

## OptiMOS<sup>™</sup>3 Power-Transistor

### Features

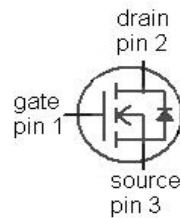
- Ideal for high frequency switching
- Optimized technology for DC/DC converters
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- N-channel, normal level
- 100% avalanche tested
- Pb-free plating; RoHS compliant
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Halogen-free according to IEC61249-2-21

### Product Summary

|                  |     |            |
|------------------|-----|------------|
| $V_{DS}$         | 80  | V          |
| $R_{DS(on),max}$ | 9.6 | m $\Omega$ |
| $I_D$            | 73  | A          |



|                |                                                                                    |
|----------------|------------------------------------------------------------------------------------|
| <b>Type</b>    | IPD096N08N3 G                                                                      |
|                |  |
| <b>Package</b> | PG-TO252-3                                                                         |
| <b>Marking</b> | 096N08N                                                                            |



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

| Parameter                                    | Symbol            | Conditions                                    | Value       | Unit |
|----------------------------------------------|-------------------|-----------------------------------------------|-------------|------|
| Continuous drain current                     | $I_D$             | $T_C=25\text{ °C}^{2)}$                       | 73          | A    |
|                                              |                   | $T_C=100\text{ °C}$                           | 52          |      |
|                                              |                   |                                               |             |      |
| Pulsed drain current <sup>2)</sup>           | $I_{D,pulse}$     | $T_C=25\text{ °C}$                            | 292         |      |
| Avalanche energy, single pulse <sup>3)</sup> | $E_{AS}$          | $I_D=46\text{ A}$ , $R_{GS}=25\text{ }\Omega$ | 90          | mJ   |
| Gate source voltage                          | $V_{GS}$          |                                               | $\pm 20$    | V    |
| Power dissipation                            | $P_{tot}$         | $T_C=25\text{ °C}$                            | 100         | W    |
| Operating and storage temperature            | $T_j$ , $T_{stg}$ |                                               | -55 ... 175 | °C   |
| IEC climatic category; DIN IEC 68-1          |                   |                                               | 55/175/56   |      |

<sup>1)</sup> J-STD20 and JESD22

<sup>2)</sup> See figure 3 for more detailed information

<sup>3)</sup> See figure 13 for more detailed information

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

#### Thermal characteristics

|                                           |            |                                              |   |   |     |     |
|-------------------------------------------|------------|----------------------------------------------|---|---|-----|-----|
| Thermal resistance, junction - case       | $R_{thJC}$ |                                              | - | - | 1.5 | K/W |
| Thermal resistance,<br>junction - ambient | $R_{thJA}$ | minimal footprint                            | - | - | 75  |     |
|                                           |            | 6 cm <sup>2</sup> cooling area <sup>4)</sup> | - | - | 50  |     |

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

#### Static characteristics

|                                  |               |                                                            |    |      |      |               |
|----------------------------------|---------------|------------------------------------------------------------|----|------|------|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$                       | 80 | -    | -    | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=46\text{ }\mu\text{A}$                 | 2  | 2.8  | 3.5  |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=80\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$  | -  | 0.1  | 1    | $\mu\text{A}$ |
|                                  |               | $V_{DS}=80\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$ | -  | 10   | 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 | $R_{DS(on)}$  | $V_{GS}=10\text{ V}, I_D=46\text{ A}$                      | -  | 7.9  | 9.6  | m $\Omega$    |
|                                  |               | $V_{GS}=6\text{ V}, I_D=23\text{ A}$                       | -  | 10.5 | 17.8 |               |
| Gate resistance                  | $R_G$         |                                                            | -  | 1.6  | -    | $\Omega$      |
| Transconductance                 | $g_{fs}$      | $ V_{DS}  > 2 I_D R_{DS(on)max}, I_D=46\text{ A}$          | 30 | 60   | -    | S             |

<sup>4)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical in still air.

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

#### Dynamic characteristics

|                              |              |                                                                                       |   |      |      |    |
|------------------------------|--------------|---------------------------------------------------------------------------------------|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=40\text{ V},$<br>$f=1\text{ MHz}$                          | - | 1810 | 2410 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                       | - | 490  | 652  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                       | - | 20   | -    |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=40\text{ V}, V_{GS}=10\text{ V},$<br>$I_D=40\text{ A}, R_{G,ext}=1.6\ \Omega$ | - | 13   | -    | ns |
| Rise time                    | $t_r$        |                                                                                       | - | 30   | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                       | - | 23   | -    |    |
| Fall time                    | $t_f$        |                                                                                       | - | 5    | -    |    |

#### Gate Charge Characteristics<sup>5)</sup>

|                       |               |                                                                            |   |     |    |    |
|-----------------------|---------------|----------------------------------------------------------------------------|---|-----|----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=40\text{ V}, I_D=46\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 9   | -  | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                                            | - | 5   | -  |    |
| Switching charge      | $Q_{sw}$      |                                                                            | - | 10  | -  |    |
| Gate charge total     | $Q_g$         |                                                                            | - | 26  | 35 |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                                            | - | 5.2 | -  | V  |
| Output charge         | $Q_{oss}$     | $V_{DD}=40\text{ V}, V_{GS}=0\text{ V}$                                    | - | 35  | 47 | nC |

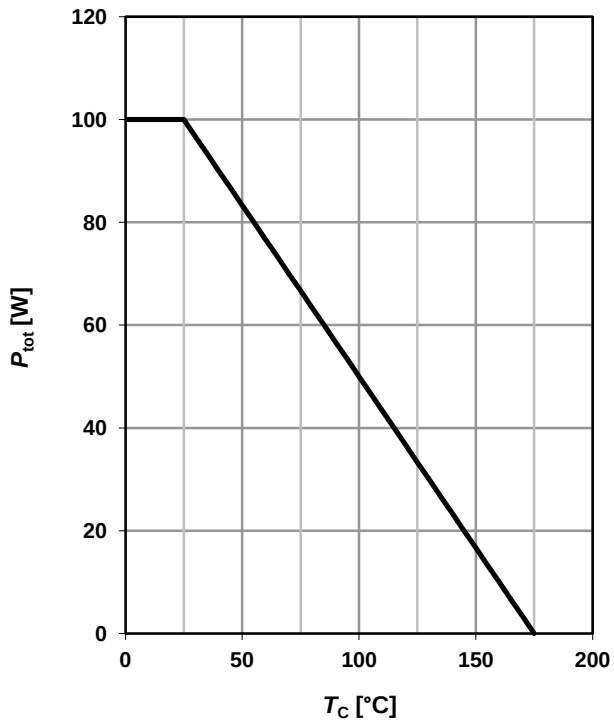
#### Reverse Diode

|                                  |               |                                                                           |   |     |     |    |
|----------------------------------|---------------|---------------------------------------------------------------------------|---|-----|-----|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ °C}$                                                        | - | -   | 74  | A  |
| Diode pulse current              | $I_{S,pulse}$ |                                                                           | - | -   | 296 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=46\text{ A},$<br>$T_J=25\text{ °C}$               | - | 1.0 | 1.2 | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=40\text{ V}, I_F=40\text{ A},$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 57  | -   | ns |
| Reverse recovery charge          | $Q_{rr}$      |                                                                           | - | 91  | -   | nC |

<sup>5)</sup> See figure 16 for gate charge parameter definition

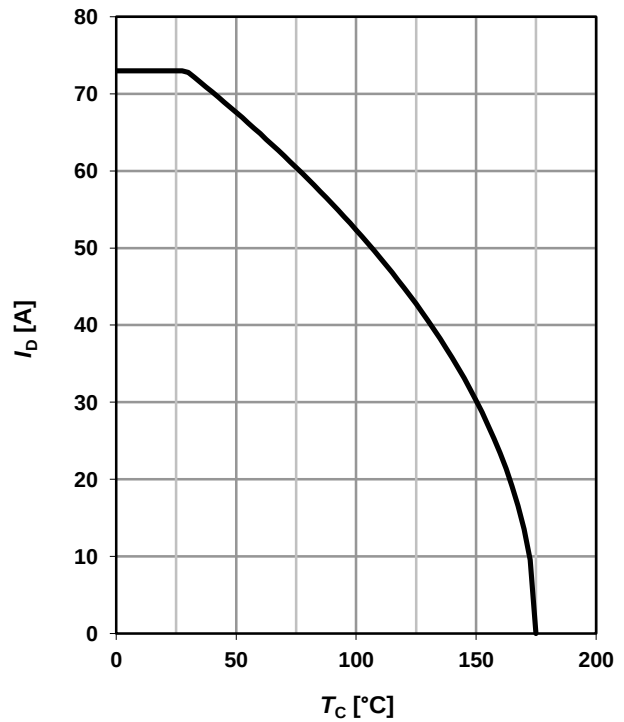
### 1 Power dissipation

$$P_{\text{tot}} = f(T_C)$$



### 2 Drain current

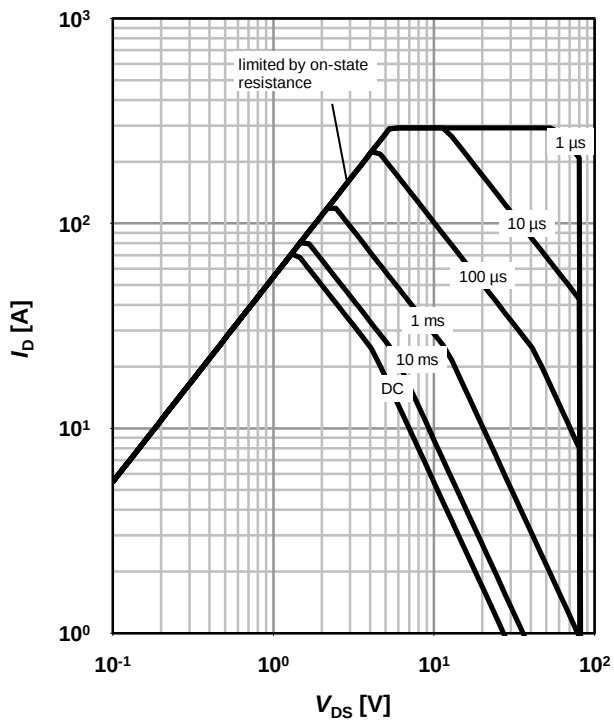
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



### 3 Safe operating area

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

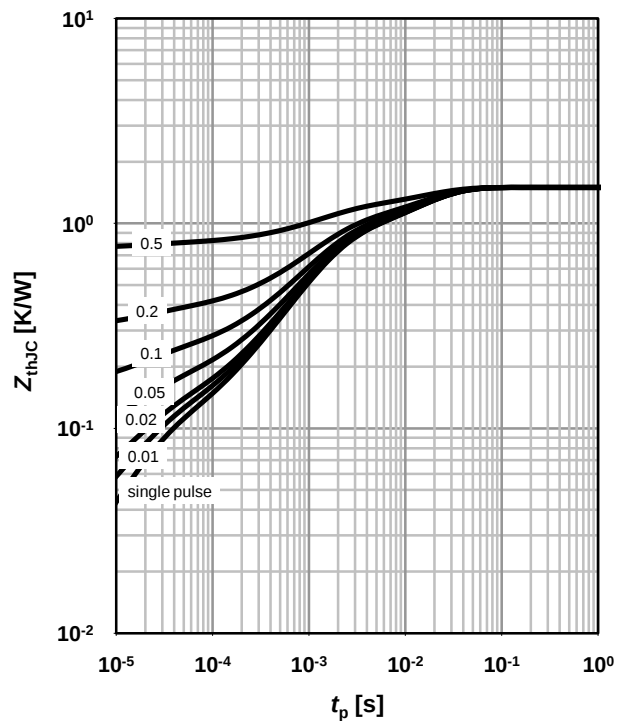
parameter:  $t_p$



### 4 Max. transient thermal impedance

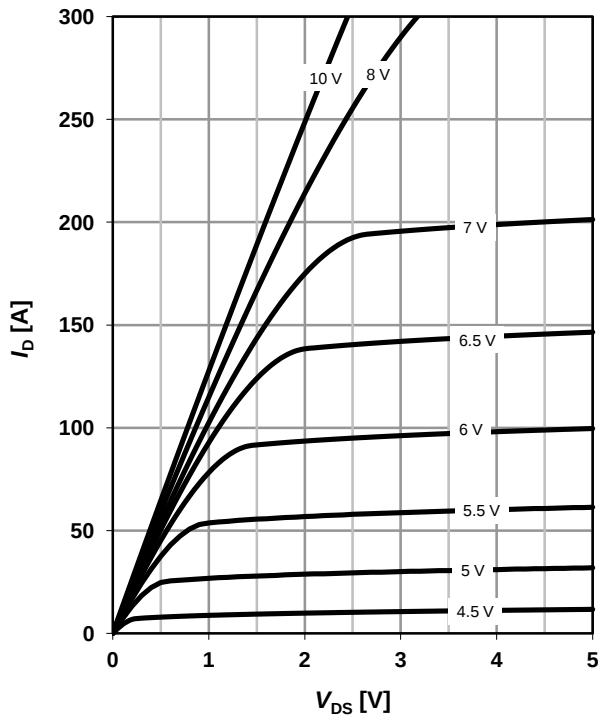
$$Z_{thJC} = f(t_p)$$

parameter:  $D = t_p/T$



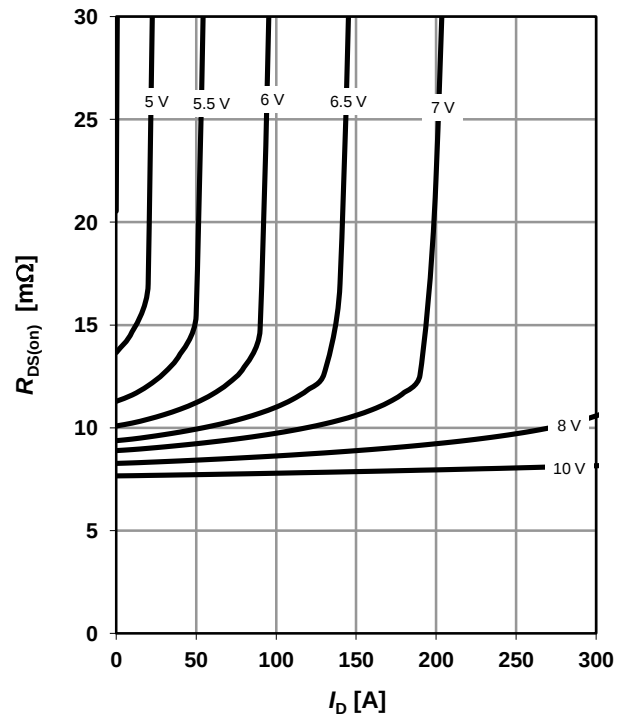
### 5 Typ. output characteristics

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

parameter:  $V_{GS}$ 


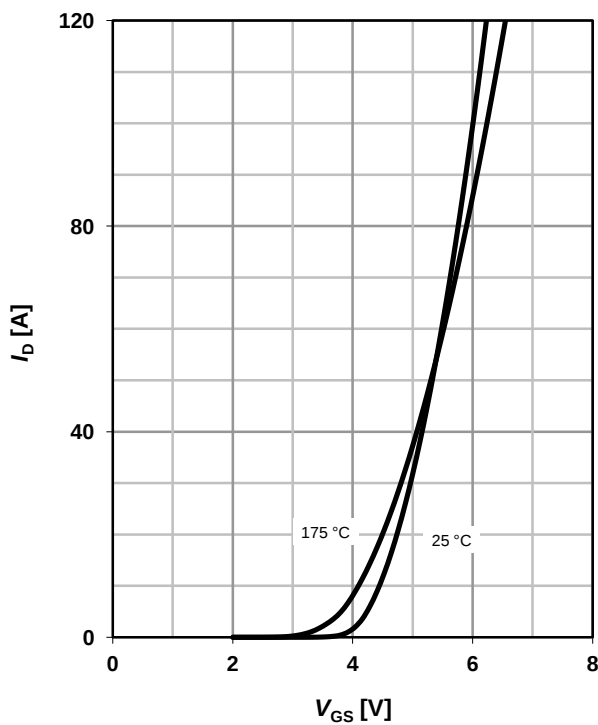
### 6 Typ. drain-source on resistance

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

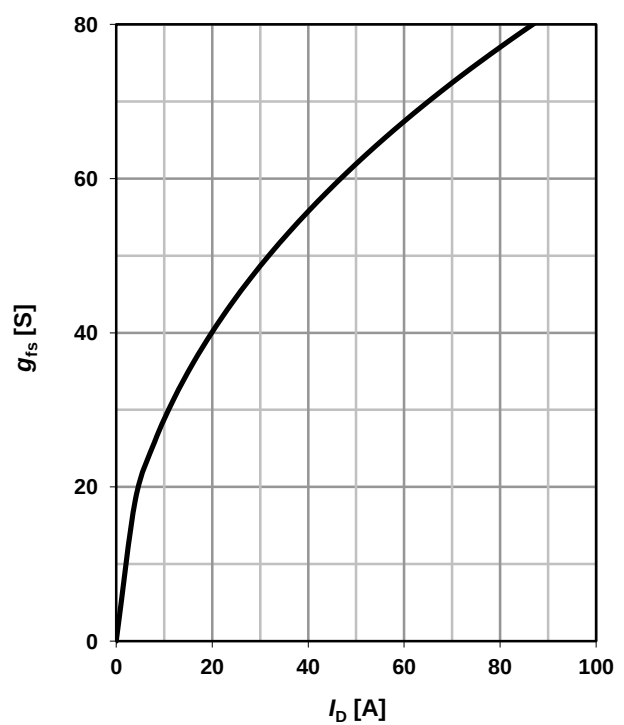
parameter:  $V_{GS}$ 


### 7 Typ. transfer characteristics

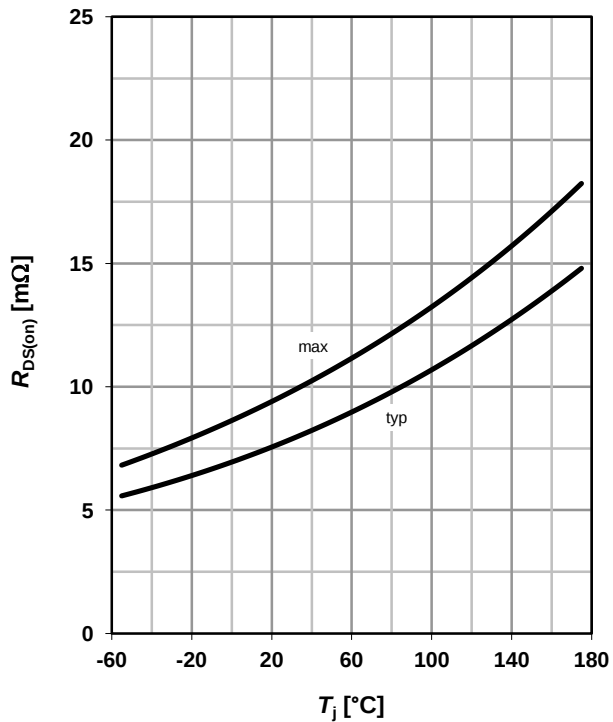
 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$ 

parameter:  $T_j$ 


### 8 Typ. forward transconductance

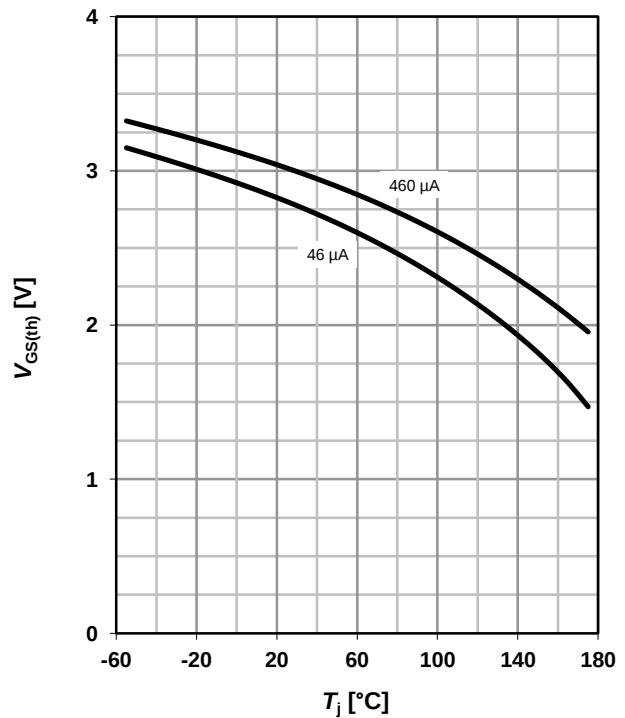
 $g_{fs} = f(I_D); T_j = 25^\circ\text{C}$ 


## 9 Drain-source on-state resistance

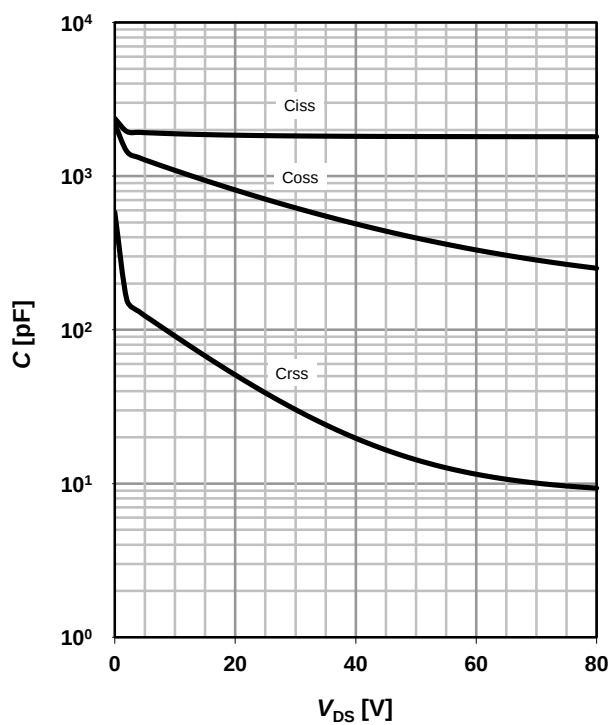
 $R_{DS(on)} = f(T_j); I_D = 46 \text{ A}; V_{GS} = 10 \text{ V}$ 


## 10 Typ. gate threshold voltage

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

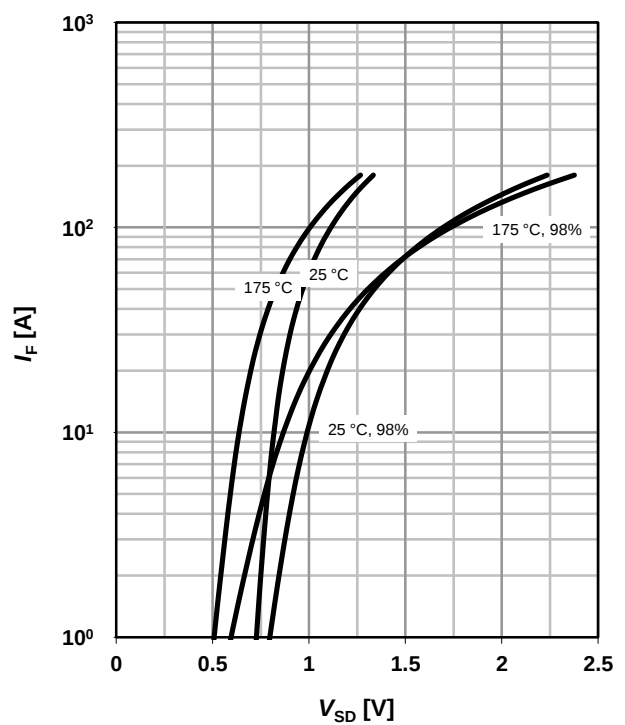
parameter:  $I_D$ 


## 11 Typ. capacitances

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


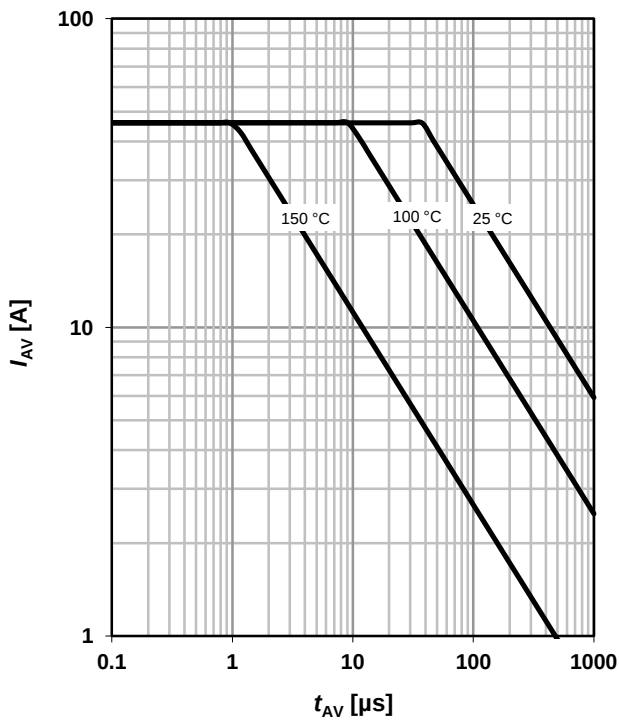
## 12 Forward characteristics of reverse diode

 $I_F = f(V_{SD})$ 

parameter:  $T_j$ 


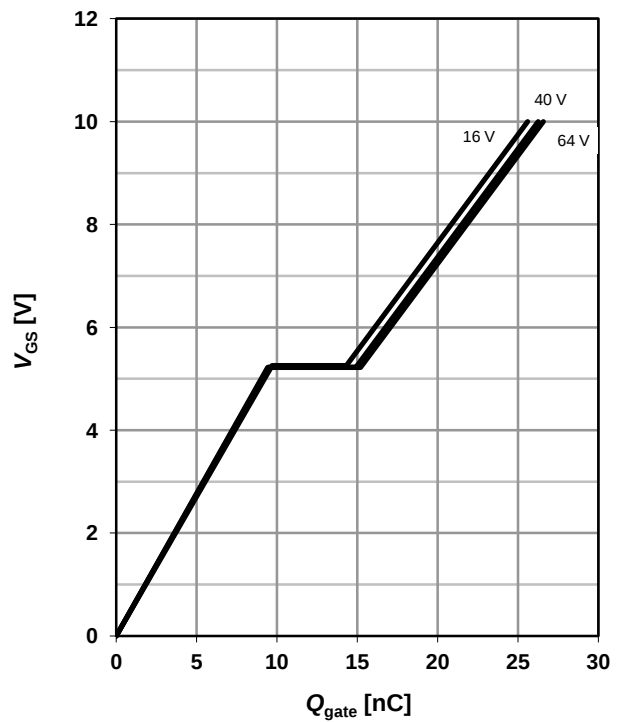
### 13 Avalanche characteristics

 $I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega$ 

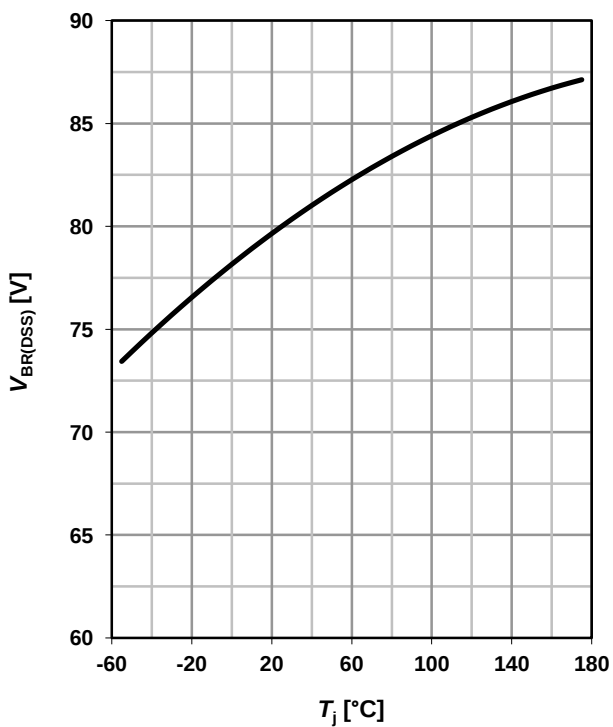
parameter:  $T_{j(start)}$ 


### 14 Typ. gate charge

 $V_{GS}=f(Q_{gate}); I_D=46\ A\ pulsed$ 

parameter:  $V_{DD}$ 


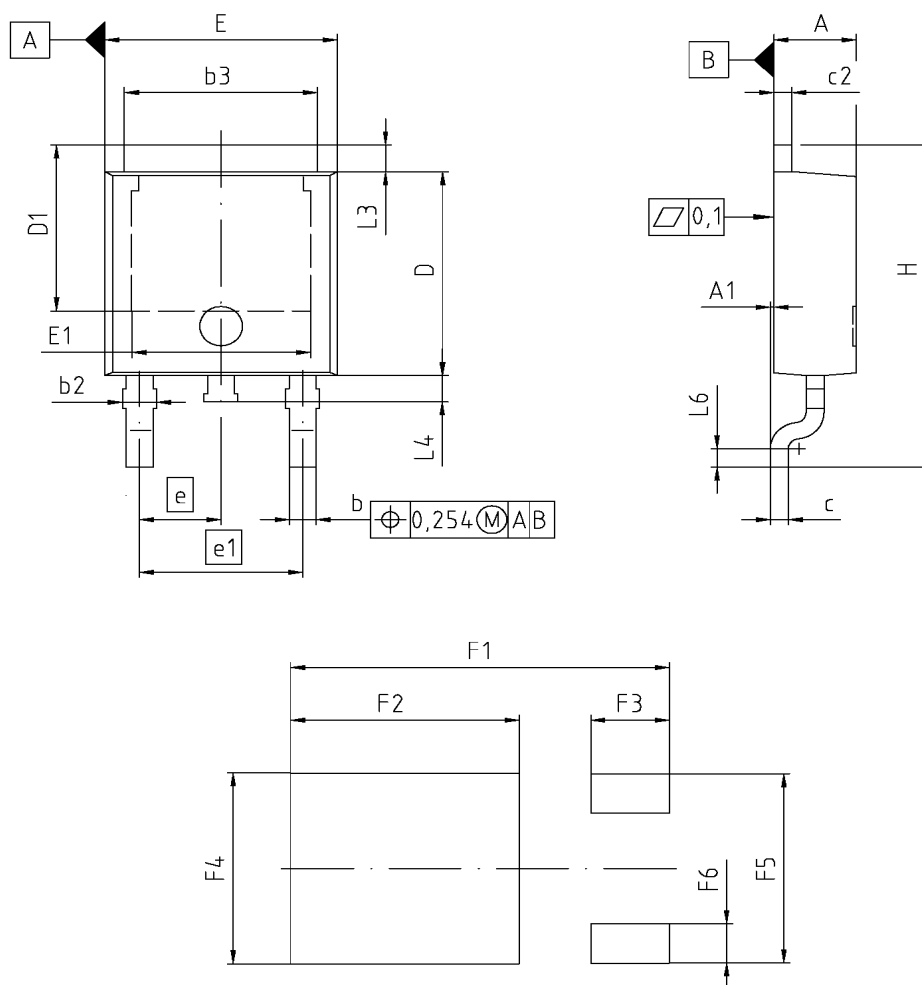
### 15 Drain-source breakdown voltage

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


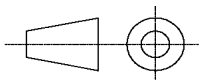
### 16 Gate charge waveforms



## PG-T0252-3



| DIM | MILLIMETERS |        | INCHES |       |
|-----|-------------|--------|--------|-------|
|     | MIN         | MAX    | MIN    | MAX   |
| A   | 2.159       | 2.413  | 0.085  | 0.095 |
| A1  | 0.000       | 0.150  | 0.000  | 0.006 |
| b   | 0.635       | 0.889  | 0.025  | 0.035 |
| b2  | 0.650       | 1.150  | 0.026  | 0.045 |
| b3  | 5.004       | 5.500  | 0.197  | 0.217 |
| c   | 0.457       | 0.580  | 0.018  | 0.023 |
| c2  | 0.460       | 0.980  | 0.018  | 0.039 |
| D   | 5.969       | 6.223  | 0.235  | 0.245 |
| D1  | 5.020       | 5.842  | 0.198  | 0.230 |
| E   | 6.400       | 6.731  | 0.252  | 0.265 |
| E1  | 4.850       | 5.207  | 0.191  | 0.205 |
| e   | 2.286       |        | 0.090  |       |
| e1  | 4.572       |        | 0.180  |       |
| N   | 3           |        | 3      |       |
| H   | 9.400       | 10.480 | 0.370  | 0.413 |
| L3  | 0.900       | 1.143  | 0.035  | 0.045 |
| L4  | 0.584       | 0.950  | 0.023  | 0.037 |
| L6  | 0.510       | 0.686  | 0.020  | 0.027 |
| F1  | 10.500      | 10.700 | 0.413  | 0.421 |
| F2  | 6.300       | 6.500  | 0.248  | 0.256 |
| F3  | 2.100       | 2.300  | 0.083  | 0.091 |
| F4  | 5.700       | 5.900  | 0.224  | 0.232 |
| F5  | 5.660       | 5.860  | 0.222  | 0.231 |
| F6  | 1.100       | 1.300  | 0.043  | 0.051 |

|                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------|
| <b>REFERENCE</b><br>JEDEC TO252                                                                                     |
| <b>SCALE</b><br>0 2.0 4mm                                                                                           |
| <b>EUROPEAN PROJECTION</b><br> |
| <b>ISSUE DATE</b><br>21-09-2005                                                                                     |
| <b>FILE</b><br>TO252_1                                                                                              |

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