

## OptiMOS® Power-Transistor

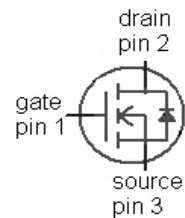
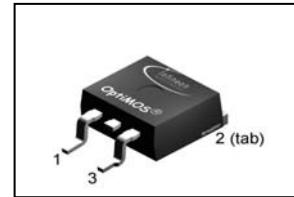
### Features

- N-channel - Enhancement mode
- Automotive AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green package (lead free)
- Ultra low Rds(on)
- 100% Avalanche tested

### Product Summary

|                                |    |    |
|--------------------------------|----|----|
| $V_{DS}$                       | 55 | V  |
| $R_{DS(on),max}$ (SMD version) | 80 | mΩ |
| $I_D$                          | 17 | A  |

PG-TO252-3-11



| Type          | Package       | Marking |
|---------------|---------------|---------|
| IPD14N06S2-80 | PG-TO252-3-11 | 2N0680  |

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

| Parameter                           | Symbol            | Conditions                                         | Value        | Unit |
|-------------------------------------|-------------------|----------------------------------------------------|--------------|------|
| Continuous drain current            | $I_D$             | $T_C=25\text{ °C}$ , $V_{GS}=10\text{ V}$          | 17           | A    |
|                                     |                   | $T_C=100\text{ °C}$ ,<br>$V_{GS}=10\text{ V}^{2)}$ | 12           |      |
| Pulsed drain current <sup>1)</sup>  | $I_{D,pulse}$     | $T_C=25\text{ °C}$                                 | 68           |      |
| Avalanche energy, single pulse      | $E_{AS}$          | $I_D=14\text{ A}$                                  | 43           | mJ   |
| Gate source voltage                 | $V_{GS}$          |                                                    | ±20          | V    |
| Power dissipation                   | $P_{tot}$         | $T_C=25\text{ °C}$                                 | 47           | 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

|                                                |            |                                              |   |   |     |     |
|------------------------------------------------|------------|----------------------------------------------|---|---|-----|-----|
| Thermal resistance, junction - case            | $R_{thJC}$ |                                              | - | - | 3.2 | K/W |
| Thermal resistance, junction - ambient, leaded | $R_{thJA}$ |                                              | - | - | 100 |     |
| SMD version, device on PCB                     | $R_{thJA}$ | 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   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$                            | 55  | -    | -    | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=14\text{ }\mu\text{A}$                      | 2.1 | 3.0  | 4.0  |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=55\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$       | -   | 0.01 | 1    | $\mu\text{A}$ |
|                                  |               | $V_{DS}=55\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}^{2)}$ | -   | 1    | 100  |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$                         | -   | 1    | 100  | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=10\text{ V}, I_D=7\text{ A},$                           | -   | 50.0 | 80.0 | m $\Omega$    |

| 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>$f=1\text{ MHz}$                   | - | 293 | - | pF |
| Output capacitance           | $C_{oss}$    |                                                                                | - | 94  | - |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                | - | 37  | - |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=30\text{ V}, V_{GS}=10\text{ V},$<br>$I_D=14\text{ A}, R_G=39\ \Omega$ | - | 6   | - | ns |
| Rise time                    | $t_r$        |                                                                                | - | 17  | - |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                | - | 15  | - |    |
| Fall time                    | $t_f$        |                                                                                | - | 20  | - |    |

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

|                       |               |                                                                            |   |     |    |    |
|-----------------------|---------------|----------------------------------------------------------------------------|---|-----|----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=44\text{ V}, I_D=14\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 1.6 | 2  | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                                            | - | 3.7 | 5  |    |
| Gate charge total     | $Q_g$         |                                                                            | - | 8.0 | 10 |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                                            | - | 5.7 | -  | V  |

#### Reverse Diode

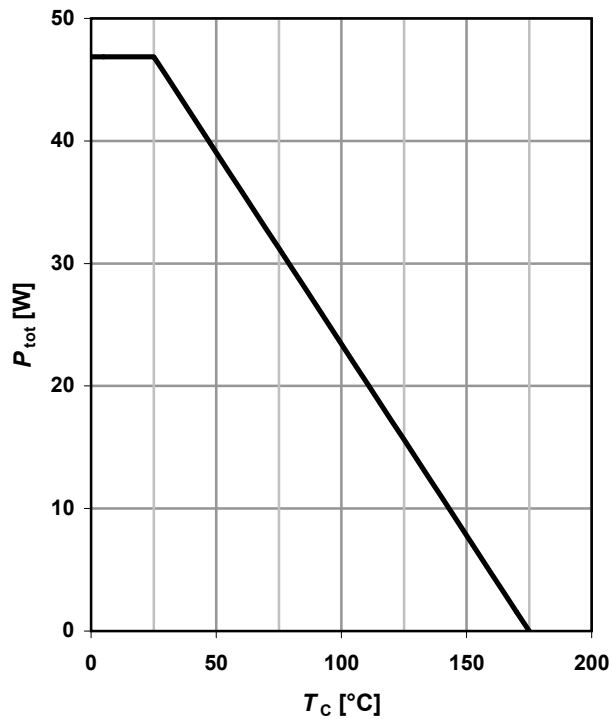
|                                                |               |                                                                   |   |     |     |    |
|------------------------------------------------|---------------|-------------------------------------------------------------------|---|-----|-----|----|
| Diode continuous forward current <sup>1)</sup> | $I_S$         | $T_C=25\text{ °C}$                                                | - | -   | 17  | A  |
| Diode pulse current <sup>1)</sup>              | $I_{S,pulse}$ |                                                                   | - | -   | 68  |    |
| Diode forward voltage                          | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=17\text{ A},$<br>$T_j=25\text{ °C}$       | - | 0.9 | 1.3 | V  |
| Reverse recovery time <sup>1)</sup>            | $t_{rr}$      | $V_R=30\text{ V}, I_F=I_S,$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 25  | -   | ns |
| Reverse recovery charge <sup>1)</sup>          | $Q_{rr}$      | $V_R=30\text{ V}, I_F=I_S,$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 35  | -   | nC |

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

<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 µm thick) copper area for drain connection. PCB is vertical in still air.

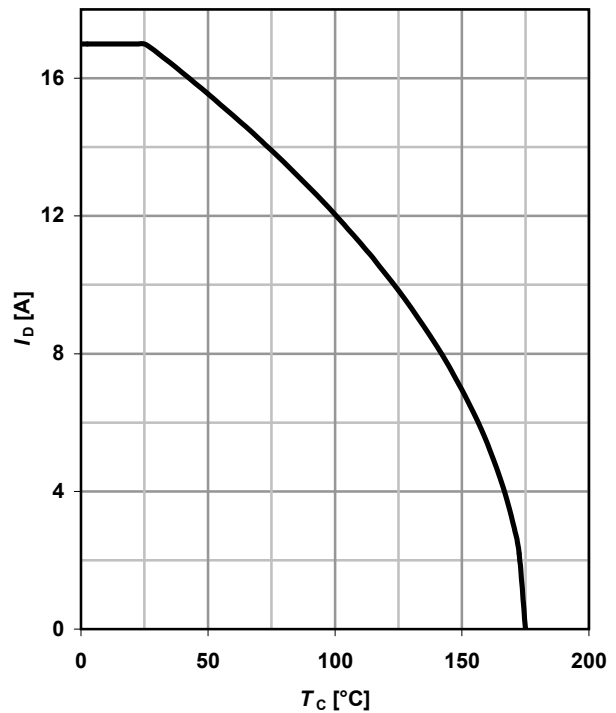
### 1 Power dissipation

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



### 2 Drain current

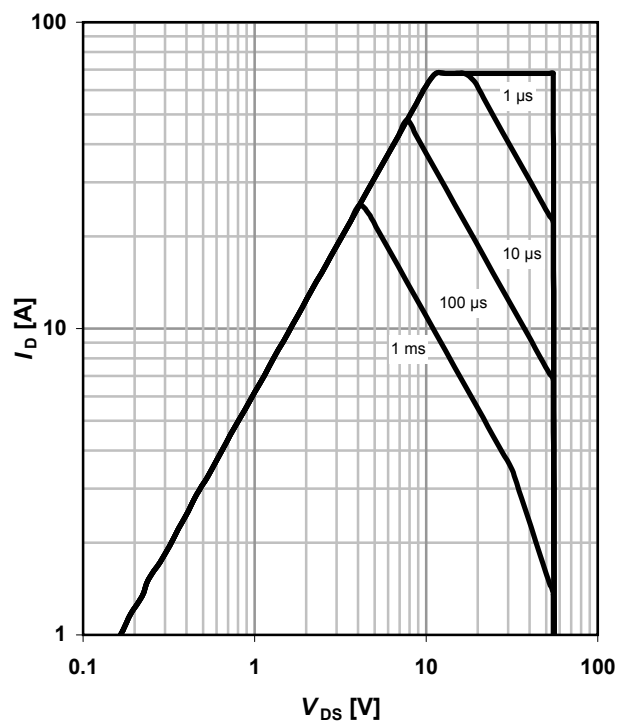
$$I_D = f(T_C); V_{\text{GS}} \geq 10 \text{ V}$$



### 3 Safe operating area

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

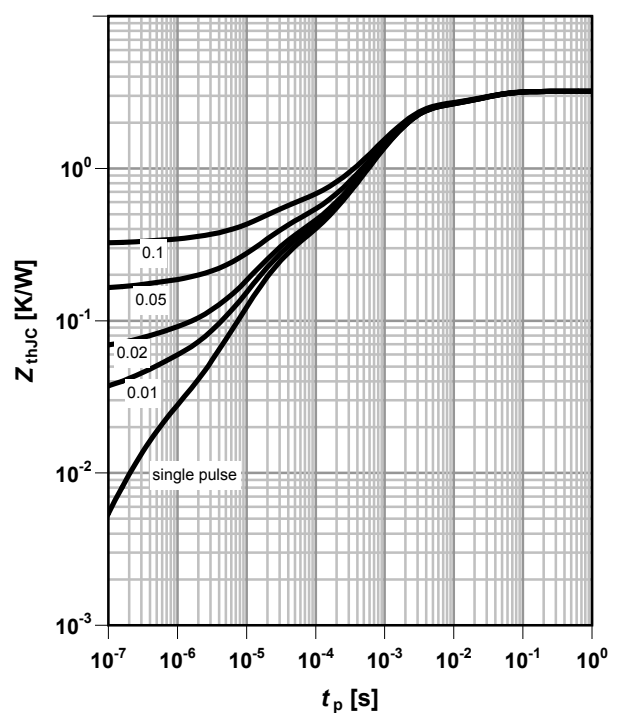
parameter:  $t_p$



### 4 Max. transient thermal impedance

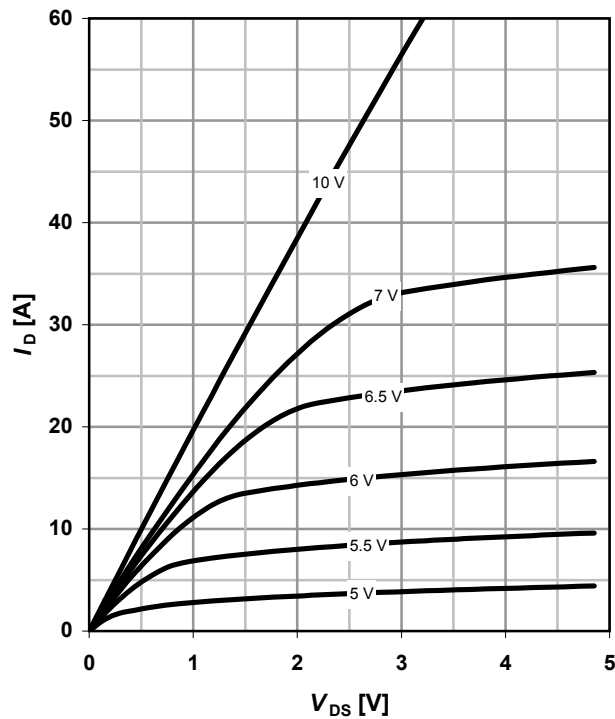
$$Z_{\text{thJC}} = f(t_p)$$

parameter:  $D = t_p/T$



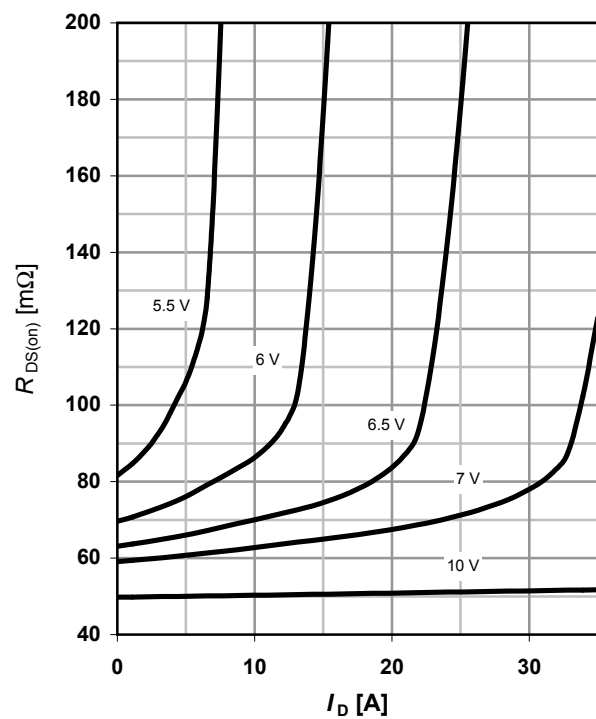
### 5 Typ. output characteristics

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

parameter:  $V_{GS}$ 


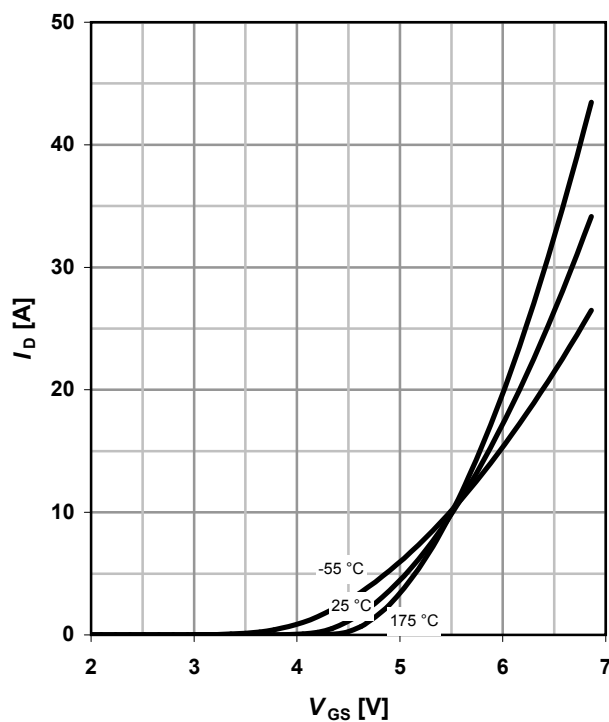
### 6 Typ. drain-source on-state resistance

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

parameter:  $V_{GS}$ 


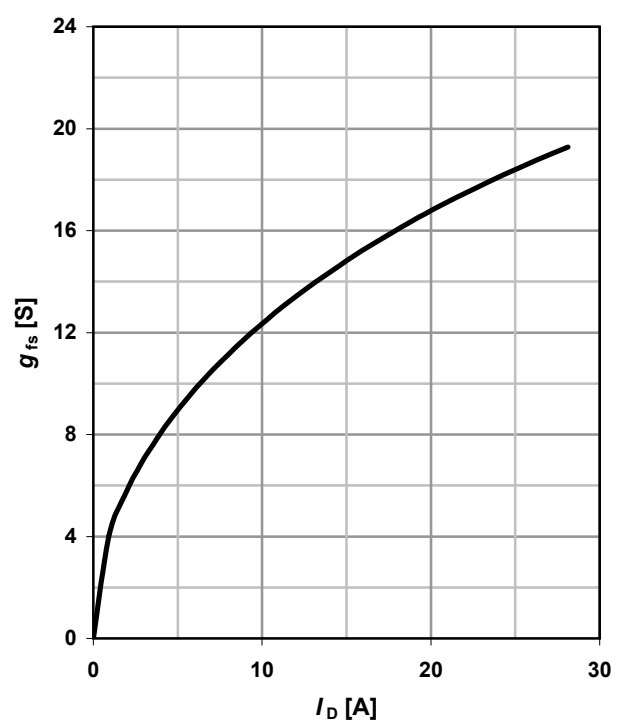
### 7 Typ. transfer characteristics

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

parameter:  $T_j$ 


### 8 Typ. Forward transconductance

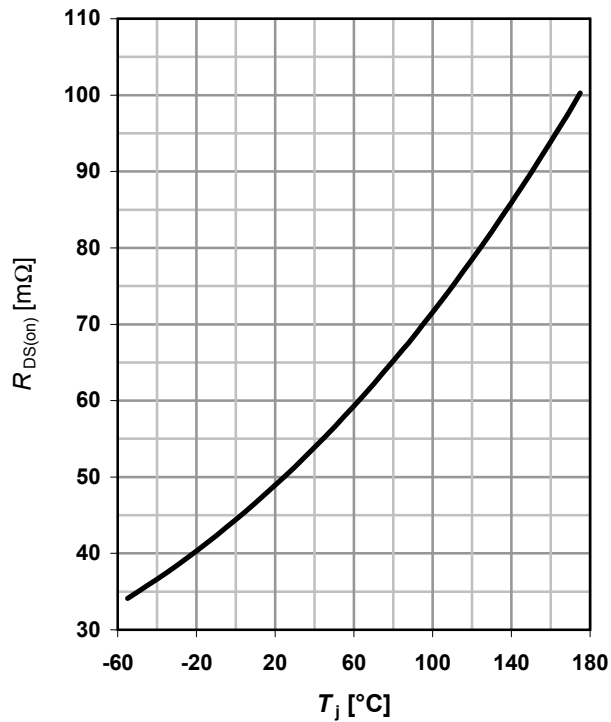
 $g_{fs} = f(I_D); T_j = 25^\circ\text{C}$ 

parameter:  $g_{fs}$ 


### 9 Typ. Drain-source on-state resistance

$$R_{DS(on)} = f(T_j)$$

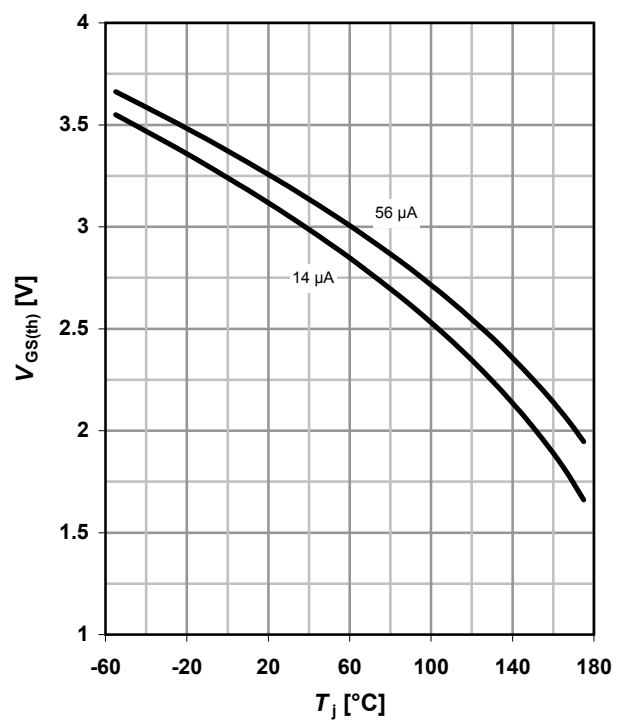
parameter:  $I_D = 7\text{ A}$ ;  $V_{GS} = 10\text{ V}$



### 10 Typ. gate threshold voltage

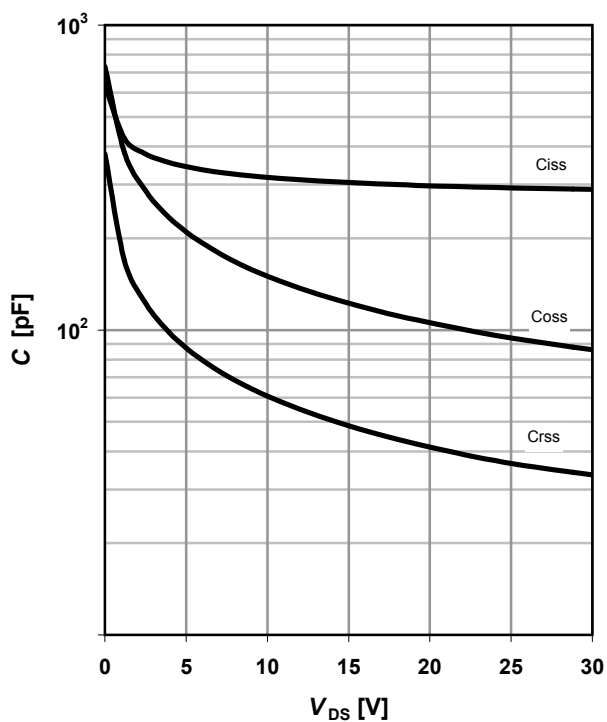
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



### 11 Typ. capacitances

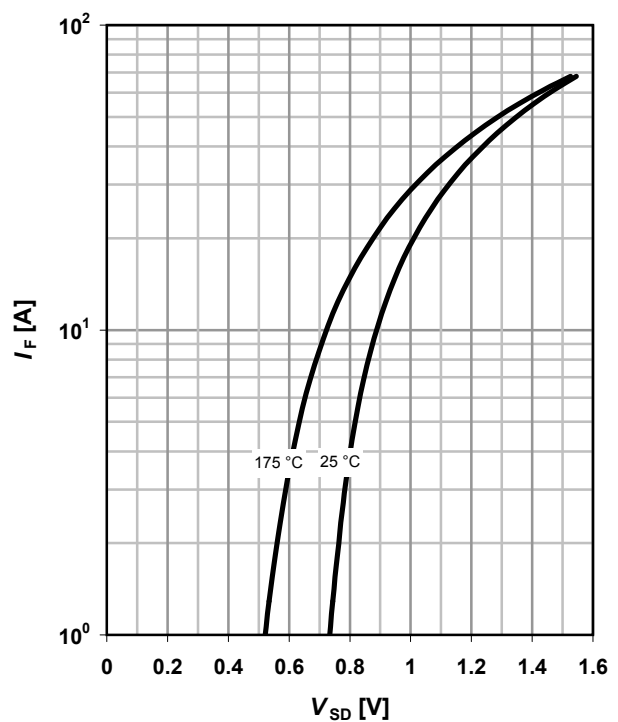
$$C = f(V_{DS}); V_{GS} = 0\text{ V}; f = 1\text{ MHz}$$



### 12 Typical forward diode characteristics

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

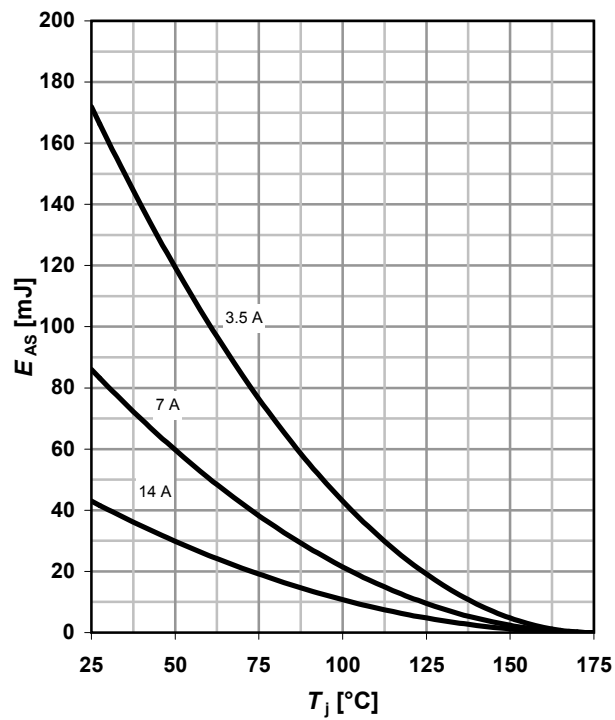
parameter:  $T_j$



### 13 Typical avalanche energy

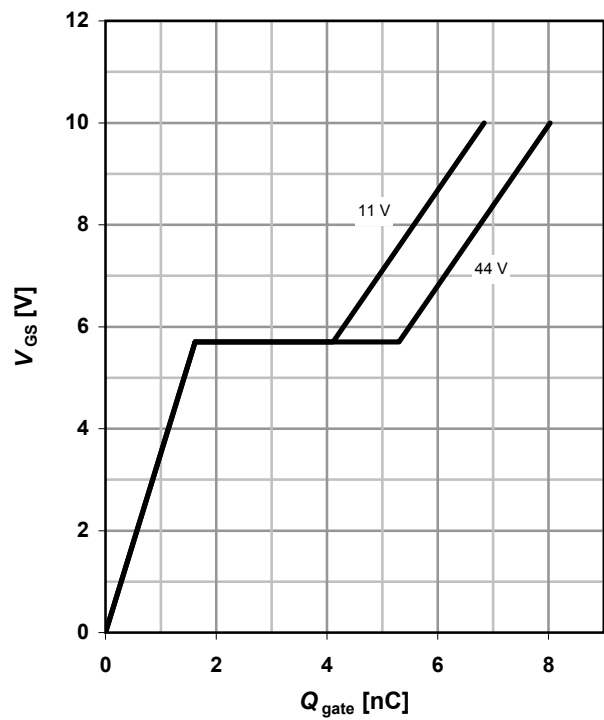
$$E_{AS} = f(T_j)$$

parameter:  $I_D$



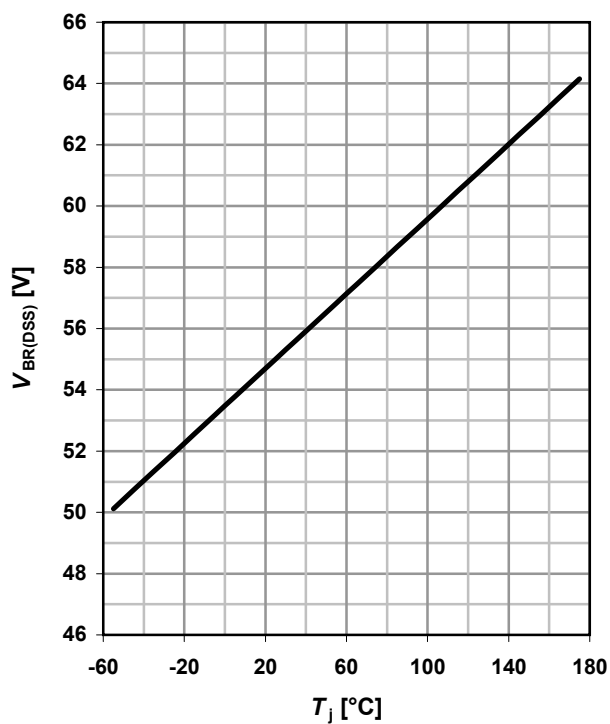
### 14 Typ. gate charge

$$V_{GS} = f(Q_{gate}); I_D = 14 \text{ A pulsed}$$



### 15 Typ. drain-source breakdown voltage

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



### 16 Gate charge waveforms

