# MOSFET

Metal Oxide Semiconductor Field Effect Transistor

# OptiMOS™ Power-Transistor, 80V

OptiMOS™3 Power-Transistor
IPA057N08N3 G

## Data Sheet

Rev. 2.2
Final

Power Management & Multimarket

# OptiMOS(TM)3 Power-Transistor

### Features

- Ideal for high frequency switching and sync. rec.
- Optimized technology for DC/DC converters
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- N-channel, normal level
- 100% avalanche tested
- Pb-free plating; RoHS compliant
- Qualified according to JEDEC[1)] for target applications
- Halogen-free according to IEC61249-2-21
- Fully isolated package (2500 VAC; 1 minute)

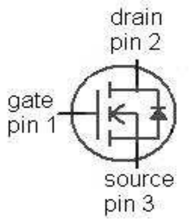
### Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 80 | V |
| $R_{DS(on),max}$ | 5.7 | mΩ |
| $I_D$ | 60 | A |

RoHS

Halogen-Free

| Type | IPA057N08N3 G |
|---|---|
| |  |
| **Package** | PG-TO220-FP |
| **Marking** | 057N08N |




**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)] | 60 | A |
| | | $T_C$=100 °C | 43 | |
| Pulsed drain current[3)] | $I_{D,pulse}$ | $T_C$=25 °C | 240 | |
| Avalanche energy, single pulse[4)] | $E_{AS}$ | $I_D$=60 A, $R_{GS}$=25 Ω | 290 | mJ |
| Gate source voltage | $V_{GS}$ | | ±20 | V |
| Power dissipation | $P_{tot}$ | $T_C$=25 °C | 39 | 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) Current is limited by package; with an $R_{thJC}$=1 K/W in a standard TO-220 package the chip is able to carry 119A.

3) See figure 3 for more detailed information

4) See figure 13 for more detailed information

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Thermal characteristics** | | | | | | |
| Thermal resistance, junction - case | $R_{thJC}$ | | - | - | 3.8 | K/W |

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

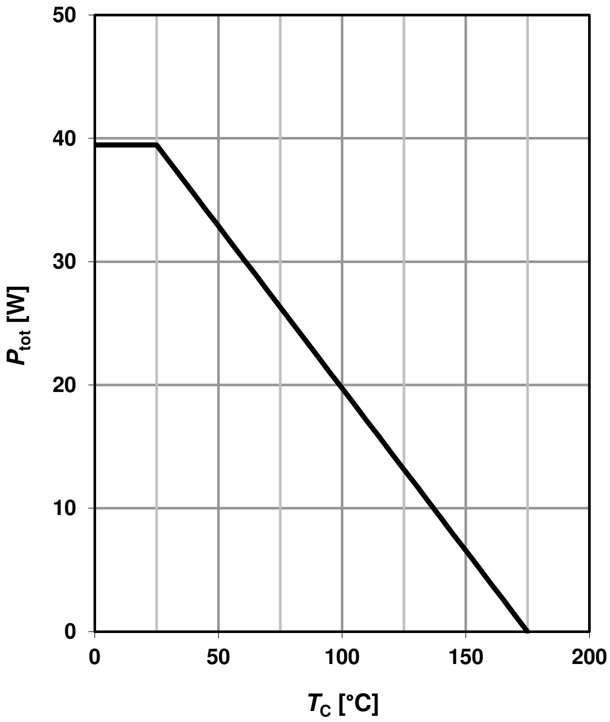
| Parameter | Symbol | Conditions | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0 V, $I_D$=1 mA | 80 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=90 µA | 2 | 2.8 | 3.5 | |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=80 V, $V_{GS}$=0 V, $T_j$=25 °C | - | 0.1 | 1 | µA |
| | | $V_{DS}$=80 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, $I_D$=60 A | - | 4.9 | 5.7 | mΩ |
| | | $V_{GS}$=6 V, $I_D$=30 A | - | 6.3 | 9.9 | |
| Gate resistance | $R_G$ | | - | 2.2 | - | Ω |
| Transconductance | $g_{fs}$ | $\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, $I_D$=60 A | 45 | 90 | - | S |

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic characteristics** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0 V, $V_{DS}$=40 V, $f$=1 MHz | - | 3570 | 4750 | pF |
| Output capacitance | $C_{oss}$ | | - | 963 | 1280 | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 36 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=40 V, $V_{GS}$=10 V, $I_D$=60 A, $R_{G,ext}$=1.6 Ω | - | 17 | - | ns |
| Rise time | $t_r$ | | - | 42 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 36 | - | |
| Fall time | $t_f$ | | - | 9 | - | |
| Gate Charge Characteristics[5)] | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=40 V, $I_D$=60 A, $V_{GS}$=0 to 10 V | - | 18 | - | nC |
| Gate to drain charge | $Q_{gd}$ | | - | 10 | - | |
| Switching charge | $Q_{sw}$ | | - | 18 | - | |
| Gate charge total | $Q_g$ | | - | 52 | 69 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 5.0 | - | V |
| Output charge | $Q_{oss}$ | $V_{DD}$=40 V, $V_{GS}$=0 V | - | 70 | 93 | nC |
| **Reverse Diode** | | | | | | |
| Diode continous forward current | $I_S$ | $T_C$=25 °C | - | - | 60 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 240 | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0 V, $I_F$=60 A, $T_j$=25 °C | - | 1.0 | 1.2 | V |
| Reverse recovery time | $t_{rr}$ | $V_R$=40 V, $I_F$=$I_S$, d$i_F$/d$t$=100 A/µs | - | 64 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 121 | - | nC |

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

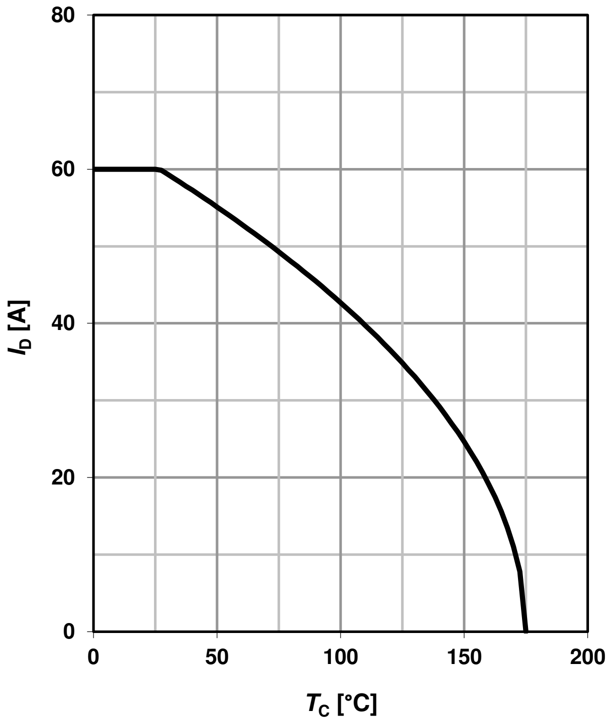
**1 Power dissipation**

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




**2 Drain current**

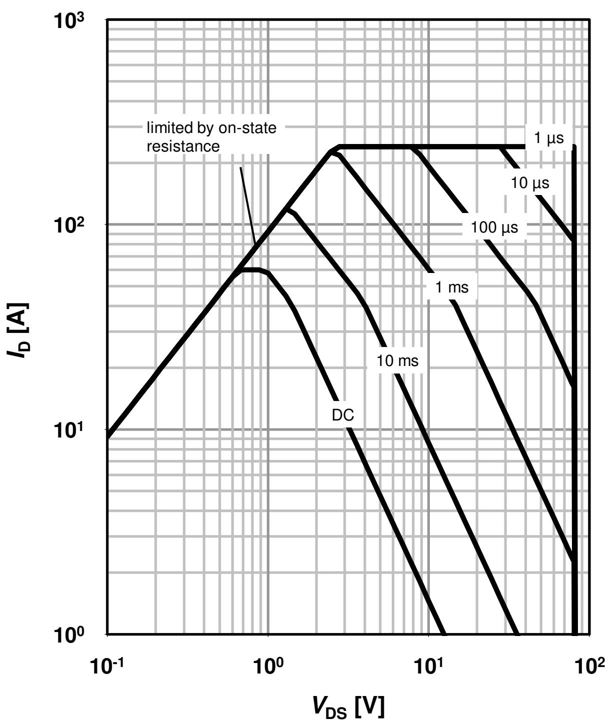
$I_D$=f($T_C$); $V_{GS}$≥10 V




**3 Safe operating area**

$I_D$=f($V_{DS}$); $T_C$=25 °C; $D$=0

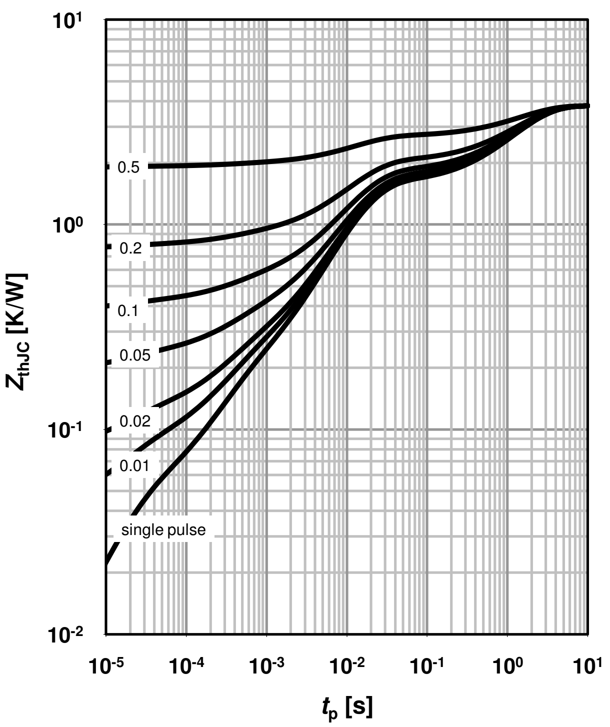
parameter: $t_p$




**4 Max. transient thermal impedance**

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

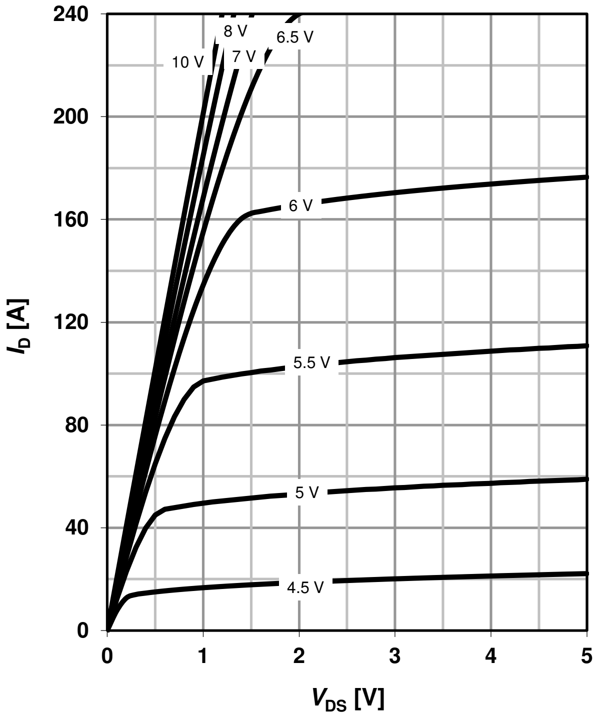
parameter: $D$=$t_p$/$T$



### 5 Typ. output characteristics

$I_D$=f($V_{DS}$); $T_j$=25 °C

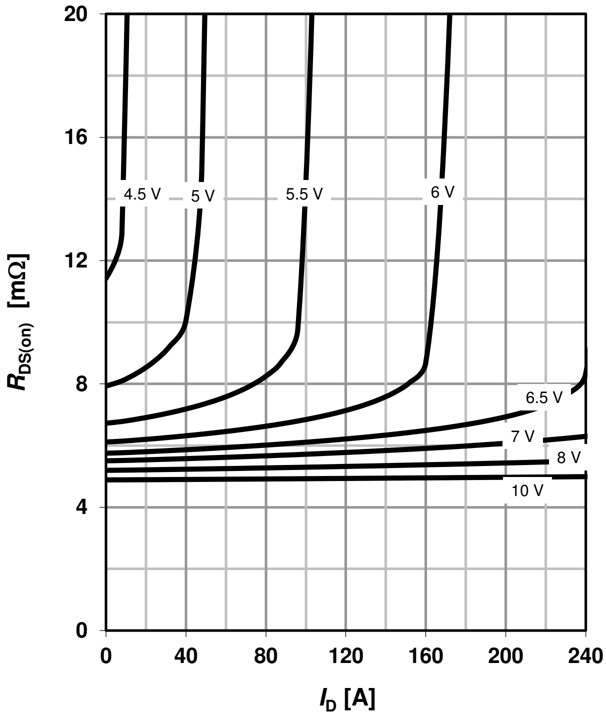
parameter: $V_{GS}$




### 6 Typ. drain-source on resistance

$R_{DS(on)}$=f($I_D$); $T_j$=25 °C

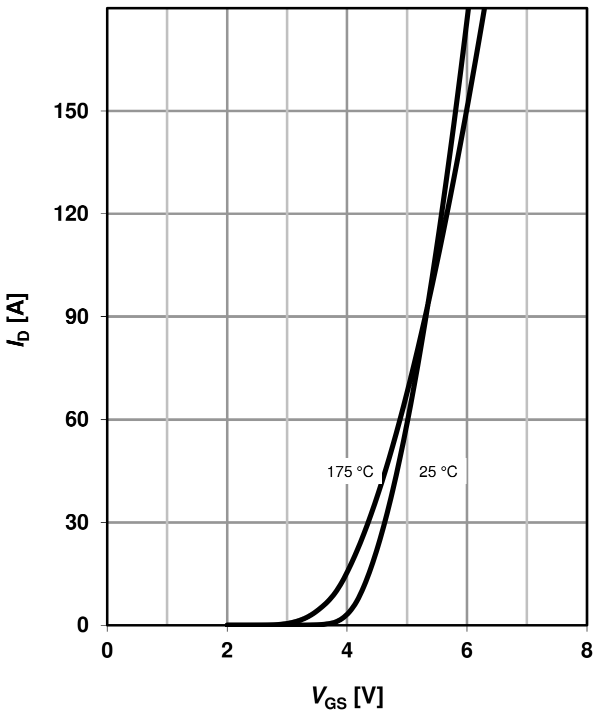
parameter: $V_{GS}$




### 7 Typ. transfer characteristics

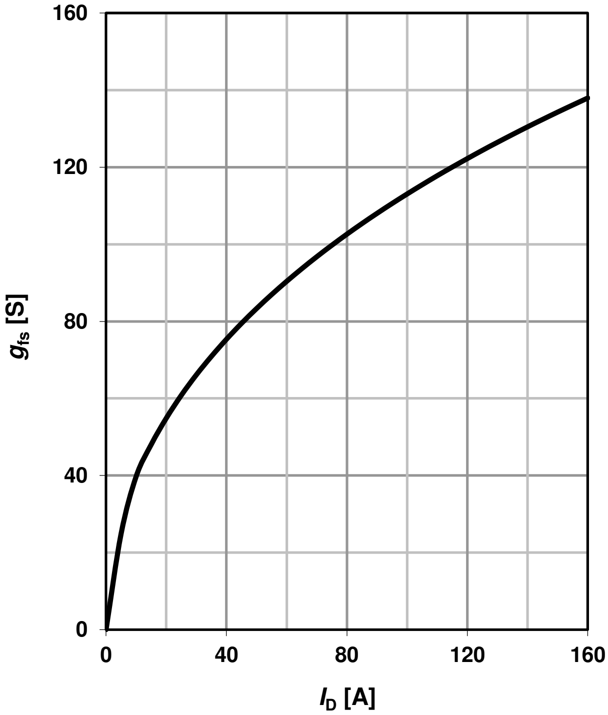
$I_D$=f($V_{GS}$); |$V_{DS}$|>2|$I_D$|$R_{DS(on)max}$

parameter: $T_j$



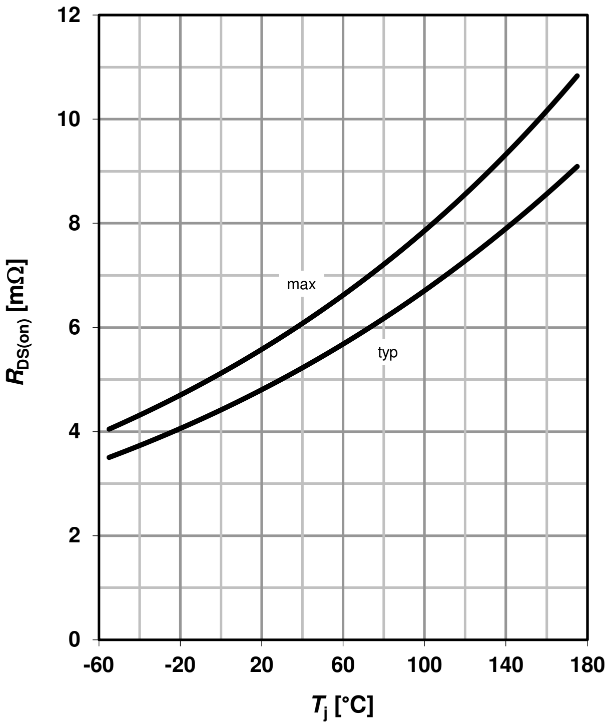

### 8 Typ. forward transconductance

$g_{fs}$=f($I_D$); $T_j$=25 °C



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

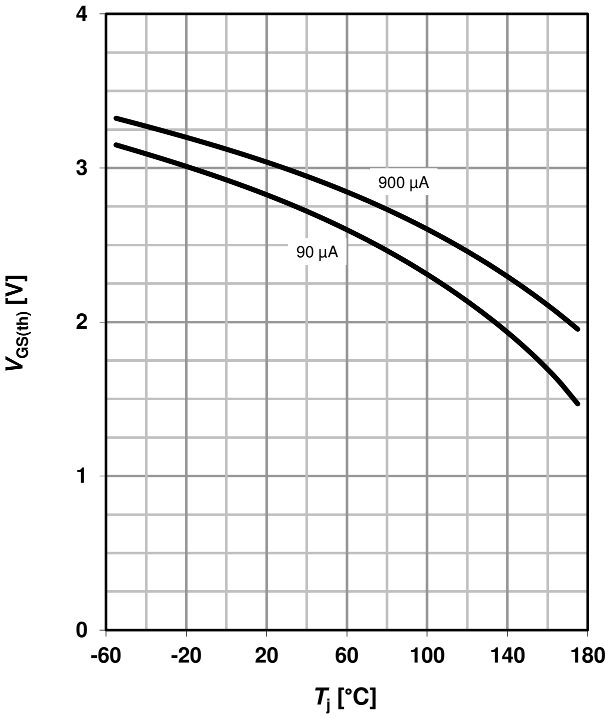
$R_{DS(on)}$=f($T_j$); $I_D$=60 A; $V_{GS}$=10 V




**10 Typ. gate threshold voltage**

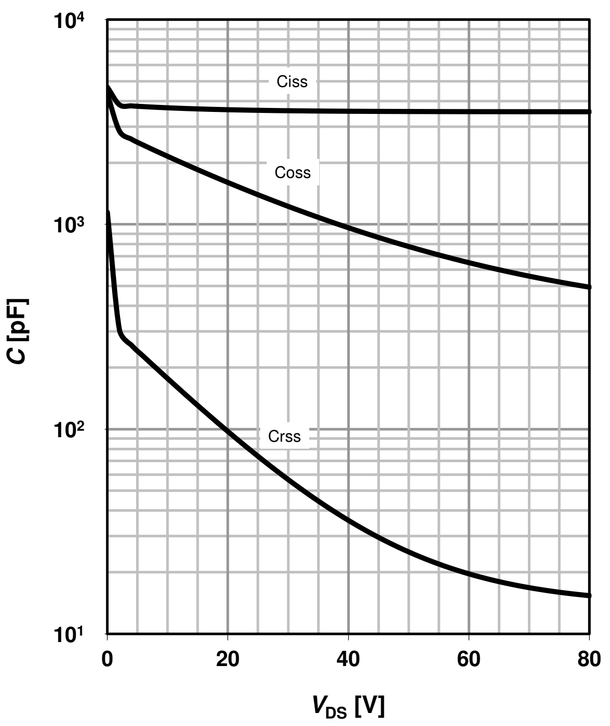
$V_{GS(th)}$=f($T_j$); $V_{GS}$=$V_{DS}$

parameter: $I_D$




**11 Typ. capacitances**

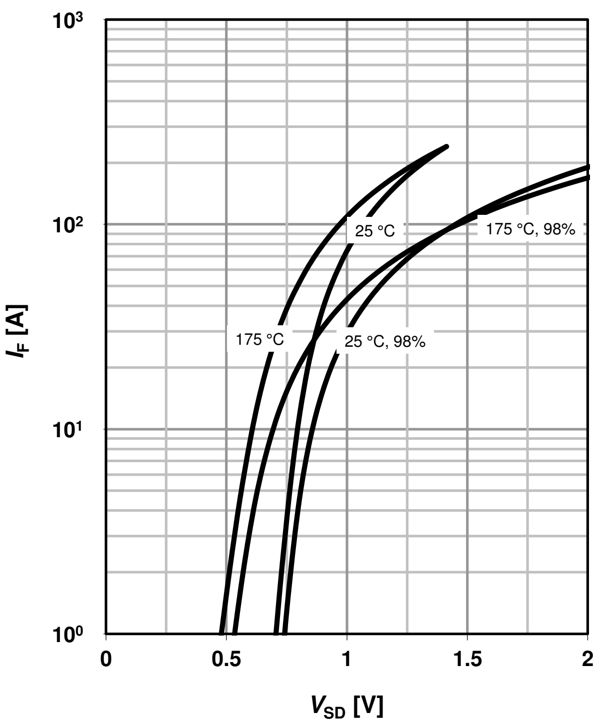
$C$=f($V_{DS}$); $V_{GS}$=0 V; $f$=1 MHz




**12 Forward characteristics of reverse diode**

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

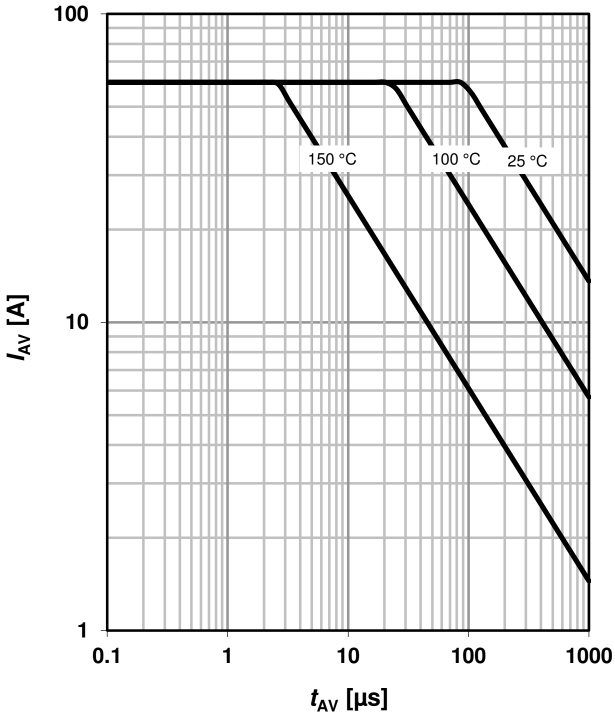
parameter: $T_j$



**13 Avalanche characteristics**

$I_{AS}$=f($t_{AV}$); $R_{GS}$=25 Ω

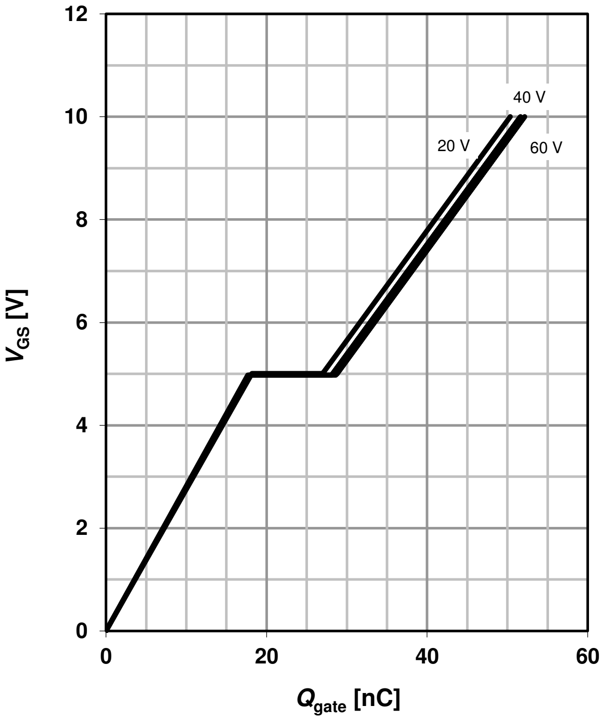
parameter: $T_{j(start)}$




**14 Typ. gate charge**

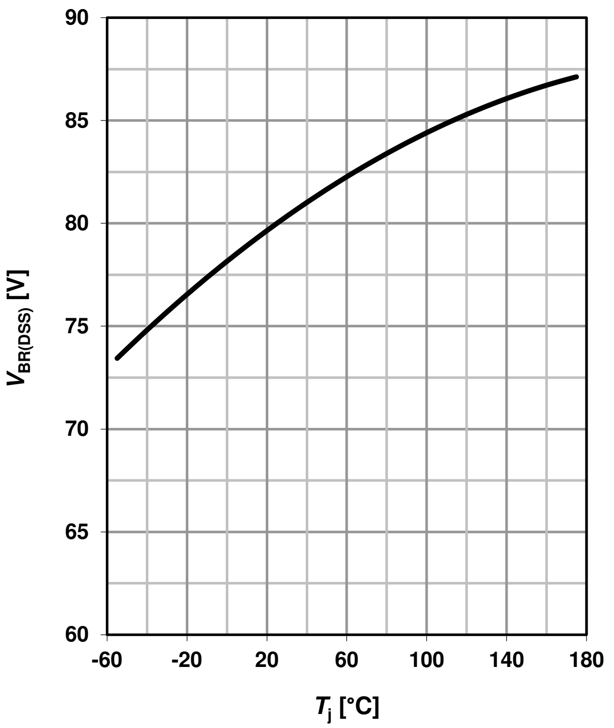
$V_{GS}$=f($Q_{gate}$); $I_D$=60 A pulsed

parameter: $V_{DD}$

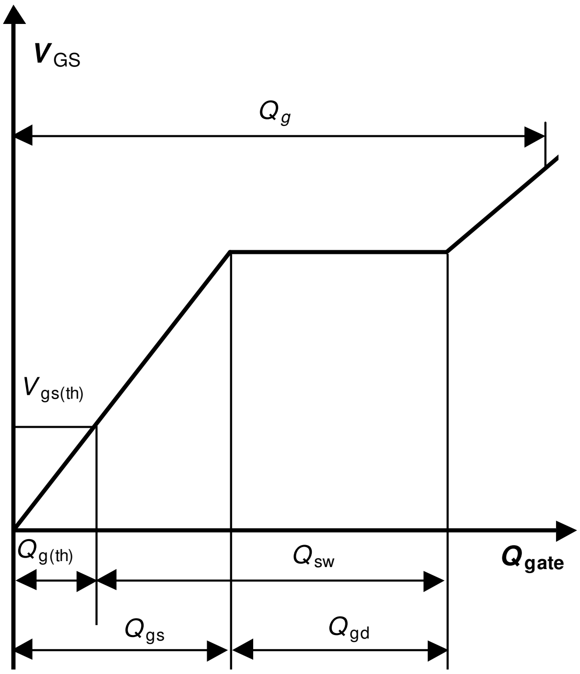



**15 Drain-source breakdown voltage**

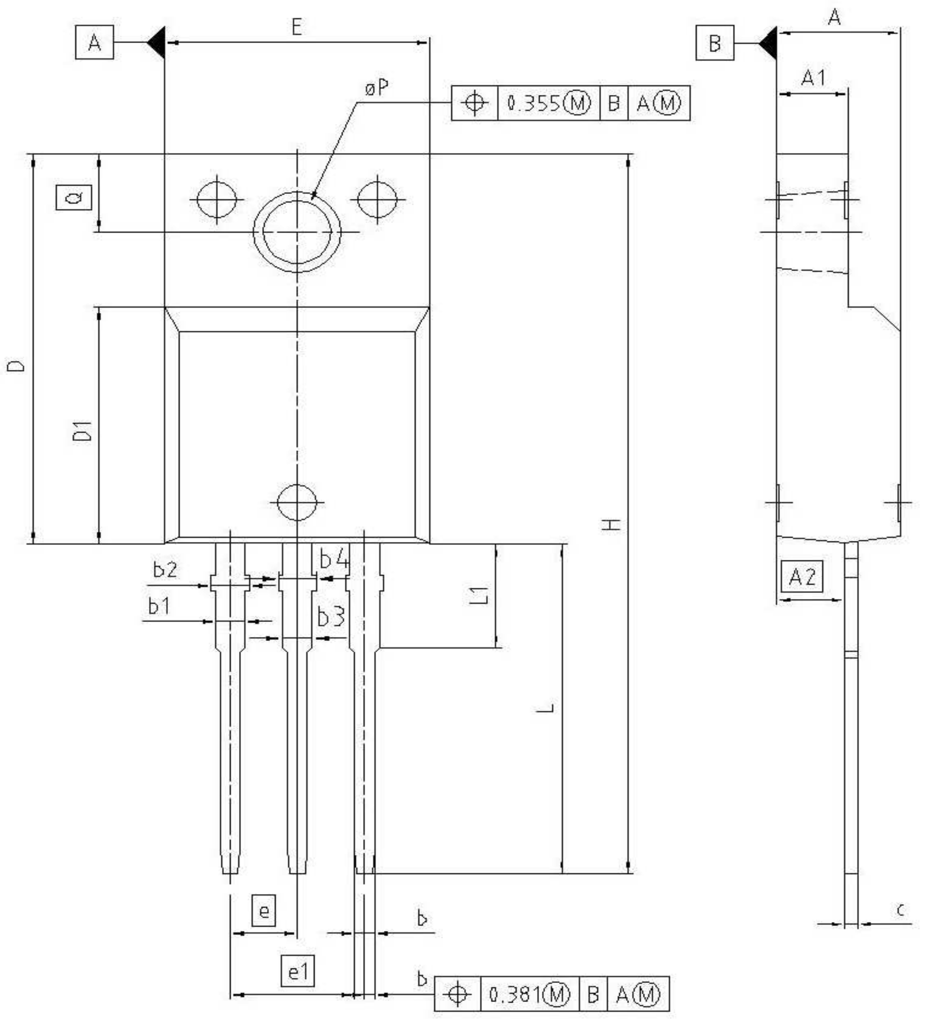
$V_{BR(DSS)}$=f($T_j$); $I_D$=1 mA




**16 Gate charge waveforms**



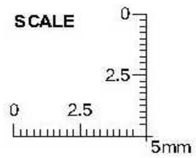
**PG-TO-220-3-31**



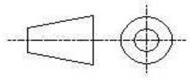

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| **A** | 4.55 | 4.85 | 0.179 | 0.191 |
| **A1** | 2.55 | 2.85 | 0.100 | 0.112 |
| **A2** | 2.42 | 2.72 | 0.095 | 0.107 |
| **b** | 0.65 | 0.85 | 0.026 | 0.033 |
| **b1** | 0.95 | 1.33 | 0.037 | 0.052 |
| **b2** | 0.95 | 1.51 | 0.037 | 0.059 |
| **b3** | 0.65 | 1.33 | 0.026 | 0.052 |
| **b4** | 0.65 | 1.51 | 0.026 | 0.059 |
| **c** | 0.40 | 0.63 | 0.016 | 0.025 |
| **D** | 15.85 | 16.15 | 0.624 | 0.636 |
| **D1** | 9.53 | 9.83 | 0.375 | 0.387 |
| **E** | 10.35 | 10.65 | 0.407 | 0.419 |
| **e** | 2.54 | | 0.100 | |
| **e1** | 5.08 | | 0.200 | |
| **N** | 3 | | 3 | |
| **H** | 29.45 | 29.75 | 1.159 | 1.171 |
| **L** | 13.45 | 13.75 | 0.530 | 0.541 |
| **L1** | 3.15 | 3.45 | 0.124 | 0.136 |
| **øP** | 2.95 | 3.20 | 0.116 | 0.126 |
| **Q** | 3.15 | 3.50 | 0.124 | 0.138 |

**REFERENCE**
../..

**SCALE**




**EUROPEAN PROJECTION**



**ISSUE DATE**
08-01-2007

**FILE**
TO220_2

## Revision History

IPA057N08N3 G

**Revision: 2015-08-27, Rev. 2.2**

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|---|---|---|
| 2.2 | 2015-08-27 | Update features: "Fully isolated package..." |

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