</sup>            | $t_{rr}$      | $V_R=27.5\text{ V}, I_F=50\text{ A},$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | -   | 40  | -   | ns |
| Reverse recovery charge <sup>1)</sup>          | $Q_{rr}$      |                                                                             | -   | 50  | -   | nC |

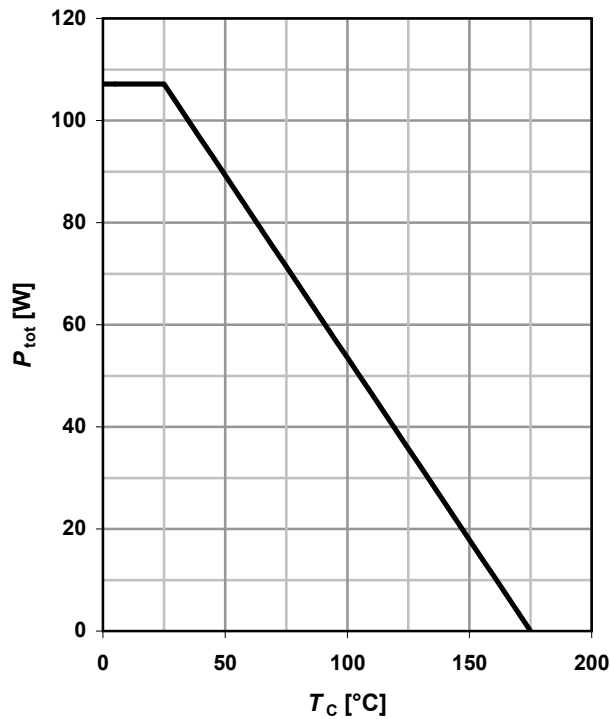
<sup>1)</sup> Defined by design. Not subject to production test.

<sup>2)</sup> Qualified at -5V and +16V.

<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.

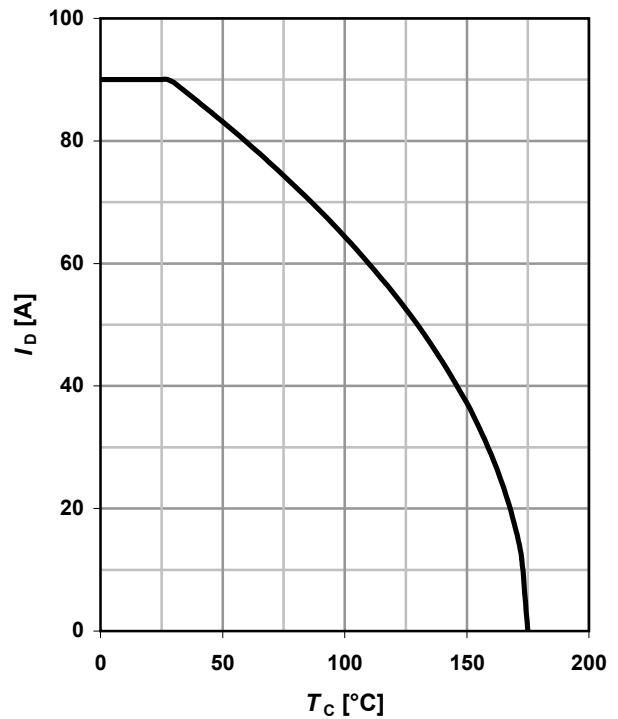
### 1 Power dissipation

$$P_{\text{tot}} = f(T_C); V_{\text{GS}} \geq 4 \text{ V}$$



### 2 Drain current

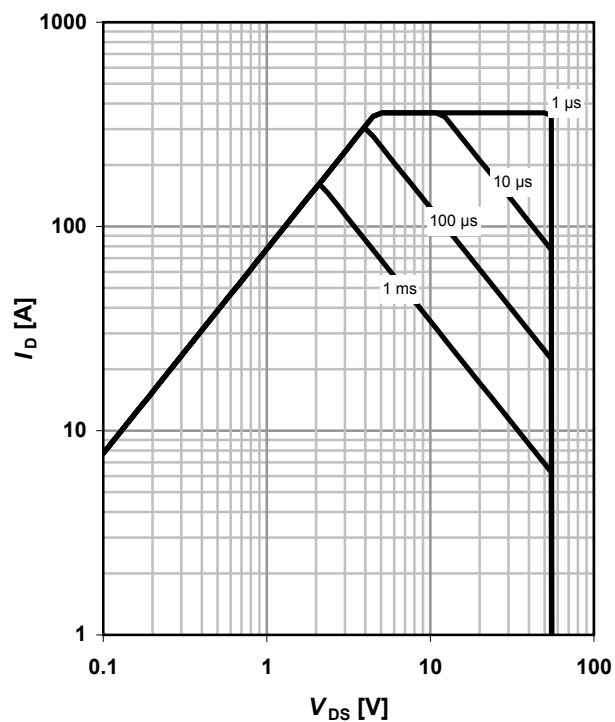
$$I_D = f(T_C); V_{\text{GS}} \geq 4 \text{ V}$$



### 3 Safe operating area

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

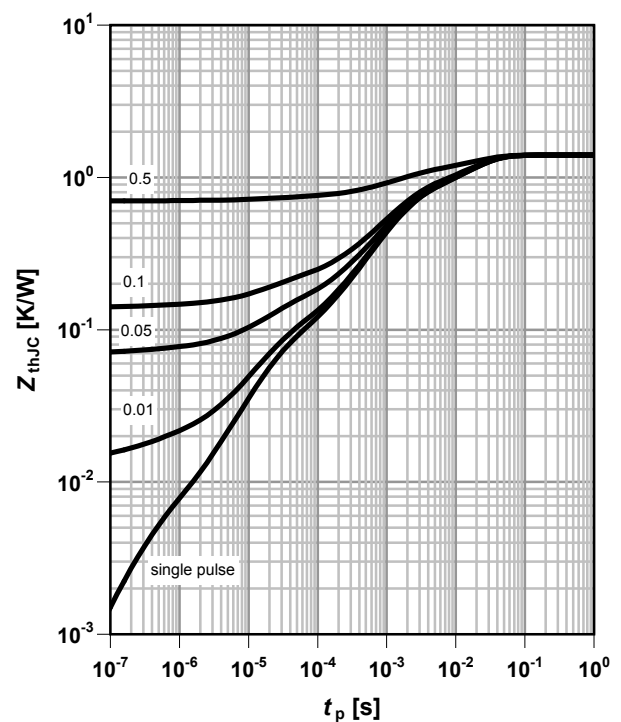
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

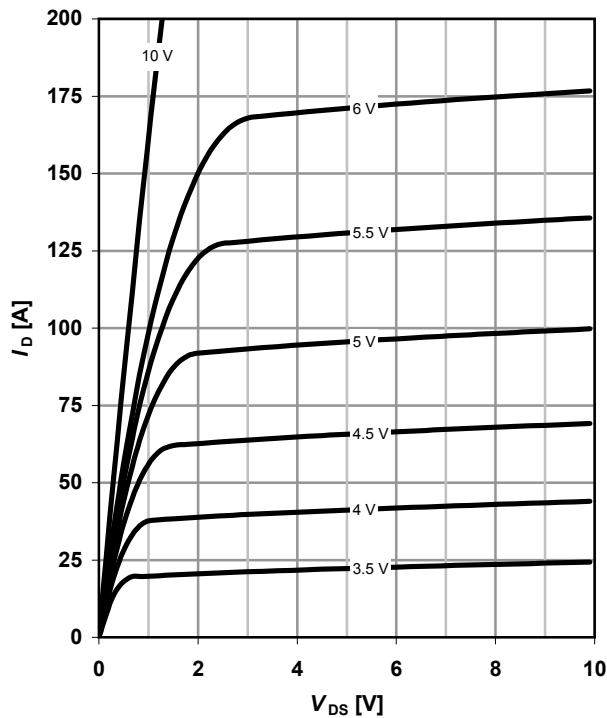
parameter:  $D = t_p/T$



### 5 Typ. output characteristics

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

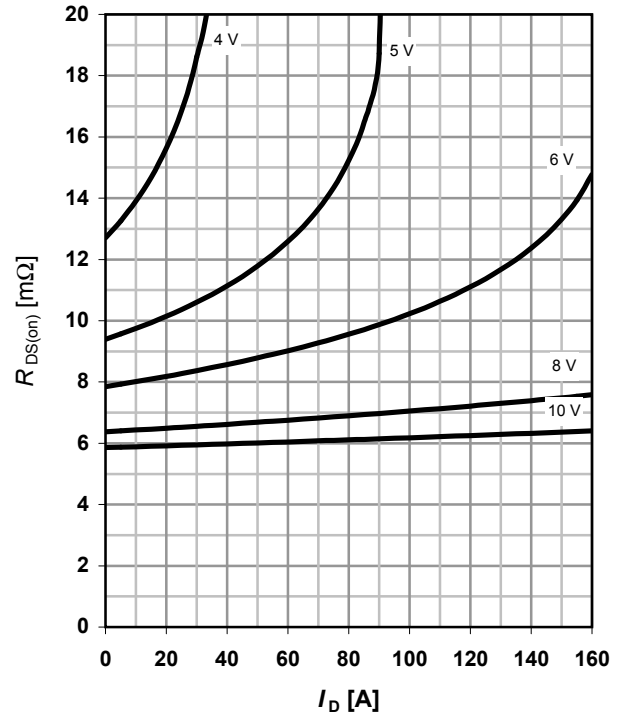
parameter:  $V_{GS}$



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

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

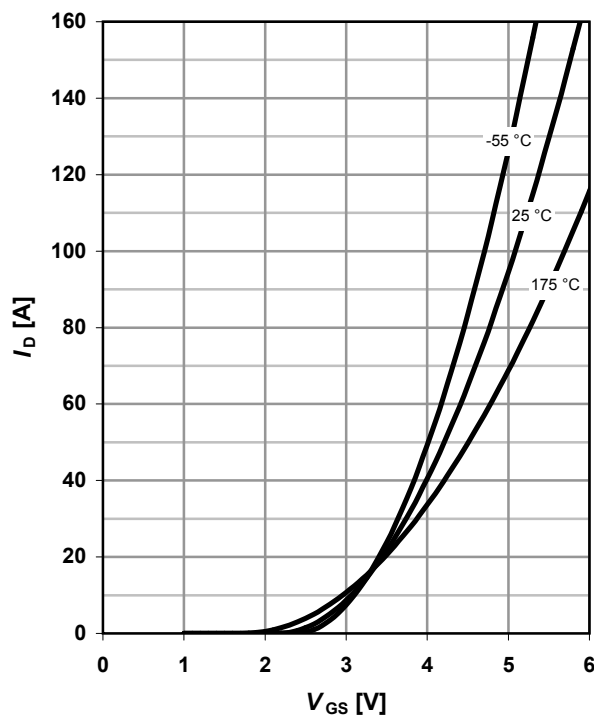
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

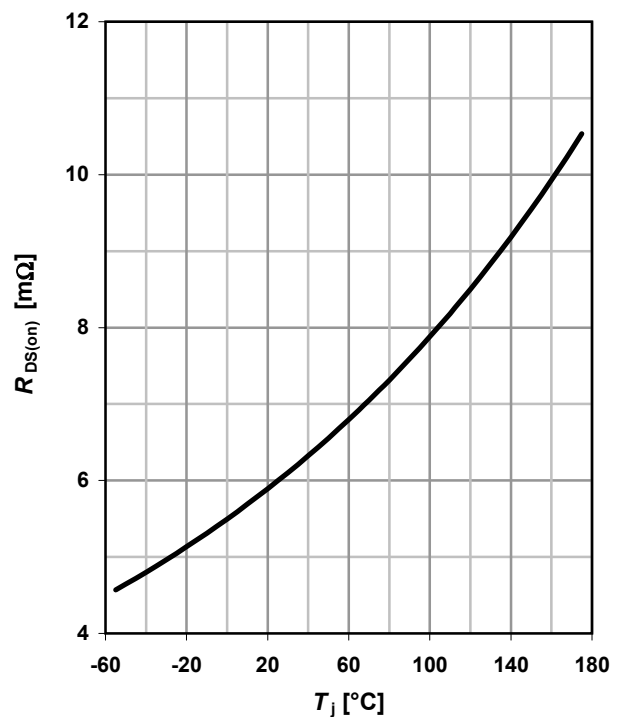
$$I_D = f(V_{GS}); V_{DS} = 4\text{ V}$$

parameter:  $T_j$



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

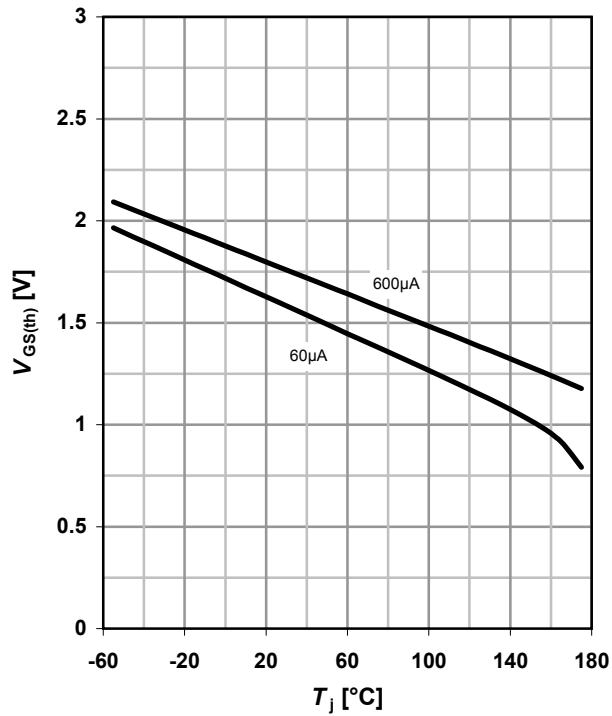
$$R_{DS(on)} = f(T_j); I_D = 43\text{ A}; V_{GS} = 10\text{ V}$$



## 9 Typ. gate threshold voltage

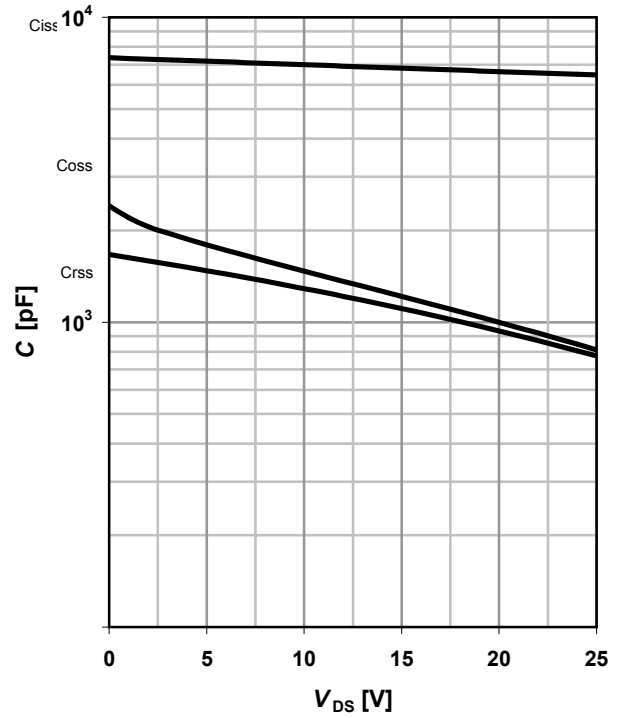
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



## 10 Typ. capacitances

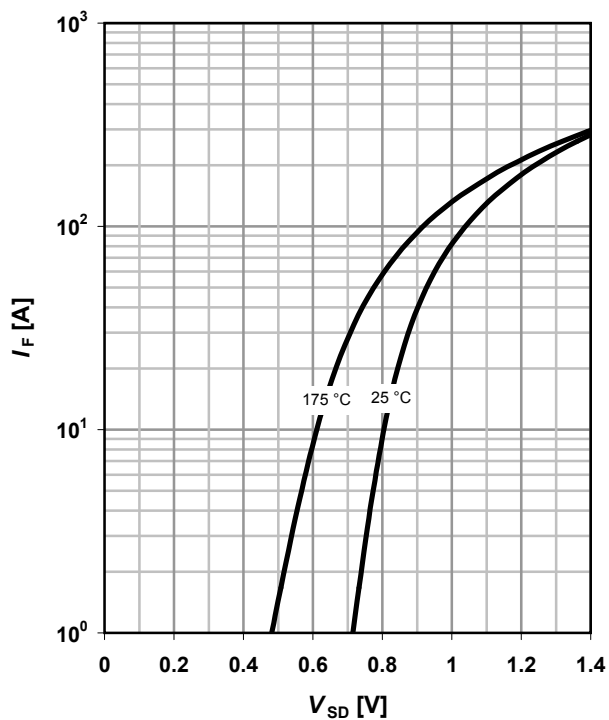
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



## 11 Typical forward diode characteristics

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

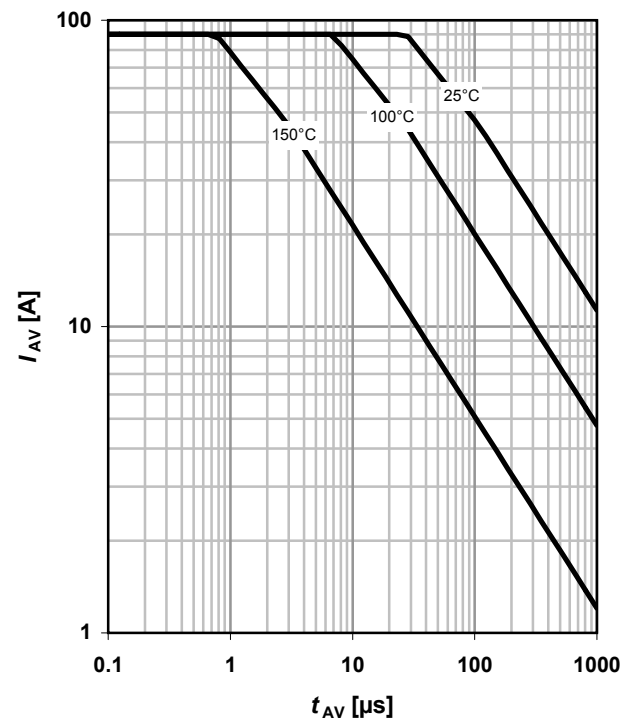
parameter:  $T_j$



## 12 Typ. avalanche characteristics

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

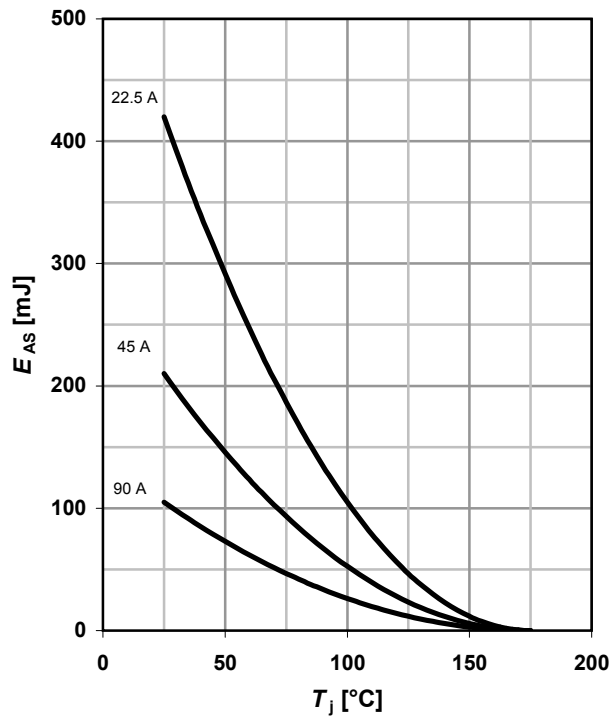
parameter:  $T_{j(start)}$



### 13 Typical avalanche Energy

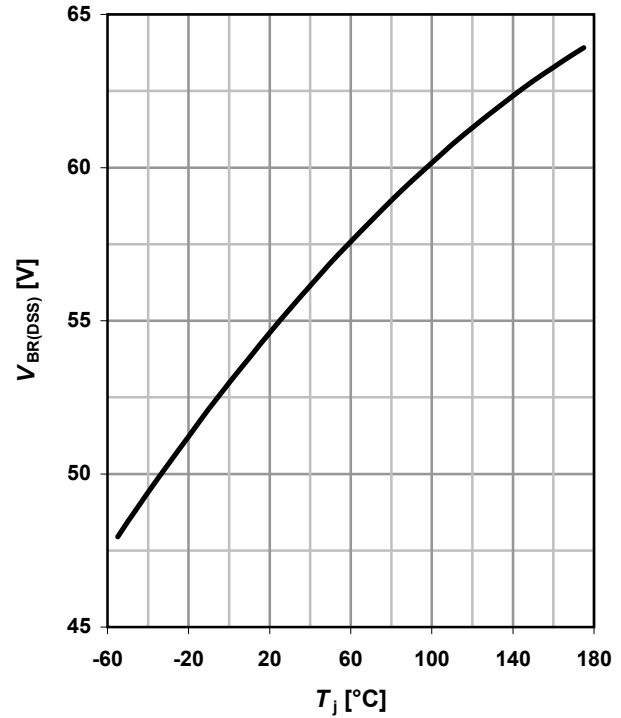
$$E_{AS} = f(T_j)$$

parameter:  $I_D$



### 14 Drain-source breakdown voltage

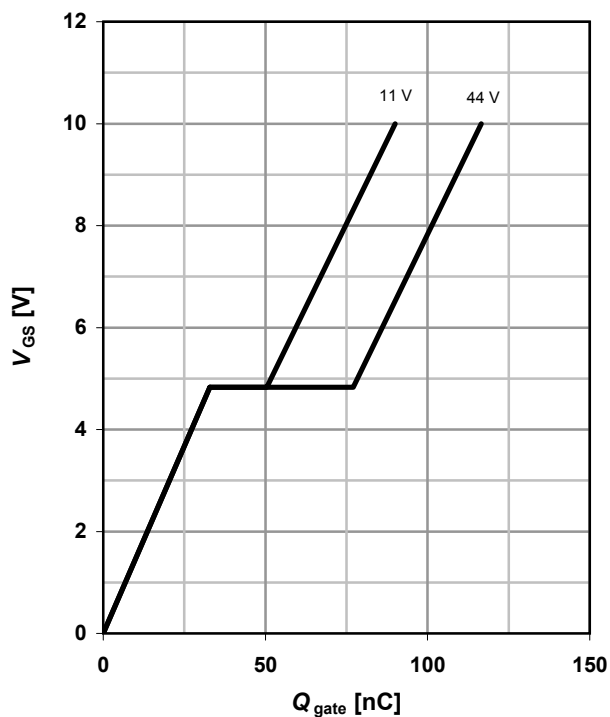
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



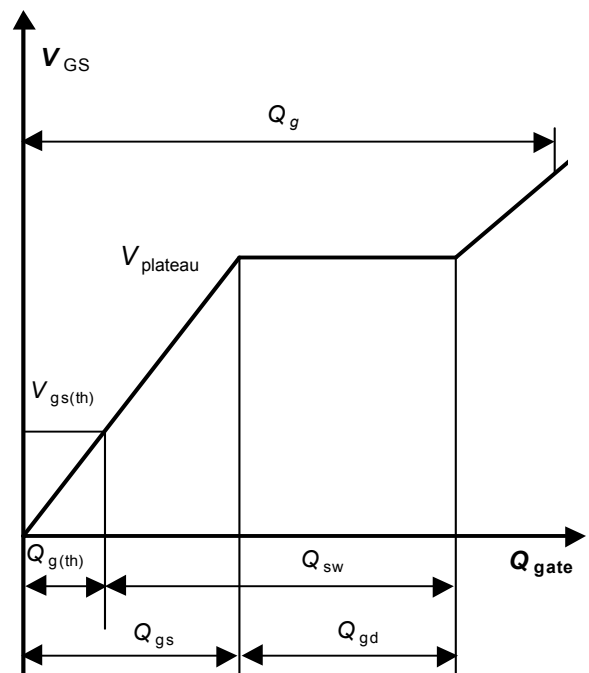
### 15 Typ. gate charge

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

parameter:  $V_{DD}$



### 16 Gate charge waveforms



**Published by**  
**Infineon Technologies AG**  
**81726 Munich, Germany**

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Revision History

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| Version                | Date       | Changes                                        |
|------------------------|------------|------------------------------------------------|
| Data Sheet version 1.1 | 15.06.2009 | Correction of marking and update of disclaimer |
| Data Sheet version 1.1 | 15.06.2009 | Correction of package name                     |