

**SIPMOS® Power-Transistor**
**Features**

- P-Channel
- Enhancement mode
- logic level
- Avalanche rated
- Pb-free lead plating; RoHS compliant
- ° Halogen-free according to IEC61249-2-21
- ° Qualified according to AEC Q101

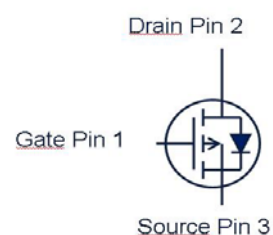
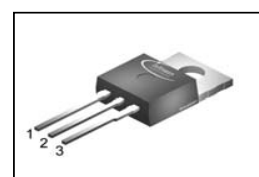


| Type         | Package    | Marking | Lead free | Packing |
|--------------|------------|---------|-----------|---------|
| SPP15P10PL H | PG-TO220-3 | 15P10PL | Yes       | Non dry |

**Product Summary**

|                  |      |          |
|------------------|------|----------|
| $V_{DS}$         | -100 | V        |
| $R_{DS(on),max}$ | 0.20 | $\Omega$ |
| $I_D$            | -15  | A        |

PG-TO220-3


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

| Parameter                           | Symbol         | Conditions                                  | Value           | Unit |
|-------------------------------------|----------------|---------------------------------------------|-----------------|------|
| Continuous drain current            | $I_D$          | $T_C=25\text{ °C}$                          | -15             | A    |
|                                     |                | $T_C=100\text{ °C}$                         | 11.3            |      |
| Pulsed drain current                | $I_{D,pulse}$  | $T_C=25\text{ °C}$                          | -60             |      |
| Avalanche energy, single pulse      | $E_{AS}$       | $I_D=-15\text{ A}, R_{GS}=25\text{ }\Omega$ | 230             | mJ   |
| Gate source voltage                 | $V_{GS}$       |                                             | $\pm 20$        | V    |
| Power dissipation                   | $P_{tot}$      | $T_C=25\text{ °C}$                          | 128             | W    |
| Operating and storage temperature   | $T_j, T_{stg}$ |                                             | -55 ... 175     | °C   |
| ESD Class                           |                |                                             | 1C (1kV to 2kV) |      |
| Soldering temperature               |                |                                             | 260 °C          |      |
| IEC climatic category; DIN IEC 68-1 |                |                                             | 55/175/56       |      |

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

**Thermal characteristics**

|                                                   |            |                                                                |   |   |      |     |
|---------------------------------------------------|------------|----------------------------------------------------------------|---|---|------|-----|
| Thermal resistance,<br>junction - soldering point | $R_{thJC}$ |                                                                | - | - | 1.17 | K/W |
| Thermal resistance,<br>junction - ambient         | $R_{thJA}$ | minimal footprint,<br>steady state                             | - | - | 75   |     |
|                                                   |            | 6 cm <sup>2</sup> cooling area <sup>1)</sup> ,<br>steady state | - | - | 45   |     |

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

|                                  |               |                                                                       |      |      |      |                  |
|----------------------------------|---------------|-----------------------------------------------------------------------|------|------|------|------------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}$ , $I_D=-250\text{ mA}$                            | -100 | -    | -    | V                |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}$ , $I_D=-1.54\text{ mA}$                               | -1   | -1.5 | -2   |                  |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=-100\text{ V}$ , $V_{GS}=0\text{ V}$ ,<br>$T_j=25\text{ °C}$  | -    | -0.1 | -1   | $\mu\text{A}$    |
|                                  |               | $V_{DS}=-100\text{ V}$ , $V_{GS}=0\text{ V}$ ,<br>$T_j=150\text{ °C}$ | -    | -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 | $R_{DS(on)}$  | $V_{GS}=-4.5\text{ V}$ , $I_D=-9.7\text{ A}$                          | -    | 190  | 270  | $\text{m}\Omega$ |
|                                  |               | $V_{GS}=-10\text{ V}$ ,<br>$I_D=-11.3\text{ A}$                       | -    | 140  | 200  | $\text{m}\Omega$ |
| Transconductance                 | $g_{fs}$      | $ V_{DS}  > 2 I_D R_{DS(on)max}$ ,<br>$I_D=-11.3\text{ A}$            | 5.5  | 11.0 | -    | S                |

<sup>1)</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            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=-25\text{ V},$<br>$f=1\text{ MHz}$                    | - | 1120 | 1490 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                  | - | 272  | 362  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                  | - | 120  | 180  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=-50\text{ V}, V_{GS}=-10\text{ V}, I_D=-15\text{ A},$<br>$R_G=6\ \Omega$ | - | 7.6  | 11   | ns |
| Rise time                    | $t_r$        |                                                                                  | - | 21   | 31   |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                  | - | 50   | 75   |    |
| Fall time                    | $t_f$        |                                                                                  | - | 29   | 44   |    |

**Gate Charge Characteristics<sup>2)</sup>**

|                       |               |                                                                               |   |     |     |    |
|-----------------------|---------------|-------------------------------------------------------------------------------|---|-----|-----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=-80\text{ V}, I_D=-15\text{ A},$<br>$V_{GS}=0\text{ to }-10\text{ V}$ | - | 4.3 | 5.7 | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                                               | - | 17  | 26  |    |
| Gate charge total     | $Q_g$         |                                                                               | - | 47  | 62  |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                                               | - | 4.0 | -   | V  |

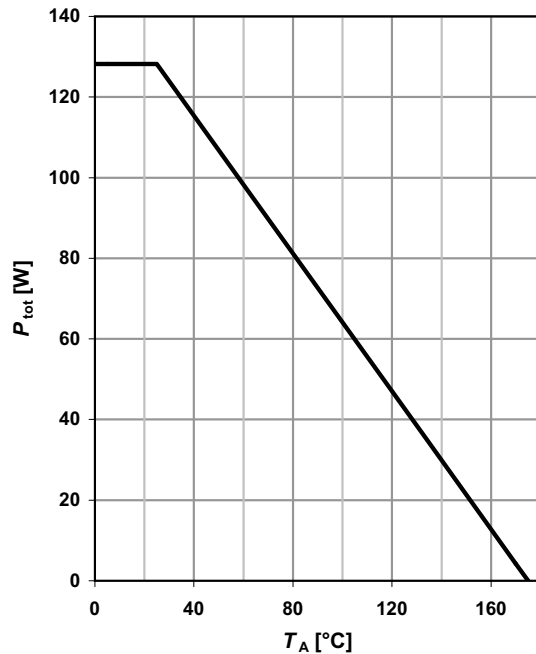
**Reverse Diode**

|                                  |               |                                                                     |   |       |       |    |
|----------------------------------|---------------|---------------------------------------------------------------------|---|-------|-------|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ °C}$                                                  | - | -     | -15   | A  |
| Diode pulse current              | $I_{S,pulse}$ |                                                                     | - | -     | -60   |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=-15\text{ A},$<br>$T_j=25\text{ °C}$        | - | -0.96 | -1.35 | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=50\text{ V}, I_F= I_S ,$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 110   | 165   | ns |
| Reverse recovery charge          | $Q_{rr}$      |                                                                     | - | 450   | 675   | nC |

<sup>2)</sup> See figure 16 for gate charge parameter definition

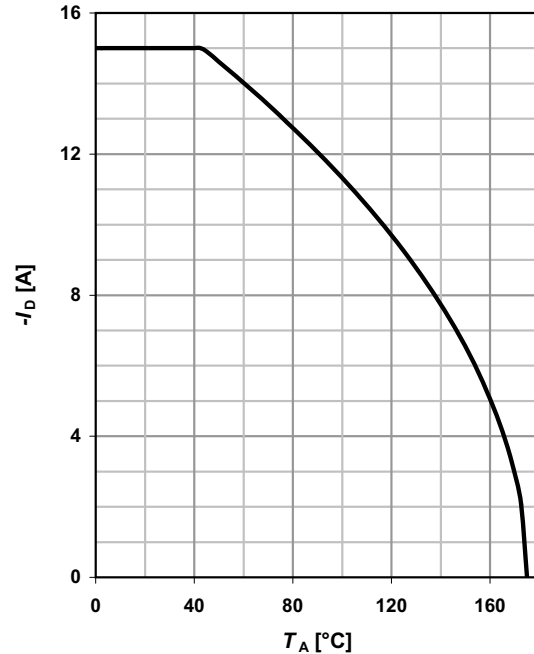
### 1 Power dissipation

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



### 2 Drain current

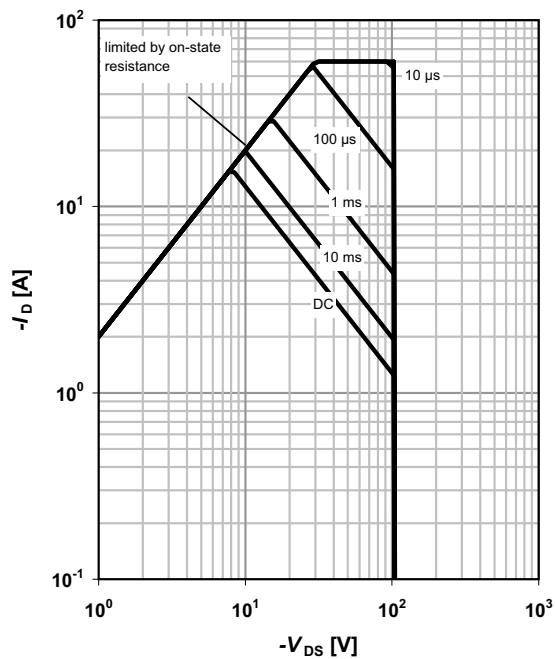
$$I_D = f(T_C); |V_{GS}| \geq 10 \text{ V}$$



### 3 Safe operating area

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

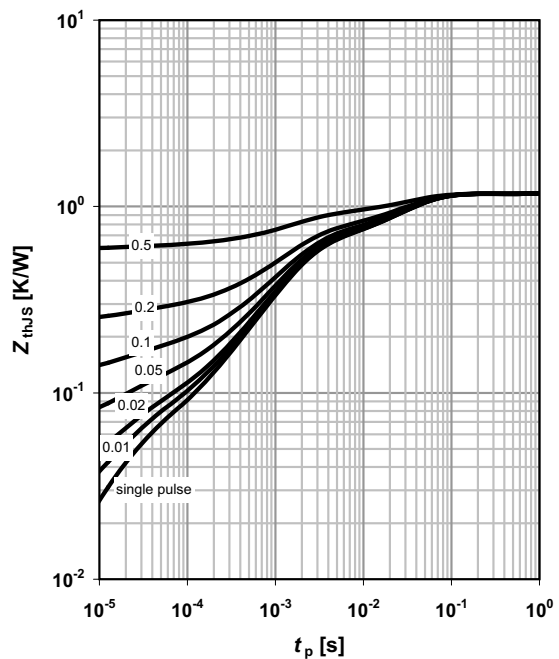
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

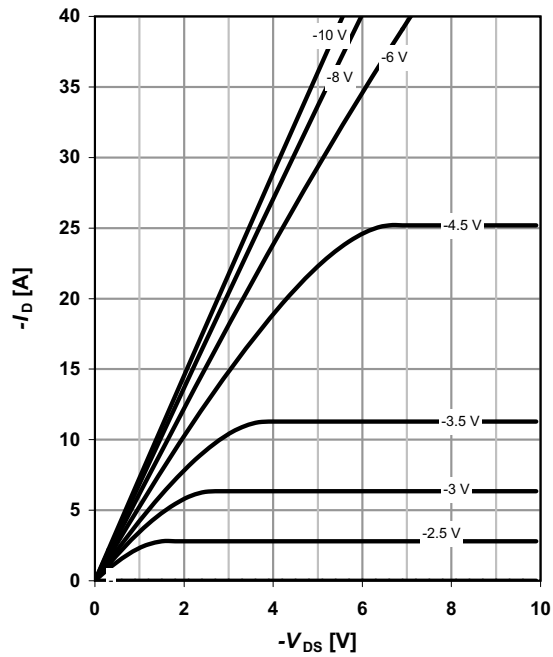
parameter:  $D = t_p/T$



### 5 Typ. output characteristics

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

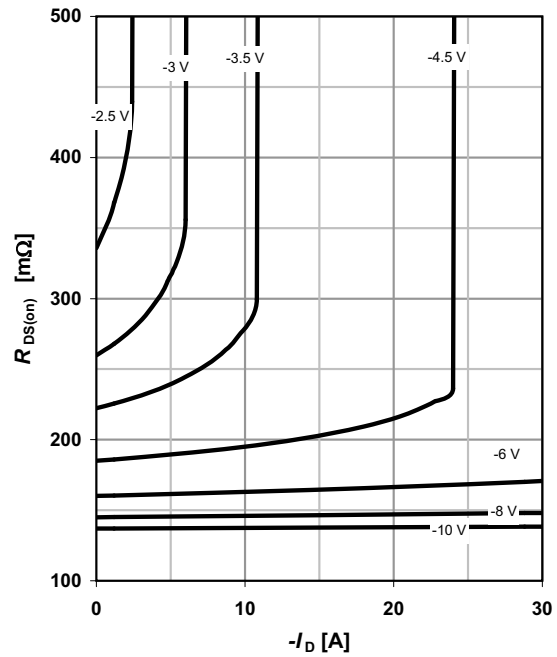
parameter:  $V_{GS}$



### 6 Typ. drain-source on resistance

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

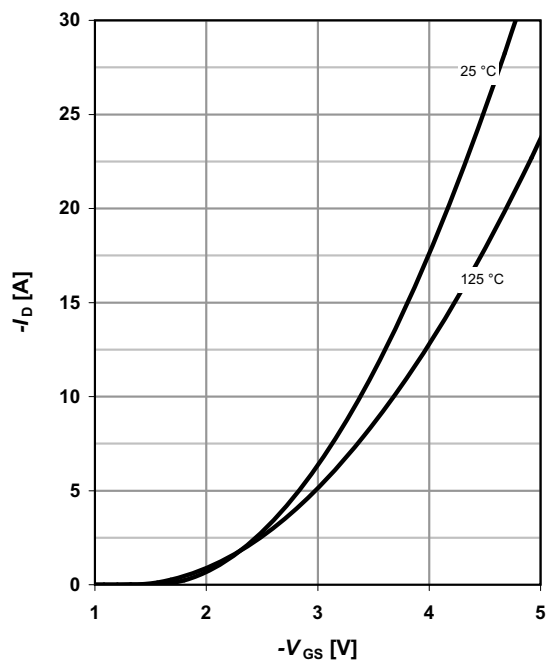
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

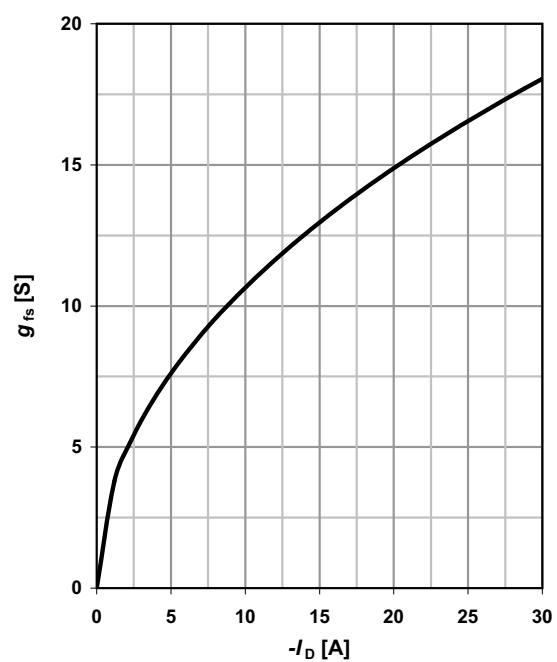
$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$$

parameter:  $T_j$



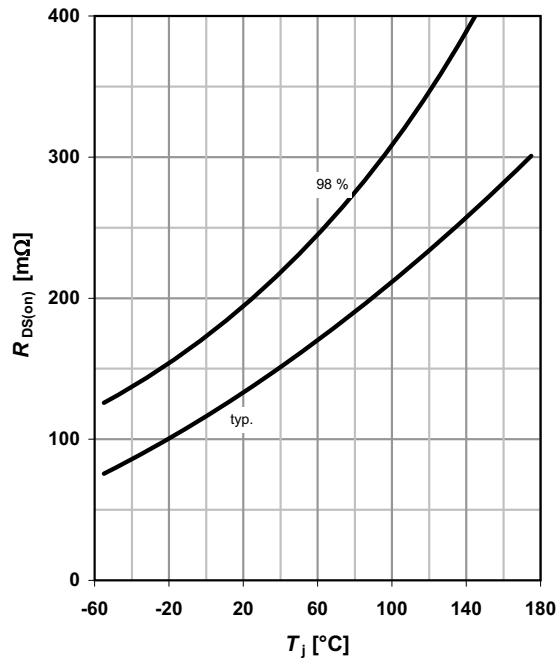
### 8 Typ. forward transconductance

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



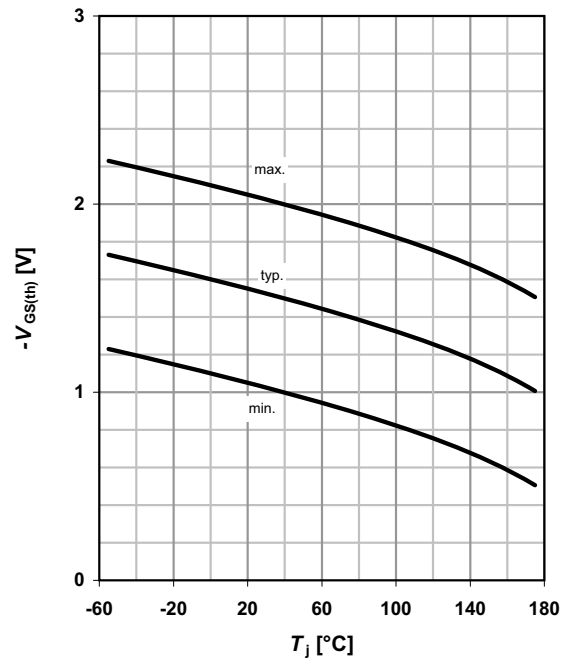
### 9 Drain-source on-state resistance

$$R_{DS(on)} = f(T_j); I_D = -11.3 \text{ A}; V_{GS} = -10 \text{ V}$$



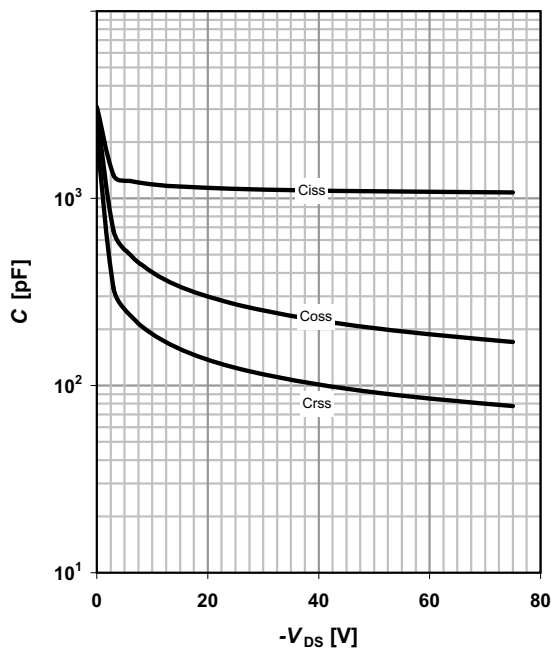
### 10 Typ. gate threshold voltage

$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = -1.54 \text{ mA}$$



### 11 Typ. capacitances

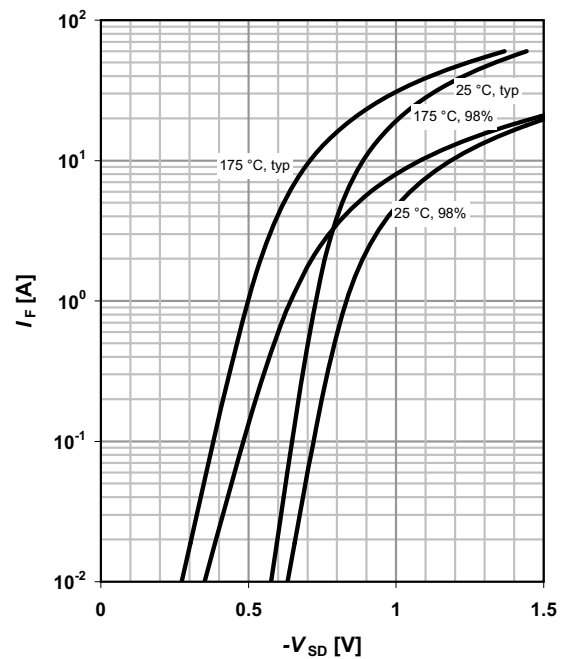
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



### 12 Forward characteristics of reverse diode

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

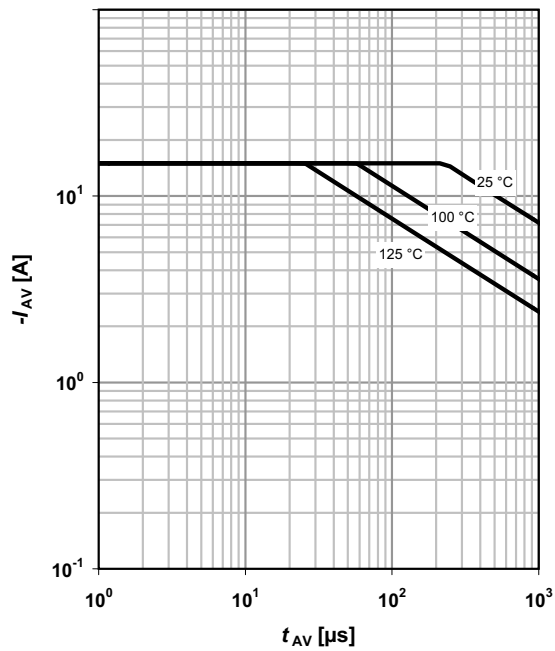
parameter:  $T_j$



### 13 Avalanche characteristics

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

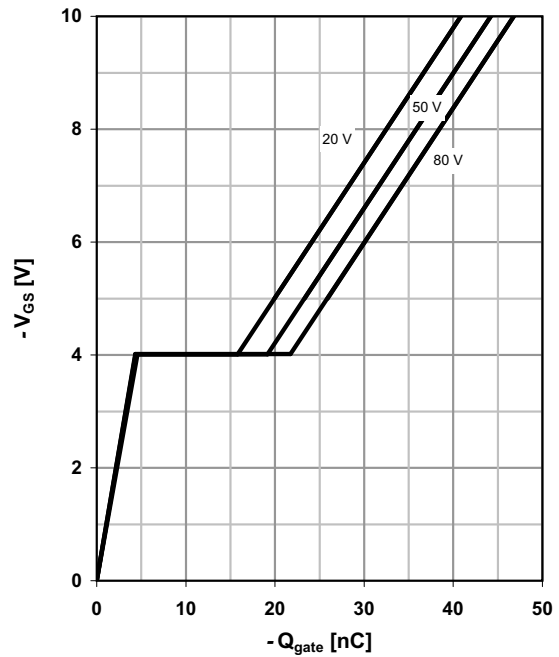
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

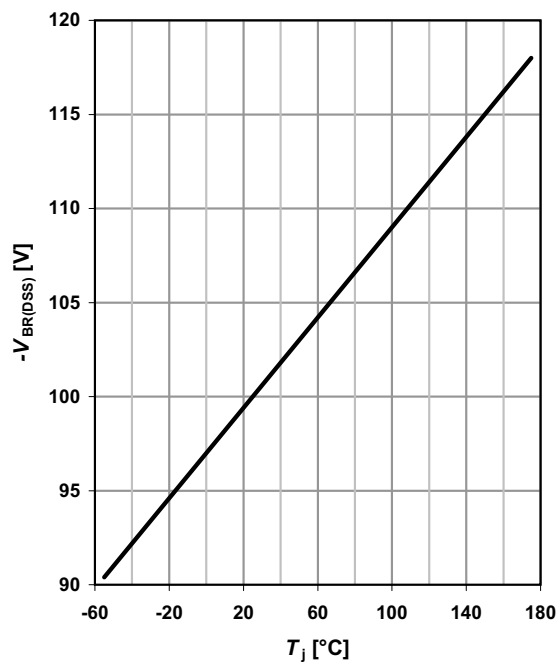
$$V_{GS}=f(Q_{\text{gate}}); I_D=-15\ \text{A pulsed}$$

parameter:  $V_{DD}$

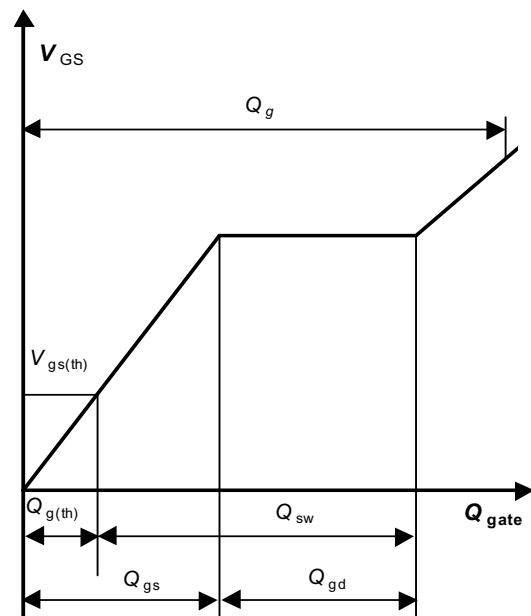


### 15 Drain-source breakdown voltage

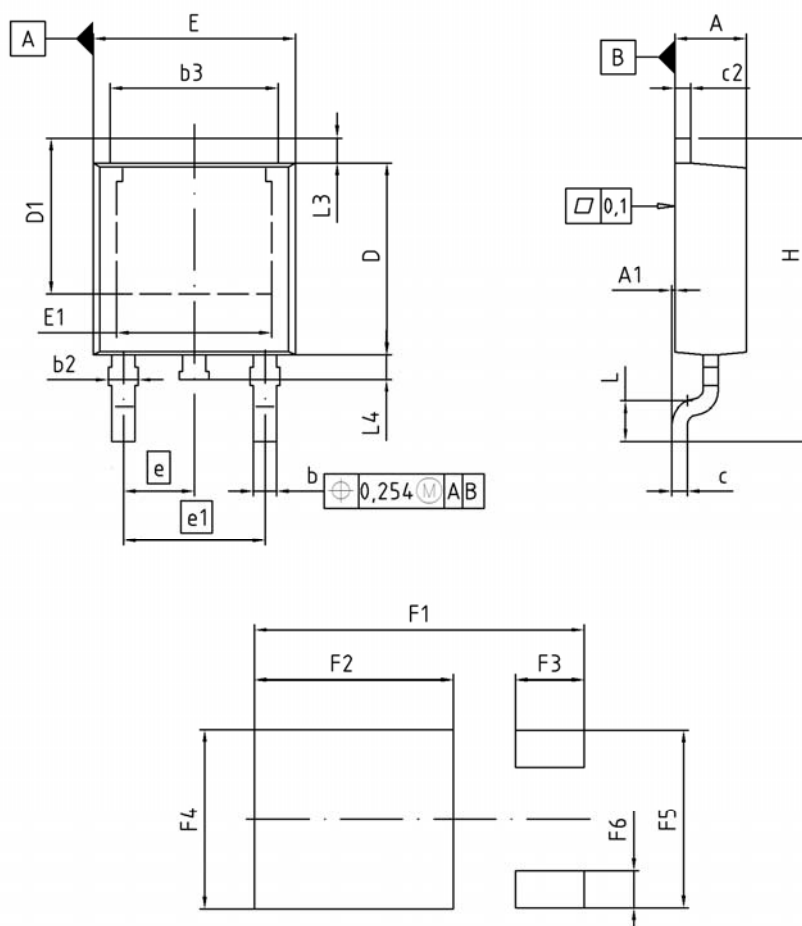
$$V_{BR(DSS)}=f(T_j); I_D=-1\ \text{mA}$$



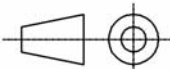
### 16 Gate charge waveforms



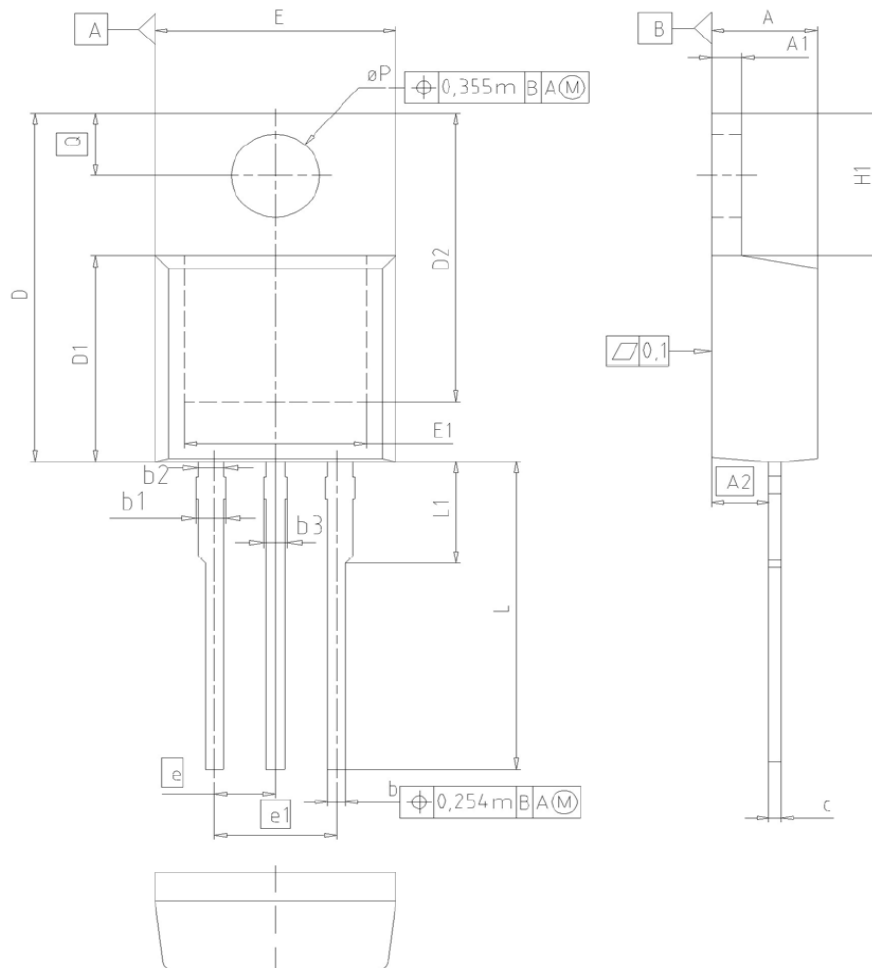
## Package Outline: PG-TO-252-3



| DIM | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN         | MAX   | MIN    | MAX   |
| A   | 2.16        | 2.41  | 0.085  | 0.095 |
| A1  | 0.00        | 0.15  | 0.000  | 0.006 |
| b   | 0.64        | 0.89  | 0.025  | 0.035 |
| b2  | 0.65        | 1.15  | 0.026  | 0.045 |
| b3  | 5.00        | 5.50  | 0.197  | 0.217 |
| c   | 0.46        | 0.60  | 0.018  | 0.024 |
| c2  | 0.46        | 0.98  | 0.018  | 0.039 |
| D   | 5.97        | 6.22  | 0.235  | 0.245 |
| D1  | 5.02        | 5.84  | 0.198  | 0.230 |
| E   | 6.40        | 6.73  | 0.252  | 0.265 |
| E1  | 4.70        | 5.21  | 0.185  | 0.205 |
| e   | 2.29        |       | 0.090  |       |
| e1  | 4.57        |       | 0.180  |       |
| N   | 3           |       | 3      |       |
| H   | 9.40        | 10.48 | 0.370  | 0.413 |
| L   | 1.18        | 1.70  | 0.046  | 0.067 |
| L3  | 0.90        | 1.25  | 0.035  | 0.049 |
| L4  | 0.51        | 1.00  | 0.020  | 0.039 |
| F1  | 10.50       | 10.70 | 0.413  | 0.421 |
| F2  | 6.30        | 6.50  | 0.248  | 0.256 |
| F3  | 2.10        | 2.30  | 0.083  | 0.091 |
| F4  | 5.70        | 5.90  | 0.224  | 0.232 |
| F5  | 5.66        | 5.86  | 0.223  | 0.231 |
| F6  | 1.10        | 1.30  | 0.043  | 0.051 |

|                                                                                                              |
|--------------------------------------------------------------------------------------------------------------|
| DOCUMENT NO.<br>Z8B00003328                                                                                  |
| SCALE<br>0 2.0 4mm                                                                                           |
| EUROPEAN PROJECTION<br> |
| ISSUE DATE<br>19-10-2007                                                                                     |
| REVISION<br>03                                                                                               |



**PG-TO220-3: Outline**


| DIM      | MILLIMETERS |       | INCHES |       |
|----------|-------------|-------|--------|-------|
|          | MIN         | MAX   | MIN    | MAX   |
| A        | 4.30        | 4.57  | 0.169  | 0.180 |
| A1       | 1.17        | 1.40  | 0.046  | 0.055 |
| A2       | 2.15        | 2.72  | 0.085  | 0.107 |
| b        | 0.65        | 0.86  | 0.026  | 0.034 |
| b1       | 0.95        | 1.40  | 0.037  | 0.055 |
| b2       | 0.95        | 1.15  | 0.037  | 0.045 |
| b3       | 0.65        | 1.15  | 0.026  | 0.045 |
| c        | 0.33        | 0.60  | 0.013  | 0.024 |
| D        | 14.81       | 15.95 | 0.583  | 0.628 |
| D1       | 8.51        | 9.45  | 0.335  | 0.372 |
| D2       | 12.19       | 13.10 | 0.480  | 0.516 |
| E        | 9.70        | 10.36 | 0.382  | 0.408 |
| E1       | 6.50        | 8.60  | 0.256  | 0.339 |
| e        | 2.54        |       | 0.100  |       |
| e1       | 5.08        |       | 0.200  |       |
| N        | 3           |       | 3      |       |
| H1       | 5.90        | 6.90  | 0.232  | 0.272 |
| L        | 13.00       | 14.00 | 0.512  | 0.551 |
| L1       | -           | 4.80  | -      | 0.189 |
| $\phi P$ | 3.60        | 3.89  | 0.142  | 0.153 |
| Q        | 2.60        | 3.00  | 0.102  | 0.118 |

|                                    |
|------------------------------------|
| <b>DOCUMENT NO.</b><br>Z8B00003318 |
| <b>SCALE</b><br>0 2.5 5mm          |
| <b>EUROPEAN PROJECTION</b>         |
| <b>ISSUE DATE</b><br>23-08-2007    |
| <b>REVISION</b><br>05              |

**Published by**  
**Infineon Technologies AG**  
**81726 Munich, Germany**  
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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А