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MOSFET

800V CoolMOS™ P7 Power Transistor

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 $\pm 0.5V$
- 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 separate totem poles is generally recommended.

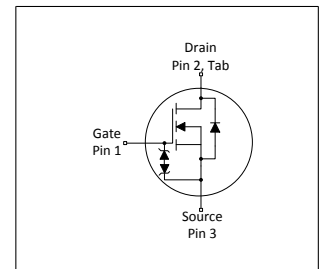
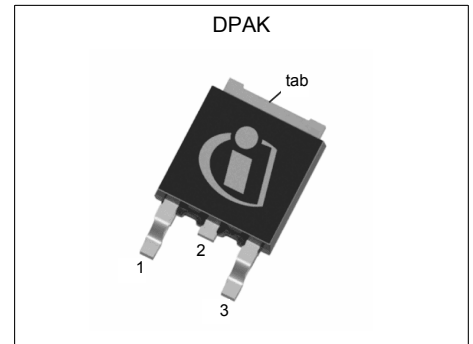


Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_j=25^\circ C$	800	V
$R_{DS(on),max}$	1.4	Ω
$Q_{g,typ}$	10	nC
I_D	4	A
$E_{oss} @ 500V$	0.9	μJ
$V_{GS(th),typ}$	3	V
ESD class (HBM)	2	-

Type / Ordering Code	Package	Marking	Related Links
IPD80R1K4P7	PG-TO 252	80R1K4P7	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 2.7	A	$T_C=25^\circ\text{C}$ $T_C=100^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	8.9	A	$T_C=25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}	-	-	8	mJ	$I_D=0.6\text{A}$; $V_{DD}=50\text{V}$
Avalanche energy, repetitive	E_{AR}	-	-	0.07	mJ	$I_D=0.6\text{A}$; $V_{DD}=50\text{V}$
Avalanche current, repetitive	I_{AR}	-	-	0.6	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	100	V/ns	$V_{DS}=0$ to 400V
Gate source voltage	V_{GS}	-20 -30	-	20 30	V	static; AC ($f>1$ Hz)
Power dissipation	P_{tot}	-	-	32	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	-	-	3	A	$T_C=25^\circ\text{C}$
Diode pulse current ²⁾	$I_{S,pulse}$	-	-	8.9	A	$T_C=25^\circ\text{C}$
Reverse diode dv/dt ³⁾	dv/dt	-	-	1	V/ns	$V_{DS}=0$ to 400V, $I_{SD}\leq 0.7\text{A}$, $T_j=25^\circ\text{C}$
Maximum diode commutation speed ³⁾	di/dt	-	-	50	A/ μs	$V_{DS}=0$ to 400V, $I_{SD}\leq 0.7\text{A}$, $T_j=25^\circ\text{C}$

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	3.9	$^\circ\text{C/W}$	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	62	$^\circ\text{C/W}$	Device on PCB, minimal footprint
Thermal resistance, junction - ambient for SMD version	R_{thJA}	-	35	45	$^\circ\text{C/W}$	Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm ² (one layer 70 μm thickness) copper area for drain connection and cooling. PCB is vertical without air stream cooling.
Soldering temperature, wave- & reflow soldering allowed	T_{sold}	-	-	260	$^\circ\text{C}$	reflow MSL1

1) Limited by $T_{j,max}$. Maximum duty cycle $D=0.5$

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

3) $V_{DClink}=400\text{V}$; $V_{DS,peak}<V_{(BR)DSS}$; identical low side and high side switch with identical R_G ; $t_{cond}<2\mu\text{s}$

3 Electrical characteristics

at $T_j = 25^\circ\text{C}$, 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	$V_{DS}=V_{GS}, I_D=0.07mA$
Zero gate voltage drain current	I_{DSS}	-	-	1	μA	$V_{DS}=800V, V_{GS}=0V, T_j=25^\circ C$ $V_{DS}=800V, V_{GS}=0V, T_j=150^\circ C$
Gate-source leakage current incl. zener diode	I_{GSS}	-	-	1	μA	$V_{GS}=20V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	1.2	1.4	Ω	$V_{GS}=10V, I_D=1.4A, T_j=25^\circ C$ $V_{GS}=10V, I_D=1.4A, T_j=150^\circ C$
Gate resistance	R_G	-	1.5	-	Ω	$f=250kHz, \text{open drain}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	250	-	pF	$V_{GS}=0V, V_{DS}=500V, f=250kHz$
Output capacitance	C_{oss}	-	6.5	-	pF	$V_{GS}=0V, V_{DS}=500V, f=250kHz$
Effective output capacitance, energy related ¹⁾	$C_{o(er)}$	-	8	-	pF	$V_{GS}=0V, V_{DS}=0 \text{ to } 500V$
Effective output capacitance, time related ²⁾	$C_{o(tr)}$	-	97	-	pF	$I_D=\text{constant}, V_{GS}=0V, V_{DS}=0 \text{ to } 500V$
Turn-on delay time	$t_{d(on)}$	-	10	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.4A, R_G=22\Omega$
Rise time	t_r	-	8	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.4A, R_G=22\Omega$
Turn-off delay time	$t_{d(off)}$	-	40	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.4A, R_G=22\Omega$
Fall time	t_f	-	20	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.4A, R_G=22\Omega$

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	1	-	nC	$V_{DD}=640V, I_D=1.4A, V_{GS}=0 \text{ to } 10V$
Gate to drain charge	Q_{gd}	-	5	-	nC	$V_{DD}=640V, I_D=1.4A, V_{GS}=0 \text{ to } 10V$
Gate charge total	Q_g	-	10	-	nC	$V_{DD}=640V, I_D=1.4A, V_{GS}=0 \text{ to } 10V$
Gate plateau voltage	$V_{plateau}$	-	4.5	-	V	$V_{DD}=640V, I_D=1.4A, V_{GS}=0 \text{ to } 10V$

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 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	$V_{GS}=0V, I_F=1.4A, T_i=25^{\circ}C$
Reverse recovery time	t_{rr}	-	800	-	ns	$V_R=400V, I_F=0.7A, di_F/dt=50A/\mu s$
Reverse recovery charge	Q_{rr}	-	5	-	μC	$V_R=400V, I_F=0.7A, di_F/dt=50A/\mu s$
Peak reverse recovery current	I_{rrm}	-	9	-	A	$V_R=400V, I_F=0.7A, di_F/dt=50A/\mu s$

4 Electrical characteristics diagrams

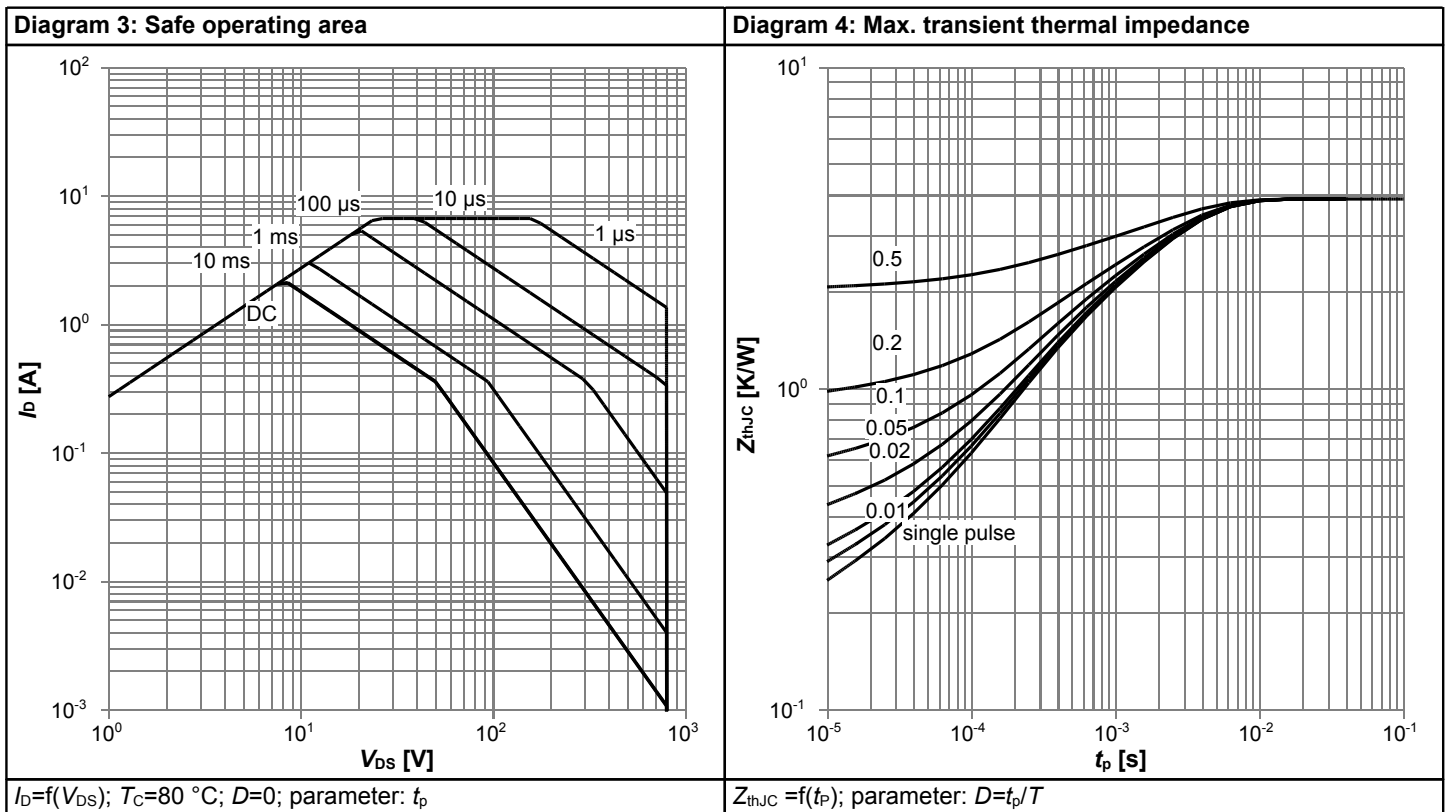
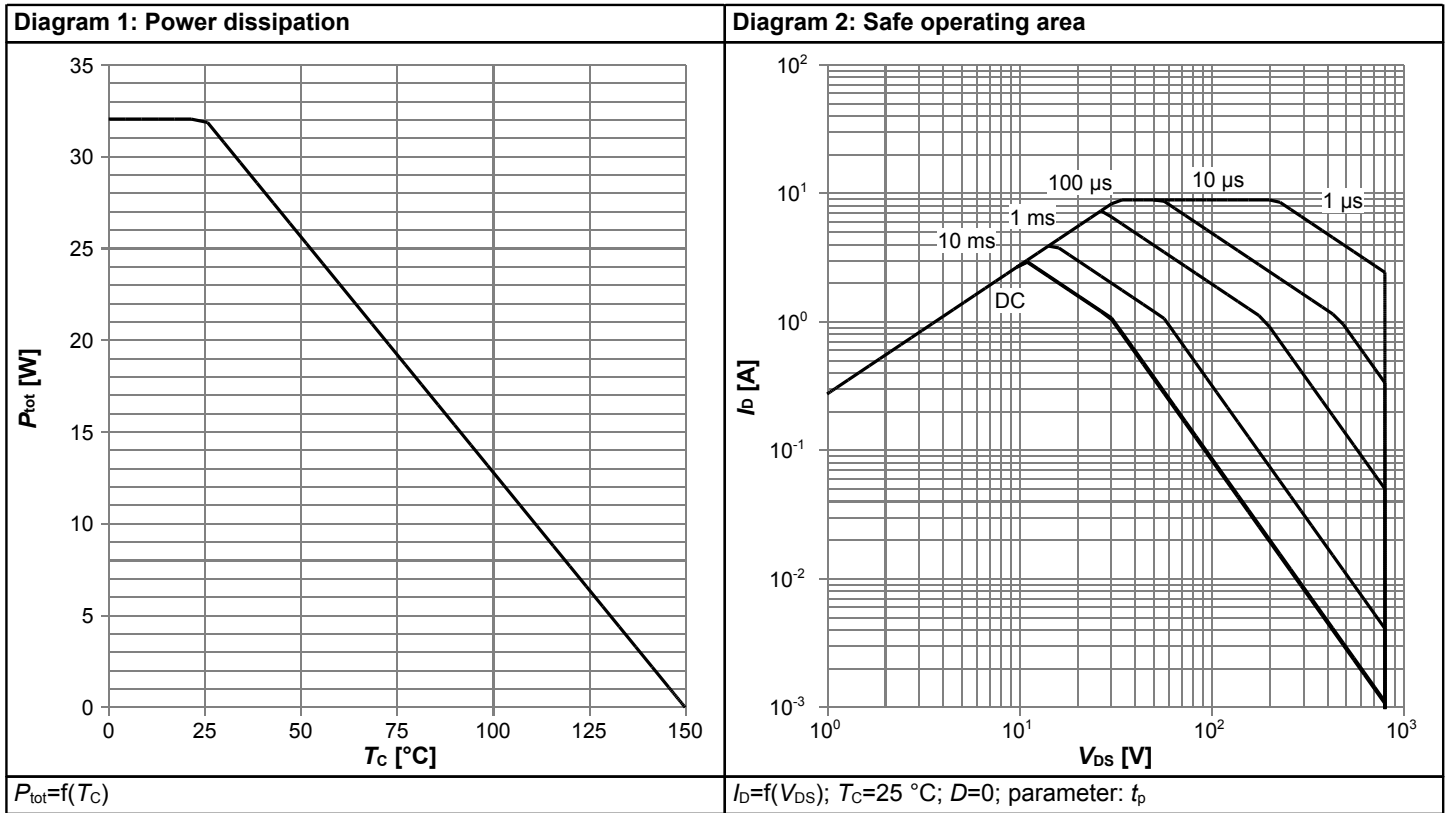
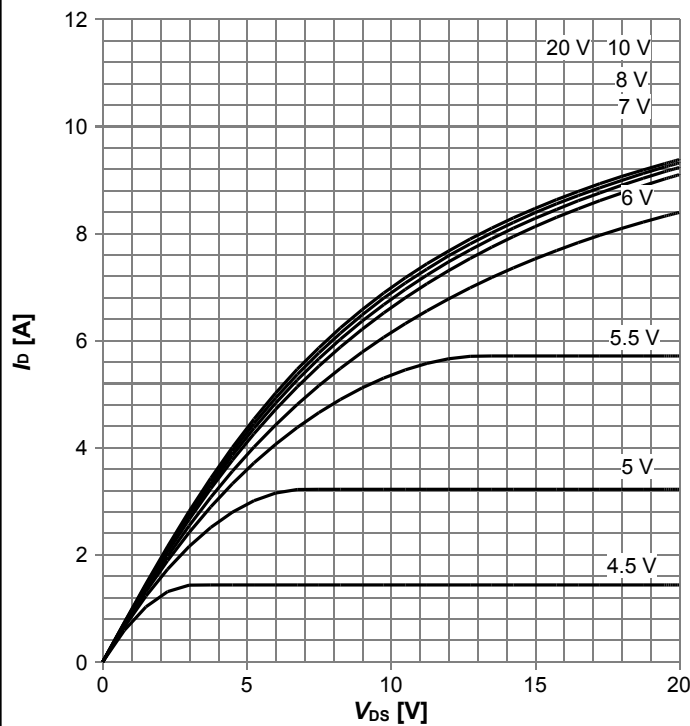
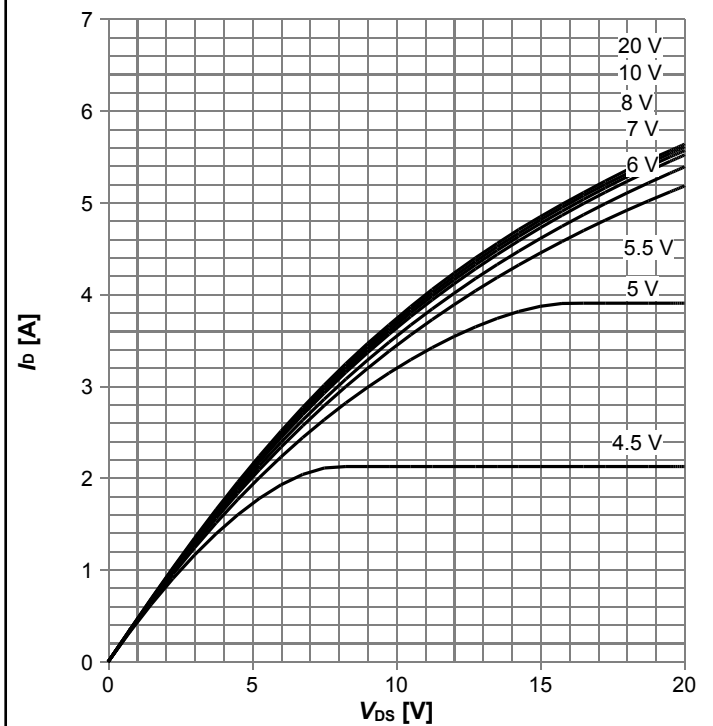


Diagram 5: Typ. output characteristics



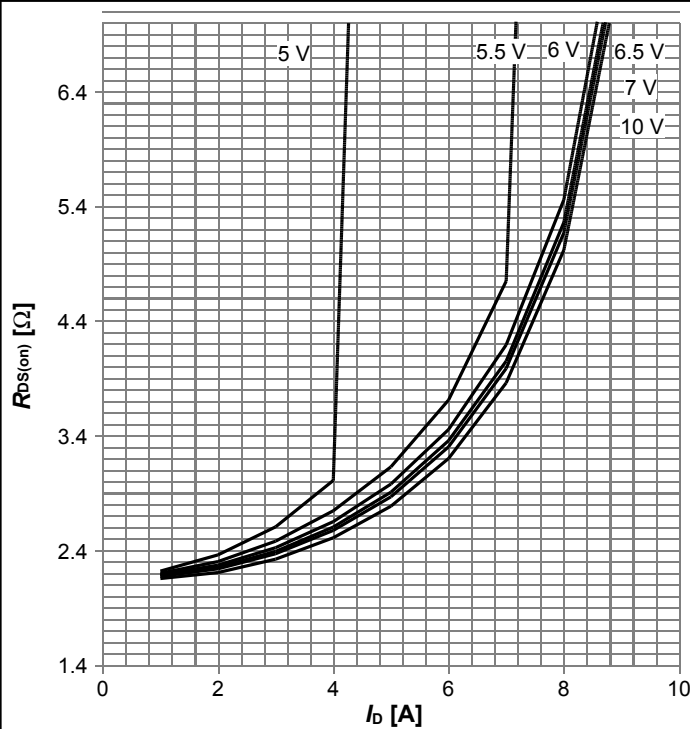
$I_D=f(V_{DS})$; $T_j=25\text{ °C}$; parameter: V_{GS}

Diagram 6: Typ. output characteristics



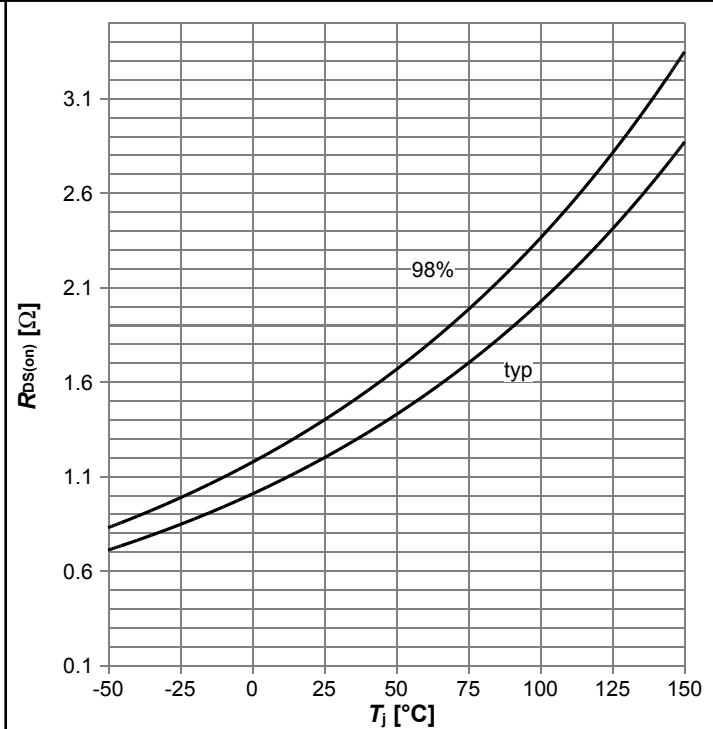
$I_D=f(V_{DS})$; $T_j=125\text{ °C}$; parameter: V_{GS}

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



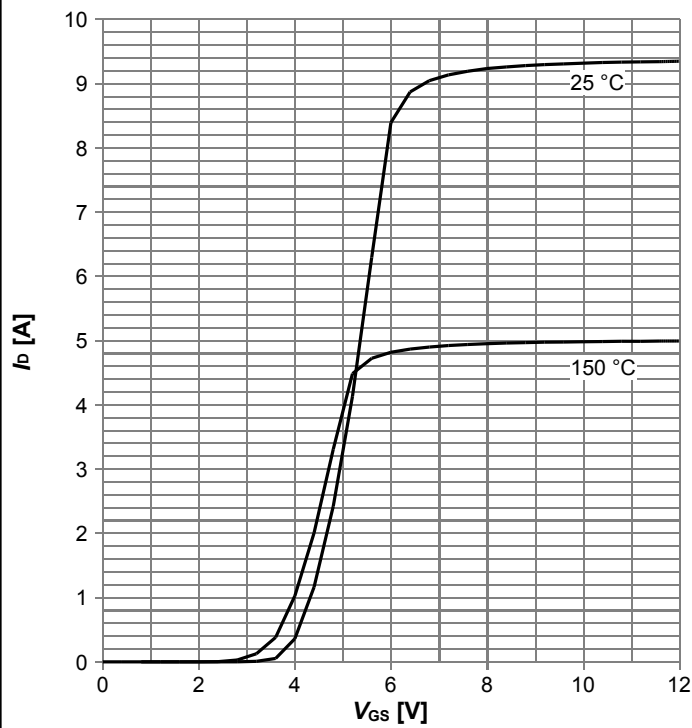
$R_{DS(on)}=f(I_D)$; $T_j=125\text{ °C}$; parameter: V_{GS}

Diagram 8: Drain-source on-state resistance



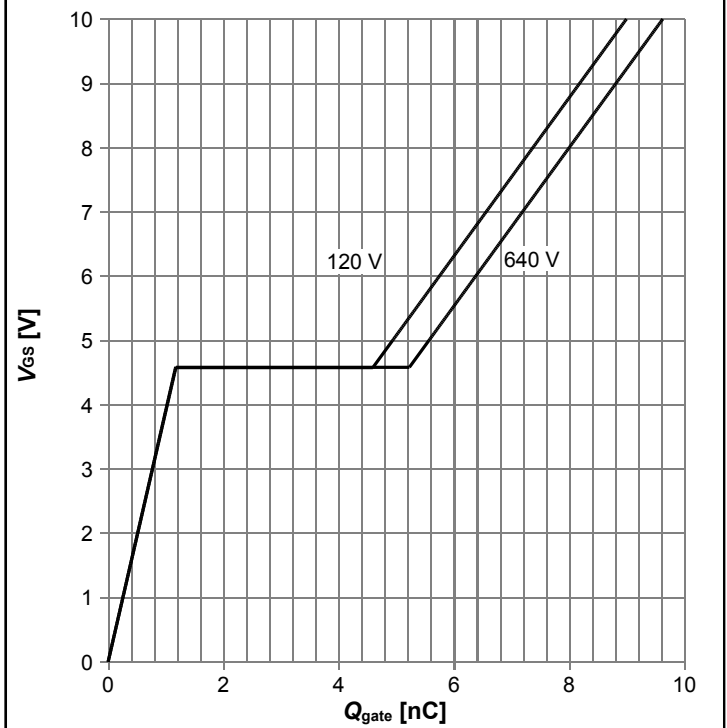
$R_{DS(on)}=f(T_j)$; $I_D=1.4\text{ A}$; $V_{GS}=10\text{ V}$

Diagram 9: Typ. transfer characteristics



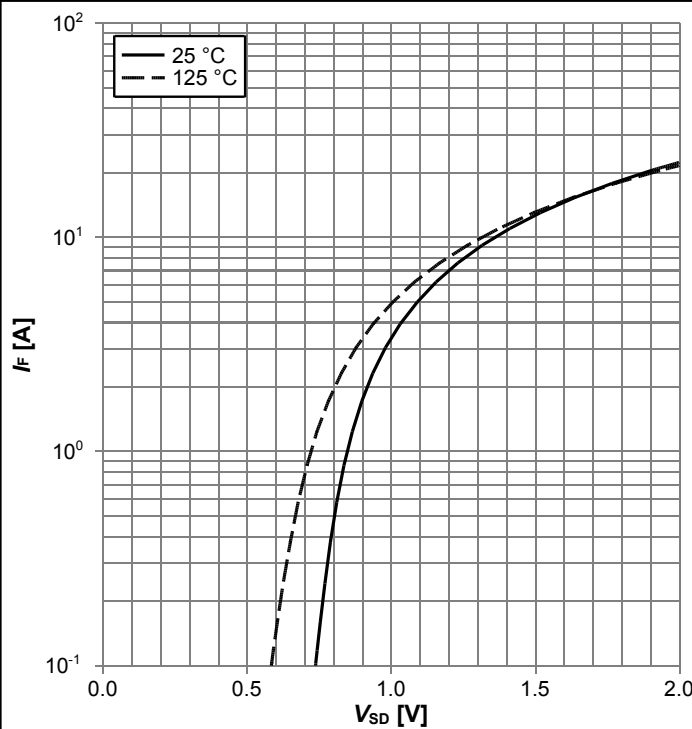
$I_D = f(V_{GS}); V_{DS} = 20V; \text{parameter: } T_j$

Diagram 10: Typ. gate charge



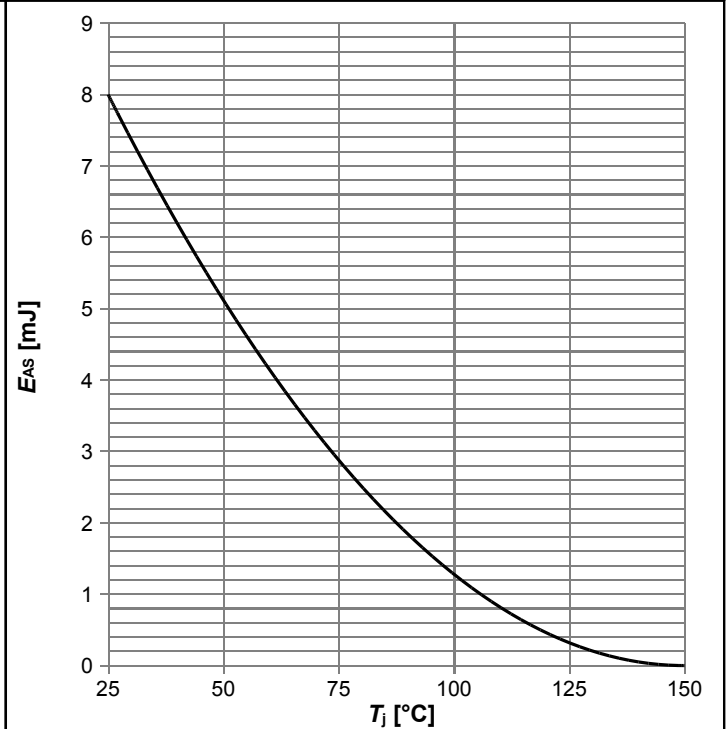
$V_{GS} = f(Q_{gate}); I_D = 1.4 \text{ A pulsed}; \text{parameter: } V_{DD}$

Diagram 11: Forward characteristics of reverse diode



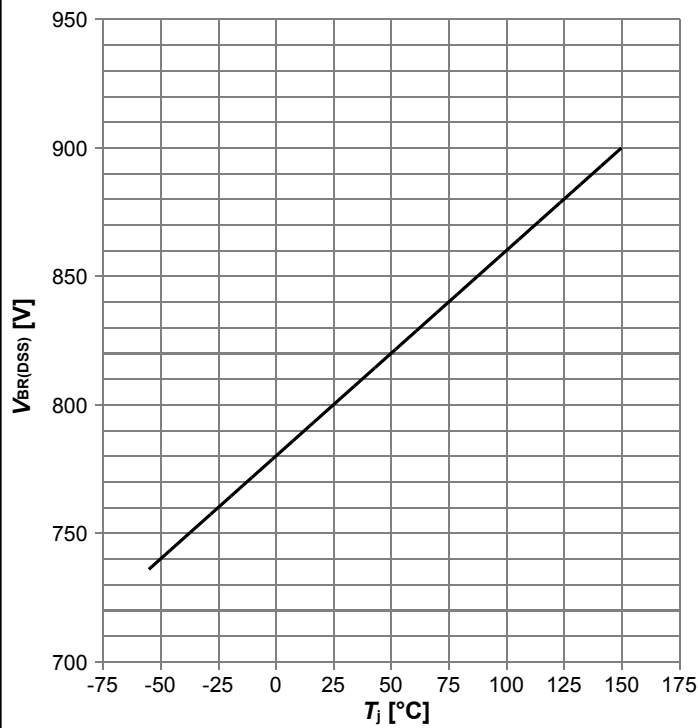
$I_F = f(V_{SD}); \text{parameter: } T_j$

Diagram 12: Avalanche energy



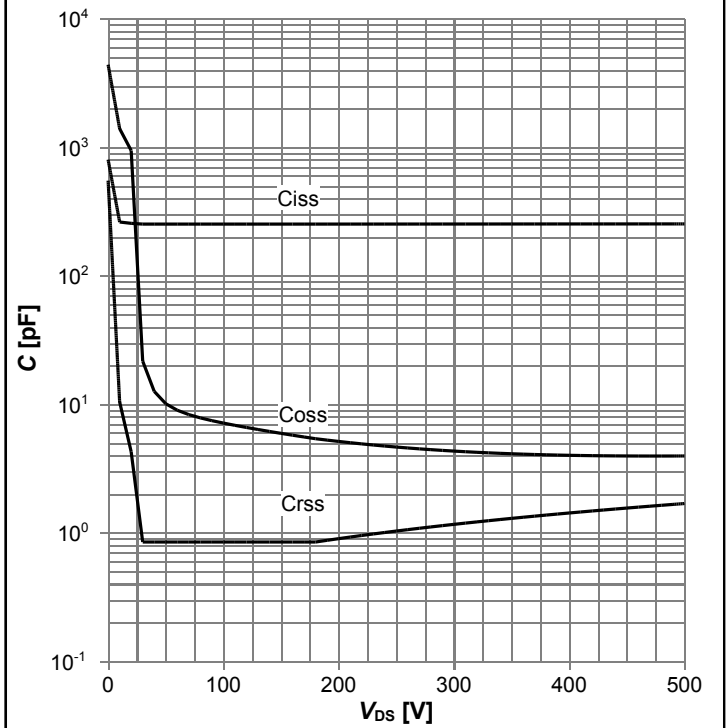
$E_{AS} = f(T_j); I_D = 0.6 \text{ A}; V_{DD} = 50 \text{ V}$

Diagram 13: Drain-source breakdown voltage



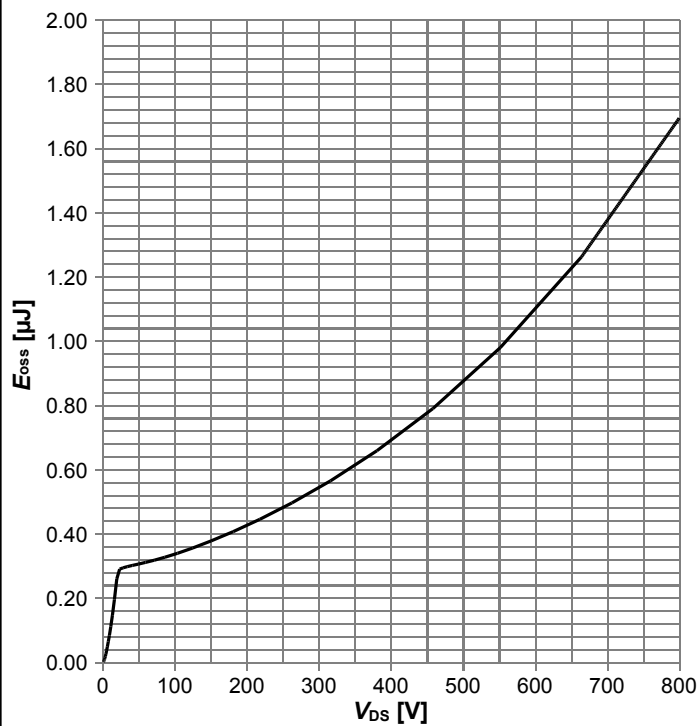
$V_{BR(DSS)}=f(T_j); I_D=1\text{ mA}$

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

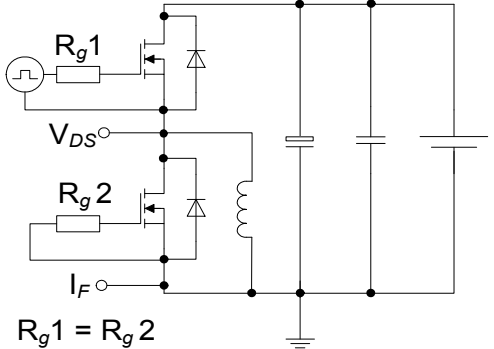
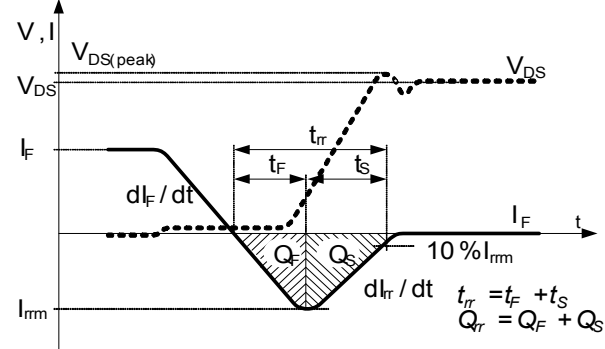
Test circuit for diode characteristics	Diode recovery waveform
 <p>$R_{g1} = R_{g2}$</p>	 <p>$t_{rr} = t_{fr} + t_s$ $Q_{rr} = Q_F + Q_S$</p>

Table 9 Switching times

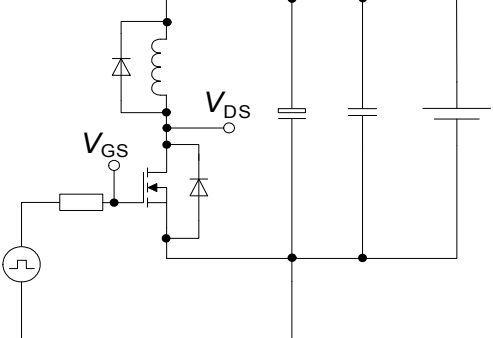
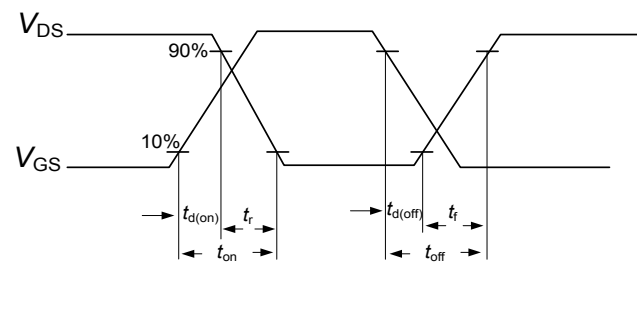
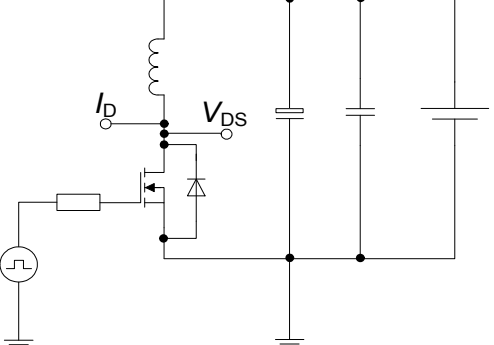
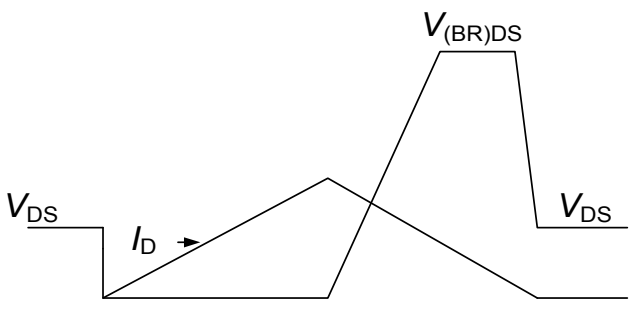
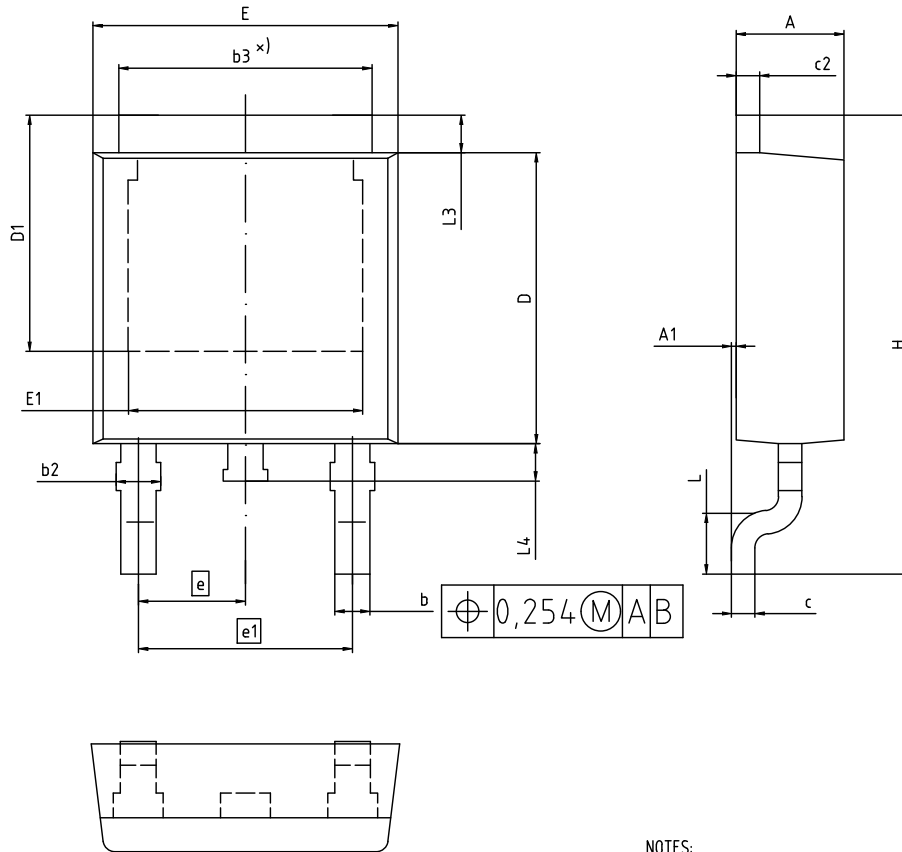
Switching times test circuit for inductive load	Switching times waveform
	

Table 10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

6 Package Outlines



NOTES:

1. INDUSTRIAL QUALITY GRADE
2. ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.16	2.41	0.085	0.095
A1	0.00	0.15	0.000	0.006
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b3	4.95	5.50	0.195	0.217
c	0.46	0.61	0.018	0.024
c2	0.40	0.98	0.016	0.039
D	5.97	6.22	0.235	0.245
D1	5.02	5.84	0.198	0.230
E	6.35	6.73	0.250	0.265
E1	4.32	5.21	0.185	0.205
e	2.29 (BSC)		0.090 (BSC)	
e1	4.57 (BSC)		0.180 (BSC)	
N	3		3	
H	9.40	10.48	0.370	0.413
L	1.18	1.78	0.046	0.070
L3	0.89	1.27	0.035	0.050
L4	0.51	1.02	0.020	0.040

DOCUMENT NO. Z8B00003328
SCALE 0 2.5 5mm
EUROPEAN PROJECTION
ISSUE DATE 05-02-2016
REVISION 06

Figure 1 Outline PG-TO 252, dimensions in mm/inches

7 Appendix A

Table 11 Related Links

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

800V CoolMOS™ P7 Power Transistor

IPD80R1K4P7

Revision History

IPD80R1K4P7

Revision: 2016-07-05, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2016-07-05	Release of final version

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Published by

Infineon Technologies AG

81726 München, Germany

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