

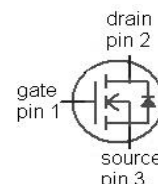
## OptiMOS™ 3 Power-Transistor

### Features

- N-channel, normal level
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC<sup>1)</sup> for target application
- Ideal for high-frequency switching and synchronous rectification
- Halogen-free according to IEC61249-2-21

### Product Summary

|                           |     |    |
|---------------------------|-----|----|
| $V_{DS}$                  | 100 | V  |
| $R_{DS(on),max}$ (TO 252) | 8.2 | mΩ |
| $I_D$                     | 80  | A  |



| Type    | IPP086N10N3 G                                                                      | IPI086N10N3 G                                                                      | IPB083N10N3 G                                                                       | IPD082N10N3 G                                                                        |
|---------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|         |  |  |  |  |
| Package | PG-TO220-3                                                                         | PG-TO262-3                                                                         | PG-TO263-3                                                                          | PG-TO252-3                                                                           |
| Marking | 086N10N                                                                            | 086N10N                                                                            | 083N10N                                                                             | 082N10N                                                                              |

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

| Parameter                           | Symbol            | Conditions                               | Value       | Unit |
|-------------------------------------|-------------------|------------------------------------------|-------------|------|
| Continuous drain current            | $I_D$             | $T_C=25\text{ °C}^{2)}$                  | 80          | A    |
|                                     |                   | $T_C=100\text{ °C}$                      | 58          |      |
| Pulsed drain current <sup>2)</sup>  | $I_{D,pulse}$     | $T_C=25\text{ °C}$                       | 320         |      |
| Avalanche energy, single pulse      | $E_{AS}$          | $I_D=73\text{ A}$ , $R_{GS}=25\text{ Ω}$ | 110         | mJ   |
| Gate source voltage                 | $V_{GS}$          |                                          | ±20         | V    |
| Power dissipation                   | $P_{tot}$         | $T_C=25\text{ °C}$                       | 125         | W    |
| Operating and storage temperature   | $T_j$ , $T_{stg}$ |                                          | -55 ... 175 | °C   |
| IEC climatic category; DIN IEC 68-1 |                   |                                          | 55/175/56   |      |

<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       | $R_{thJC}$ |                                              | - | - | 1.2 | K/W |
| Thermal resistance,<br>junction - ambient | $R_{thJA}$ | minimal footprint                            | - | - | 62  |     |
|                                           |            | 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   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$                                      | 100 | -   | -    | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=75\text{ }\mu\text{A}$                                | 2   | 2.7 | 3.5  |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=100\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^{\circ}\text{C}$  | -   | 0.1 | 1    | $\mu\text{A}$ |
|                                  |               | $V_{DS}=100\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ }^{\circ}\text{C}$ | -   | 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 | $R_{DS(on)}$  | $V_{GS}=10\text{ V}, I_D=73\text{ A}, \text{TO } 220, \text{TO } 262$     | -   | 7.4 | 8.6  | m $\Omega$    |
|                                  |               | $V_{GS}=10\text{ V}, I_D=73\text{ A}, \text{TO } 263$                     | -   | 7.2 | 8.3  |               |
|                                  |               | $V_{GS}=10\text{ V}, I_D=73\text{ A}, \text{TO } 252$                     | -   | 7   | 8.2  |               |
|                                  |               | $V_{GS}=6\text{ V}, I_D=36\text{ A}, \text{TO } 220, \text{TO } 262$      | -   | 9.3 | 15.4 |               |
|                                  |               | $V_{GS}=6\text{ V}, I_D=36\text{ A}, \text{TO } 263$                      | -   | 9.0 | 15.1 |               |
|                                  |               | $V_{GS}=6\text{ V}, I_D=36\text{ A}, \text{TO } 252$                      | -   | 8.9 | 15   |               |
| Gate resistance                  | $R_G$         |                                                                           | -   | 1   | -    | $\Omega$      |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=80\text{ A}$                           | 45  | 89  | -    | 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            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=50\text{ V},$<br>$f=1\text{ MHz}$                          | - | 2990 | 3980 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                       | - | 523  | 696  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                       | - | 21   | -    |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=50\text{ V}, V_{GS}=10\text{ V},$<br>$I_D=73\text{ A}, R_{G,ext}=1.6\ \Omega$ | - | 18   | -    | ns |
| Rise time                    | $t_r$        |                                                                                       | - | 42   | -    |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                       | - | 31   | -    |    |
| Fall time                    | $t_f$        |                                                                                       | - | 8    | -    |    |

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

|                       |               |                                                                            |   |     |    |    |
|-----------------------|---------------|----------------------------------------------------------------------------|---|-----|----|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD}=50\text{ V}, I_D=73\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 15  | -  | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                                            | - | 8   | -  |    |
| Switching charge      | $Q_{sw}$      |                                                                            | - | 14  | -  |    |
| Gate charge total     | $Q_g$         |                                                                            | - | 42  | 55 |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                                            | - | 4.9 | -  |    |
| Output charge         | $Q_{oss}$     | $V_{DD}=50\text{ V}, V_{GS}=0\text{ V}$                                    | - | 55  | 73 | nC |

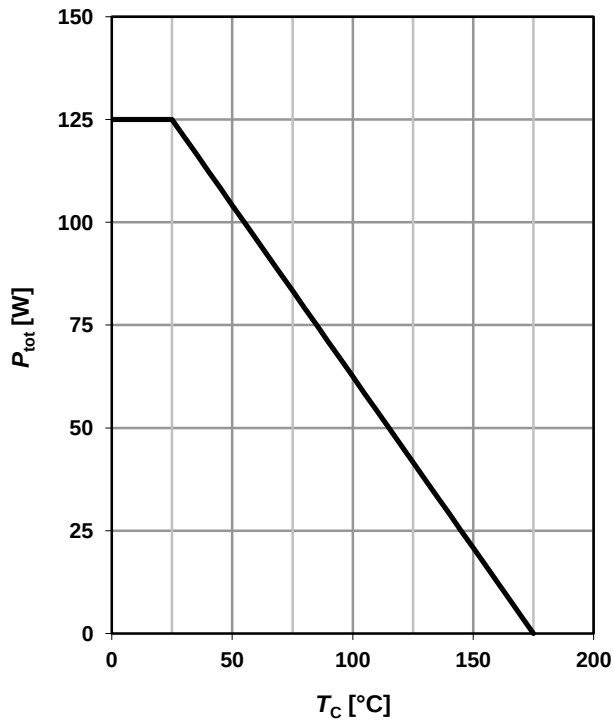
#### Reverse Diode

|                                  |               |                                                                           |   |     |     |    |
|----------------------------------|---------------|---------------------------------------------------------------------------|---|-----|-----|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ °C}$                                                        | - | -   | 80  | A  |
| Diode pulse current              | $I_{S,pulse}$ |                                                                           | - | -   | 320 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=80\text{ A},$<br>$T_J=25\text{ °C}$               | - | 1.0 | 1.2 | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=50\text{ V}, I_F=73\text{ A},$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 71  | -   | ns |
| Reverse recovery charge          | $Q_{rr}$      |                                                                           | - | 123 | -   | nC |

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

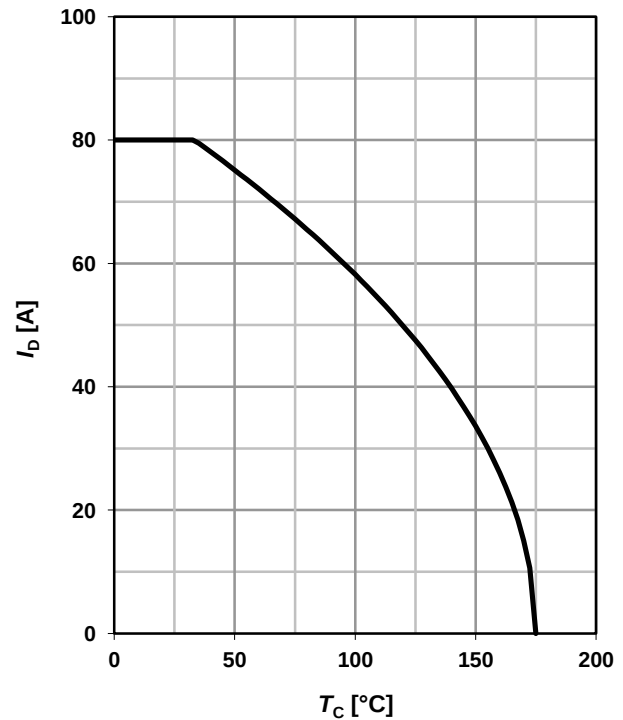
### 1 Power dissipation

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



### 2 Drain current

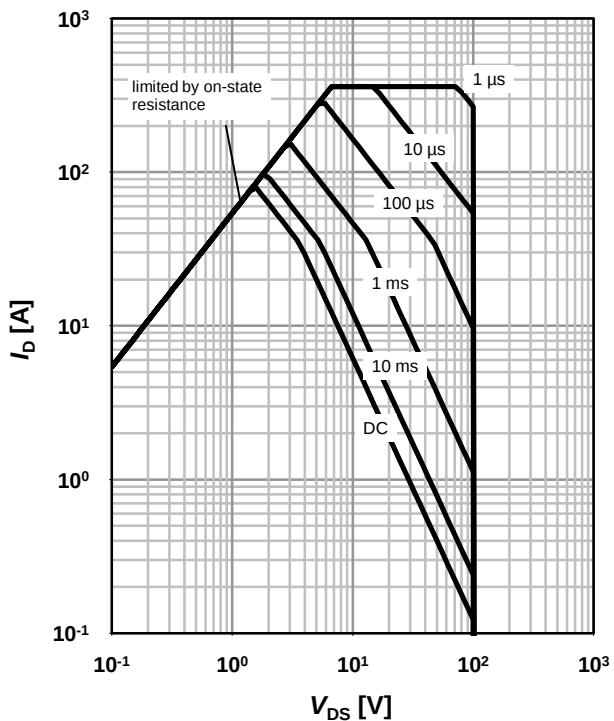
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



### 3 Safe operating area

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

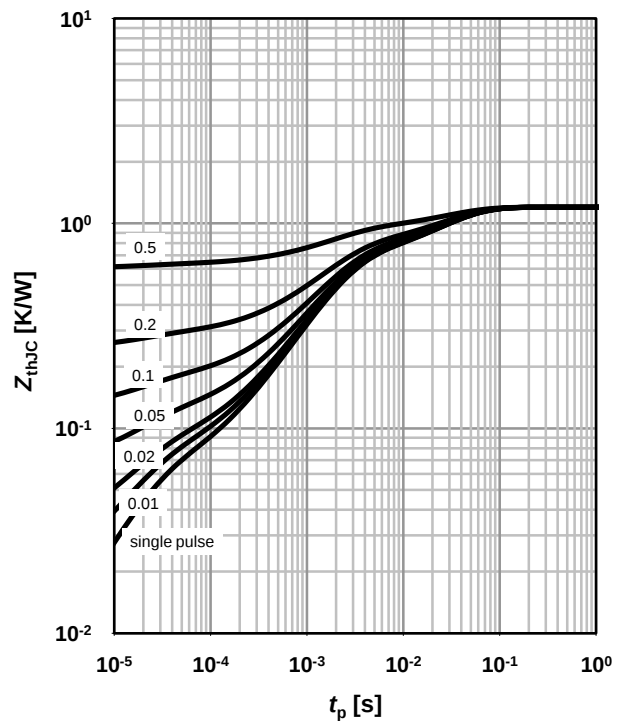
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

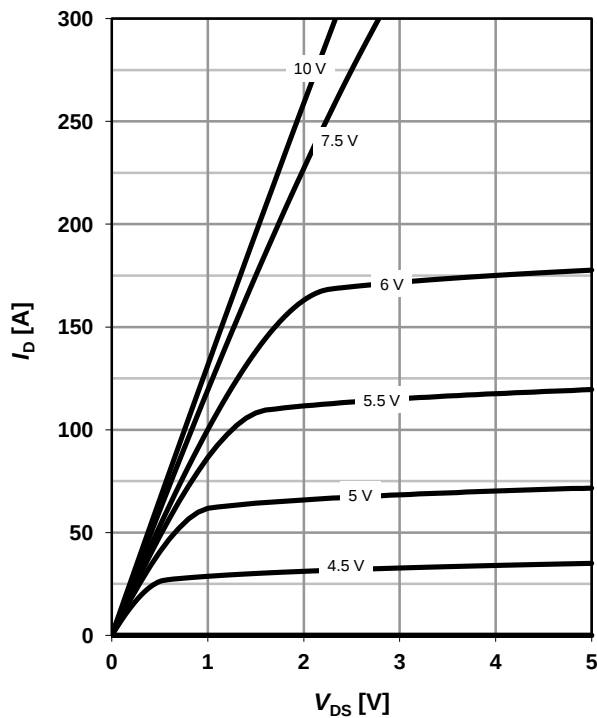
parameter:  $D = t_p/T$



## 5 Typ. output characteristics

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

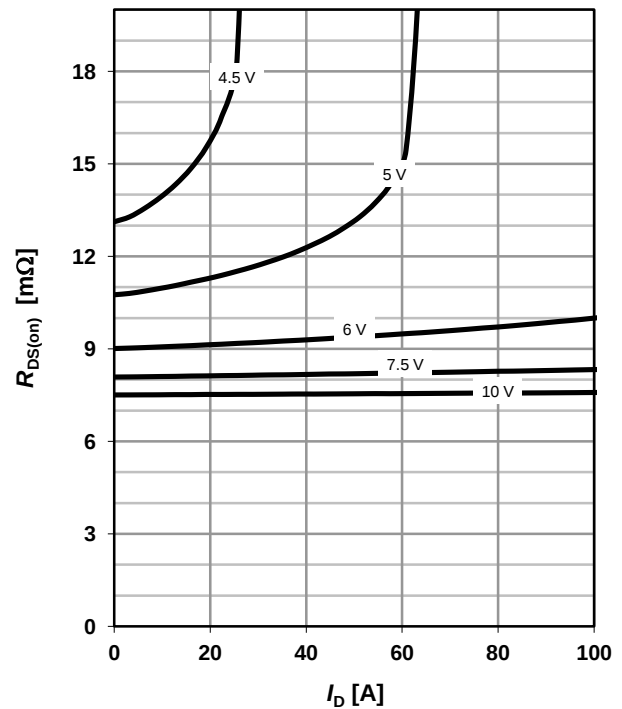
parameter:  $V_{GS}$



## 6 Typ. drain-source on resistance

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

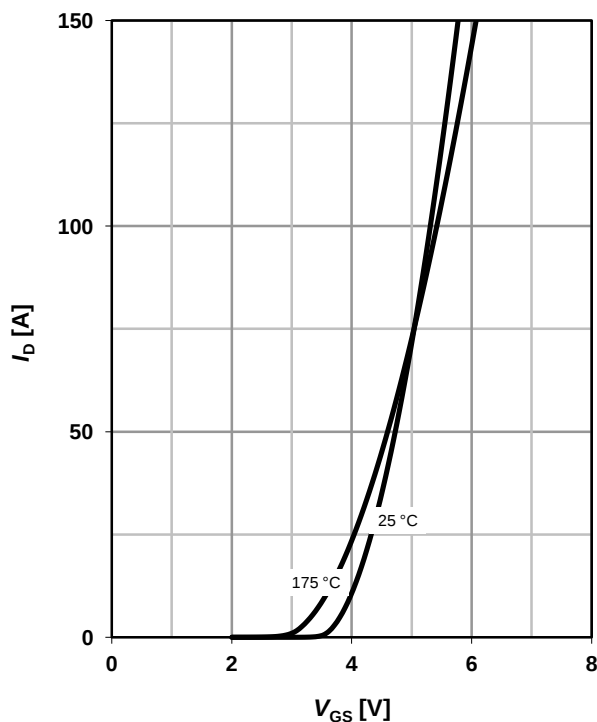
parameter:  $V_{GS}$



## 7 Typ. transfer characteristics

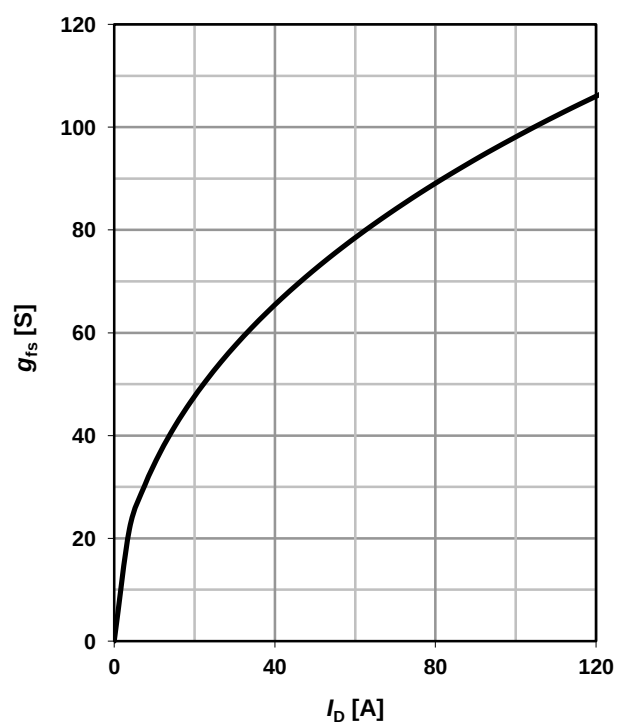
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter:  $T_j$



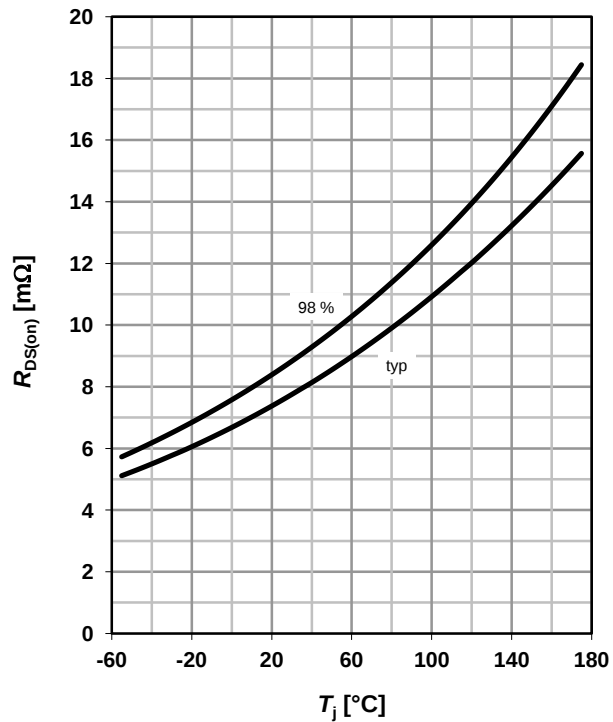
## 8 Typ. forward transconductance

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



## 9 Drain-source on-state resistance

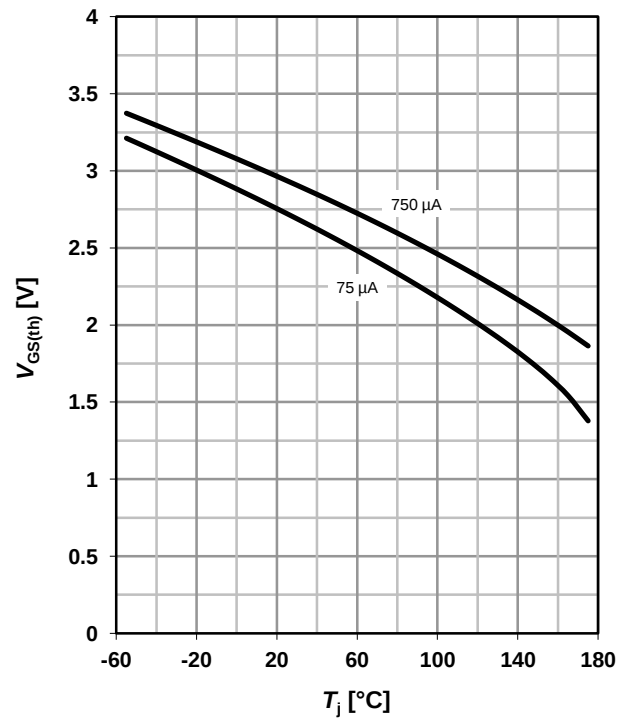
$R_{DS(on)} = f(T_j)$ ;  $I_D = 73 \text{ A}$ ;  $V_{GS} = 10 \text{ V}$ ; TO 220



## 10 Typ. gate threshold voltage

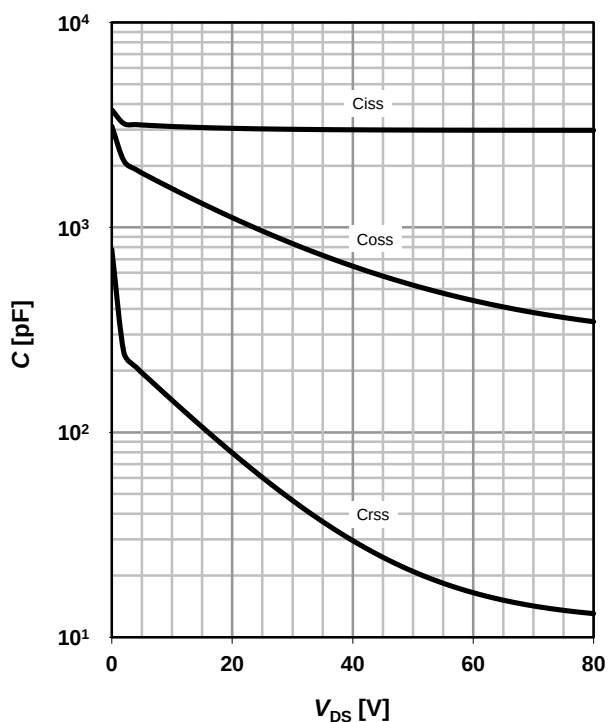
$V_{GS(th)} = f(T_j)$ ;  $V_{GS} = V_{DS}$

parameter:  $I_D$



## 11 Typ. capacitances

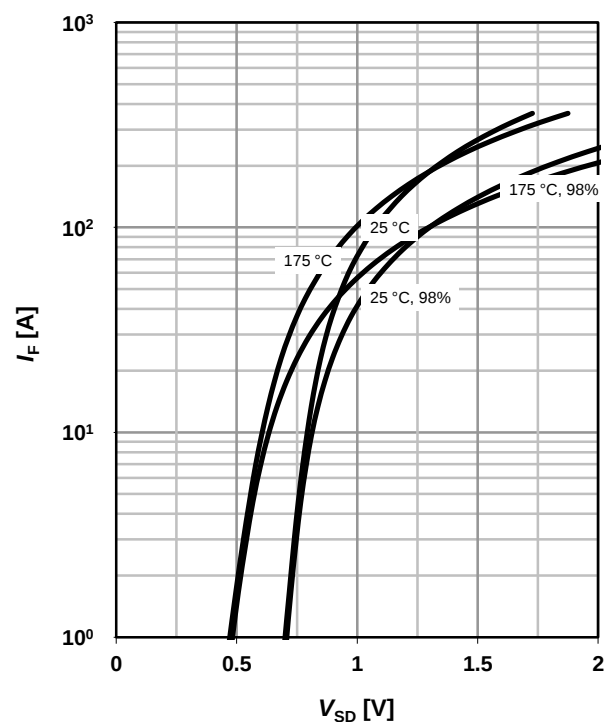
$C = f(V_{DS})$ ;  $V_{GS} = 0 \text{ V}$ ;  $f = 1 \text{ MHz}$



## 12 Forward characteristics of reverse diode

$I_F = f(V_{SD})$

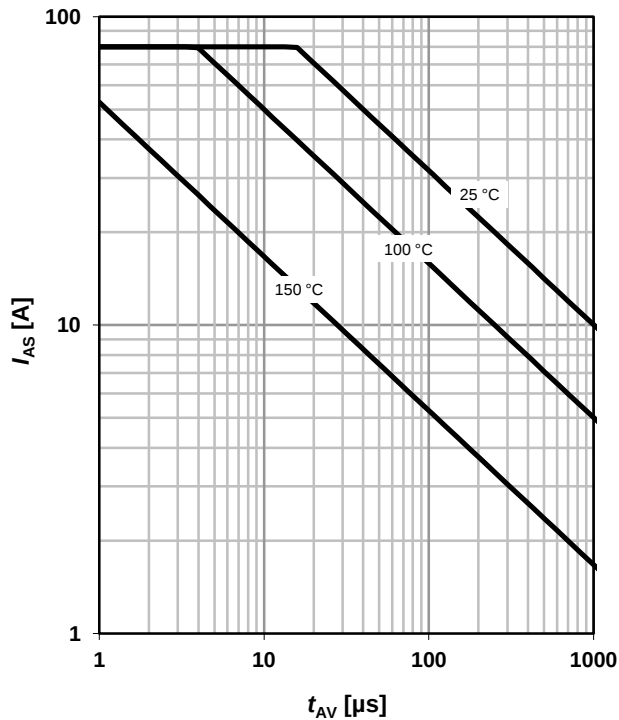
parameter:  $T_j$



### 13 Avalanche characteristics

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

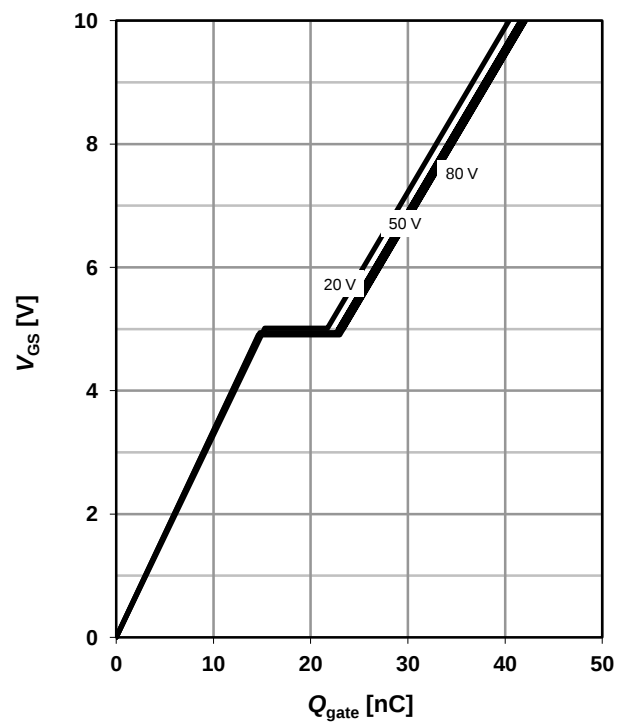
parameter:  $T_{j(start)}$



### 14 Typ. gate charge

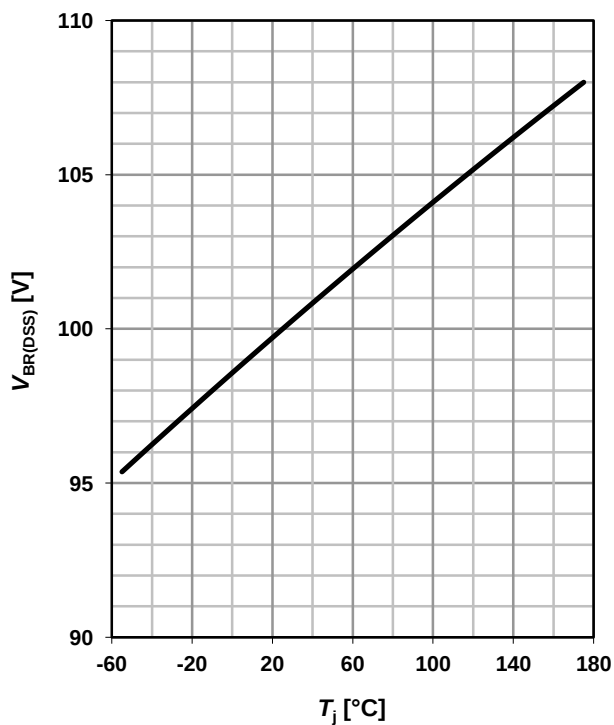
$V_{GS}=f(Q_{gate}); I_D=73\text{ A pulsed}$

parameter:  $V_{DD}$

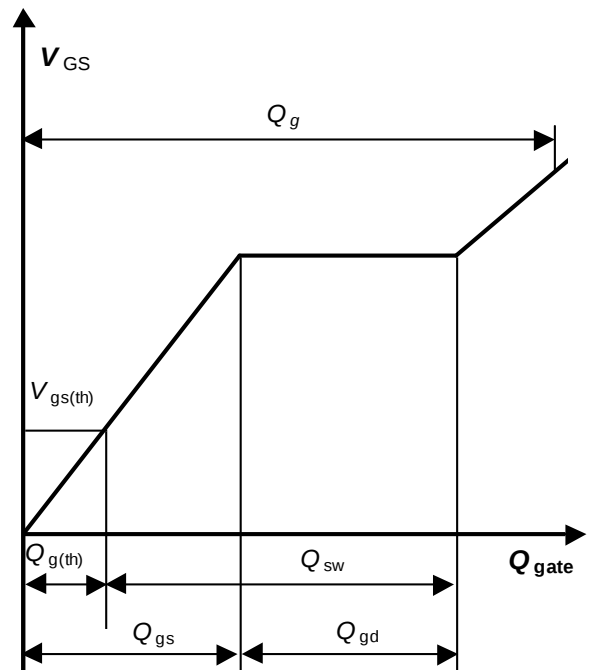


### 15 Drain-source breakdown voltage

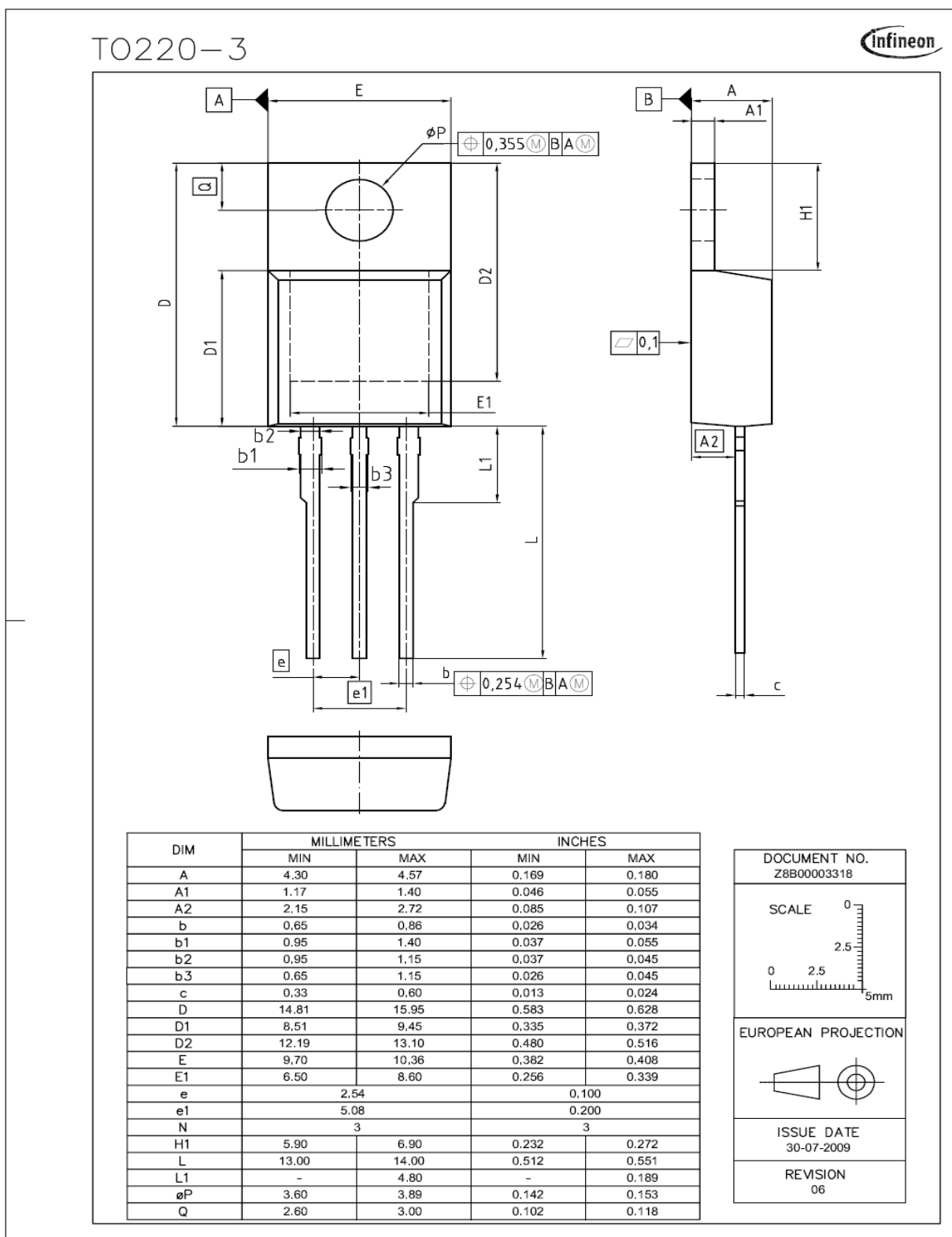
$V_{BR(DSS)}=f(T_j); I_D=1\text{ mA}$



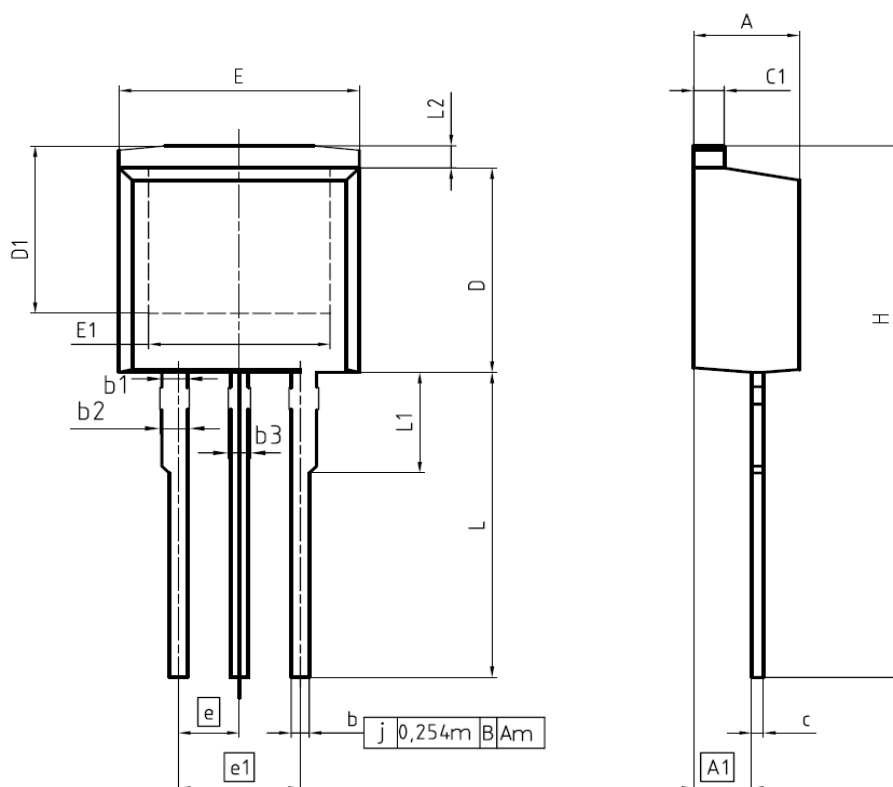
### 16 Gate charge waveforms



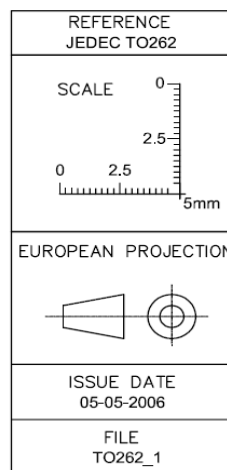
PG-TO220-3: Outline



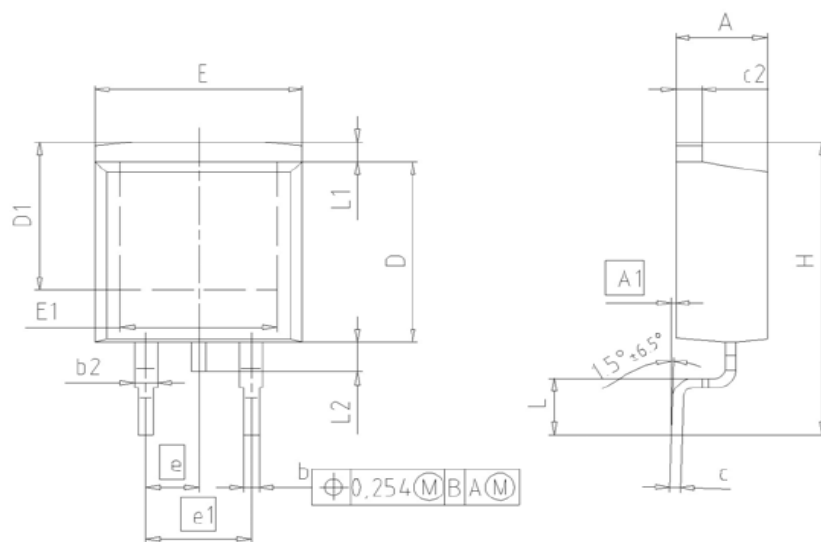
PG-TO262-3



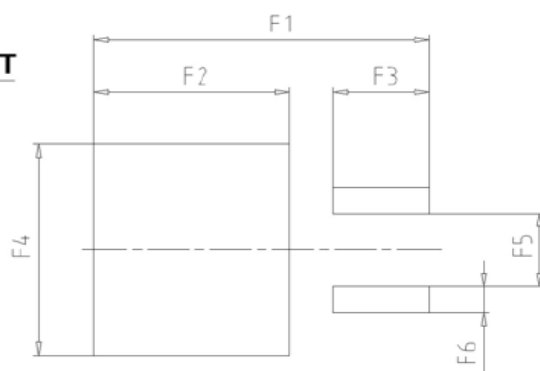
| DIM | MILLIMETERS |        | INCHES |       |
|-----|-------------|--------|--------|-------|
|     | MIN         | MAX    | MIN    | MAX   |
| A   | 4.300       | 4.572  | 0.169  | 0.180 |
| A1  | 2.150       | 2.718  | 0.085  | 0.107 |
| b   | 0.650       | 0.864  | 0.026  | 0.034 |
| b1  | 0.950       | 1.093  | 0.037  | 0.043 |
| b2  | 0.950       | 1.400  | 0.037  | 0.055 |
| b3  | 0.650       | 1.118  | 0.026  | 0.044 |
| c   | 0.330       | 0.600  | 0.013  | 0.024 |
| c1  | 1.170       | 1.400  | 0.046  | 0.055 |
| D   | 8.509       | 9.450  | 0.335  | 0.372 |
| D1  | 6.900       | -      | 0.272  | -     |
| E   | 9.700       | 10.363 | 0.382  | 0.408 |
| E1  | 6.500       | 8.600  | 0.256  | 0.339 |
| e   | 2.540       |        | 0.100  |       |
| e1  | 5.080       |        | 0.200  |       |
| N   | 3           |        | 3      |       |
| L   | 13.000      | 14.000 | 0.512  | 0.551 |
| L1  | -           | 4.800  | -      | 0.189 |
| L2  | -           | 1.727  | -      | 0.068 |



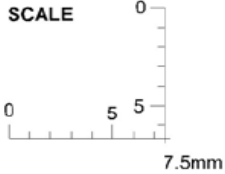
# PG-TO-263 (D<sup>2</sup>-Pak)



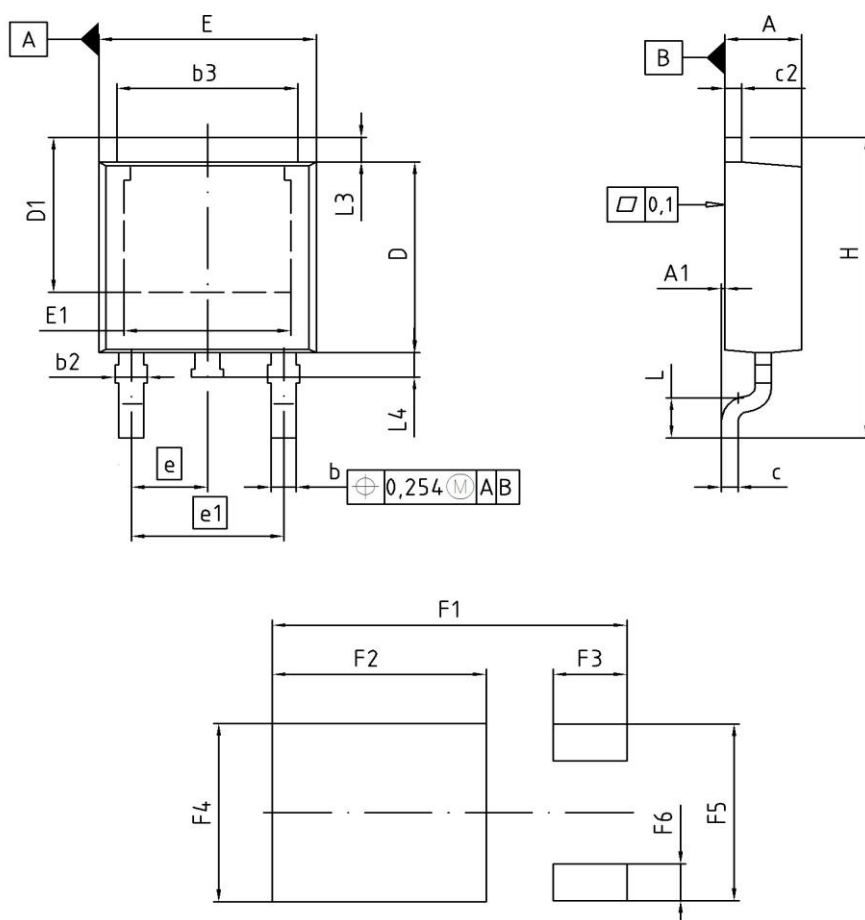
## FOOTPRINT



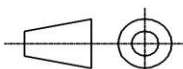
| DIM | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN         | MAX   | MIN    | MAX   |
| A   | 4.30        | 4.57  | 0.169  | 0.180 |
| A1  | 0.00        | 0.25  | 0.000  | 0.010 |
| b   | 0.65        | 0.85  | 0.026  | 0.033 |
| b2  | 0.95        | 1.15  | 0.037  | 0.045 |
| c   | 0.33        | 0.65  | 0.013  | 0.026 |
| c2  | 1.17        | 1.40  | 0.046  | 0.055 |
| D   | 8.51        | 9.45  | 0.335  | 0.372 |
| D1  | 7.10        | 7.90  | 0.280  | 0.311 |
| E   | 9.80        | 10.31 | 0.388  | 0.406 |
| E1  | 6.50        | 8.60  | 0.256  | 0.339 |
| e   | 2.54        |       | 0.100  |       |
| e1  | 5.08        |       | 0.200  |       |
| N   | 2           |       | 2      |       |
| H   | 14.61       | 15.88 | 0.575  | 0.625 |
| L   | 2.29        | 3.00  | 0.090  | 0.118 |
| L1  | 0.70        | 1.60  | 0.028  | 0.063 |
| L2  | 1.00        | 1.78  | 0.039  | 0.070 |
| F1  | 16.05       | 16.25 | 0.632  | 0.640 |
| F2  | 9.30        | 9.50  | 0.366  | 0.374 |
| F3  | 4.50        | 4.70  | 0.177  | 0.185 |
| F4  | 10.70       | 10.90 | 0.421  | 0.429 |
| F5  | 3.65        | 3.85  | 0.144  | 0.152 |
| F6  | 1.25        | 1.45  | 0.049  | 0.057 |

|                                                                                       |                                                                                       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| DOCUMENT NO.<br>Z8B00003324                                                           |                                                                                       |
| SCALE                                                                                 |  |
| EUROPEAN PROJECTION                                                                   |                                                                                       |
|  |                                                                                       |
| ISSUE DATE<br>30-08-2007                                                              |                                                                                       |
| REVISION<br>01                                                                        |                                                                                       |

PG-TO-252 (D-Pak)



| 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                                                                                               |

**Published by**  
**Infineon Technologies AG**  
**81726 Munich, Germany**  
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