# 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[1] for target application
- Ideal for high-frequency switching and synchronous rectification
- Halogen-free according to IEC61249-2-21

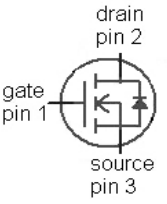
## Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 100 | V |
| $R_{DS(on),max\ (TO\ 263)}$ | 4.2 | mΩ |
| $I_D$ | 100 | A |

RoHS

Halogen-Free

| Type | IPB042N10N3 G | IPI045N10N3 G | IPP045N10N3 G |
|---|---|---|---|
| | | | |
| Package | PG-TO263-3 | PG-TO262-3 | PG-TO220-3 |
| Marking | 042N10N | 045N10N | 045N10N |




**Maximum ratings,** at $T_j$=25 °C, unless otherwise specified

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Continuous drain current | $I_D$ | $T_C$=25 °C[2] | 100 | A |
| | | $T_C$=100 °C | 100 | |
| Pulsed drain current[2] | $I_{D,pulse}$ | $T_C$=25 °C | 400 | |
| Avalanche energy, single pulse | $E_{AS}$ | $I_D$=100 A, $R_{GS}$=25 Ω | 340 | mJ |
| Gate source voltage | $V_{GS}$ | | ±20 | V |
| Power dissipation | $P_{tot}$ | $T_C$=25 °C | 214 | W |
| Operating and storage temperature | $T_j$, $T_{stg}$ | | -55 ... 175 | °C |
| IEC climatic category; DIN IEC 68-1 | | | 55/175/56 | |

[1] J-STD20 and JESD22

[2] See figure 3



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| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Thermal characteristics** | | | | | | |
| Thermal resistance, junction - case | $R_{thJC}$ | | - | - | 0.7 | K/W |
| Thermal resistance, junction - ambient | $R_{thJA}$ | minimal footprint | - | - | 62 | |
| | | 6 cm$^2$ cooling area[3)] | - | - | 50 | |
| **Electrical characteristics,** at $T_j$=25 °C, unless otherwise specified | | | | | | |
| **Static characteristics** | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0 V, $I_D$=1 mA | 100 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=150 µA | 2 | 2.7 | 3.5 | |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=100 V, $V_{GS}$=0 V, $T_j$=25 °C | - | 0.1 | 1 | µA |
| | | $V_{DS}$=100 V, $V_{GS}$=0 V, $T_j$=125 °C | - | 10 | 100 | |
| Gate-source leakage current | $I_{GSS}$ | $V_{GS}$=20 V, $V_{DS}$=0 V | - | 1 | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}$=10 V, $I_D$=100 A, TO 220, TO 262 | - | 3.9 | 4.5 | mΩ |
| | | $V_{GS}$=10 V, $I_D$=50 A, TO263 | - | 3.6 | 4.2 | |
| | | $V_{GS}$=6 V, $I_D$=50 A, TO 220, TO 262 | - | 4.7 | 7.7 | |
| | | $V_{GS}$=6 V, $I_D$=50 A, TO263 | - | 4.4 | 7.4 | |
| Gate resistance | $R_G$ | | - | 1.4 | - | Ω |
| Transconductance | $g_{fs}$ | $\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, $I_D$=100 A | 73 | 145 | - | S |

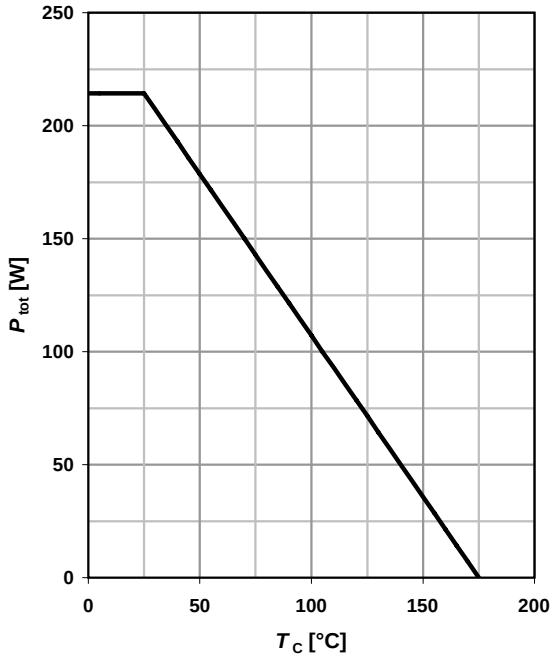
[3)] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm$^2$ (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic characteristics** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0 V, $V_{DS}$=50 V, $f$=1 MHz | - | 6320 | 8410 | pF |
| Output capacitance | $C_{oss}$ | | - | 1210 | 1610 | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 41 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=50 V, $V_{GS}$=10 V, $I_D$=50 A, $R_G$=1.6 Ω | - | 27 | - | ns |
| Rise time | $t_r$ | | - | 59 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 48 | - | |
| Fall time | $t_f$ | | - | 14 | - | |
| Gate Charge Characteristics[4)] | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=50 V, $I_D$=100 A, $V_{GS}$=0 to 10 V | - | 30 | 39 | nC |
| Gate to drain charge | $Q_{gd}$ | | - | 16 | - | |
| Switching charge | $Q_{sw}$ | | - | 27 | - | |
| Gate charge total | $Q_g$ | | - | 88 | 117 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 4.7 | - | V |
| Output charge | $Q_{oss}$ | $V_{DD}$=50 V, $V_{GS}$=0 V | - | 122 | 162 | nC |
| **Reverse Diode** | | | | | | |
| Diode continous forward current | $I_S$ | $T_C$=25 °C | - | - | 100 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 400 | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0 V, $I_F$=100 A, $T_j$=25 °C | - | 1.0 | 1.2 | V |
| Reverse recovery time | $t_{rr}$ | $V_R$=50 V, $I_F$=$I_S$, $di_F/dt$=100 A/µs | - | 68 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 135 | - | nC |

[4)] See figure 16 for gate charge parameter definition

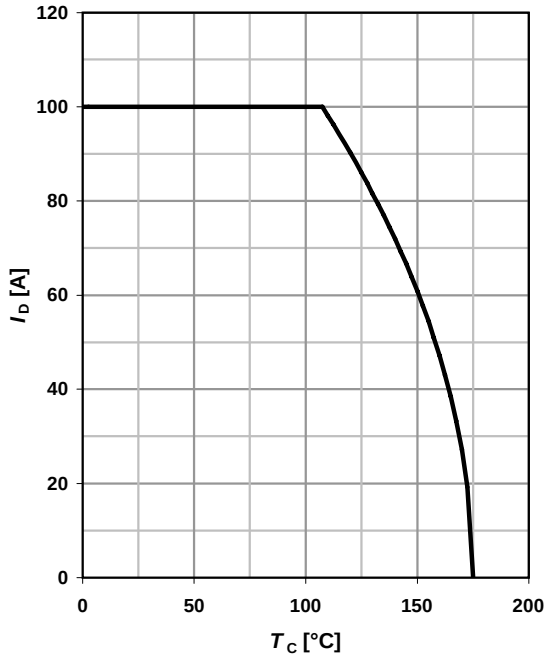
**1 Power dissipation**

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




**2 Drain current**

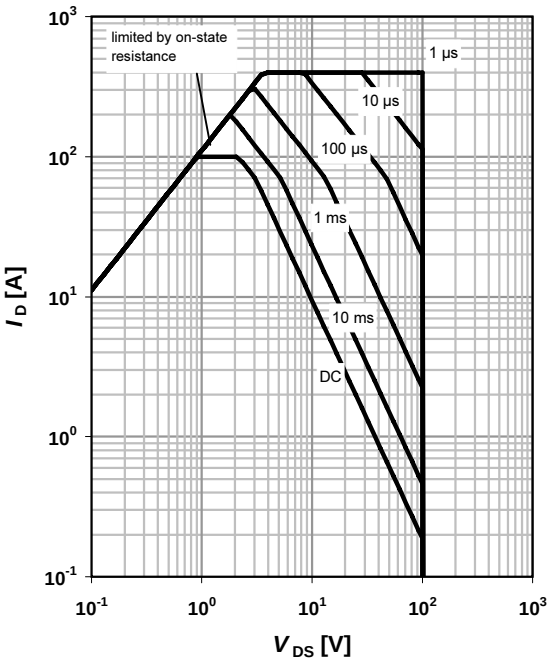
$I_D$=f($T_C$); $V_{GS}$≥10 V




**3 Safe operating area**

$I_D$=f($V_{DS}$); $T_C$=25 °C; $D$=0

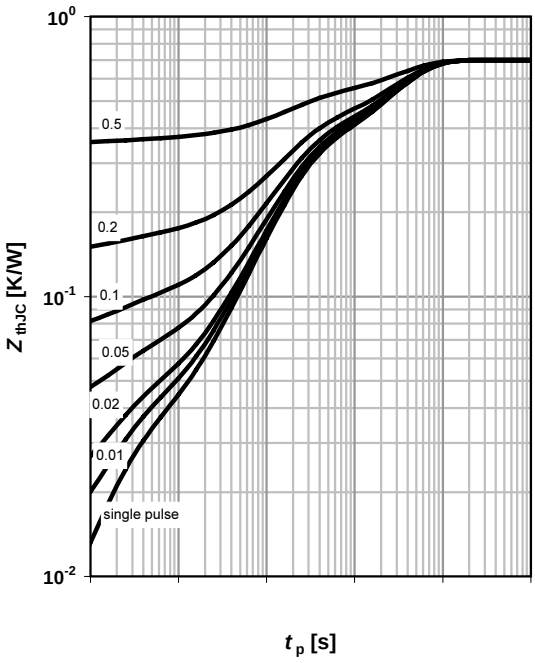
parameter: $t_p$




**4 Max. transient thermal impedance**

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

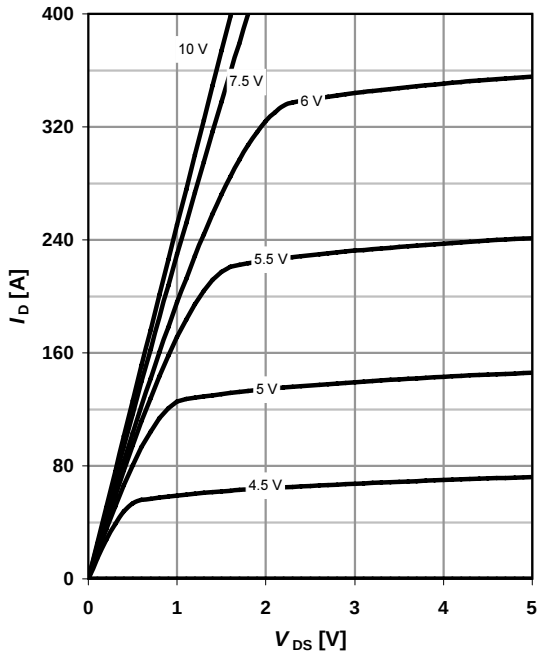
parameter: $D$=$t_p$/$T$



**5 Typ. output characteristics**

$I_D$=f($V_{DS}$); $T_j$=25 °C

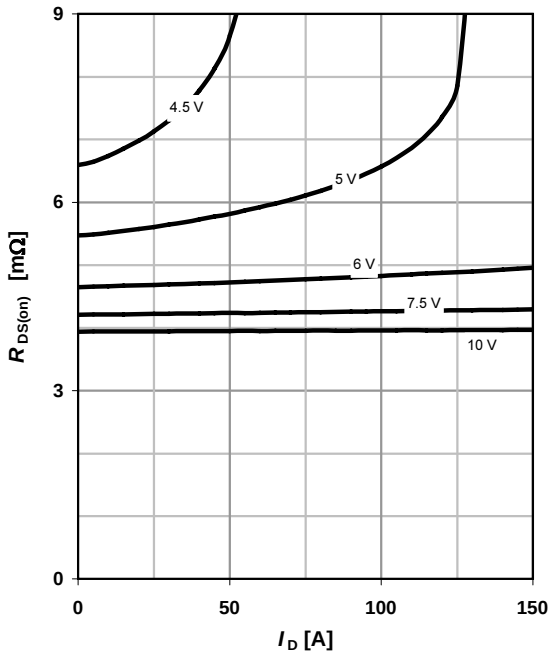
parameter: $V_{GS}$




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

$R_{DS(on)}$=f($I_D$); $T_j$=25 °C

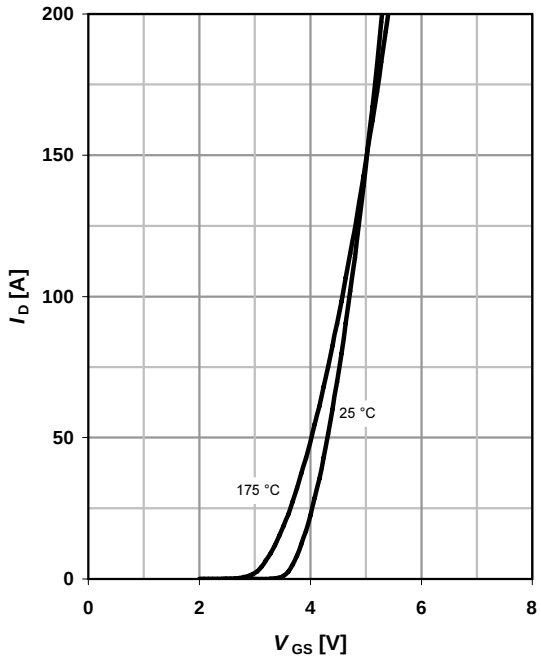
parameter: $V_{GS}$




**7 Typ. transfer characteristics**

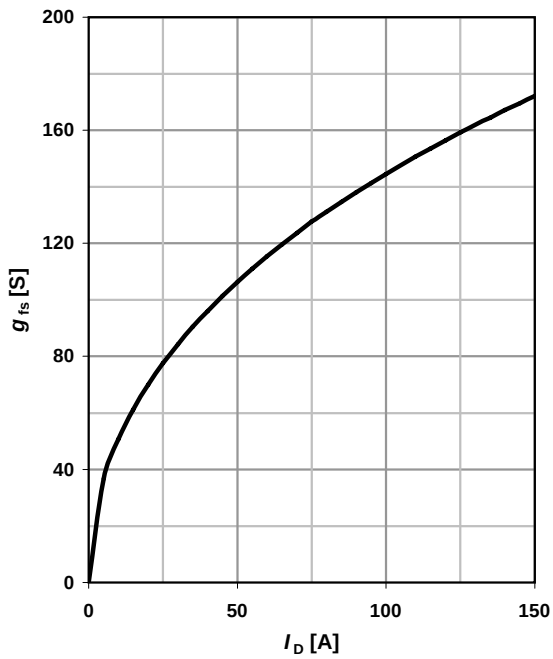
$I_D$=f($V_{GS}$); $|V_{DS}|>2|I_D|R_{DS(on)max}$

parameter: $T_j$



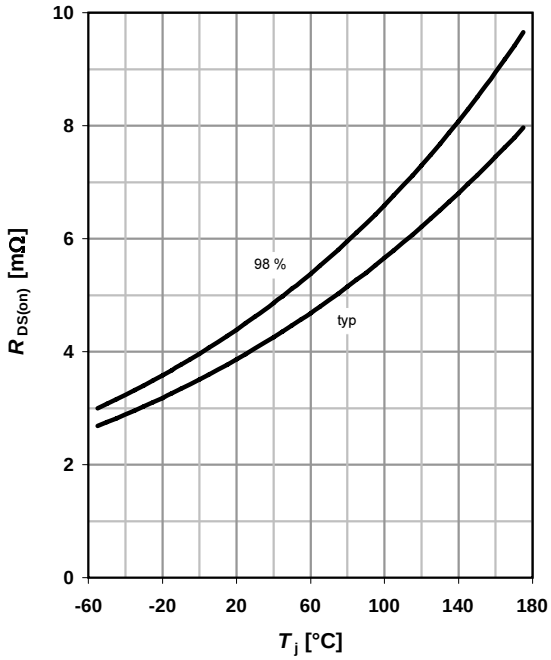

**8 Typ. forward transconductance**

$g_{fs}$=f($I_D$); $T_j$=25 °C



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

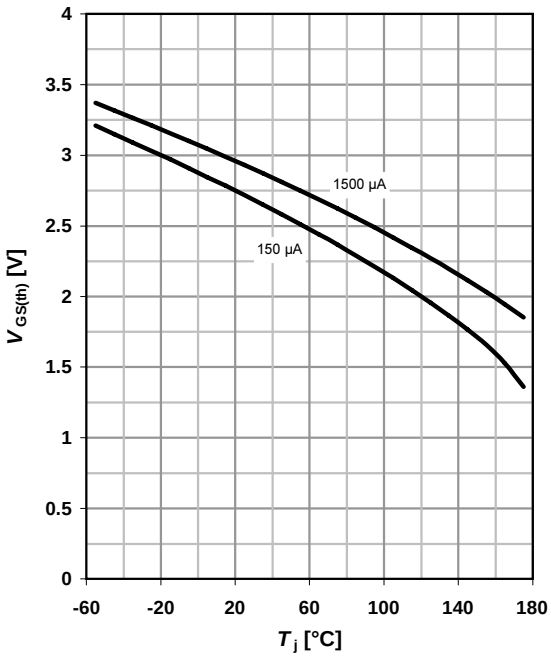
$R_{DS(on)}$=f($T_j$); $I_D$=100 A; $V_{GS}$=10 V




**10 Typ. gate threshold voltage**

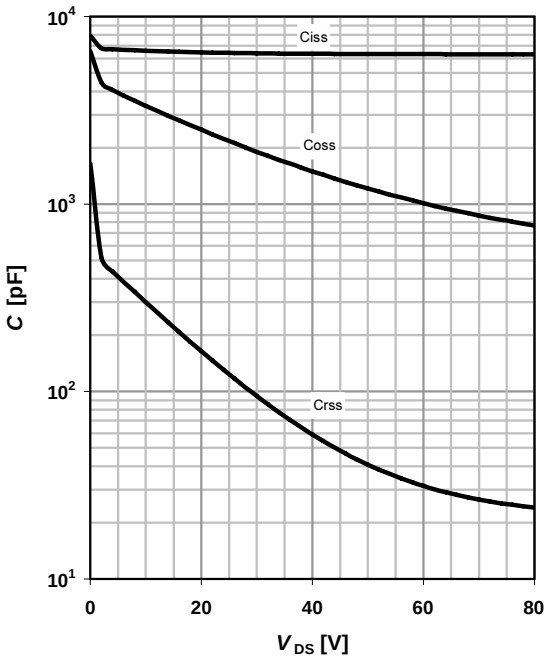
$V_{GS(th)}$=f($T_j$); $V_{GS}$=$V_{DS}$

parameter: $I_D$




**11 Typ. capacitances**

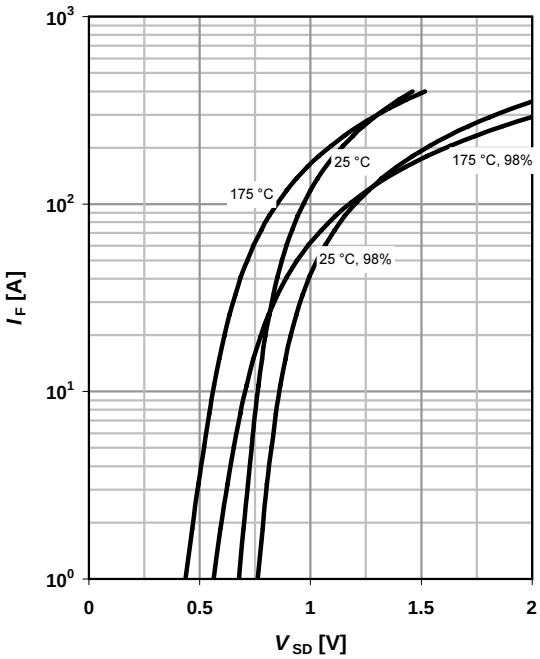
$C$=f($V_{DS}$); $V_{GS}$=0 V; $f$=1 MHz




**12 Forward characteristics of reverse diode**

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

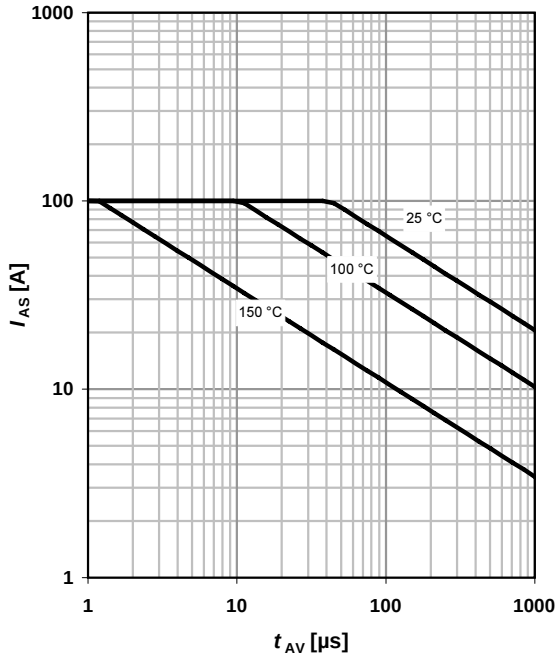
parameter: $T_j$



**13 Avalanche characteristics**

$I_{AS}$=f($t_{AV}$); $R_{GS}$=25 Ω

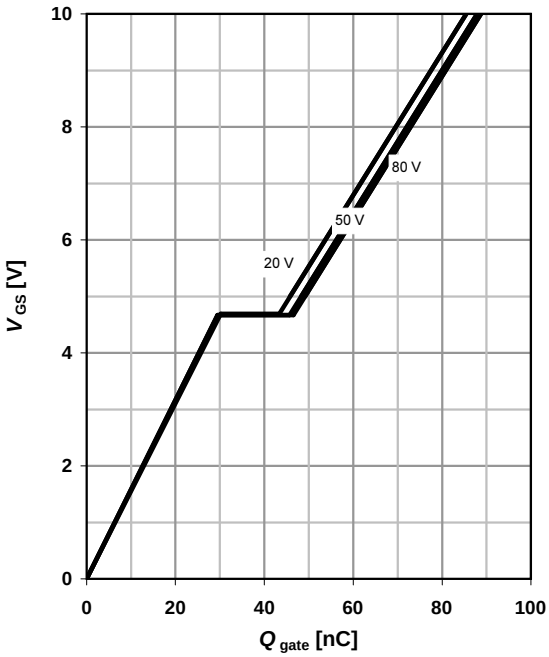
parameter: $T_{j(start)}$




**14 Typ. gate charge**

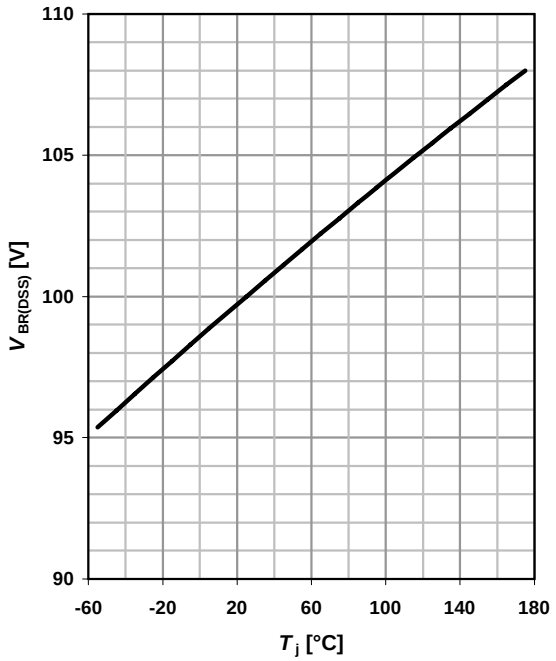
$V_{GS}$=f($Q_{gate}$); $I_D$=100 A pulsed

parameter: $V_{DD}$

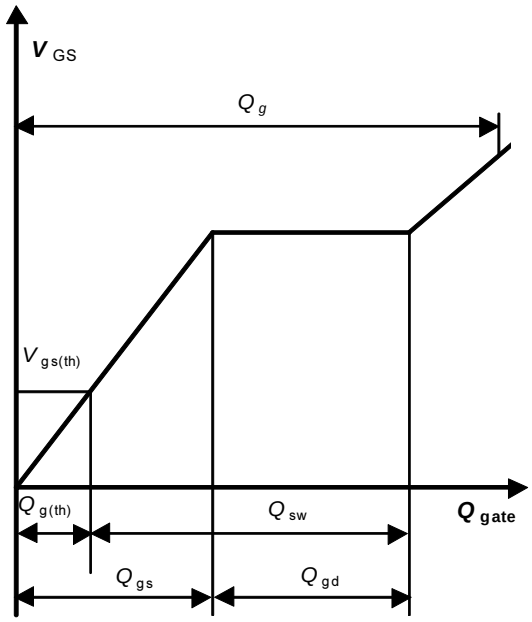



**15 Drain-source breakdown voltage**

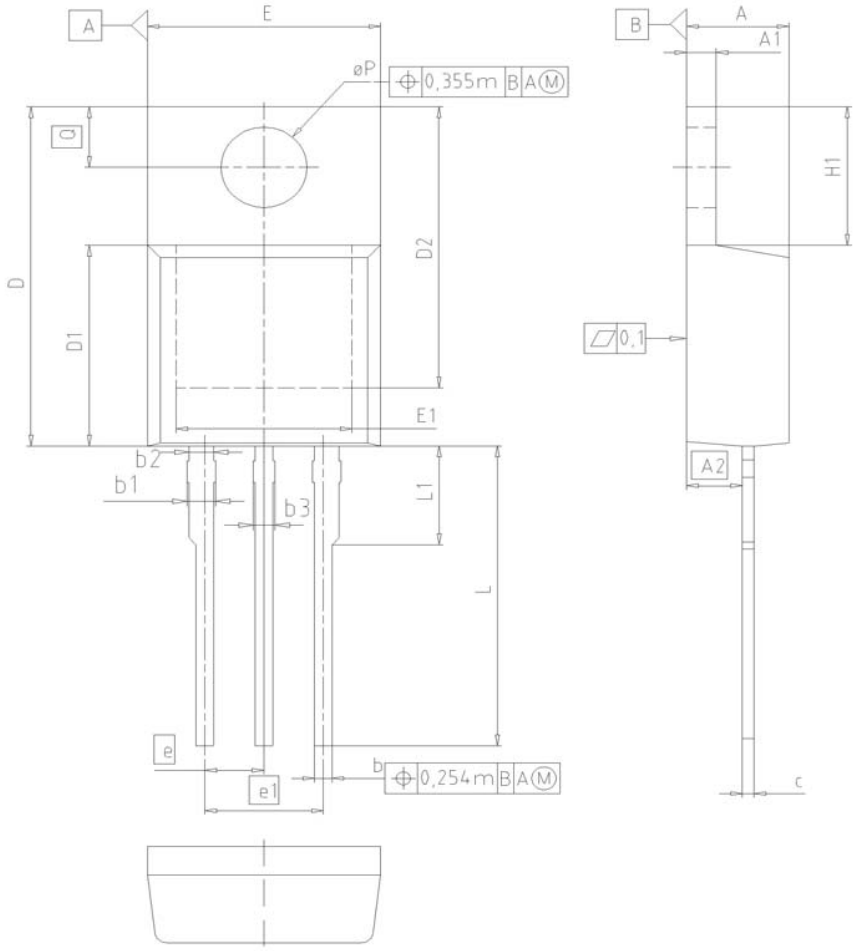
$V_{BR(DSS)}$=f($T_j$); $I_D$=1 mA




**16 Gate charge waveforms**



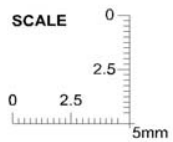
**PG-TO220-3: Outline**



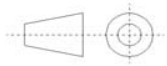

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.30 | 4.57 | 0.169 | 0.180 |
| A1 | 1.17 | 1.40 | 0.046 | 0.055 |
| A2 | 2.15 | 2.72 | 0.085 | 0.107 |
| b | 0.65 | 0.86 | 0.026 | 0.034 |
| b1 | 0.95 | 1.40 | 0.037 | 0.055 |
| b2 | 0.95 | 1.15 | 0.037 | 0.045 |
| 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 |
| øP | 3.60 | 3.89 | 0.142 | 0.153 |
| Q | 2.60 | 3.00 | 0.102 | 0.118 |

**DOCUMENT NO.**
Z8B00003318

**SCALE**




**EUROPEAN PROJECTION**



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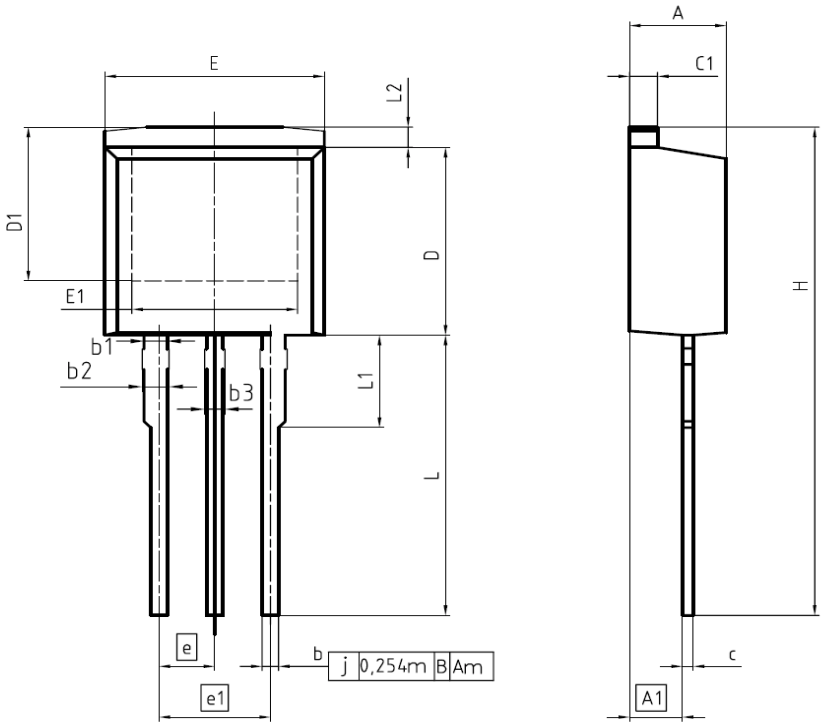
05

**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 |

REFERENCE
JEDEC TO262

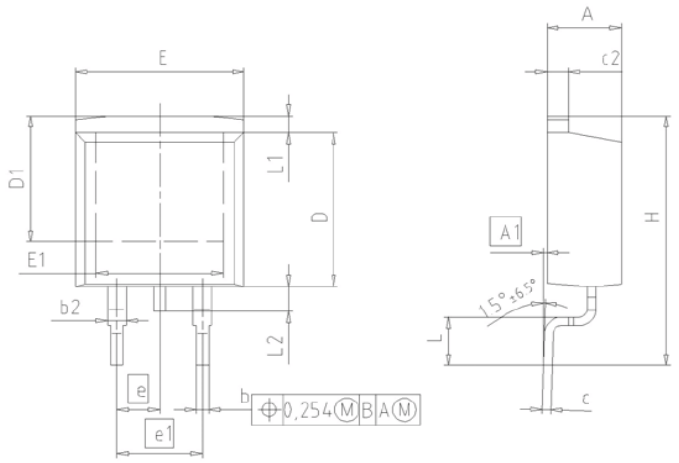
SCALE 0 2.5 0 2.5 5mm

EUROPEAN PROJECTION

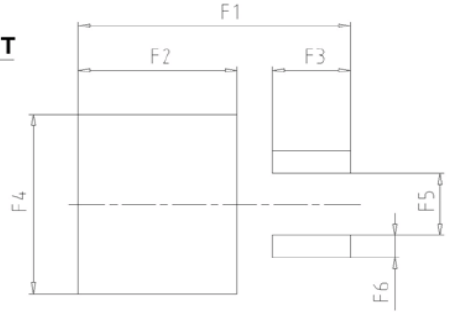
ISSUE DATE
05-05-2006

FILE
TO262_1

**PG-TO-263 (D²-Pak)**



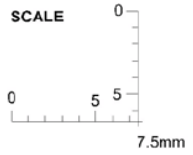

**FOOTPRINT**



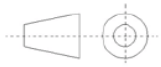

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.30 | 4.57 | 0.169 | 0.180 |
| A1 | 0.00 | 0.25 | 0.000 | 0.010 |
| b | 0.65 | 0.85 | 0.026 | 0.033 |
| b2 | 0.95 | 1.15 | 0.037 | 0.045 |
| c | 0.33 | 0.65 | 0.013 | 0.026 |
| c2 | 1.17 | 1.40 | 0.046 | 0.055 |
| D | 8.51 | 9.45 | 0.335 | 0.372 |
| D1 | 7.10 | 7.90 | 0.280 | 0.311 |
| E | 9.80 | 10.31 | 0.386 | 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.**
Z8B00003324

**SCALE**




**EUROPEAN PROJECTION**



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01

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