

## OptiMOS™ -5 Power-Transistor



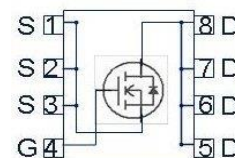
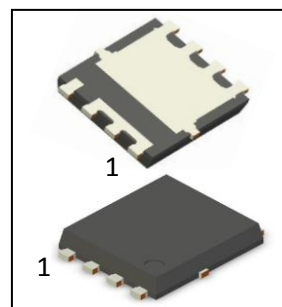
### Features

- OptiMOS™ - power MOSFET for automotive applications
- 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

### Product Summary

|                  |     |    |
|------------------|-----|----|
| $V_{DS}$         | 40  | V  |
| $R_{DS(on),max}$ | 2.8 | mΩ |
| $I_D$            | 100 | A  |

### PG-TDSON-8-33



| Type            | Package       | Marking |
|-----------------|---------------|---------|
| IPC100N04S5-2R8 | PG-TDSON-8-33 | 5N042R8 |

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

| Parameter                                     | Symbol         | Conditions                                         | Value        | Unit |
|-----------------------------------------------|----------------|----------------------------------------------------|--------------|------|
| Continuous drain current <sup>1)</sup>        | $I_D$          | $T_C=25^\circ\text{C}$ , $V_{GS}=10\text{V}$       | 100          | A    |
|                                               |                | $T_C=100^\circ\text{C}$ , $V_{GS}=10\text{V}^{2)}$ | 85           |      |
| Pulsed drain current <sup>2)</sup>            | $I_{D,pulse}$  | $T_C=25^\circ\text{C}$                             | 400          |      |
| Avalanche energy, single pulse <sup>2)</sup>  | $E_{AS}$       | $I_D=50\text{A}$                                   | 66           | mJ   |
| Avalanche current, single pulse <sup>4)</sup> | $I_{AS}$       | -                                                  | 100          | A    |
| Gate source voltage                           | $V_{GS}$       | -                                                  | $\pm 20$     | V    |
| Power dissipation                             | $P_{tot}$      | $T_C=25^\circ\text{C}$                             | 75           | 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  | K/W |
| Thermal resistance, junction - ambient | $R_{thJA}$ | 6 cm <sup>2</sup> cooling area <sup>3)</sup> | - | - | 50 |     |

### 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           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=30\mu A$                        | 2.2 | 2.8 | 3.4 |            |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=40V, V_{GS}=0V, T_j=25^\circ\text{C}$       | -   | -   | 1   | $\mu A$    |
|                                  |               | $V_{DS}=40V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$ | -   | -   | 100 |            |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20V, V_{DS}=0V$                             | -   | -   | 100 | nA         |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=7V, I_D=50A$                                | -   | 2.8 | 3.4 | m $\Omega$ |
|                                  |               | $V_{GS}=10V, I_D=50A$                               | -   | 2.3 | 2.8 |            |

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

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

|                              |              |                                                              |   |      |      |    |
|------------------------------|--------------|--------------------------------------------------------------|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0V, V_{DS}=25V,$<br>$f=1MHz$                         | - | 2000 | 2600 | pF |
| Output capacitance           | $C_{oss}$    |                                                              | - | 550  | 730  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                              | - | 30   | 45   |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=20V, V_{GS}=10V,$<br>$I_D=100A, R_{G,ext}=3.5\Omega$ | - | 6    | -    | ns |
| Rise time                    | $t_r$        |                                                              | - | 3    | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                              | - | 11   | -    |    |
| Fall time                    | $t_f$        |                                                              | - | 6    | -    |    |

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

|                       |               |                                                       |   |     |      |    |
|-----------------------|---------------|-------------------------------------------------------|---|-----|------|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=32V, I_D=100A,$<br>$V_{GS}=0 \text{ to } 10V$ | - | 9   | 12   | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                       | - | 7.6 | 11.4 |    |
| Gate charge total     | $Q_g$         |                                                       | - | 34  | 45   |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                       | - | 4.8 | -    | V  |

### Reverse Diode

|                                                |               |                                             |   |     |     |    |
|------------------------------------------------|---------------|---------------------------------------------|---|-----|-----|----|
| Diode continuous forward current <sup>2)</sup> | $I_S$         | $T_C=25^\circ C$                            | - | -   | 100 | A  |
| Diode pulse current <sup>2)</sup>              | $I_{S,pulse}$ |                                             | - | -   | 400 |    |
| Diode forward voltage                          | $V_{SD}$      | $V_{GS}=0V, I_F=50A,$<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>$di_F/dt=100A/\mu s$ | - | 45  | -   | ns |
| Reverse recovery charge <sup>2)</sup>          | $Q_{rr}$      |                                             | - | 35  | -   | nC |

<sup>1)</sup> Current is limited by package; with an  $R_{thJC} = 2 \text{ K/W}$  the chip is able to carry 120A at 25°C.

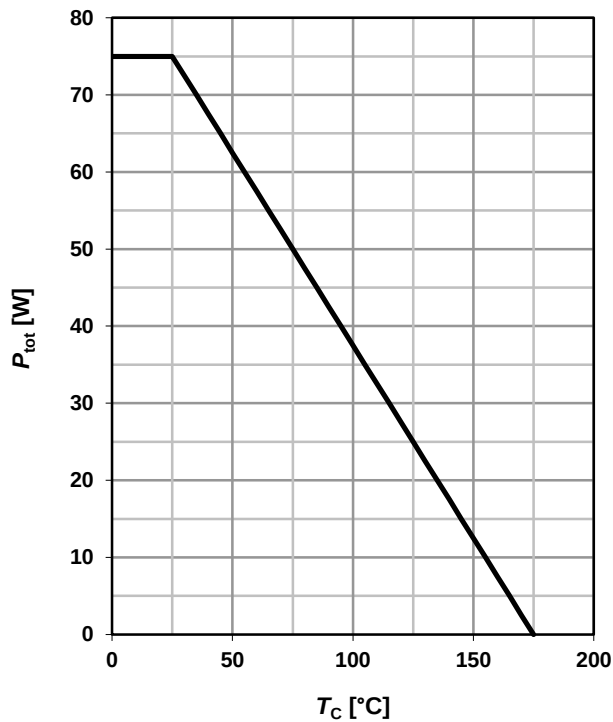
<sup>2)</sup> The parameter is not subject to production test- verified by design/characterization.

<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.

<sup>4)</sup> The device is tested in production with an avalanche current of 85 A.

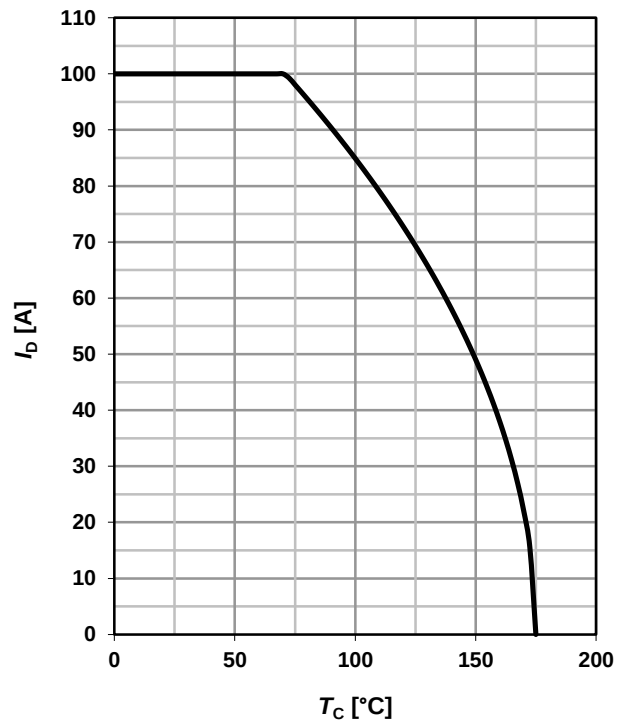
### 1 Power dissipation

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



### 2 Drain current

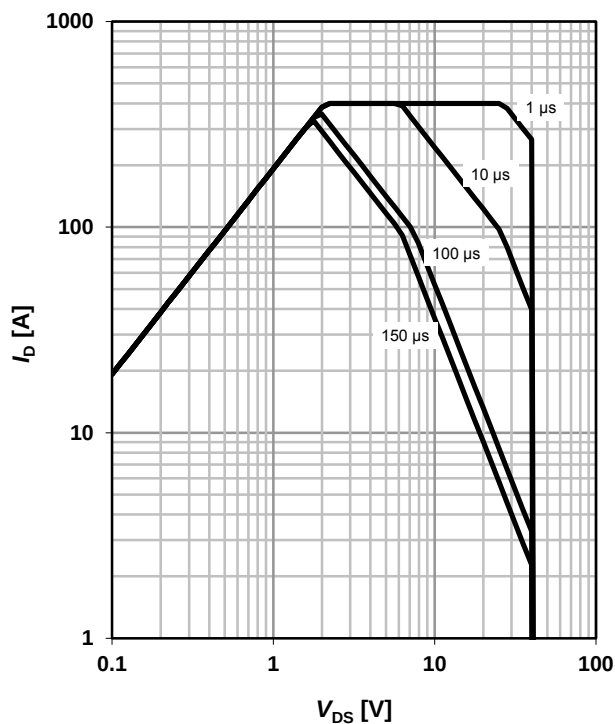
$$I_D = f(T_C); V_{\text{GS}} = 10 \text{ V}$$



### 3 Safe operating area

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

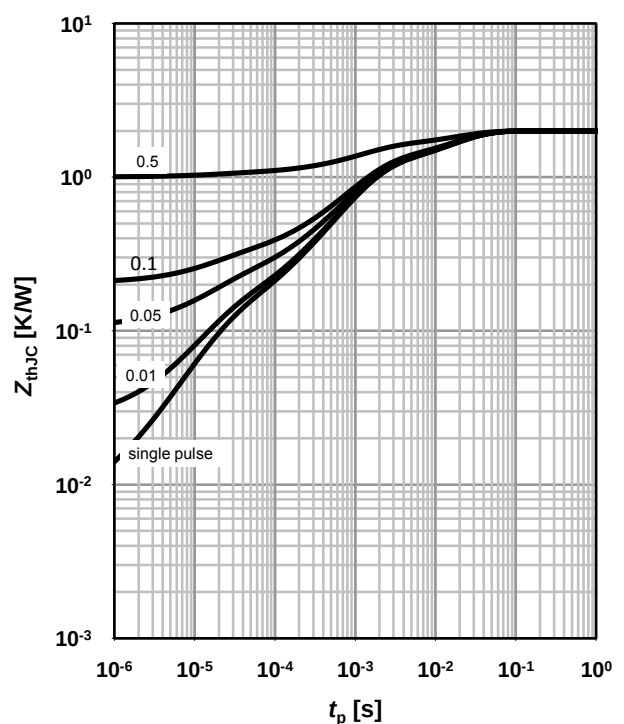
parameter:  $t_p$



### 4 Max. transient thermal impedance

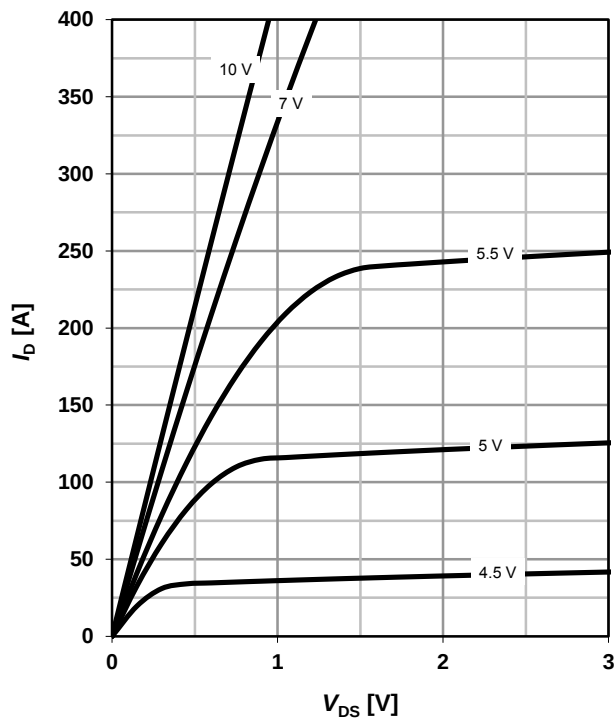
$$Z_{\text{thJC}} = f(t_p)$$

parameter:  $D = t_p/T$



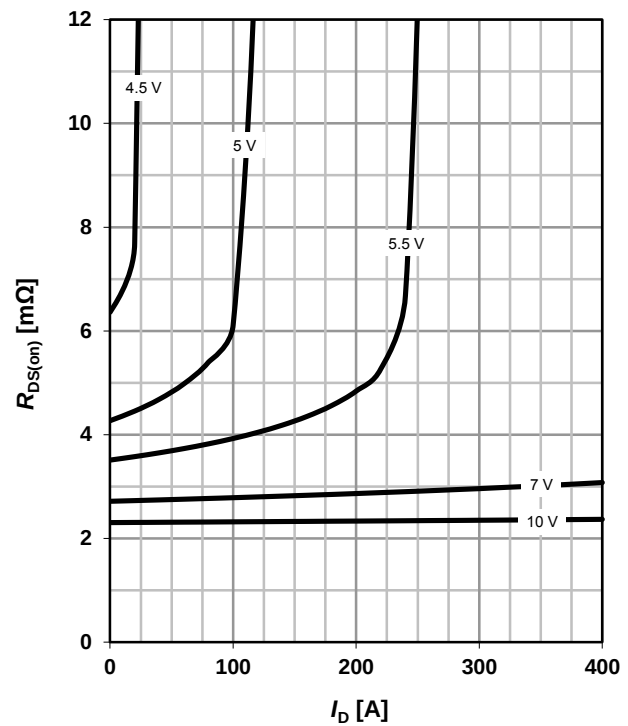
### 5 Typ. output characteristics

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

parameter:  $V_{GS}$ 


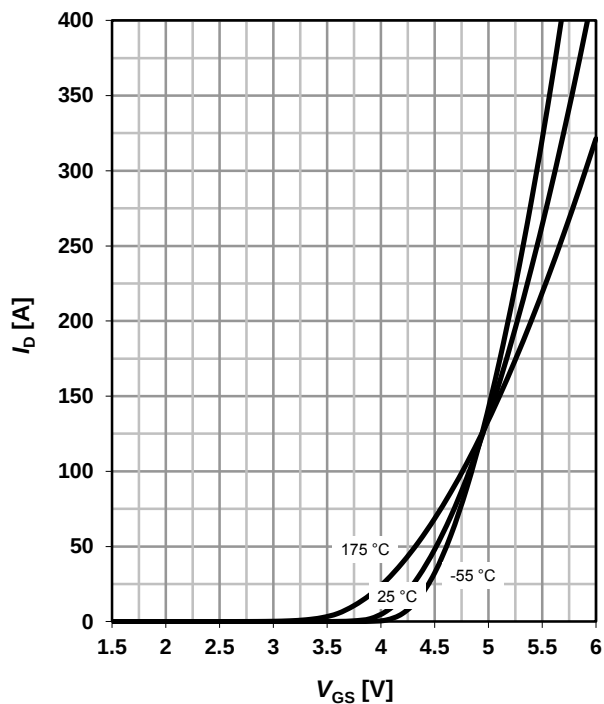
### 6 Typ. drain-source on-state resistance

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

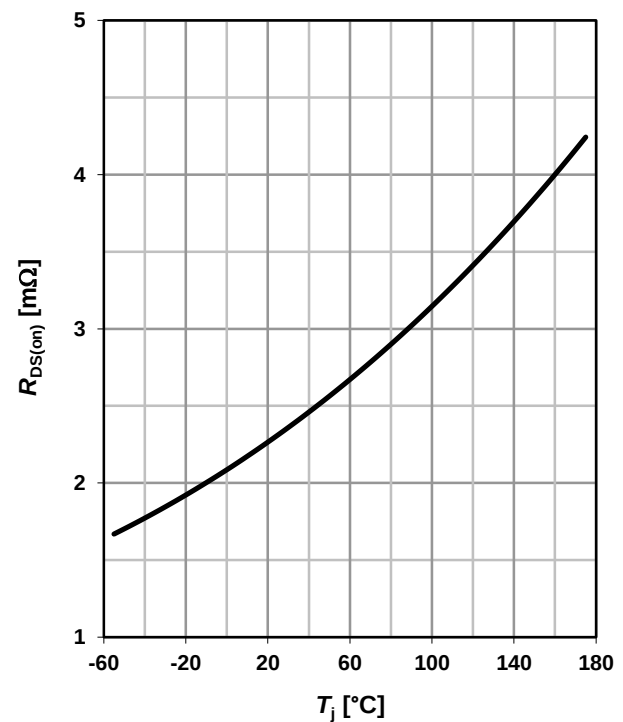
parameter:  $V_{GS}$ 


### 7 Typ. transfer characteristics

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

parameter:  $T_j$ 


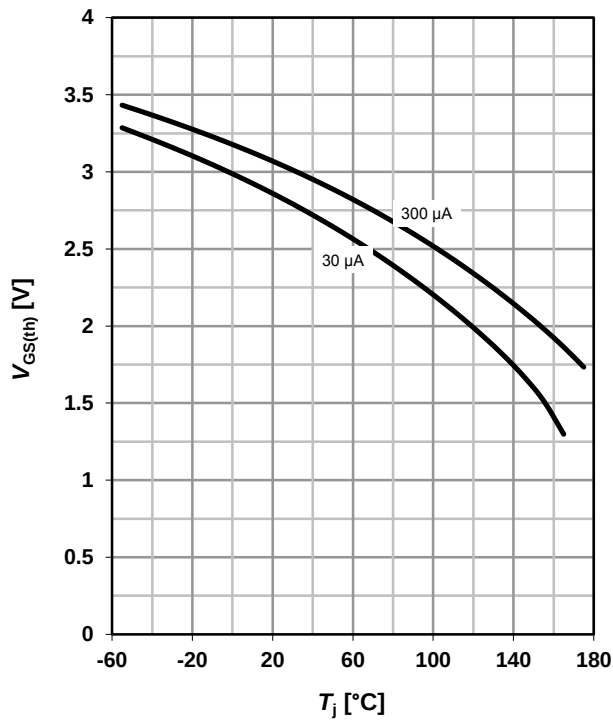
### 8 Typ. drain-source on-state resistance

 $R_{DS(on)} = f(T_j); I_D = 50\text{ A}; V_{GS} = 10\text{ V}$ 


## 9 Typ. gate threshold voltage

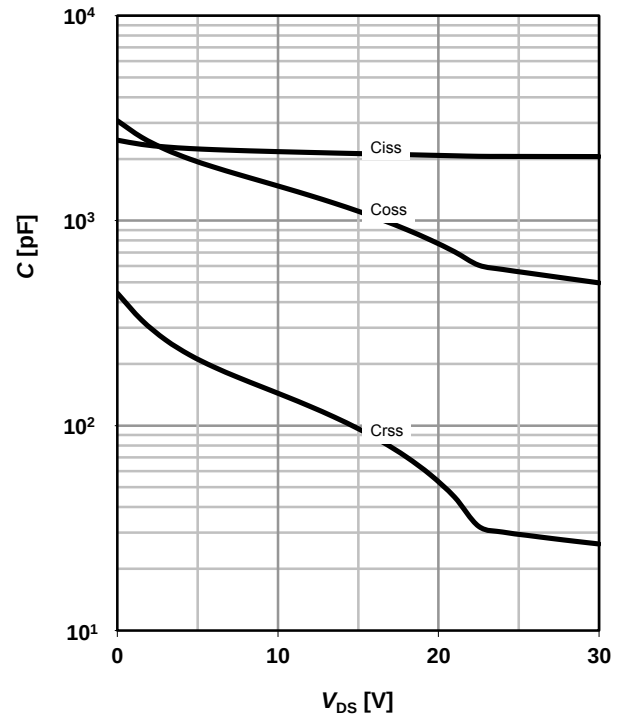
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



## 10 Typ. capacitances

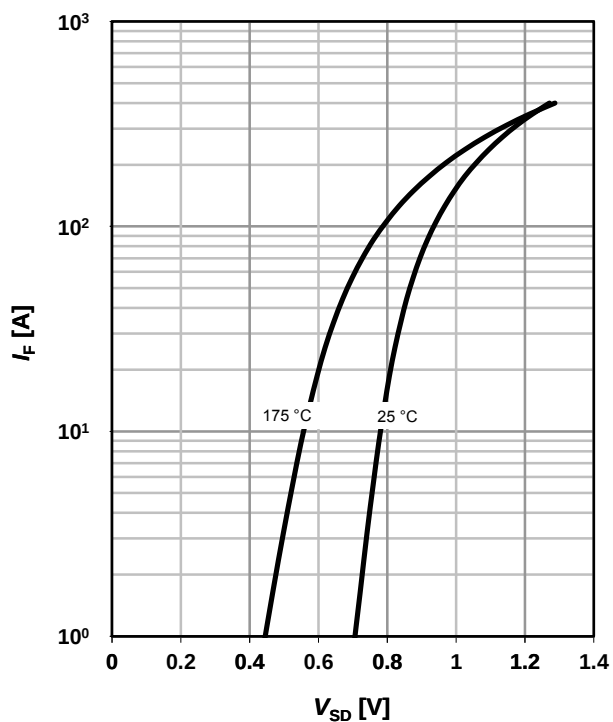
$$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$$



## 11 Typical forward diode characteristics

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

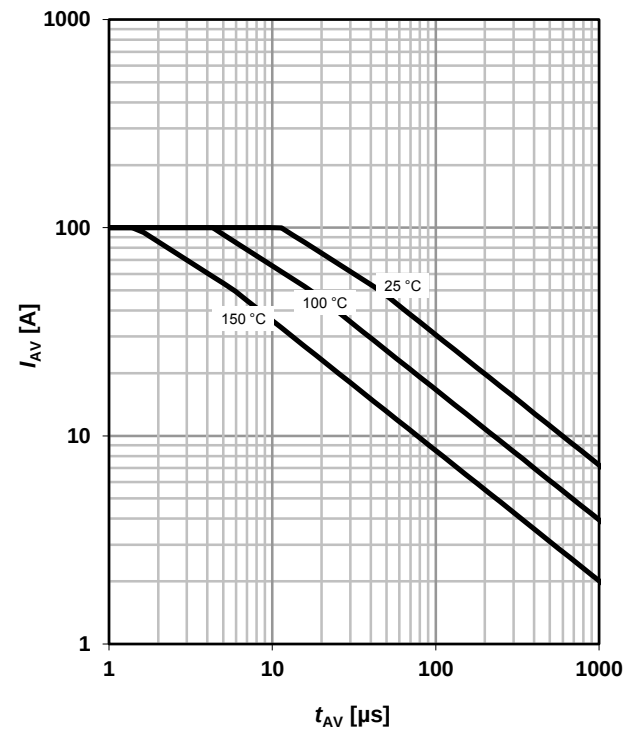
parameter:  $T_j$



## 12 Avalanche characteristics

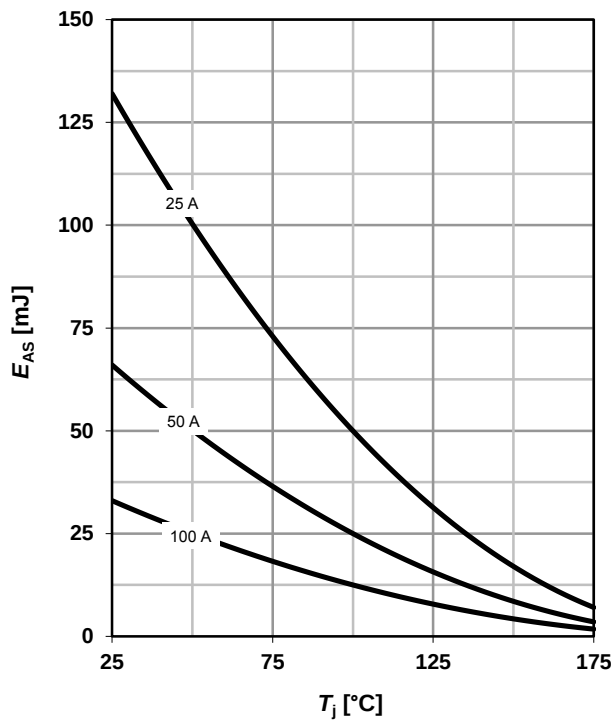
$$I_{AS} = f(t_{AV})$$

parameter:  $T_{j(start)}$



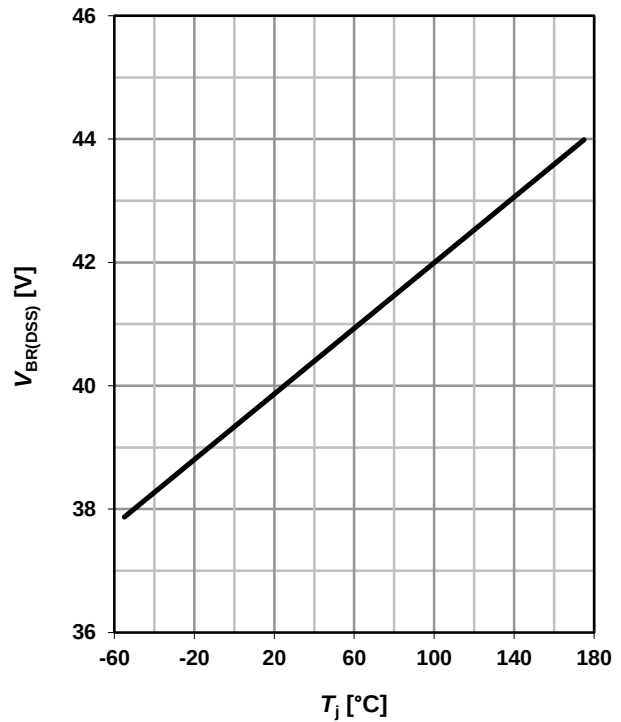
### 13 Avalanche energy

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



### 14 Drain-source breakdown voltage

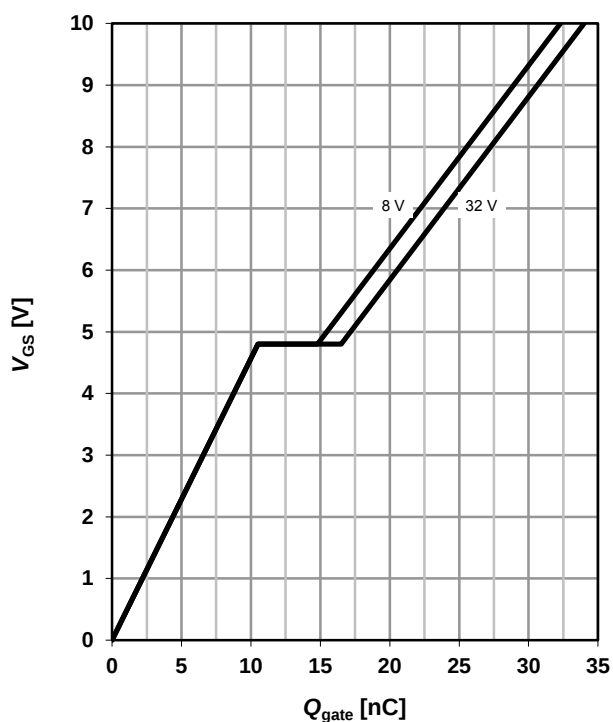
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



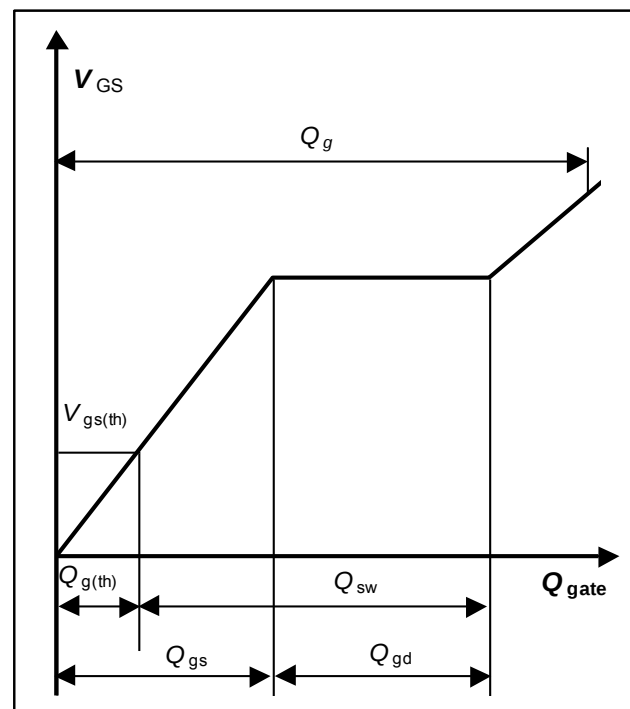
### 15 Typ. gate charge

$$V_{GS} = f(Q_{gate}); I_D = 100 \text{ A pulsed}$$

parameter:  $V_{DD}$



### 16 Gate charge waveforms



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Revision History

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| Version      | Date       | Changes          |
|--------------|------------|------------------|
| Revision 1.0 | 06.12.2016 | Final Data Sheet |

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