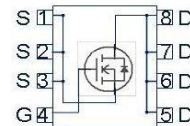
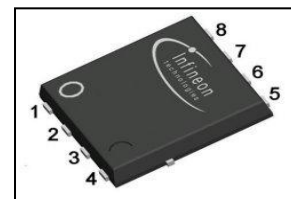


**OptiMOS™ Power-MOSFET**
**Features**

- Optimized for high performance Buck converter
- Very low on-resistance  $R_{DS(on)}$  @  $V_{GS}=4.5\text{ V}$
- 100% avalanche tested
- Superior thermal resistance
- N-channel
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21


**Product Summary**

|                  |     |    |
|------------------|-----|----|
| $V_{DS}$         | 30  | V  |
| $R_{DS(on),max}$ | 5.2 | mΩ |
| $I_D$            | 57  | A  |
| $Q_{GD}$         | 1.9 | nC |
| $Q_G(0V..10V)$   | 12  | nC |

**PG-TDSON-8**


| Type        | Package    | Marking  |
|-------------|------------|----------|
| BSC052N03LS | PG-TDSON-8 | 052N03LS |

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

| Parameter                                     | Symbol        | Conditions  | Value | Unit |
|---|---------------|---|-------|------|
| Continuous drain current                      | $I_D$         | $V_{GS}=10\text{ V}, T_C=25\text{ °C}$                            | 57    | A    |
|   |               | $V_{GS}=10\text{ V}, T_C=100\text{ °C}$                           | 36    |      |
|   |               | $V_{GS}=4.5\text{ V}, T_C=25\text{ °C}$                           | 48    |      |
|   |               | $V_{GS}=4.5\text{ V}, T_C=100\text{ °C}$                          | 31    |      |
|   |               | $V_{GS}=10\text{ V}, T_A=25\text{ °C}, R_{thJA}=50\text{ K/W}^2)$ | 17    |      |
| Pulsed drain current <sup>3)</sup>            | $I_{D,pulse}$ | $T_C=25\text{ °C}$  | 228   |      |
| Avalanche current, single pulse <sup>4)</sup> | $I_{AS}$      | $T_C=25\text{ °C}$  | 35    |      |
| Avalanche energy, single pulse                | $E_{AS}$      | $I_D=35\text{ A}, R_{GS}=25\text{ Ω}$                             | 12    | mJ   |
| Gate source voltage                           | $V_{GS}$      |   | ±20   | V    |

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

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

| Parameter                           | Symbol                | Conditions   | Value       | Unit |
|-------------------------------------|-----------------------|--|-------------|------|
| Power dissipation                   | $P_{\text{tot}}$      | $T_C=25\text{ °C}$   | 28          | W    |
|                                     |                       | $T_A=25\text{ °C}$ ,<br>$R_{\text{thJA}}=50\text{ K/W}^2)$ | 2.5         |      |
| Operating and storage temperature   | $T_j, T_{\text{stg}}$ |  | -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 | $R_{\text{thJC}}$ |  | - | - | 4.5 | K/W |
|                                     |                   | top  | - | - | 20  |     |
| Device on PCB                       | $R_{\text{thJA}}$ | 6 cm <sup>2</sup> cooling area <sup>2)</sup> | - | - | 50  |     |

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

### Static characteristics

|                                  |                             |   |     |      |     |               |
|----------------------------------|-----------------------------|---|-----|------|-----|---------------|
| Drain-source breakdown voltage   | $V_{(\text{BR})\text{DSS}}$ | $V_{\text{GS}}=0\text{ V}$ , $I_{\text{D}}=1\text{ mA}$                               | 30  | -    | -   | V             |
| Gate threshold voltage           | $V_{\text{GS(th)}}$         | $V_{\text{DS}}=V_{\text{GS}}$ , $I_{\text{D}}=250\text{ }\mu\text{A}$                 | 1.2 | -    | 2   |               |
| Zero gate voltage drain current  | $I_{\text{DSS}}$            | $V_{\text{DS}}=30\text{ V}$ , $V_{\text{GS}}=0\text{ V}$ ,<br>$T_j=25\text{ °C}$      | -   | 0.1  | 1   | $\mu\text{A}$ |
|                                  |                             | $V_{\text{DS}}=30\text{ V}$ , $V_{\text{GS}}=0\text{ V}$ ,<br>$T_j=125\text{ °C}$     | -   | 10   | 100 |               |
| Gate-source leakage current      | $I_{\text{GSS}}$            | $V_{\text{GS}}=20\text{ V}$ , $V_{\text{DS}}=0\text{ V}$                              | -   | 10   | 100 | nA            |
| Drain-source on-state resistance | $R_{\text{DS(on)}}$         | $V_{\text{GS}}=4.5\text{ V}$ , $I_{\text{D}}=30\text{ A}$                             | -   | 5.8  | 7.2 | m $\Omega$    |
|                                  |                             | $V_{\text{GS}}=10\text{ V}$ , $I_{\text{D}}=30\text{ A}$                              | -   | 4.3  | 5.2 |               |
| Gate resistance                  | $R_{\text{G}}$              |   | 0.3 | 0.65 | 1.3 | $\Omega$      |
| Transconductance                 | $g_{\text{fs}}$             | $ V_{\text{DS}} >2 I_{\text{D}} R_{\text{DS(on)max}}$ ,<br>$I_{\text{D}}=30\text{ A}$ | 38  | 75   | -   | S             |

<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 for more detailed information

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

**Dynamic characteristics**

|                              |              |  |   |     |      |    |
|------------------------------|--------------|--|---|-----|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=15\text{ V}, f=1\text{ MHz}$                          | - | 770 | 1024 | pF |
| Output capacitance           | $C_{oss}$    |  | - | 300 | 399  |    |
| Reverse transfer capacitance | $C_{rss}$    |  | - | 44  | -    |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=15\text{ V}, V_{GS}=10\text{ V}, I_D=30\text{ A}, R_{G,ext}=1.6\ \Omega$ | - | 2.4 | -    | ns |
| Rise time                    | $t_r$        |  | - | 3.6 | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |  | - | 13  | -    |    |
| Fall time                    | $t_f$        |  | - | 2.4 | -    |    |

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

|                              |               |  |   |     |     |    |
|------------------------------|---------------|--|---|-----|-----|----|
| Gate to source charge        | $Q_{gs}$      | $V_{DD}=15\text{ V}, I_D=30\text{ A}, V_{GS}=0\text{ to }4.5\text{ V}$ | - | 2.2 | 3   | nC |
| Gate charge at threshold     | $Q_{g(th)}$   |  | - | 1.2 | -   |    |
| Gate to drain charge         | $Q_{gd}$      |  | - | 1.9 | 3   |    |
| Switching charge             | $Q_{sw}$      |  | - | 2.9 | -   |    |
| Gate charge total            | $Q_g$         |  | - | 5.9 | 7.8 |    |
| Gate plateau voltage         | $V_{plateau}$ |  | - | 2.8 | -   | V  |
| Gate charge total            | $Q_g$         | $V_{DD}=15\text{ V}, I_D=30\text{ A}, V_{GS}=0\text{ to }10\text{ V}$  | - | 12  | 16  | nC |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | $V_{DS}=0.1\text{ V}, V_{GS}=0\text{ to }4.5\text{ V}$                 | - | 4.8 | -   |    |
| Output charge                | $Q_{oss}$     | $V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$                                | - | 7.7 | 10  |    |

**Reverse Diode**

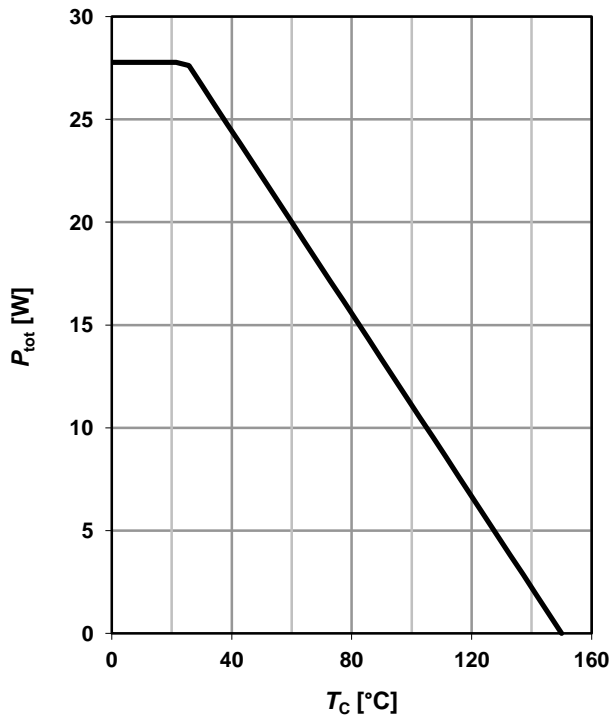
|                                  |               |  |   |     |     |    |
|----------------------------------|---------------|--|---|-----|-----|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ }^\circ\text{C}$                                     | - | -   | 28  | A  |
| Diode pulse current              | $I_{S,pulse}$ |  | - | -   | 112 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=30\text{ A}, T_j=25\text{ }^\circ\text{C}$ | - | 0.9 | 1   | V  |
| Reverse recovery charge          | $Q_{rr}$      | $V_R=15\text{ V}, I_F=I_S, di_F/dt=400\text{ A}/\mu\text{s}$       | - | 5   | -   | nC |

<sup>4)</sup> See figure 13 for more detailed information

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

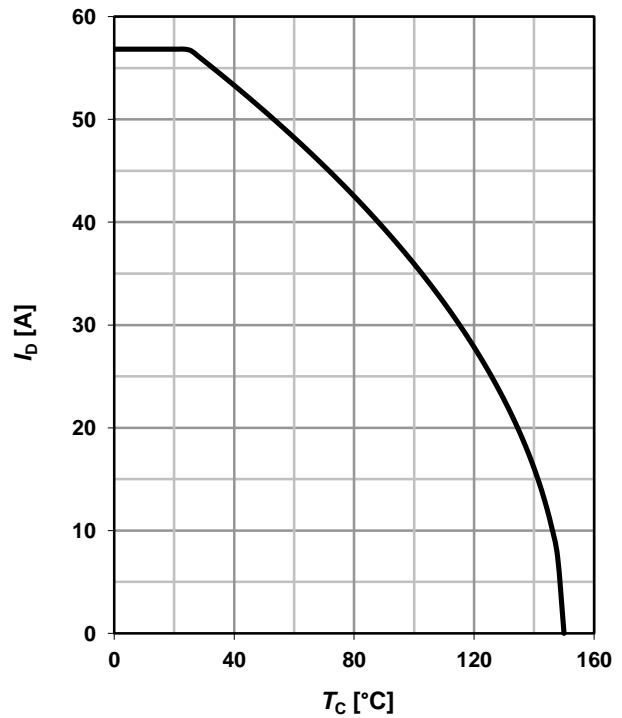
### 1 Power dissipation

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



### 2 Drain current

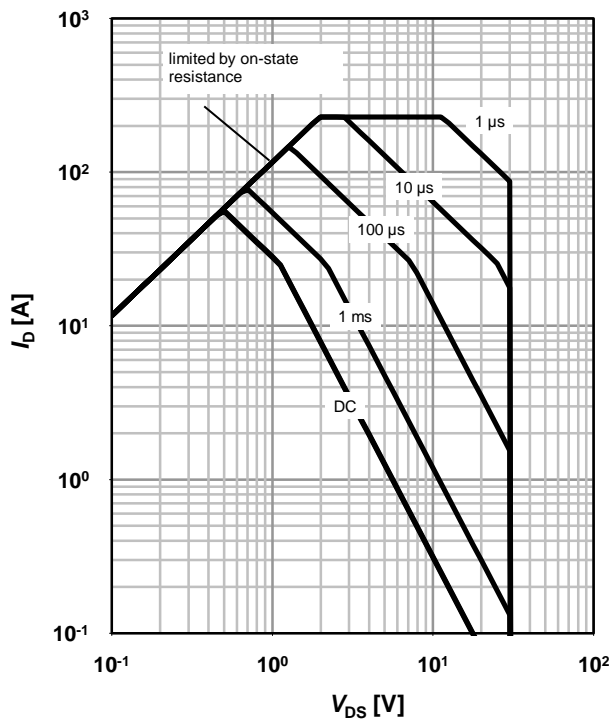
$$I_D=f(T_C); V_{GS}\geq 10\text{ V}$$



### 3 Safe operating area

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

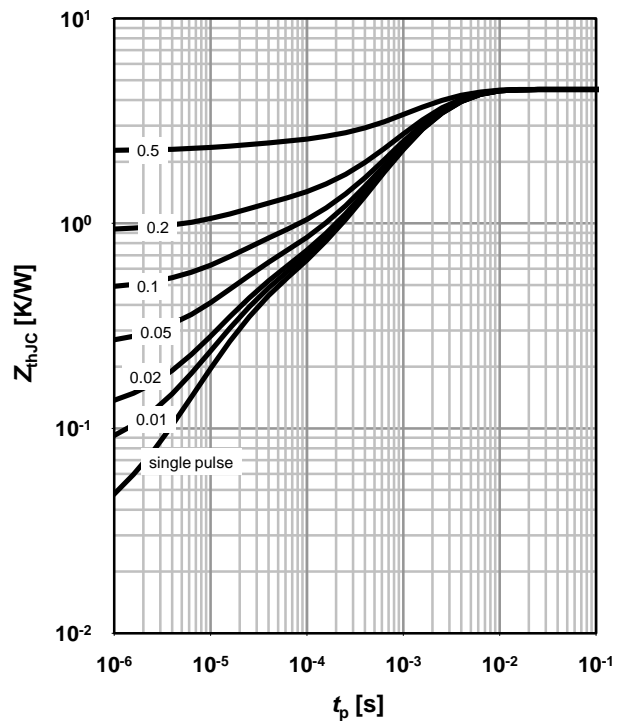
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

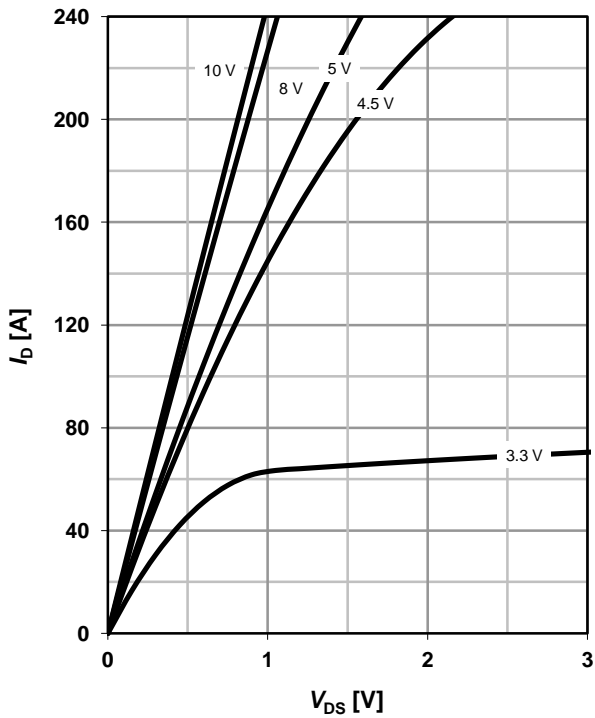
parameter:  $D=t_p/T$



**5 Typ. output characteristics**

$I_D=f(V_{DS}); T_j=25\text{ °C}$

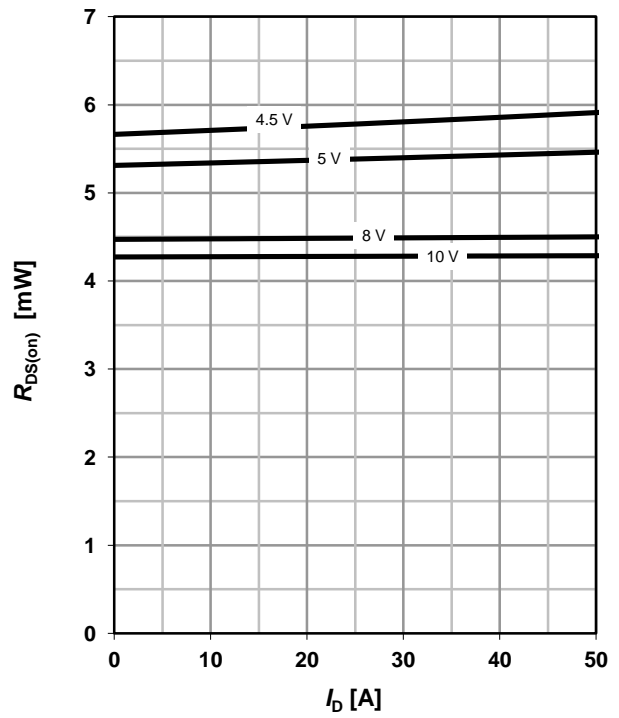
parameter:  $V_{GS}$



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

$R_{DS(on)}=f(I_D); T_j=25\text{ °C}$

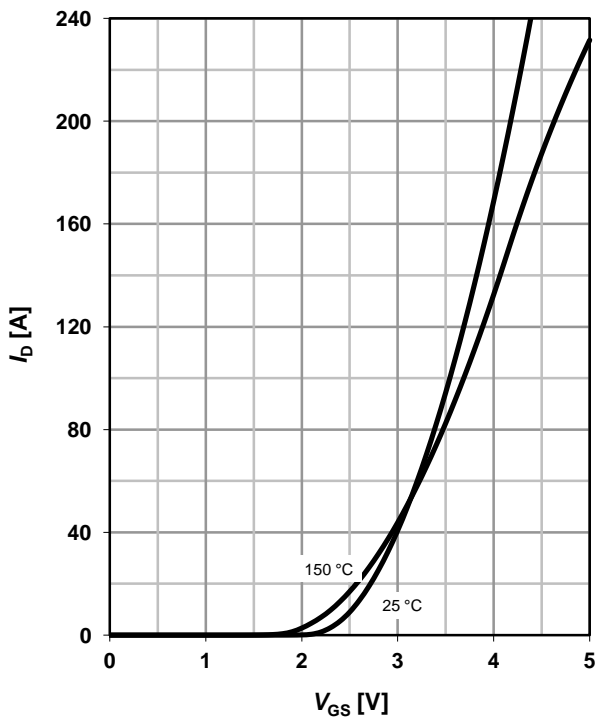
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

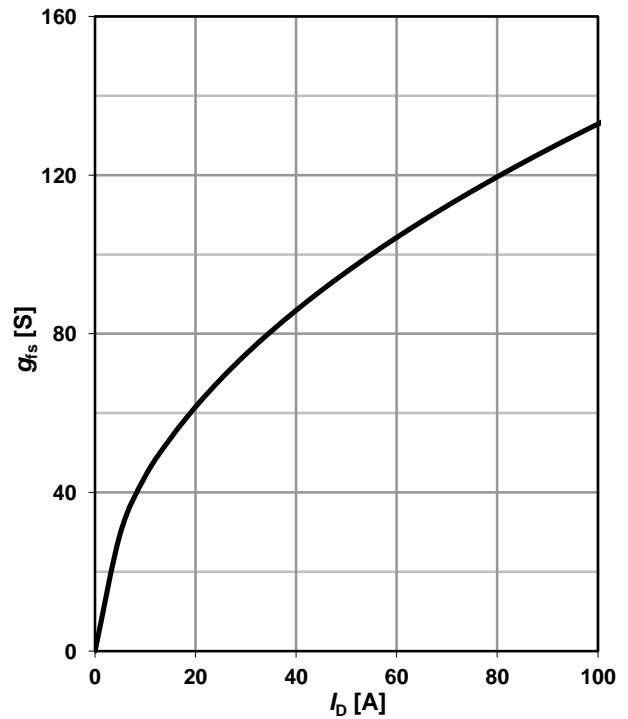
$I_D=f(V_{GS}); |V_{DS}|>2|I_D|R_{DS(on)max}$

parameter:  $T_j$



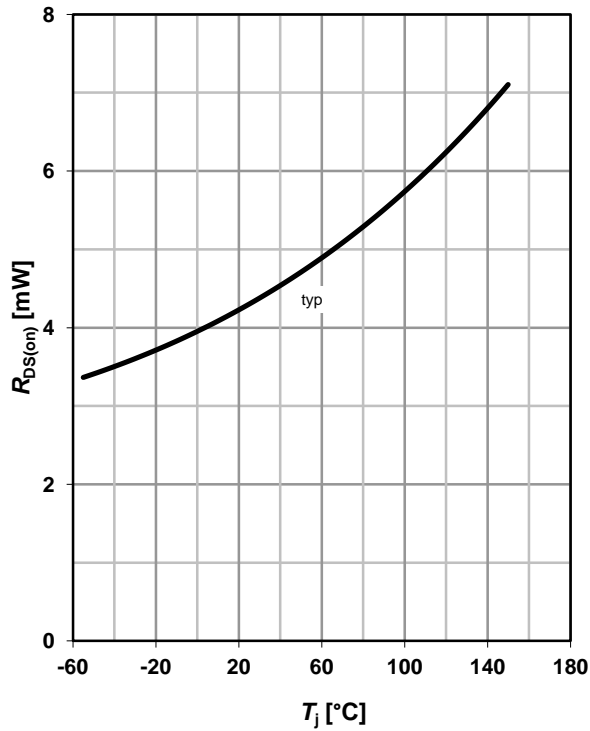
**8 Typ. forward transconductance**

$g_{fs}=f(I_D); T_j=25\text{ °C}$



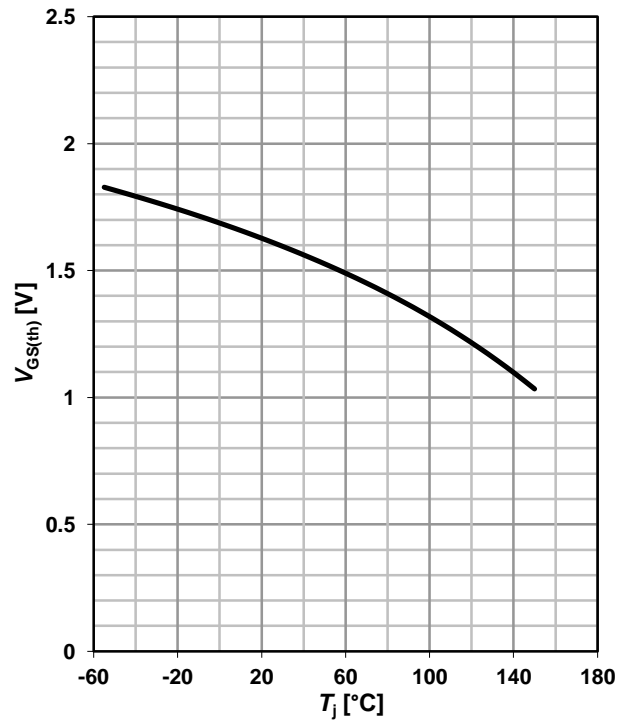
**9 Drain-source on-state resistance**

$R_{DS(on)}=f(T_j); I_D=30\text{ A}; V_{GS}=10\text{ V}$



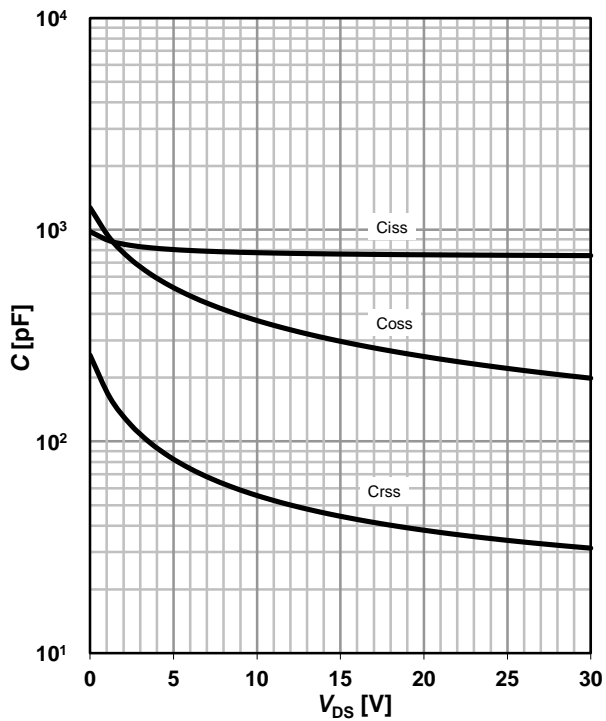
**10 Typ. gate threshold voltage**

$V_{GS(th)}=f(T_j); V_{GS}=V_{DS}; I_D=250\ \mu\text{A}$



**11 Typ. capacitances**

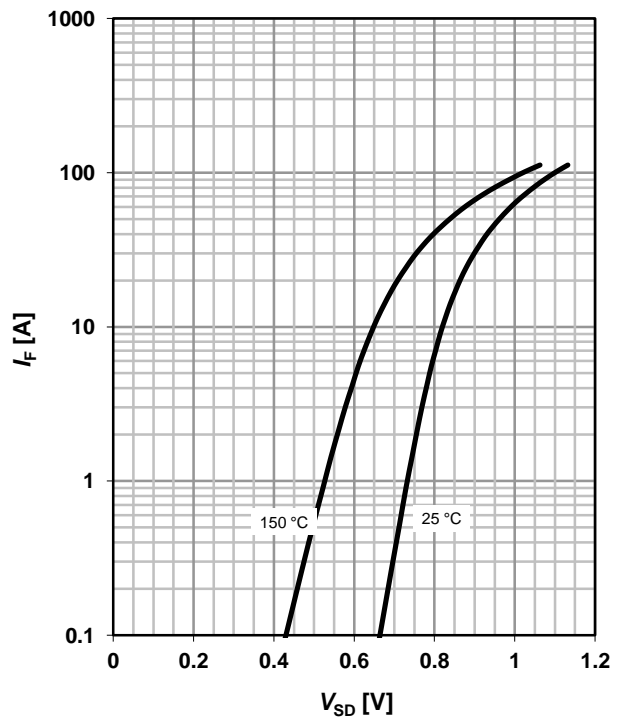
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$



**12 Forward characteristics of reverse diode**

$I_F=f(V_{SD})$

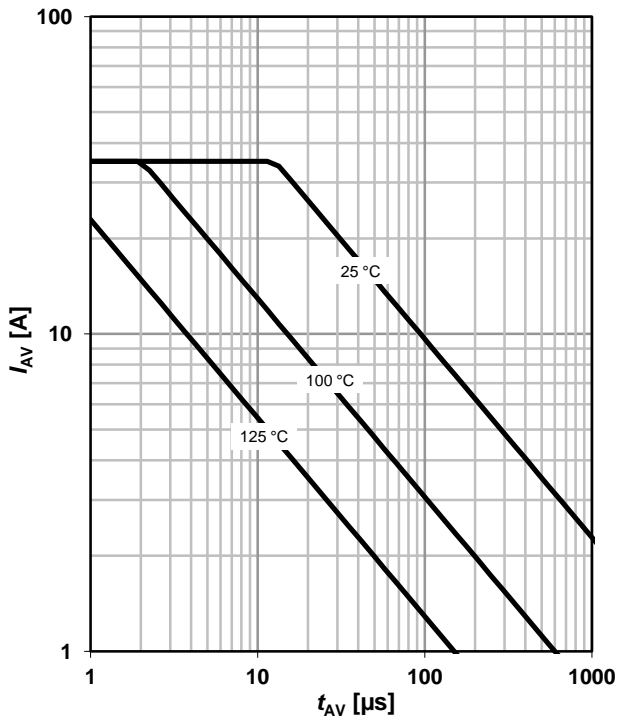
parameter:  $T_j$



**13 Avalanche characteristics**

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

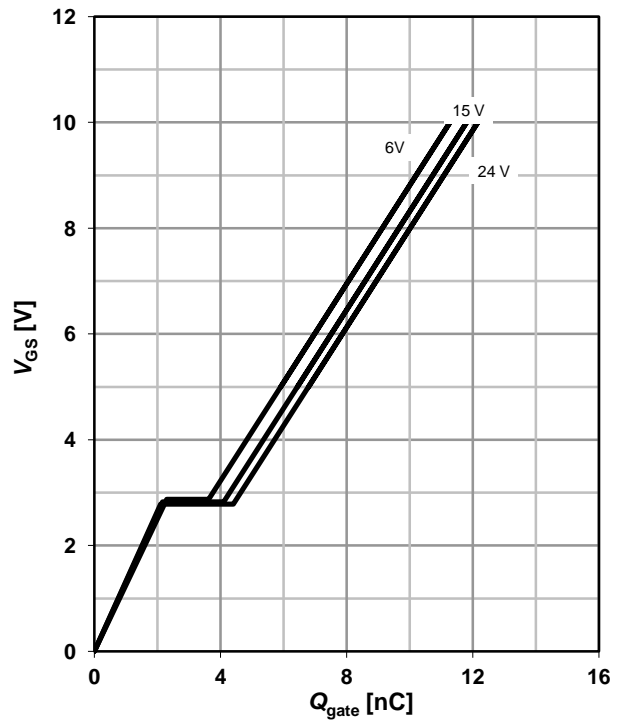
parameter:  $T_{j(\text{start})}$



**14 Typ. gate charge**

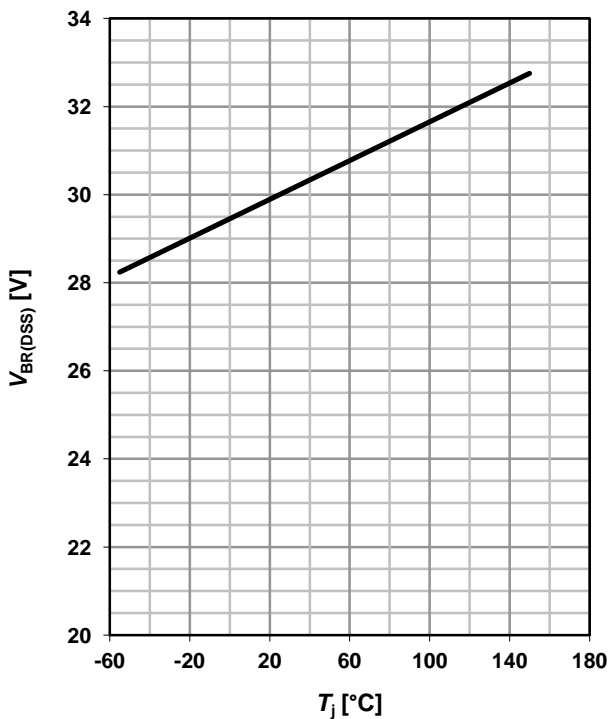
$V_{GS}=f(Q_{\text{gate}}); I_D=30 \text{ A pulsed}$

parameter:  $V_{DD}$

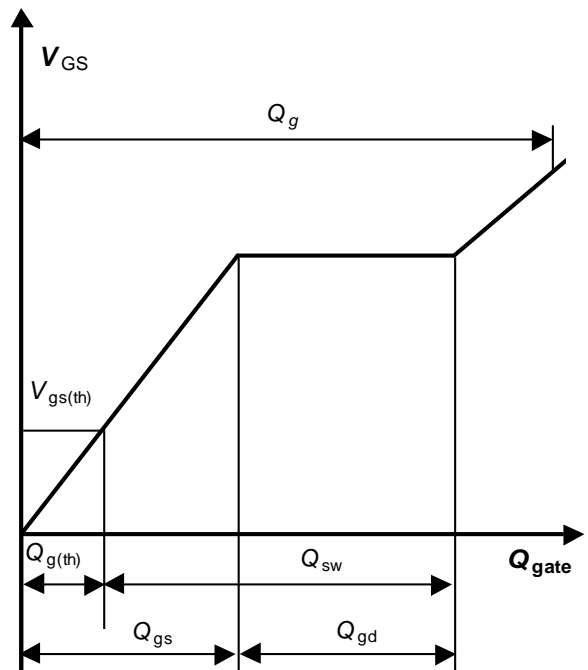


**15 Drain-source breakdown voltage**

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



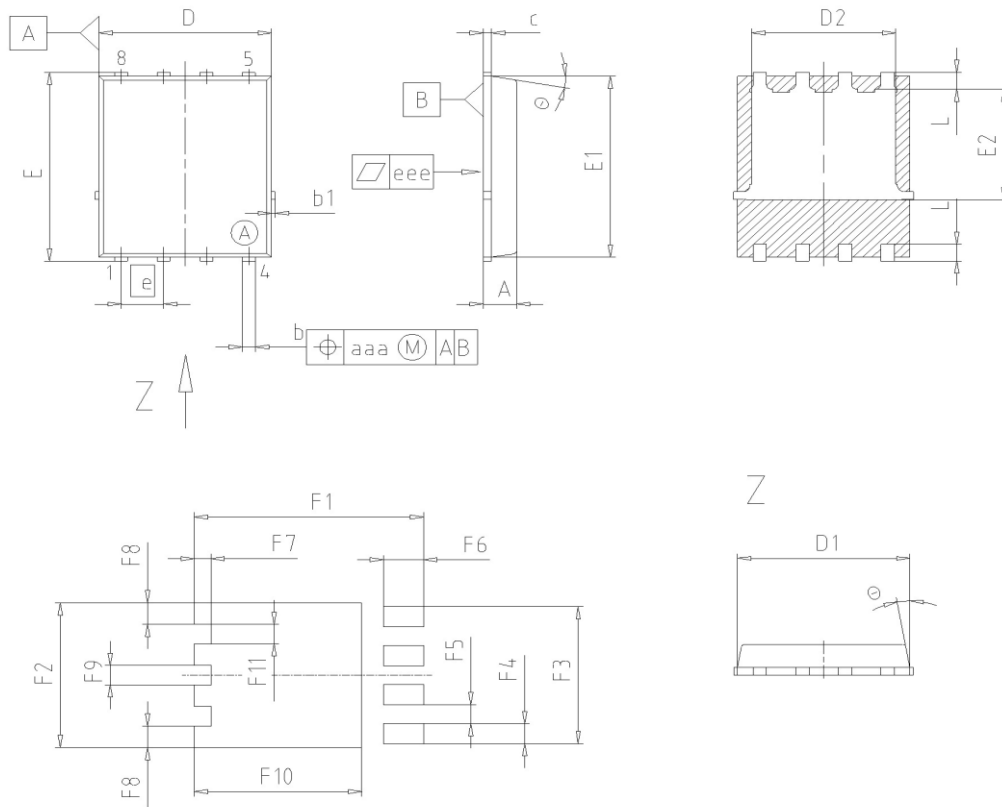
**16 Gate charge waveforms**



Package Outline

PG-TDSON-8

PG-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 |

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