

MOSFET

700V CoolMOS™ CE Power Transistor

CoolMOS™ is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infineon Technologies. CoolMOS™ CE is a price-performance optimized platform enabling to target applications in Charger and Adapter markets by still meeting highest efficiency standards. The new series provides all benefits of a fast switching Superjunction MOSFET while not sacrificing ease of use and offering the best cost down performance ratio available on the market.

Features

- Extremely low losses due to very low FOM $R_{DS(on)} \cdot Q_g$ and E_{oss}
- Very high commutation ruggedness
- Easy to use/drive
- Pb-free plating, Halogen free mold compound

Applications

(QR) Flyback in low power chargers for mobile devices and power tools

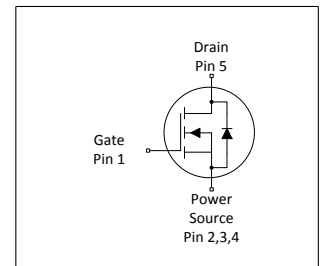
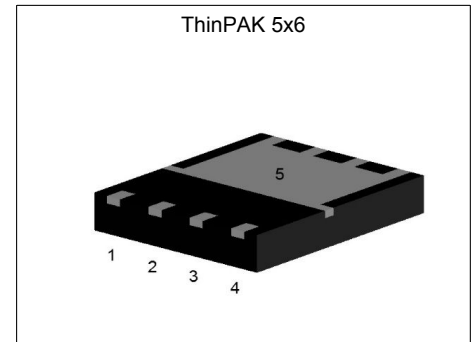


Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	750	V
$R_{DS(on),max}$	2100	mΩ
$Q_{g,typ}$	7.8	nC
$I_{D,pulse}$	6.3	A
$E_{oss}@400V$	0.85	μJ
Body diode di/dt	500	A/μs



Type / Ordering Code	Package	Marking	Related Links
IPL70R2K1CES	ThinPAK 5x6 SMD	7R2K1CE	see Appendix A

Table of Contents

Description	1
Maximum ratings	3
Thermal characteristics	4
Electrical characteristics	5
Electrical characteristics diagrams	7
Test Circuits	11
Package Outlines	12
Appendix A	13
Revision History	14
Trademarks	14
Disclaimer	14

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	-	-	2.3 1.5	A	$T_C=25^\circ\text{C}$ $T_C=100^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	6.3	A	$T_C=25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}	-	-	11	mJ	$I_D=0.4\text{A}$; $V_{DD}=50\text{V}$; see table 10
Avalanche energy, repetitive	E_{AR}	-	-	0.07	mJ	$I_D=0.4\text{A}$; $V_{DD}=50\text{V}$; see table 10
Avalanche current, repetitive	I_{AR}	-	-	0.4	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	50	V/ns	$V_{DS}=0\dots480\text{V}$
Gate source voltage (static)	V_{GS}	-20	-	20	V	static;
Gate source voltage (dynamic)	V_{GS}	-30	-	30	V	AC ($f>1\text{ Hz}$)
Power dissipation	P_{tot}	-	-	22	W	$T_C=25^\circ\text{C}$
Storage temperature	T_{stg}	-40	-	150	$^\circ\text{C}$	-
Operating junction temperature	T_j	-40	-	150	$^\circ\text{C}$	-
Continuous diode forward current	I_S	-	-	2.0	A	$T_C=25^\circ\text{C}$
Diode pulse current ²⁾	$I_{S,pulse}$	-	-	6.3	A	$T_C=25^\circ\text{C}$
Reverse diode dv/dt ³⁾	dv/dt	-	-	15	V/ns	$V_{DS}=0\dots400\text{V}$, $I_{SD}\leq I_S$, $T_j=25^\circ\text{C}$ see table 8
Maximum diode commutation speed	di_f/dt	-	-	500	A/ μs	$V_{DS}=0\dots400\text{V}$, $I_{SD}\leq I_S$, $T_j=25^\circ\text{C}$ see table 8

¹⁾ Limited by $T_{j,max}$. Maximum duty cycle $D=0.75$

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

³⁾ Identical low side and high side switch with identical R_θ

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	5.6	°C/W	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	62	°C/W	device on PCB, minimal footprint
Thermal resistance, junction - ambient for SMD version	R_{thJA}	-	35	45	°C/W	Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm ² (one layer, 70µm thickness) copper area for drain connection and cooling. PCB is vertical without air stream cooling.
Soldering temperature, wave & reflow soldering allowed	T_{sold}	-	-	260	°C	1.6mm (0.063 in.) from case for 10s

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	$V_{(BR)DSS}$	700	-	-	V	$V_{GS}=0V, I_D=1mA$
Gate threshold voltage	$V_{(GS)th}$	2.5	3.0	3.5	V	$V_{DS}=V_{GS}, I_D=0.07mA$
Zero gate voltage drain current	I_{DSS}	-	-	1	μA	$V_{DS}=700V, V_{GS}=0V, T_j=25^\circ\text{C}$ $V_{DS}=700V, V_{GS}=0V, T_j=150^\circ\text{C}$
Gate-source leakage current	I_{GSS}	-	-	100	nA	$V_{GS}=20V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	1.9	2.1	Ω	$V_{GS}=10V, I_D=1.0A, T_j=25^\circ\text{C}$ $V_{GS}=10V, I_D=1.0A, T_j=150^\circ\text{C}$
Gate resistance	R_G	-	6.5	-	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}	-	163	-	pF	$V_{GS}=0V, V_{DS}=100V, f=1\text{MHz}$
Output capacitance	C_{oss}	-	14	-	pF	$V_{GS}=0V, V_{DS}=100V, f=1\text{MHz}$
Effective output capacitance, energy related ¹⁾	$C_{o(er)}$	-	10	-	pF	$V_{GS}=0V, V_{DS}=0\dots480V$
Effective output capacitance, time related ²⁾	$C_{o(tr)}$	-	33	-	pF	$I_D=\text{constant}, V_{GS}=0V, V_{DS}=0\dots480V$
Turn-on delay time	$t_{d(on)}$	-	5.3	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.1A,$ $R_G=10.2\Omega$; see table 9
Rise time	t_r	-	3.7	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.1A,$ $R_G=10.2\Omega$; see table 9
Turn-off delay time	$t_{d(off)}$	-	24	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.1A,$ $R_G=10.2\Omega$; see table 9
Fall time	t_f	-	18	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.1A,$ $R_G=10.2\Omega$; see table 9

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{GS}	-	0.9	-	nC	$V_{DD}=480V, I_D=1.1A, V_{GS}=0$ to 10V
Gate to drain charge	Q_{gd}	-	4.3	-	nC	$V_{DD}=480V, I_D=1.1A, V_{GS}=0$ to 10V
Gate charge total	Q_g	-	7.8	-	nC	$V_{DD}=480V, I_D=1.1A, V_{GS}=0$ to 10V
Gate plateau voltage	$V_{plateau}$	-	5.4	-	V	$V_{DD}=480V, I_D=1.1A, V_{GS}=0$ 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 480V

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 480V

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}	-	194	-	ns	$V_R=400V, I_F=1.1A, di_F/dt=100A/\mu s$; see table 8
Reverse recovery charge	Q_{rr}	-	1.1	-	μC	$V_R=400V, I_F=1.1A, di_F/dt=100A/\mu s$; see table 8
Peak reverse recovery current	I_{rrm}	-	11	-	A	$V_R=400V, I_F=1.1A, di_F/dt=100A/\mu s$; see table 8

4 Electrical characteristics diagrams

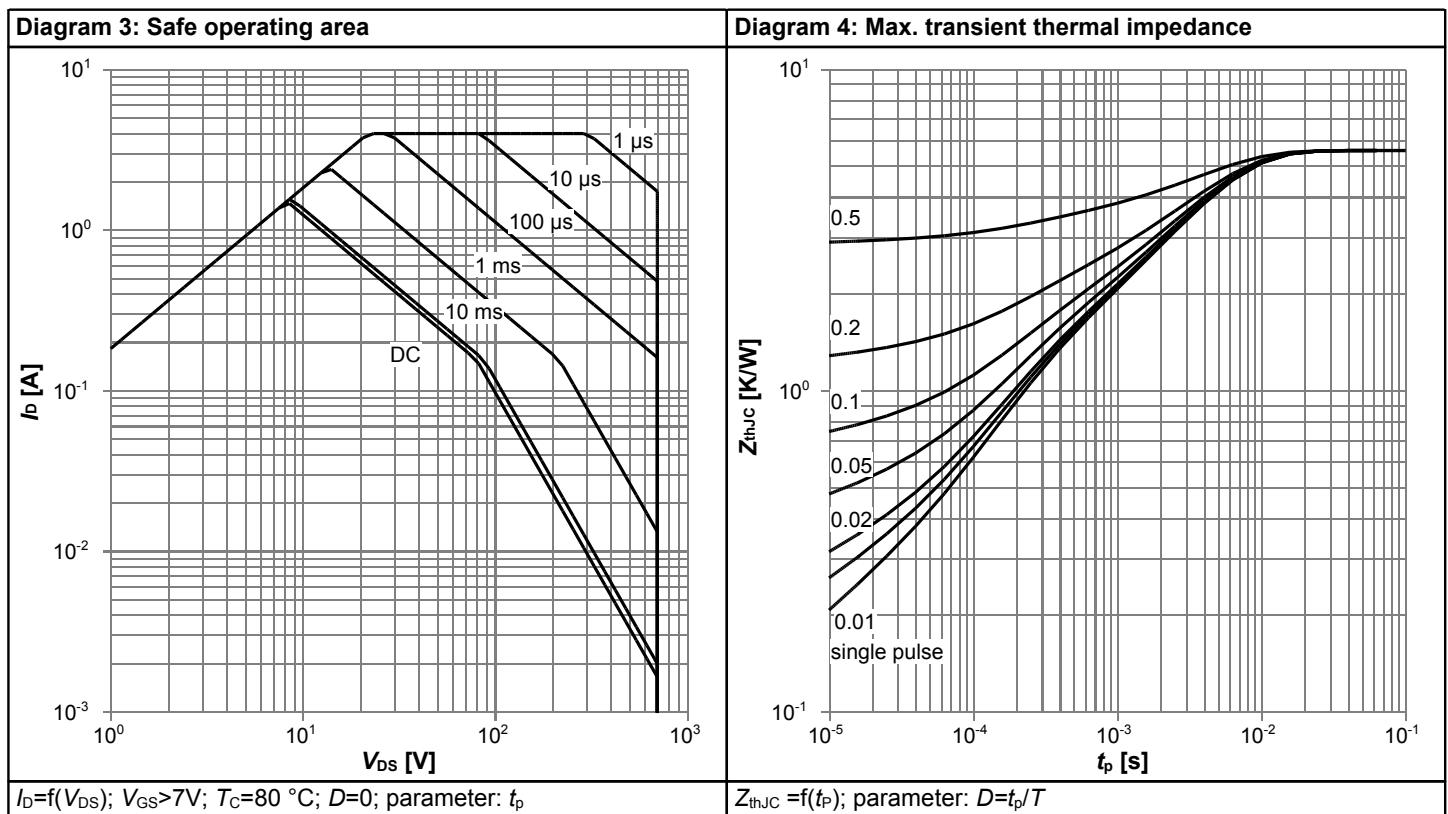
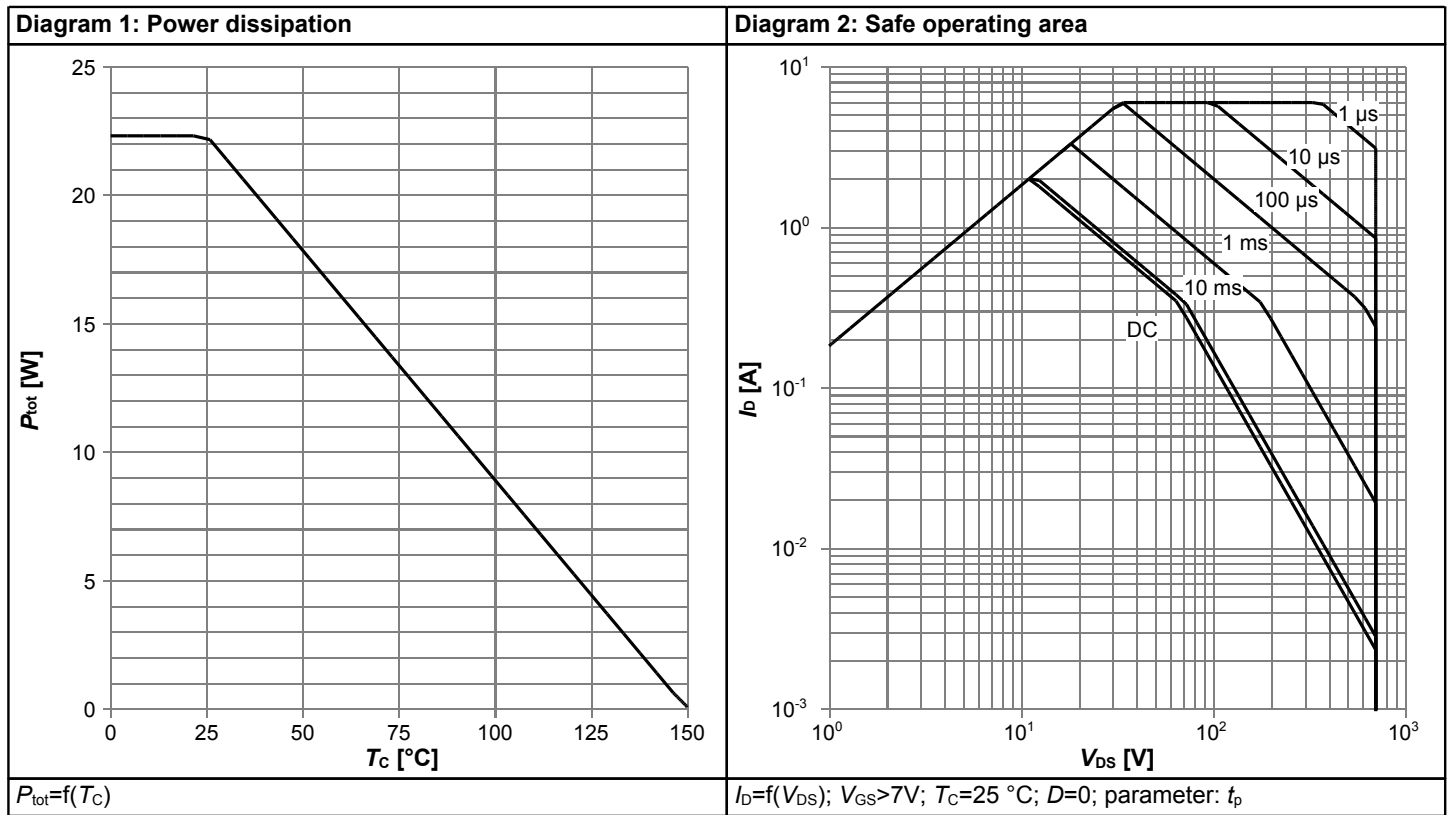
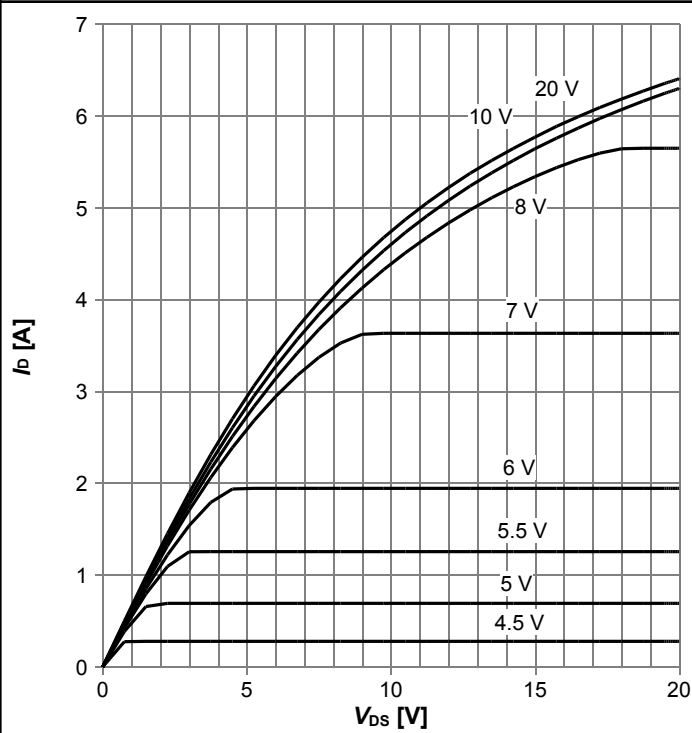
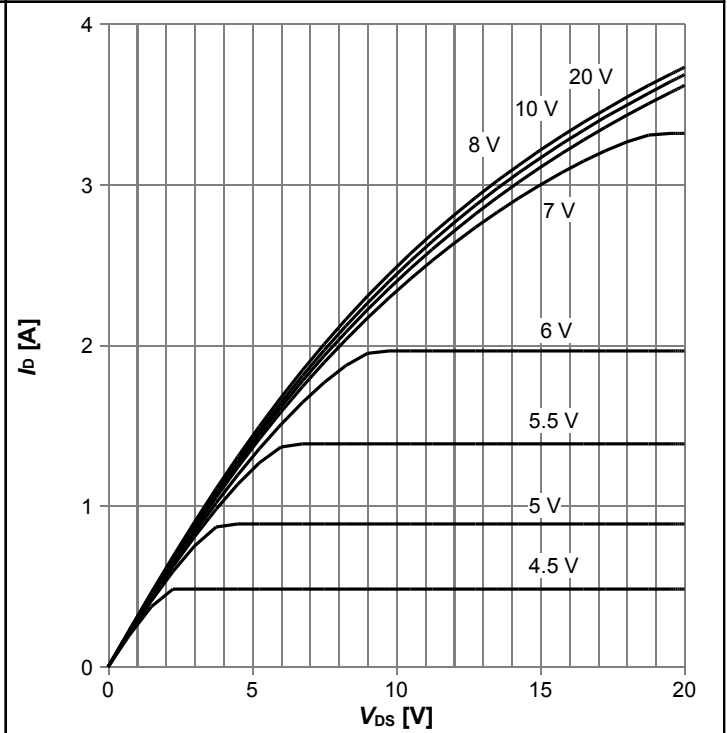


Diagram 5: Typ. output characteristics



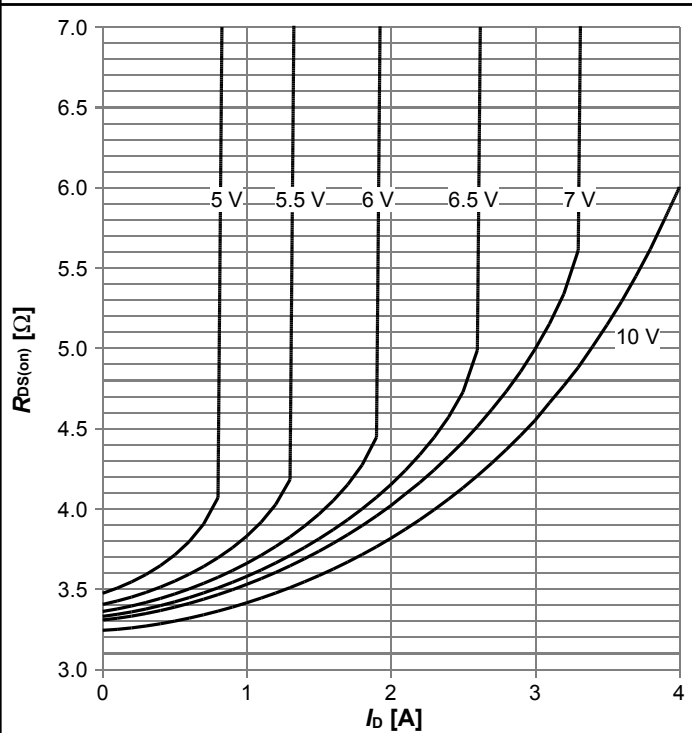
$I_D=f(V_{DS}); T_j=25\text{ }^\circ\text{C};$ parameter: V_{GS}

Diagram 6: Typ. output characteristics



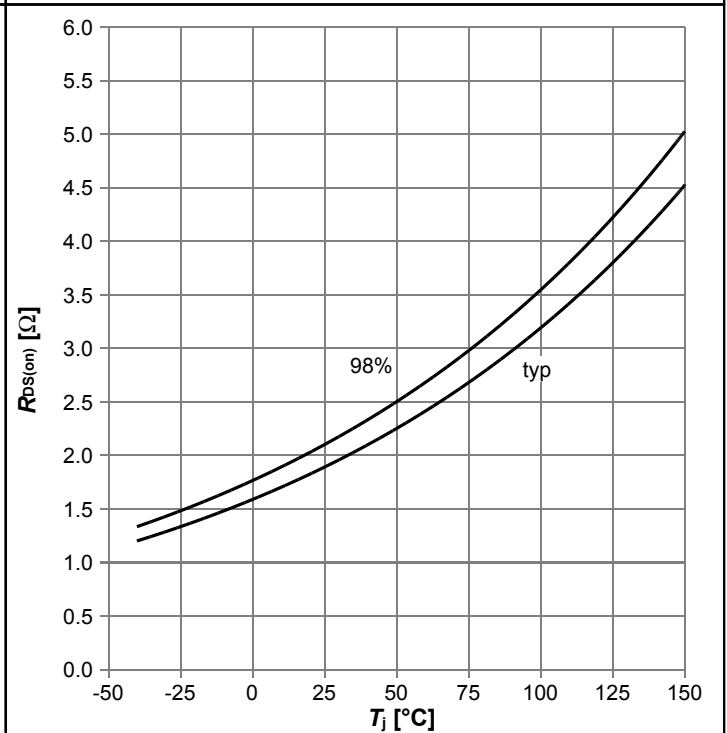
$I_D=f(V_{DS}); T_j=125\text{ }^\circ\text{C};$ parameter: V_{GS}

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



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

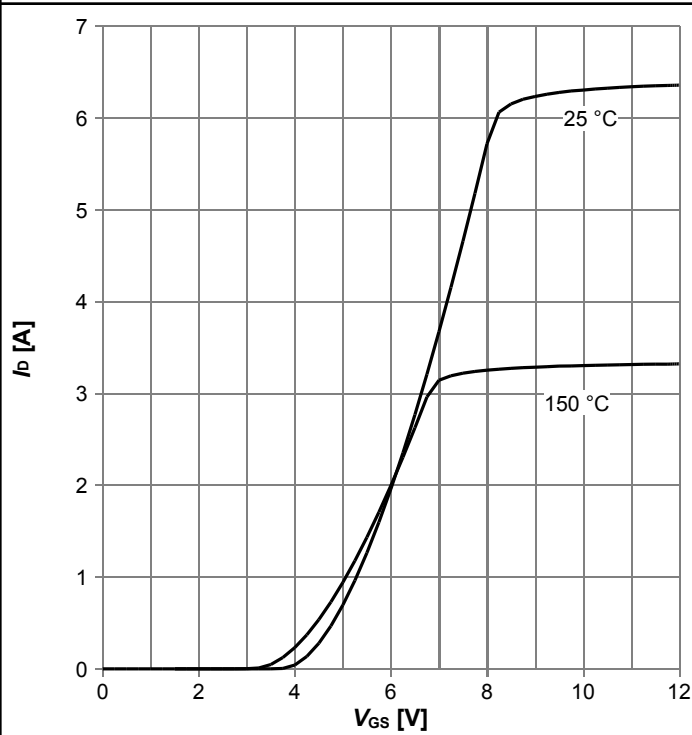
Diagram 8: Drain-source on-state resistance



$R_{DS(on)}=f(T_j); I_D=1.0\text{ A}; V_{GS}=10\text{ V}$

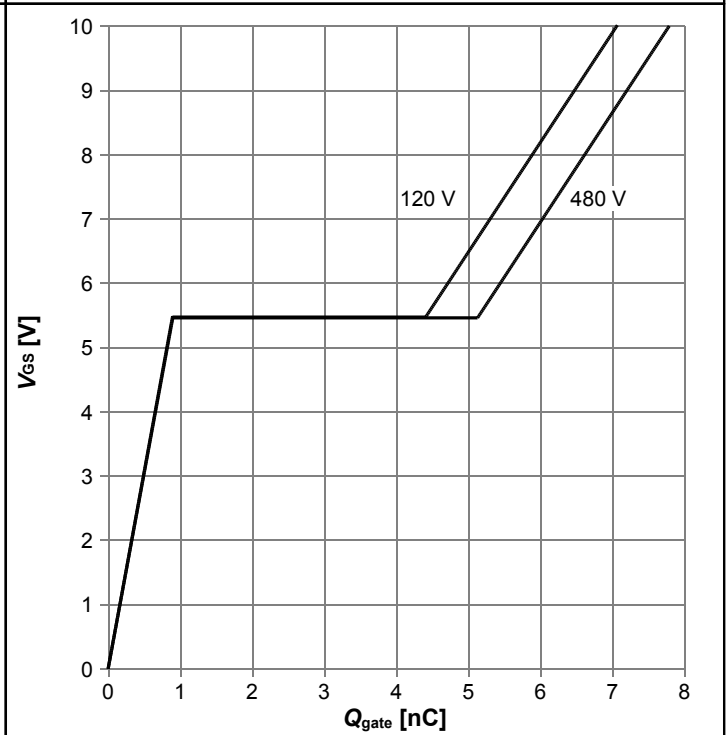
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Diagram 9: Typ. transfer characteristics



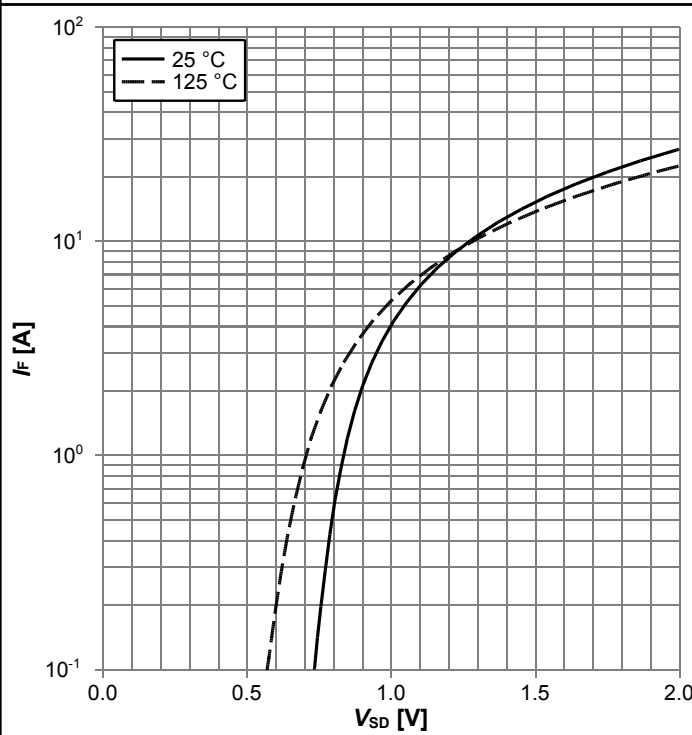
$I_D=f(V_{GS}); V_{DS}=20V; \text{parameter: } T_j$

Diagram 10: Typ. gate charge



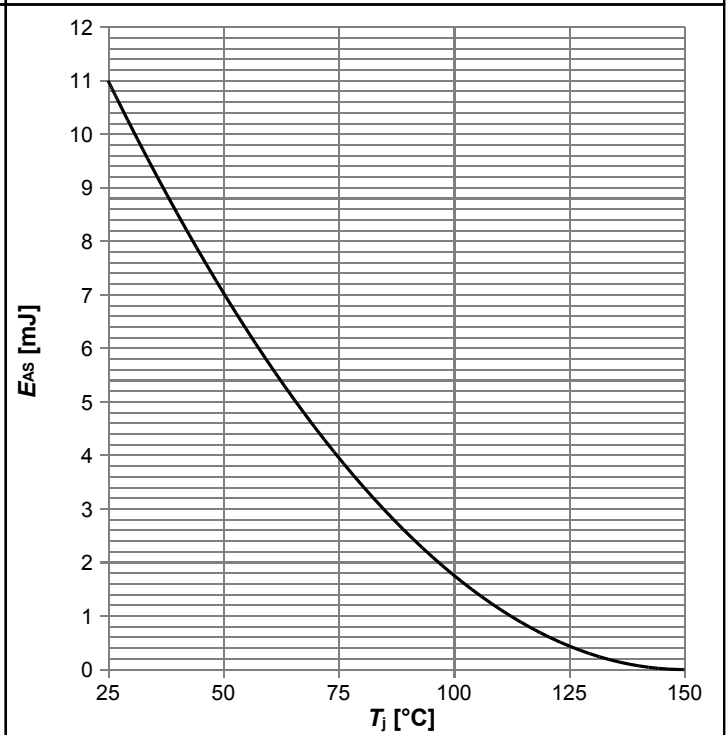
$V_{GS}=f(Q_{gate}); I_D=1.1 \text{ A pulsed}; \text{parameter: } V_{DD}$

Diagram 11: Forward characteristics of reverse diode



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

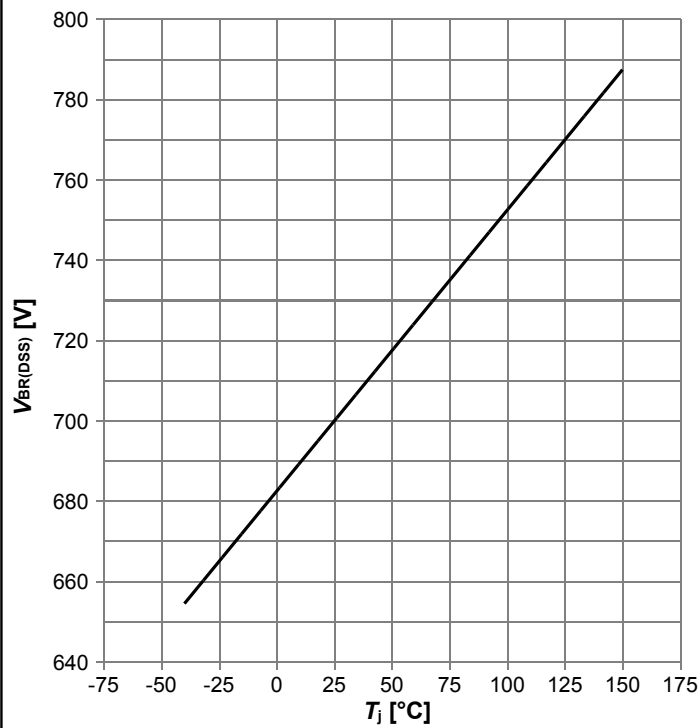
Diagram 12: Avalanche energy



$E_{AS}=f(T_j); I_D=0.4 \text{ A}; V_{DD}=50 \text{ V}$

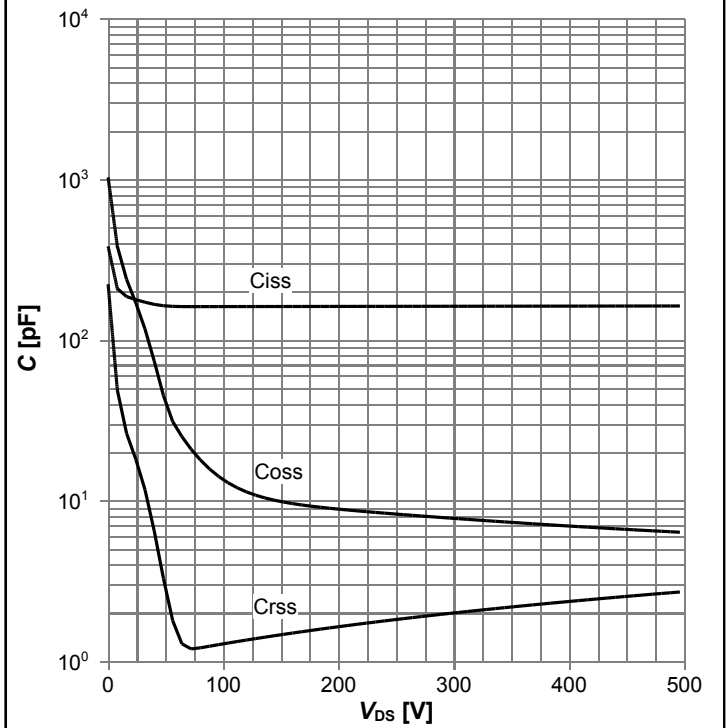
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Diagram 13: Drain-source breakdown voltage



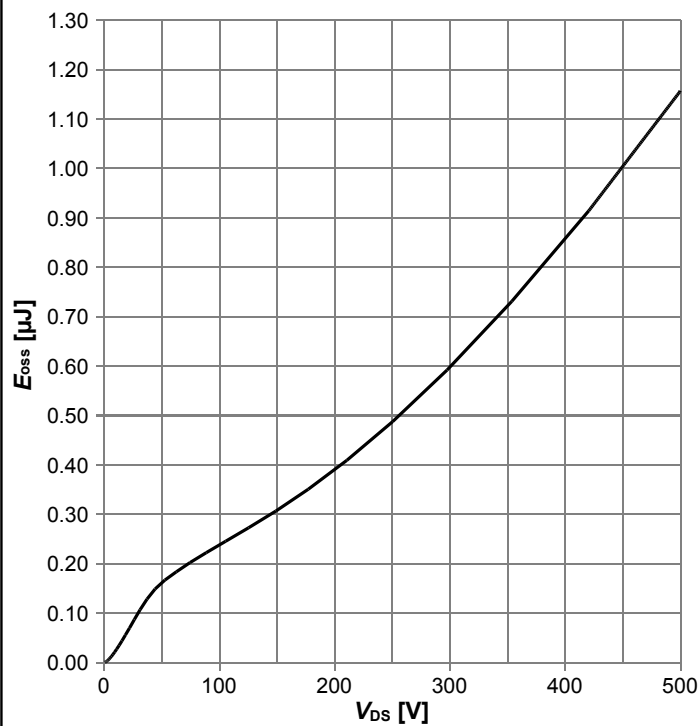
$V_{BR(DSS)}=f(T_j); I_D=1.0 \text{ mA}$

Diagram 14: Typ. capacitances



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

Diagram 15: Typ. Coss stored energy



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

5 Test Circuits

Table 8 Diode characteristics

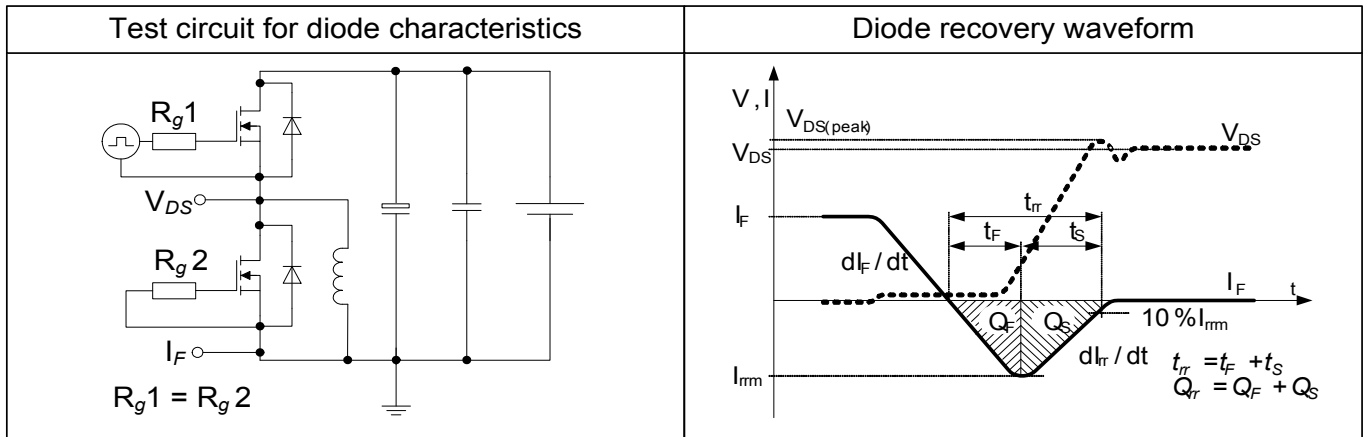


Table 9 switching times (ss)

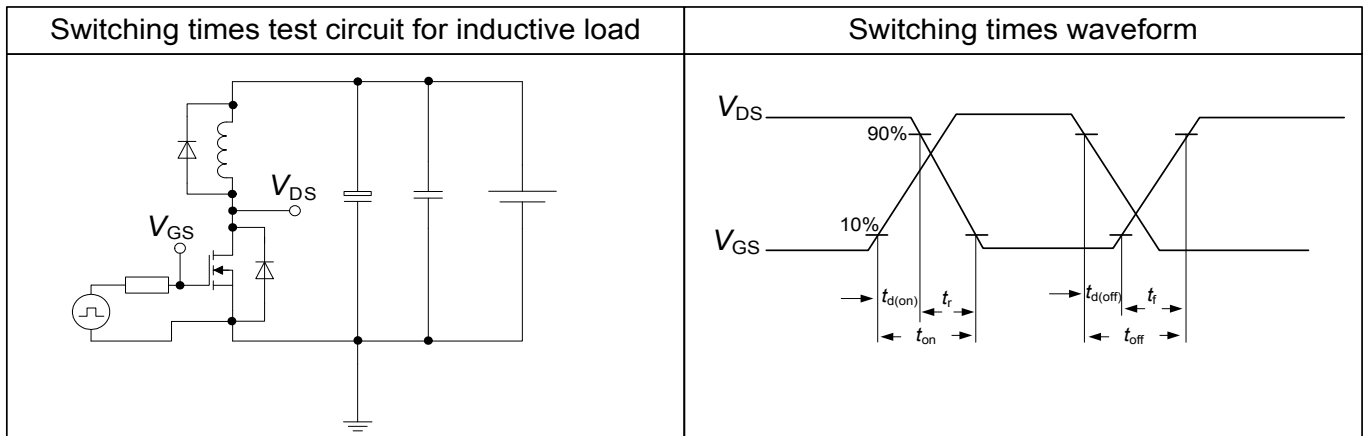
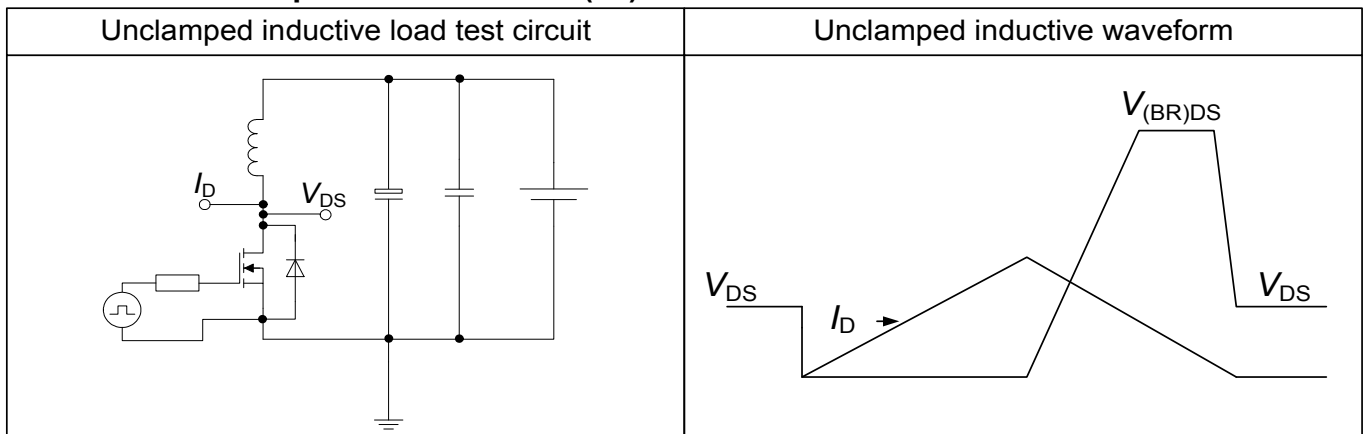


Table 10 Unclamped inductive load (ss)



6 Package Outlines

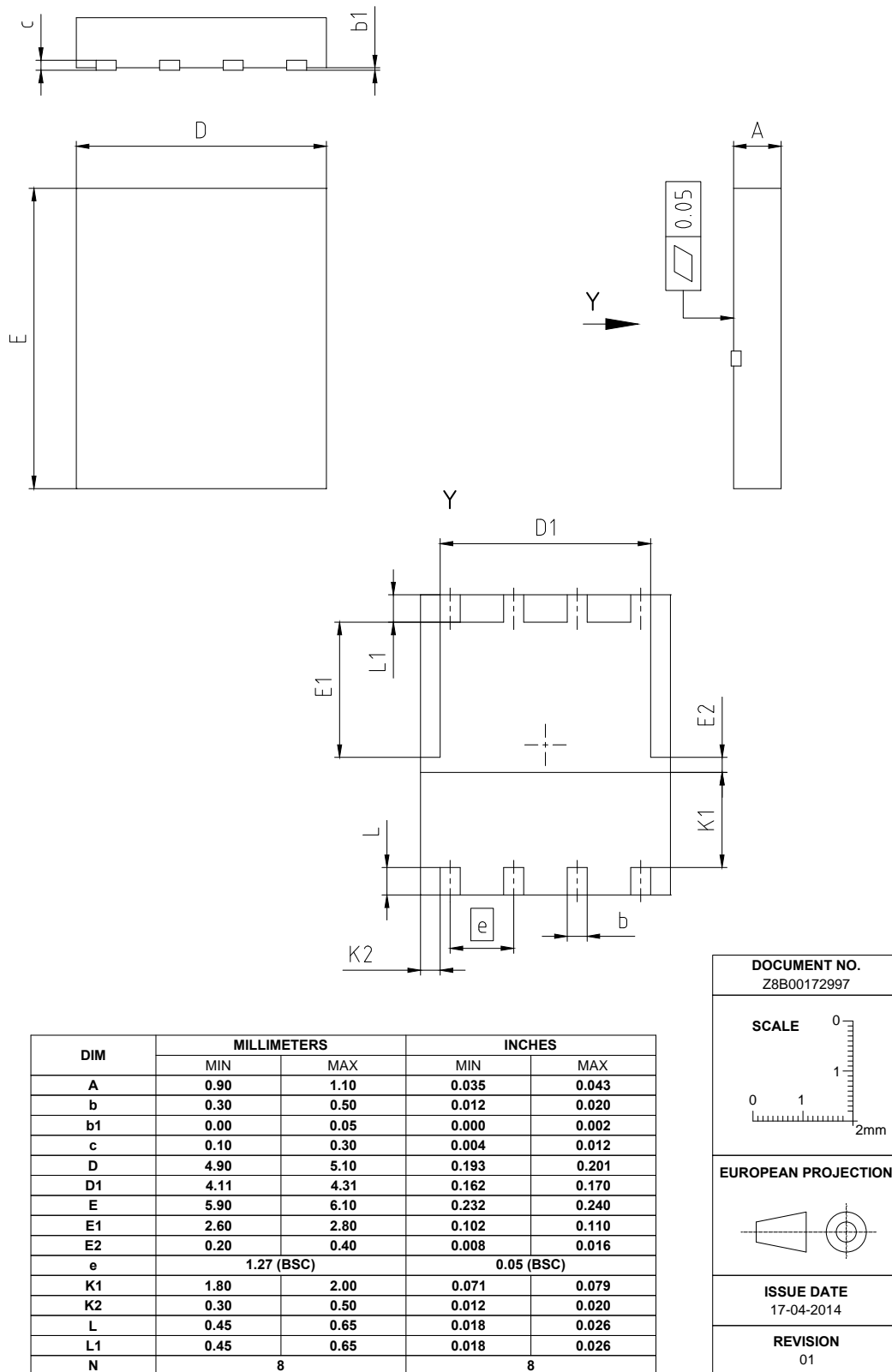


Figure 1 Outline ThinPAK 5x6 SMD, dimensions in mm/inches

7 Appendix A

Table 11 Related Links

- **IFX CoolMOS™ CE Webpage:** www.infineon.com
- **IFX CoolMOS™ CE application note:** www.infineon.com
- **IFX CoolMOS™ CE simulation model:** www.infineon.com
- **IFX Design tools:** www.infineon.com

700V CoolMOS™ CE Power Transistor IPL70R2K1CES

Revision History

IPL70R2K1CES

Revision: 2016-04-15, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2016-04-15	Release of final version

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