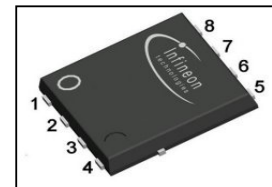


**OptiMOS™3 Power-Transistor**
**Features**

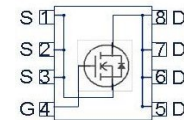
- Optimized for dc-dc conversion
- N-channel, normal level
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC<sup>1)</sup> for target application
- Halogen-free according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


**Product Summary**

|                  |      |    |
|------------------|------|----|
| $V_{DS}$         | 200  | V  |
| $R_{DS(on),max}$ | 125  | mΩ |
| $I_D$            | 11.3 | A  |

**PG-TDSON-8**


| Type           | Package    | Marking  |
|----------------|------------|----------|
| BSC12DN20NS3 G | PG-TDSON-8 | 12DN20NS |


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

| Parameter                           | Symbol            | Conditions                                     | Value       | Unit        |
|-------------------------------------|-------------------|--|-------------|-------------|
| Continuous drain current            | $I_D$             | $T_C=25\text{ °C}$                             | 11.3        | A           |
|                                     |                   | $T_C=100\text{ °C}$                            | 8.0         |             |
| Pulsed drain current <sup>2)</sup>  | $I_{D,pulse}$     | $T_C=25\text{ °C}$                             | 45          |             |
| Avalanche energy, single pulse      | $E_{AS}$          | $I_D=5.7\text{ A}$ , $R_{GS}=25\text{ }\Omega$ | 60          | mJ          |
| Reverse diode $dv/dt$               | $dv/dt$           |  | 10          | kV/ $\mu$ s |
| Gate source voltage                 | $V_{GS}$          |  | $\pm 20$    | V           |
| Power dissipation                   | $P_{tot}$         | $T_C=25\text{ °C}$                             | 50          | 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. |      |

**Thermal characteristics**

|  |            |  |   |   |     |     |
|--|------------|--|---|---|-----|-----|
| Thermal resistance, junction - case    | $R_{thJC}$ |  | - | - | 2.5 | K/W |
| Thermal resistance, junction - ambient | $R_{thJA}$ | 6 cm <sup>2</sup> cooling area <sup>3)</sup> | - | - | 50  |     |

**Electrical characteristics**, at  $T_j=25\text{ }^\circ\text{C}$ , 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           | $V_{GS(th)}$  | $V_{DS}=V_{GS}$ , $I_D=25\text{ }\mu\text{A}$                                    | 2   | 3   | 4   |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=160\text{ V}$ , $V_{GS}=0\text{ V}$ ,<br>$T_j=25\text{ }^\circ\text{C}$  | -   | 0.1 | 1   | $\mu\text{A}$ |
|                                  |               | $V_{DS}=160\text{ V}$ , $V_{GS}=0\text{ V}$ ,<br>$T_j=125\text{ }^\circ\text{C}$ | -   | 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 | $R_{DS(on)}$  | $V_{GS}=10\text{ V}$ , $I_D=5.7\text{ A}$  | -   | 108 | 125 | m $\Omega$    |
| Gate resistance                  | $R_G$         |  | -   | 1.9 | -   | $\Omega$      |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max}$ ,<br>$I_D=5.7\text{ A}$                           | 6   | 12  | -   | 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            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=100\text{ V},$<br>$f=1\text{ MHz}$                          | - | 510 | 680 | pF |
| Output capacitance           | $C_{oss}$    |  | - | 39  | 52  |    |
| Reverse transfer capacitance | $C_{rss}$    |  | - | 5.1 | -   |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=100\text{ V},$<br>$V_{GS}=10\text{ V}, I_D=5.7\text{ A},$<br>$R_G=1.6\ \Omega$ | - | 6   | -   | ns |
| Rise time                    | $t_r$        |  | - | 4   | -   |    |
| Turn-off delay time          | $t_{d(off)}$ |  | - | 10  | -   |    |
| Fall time                    | $t_f$        |  | - | 3   | -   |    |

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

|                       |               |  |   |     |     |    |
|-----------------------|---------------|--|---|-----|-----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=100\text{ V}, I_D=5.7\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 2.3 | -   | nC |
| Gate to drain charge  | $Q_{gd}$      |  | - | 1.1 | -   |    |
| Switching charge      | $Q_{sw}$      |  | - | 1.8 | -   |    |
| Gate charge total     | $Q_g$         |  | - | 6.5 | 8.7 |    |
| Gate plateau voltage  | $V_{plateau}$ |  | - | 4.5 | -   | V  |
| Output charge         | $Q_{oss}$     | $V_{DD}=100\text{ V}, V_{GS}=0\text{ V}$                                     | - | 14  | 19  | nC |

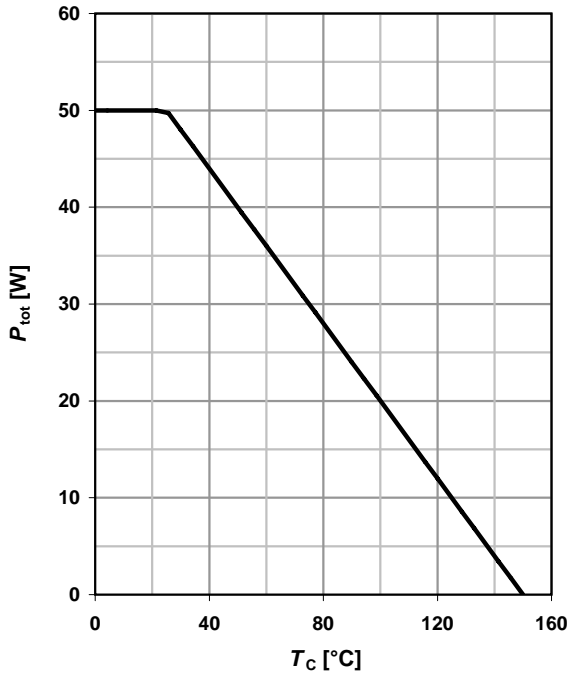
**Reverse Diode**

|                                  |               |   |   |     |      |    |
|----------------------------------|---------------|---|---|-----|------|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ }^\circ\text{C}$  | - | -   | 11.3 | A  |
| Diode pulse current              | $I_{S,pulse}$ |   | - | -   | 45   |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=11.3\text{ A},$<br>$T_j=25\text{ }^\circ\text{C}$ | - | 1   | 1.2  | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=100\text{ V}, I_F=I_S,$<br>$di_F/dt=100\text{ A}/\mu\text{s}$        | - | 74  | -    | ns |
| Reverse recovery charge          | $Q_{rr}$      |   | - | 208 | -    | nC |

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

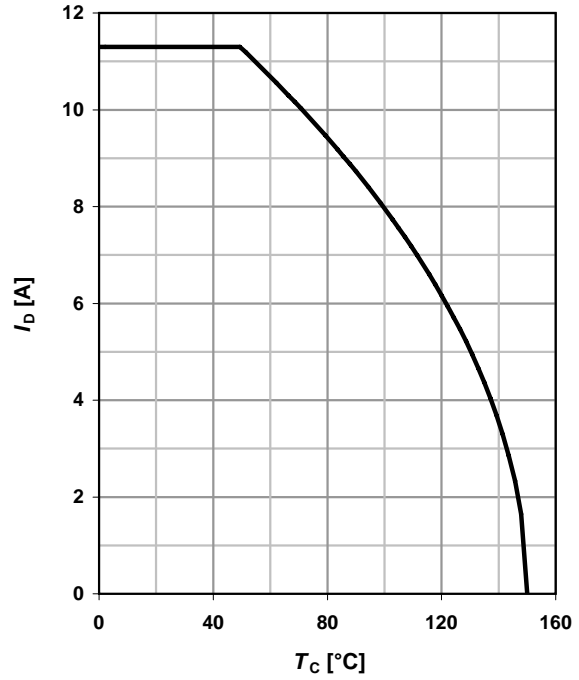
**1 Power dissipation**

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



**2 Drain current**

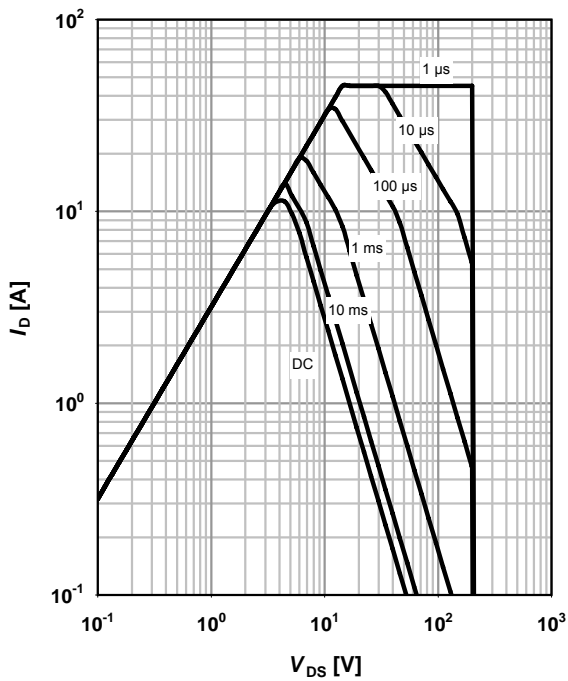
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



**3 Safe operating area**

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

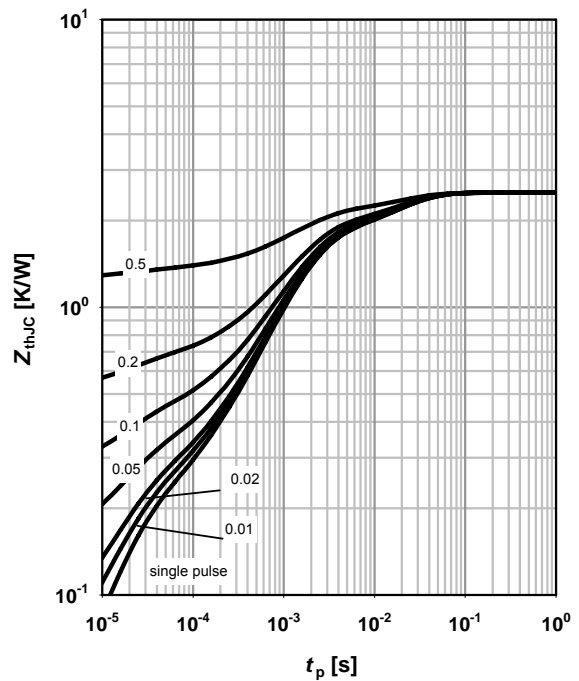
parameter:  $t_p$



**4 Max. transient thermal impedance**

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

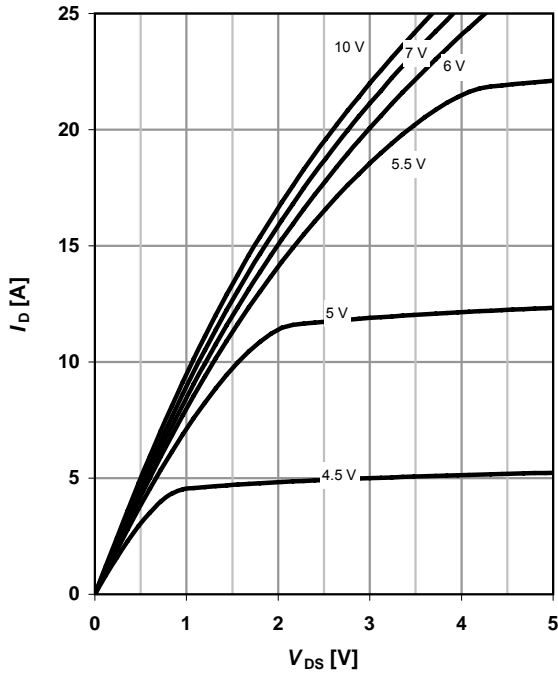
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

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

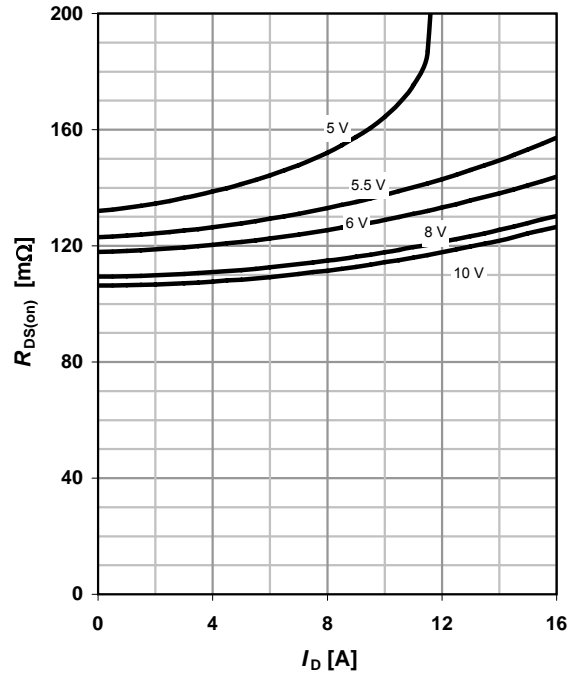
parameter:  $V_{GS}$



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

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

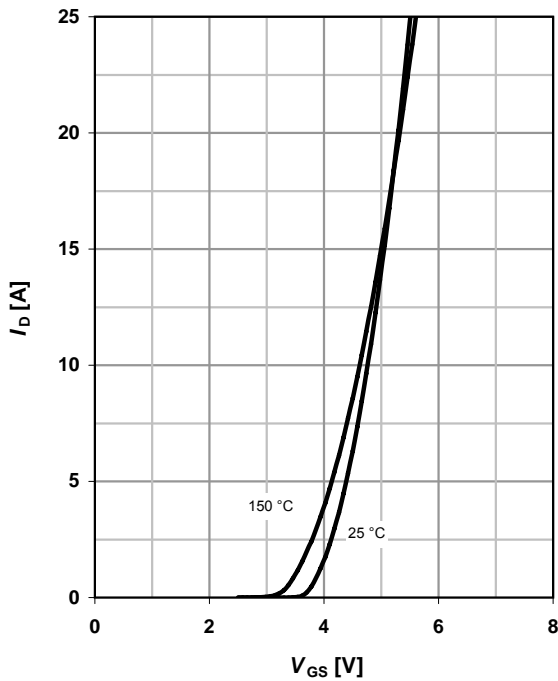
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

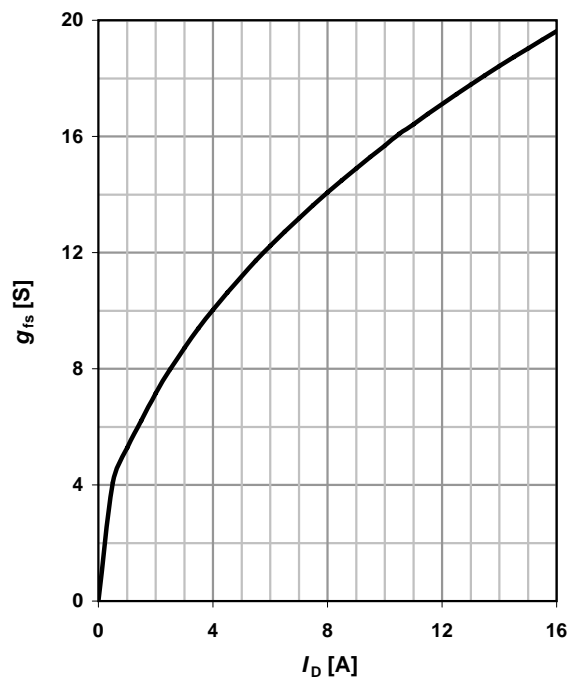
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter:  $T_j$



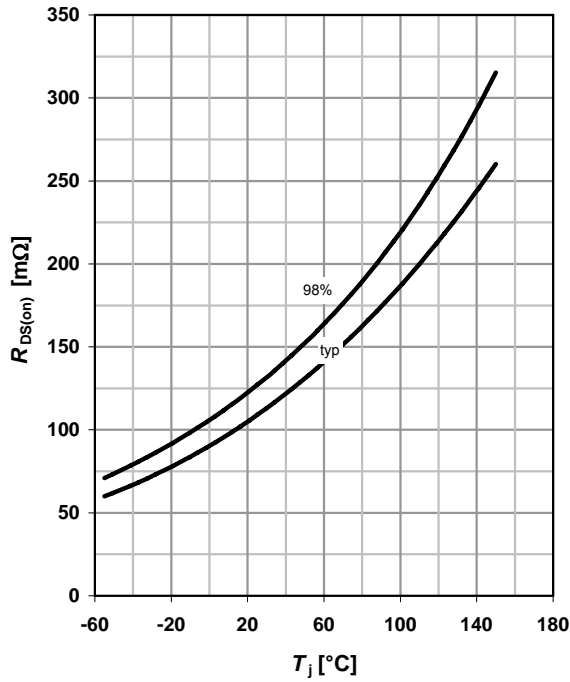
**8 Typ. forward transconductance**

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



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

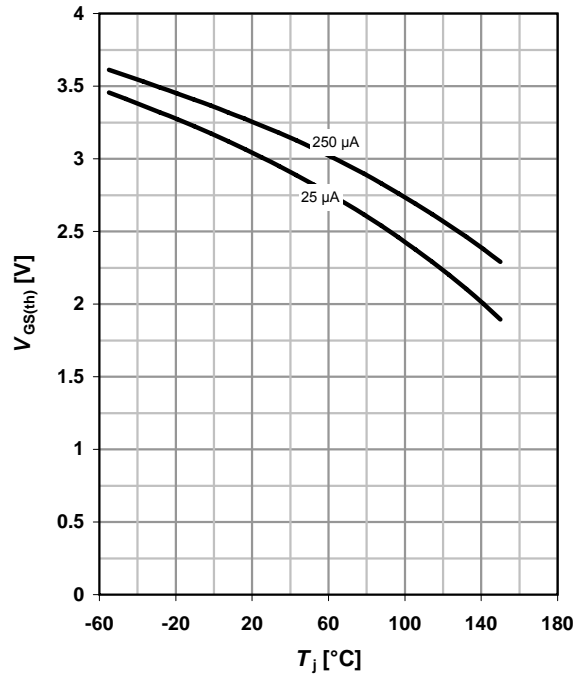
$R_{DS(on)} = f(T_j); I_D = 5.7 \text{ A}; V_{GS} = 10 \text{ V}$



**10 Typ. gate threshold voltage**

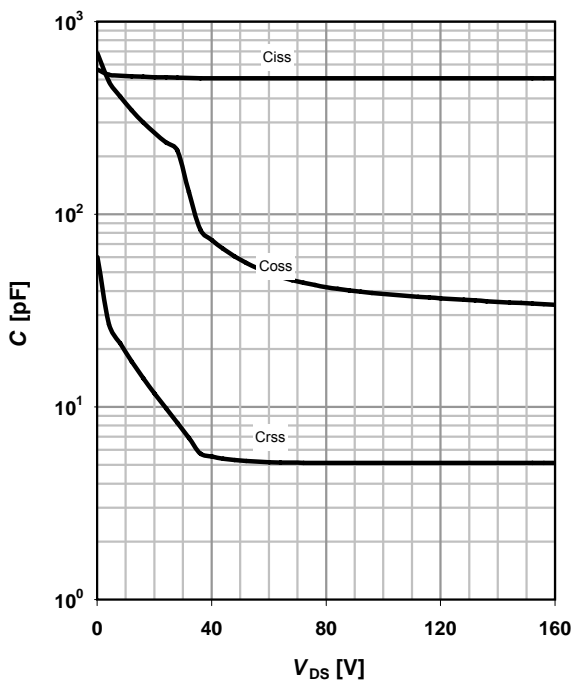
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**11 Typ. capacitances**

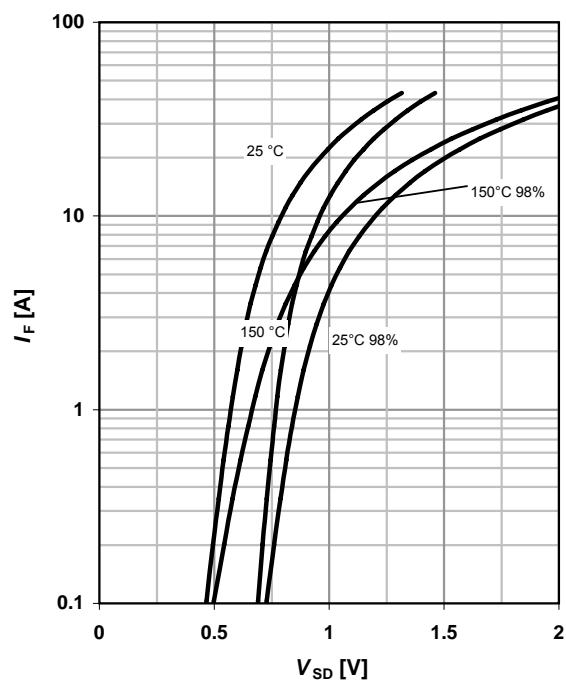
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



**12 Forward characteristics of reverse diode**

$I_F = f(V_{SD})$

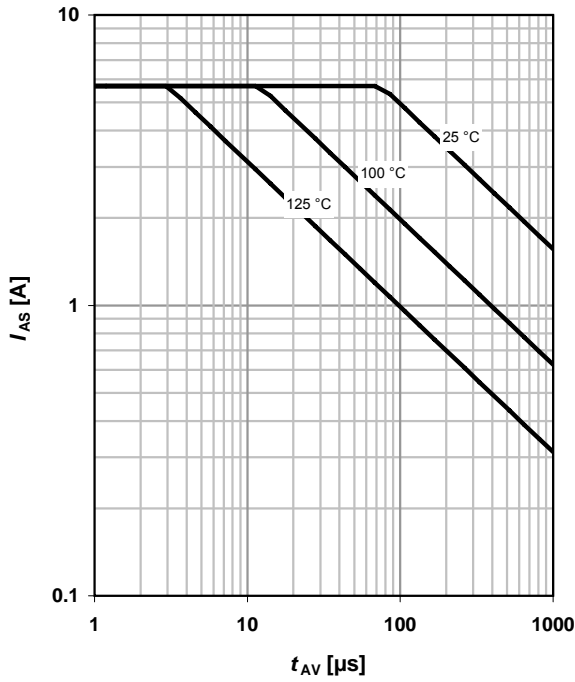
parameter:  $T_j$



**13 Avalanche characteristics**

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

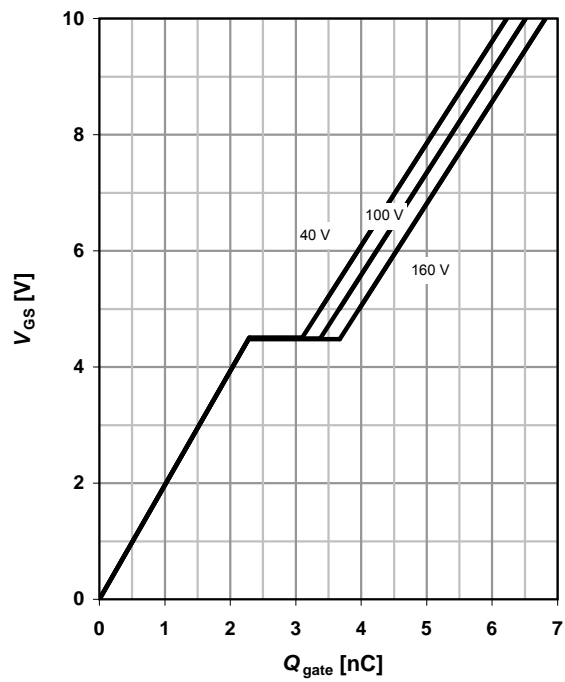
parameter:  $T_{j(start)}$



**14 Typ. gate charge**

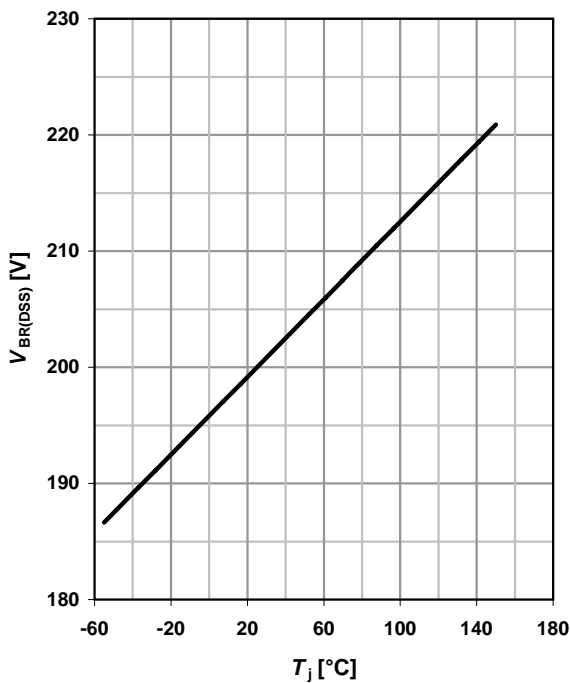
$V_{GS}=f(Q_{gate}); I_D=5.7 \text{ A pulsed}$

parameter:  $V_{DD}$

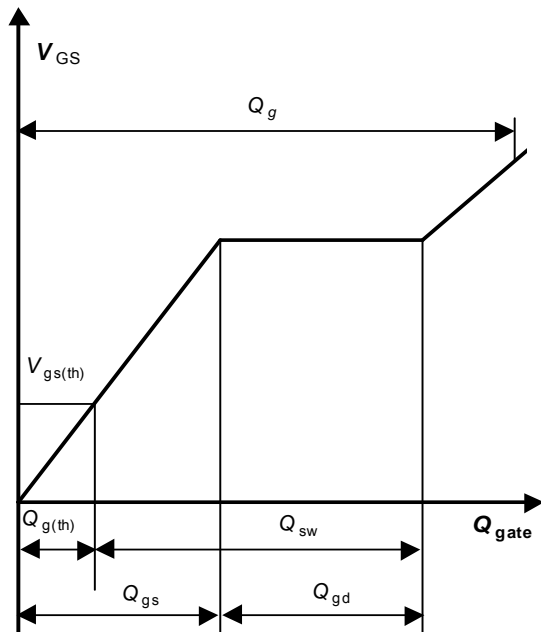


**15 Drain-source breakdown voltage**

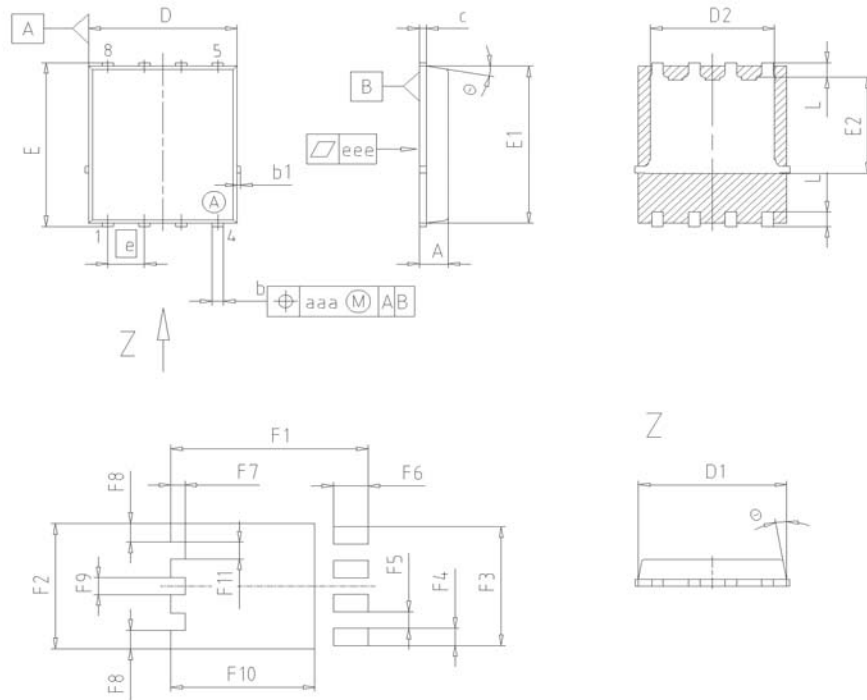
$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$



**16 Gate charge waveforms**



Package Outline:PG-TDSON-8



| DIM  | MILLIMETERS |       | INCHES |       |
|------|-------------|-------|--------|-------|
|      | MIN         | MAX   | MIN    | MAX   |
| A    | 0.90        | 1.10  | 0.035  | 0.043 |
| b    | 0.34        | 0.54  | 0.013  | 0.021 |
| b1   | 0.02        | 0.22  | 0.001  | 0.008 |
| c    | 0.15        | 0.35  | 0.006  | 0.014 |
| D=D1 | 4.95        | 5.35  | 0.195  | 0.211 |
| D2   | 4.20        | 4.40  | 0.165  | 0.173 |
| E    | 5.95        | 6.35  | 0.234  | 0.250 |
| E1   | 5.70        | 6.10  | 0.224  | 0.240 |
| E2   | 3.40        | 3.80  | 0.134  | 0.150 |
| e    | 1.27        |       | 0.050  |       |
| N    | 8           |       | 8      |       |
| L    | 0.45        | 0.65  | 0.018  | 0.026 |
| □    | 8.5°        | 11.5° | 8.5°   | 11.5° |
| aaa  | 0.25        |       | 0.010  |       |
| eee  | 0.05        |       | 0.002  |       |
| F1   | 6.75        | 6.95  | 0.266  | 0.274 |
| F2   | 4.60        | 4.80  | 0.181  | 0.189 |
| F3   | 4.36        | 4.56  | 0.172  | 0.180 |
| F4   | 0.55        | 0.75  | 0.022  | 0.030 |
| F5   | 0.52        | 0.72  | 0.020  | 0.028 |
| F6   | 1.10        | 1.30  | 0.043  | 0.051 |
| F7   | 0.40        | 0.60  | 0.016  | 0.024 |
| F8   | 0.60        | 0.80  | 0.024  | 0.031 |
| F9   | 0.53        | 0.73  | 0.021  | 0.029 |
| F10  | 4.90        | 5.10  | 0.193  | 0.201 |
| F11  | 0.53        | 0.73  | 0.021  | 0.029 |

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#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.