

## OptiMOS™ - 6 Power-Transistor



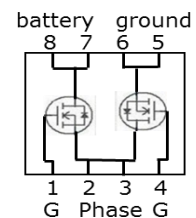
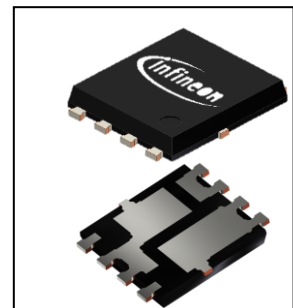
### Product Summary

|                  |     |    |
|------------------|-----|----|
| $V_{DS}$         | 40  | V  |
| $R_{DS(on),max}$ | 5.0 | mΩ |
| $I_D$            | 60  | A  |

### Features

- OptiMOS™ - power MOSFET for automotive applications
- Half-Bridge - N-channel - Enhancement mode - Normal Level
- AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green Product (RoHS compliant)
- 100% Avalanche tested

### PG-TDSON-8-57



| Type             | Package       | Marking  |
|------------------|---------------|----------|
| IAUC60N04S6N050H | PG-TDSON-8-57 | 6N04N050 |

Maximum ratings per channel, at  $T_j=25^\circ\text{C}$ , unless otherwise specified

| Parameter                                    | Symbol         | Conditions                                                                           | Value        | Unit |
|----------------------------------------------|----------------|--------------------------------------------------------------------------------------|--------------|------|
| Drain current                                | $I_D$          | $V_{GS}=10\text{V}$ ,<br>Chip Limitation <sup>1,2)</sup>                             | 74           | A    |
|                                              |                | $V_{GS}=10\text{V}$ ,<br>DC current <sup>3)</sup>                                    | 60           |      |
|                                              |                | $T_a=85^\circ\text{C}$ , $V_{GS}=10\text{V}$ ,<br>$R_{thJA}$ on 2s2p <sup>2,4)</sup> | 16           |      |
| Pulsed drain current <sup>2)</sup>           | $I_{D,pulse}$  | $T_C=25^\circ\text{C}$ , $t_p=100\mu\text{s}$                                        | 171          |      |
| Avalanche energy, single pulse <sup>2)</sup> | $E_{AS}$       | $I_D=12\text{A}$ , $R_{g,min}=25\Omega$                                              | 53           | mJ   |
| Avalanche current, single pulse              | $I_{AS}$       | $R_{g,min}=25\Omega$                                                                 | 12           | A    |
| Gate source voltage                          | $V_{GS}$       | -                                                                                    | $\pm 20$     | V    |
| Power dissipation                            | $P_{tot}$      | $T_C=25^\circ\text{C}$                                                               | 52           | W    |
| Operating and storage temperature            | $T_j, T_{stg}$ | -                                                                                    | -55 ... +175 | °C   |

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

### Thermal characteristics<sup>2)</sup>

|                                                      |            |   |   |    |     |     |
|------------------------------------------------------|------------|---|---|----|-----|-----|
| Thermal resistance, junction - case                  | $R_{thJC}$ | - | - | -  | 2.9 | K/W |
| Thermal resistance, junction - ambient <sup>4)</sup> | $R_{thJA}$ | - | - | 35 | -   |     |

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

#### Static characteristics

|                                  |               |                                                     |     |     |     |           |
|----------------------------------|---------------|-----------------------------------------------------|-----|-----|-----|-----------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=1mA$                                | 40  | -   | -   | V         |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=13\mu A$                        | 2.2 | 2.6 | 3.0 |           |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=40V, V_{GS}=0V, T_j=25^\circ\text{C}$       | -   | -   | 1   | $\mu A$   |
|                                  |               | $V_{DS}=40V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$ | -   | -   | 10  |           |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20V, V_{DS}=0V$                             | -   | -   | 100 | nA        |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=7V, I_D=30A$                                | -   | 4.9 | 6.5 | $m\Omega$ |
|                                  |               | $V_{GS}=10V, I_D=30A$                               | -   | 4.0 | 5.0 |           |

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

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

|                              |              |                                                       |   |     |      |    |
|------------------------------|--------------|-------------------------------------------------------|---|-----|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0V, V_{DS}=25V,$<br>$f=1MHz$                  | - | 790 | 1027 | pF |
| Output capacitance           | $C_{oss}$    |                                                       | - | 248 | 322  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                       | - | 17  | 26   |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=20V, V_{GS}=10V,$<br>$I_D=60A, R_G=3.5\Omega$ | - | 3   | -    | ns |
| Rise time                    | $t_r$        |                                                       | - | 1   | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                       | - | 6   | -    |    |
| Fall time                    | $t_f$        |                                                       | - | 3   | -    |    |

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

|                       |               |                                                      |   |     |     |    |
|-----------------------|---------------|------------------------------------------------------|---|-----|-----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=32V, I_D=60A,$<br>$V_{GS}=0 \text{ to } 10V$ | - | 3.7 | 4.9 | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                      | - | 2.8 | 4.2 |    |
| Gate charge total     | $Q_g$         |                                                      | - | 13  | 17  |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                      | - | 4.7 | -   | V  |

### Reverse Diode

|                                                |               |                                             |   |     |     |    |
|------------------------------------------------|---------------|---------------------------------------------|---|-----|-----|----|
| Diode continuous forward current <sup>2)</sup> | $I_S$         | $T_C=25^\circ C$                            | - | -   | 50  | A  |
| Diode pulse current <sup>2)</sup>              | $I_{S,pulse}$ | $T_C=25^\circ C, t_p=100\mu s$              | - | -   | 210 |    |
| Diode forward voltage                          | $V_{SD}$      | $V_{GS}=0V, I_F=30A,$<br>$T_J=25^\circ C$   | - | 0.8 | 1.1 | V  |
| Reverse recovery time <sup>2)</sup>            | $t_{rr}$      | $V_R=20V, I_F=50A,$<br>$di_F/dt=100A/\mu s$ | - | 20  | -   | ns |
| Reverse recovery charge <sup>2)</sup>          | $Q_{rr}$      |                                             | - | 8   | -   | nC |

<sup>1)</sup> Practically the current is limited by overall system design including customer specific PCB.

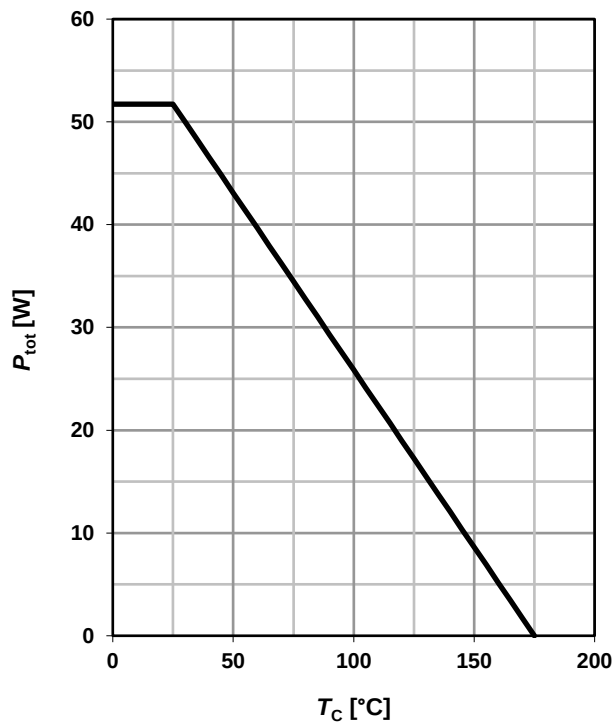
<sup>2)</sup> The parameter is not subject to production test - specified by design.

<sup>3)</sup> The product can operate at specified current based on best practice to minimize electromigration at the solder joint. For rare events and inrush currents the value may be exceeded.

<sup>4)</sup> Device on 2s2p FR4 PCB defined in accordance with JEDEC standards (JESD51-5, -7). PCB is vertical in still air.

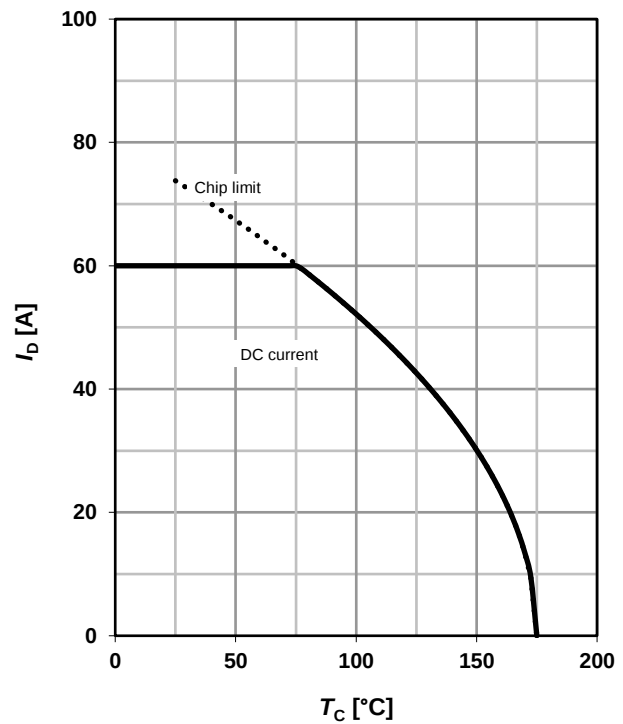
### 1 Power dissipation

$$P_{\text{tot}} = f(T_C); V_{\text{GS}} = 10 \text{ V}$$



### 2 Drain current

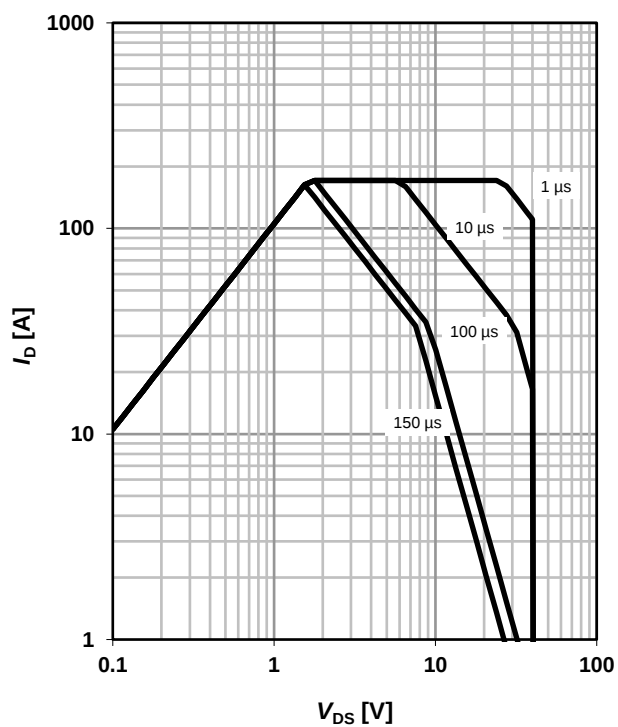
$$I_D = f(T_C); V_{\text{GS}} = 10 \text{ V}$$



### 3 Safe operating area

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

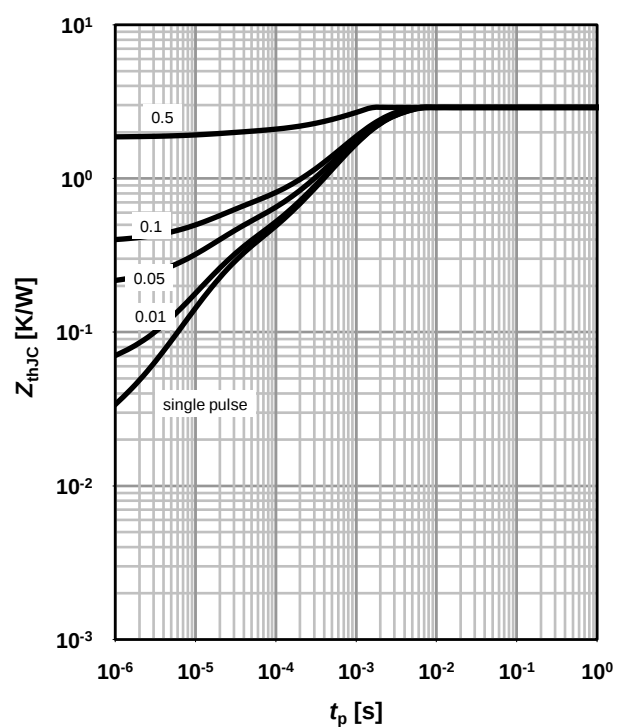
parameter:  $t_p$



### 4 Max. transient thermal impedance

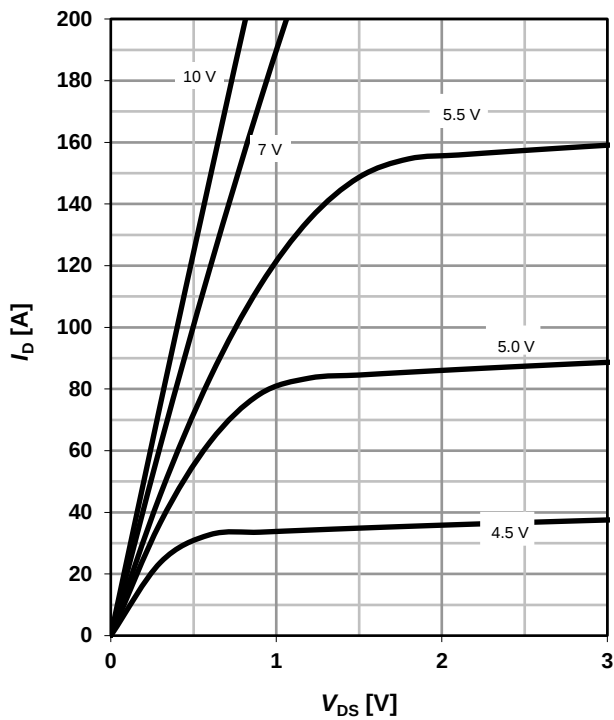
$$Z_{\text{thJC}} = f(t_p)$$

parameter:  $D = t_p/T$



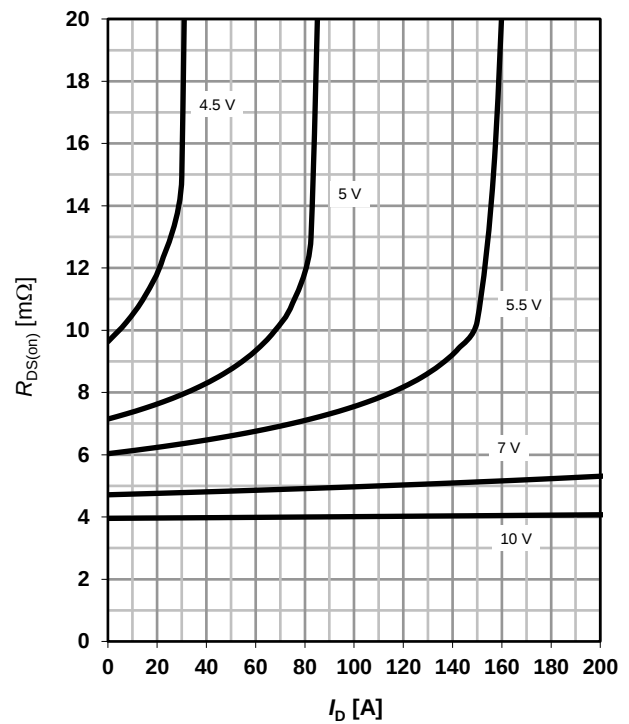
### 5 Typ. output characteristics

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

parameter:  $V_{GS}$ 


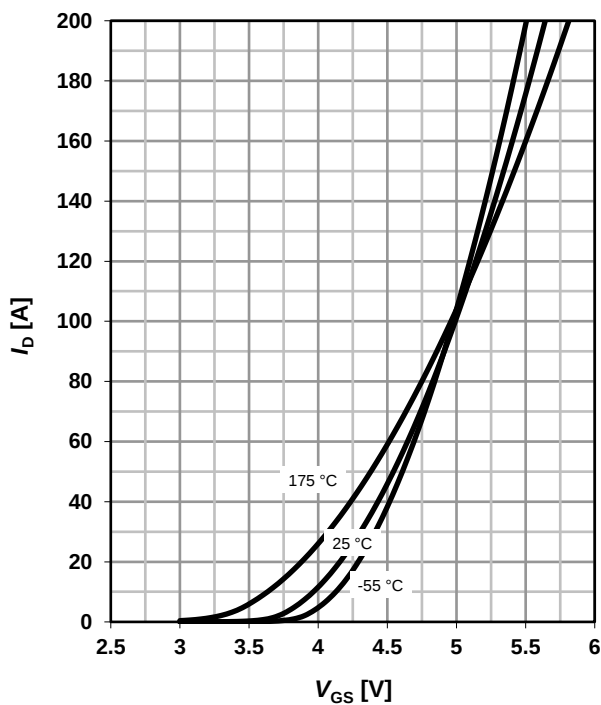
### 6 Typ. drain-source on-state resistance

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

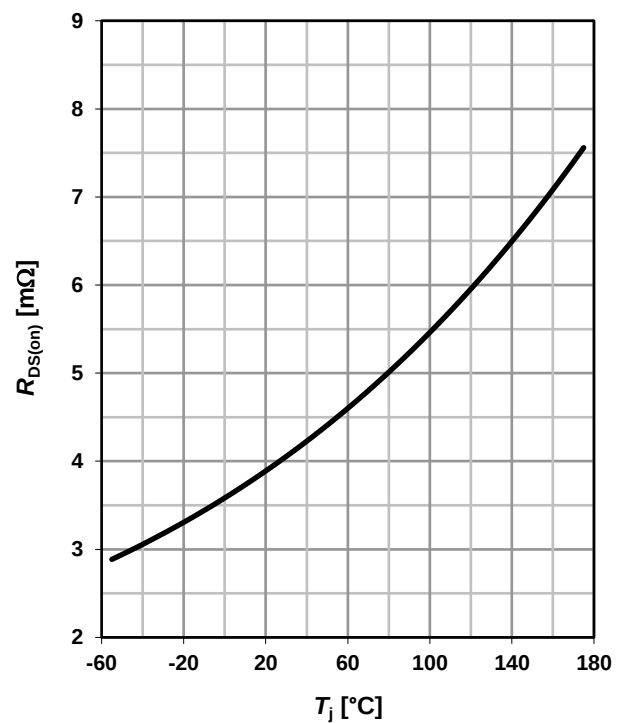
parameter:  $V_{GS}$ 


### 7 Typ. transfer characteristics

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

parameter:  $T_j$ 


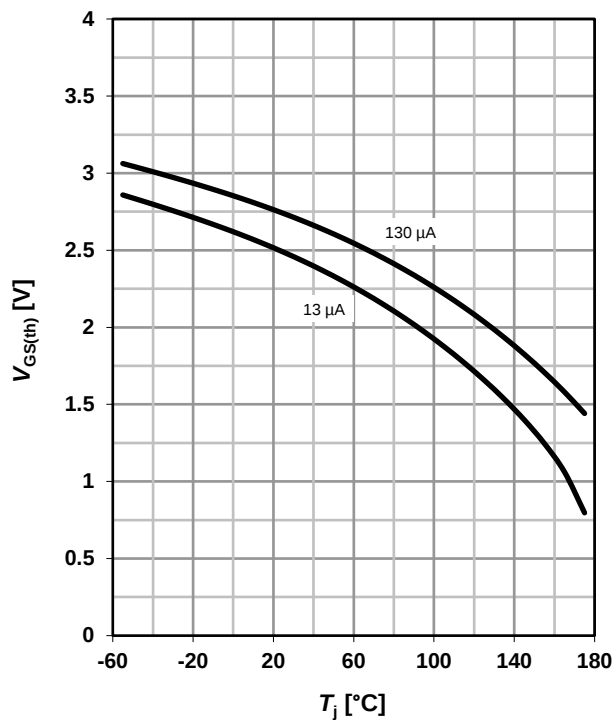
### 8 Typ. drain-source on-state resistance

 $R_{DS(on)} = f(T_j); I_D = 30\text{ A}; V_{GS} = 10\text{ V}$ 


## 9 Typ. gate threshold voltage

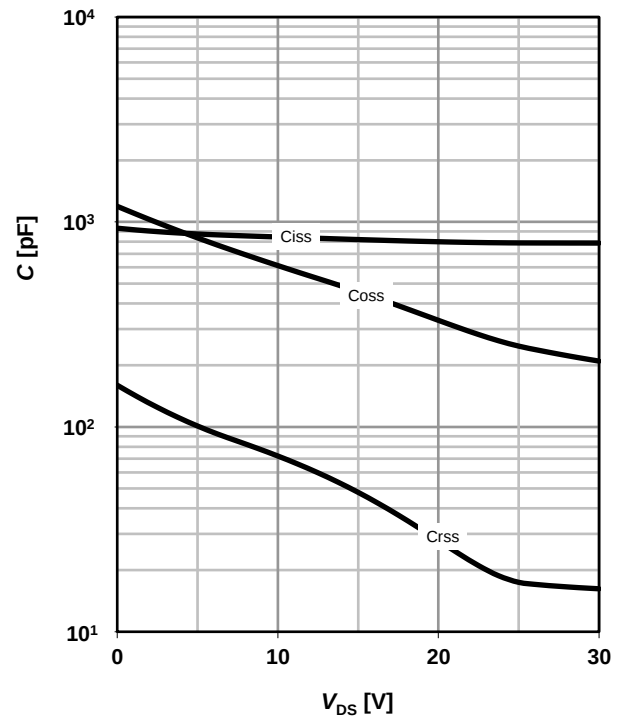
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



## 10 Typ. capacitances

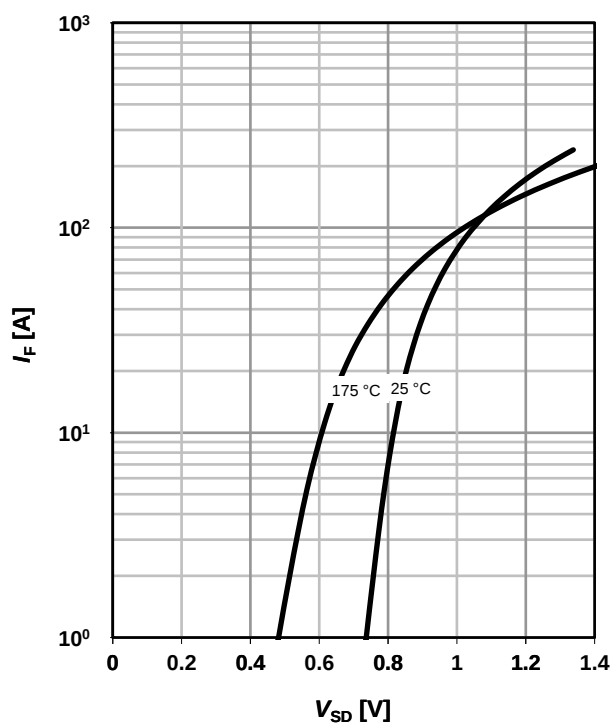
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



## 11 Typical forward diode characteristics

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

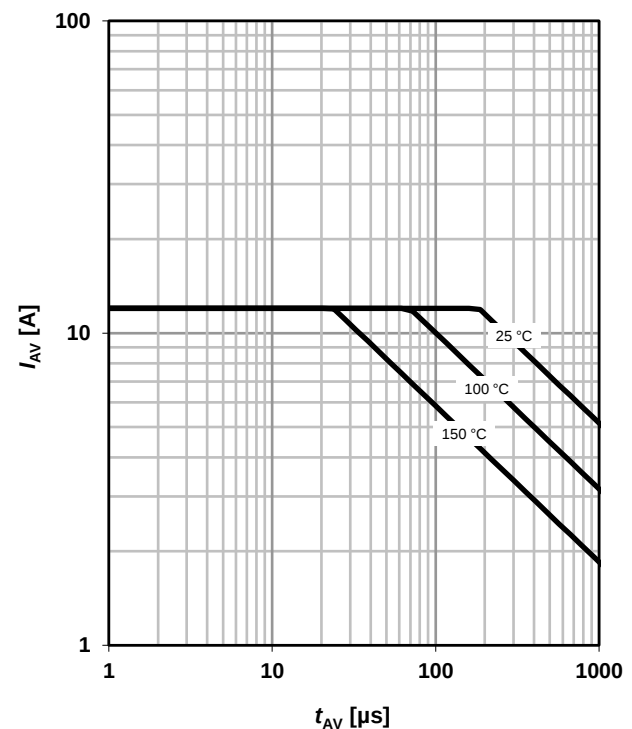
parameter:  $T_j$



## 12 Avalanche characteristics

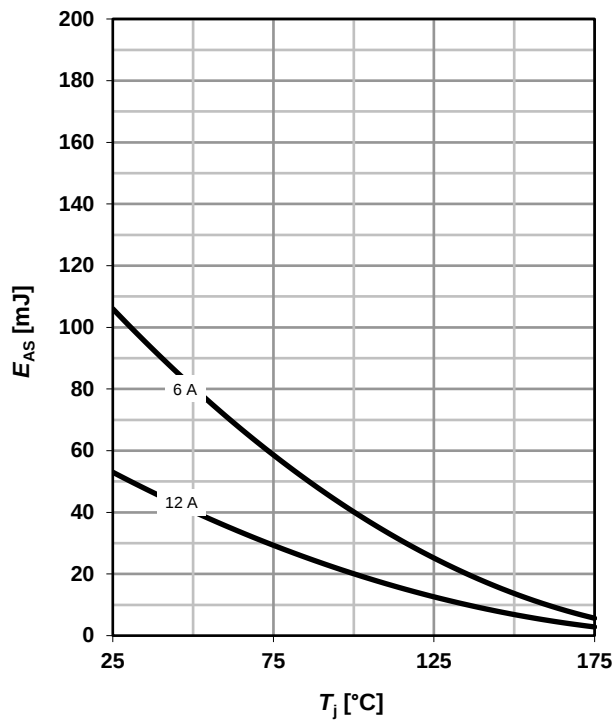
$$I_{AS} = f(t_{AV})$$

parameter:  $T_{j(start)}$



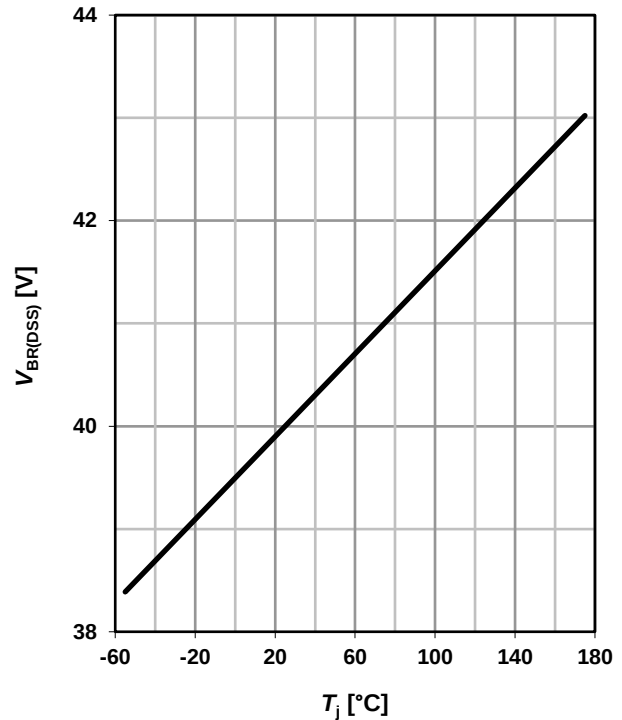
### 13 Avalanche energy

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



### 14 Drain-source breakdown voltage

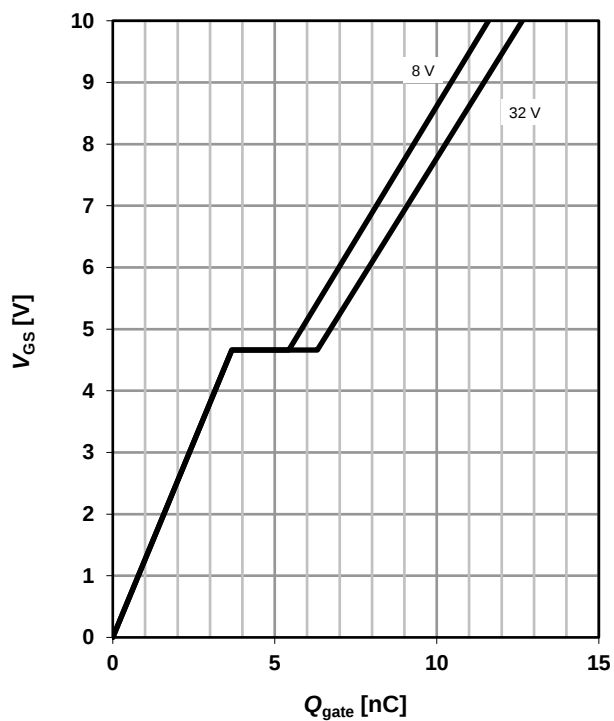
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



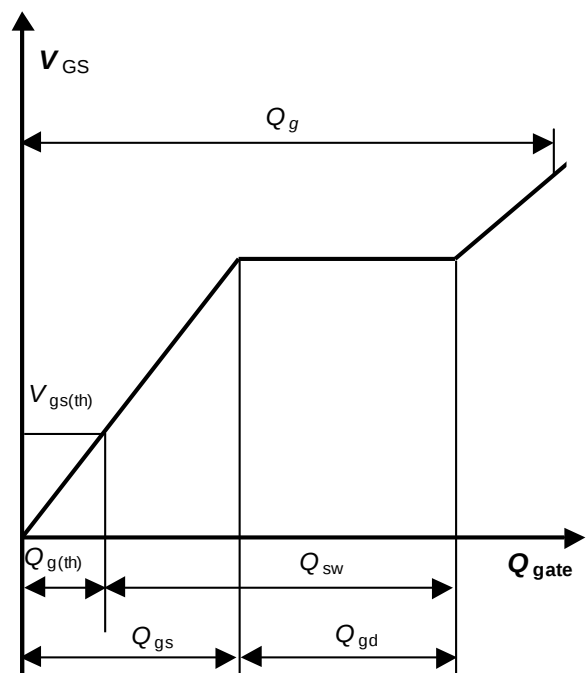
### 15 Typ. gate charge

$$V_{GS} = f(Q_{gate}); I_D = 30 \text{ A pulsed}$$

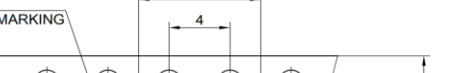
parameter:  $V_{DD}$



### 16 Gate charge waveforms



- 



Technical drawing of the 1000 Series 1/2. The drawing shows a top view and a side view. The top view is a rectangle with a width of 8 and a height of 12. It features a central circular hole with a diameter of 4. There are four smaller circular holes, each with a diameter of 0.3, arranged in a 2x2 grid. A label 'PIN 1 INDEX MARKING' points to the top-left corner. The side view shows a cross-section of the component with a total height of 5.5 and a base thickness of 0.3.

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## Revision History

| Version      | Date       | Changes         |
|--------------|------------|-----------------|
| Revision 1.0 | 22.09.2020 | Final Datasheet |
|              |            |                 |
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