

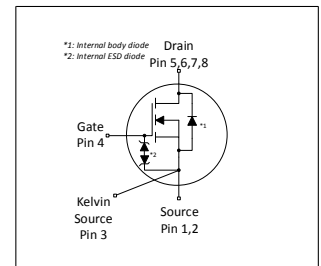
MOSFET

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 $R_{DS(on)} \cdot Q_g$ and $R_{DS(on)} \cdot E_{oss}$
- Excellent thermal behavior
- Integrated ESD protection diode
- Low switching losses (E_{oss})
- Fully qualified acc. JEDEC for Industrial Applications

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 in Chargers and Adapters

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
$V_{DS} @ T_J=25^\circ\text{C}$	700	V
$R_{DS(on),max}$	1.2	Ω
$Q_{g,typ}$	4.8	nC
$I_{D,pulse}$	9.4	A
$E_{oss} @ 400V$	0.7	μJ
$V_{(GS)th,typ}$	3	V
ESD class (HBM)	1C	

Type / Ordering Code	Package	Marking	Related Links
IPLK70R1K2P7	ThinPAK 5x6 SMD	70R1K2P7	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	-	-	4.4 2.7	A	$T_C = 20^\circ\text{C}$ $T_C = 100^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	9.4	A	$T_C=25^\circ\text{C}$
Application (Flyback) relevant avalanche current, single pulse ³⁾	I_{AS}	-	1.6	-	A	measured with standard leakage inductance of transformer of 5μH
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}	-	-	25.5	W	$T_C=25^\circ\text{C}$
Operating and storage temperature	T_j, T_{stg}	-55	-	150	$^\circ\text{C}$	-
Continuous diode forward current	I_S	-	-	5.6	A	$T_C=25^\circ\text{C}$
Diode pulse current ²⁾	$I_{S,pulse}$	-	-	9.4	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}	-	-	n.a.	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}	-	-	4.9	$^\circ\text{C/W}$	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	80	$^\circ\text{C/W}$	Device on PCB, minimal footprint
Thermal resistance, junction - ambient for SMD version	R_{thJA}	-	35	62	$^\circ\text{C/W}$	Device on 40mm*40mm*1.5 epoxy PCB FR4 with 6cm ² (one layer 70μm thickness) copper area for drain connection and cooling. PCB is vertical without airflow.
Soldering temperature, wave- & reflow soldering allowed	T_{sold}	-	-	260	$^\circ\text{C}$	reflow MSL1

¹⁾ 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. Avalanche value is assuming only the energy from a Flyback transformer leakage inductance is transferred to the MOSFET. For less common avalanche situations it is recommended to contact Infineon for more information. For explanation please read AN - CoolMOS™ 700V P7.

⁴⁾ $V_{DClamp}=400\text{V}$; $V_{DS,peak} < V_{(BR)DSS}$; 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	$V_{DS}=V_{GS}$, $I_D=0.04mA$
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	$R_{DS(on)}$	-	0.98 2.24	1.20 -	Ω	$V_{GS}=10V$, $I_D=0.9A$, $T_j=25^\circ C$ $V_{GS}=10V$, $I_D=0.9A$, $T_j=150^\circ C$
Gate resistance	R_G	-	1.6	-	Ω	$f=1\text{ MHz}$, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	174	-	pF	$V_{GS}=0V$, $V_{DS}=400V$, $f=250kHz$
Output capacitance	C_{oss}	-	3.6	-	pF	$V_{GS}=0V$, $V_{DS}=400V$, $f=250kHz$
Effective output capacitance, energy related ¹⁾	$C_{o(er)}$	-	10	-	pF	$V_{GS}=0V$, $V_{DS}=0...400V$
Effective output capacitance, time related ²⁾	$C_{o(tr)}$	-	132	-	pF	$I_D=\text{constant}$, $V_{GS}=0V$, $V_{DS}=0...400V$
Turn-on delay time	$t_{d(on)}$	-	12	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=0.6A$, $R_G=8.2\Omega$
Rise time	t_r	-	4.8	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=0.6A$, $R_G=8.2\Omega$
Turn-off delay time	$t_{d(off)}$	-	60	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=0.6A$, $R_G=8.2\Omega$
Fall time	t_f	-	48	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=0.6A$, $R_G=8.2\Omega$

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	0.8	-	nC	$V_{DD}=400V$, $I_D=0.6A$, $V_{GS}=0$ to 10V
Gate to drain charge	Q_{gd}	-	1.9	-	nC	$V_{DD}=400V$, $I_D=0.6A$, $V_{GS}=0$ to 10V
Gate charge total	Q_g	-	4.8	-	nC	$V_{DD}=400V$, $I_D=0.6A$, $V_{GS}=0$ to 10V
Gate plateau voltage	$V_{plateau}$	-	4.3	-	V	$V_{DD}=400V$, $I_D=0.6A$, $V_{GS}=0$ 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 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	$V_{GS}=0V$, $I_F=1.1A$, $T_J=25^{\circ}C$
Reverse recovery time	t_{rr}	-	270	-	ns	$V_R=400V$, $I_F=0.6A$, $di_F/dt=50A/\mu s$
Reverse recovery charge	Q_{rr}	-	0.5	-	μC	$V_R=400V$, $I_F=0.6A$, $di_F/dt=50A/\mu s$
Peak reverse recovery current	I_{rrm}	-	6	-	A	$V_R=400V$, $I_F=0.6A$, $di_F/dt=50A/\mu s$

4 Electrical characteristics diagrams

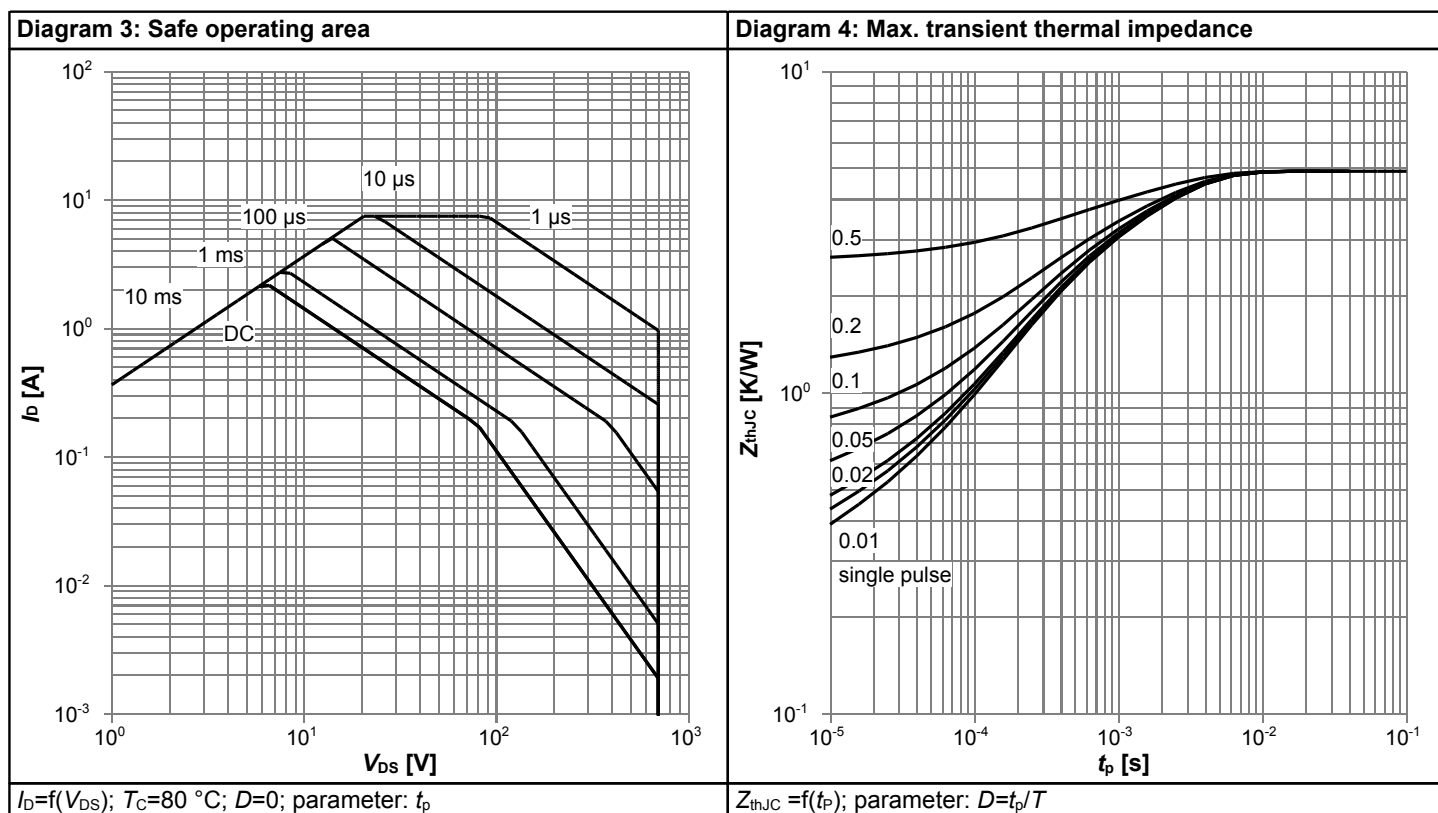
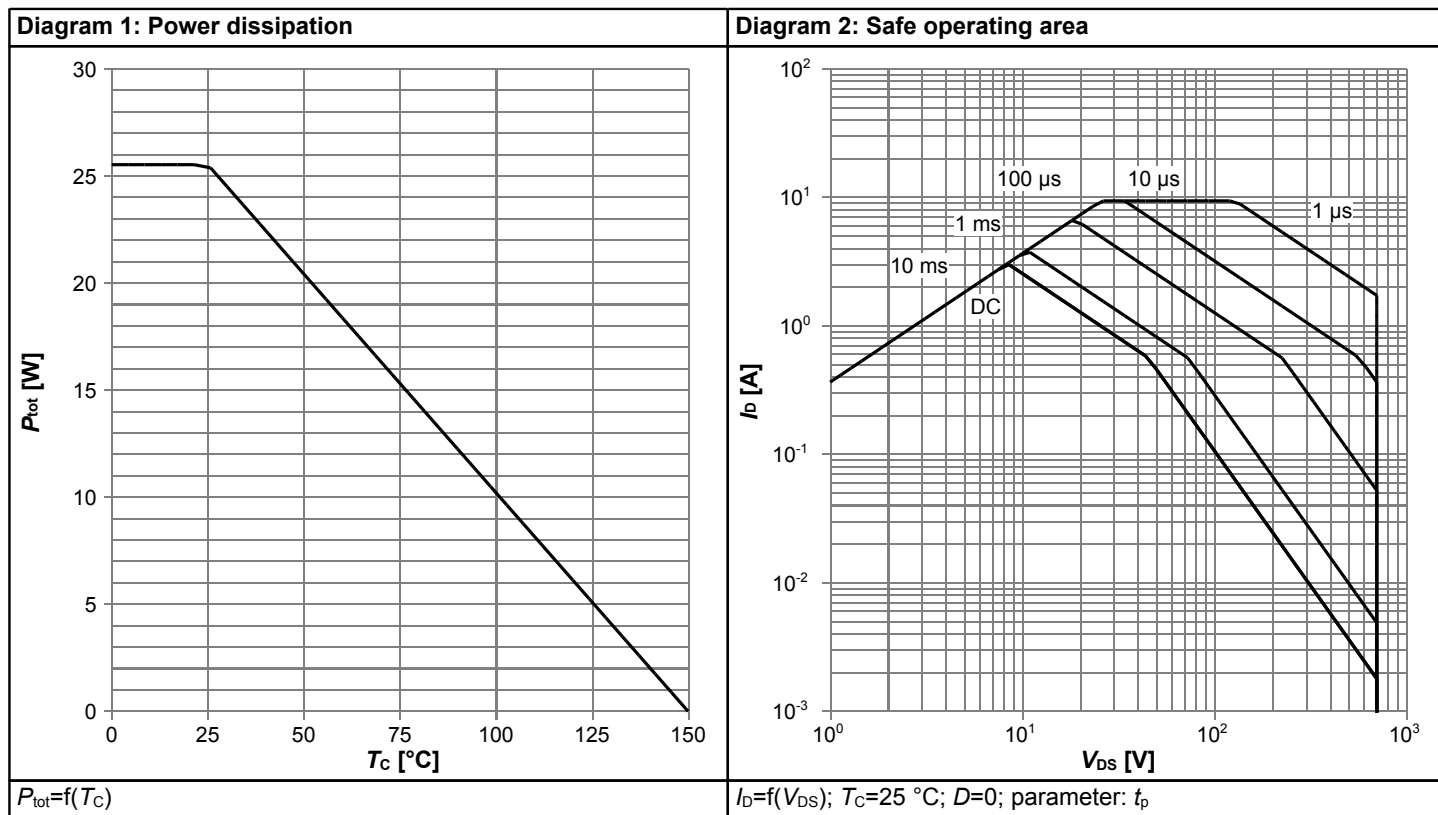
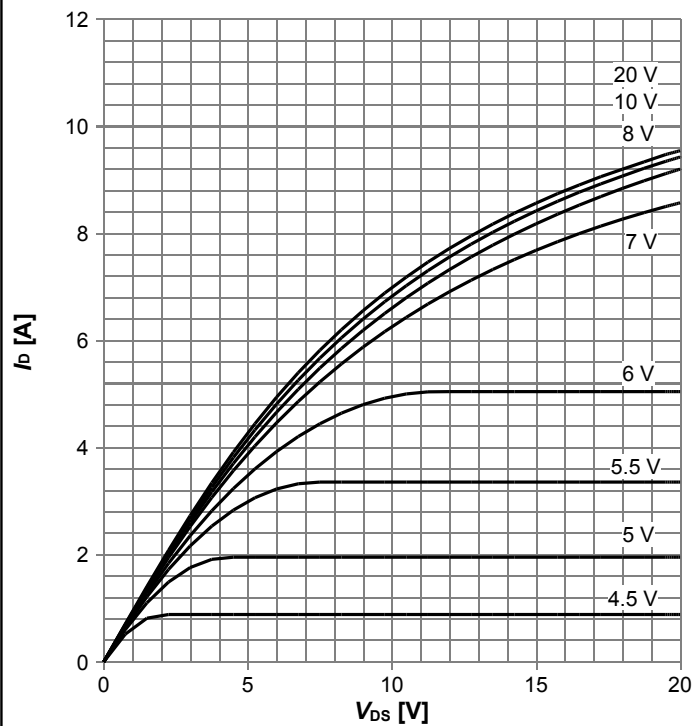
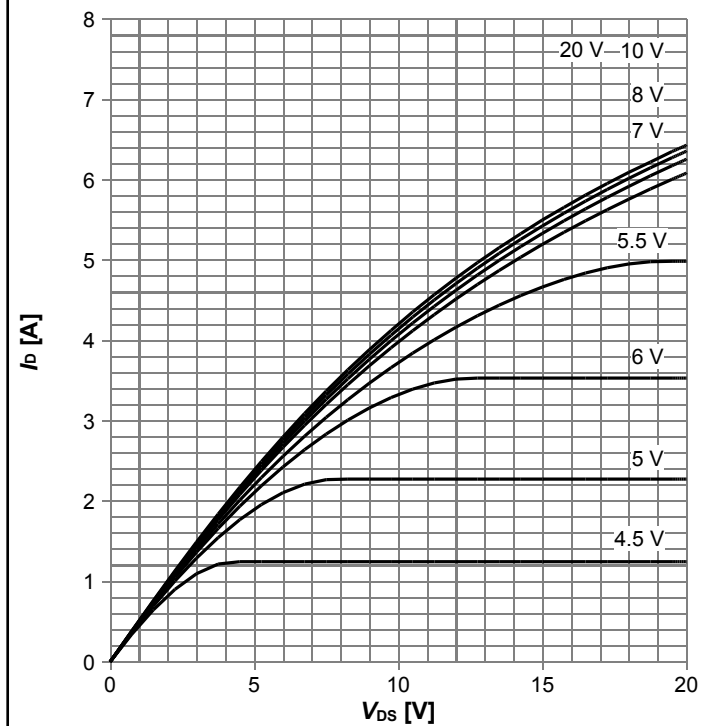


Diagram 5: Typ. output characteristics



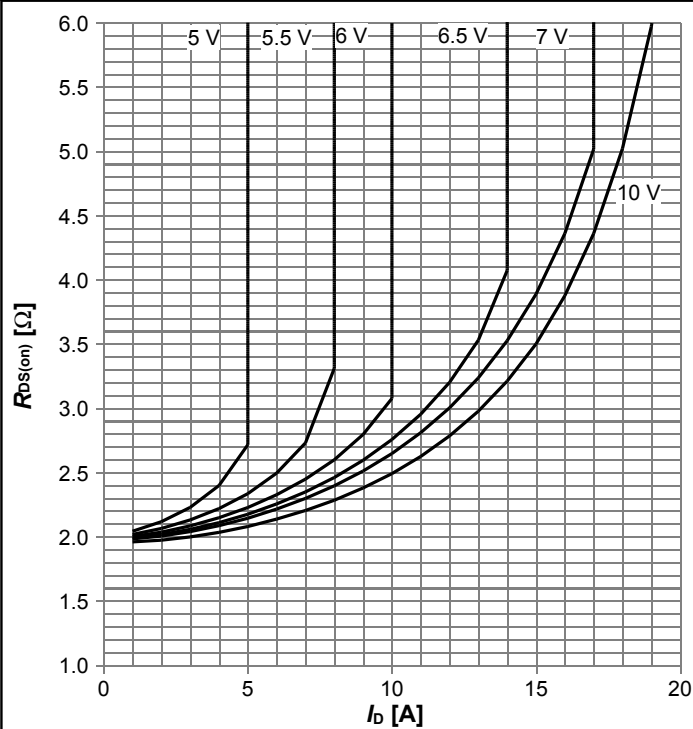
$I_D = f(V_{DS})$; $T_j = 25\text{ °C}$; parameter: V_{GS}

Diagram 6: Typ. output characteristics



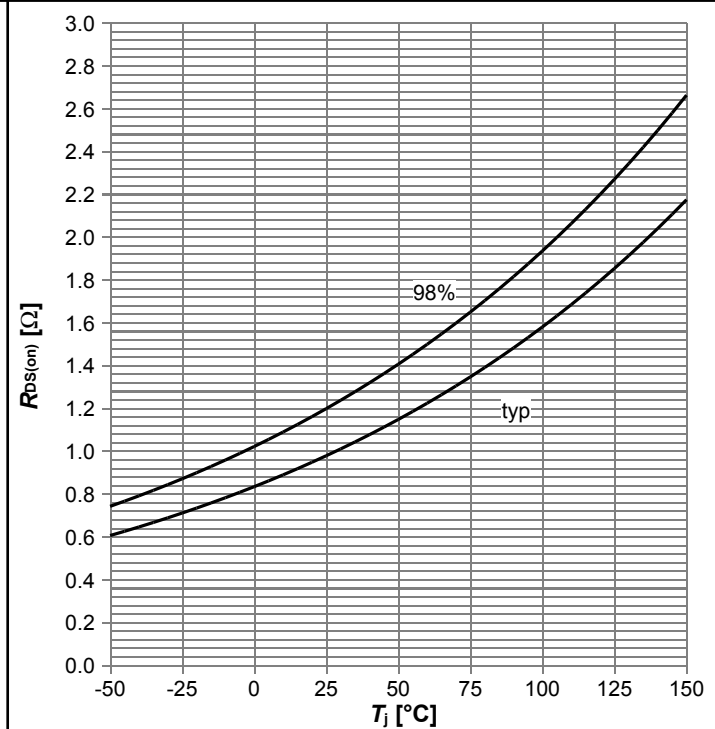
$I_D = f(V_{DS})$; $T_j = 125\text{ °C}$; parameter: V_{GS}

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



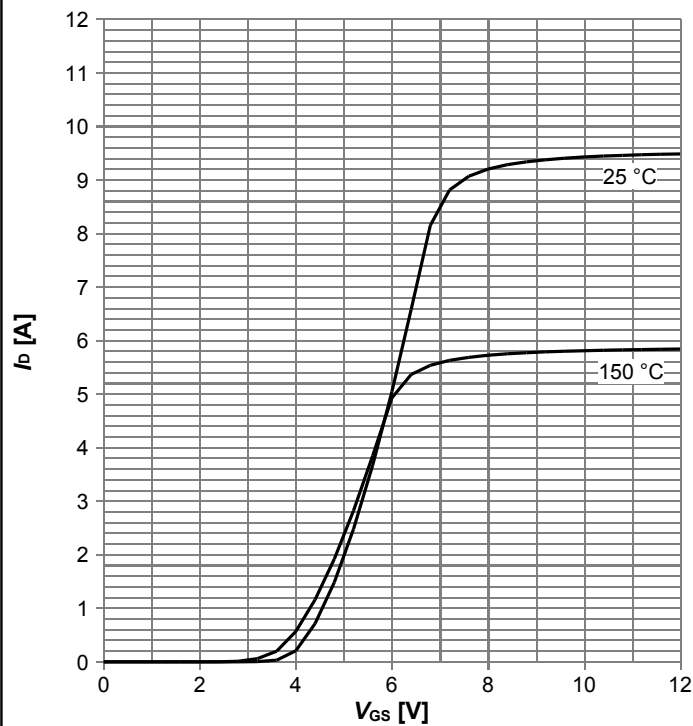
$R_{DS(on)} = f(I_D)$; $T_j = 125\text{ °C}$; parameter: V_{GS}

Diagram 8: Drain-source on-state resistance



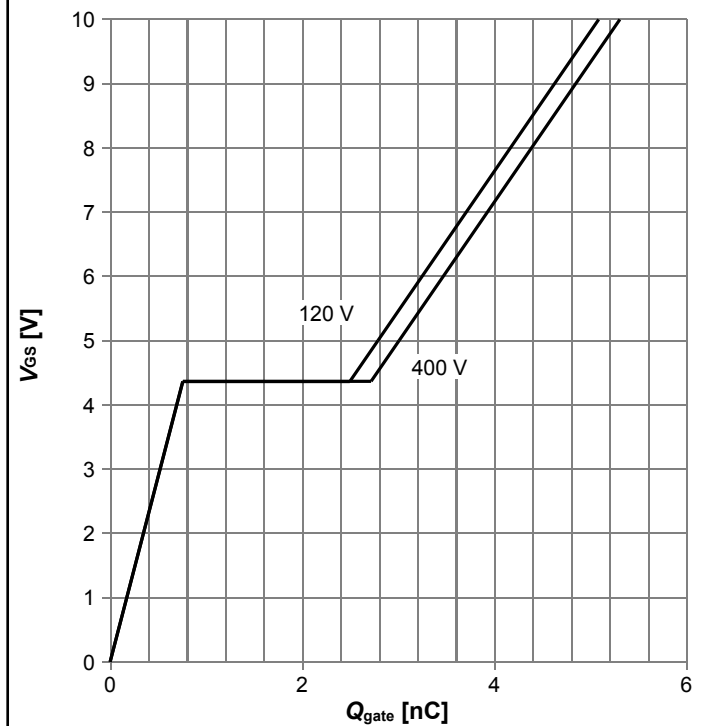
$R_{DS(on)} = f(T_j)$; $I_D = 0.9\text{ A}$; $V_{GS} = 10\text{ V}$

Diagram 9: Typ. transfer characteristics



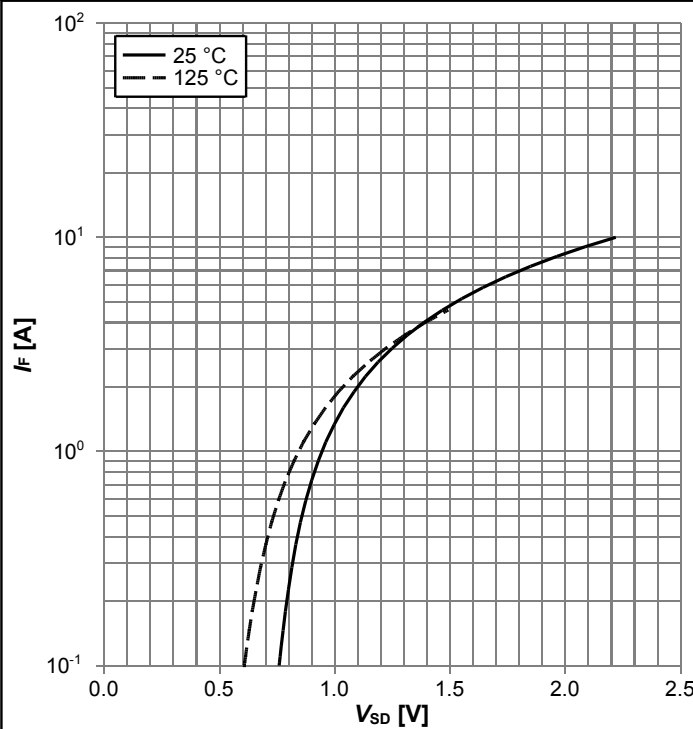
$I_D = f(V_{GS})$; $V_{DS} = 20V$; parameter: T_j

Diagram 10: Typ. gate charge



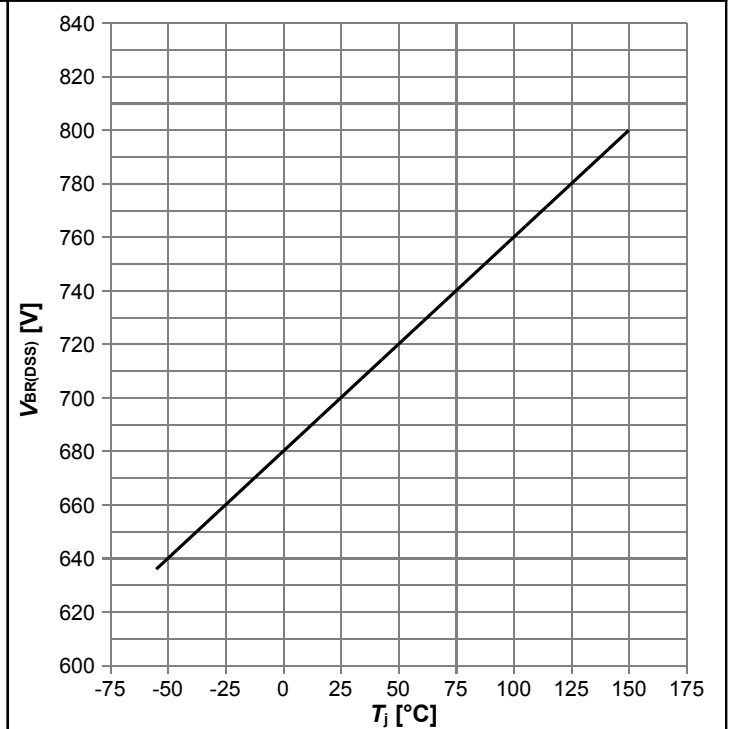
$V_{GS} = f(Q_{gate})$; $I_D = 0.6 A$ pulsed; parameter: V_{DD}

Diagram 11: Forward characteristics of reverse diode



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

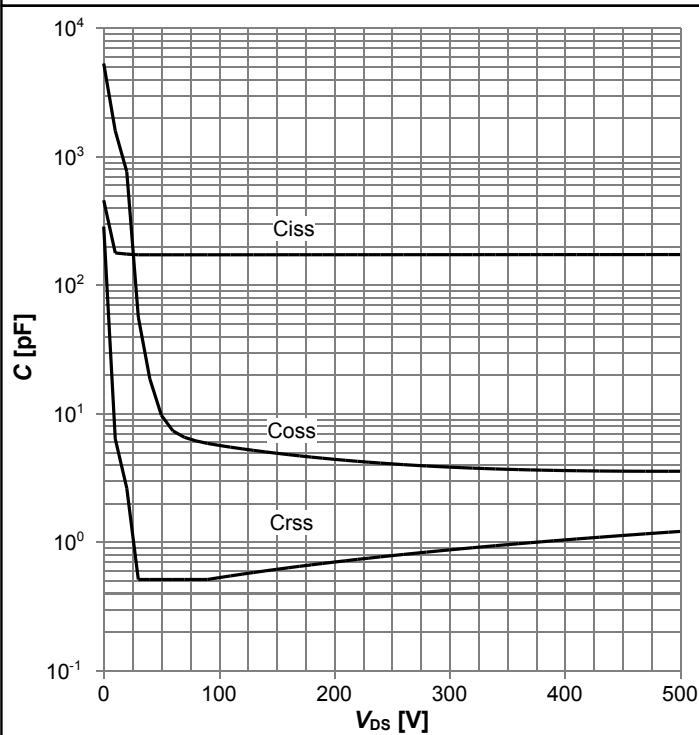
Diagram 13: Drain-source breakdown voltage



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

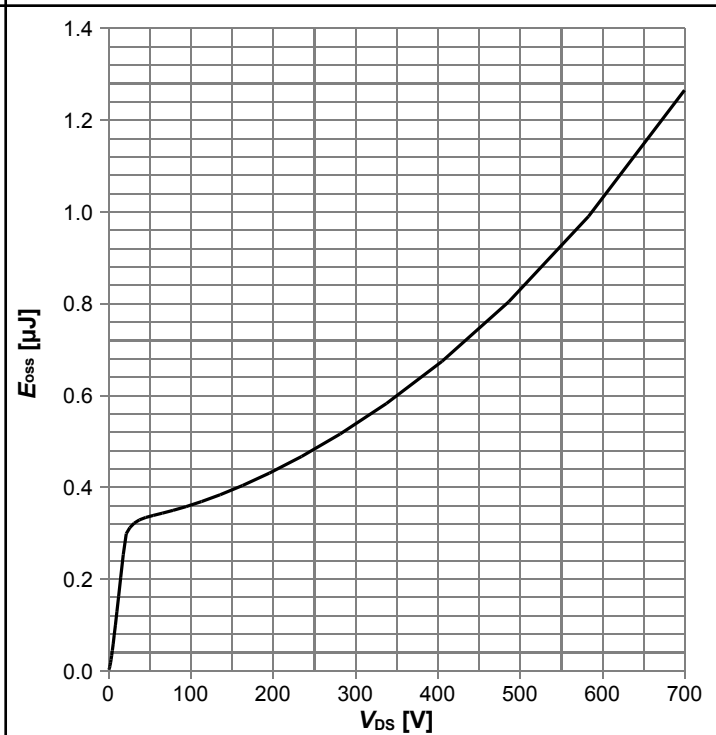
700V CoolMOS™ P7 Power Transistor
IPLK70R1K2P7

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

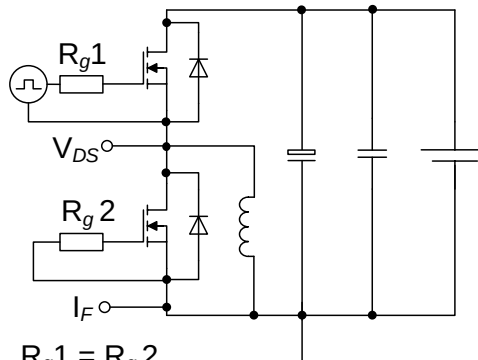
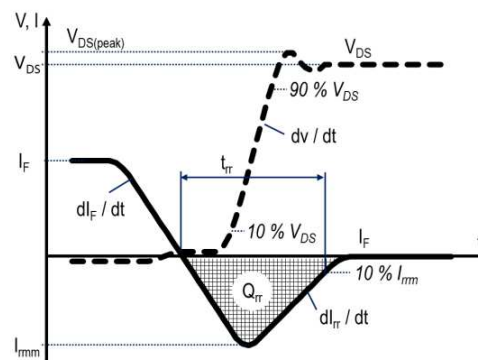
Test circuit for diode characteristics	Diode recovery waveform
 $R_{g1} = R_{g2}$	

Table 9 Switching times

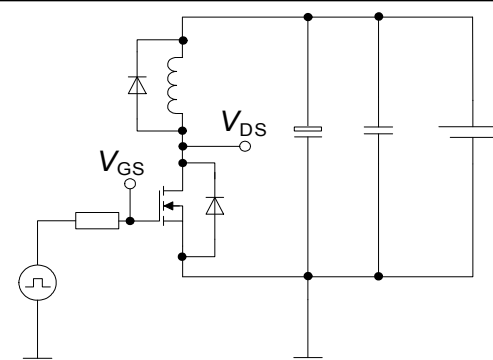
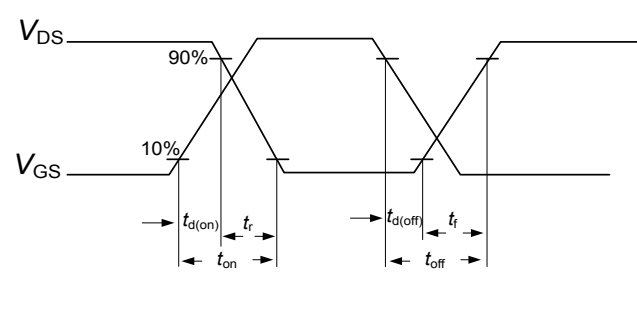
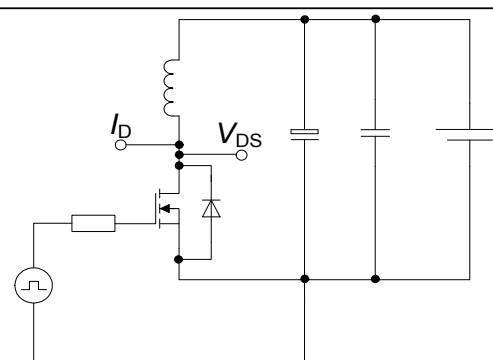
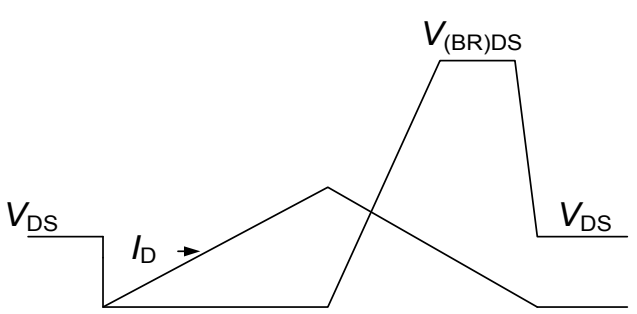
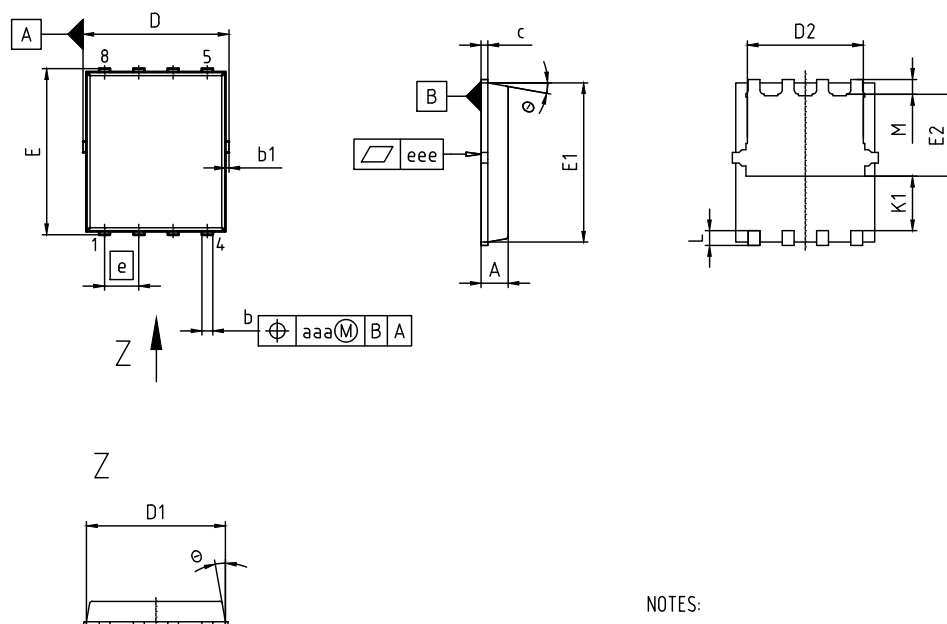
Switching times test circuit for inductive load	Switching times waveform
	

Table 10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	



1. INDUSTRIAL QUALITY GRADE
2. ALL DIMENSIONS REFER TO JEDEC STANDARD MO240A NOT INCLUDE MOLD FLASH
3. REMOVAL ON MOLD GATE, INTRUSION 0.1mm;
PROPRUSION 0.1mm
4. ALL METAL SURFACE ARE PLATEDEXCEPT AREA OF CUT

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.10	0.035	0.043
b	0.34	0.54	0.013	0.021
b1	0.03	0.23	0.001	0.009
c	0.15	0.35	0.006	0.014
D	5.15	5.51	0.203	0.217
D1	4.95	5.35	0.195	0.211
D2	4.20	4.40	0.165	0.173
E	5.95	6.35	0.234	0.250
E1	5.70	6.10	0.224	0.240
E2	2.93	3.13	0.115	0.123
e	1.27		0.050	
N	8		8	
K1	1.92	2.12	0.076	0.083
L	0.45	0.65	0.018	0.026
M	0.45	0.65	0.018	0.026
Ø	8.5°	12°	8.5°	12°
aaa	0.25		0.010	
eee	0.08		0.003	

DOCUMENT NO. Z8B00181453
SCALE 
EUROPEAN PROJECTION 
ISSUE DATE 13-05-2016
REVISION 01

7 Appendix A

Table 11 Related Links

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

Revision History

IPLK70R1K2P7

Revision: 2018-09-26, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2018-09-26	Release of final version

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erratum@infineon.com

Published by

Infineon Technologies AG

81726 München, Germany

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