

**OptiMOS™3 Power-Transistor**
**Features**

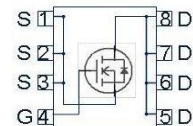
- Optimized for dc-dc conversion
- N-channel, normal level
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC<sup>1)</sup> for target application
- Halogen-free according to IEC61249-2-21


**Product Summary**

|                  |     |    |
|------------------|-----|----|
| $V_{DS}$         | 200 | V  |
| $R_{DS(on),max}$ | 225 | mΩ |
| $I_D$            | 7   | A  |

**PG-TSDSON-8**


| Type           | Package     | Marking |
|----------------|-------------|---------|
| BSZ22DN20NS3 G | PG-TSDSON-8 | 22DN20N |


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

| Parameter                           | Symbol            | Conditions                                | Value       | Unit  |
|-------------------------------------|-------------------|---|-------------|-------|
| Continuous drain current            | $I_D$             | $T_C=25\text{ °C}$                        | 7.0         | A     |
|                                     |                   | $T_C=100\text{ °C}$                       | 4.9         |       |
| Pulsed drain current <sup>2)</sup>  | $I_{D,pulse}$     | $T_C=25\text{ °C}$                        | 28          |       |
| Avalanche energy, single pulse      | $E_{AS}$          | $I_D=3.5\text{ A}$ , $R_{GS}=25\text{ Ω}$ | 30          | mJ    |
| Reverse diode $dv/dt$               | $dv/dt$           |   | 10          | kV/μs |
| Gate source voltage                 | $V_{GS}$          |   | ±20         | V     |
| Power dissipation                   | $P_{tot}$         | $T_C=25\text{ °C}$                        | 34          | W     |
| Operating and storage temperature   | $T_j$ , $T_{stg}$ |   | -55 ... 150 | °C    |
| IEC climatic category; DIN IEC 68-1 |                   |   | 55/150/56   |       |

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

<sup>2)</sup> see figure 3

| Parameter                              | Symbol     | Conditions                                   | Values |      |      | Unit |
|--|------------|--|--------|------|------|------|
|  |            |  | min.   | typ. | max. |      |
| <b>Thermal characteristics</b>         |            |  |        |      |      |      |
| Thermal resistance, junction - case    | $R_{thJC}$ |  | -      | -    | 3.7  | K/W  |
| Thermal resistance, junction - ambient | $R_{thJA}$ | 6 cm <sup>2</sup> cooling area <sup>3)</sup> | -      | -    | 60   |      |

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

**Static characteristics**

|                                  |               |   |     |     |     |               |
|----------------------------------|---------------|---|-----|-----|-----|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$                        | 200 | -   | -   | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=13\text{ }\mu\text{A}$                  | 2   | 3   | 4   |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=160\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$  | -   | 0.1 | 1   | $\mu\text{A}$ |
|                                  |               | $V_{DS}=160\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$ | -   | 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 | $R_{DS(on)}$  | $V_{GS}=10\text{ V}, I_D=3.5\text{ A}$                      | -   | 194 | 225 | m $\Omega$    |
| Gate resistance                  | $R_G$         |   | -   | 1.6 | -   | $\Omega$      |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=3.5\text{ A}$            | 3.5 | 7   | -   | S             |

<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  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical in still air.

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

**Dynamic characteristics**

|                              |              |  |   |     |     |    |
|------------------------------|--------------|--|---|-----|-----|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=100\text{ V}, f=1\text{ MHz}$                     | - | 320 | 430 | pF |
| Output capacitance           | $C_{oss}$    |  | - | 24  | 32  |    |
| Reverse transfer capacitance | $C_{rss}$    |  | - | 5.1 | -   |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=100\text{ V}, V_{GS}=10\text{ V}, I_D=3.5\text{ A}, R_G=1.6\ \Omega$ | - | 4   | -   | ns |
| Rise time                    | $t_r$        |  | - | 4   | -   |    |
| Turn-off delay time          | $t_{d(off)}$ |  | - | 6   | -   |    |
| Fall time                    | $t_f$        |  | - | 3   | -   |    |

**Gate Charge Characteristics<sup>4)</sup>**

|                       |               |   |   |     |     |    |
|-----------------------|---------------|---|---|-----|-----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=100\text{ V}, I_D=3.5\text{ A}, V_{GS}=0\text{ to }10\text{ V}$ | - | 1.4 | -   | nC |
| Gate to drain charge  | $Q_{gd}$      |   | - | 0.8 | -   |    |
| Switching charge      | $Q_{sw}$      |   | - | 1.3 | -   |    |
| Gate charge total     | $Q_g$         |   | - | 4.2 | 5.6 |    |
| Gate plateau voltage  | $V_{plateau}$ |   | - | 4.5 | -   |    |
| Output charge         | $Q_{oss}$     | $V_{DD}=100\text{ V}, V_{GS}=0\text{ V}$                                | - | 8   | 11  | nC |

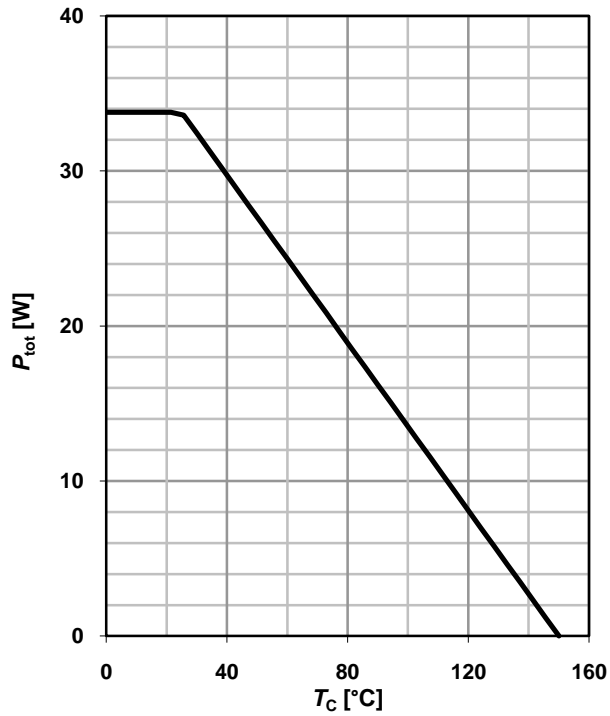
**Reverse Diode**

|                                  |               |   |   |     |     |    |
|----------------------------------|---------------|---|---|-----|-----|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ }^\circ\text{C}$                                    | - | -   | 7   | A  |
| Diode pulse current              | $I_{S,pulse}$ |   | - | -   | 28  |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=7\text{ A}, T_j=25\text{ }^\circ\text{C}$ | - | 1   | 1.2 | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=100\text{ V}, I_F=I_S, di_F/dt=100\text{ A}/\mu\text{s}$     | - | 70  | -   | ns |
| Reverse recovery charge          | $Q_{rr}$      |   | - | 156 | -   | nC |

<sup>4)</sup> See figure 16 for gate charge parameter definition

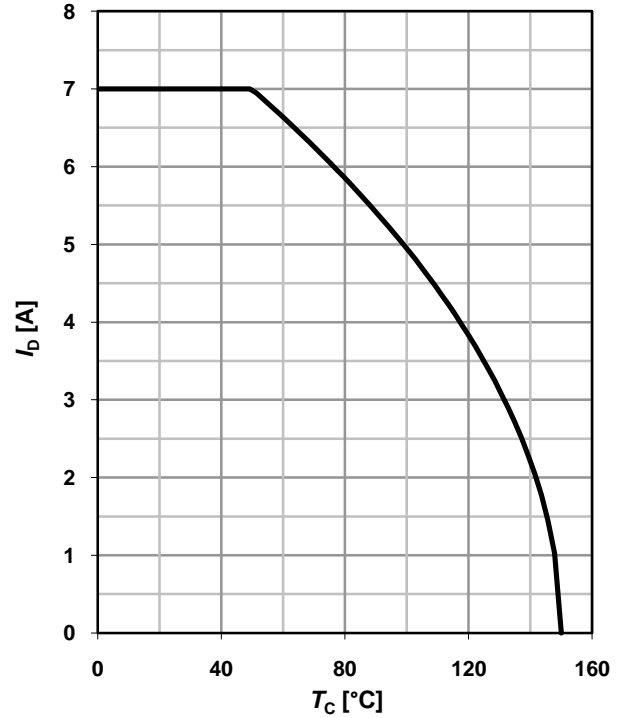
**1 Power dissipation**

$P_{tot}=f(T_C)$



**2 Drain current**

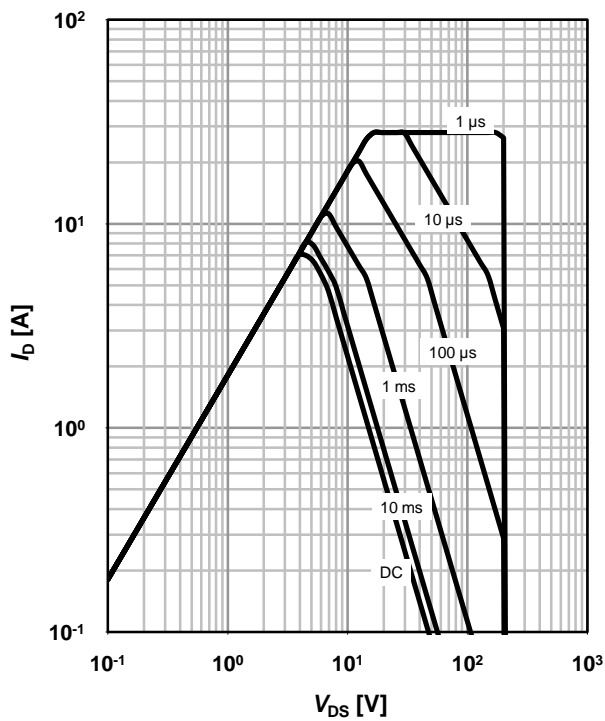
$I_D=f(T_C); V_{GS} \geq 10\text{ V}$



**3 Safe operating area**

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

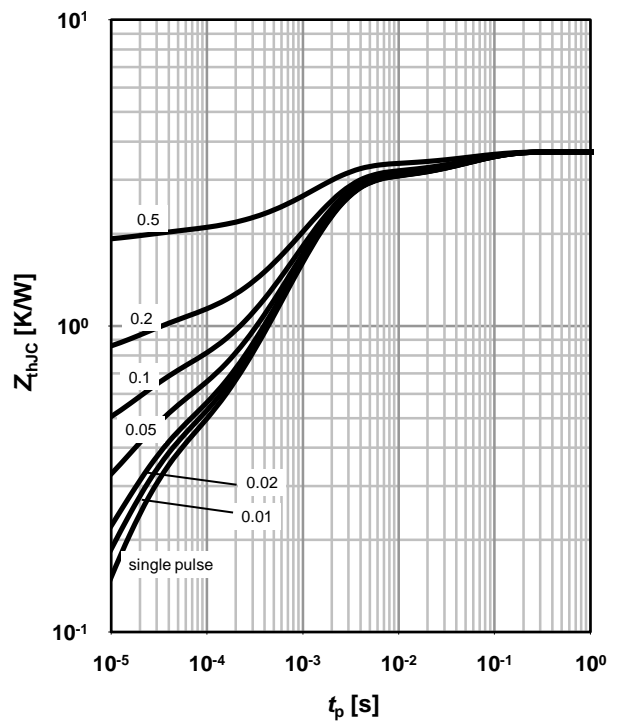
parameter:  $t_p$



**4 Max. transient thermal impedance**

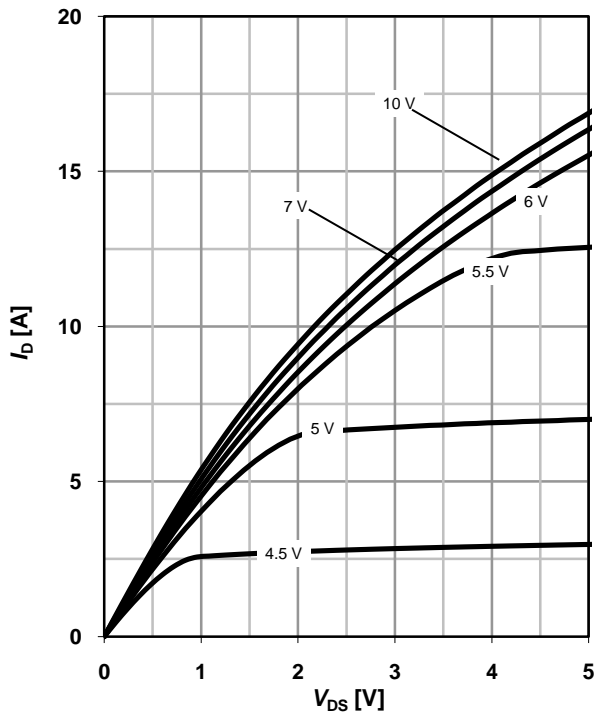
$Z_{thJC}=f(t_p)$

parameter:  $D=t_p/T$

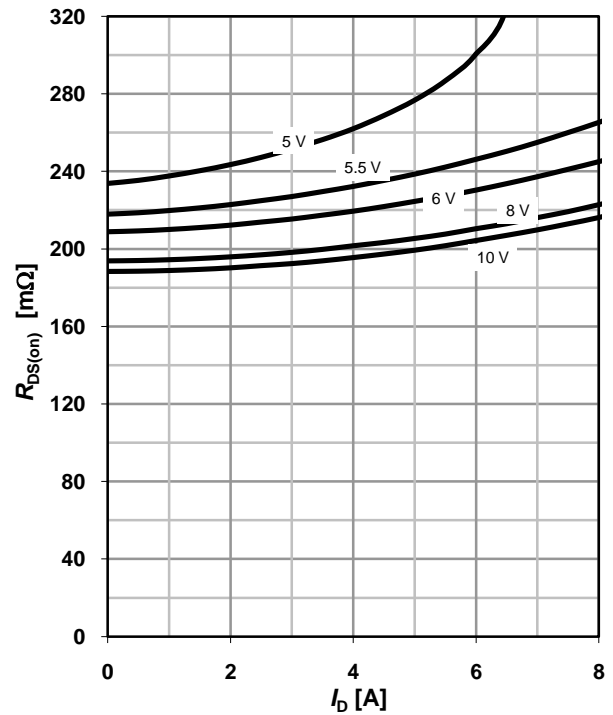


**5 Typ. output characteristics**

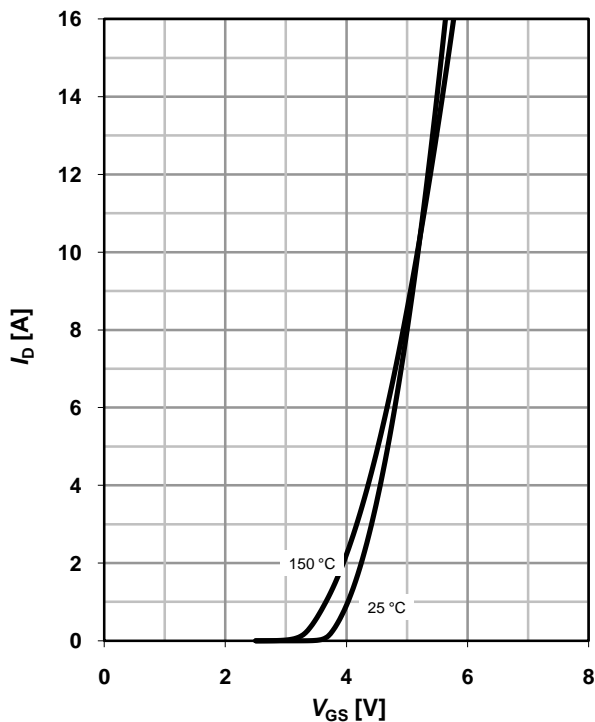
$$I_D = f(V_{DS}); T_j = 25\text{ °C}$$

 parameter:  $V_{GS}$ 

**6 Typ. drain-source on resistance**

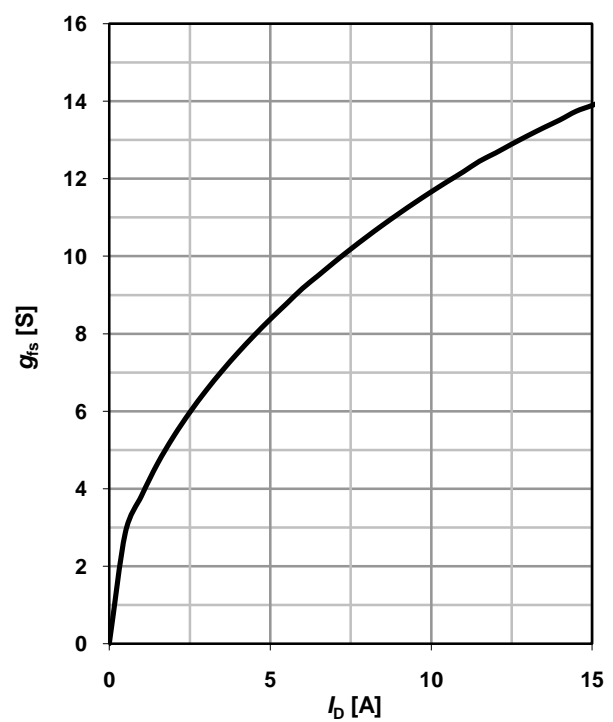
$$R_{DS(on)} = f(I_D); T_j = 25\text{ °C}$$

 parameter:  $V_{GS}$ 

**7 Typ. transfer characteristics**

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

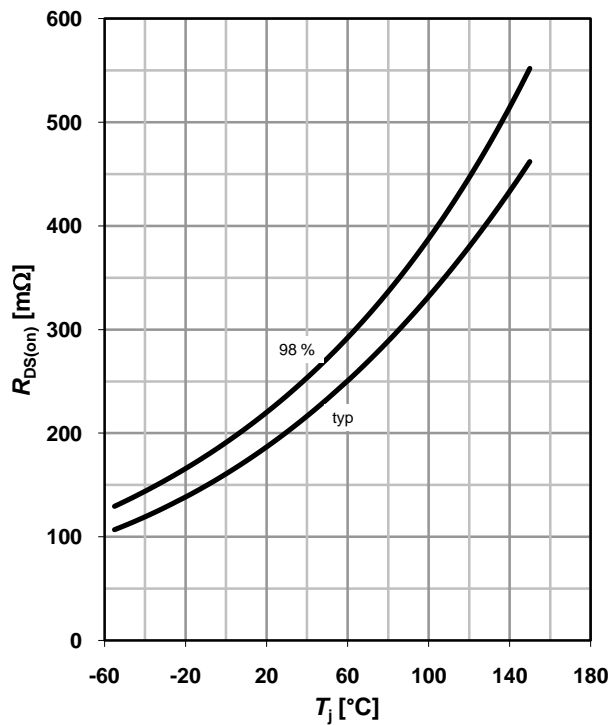
 parameter:  $T_j$ 

**8 Typ. forward transconductance**

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

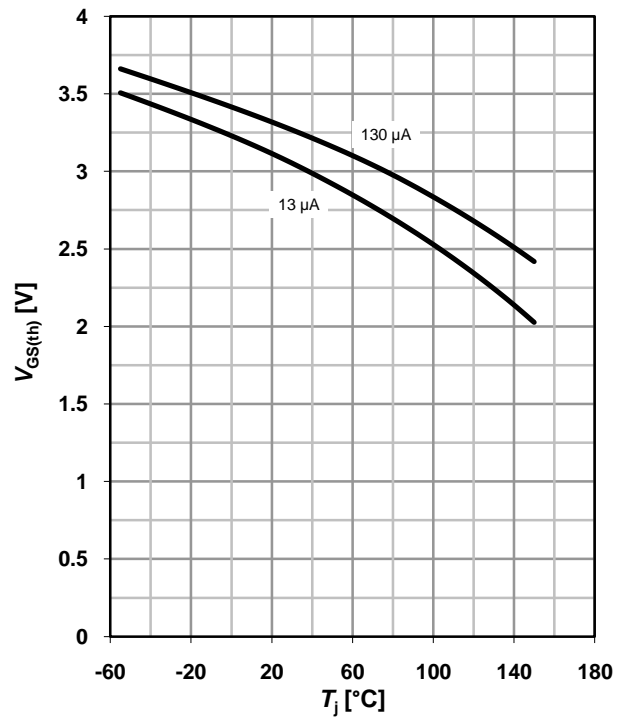


**9 Drain-source on-state resistance**

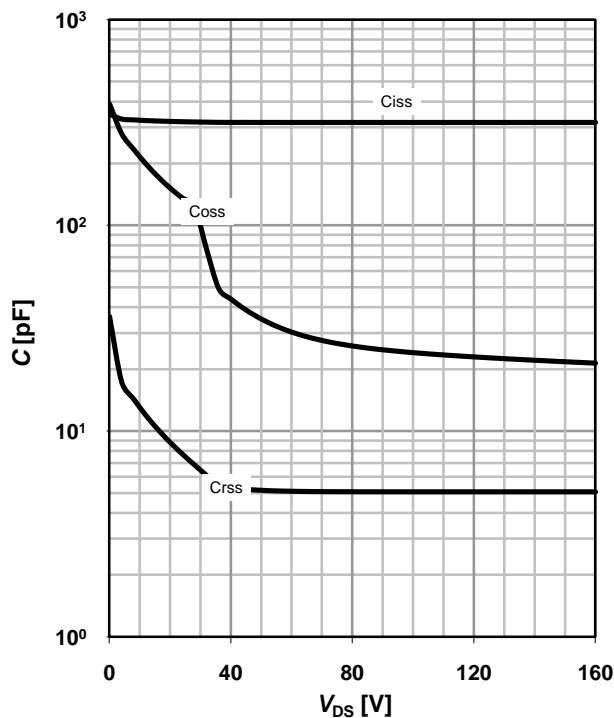
$$R_{DS(on)} = f(T_j); I_D = 3.5 \text{ A}; V_{GS} = 10 \text{ V}$$


**10 Typ. gate threshold voltage**

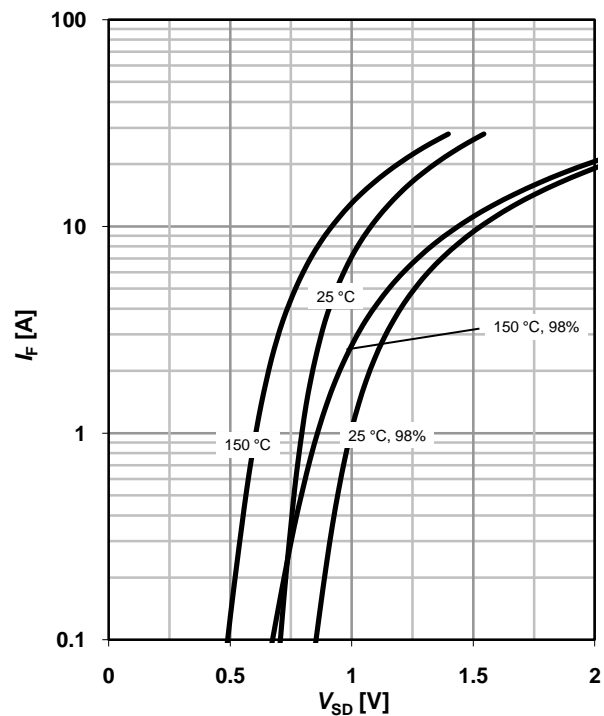
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

 parameter:  $I_D$ 

**11 Typ. capacitances**

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

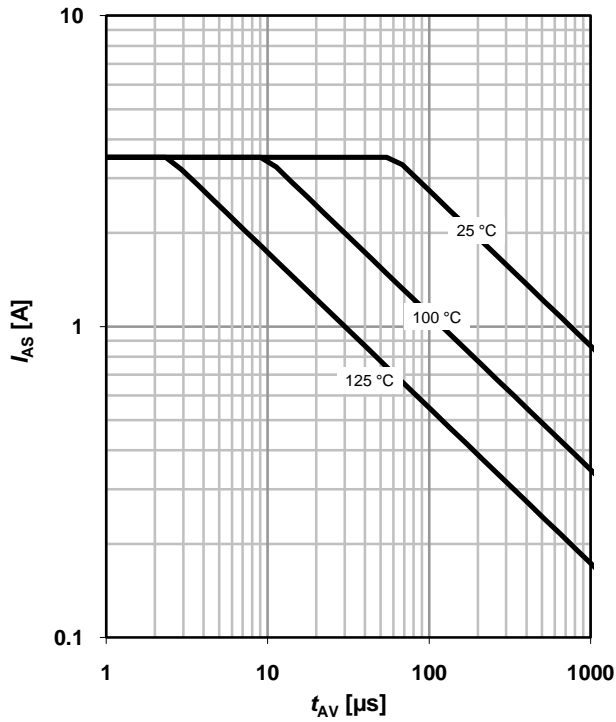

**12 Forward characteristics of reverse diode**

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

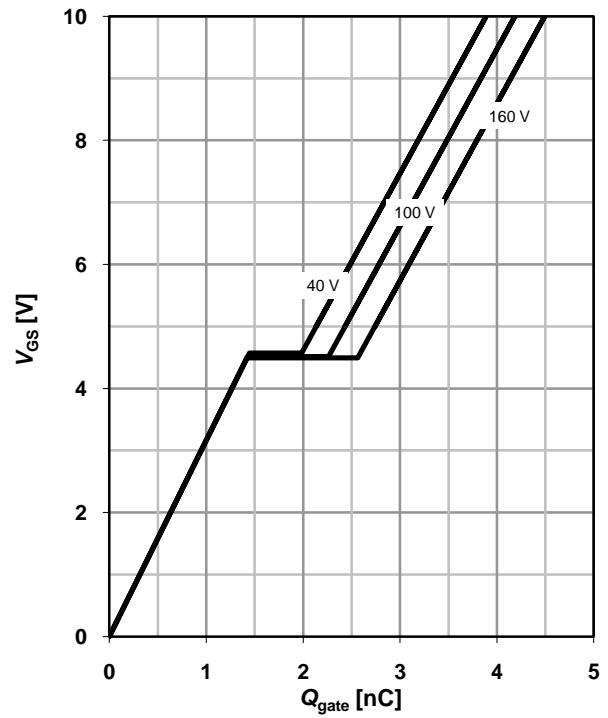
 parameter:  $T_j$ 


**13 Avalanche characteristics**

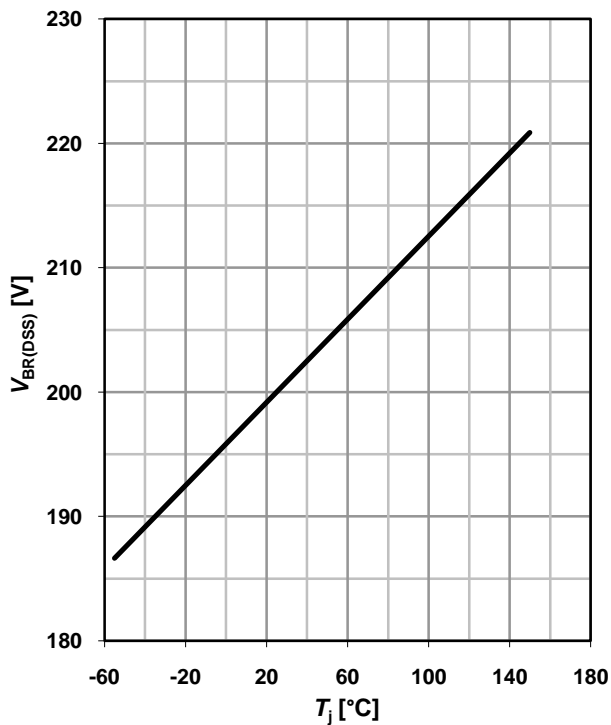
$$I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega$$

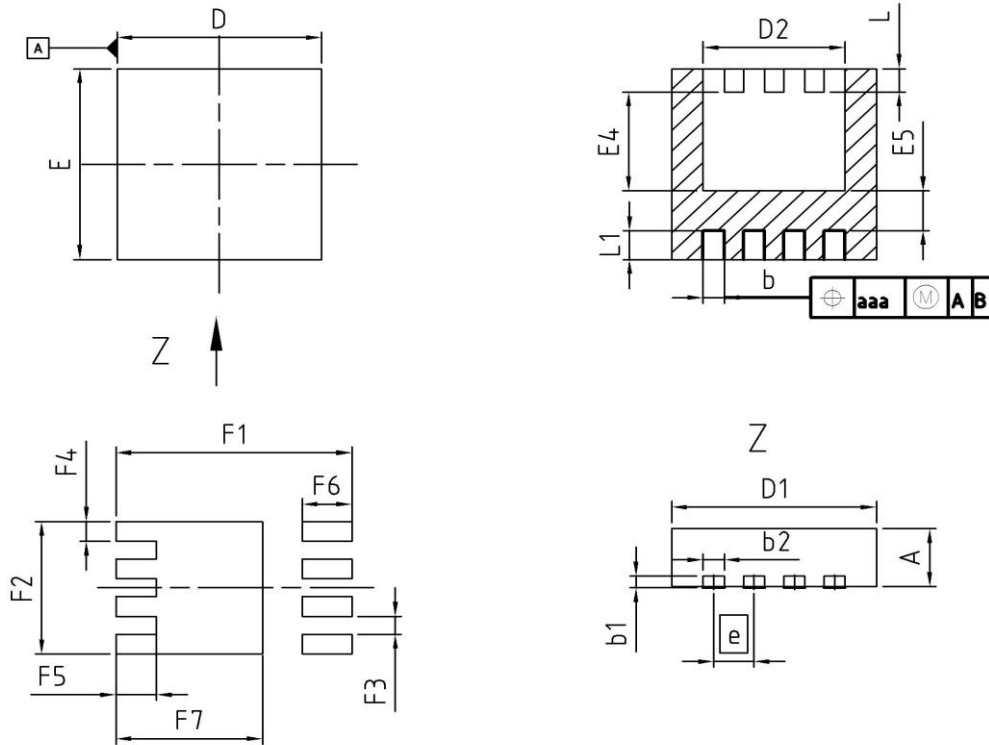
 parameter:  $T_{j(\text{start})}$ 

**14 Typ. gate charge**

$$V_{GS}=f(Q_{\text{gate}}); I_D=3.5\ \text{A pulsed}$$

 parameter:  $V_{DD}$ 

**15 Drain-source breakdown voltage**

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


**16 Gate charge waveforms**


**Package Outline:PG-TSDSON-8**


| DIM  | MILLIMETERS |      | INCHES |       |
|------|-------------|------|--------|-------|
|      | MIN         | MAX  | MIN    | MAX   |
| A    | 0.90        | 1.10 | 0.035  | 0.043 |
| b    | 0.24        | 0.44 | 0.009  | 0.017 |
| b1   | 0.10        | 0.30 | 0.004  | 0.012 |
| b2   | 0.20        | 0.44 | 0.008  | 0.017 |
| D=D1 | 3.20        | 3.40 | 0.126  | 0.134 |
| D2   | 2.15        | 2.45 | 0.085  | 0.096 |
| E    | 3.20        | 3.40 | 0.126  | 0.134 |
| E4   | 1.60        | 1.81 | 0.063  | 0.071 |
| E5   | 0.59        | 0.86 | 0.023  | 0.034 |
| e    | 0.65        |      | 0.026  |       |
| N    | 8           |      | 8      |       |
| L    | 0.30        | 0.56 | 0.012  | 0.022 |
| L1   | 0.33        | 0.60 | 0.013  | 0.024 |
| aaa  | 0.25        |      | 0.010  |       |
| F1   | 3.80        |      | 0.150  |       |
| F2   | 2.29        |      | 0.090  |       |
| F3   | 0.31        |      | 0.012  |       |
| F4   | 0.34        |      | 0.013  |       |
| F5   | 0.65        |      | 0.026  |       |
| F6   | 0.80        |      | 0.031  |       |
| F7   | 2.36        |      | 0.093  |       |

|                             |
|-----------------------------|
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