## OptiMOS™3 Power-Transistor

### Features

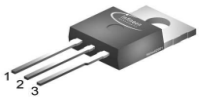
- Fast switching MOSFET for SMPS
- Optimized technology for DC/DC converters
- Qualified according to JEDEC[1] for target applications
- N-channel, logic level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- 100% Avalanche tested
- Pb-free plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

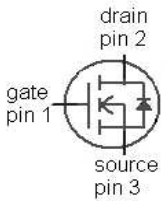
### Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 40 | V |
| $R_{DS(on),max}$ | 3.9 | mΩ |
| $I_D$ | 80 | A |

RoHS

Halogen-Free

| **Type** | IPB039N04L G | IPP039N04L G |
|---|---|---|
| |  |  |
| **Package** | PG-TO263-3 | PG-TO220-3 |
| **Marking** | 039N04L | 039N04L |




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

| **Parameter** | **Symbol** | **Conditions** | **Value** | **Unit** |
|---|---|---|---|---|
| Continuous drain current | $I_D$ | $V_{GS}$=10 V, $T_C$=25 ℃ | 80 | A |
| | | $V_{GS}$=10 V, $T_C$=100 ℃ | 80 | |
| | | $V_{GS}$=4.5 V, $T_C$=25 ℃ | 80 | |
| | | $V_{GS}$=4.5 V, $T_C$=100 ℃ | 73 | |
| Pulsed drain current[2] | $I_{D,pulse}$ | $T_C$=25 ℃ | 400 | |
| Avalanche current, single pulse[3] | $I_{AS}$ | $T_C$=25 ℃ | 80 | |
| Avalanche energy, single pulse | $E_{AS}$ | $I_D$=80 A, $R_{GS}$=25 Ω | 60 | mJ |
| Gate source voltage | $V_{GS}$ | | ±20 | V |

[1] J-STD20 and JESD22

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

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Power dissipation | $P_{tot}$ | $T_C$=25 ℃ | 94 | W |
| Operating and storage temperature | $T_j$, $T_{stg}$ | | -55 ... 175 | ℃ |
| IEC climatic category; DIN IEC 68-1 | | | 55/175/56 | |

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Thermal characteristics** | | | | | | |
| Thermal resistance, junction - case | $R_{thJC}$ | | - | - | 1.6 | K/W |
| SMD version, device on PCB | $R_{thJA}$ | minimal footprint | - | - | 62 | |
| | | 6 cm² cooling area[4] | - | - | 40 | |

**Electrical characteristics,** at $T_j$=25 ℃, unless otherwise specified

| **Static characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0 V, $I_D$=1 mA | 40 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=45 µA | 1.2 | - | 2 | |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=40 V, $V_{GS}$=0 V, $T_j$=25 ℃ | - | 0.1 | 1 | µA |
| | | $V_{DS}$=40 V, $V_{GS}$=0 V, $T_j$=125 ℃ | - | 10 | 100 | |
| Gate-source leakage current | $I_{GSS}$ | $V_{GS}$=20 V, $V_{DS}$=0 V | - | 10 | 100 | nA |
| Drain-source on-state resistance[5] | $R_{DS(on)}$ | $V_{GS}$=4.5 V, $I_D$=80 A | - | 4.2 | 5.2 | mΩ |
| | | $V_{GS}$=10 V, $I_D$=80 A | - | 3.1 | 3.9 | |
| Gate resistance | $R_G$ | | - | 1.6 | - | Ω |
| Transconductance | $g_{fs}$ | $\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, $I_D$=80 A | 75 | 151 | - | S |

[2] See figure 3 for more detailed information

[3] See figure 13 for more detailed information

[4] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

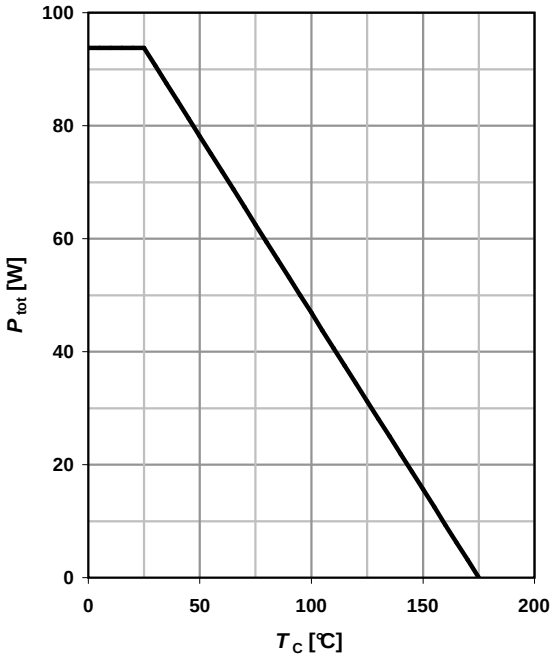
[5] Measured from drain tab to source pin

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic characteristics** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0 V, $V_{DS}$=25 V, $f$=1 MHz | - | 4600 | 6100 | pF |
| Output capacitance | $C_{oss}$ | | - | 820 | 1100 | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 39 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=20 V, $V_{GS}$=10 V, $I_D$=30 A, $R_G$=1.6 Ω | - | 10 | - | ns |
| Rise time | $t_r$ | | - | 5.4 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 38 | - | |
| Fall time | $t_f$ | | - | 6.0 | - | |
| Gate Charge Characteristics[6)] | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=20 V, $I_D$=30 A, $V_{GS}$=0 to 10 V | - | 14 | - | nC |
| Gate charge at threshold | $Q_{g(th)}$ | | - | 7.4 | - | |
| Gate to drain charge | $Q_{gd}$ | | - | 6.1 | - | |
| Switching charge | $Q_{sw}$ | | - | 13 | - | |
| Gate charge total | $Q_g$ | | - | 59 | 78 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 3.0 | - | V |
| Gate charge total | $Q_g$ | $V_{DD}$=20 V, $I_D$=30 A, $V_{GS}$=0 to 4.5 V | - | 28 | 38 | nC |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | $V_{DS}$=0.1 V, $V_{GS}$=0 to 10 V | - | 55 | - | |
| Output charge | $Q_{oss}$ | $V_{DD}$=20 V, $V_{GS}$=0 V | - | 42 | - | |
| **Reverse Diode** | | | | | | |
| Diode continuous forward current | $I_S$ | $T_C$=25 ℃ | - | - | 78 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 400 | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0 V, $I_F$=80 A, $T_j$=25 ℃ | - | 0.92 | 1.2 | V |
| Reverse recovery charge | $Q_{rr}$ | $V_R$=20 V, $I_F$=$I_S$, d$i_F$/d$t$=400 A/µs | - | 50 | - | nC |

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

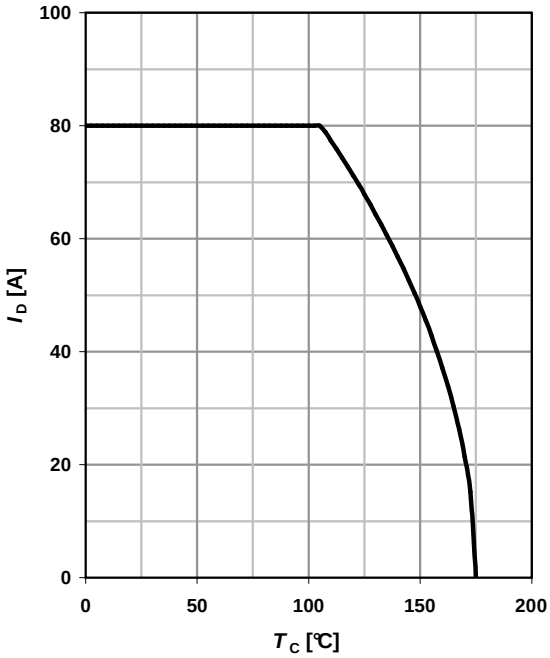
## 1 Power dissipation

$P_{tot}=f(T_C)$




## 2 Drain current

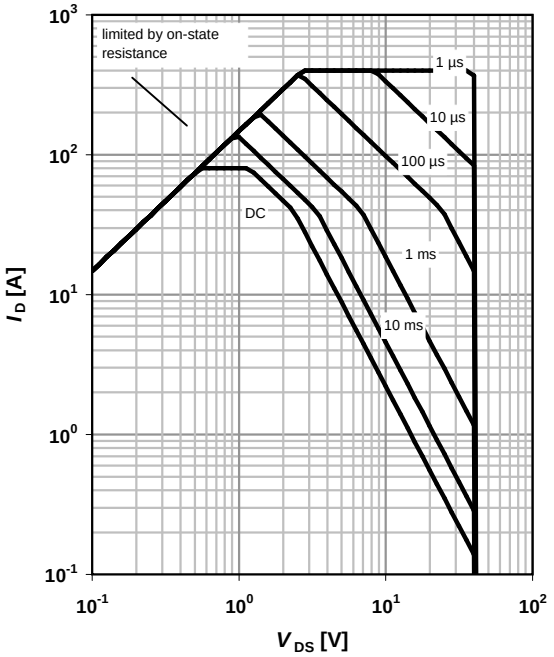
$I_D=f(T_C)$; $V_{GS}\geq 10$ V




## 3 Safe operating area

$I_D=f(V_{DS})$; $T_C=25$ ℃; $D=0$

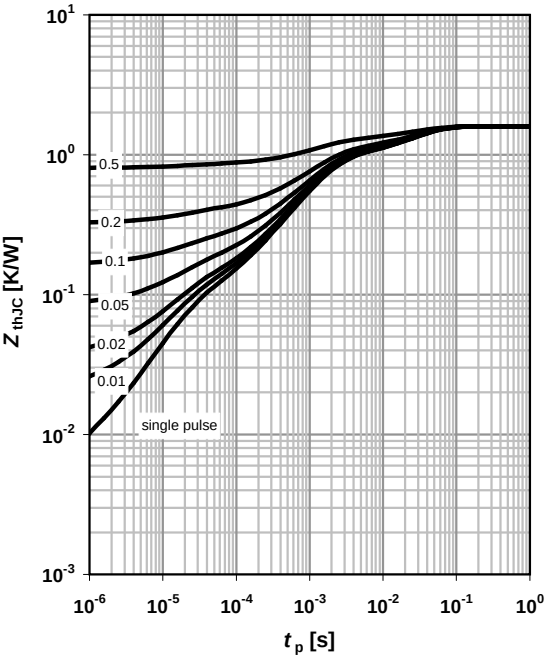
parameter: $t_p$




## 4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

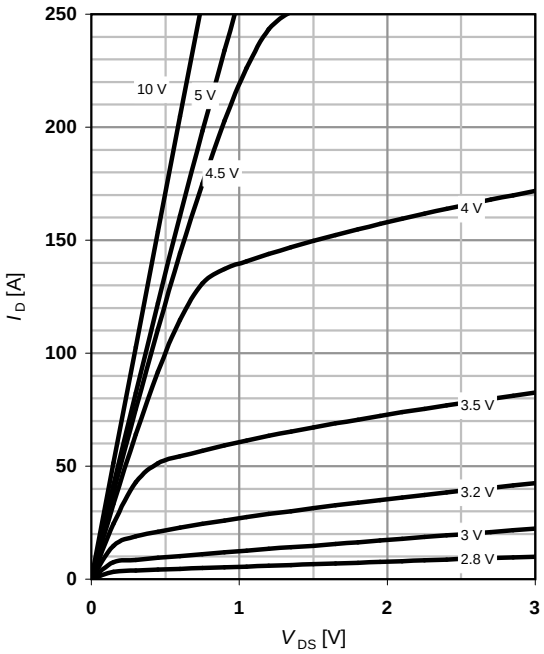
parameter: $D=t_p/T$



### 5 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=25$ ℃

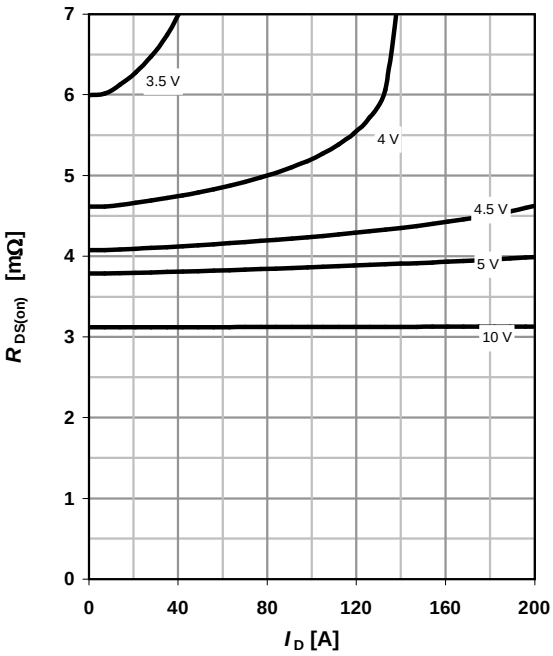
parameter: $V_{GS}$




### 6 Typ. drain-source on resistance

$R_{DS(on)}=f(I_D)$; $T_j=25$ ℃

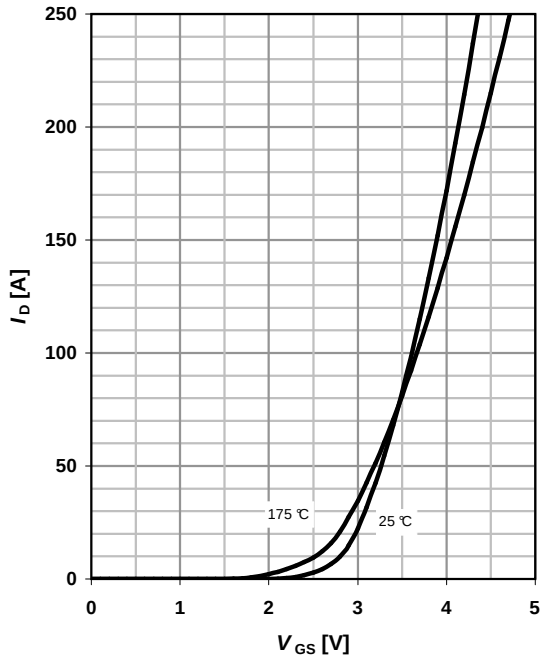
parameter: $V_{GS}$




### 7 Typ. transfer characteristics

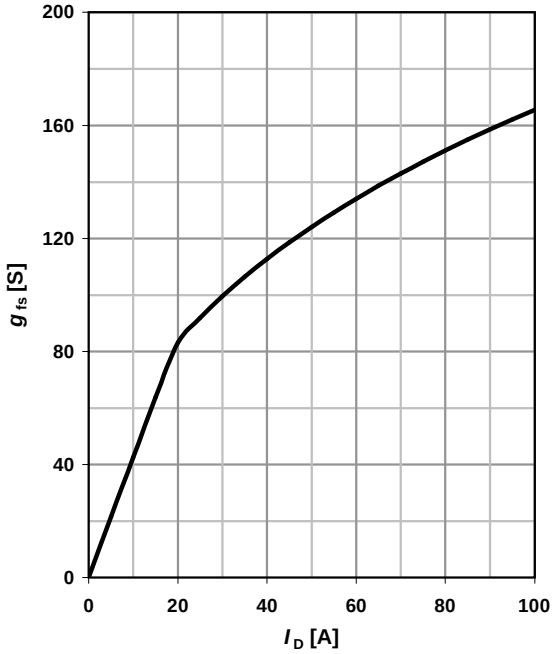
$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$

parameter: $T_j$



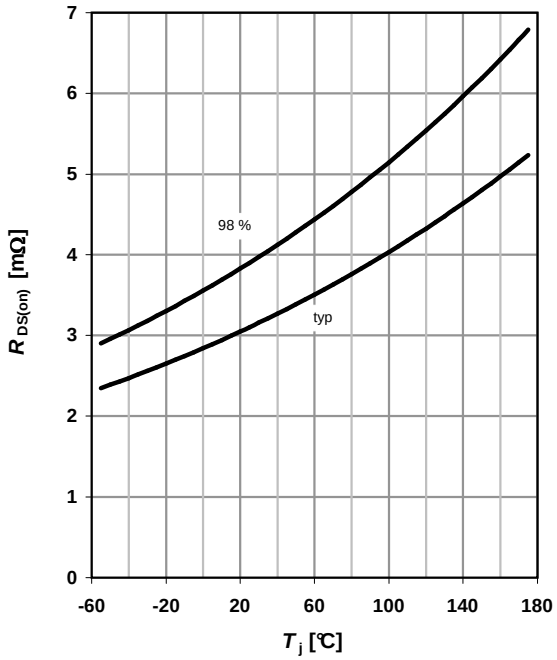

### 8 Typ. forward transconductance

$g_{fs}=f(I_D)$; $T_j=25$ ℃



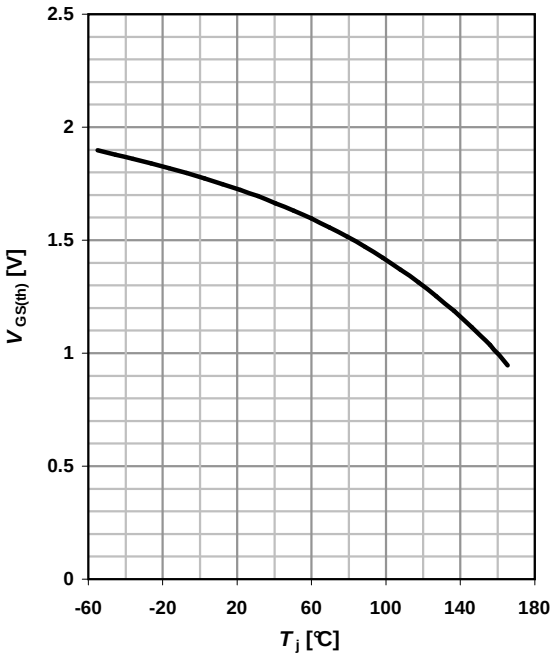
### 9 Drain-source on-state resistance

$R_{DS(on)}=f(T_j)$; $I_D=80$ A; $V_{GS}=10$ V



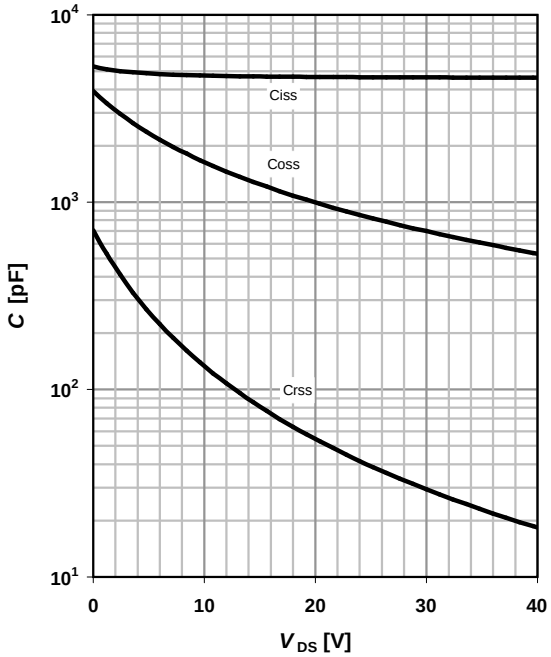

### 10 Typ. gate threshold voltage

$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; $I_D=250$ µA




### 11 Typ. capacitances

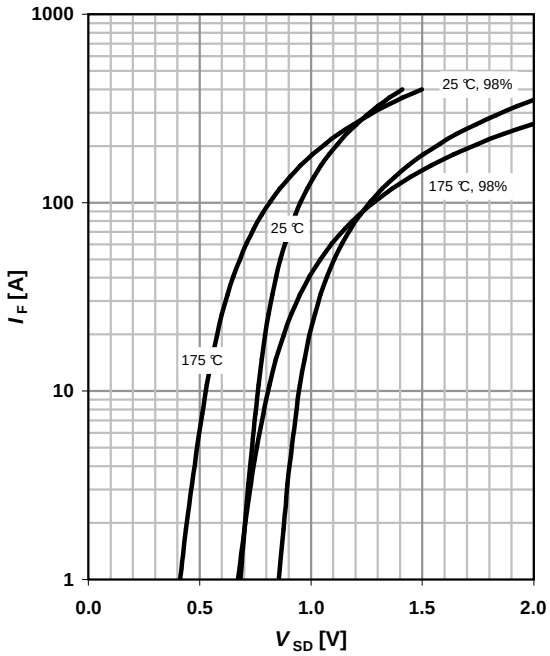
$C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz




### 12 Forward characteristics of reverse diode

$I_F=f(V_{SD})$

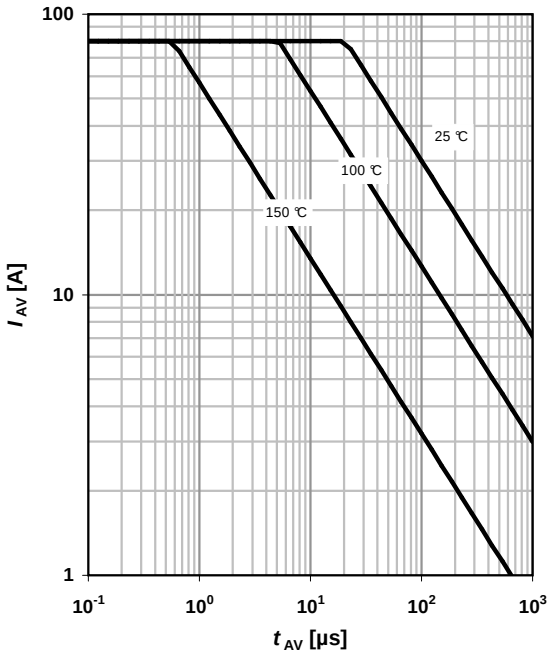
parameter: $T_j$



## 13 Avalanche characteristics

$I_{AS}$=f($t_{AV}$); $R_{GS}$=25 Ω

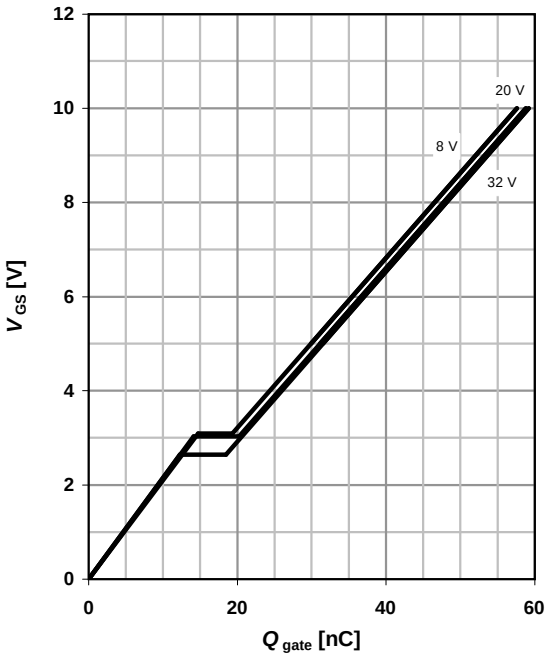
parameter: $T_{j(start)}$




## 14 Typ. gate charge

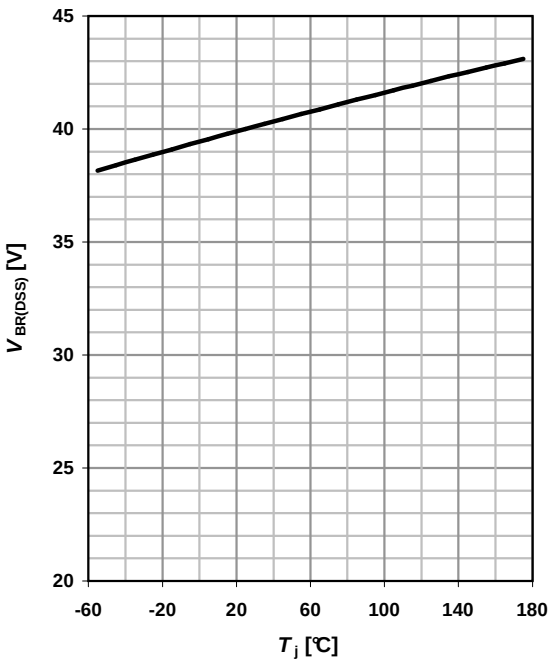
$V_{GS}$=f($Q_{gate}$); $I_D$=30 A pulsed

parameter: $V_{DD}$

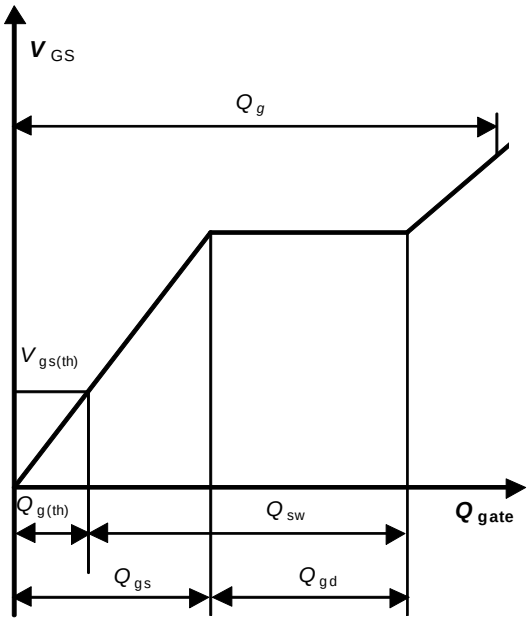



## 15 Drain-source breakdown voltage

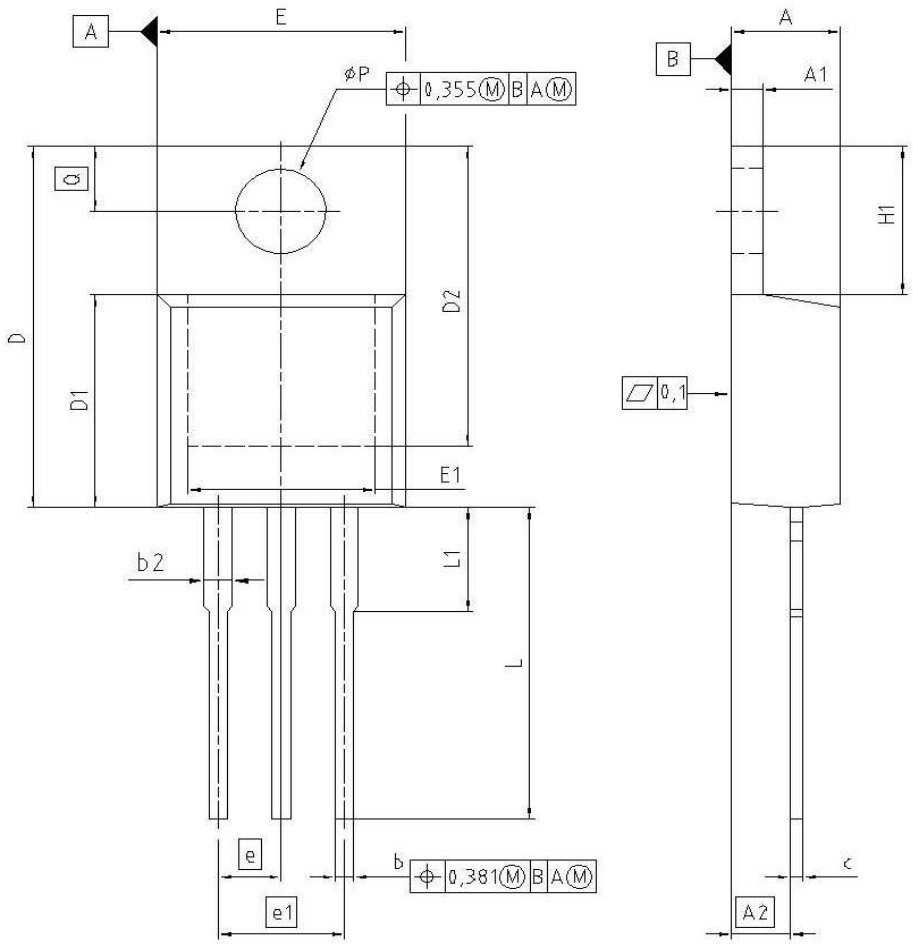
$V_{BR(DSS)}$=f($T_j$); $I_D$=1 mA




## 16 Gate charge waveforms



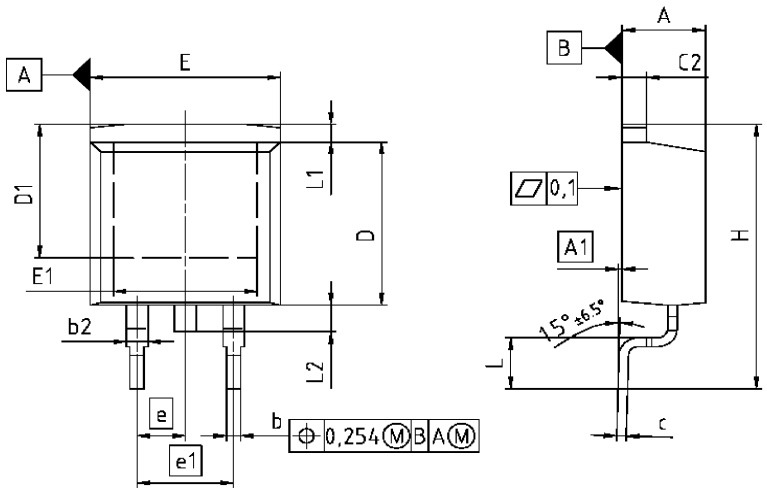
**Package Outline** **PG-TO220-3-1**



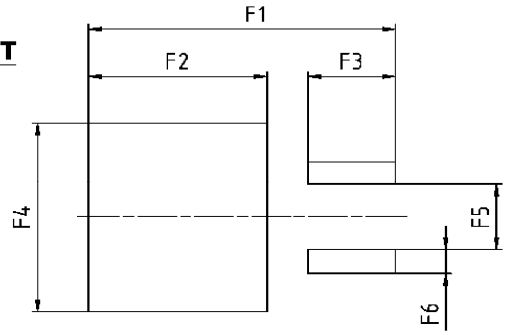

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.300 | 4.572 | 0.169 | 0.180 |
| A1 | 1.170 | 1.400 | 0.046 | 0.055 |
| A2 | 2.215 | 2.718 | 0.087 | 0.107 |
| b | 0.650 | 0.864 | 0.026 | 0.034 |
| b2 | 0.635 | 1.778 | 0.025 | 0.070 |
| c | 0.330 | 0.600 | 0.013 | 0.024 |
| D | 14.808 | 15.950 | 0.583 | 0.628 |
| D1 | 8.509 | 9.450 | 0.335 | 0.372 |
| D2 | 12.850 | 13.100 | 0.506 | 0.516 |
| 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 | |
| H1 | 5.900 | 6.900 | 0.232 | 0.272 |
| L | 13.000 | 14.000 | 0.512 | 0.551 |
| L1 | - | 4.800 | - | 0.189 |
| øP | 3.700 | 3.886 | 0.146 | 0.153 |
| Q | 2.600 | 3.000 | 0.102 | 0.118 |

| | |
|---|---|
| REFERENCE | JEDEC TO220 |
| SCALE | 0 2.5 0 2.5 5mm |
| EUROPEAN PROJECTION | |
| ISSUE DATE | 01-06-2005 |
| FILE | TO220_1 |

**Package Outline** **PG-TO263-3**




**FOOTPRINT**




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.300 | 4.572 | 0.169 | 0.180 |
| A1 | 0.000 | 0.254 | 0.000 | 0.010 |
| b | 0.650 | 0.850 | 0.026 | 0.033 |
| b2 | 0.950 | 1.321 | 0.037 | 0.052 |
| c | 0.330 | 0.650 | 0.013 | 0.026 |
| c2 | 0.170 | 1.400 | 0.046 | 0.055 |
| D | 8.509 | 9.450 | 0.335 | 0.372 |
| D1 | 7.100 | - | 0.280 | - |
| E | 9.800 | 10.312 | 0.386 | 0.406 |
| E1 | 6.500 | | 0.256 | |
| e | 2.540 | | 0.100 | |
| e1 | 5.080 | | 0.200 | |
| N | 2 | | 2 | |
| H | 14.605 | 15.875 | 0.575 | 0.625 |
| L | 2.200 | 3.000 | 0.087 | 0.118 |
| L1 | - | 1.600 | - | 0.063 |
| L2 | 1.000 | 1.778 | 0.039 | 0.070 |
| F1 | 16.050 | 16.250 | 0.632 | 0.640 |
| F2 | 9.300 | 9.500 | 0.366 | 0.374 |
| F3 | 4.500 | 4.700 | 0.177 | 0.185 |
| F4 | 10.700 | 10.900 | 0.421 | 0.429 |
| F5 | 3.630 | 3.830 | 0.143 | 0.151 |
| F6 | 1.100 | 1.300 | 0.043 | 0.051 |

| |
|---|
| REFERENCE<br>JEDEC TO263 |
| SCALE<br>0 5 5<br>7.5mm |
| EUROPEAN PROJECTION |
| ISSUE DATE<br>12-02-2006 |
| FILE<br>TO263_2 |

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Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
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- Оперативные сроки поставки под заказ (от 5 рабочих дней);
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- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

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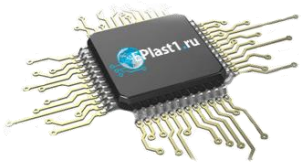
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

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**Факс:** 8 (812) 320-02-42
**Электронная почта:** org@eplast1.ru
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