

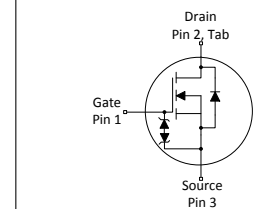
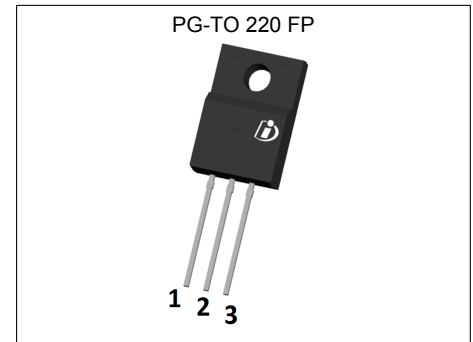
MOSFET

700V CoolMOS™ P7 Power Transistor

CoolMOS™ is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infineon Technologies.

The latest CoolMOS™ P7 is an optimized platform tailored to target cost sensitive applications in consumer markets such as charger, adapter, lighting, TV, etc.

The new series provides all the benefits of a fast switching Superjunction MOSFET, combined with an excellent price/performance ratio and state of the art ease-of-use level. The technology meets highest efficiency standards and supports high power density, enabling customers going towards very slim designs.



Features

- Extremely low losses due to very low FOM $R_{DS(on)} * Q_g$ and $R_{DS(on)} * E_{oss}$
- Excellent thermal behavior
- Integrated ESD protection diode
- Low switching losses (E_{oss})
- Product validation acc. JEDEC Standard

Benefits

- Cost competitive technology
- Lower temperature
- High ESD ruggedness
- Enables efficiency gains at higher switching frequencies
- Enables high power density designs and small form factors

Potential applications

Recommended for Flyback topologies for example used in Chargers, Adapters, Lighting Applications, etc.

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



Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j=25^{\circ}C}$	700	V
$R_{DS(on),max}$	0.45	Ω
$Q_{g,typ}$	13.1	nC
$I_{D,pulse}$	26	A
$E_{oss} @ 400V$	1.4	μJ
$V_{(GS)th,typ}$	3	V
ESD class (HBM)	2	

Type / Ordering Code	Package	Marking	Related Links
IPAN70R450P7S	PG-TO 220 FullPAK - Narrow Lead	70S450P7	see Appendix A

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1 Maximum ratings

at $T_j = 25^\circ\text{C}$, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current ¹⁾	I_D	-	-	10.0 6.5	A	$T_C = 20^\circ\text{C}$ $T_C = 100^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	25.9	A	$T_C=25^\circ\text{C}$
Application (Flyback) relevant avalanche current, single pulse ³⁾	I_{AS}	-	-	3.5	A	measured with standard leakage inductance of transformer of $7\mu\text{H}$
MOSFET dv/dt ruggedness	dv/dt	-	-	100	V/ns	$V_{DS} = 0\dots 400\text{V}$
Gate source voltage	V_{GS}	-16 -30	-	16 30	V	static; AC ($f > 1\text{ Hz}$)
Power dissipation	P_{tot}	-	-	22.7	W	$T_C=25^\circ\text{C}$
Operating and storage temperature	T_j, T_{stg}	-40	-	150	$^\circ\text{C}$	-
Continuous diode forward current	I_S	-	-	4.7	A	$T_C=25^\circ\text{C}$
Diode pulse current ²⁾	$I_{S,pulse}$	-	-	25.9	A	$T_C = 25^\circ\text{C}$
Reverse diode dv/dt ⁴⁾	dv/dt	-	-	1	V/ns	$V_{DS} = 0\dots 400\text{V}$, $I_{SD} \leq I_S$, $T_j=25^\circ\text{C}$
Maximum diode commutation speed ⁴⁾	di/dt	-	-	50	A/ μs	$V_{DS} = 0\dots 400\text{V}$, $I_{SD} \leq I_S$, $T_j=25^\circ\text{C}$
Insulation withstand voltage	V_{ISO}	-	-	2500	V	V_{rms} , $T_C=25^\circ\text{C}$, $t=1\text{ min}$

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction	R_{thJC}	-	-	5.5	$^\circ\text{C/W}$	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	80	$^\circ\text{C/W}$	leaded
Thermal resistance, junction - ambient for SMD version	R_{thJA}	-	-	-	$^\circ\text{C/W}$	n.a.
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	-	-	260	$^\circ\text{C}$	1.6 mm (0.063 in.) from case for 10s

¹⁾ DPAK / IPAK equivalent. Limited by $T_{j,max}$. $T_j = 20^\circ\text{C}$. Maximum duty cycle $D=0.5$

²⁾ Pulse width t_p limited by $T_{j,max}$

³⁾ Proven during verification test. For explanation please read AN - CoolMOS™ 700V P7.

⁴⁾ $V_{DClink}=400\text{V}$; $V_{DS,peak} < V_{(BR)DSS}$; identical low side and high side switch with identical R_G

3 Electrical characteristics

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	700	-	-	V	$V_{GS}=0V, I_D=1mA$
Gate threshold voltage	$V_{(GS)th}$	2.50	3	3.50	V	$V_{DS}=V_{GS}, I_D=0.12mA$
Zero gate voltage drain current	I_{DSS}	-	-	1	μA	$V_{DS}=700V, V_{GS}=0V, T_j=25^\circ C$ $V_{DS}=700V, V_{GS}=0V, T_j=150^\circ C$
Gate-source leakage current incl. Zener diode	I_{GSS}	-	-	1	μA	$V_{GS}=20V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.37	0.45	Ω	$V_{GS}=10V, I_D=2.3A, T_j=25^\circ C$ $V_{GS}=10V, I_D=2.3A, T_j=150^\circ C$
Gate resistance	R_G	-	10	-	Ω	$f=1\text{ MHz}, \text{open drain}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	424	-	pF	$V_{GS}=0V, V_{DS}=400V, f=250kHz$
Output capacitance	C_{oss}	-	8	-	pF	$V_{GS}=0V, V_{DS}=400V, f=250kHz$
Effective output capacitance, energy related ¹⁾	$C_{o(er)}$	-	21	-	pF	$V_{GS}=0V, V_{DS}=0...400V$
Effective output capacitance, time related ²⁾	$C_{o(tr)}$	-	251	-	pF	$I_D=\text{constant}, V_{GS}=0V, V_{DS}=0...400V$
Turn-on delay time	$t_{d(on)}$	-	16	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.7A,$ $R_G=5.3\Omega$
Rise time	t_r	-	6.5	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.7A,$ $R_G=5.3\Omega$
Turn-off delay time	$t_{d(off)}$	-	70	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.7A,$ $R_G=5.3\Omega$
Fall time	t_f	-	20	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.7A,$ $R_G=5.3\Omega$

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	1.9	-	nC	$V_{DD}=400V, I_D=1.7A, V_{GS}=0\text{ to }10V$
Gate to drain charge	Q_{gd}	-	5.0	-	nC	$V_{DD}=400V, I_D=1.7A, V_{GS}=0\text{ to }10V$
Gate charge total	Q_g	-	13.1	-	nC	$V_{DD}=400V, I_D=1.7A, V_{GS}=0\text{ to }10V$
Gate plateau voltage	$V_{plateau}$	-	4.4	-	V	$V_{DD}=400V, I_D=1.7A, V_{GS}=0\text{ to }10V$

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 400V

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 400V

Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	0.9	-	V	$V_{GS}=0V, I_F=2.6A, T_j=25^\circ C$
Reverse recovery time	t_{rr}	-	200	-	ns	$V_R=400V, I_F=1.7A, di_F/dt=50A/\mu s$
Reverse recovery charge	Q_{rr}	-	0.7	-	μC	$V_R=400V, I_F=1.7A, di_F/dt=50A/\mu s$
Peak reverse recovery current	I_{rrm}	-	8	-	A	$V_R=400V, I_F=1.7A, di_F/dt=50A/\mu s$

4 Electrical characteristics diagrams

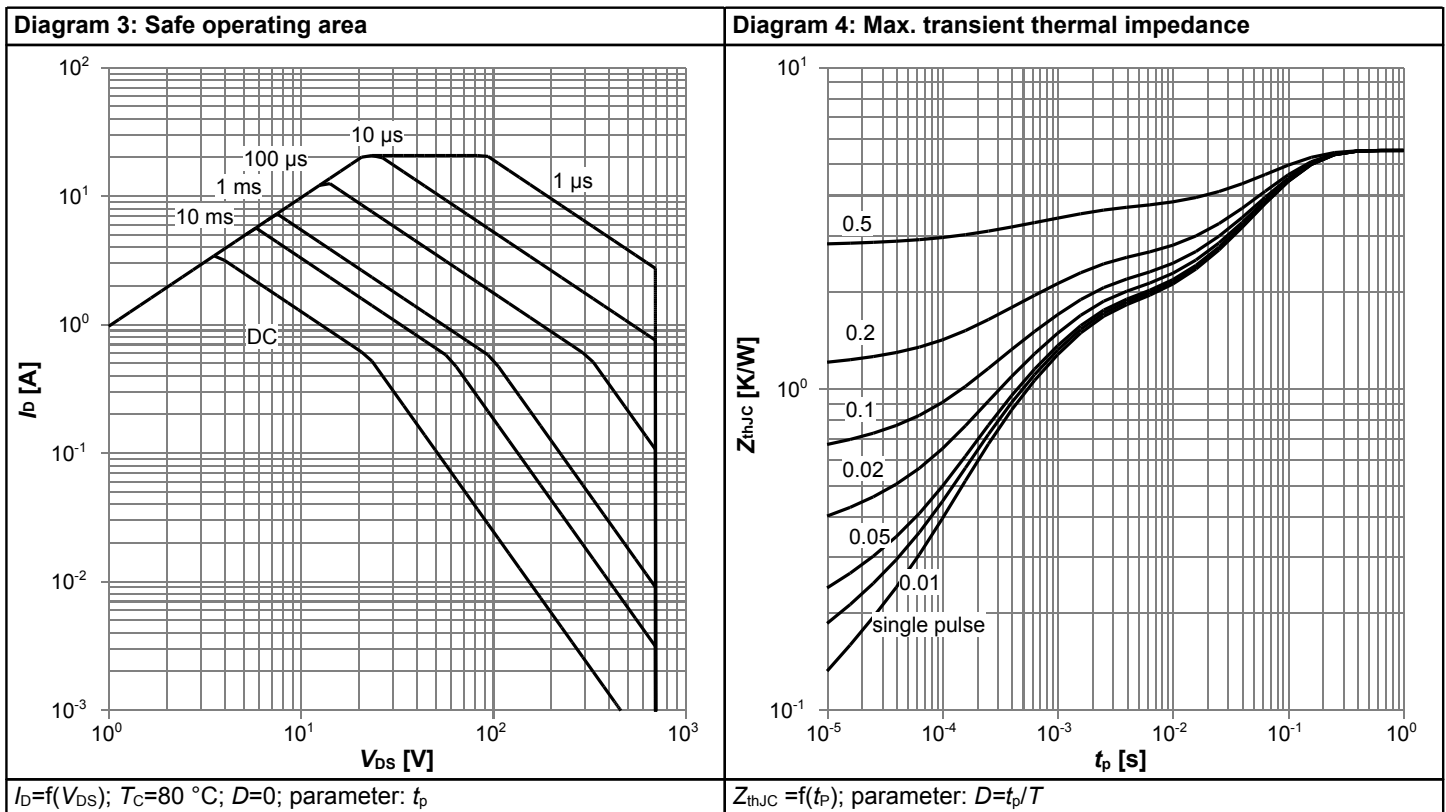
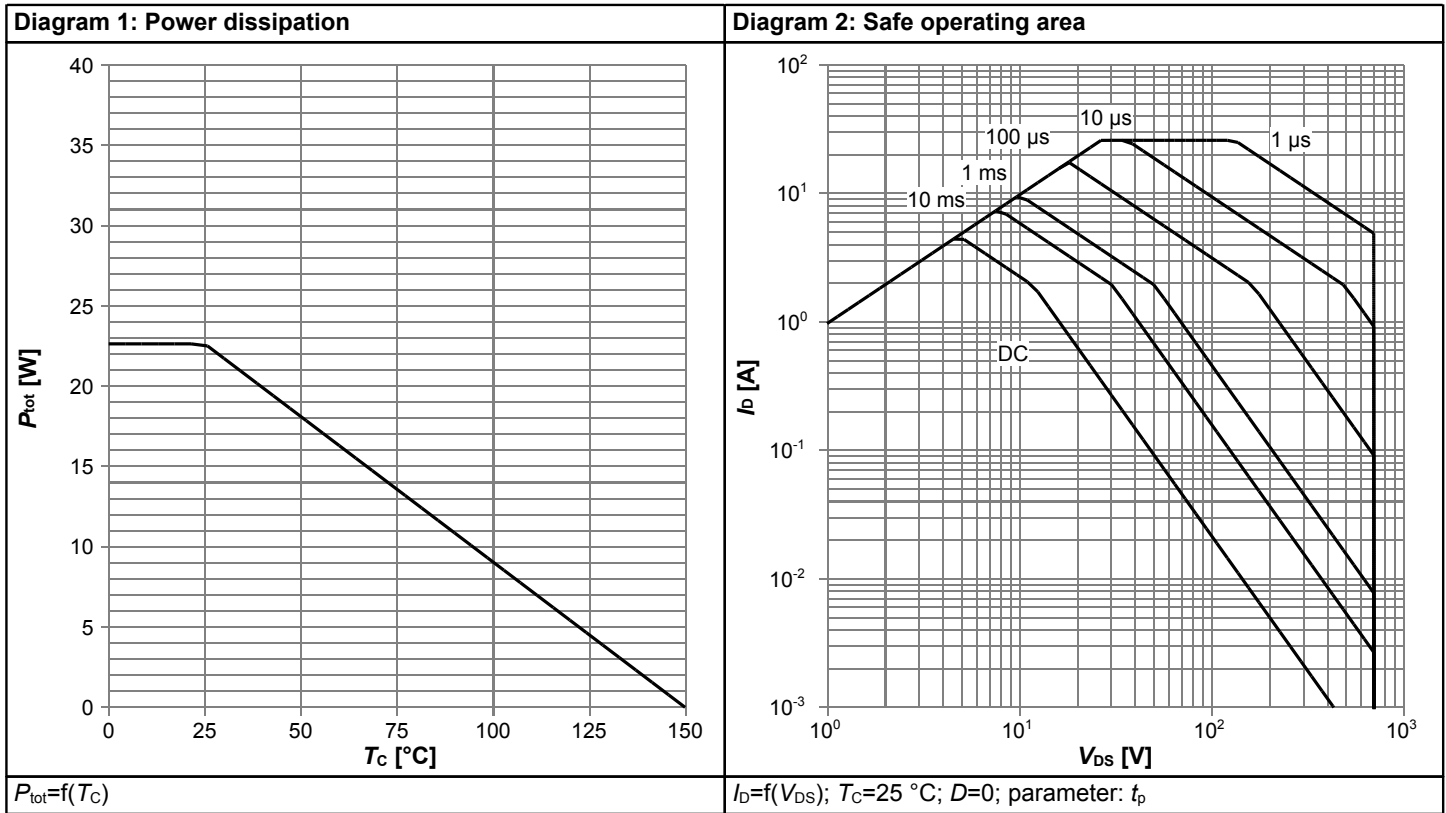
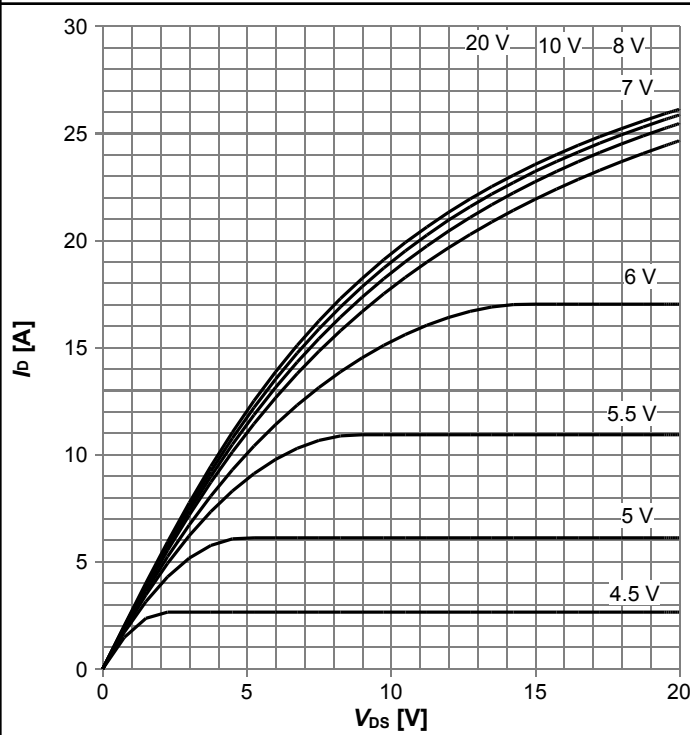
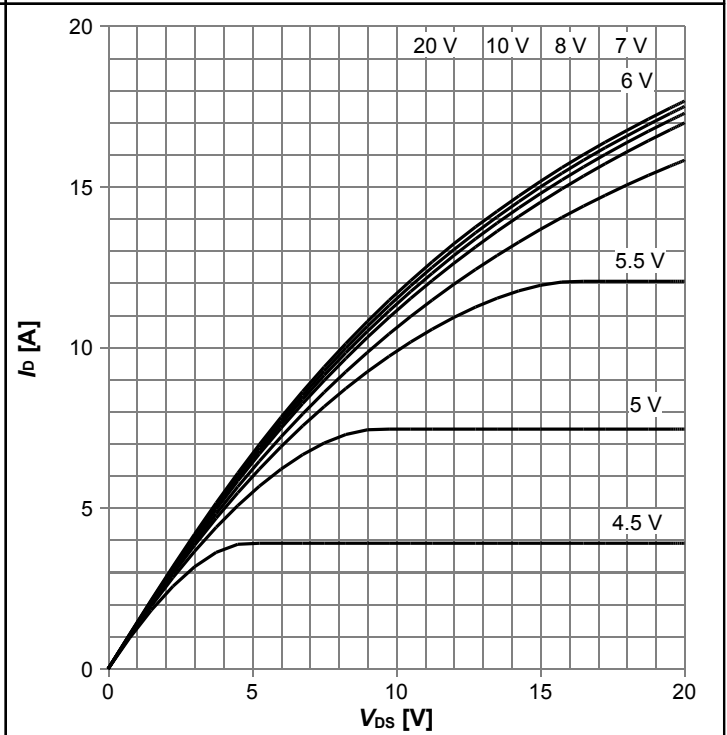


Diagram 5: Typ. output characteristics



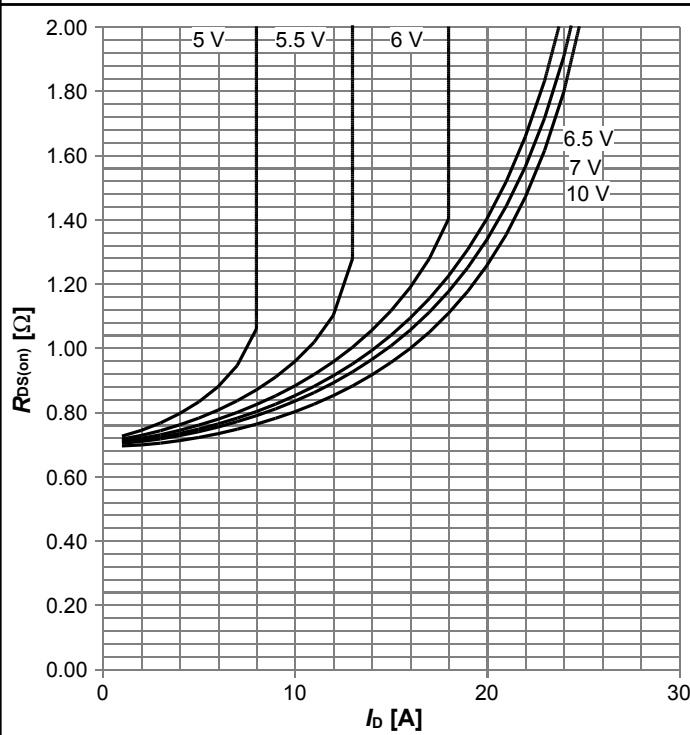
$I_D=f(V_{DS})$; $T_j=25\text{ °C}$; parameter: V_{GS}

Diagram 6: Typ. output characteristics



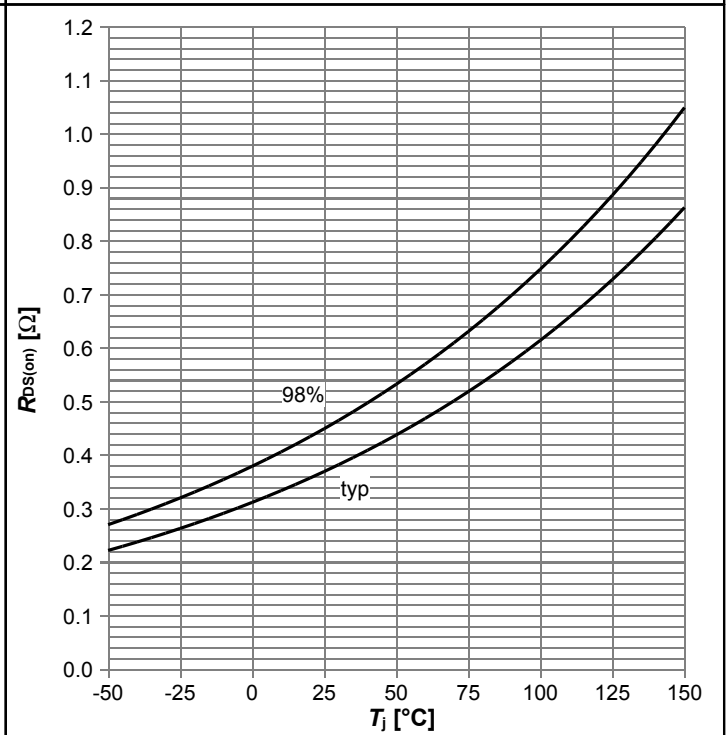
$I_D=f(V_{DS})$; $T_j=125\text{ °C}$; parameter: V_{GS}

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



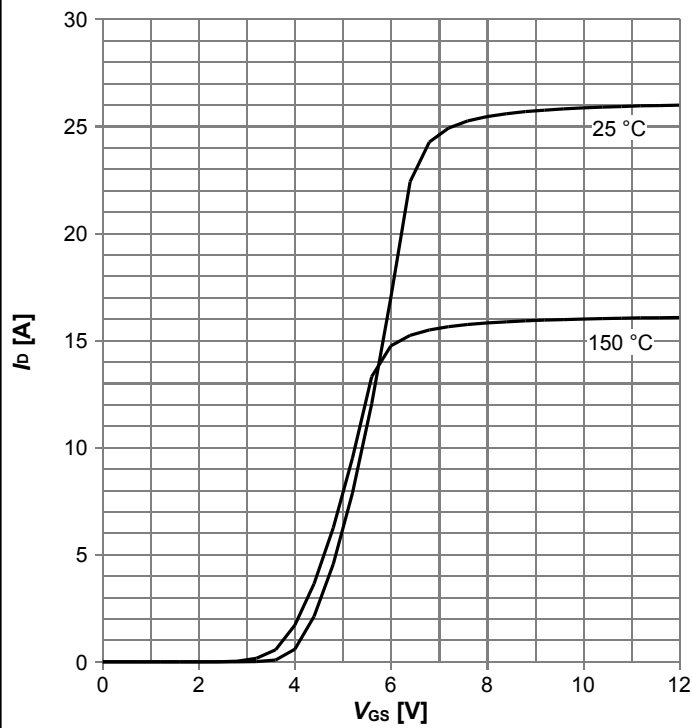
$R_{DS(on)}=f(I_D)$; $T_j=125\text{ °C}$; parameter: V_{GS}

Diagram 8: Drain-source on-state resistance



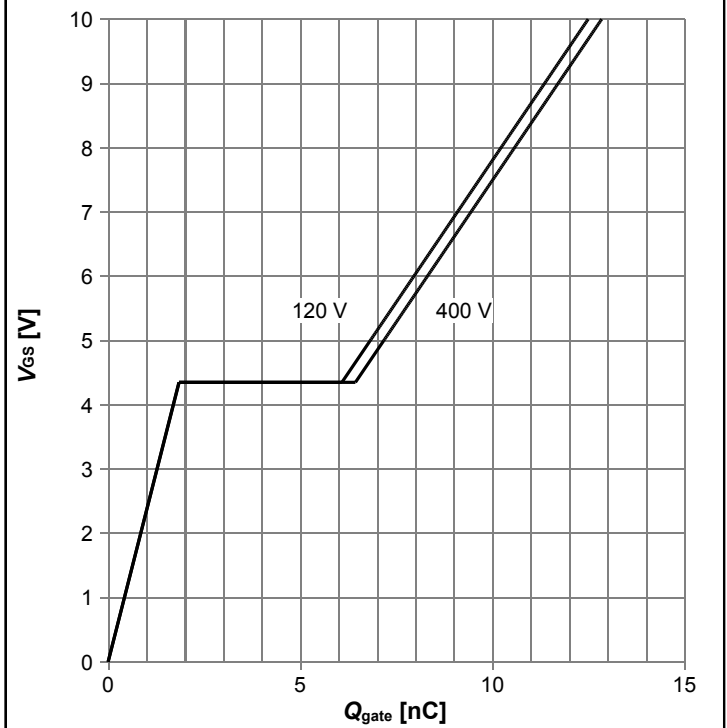
$R_{DS(on)}=f(T_j)$; $I_D=2.3\text{ A}$; $V_{GS}=10\text{ V}$

Diagram 9: Typ. transfer characteristics



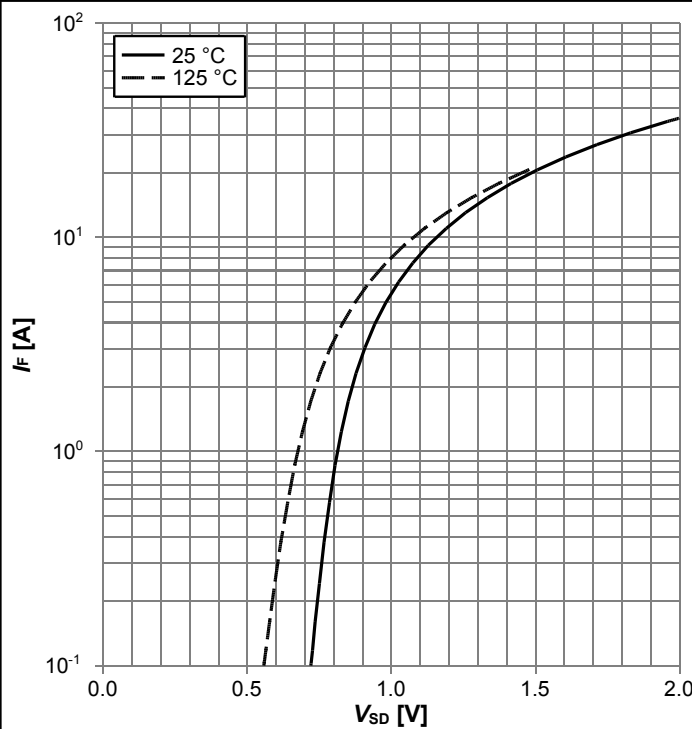
$I_D = f(V_{GS})$; $V_{DS} = 20V$; parameter: T_j

Diagram 10: Typ. gate charge



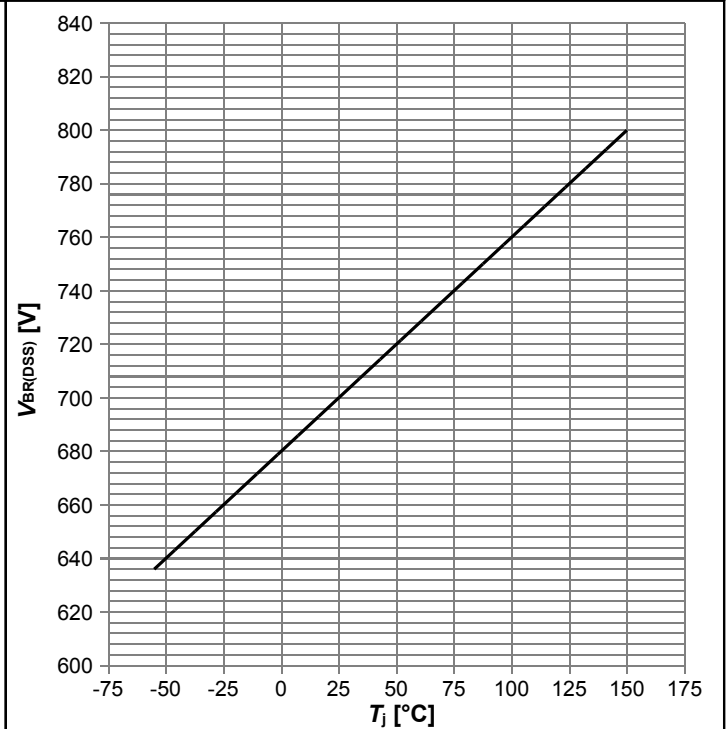
$V_{GS} = f(Q_{gate})$; $I_D = 1.7 A$ pulsed; parameter: V_{DD}

Diagram 11: Forward characteristics of reverse diode



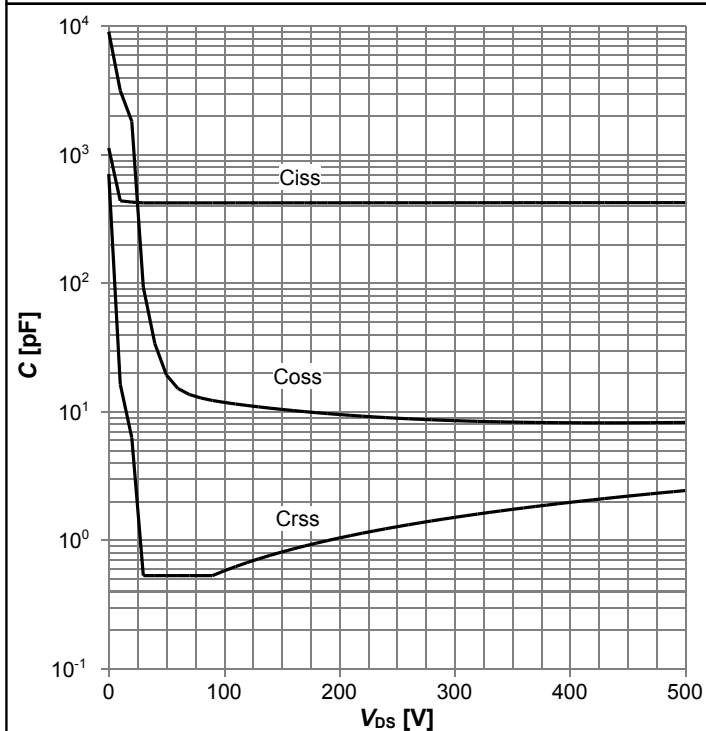
$I_F = f(V_{SD})$; parameter: T_j

Diagram 13: Drain-source breakdown voltage



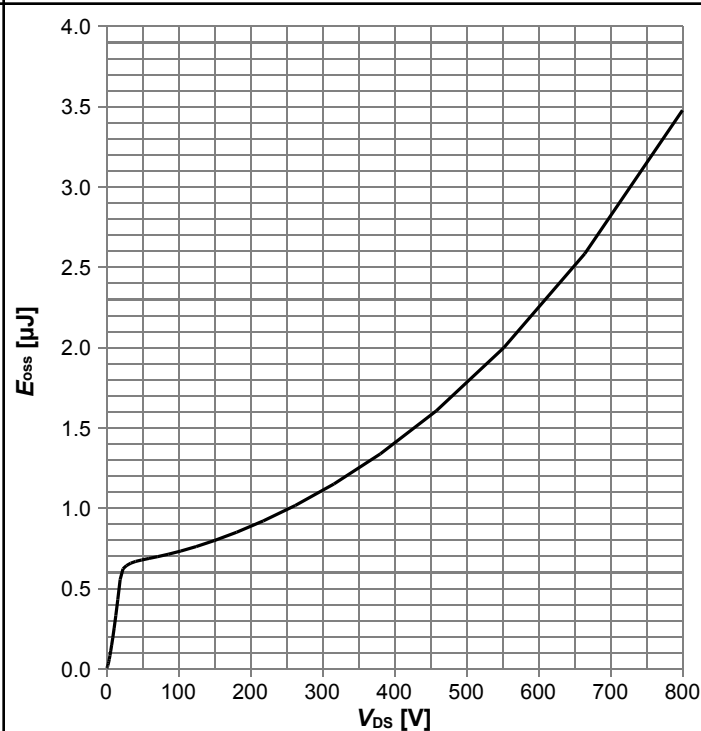
$V_{BR(DSS)} = f(T_j)$; $I_D = 1 mA$

Diagram 14: Typ. capacitances



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

Diagram 15: Typ. Coss stored energy



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

5 Test Circuits

Table 8 Diode characteristics

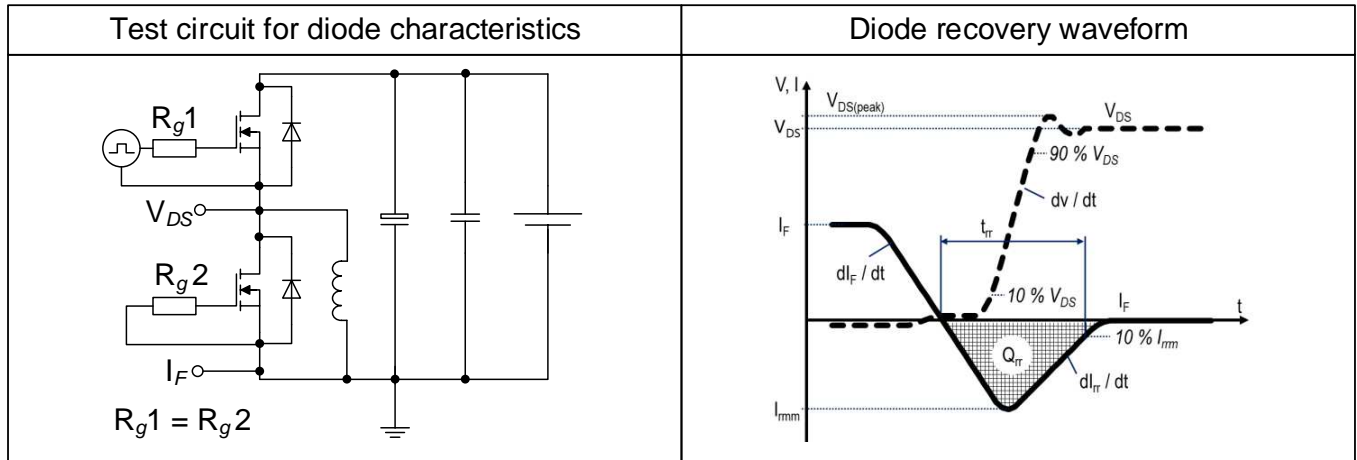


Table 9 Switching times

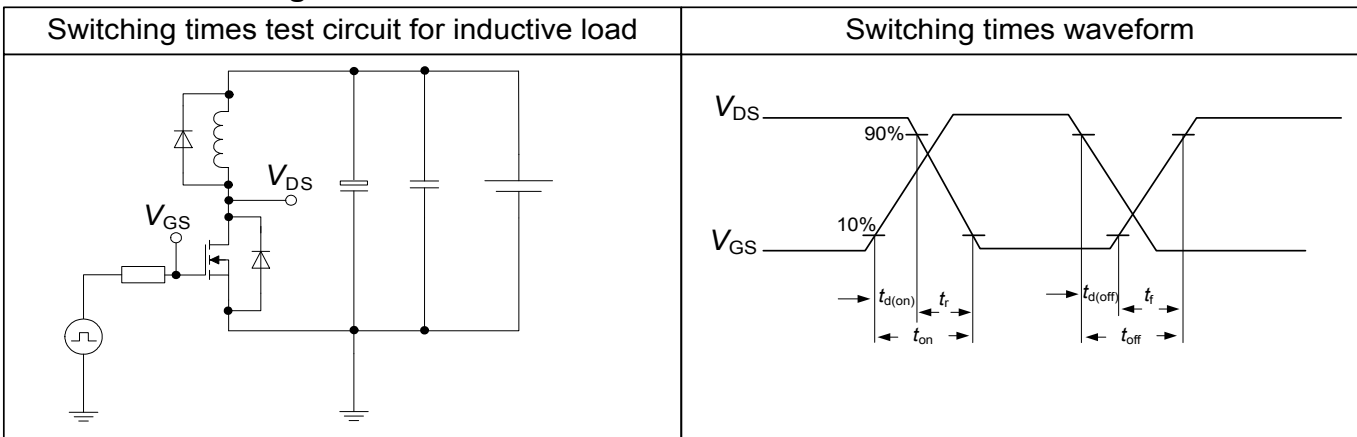
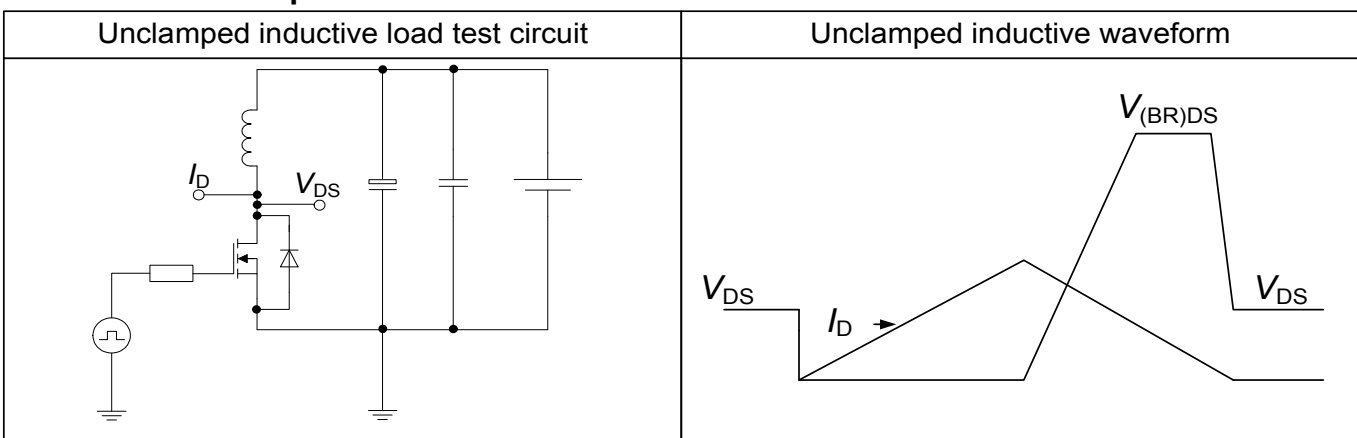
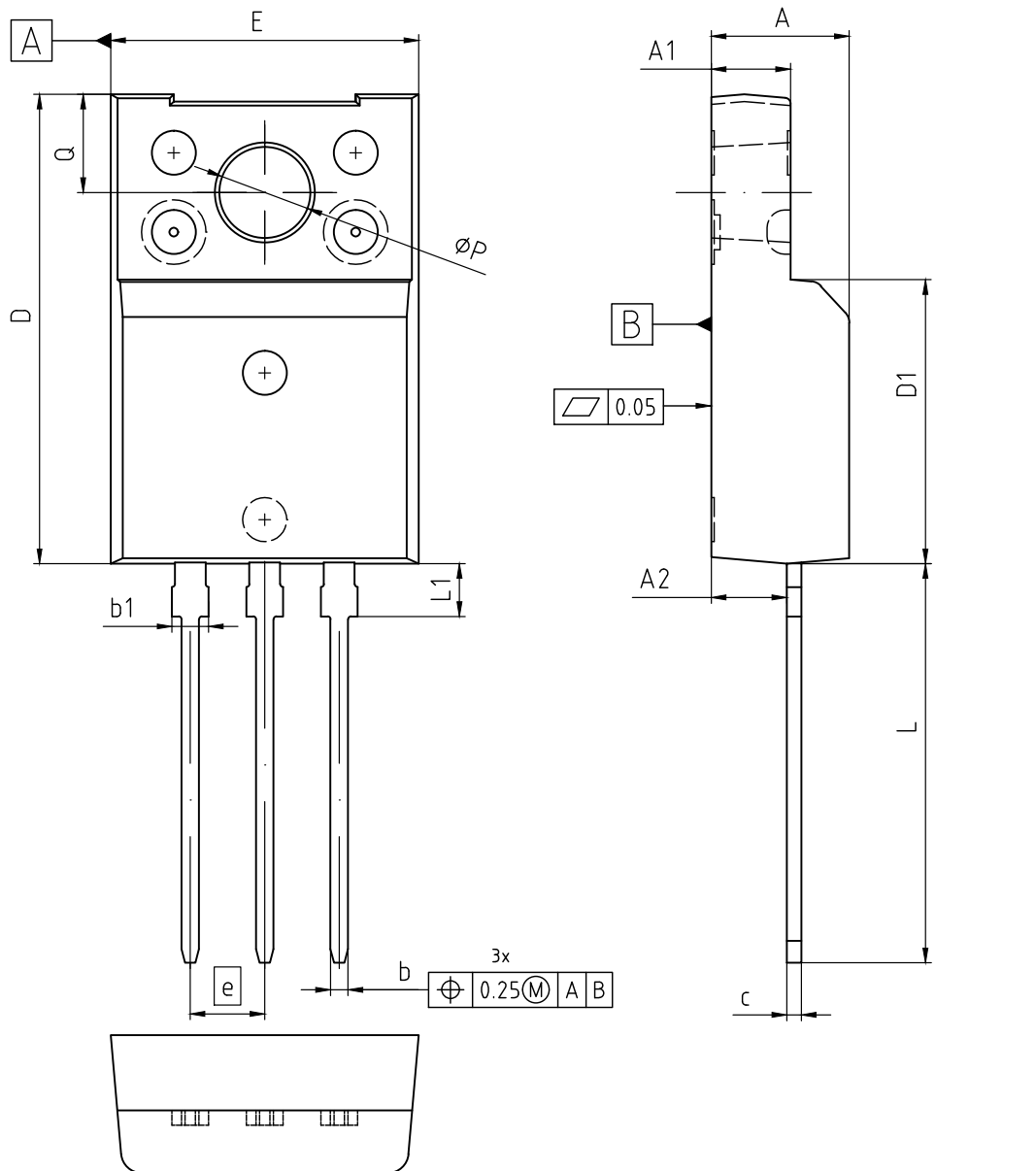


Table 10 Unclamped inductive load



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™ P7 Webpage:** www.infineon.com
- **IFX Design tools:** www.infineon.com

Revision History

IPAN70R450P7S

Revision: 2018-02-13, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2017-09-15	Release of final version
2.1	2018-02-13	Corrected front page text

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Published by

Infineon Technologies AG

81726 München, Germany

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