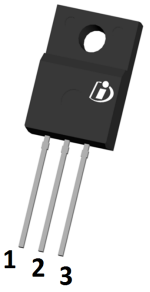
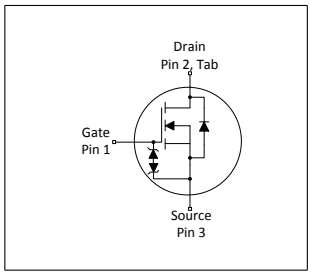
# MOSFET

## 800V CoolMOS™ P7 Power Transistor

PG-TO 220 FP




The latest 800V CoolMOS™ P7 series sets a new benchmark in 800V super junction technologies and combines best-in-class performance with state of the art ease-of-use, resulting from Infineon's over 18 years pioneering super junction technology innovation.




### Features

- Best-in-class FOM $R_{DS(on)}$ * $E_{oss}$; reduced $Q_g$, $C_{iss}$, and $C_{oss}$
- Best-in-class DPAK $R_{DS(on)}$
- Best-in-class $V_{(GS)th}$ of 3V and smallest $V_{(GS)th}$ variation of ±0.5V
- Integrated Zener Diode ESD protection
- Best-in-class CoolMOS™ quality and reliability; qualified for industrial grade applications according to JEDEC (J-STD20 and JESD22)
- Fully optimized portfolio

### Benefits

- Best-in-class performance
- Enabling higher power density designs, BOM savings and lower assembly costs
- Easy to drive and to parallel
- Better production yield by reducing ESD related failures
- Less production issues and reduced field returns
- Easy to select right parts for fine tuning of designs

### Applications

Recommended for hard and soft switching flyback topologies for LED Lighting, low power Chargers and Adapters, Audio, AUX power and Industrial power. Also suitable for PFC stage in Consumer applications and Solar.

*Please note: For MOSFET paralleling the use of ferrite beads on the gate or seperate totem poles is generally recommended.*

### Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|---|---|---|
| $V_{DS}$ @ $T_{j=25°C}$ | 800 | V |
| $R_{DS(on),max}$ | 0.45 | Ω |
| $Q_{g,typ}$ | 24 | nC |
| $I_D$ | 11 | A |
| $E_{oss}$ @ 500V | 2.7 | µJ |
| $V_{GS(th),typ}$ | 3 | V |
| ESD class (HBM) | 2 | - |

| Type / Ordering Code | Package | Marking | Related Links |
|---|---|---|---|
| IPAN80R450P7 | PG-TO 220 FullPAK - Narrow Lead | 80R450P7 | see Appendix A |

## Table of Contents

# 1 Maximum ratings

at $T_j$ = 25°C, unless otherwise specified

## Table 2 Maximum ratings

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Continuous drain current[1] | $I_D$ | -<br>- | -<br>- | 11<br>7.1 | A | $T_C$=25°C<br>$T_C$=100°C |
| Pulsed drain current[2] | $I_{D,pulse}$ | - | - | 29 | A | $T_C$=25°C |
| Avalanche energy, single pulse | $E_{AS}$ | - | - | 29 | mJ | $I_D$=1.8A; $V_{DD}$=50V |
| Avalanche energy, repetitive | $E_{AR}$ | - | - | 0.22 | mJ | $I_D$=1.8A; $V_{DD}$=50V |
| Avalanche current, repetitive | $I_{AR}$ | - | - | 1.8 | A | - |
| MOSFET dv/dt ruggedness | dv/dt | - | - | 100 | V/ns | $V_{DS}$=0 to 400V |
| Gate source voltage | $V_{GS}$ | -20<br>-30 | -<br>- | 20<br>30 | V | static;<br>AC (f>1 Hz) |
| Power dissipation | $P_{tot}$ | - | - | 29 | W | $T_C$=25°C |
| Operating and storage temperature | $T_j$, $T_{stg}$ | -55 | - | 150 | °C | - |
| Mounting torque | - | - | - | 50 | Ncm | M2.5 screw |
| Continuous diode forward current | $I_S$ | - | - | 5 | A | $T_C$=25°C |
| Diode pulse current[2] | $I_{S,pulse}$ | - | - | 29 | A | $T_C$=25°C |
| Reverse diode dv/dt[3] | dv/dt | - | - | 1 | V/ns | $V_{DS}$=0 to 400V, $I_{SD}$<=2.2A, $T_j$=25°C |
| Maximum diode commutation speed[3] | $di_f/dt$ | - | - | 50 | A/µs | $V_{DS}$=0 to 400V, $I_{SD}$<=2.2A, $T_j$=25°C |
| Insulation withstand voltage | $V_{ISO}$ | - | - | 2500 | V | $V_{rms}$, $T_C$=25°C, $t$=1min |

# 2 Thermal characteristics

## Table 3 Thermal characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Thermal resistance, junction - case | $R_{thJC}$ | - | - | 4.4 | °C/W | - |
| Thermal resistance, junction - ambient | $R_{thJA}$ | - | - | 80 | °C/W | leaded |
| Thermal resistance, junction - ambient for SMD version | $R_{thJA}$ | - | - | - | °C/W | n.a. |
| Soldering temperature, wavesoldering only allowed at leads | $T_{sold}$ | - | - | 260 | °C | 1.6 mm (0.063 in.) from case for 10s |

[1] TO220 equivalent. Limited by $T_{j\,max}$. Maximum duty cycle D=0.5
[2] Pulse width $t_p$ limited by $T_{j,max}$
[3] $V_{DClink}$=400V; $V_{DS,peak}$<$V_{(BR)DSS}$; identical low side and high side switch with identical $R_G$; $t_{cond}$<2µs

# 3 Electrical characteristics

at $T_j$ = 25°C, unless otherwise specified

## Table 4 Static characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | 800 | - | - | V | $V_{GS}$=0V, $I_D$=1mA |
| Gate threshold voltage | $V_{GS(th)}$ | 2.5 | 3 | 3.5 | V | $V_{DS}$=$V_{GS}$, $I_D$=0.22mA |
| Zero gate voltage drain current | $I_{DSS}$ | -<br>- | -<br>10 | 1<br>- | µA | $V_{DS}$=800V, $V_{GS}$=0V, $T_j$=25°C<br>$V_{DS}$=800V, $V_{GS}$=0V, $T_j$=150°C |
| Gate-source leakage curent incl. zener diode | $I_{GSS}$ | - | - | 1 | µA | $V_{GS}$=20V, $V_{DS}$=0V |
| Drain-source on-state resistance | $R_{DS(on)}$ | -<br>- | 0.38<br>0.99 | 0.45<br>- | Ω | $V_{GS}$=10V, $I_D$=4.5A, $T_j$=25°C<br>$V_{GS}$=10V, $I_D$=4.5A, $T_j$=150°C |
| Gate resistance | $R_G$ | - | 1 | - | Ω | $f$=250kHz, open drain |

## Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Input capacitance | $C_{iss}$ | - | 770 | - | pF | $V_{GS}$=0V, $V_{DS}$=500V, $f$=250kHz |
| Output capacitance | $C_{oss}$ | - | 14 | - | pF | $V_{GS}$=0V, $V_{DS}$=500V, $f$=250kHz |
| Effective output capacitance, energy related[1)] | $C_{o(er)}$ | - | 24 | - | pF | $V_{GS}$=0V, $V_{DS}$=0 to 500V |
| Effective output capacitance, time related[2)] | $C_{o(tr)}$ | - | 305 | - | pF | $I_D$=constant, $V_{GS}$=0V, $V_{DS}$=0 to 500V |
| Turn-on delay time | $t_{d(on)}$ | - | 10 | - | ns | $V_{DD}$=400V, $V_{GS}$=13V, $I_D$=4.5A, $R_G$=7.5Ω |
| Rise time | $t_r$ | - | 6 | - | ns | $V_{DD}$=400V, $V_{GS}$=13V, $I_D$=4.5A, $R_G$=7.5Ω |
| Turn-off delay time | $t_{d(off)}$ | - | 40 | - | ns | $V_{DD}$=400V, $V_{GS}$=13V, $I_D$=4.5A, $R_G$=7.5Ω |
| Fall time | $t_f$ | - | 10 | - | ns | $V_{DD}$=400V, $V_{GS}$=13V, $I_D$=4.5A, $R_G$=7.5Ω |

## Table 6 Gate charge characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | $Q_{gs}$ | - | 4 | - | nC | $V_{DD}$=640V, $I_D$=4.5A, $V_{GS}$=0 to 10V |
| Gate to drain charge | $Q_{gd}$ | - | 9 | - | nC | $V_{DD}$=640V, $I_D$=4.5A, $V_{GS}$=0 to 10V |
| Gate charge total | $Q_g$ | - | 24 | - | nC | $V_{DD}$=640V, $I_D$=4.5A, $V_{GS}$=0 to 10V |
| Gate plateau voltage | $V_{plateau}$ | - | 4.5 | - | V | $V_{DD}$=640V, $I_D$=4.5A, $V_{GS}$=0 to 10V |

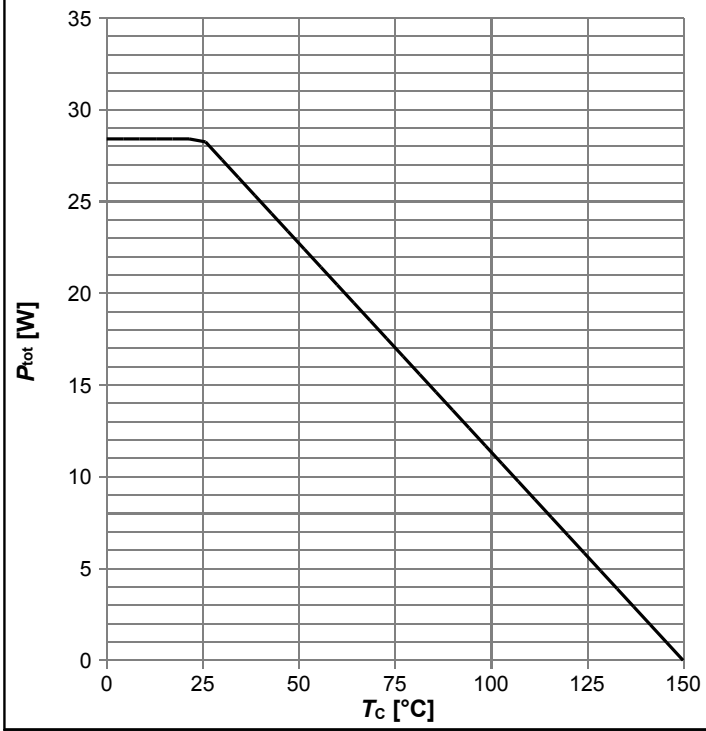
[1)] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as $C_{oss}$ while $V_{DS}$ is rising from 0 to 500V
[2)] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 500V

## Table 7 Reverse diode characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Diode forward voltage | $V_{SD}$ | - | 0.9 | - | V | $V_{GS}$=0V, $I_F$=4.5A, $T_f$=25°C |
| Reverse recovery time | $t_{rr}$ | - | 1000 | - | ns | $V_R$=400V, $I_F$=2.2A, d$i_F$/d$t$=50A/µs |
| Reverse recovery charge | $Q_{rr}$ | - | 11 | - | µC | $V_R$=400V, $I_F$=2.2A, d$i_F$/d$t$=50A/µs |
| Peak reverse recovery current | $I_{rrm}$ | - | 17 | - | A | $V_R$=400V, $I_F$=2.2A, d$i_F$/d$t$=50A/µs |

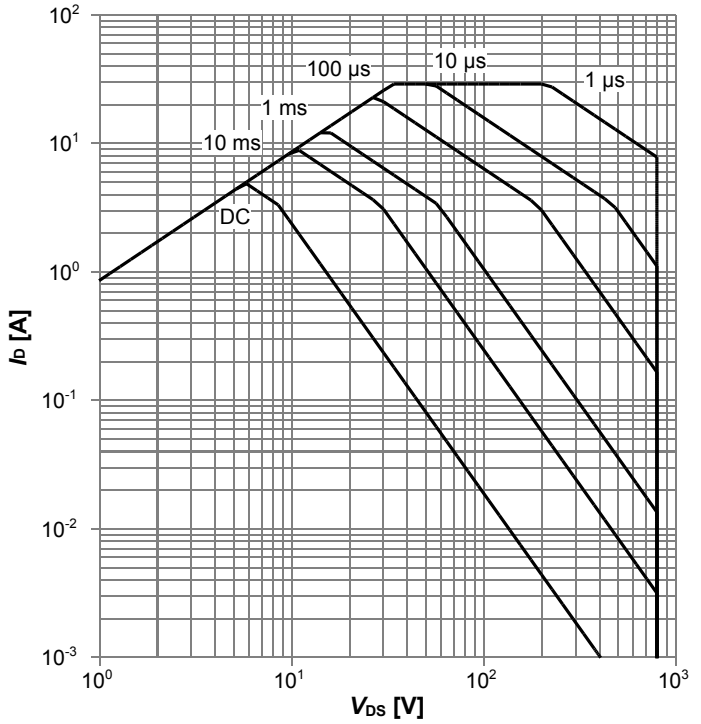
# 4 Electrical characteristics diagrams

**Diagram 1: Power dissipation**



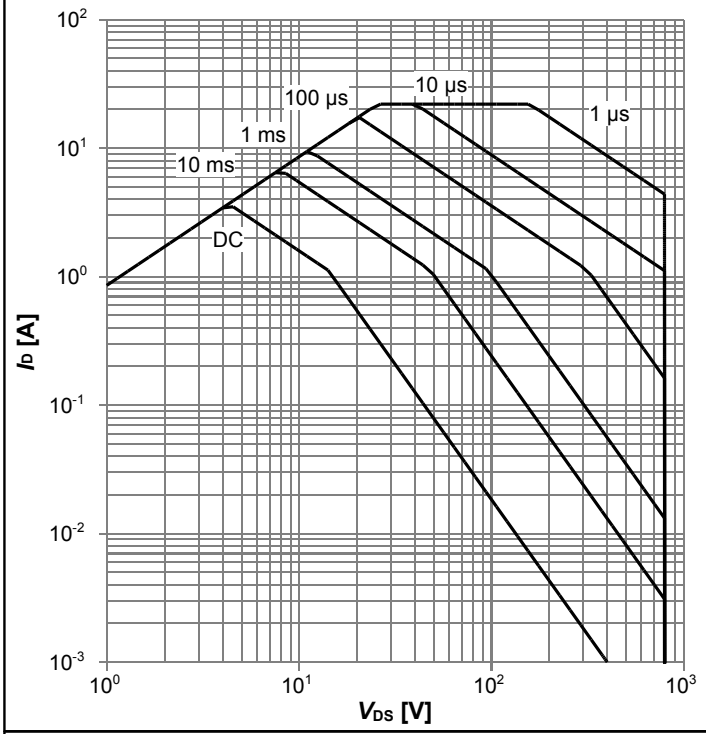

$P_{tot}=f(T_C)$

**Diagram 2: Safe operating area**



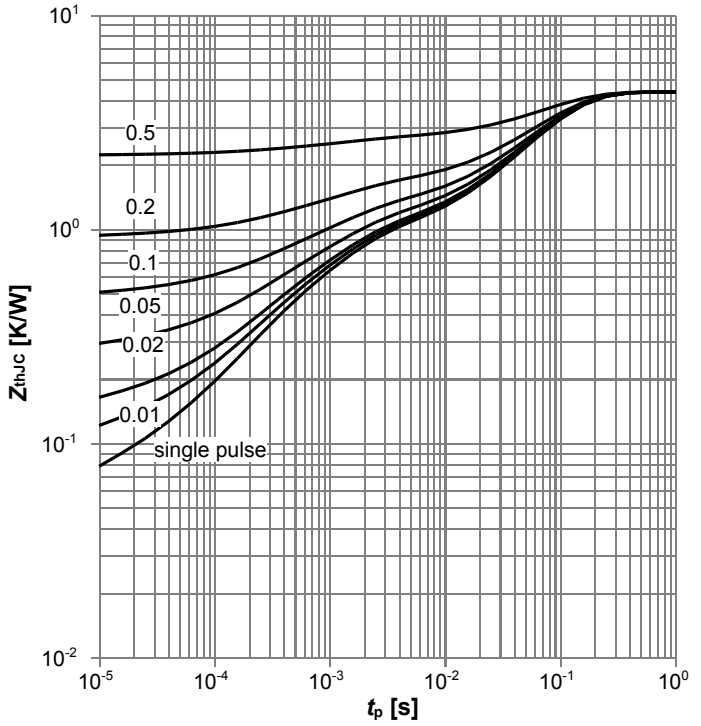

$I_D=f(V_{DS})$; $T_C$=25 °C; $D$=0; parameter: $t_p$

**Diagram 3: Safe operating area**



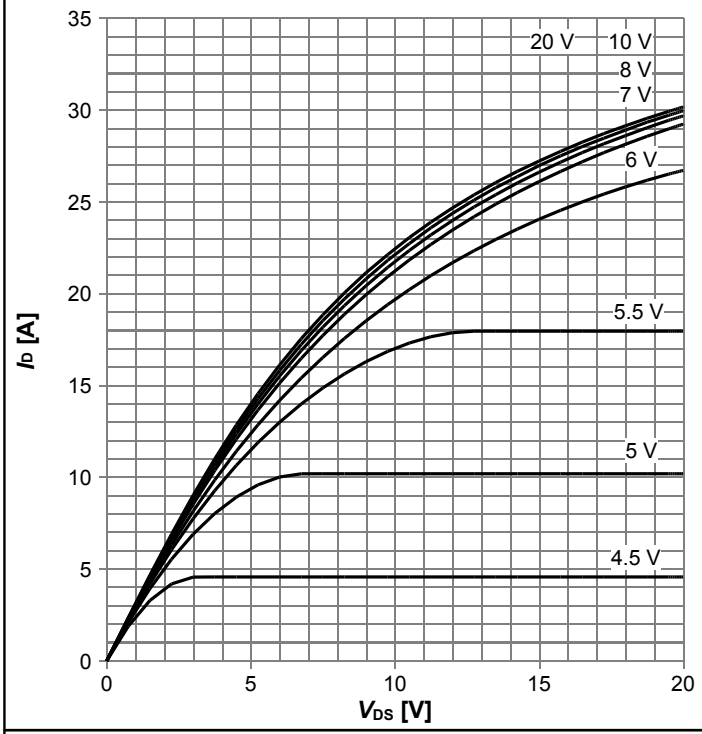

$I_D=f(V_{DS})$; $T_C$=80 °C; $D$=0; parameter: $t_p$

**Diagram 4: Max. transient thermal impedance**



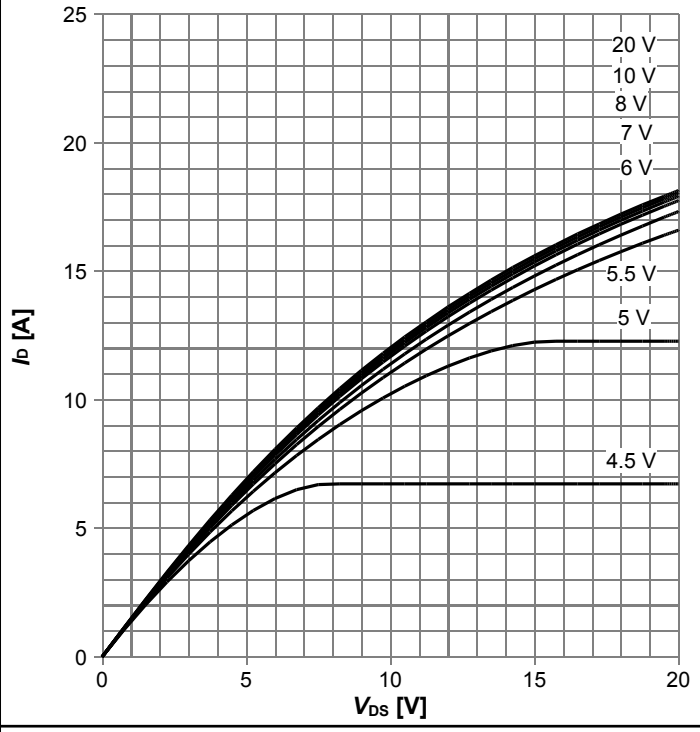

$Z_{thJC}=f(t_P)$; parameter: $D=t_p/T$

**Diagram 5: Typ. output characteristics**



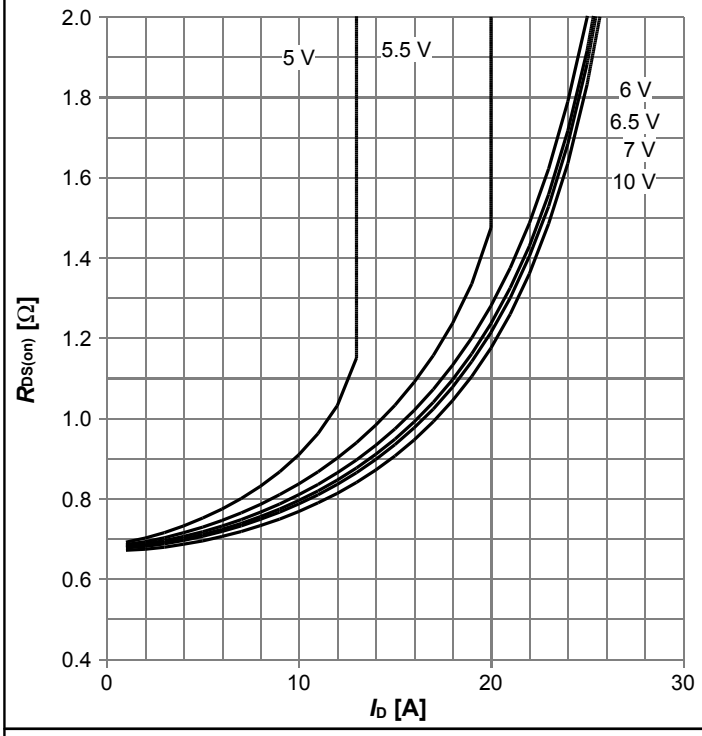

$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: $V_{GS}$

**Diagram 6: Typ. output characteristics**



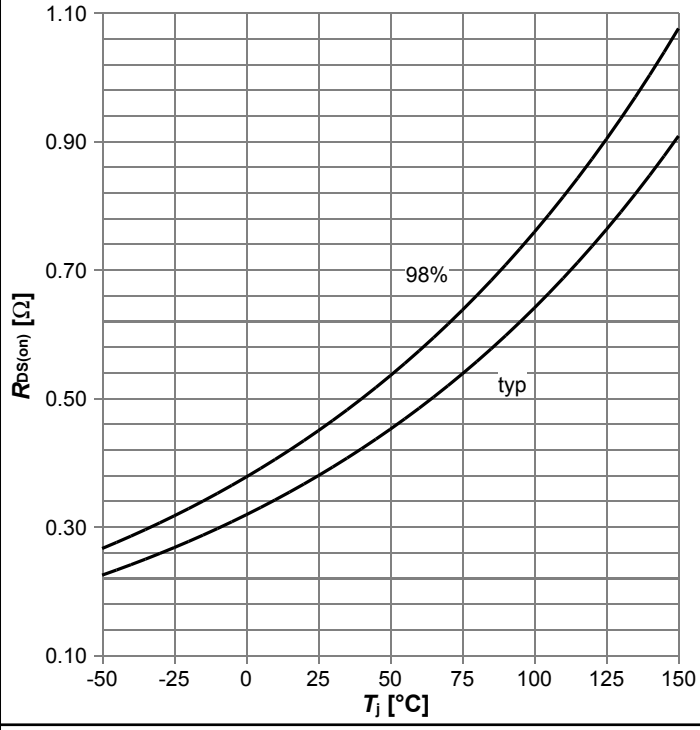

$I_D=f(V_{DS})$; $T_j=125$ °C; parameter: $V_{GS}$

**Diagram 7: Typ. drain-source on-state resistance**



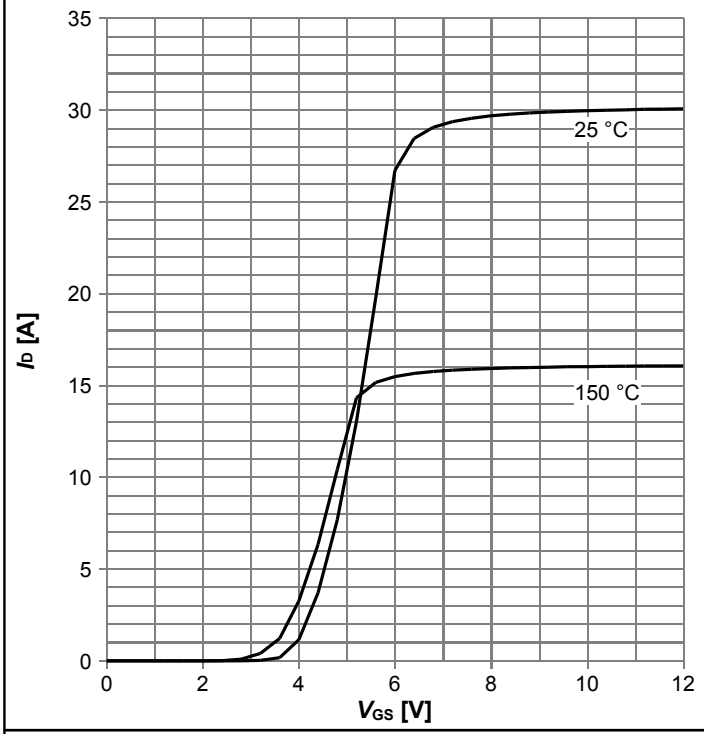

$R_{DS(on)}=f(I_D)$; $T_j=125$ °C; parameter: $V_{GS}$

**Diagram 8: Drain-source on-state resistance**



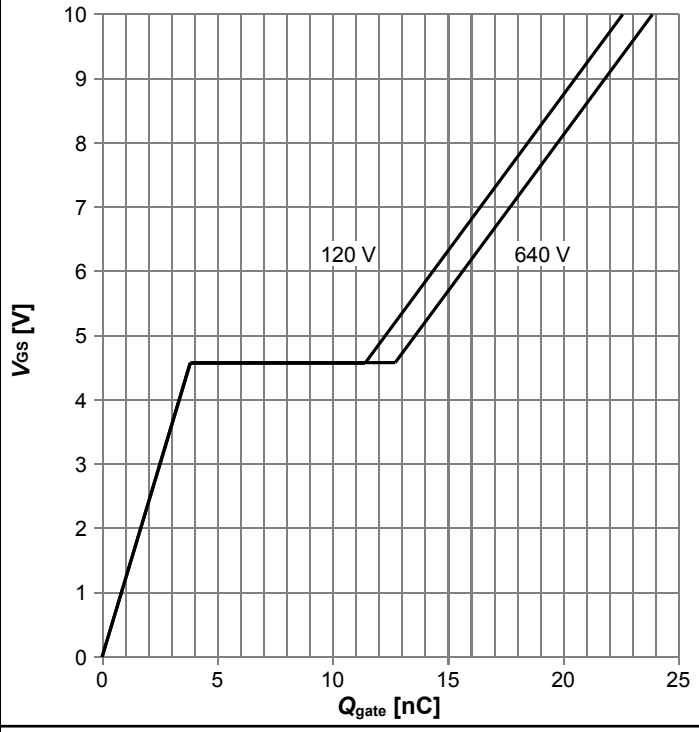

$R_{DS(on)}=f(T_j)$; $I_D=4.5$ A; $V_{GS}=10$ V

**Diagram 9: Typ. transfer characteristics**



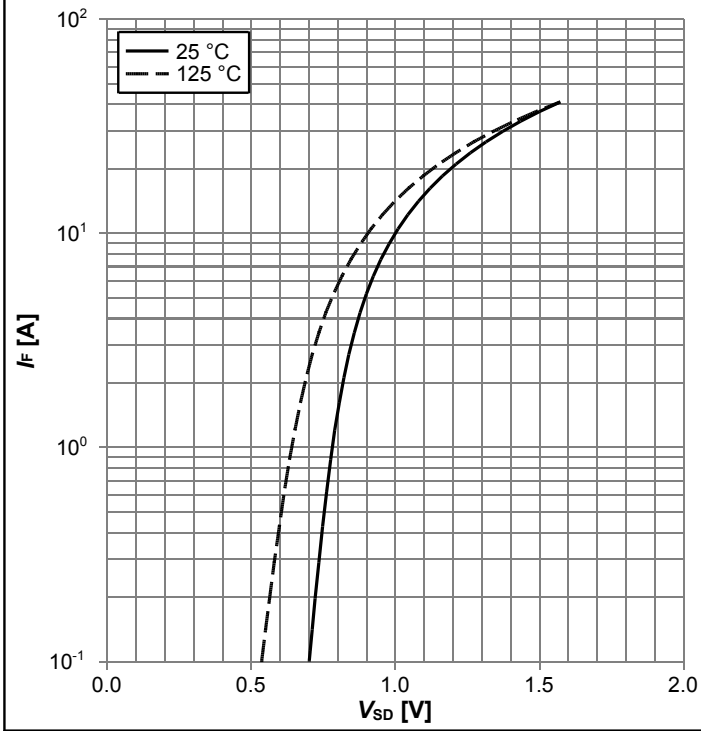

$I_D=f(V_{GS})$; $V_{DS}$=20V; parameter: $T_j$

**Diagram 10: Typ. gate charge**



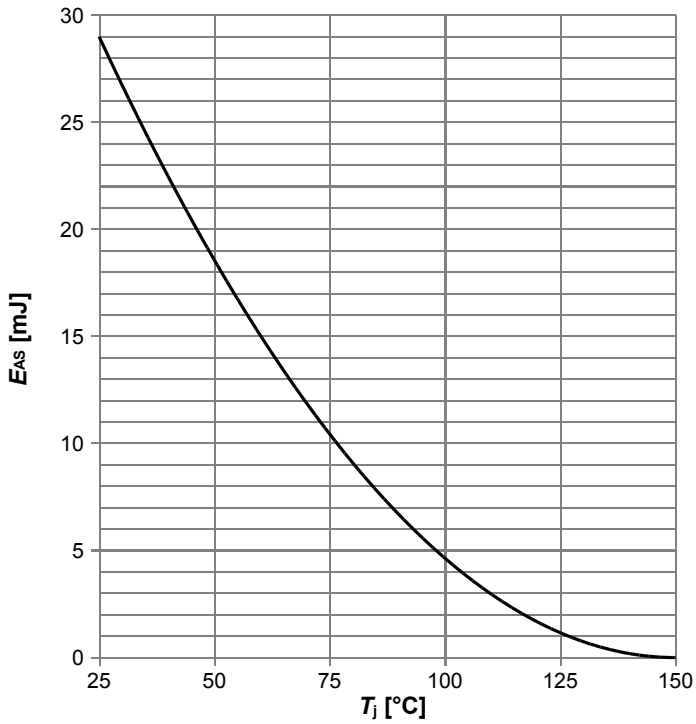

$V_{GS}=f(Q_{gate})$; $I_D$=4.5 A pulsed; parameter: $V_{DD}$

**Diagram 11: Forward characteristics of reverse diode**



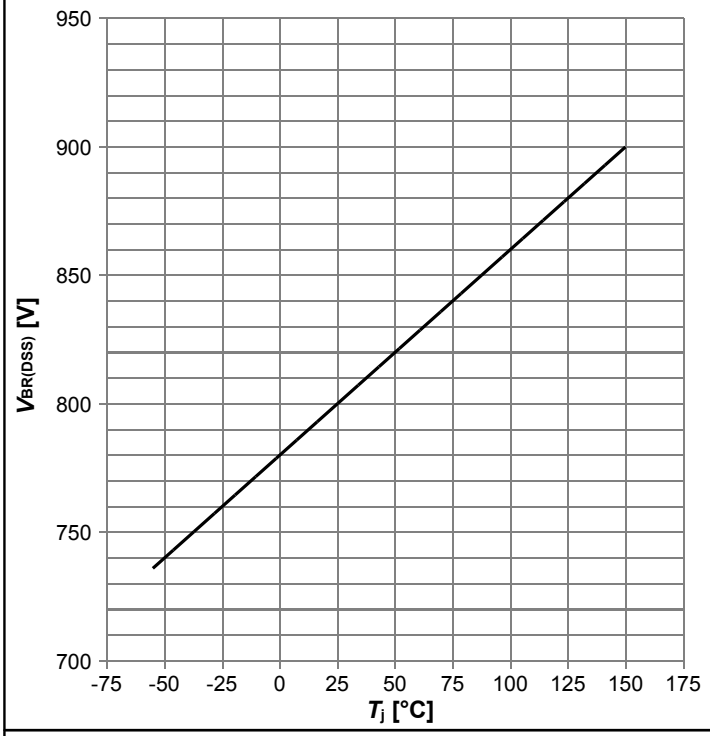

$I_F=f(V_{SD})$; parameter: $T_j$

**Diagram 12: Avalanche energy**



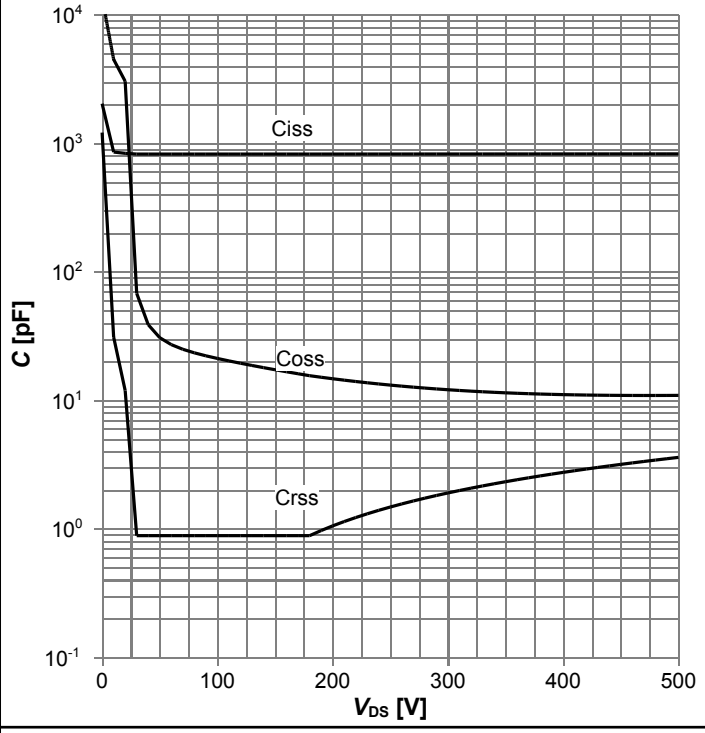

$E_{AS}=f(T_j)$; $I_D$=1.8 A; $V_{DD}$=50 V

**Diagram 13: Drain-source breakdown voltage**



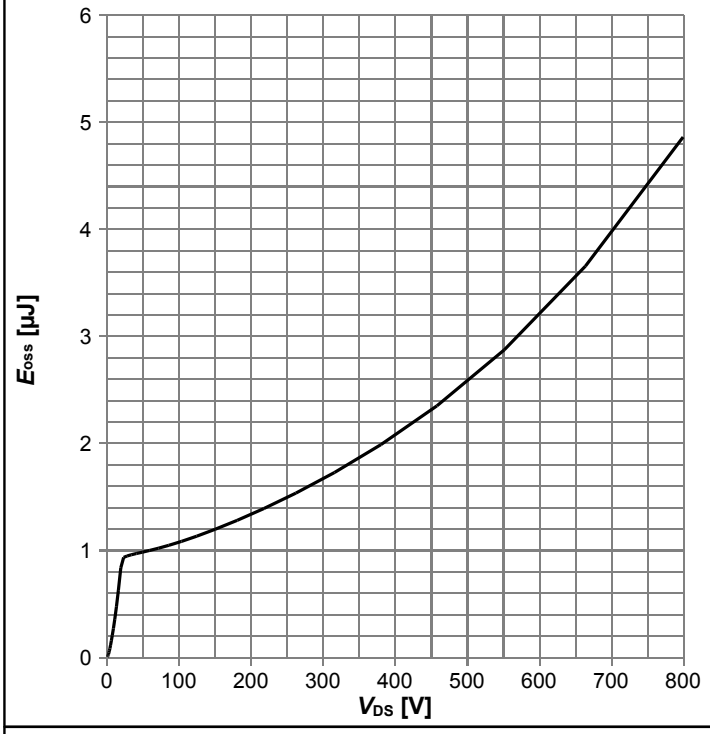

$V_{BR(DSS)}$=f($T_j$); $I_D$=1 mA

**Diagram 14: Typ. capacitances**




$C$=f($V_{DS}$); $V_{GS}$=0 V; $f$=250 kHz

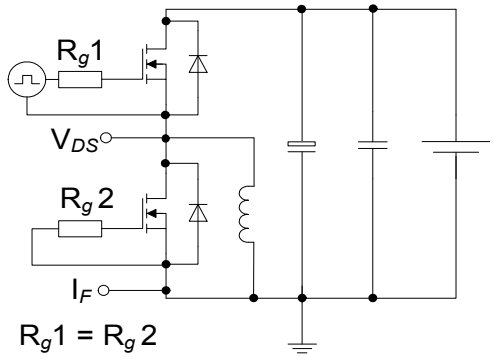
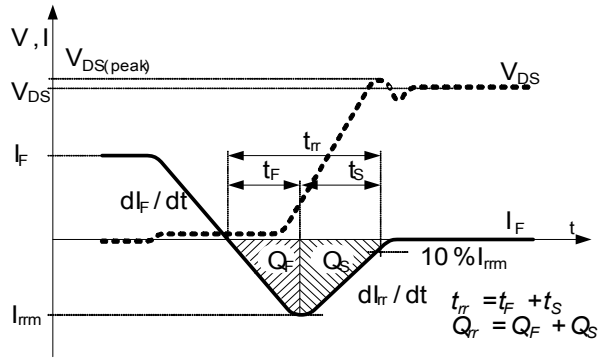
**Diagram 15: Typ. Coss stored energy**




$E_{oss}$=f($V_{DS}$)

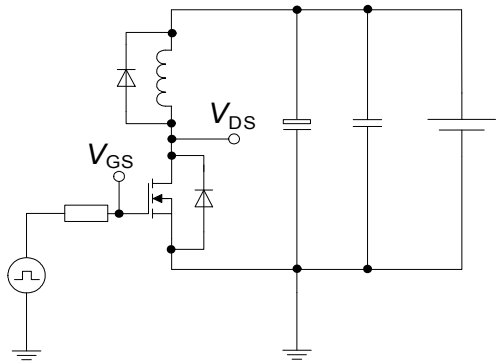
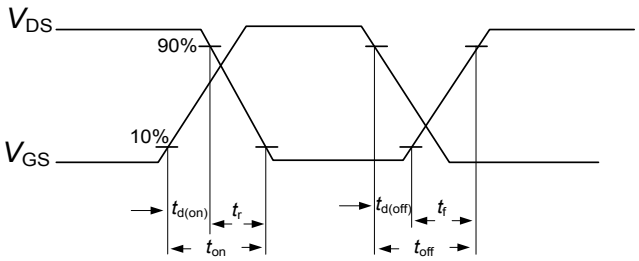
# 5 Test Circuits

## Table 8 Diode characteristics

| Test circuit for diode characteristics | Diode recovery waveform |
|---|---|
|  |  |

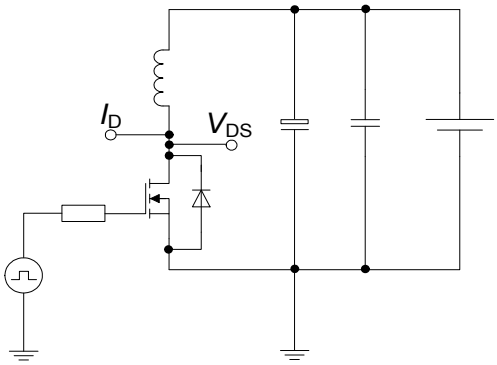
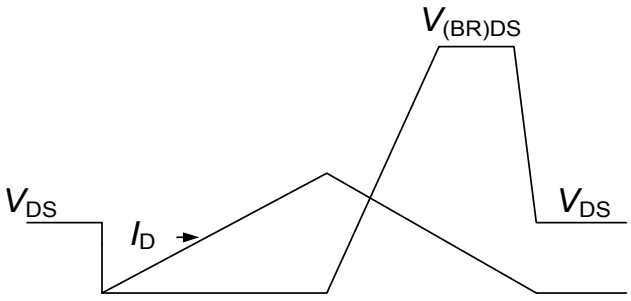


## Table 9 Switching times

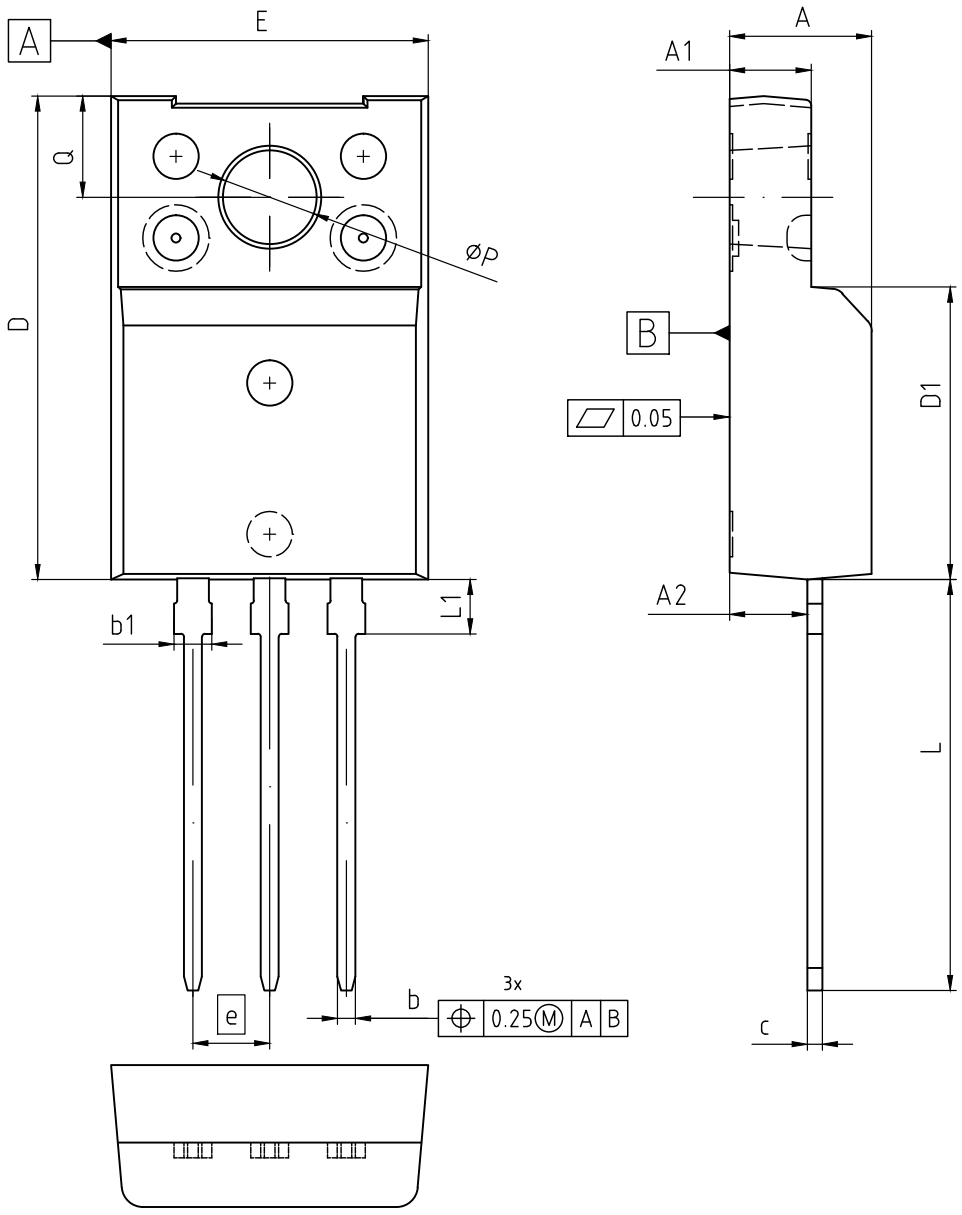
| Switching times test circuit for inductive load | Switching times waveform |
|---|---|
|  |  |



## Table 10 Unclamped inductive load

| Unclamped inductive load test circuit | Unclamped inductive waveform |
|---|---|
|  |  |

## 6 Package Outlines




| DIMENSIONS | MILLIMETERS | |
|---|---|---|
| | MIN. | MAX. |
| A | 4.60 | 4.80 |
| A1 | 2.60 | 2.80 |
| A2 | 2.47 | 2.67 |
| b | 0.56 | 0.69 |
| b1 | 1.01 | 1.15 |
| c | 0.46 | 0.59 |
| D | 15.90 | 16.10 |
| D1 | 9.58 | 9.78 |
| E | 10.40 | 10.60 |
| e | 2.54 | |
| N | 3 | |
| L | 13.45 | 13.75 |
| L1 | 1.70 | 1.90 |
| øP | 3.00 | 3.20 |
| Q | 3.25 | 3.45 |

NOTES:
ALL DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
ALL DIMENSIONS REFER TO JEDEC STANDARD TO-281

| |
|---|
| DOCUMENT NO. Z8B00180155 |
| REVISION 04 |
| SCALE 5:1 0 1 2 3 4 5mm |
| EUROPEAN PROJECTION |
| ISSUE DATE 07.11.2016 |

**Figure 1 Outline PG-TO 220 FullPAK - Narrow Lead, dimensions in mm - Industrial Grade**

# 7 Appendix A

## Table 11 Related Links

- **IFX CoolMOS Webpage:** www.infineon.com
- **IFX Design tools:** www.infineon.com

## Revision History

IPAN80R450P7

**Revision: 2016-12-02, Rev. 2.0**

| Previous Revision | | |
|---|---|---|
| Revision | Date | Subjects (major changes since last revision) |
| 2.0 | 2016-12-02 | Release of final version |



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