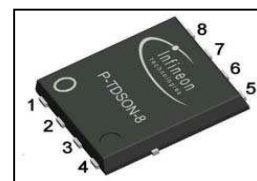


**OptiMOS™2 Power-Transistor**
**Features**

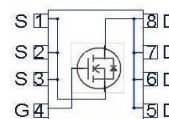
- Fast switching MOSFET for SMPS
- N-channel; Logic level
- Qualified according to JEDEC<sup>1</sup> for target applications
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low on-resistance  $R_{DS(on)}$
- Superior thermal resistance
- Avalanche rated
- $dv/dt$  rated
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

**Product Summary**

|                  |     |    |
|------------------|-----|----|
| $V_{DS}$         | 25  | V  |
| $R_{DS(on),max}$ | 2.0 | mΩ |
| $I_D$            | 100 | A  |

**PG-TDSON-8**


| Type        | Package    | Marking |
|-------------|------------|---------|
| BSC020N025S | PG-TDSON-8 | 20N025S |



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

| Parameter                           | Symbol         | Conditions                                                                                           | Value       | Unit  |
|-------------------------------------|----------------|------------------------------------------------------------------------------------------------------|-------------|-------|
| Continuous drain current            | $I_D$          | $T_C=25\text{ °C}$                                                                                   | 100         | A     |
|                                     |                | $T_C=100\text{ °C}$                                                                                  | 100         |       |
|                                     |                | $T_A=25\text{ °C}$ ,<br>$R_{thJA}=45\text{ K/W}^{(2)}$                                               | 29          |       |
| Pulsed drain current                | $I_{D,pulse}$  | $T_C=25\text{ °C}^{(3)}$                                                                             | 200         |       |
| Avalanche energy, single pulse      | $E_{AS}$       | $I_D=50\text{ A}$ , $R_{GS}=25\text{ Ω}$                                                             | 800         | mJ    |
| Reverse diode $dv/dt$               | $dv/dt$        | $I_D=50\text{ A}$ , $V_{DS}=20\text{ V}$ ,<br>$di/dt=200\text{ A/μs}$ ,<br>$T_{j,max}=150\text{ °C}$ | 6           | kV/μs |
| Gate source voltage                 | $V_{GS}$       |                                                                                                      | ±20         | V     |
| Power dissipation                   | $P_{tot}$      | $T_C=25\text{ °C}$                                                                                   | 104         | W     |
|                                     |                | $T_A=25\text{ °C}$ ,<br>$R_{thJA}=45\text{ K/W}^{(2)}$                                               | 2.8         |       |
| Operating and storage temperature   | $T_j, T_{stg}$ |                                                                                                      | -55 ... 150 | °C    |
| IEC climatic category; DIN IEC 68-1 |                |                                                                                                      | 55/150/56   |       |

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

**Thermal characteristics**

|                                        |            |                                              |   |   |     |     |
|----------------------------------------|------------|----------------------------------------------|---|---|-----|-----|
| Thermal resistance, junction - case    | $R_{thJC}$ | bottom                                       | - | - | 1.2 | K/W |
|                                        |            | top                                          |   |   | 18  |     |
| Thermal resistance, junction - ambient | $R_{thJA}$ | minimal footprint                            | - | - | 62  |     |
|                                        |            | 6 cm <sup>2</sup> cooling area <sup>2)</sup> | - | - | 45  |     |

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

|                                  |               |                                                            |     |     |     |               |
|----------------------------------|---------------|------------------------------------------------------------|-----|-----|-----|---------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$                       | 25  | -   | -   | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=110\text{ }\mu\text{A}$                | 1.2 | 1.6 | 2   |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$  | -   | 0.1 | 1   | $\mu\text{A}$ |
|                                  |               | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$ | -   | 10  | 100 |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$                    | -   | 10  | 100 | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=4.5\text{ V}, I_D=50\text{ A}$                     | -   | 2.5 | 3.1 | m $\Omega$    |
|                                  |               | $V_{GS}=10\text{ V}, I_D=50\text{ A}$                      | -   | 1.7 | 2.0 |               |
| Gate resistance                  | $R_G$         |                                                            | -   | 1.2 | -   | $\Omega$      |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=50\text{ A}$            | 66  | 131 | -   | S             |

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

<sup>2)</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.

<sup>3)</sup> See figure 3

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

**Dynamic characteristics**

|                              |              |                                                                                 |   |      |      |    |
|------------------------------|--------------|---------------------------------------------------------------------------------|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=15\text{ V},$<br>$f=1\text{ MHz}$                    | - | 6230 | 8290 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                 | - | 2360 | 3140 |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                 | - | 270  | 405  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=15\text{ V}, V_{GS}=10\text{ V},$<br>$I_D=25\text{ A}, R_G=2.7\ \Omega$ | - | 10.3 | 15   | ns |
| Rise time                    | $t_r$        |                                                                                 | - | 10   | 15   |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                 | - | 47   | 70   |    |
| Fall time                    | $t_f$        |                                                                                 | - | 8    | 12   |    |

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

|                              |               |                                                                           |   |     |    |    |
|------------------------------|---------------|---------------------------------------------------------------------------|---|-----|----|----|
| Gate to source charge        | $Q_{gs}$      | $V_{DD}=15\text{ V}, I_D=25\text{ A},$<br>$V_{GS}=0\text{ to }5\text{ V}$ | - | 18  | 23 | nC |
| Gate charge at threshold     | $Q_{g(th)}$   |                                                                           | - | 10  | 13 |    |
| Gate to drain charge         | $Q_{gd}$      |                                                                           | - | 13  | 19 |    |
| Switching charge             | $Q_{sw}$      |                                                                           | - | 20  | 29 |    |
| Gate charge total            | $Q_g$         |                                                                           | - | 50  | 66 |    |
| Gate plateau voltage         | $V_{plateau}$ |                                                                           | - | 2.8 | -  | V  |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | $V_{DS}=0.1\text{ V},$<br>$V_{GS}=0\text{ to }5\text{ V}$                 | - | 44  | 58 | nC |
| Output charge                | $Q_{oss}$     | $V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$                                   | - | 52  | 69 |    |

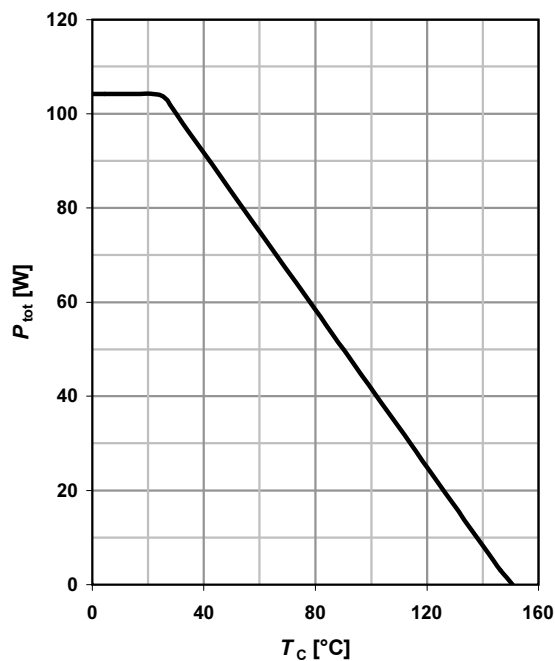
**Reverse Diode**

|                                  |               |                                                                   |   |      |     |    |
|----------------------------------|---------------|-------------------------------------------------------------------|---|------|-----|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ °C}$                                                | - | -    | 50  | A  |
| Diode pulse current              | $I_{S,pulse}$ |                                                                   | - | -    | 200 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=50\text{ A},$<br>$T_j=25\text{ °C}$       | - | 0.82 | 1   | V  |
| Reverse recovery charge          | $Q_{rr}$      | $V_R=15\text{ V}, I_F=I_S,$<br>$di_F/dt=400\text{ A}/\mu\text{s}$ | - | -    | 20  | nC |

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

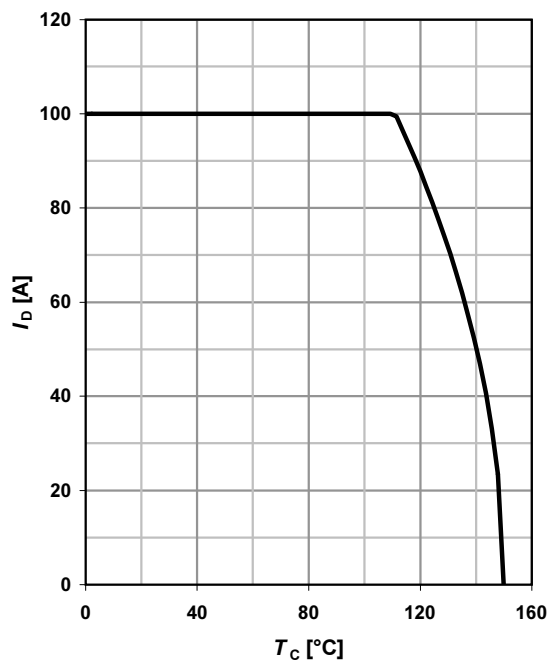
### 1 Power dissipation

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



### 2 Drain current

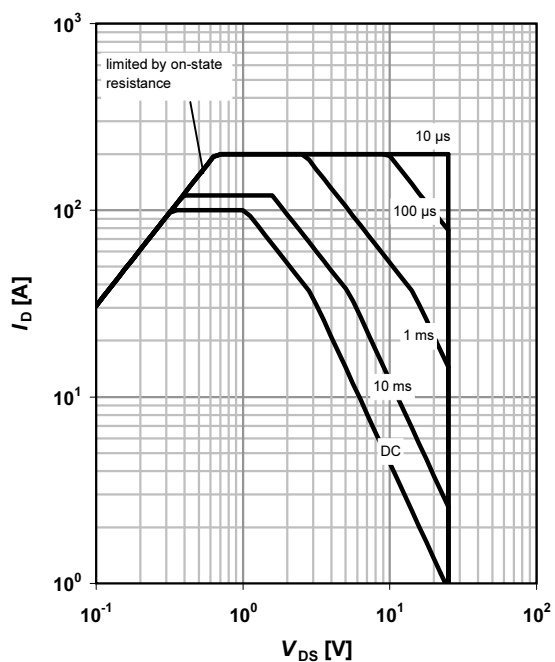
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



### 3 Safe operating area

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

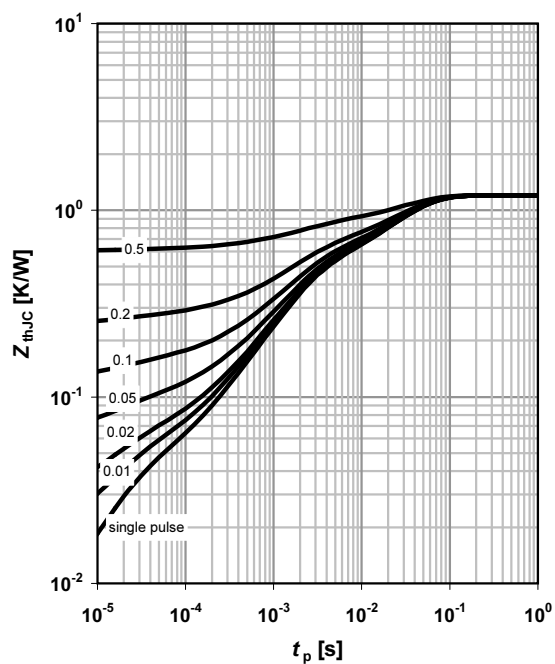
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

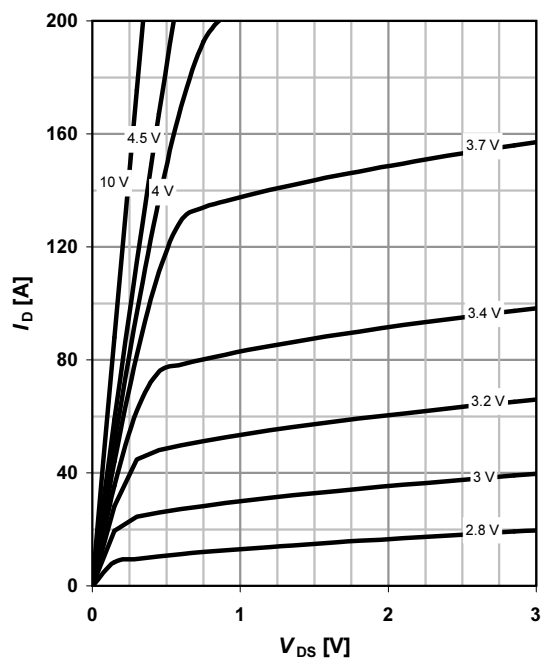
parameter:  $D = t_p/T$



### 5 Typ. output characteristics

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

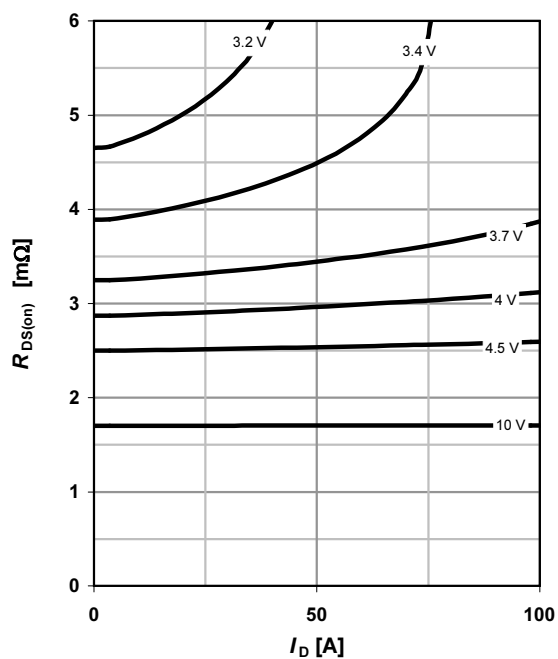
parameter:  $V_{GS}$



### 6 Typ. drain-source on resistance

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

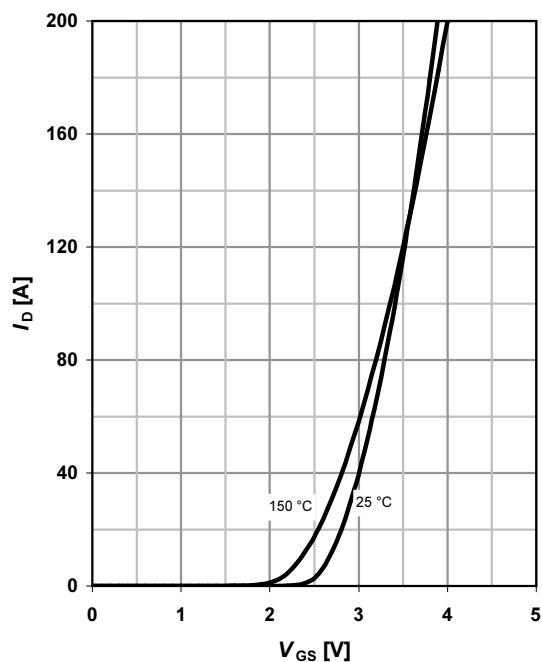
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

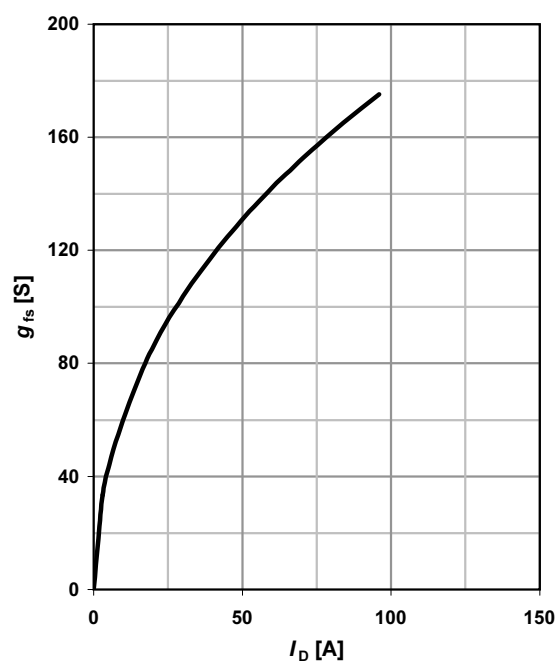
$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$$

parameter:  $T_J$



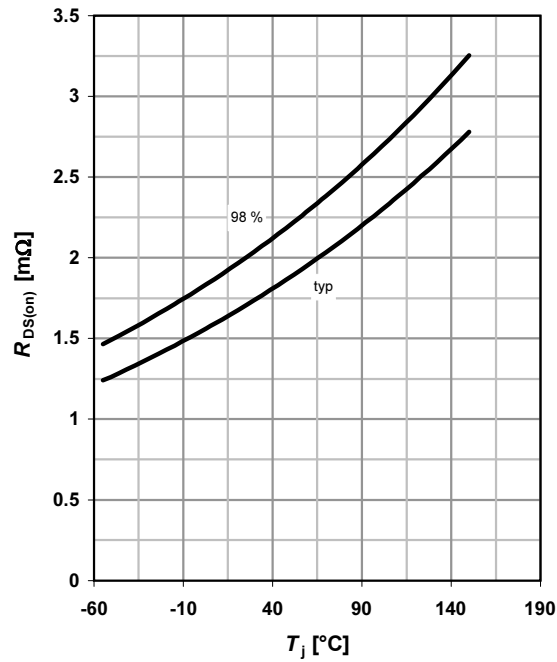
### 8 Typ. forward transconductance

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



### 9 Drain-source on-state resistance

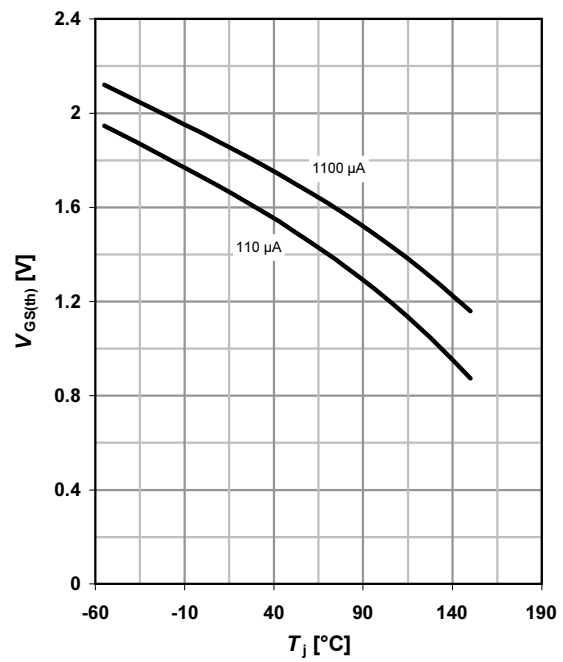
$$R_{DS(on)} = f(T_j); I_D = 50 \text{ A}; V_{GS} = 10 \text{ V}$$



### 10 Typ. gate threshold voltage

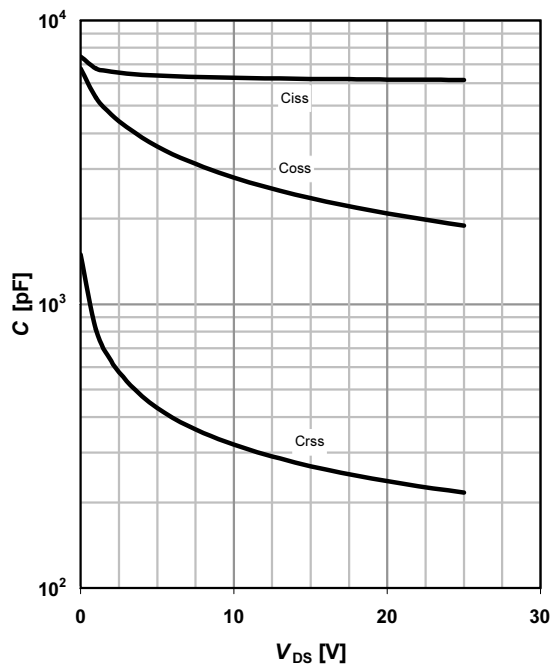
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



### 11 Typ. capacitances

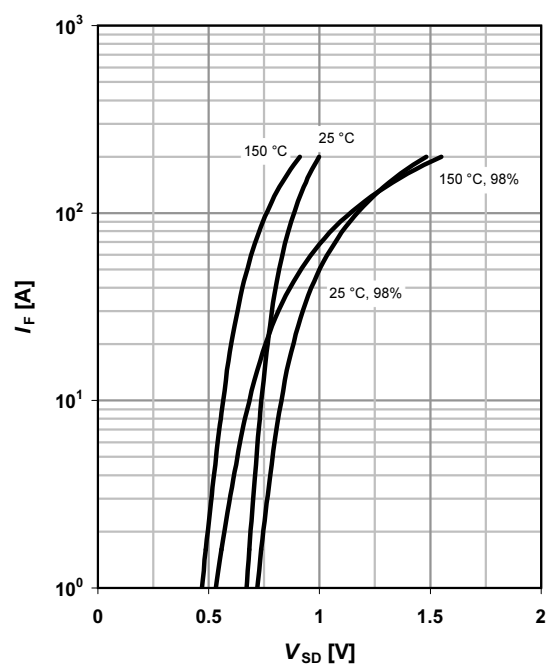
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



### 12 Forward characteristics of reverse diode

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

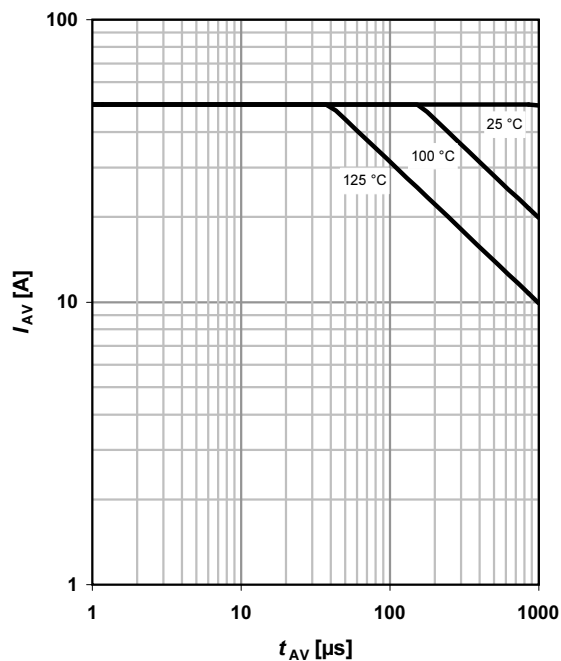
parameter:  $T_j$



### 13 Avalanche characteristics

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

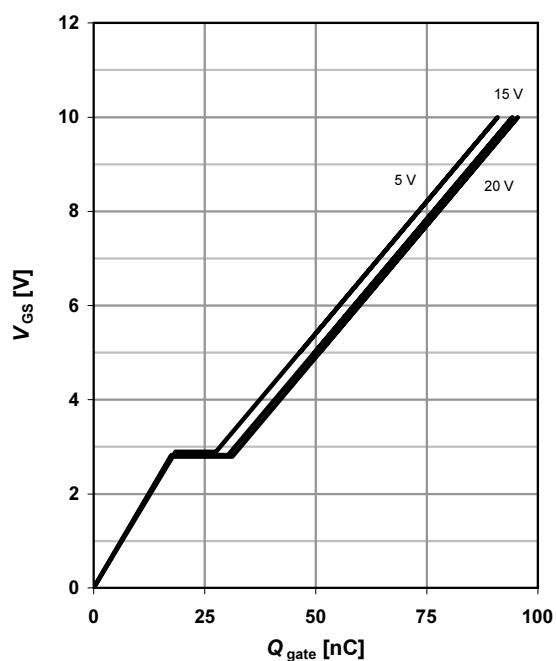
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

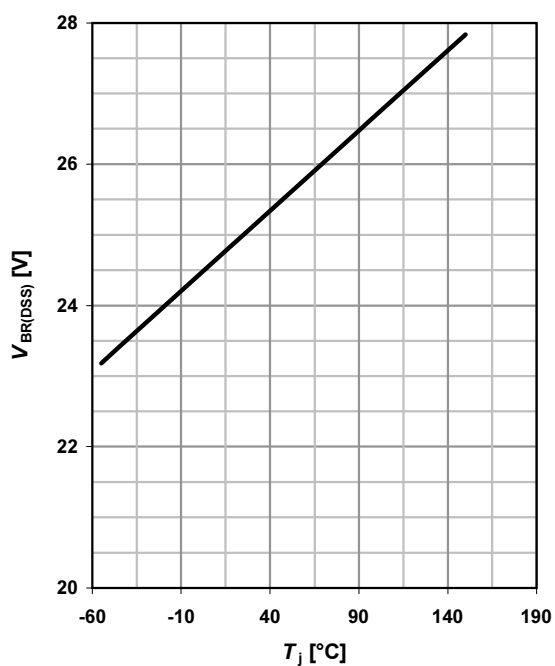
$$V_{GS}=f(Q_{\text{gate}}); I_D=25\ \text{A pulsed}$$

parameter:  $V_{DD}$

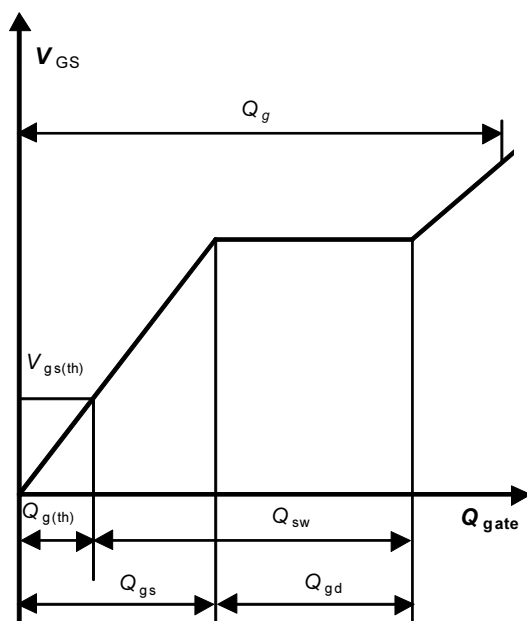


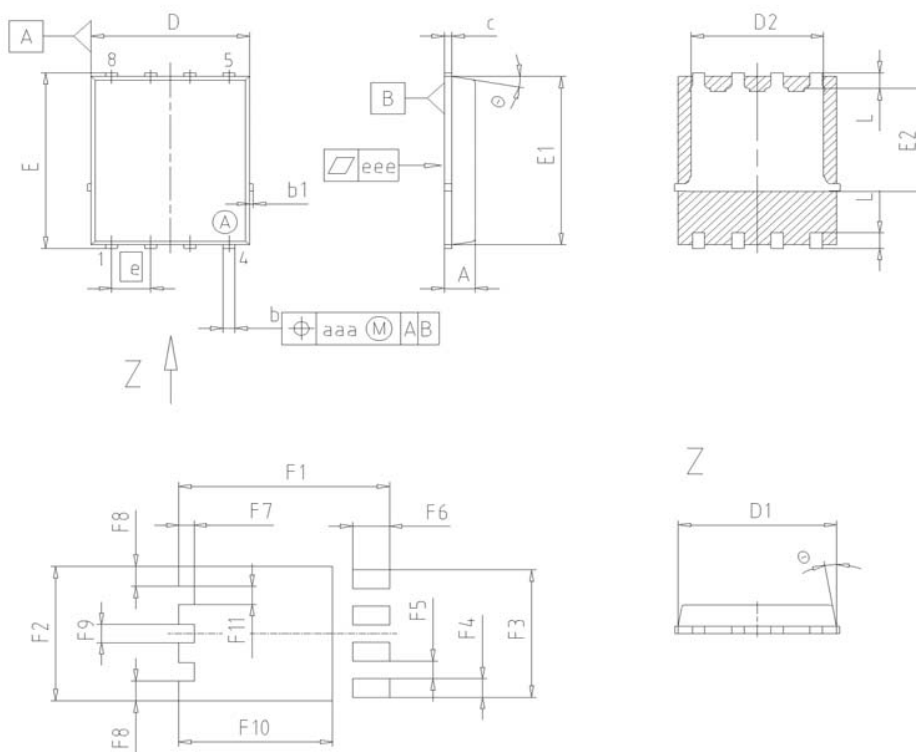
### 15 Drain-source breakdown voltage

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

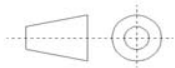


### 16 Gate charge waveforms



**Package Outline**
**P-TDSON-8**
**P-TDSON-8: Outline**


| 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 |

|                                                                                       |  |
|---------------------------------------------------------------------------------------|--|
| <b>DOCUMENT NO.</b><br>Z8B00003332                                                    |  |
| <b>SCALE</b> 0<br>2.5<br>0 2.5 5mm                                                    |  |
| <b>EUROPEAN PROJECTION</b>                                                            |  |
|  |  |
| <b>ISSUE DATE</b><br>08-03-2007                                                       |  |
| <b>REVISION</b><br>03                                                                 |  |



### P-TDSON-8: Tape



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