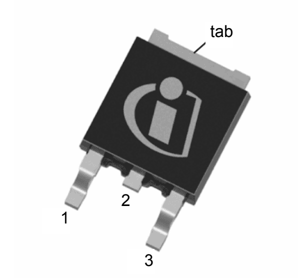
MOSFET

650V CoolMOS™ CE Power Transistor

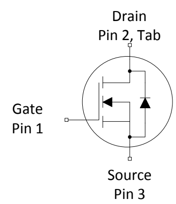
CoolMOS™ is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infineon Technologies. CoolMOS™ CE is a price-performance optimized platform enabling to target cost sensitive applications in Consumer and Lighting markets by 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.

DPAK



Features

• Extremely low losses due to very low FOM Rdson*Qg and Eoss
• Very high commutation ruggedness
• Easy to use/drive
• Pb-free plating, Halogen free mold compound
• Qualified for standard grade applications



Applications

PC Silverbox, Adapters, LCD & PDP TV and indoor Lighting

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} @ $T_{j,max}$	700	V
$R_{DS(on),max}$	1000	mΩ
$I_{d.typ}$	7.2	A
$Q_{g.typ}$	15.3	nC
$I_{D,pulse}$	12	A
E_{oss}@400V	1.5	µJ

Type / Ordering Code	**Package**	**Marking**	**Related Links**
IPD65R1K0CE	PG-TO 252	65S1K0CE	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	- -	- -	7.2 4.6	A	T_C=25°C T_C=100°C
Pulsed drain current[2]	$I_{D,pulse}$	-	-	12	A	T_C=25°C
Avalanche energy, single pulse	E_{AS}	-	-	50	mJ	I_D=1A; V_{DD}=50V; see table 10
Avalanche energy, repetitive	E_{AR}	-	-	0.15	mJ	I_D=1A; V_{DD}=50V; see table 10
Avalanche current, repetitive	I_{AR}	-	-	1.0	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	50	V/ns	V_{DS}=0...480V
Gate source voltage (static)	V_{GS}	-20	-	20	V	static;
Gate source voltage (dynamic)	V_{GS}	-30	-	30	V	AC (f>1 Hz)
Power dissipation (TO252)	P_{tot}	-	-	68	W	T_C=25°C
Storage temperature	T_{stg}	-55	-	150	°C	-
Operating junction temperature	T_j	-55	-	150	°C	-
Continuous diode forward current	I_S	-	-	5.1	A	T_C=25°C
Diode pulse current[2]	$I_{S,pulse}$	-	-	12	A	T_C=25°C
Reverse diode dv/dt[3]	dv/dt	-	-	15	V/ns	V_{DS}=0...400V, I_{SD}<=I_S, T_j=25°C see table 8
Maximum diode commutation speed	di_f/dt	-	-	500	A/µs	V_{DS}=0...400V, I_{SD}<=I_S, T_j=25°C see table 8

[1] Limited by $T_{j\,max}$. Maximum duty cycle D=0.50
[2] Pulse width t_p limited by $T_{j,max}$
[3] Identical low side and high side switch with identical R_G

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case (TO252)	R_{thJC}	-	-	1.85	°C/W	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	62	°C/W	leaded
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	-	-	260	°C	1.6mm (0.063 in.) from case for 10s

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	$V_{(BR)DSS}$	650	-	-	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=0.2mA
Zero gate voltage drain current	I_{DSS}	- -	- 10	1 -	µA	V_{DS}=650, V_{GS}=0V, T_j=25°C V_{DS}=650, V_{GS}=0V, T_j=150°C
Gate-source leakage current	I_{GSS}	-	-	100	nA	V_{GS}=20V, V_{DS}=0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	0.86 2.22	1.00 -	Ω	V_{GS}=10V, I_D=1.5A, T_j=25°C V_{GS}=10V, I_D=1.5A, T_j=150°C
Gate resistance	R_G	-	5.5	-	Ω	f=1MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	328	-	pF	V_{GS}=0V, V_{DS}=100V, f=1MHz
Output capacitance	C_{oss}	-	23	-	pF	V_{GS}=0V, V_{DS}=100V, f=1MHz
Effective output capacitance, energy related[1]	$C_{o(er)}$	-	14	-	pF	V_{GS}=0V, V_{DS}=0...480V
Effective output capacitance, time related[2]	$C_{o(tr)}$	-	58.5	-	pF	I_D=constant, V_{GS}=0V, V_{DS}=0...480V
Turn-on delay time	$t_{d(on)}$	-	6.6	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=2.2A, R_G=10.2Ω; see table 9
Rise time	t_r	-	5.2	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=2.2A, R_G=10.2Ω; see table 9
Turn-off delay time	$t_{d(off)}$	-	41	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=2.2A, R_G=10.2Ω; see table 9
Fall time	t_f	-	13.6	-	ns	V_{DD}=400V, V_{GS}=13 V, I_D=2.2A, R_G=10.2Ω; see table 9

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	1.8	-	nC	V_{DD}=480V, I_D=2.2A, V_{GS}=0 to 10V
Gate to drain charge	Q_{gd}	-	8	-	nC	V_{DD}=480V, I_D=2.2A, V_{GS}=0 to 10V
Gate charge total	Q_g	-	15.3	-	nC	V_{DD}=480V, I_D=2.2A, V_{GS}=0 to 10V
Gate plateau voltage	$V_{plateau}$	-	5.4	-	V	V_{DD}=480V, I_D=2.2A, V_{GS}=0 to 10V

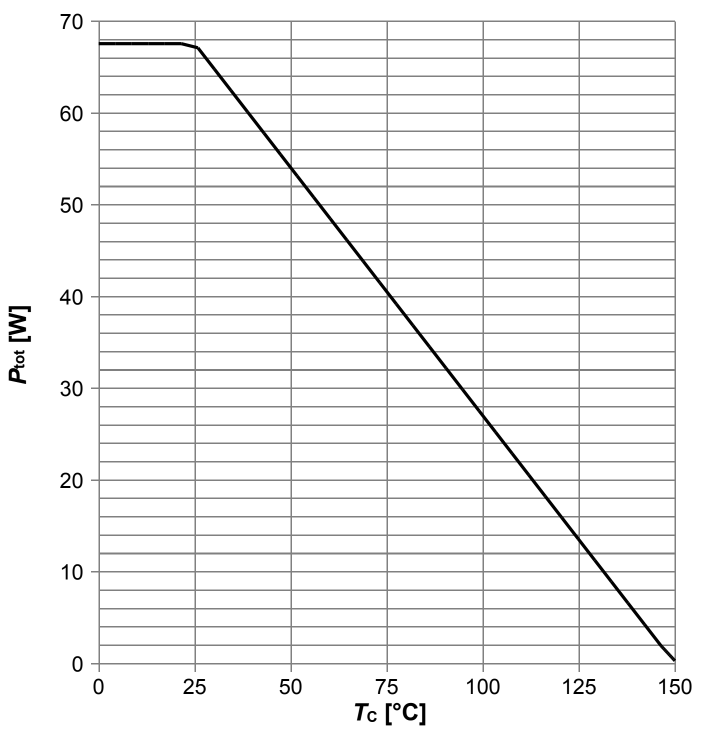
[1] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$
[2] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$

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=2.2A, T_j=25°C
Reverse recovery time	t_{rr}	-	226	-	ns	V_R=400V, I_F=2.2A, di_F/dt=100A/µs; see table 8
Reverse recovery charge	Q_{rr}	-	1.3	-	µC	V_R=400V, I_F=2.2A, di_F/dt=100A/µs; see table 8
Peak reverse recovery current	I_{rrm}	-	9.9	-	A	V_R=400V, I_F=2.2A, di_F/dt=100A/µs; see table 8

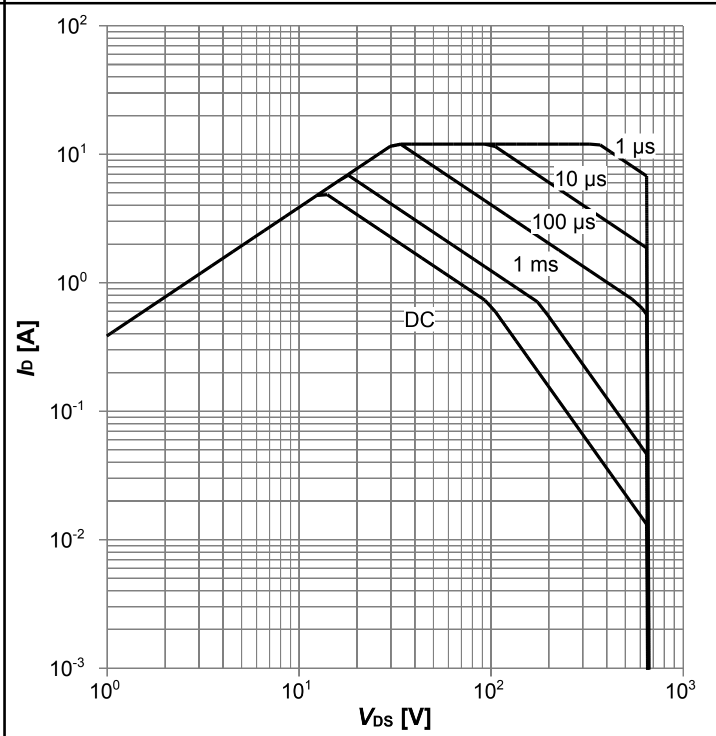
4 Electrical characteristics diagrams

Diagram 1: Power dissipation (Non FullPAK)



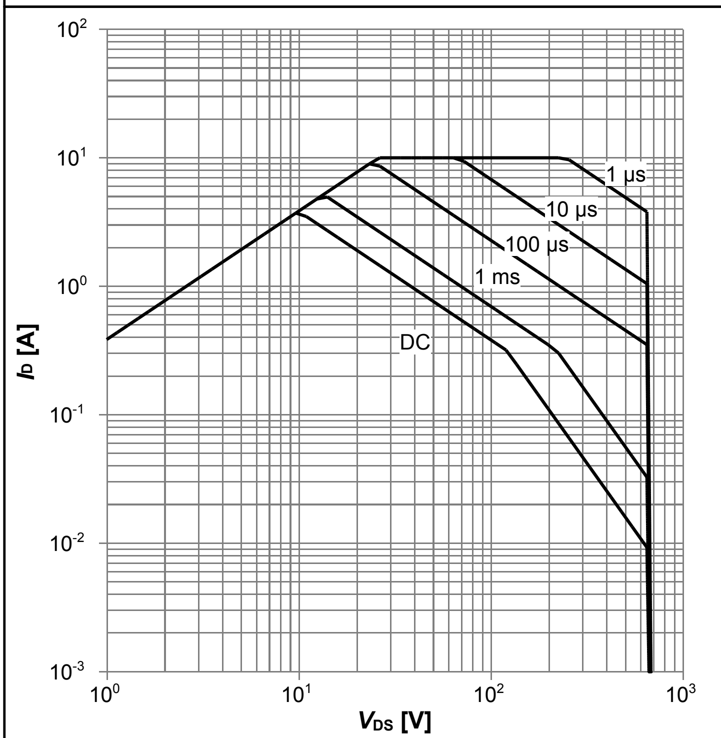
P_{tot}=f(T_C)

Diagram 2: Safe operating area (Non FullPAK)



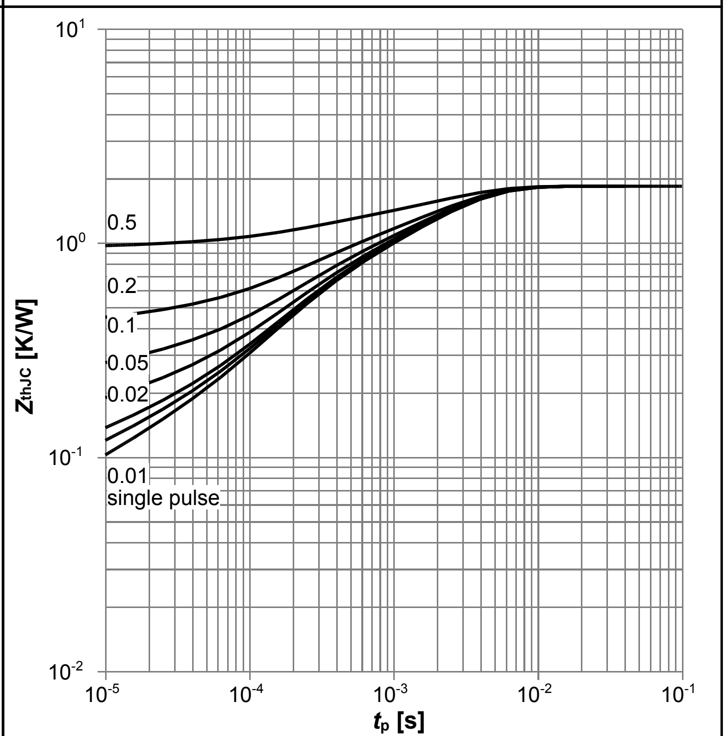
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter: t_p

Diagram 3: Safe operating area (Non FullPAK)



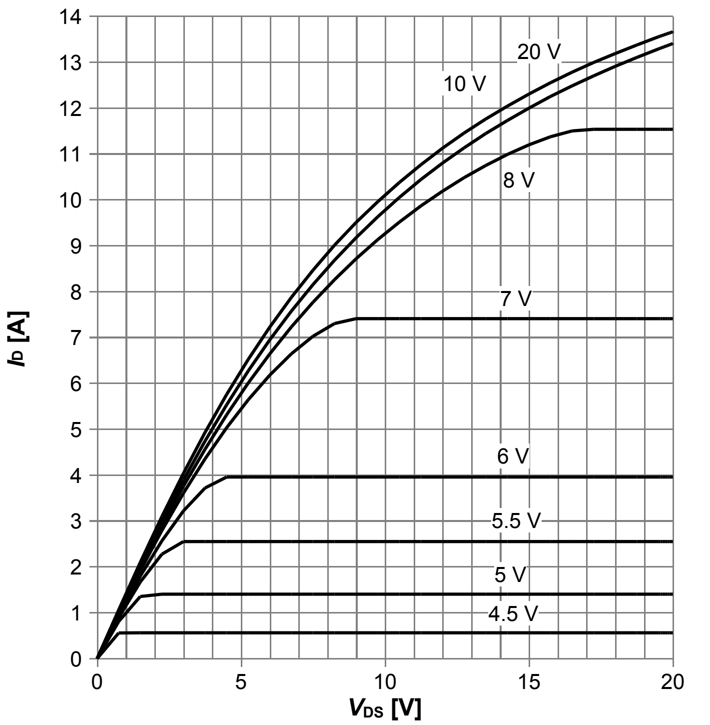
I_D=f(V_{DS}); T_C=80 °C; D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance (Non FullPAK)



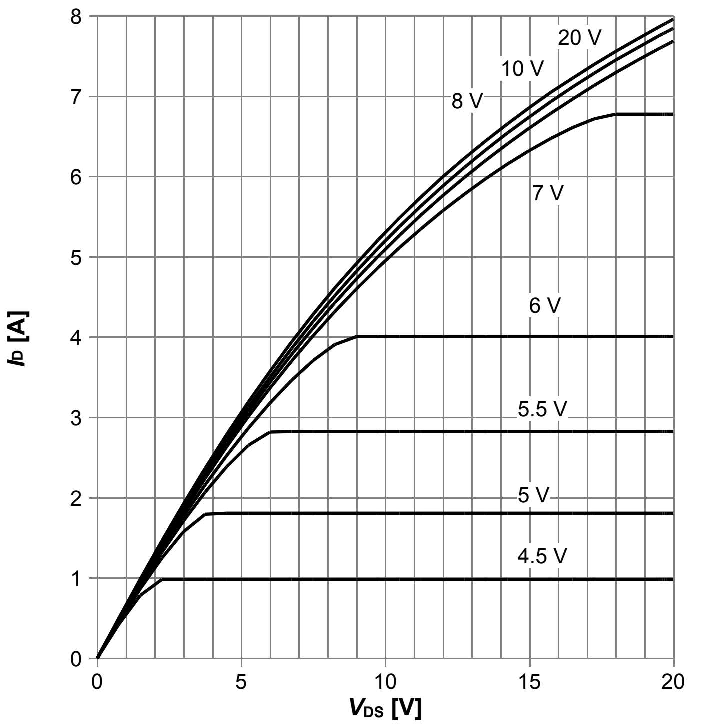
Z_{thJC} =f(t_P); parameter: D=t_p/T

Diagram 5: Typ. output characteristics



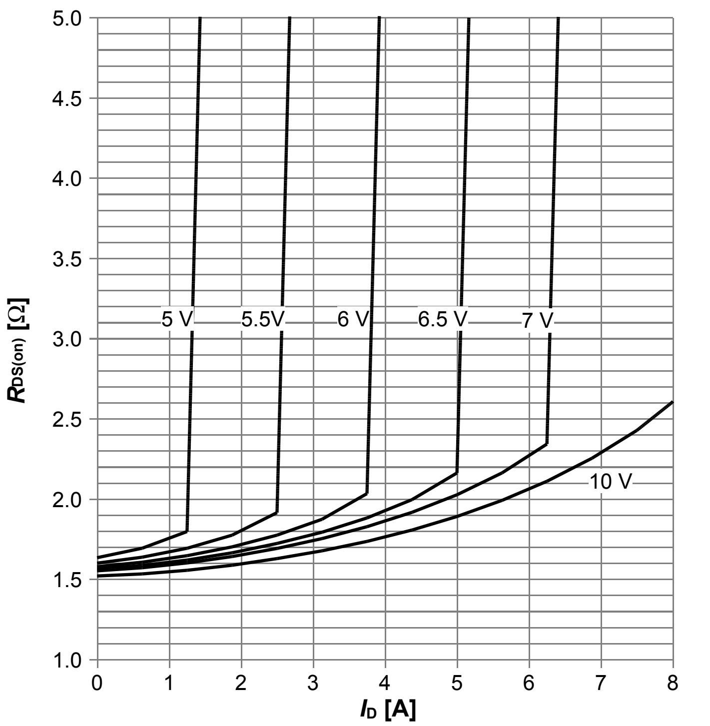
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}

Diagram 6: Typ. output characteristics



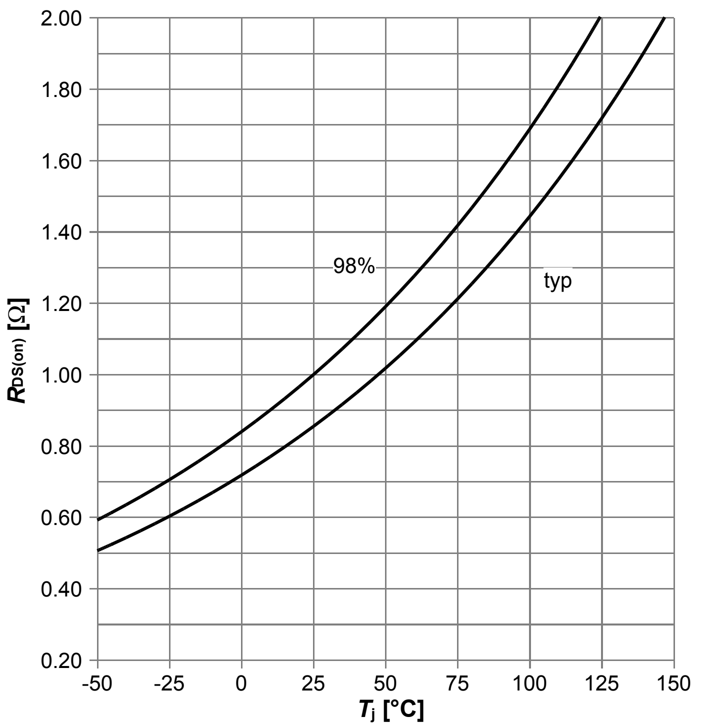
I_D=f(V_{DS}); T_j=125 °C; parameter: V_{GS}

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



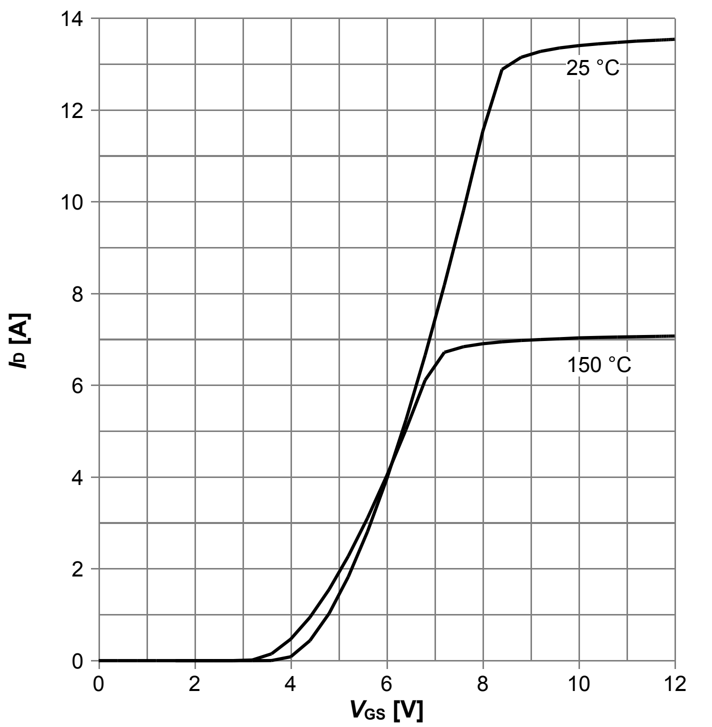
$R_{DS(on)}$=f(I_D); T_j=125 °C; parameter: V_{GS}

Diagram 8: Drain-source on-state resistance



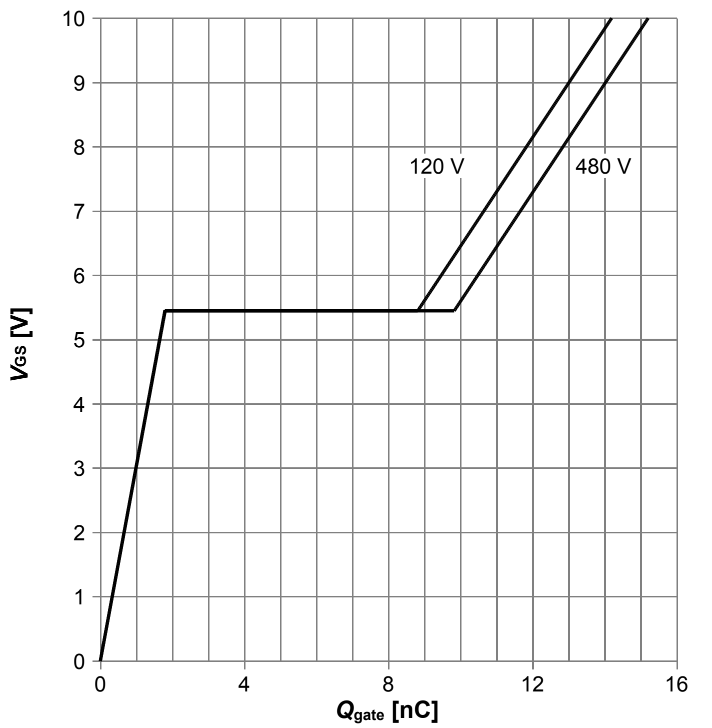
$R_{DS(on)}$=f(T_j); I_D=1.5 A; V_{GS}=10 V

Diagram 9: Typ. transfer characteristics



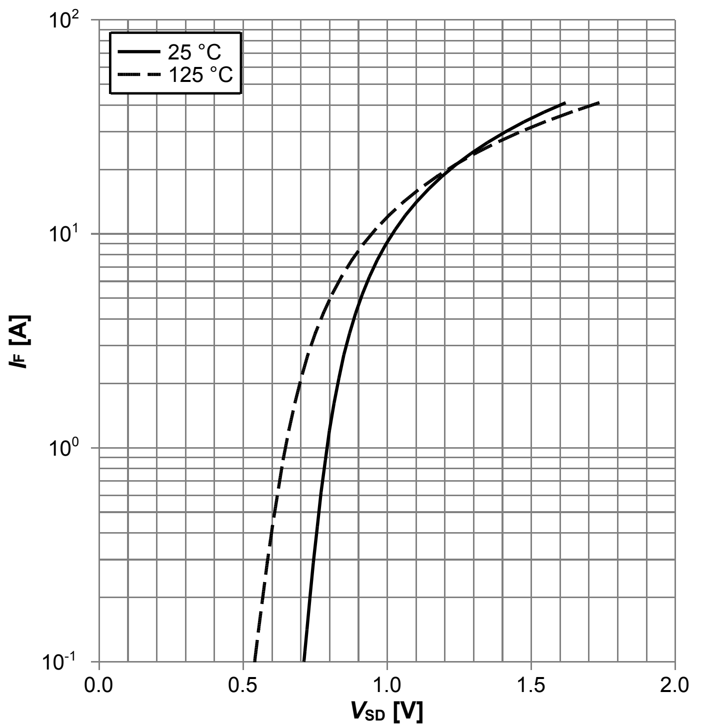
I_D=f(V_{GS}); V_{DS}=20V; parameter: T_j

Diagram 10: Typ. gate charge



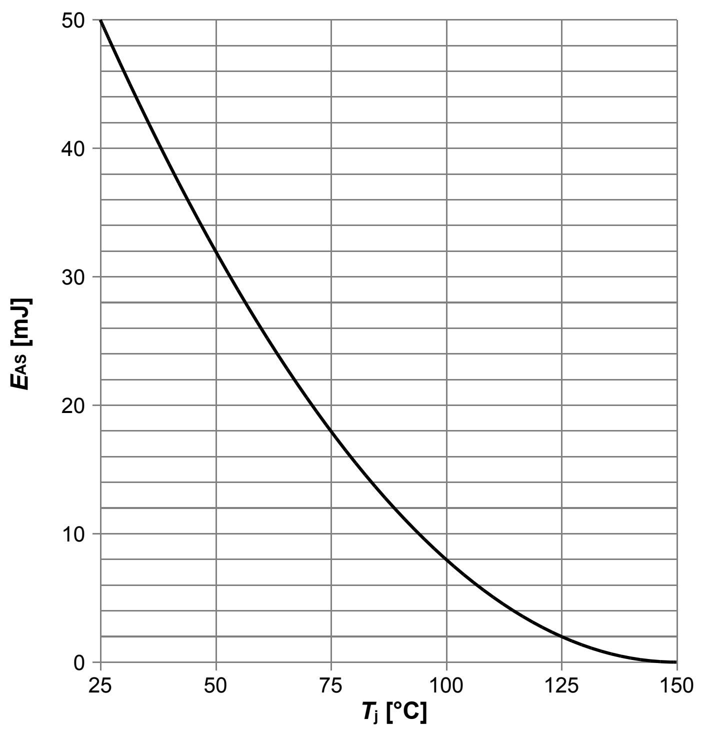
V_{GS}=f(Q_{gate}); I_D=2.2 A pulsed; parameter: V_{DD}

Diagram 11: Forward characteristics of reverse diode



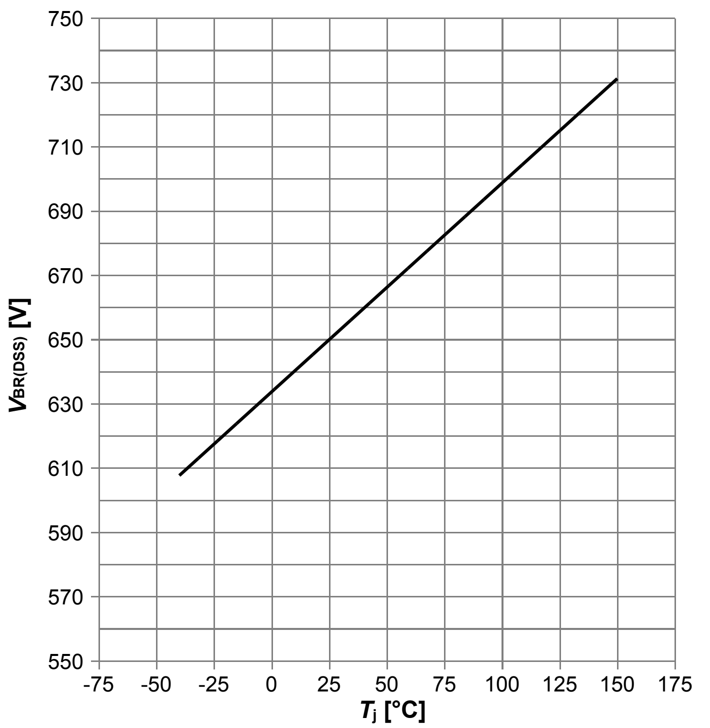
I_F=f(V_{SD}); parameter: T_j

Diagram 12: Avalanche energy



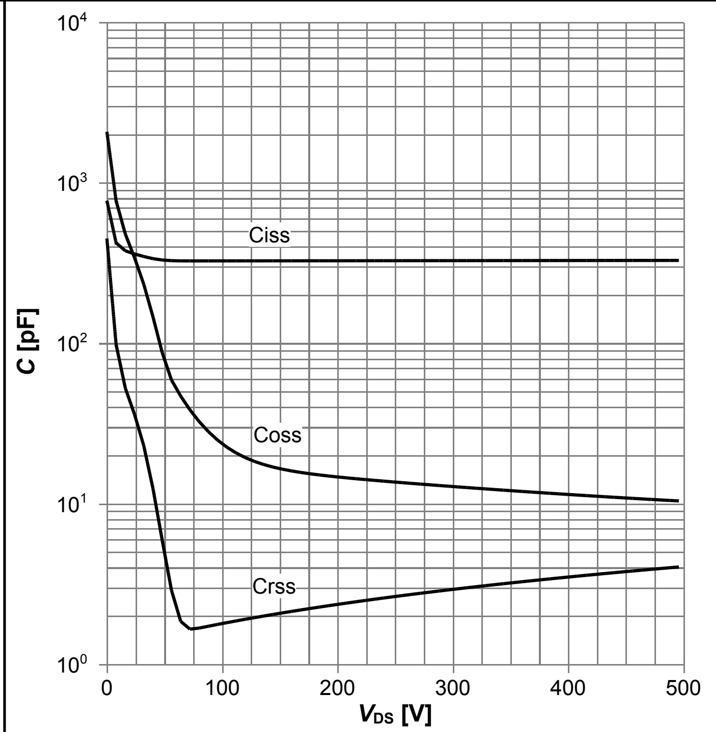
E_{AS}=f(T_j); I_D=1.0 A; V_{DD}=50 V

Diagram 13: Drain-source breakdown voltage



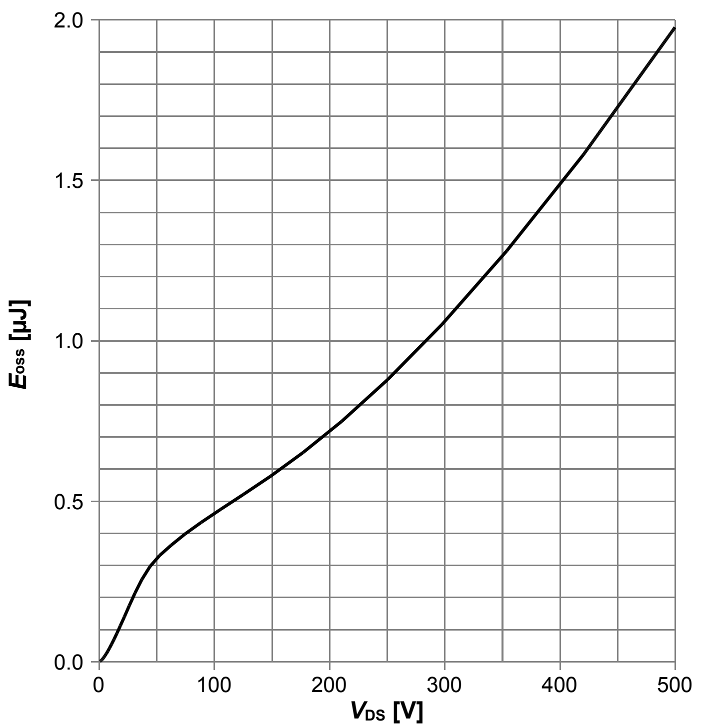
$V_{BR(DSS)}$=f(T_j); I_D=1.0 mA

Diagram 14: Typ. capacitances



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

Diagram 15: Typ. Coss stored energy



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

5 Test Circuits

Table 8 Diode characteristics

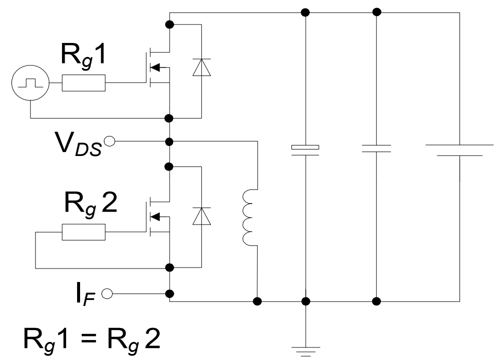
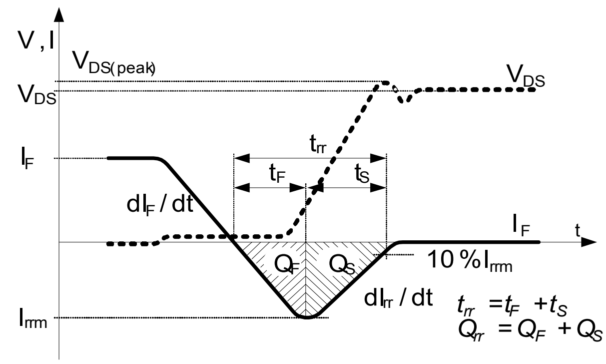
Test circuit for diode characteristics	Diode recovery waveform
	

Table 9 Switching times

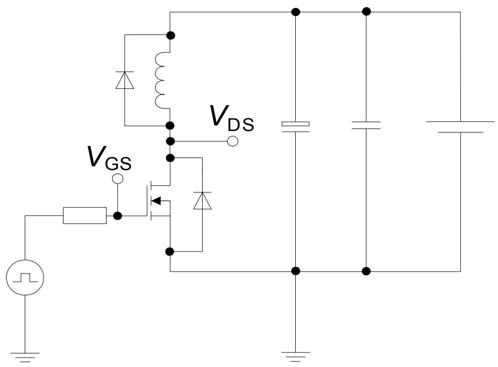
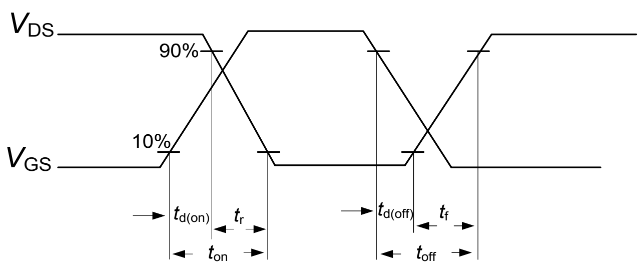
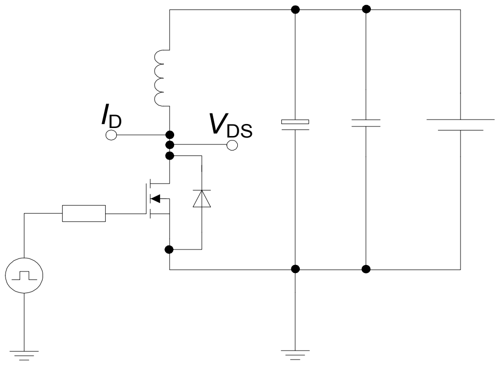
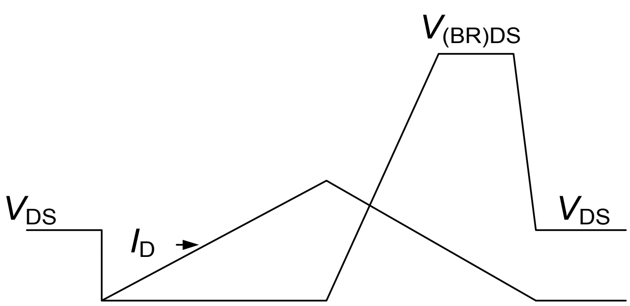
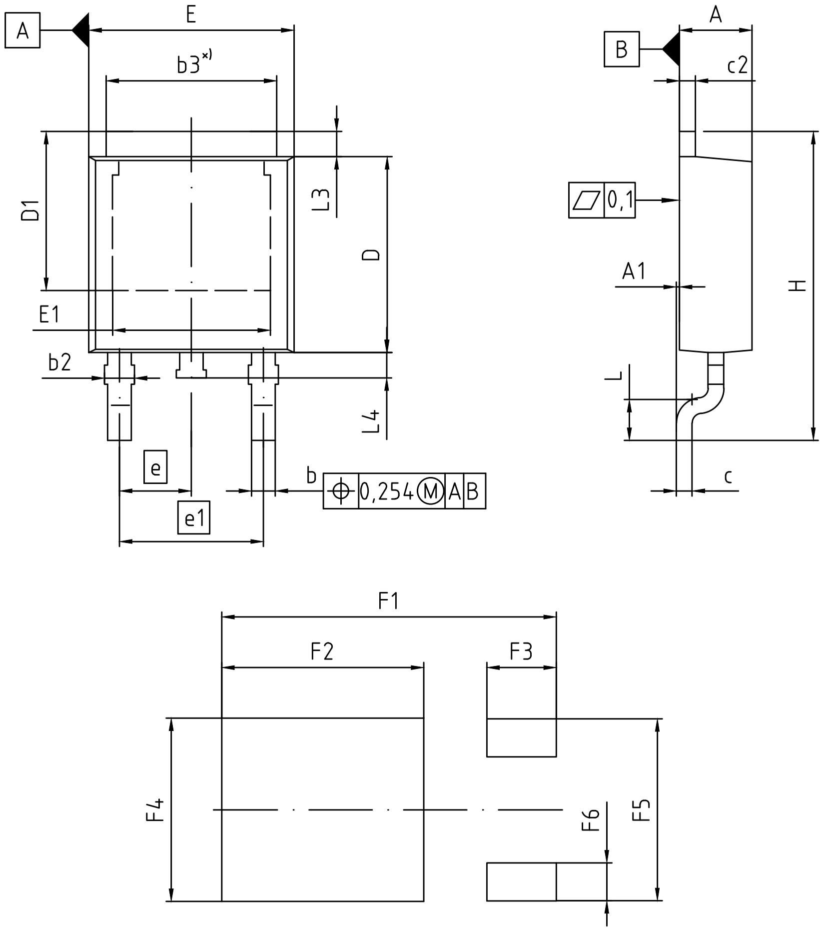
Switching times test circuit for inductive load	Switching times waveform
	

Table 10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

6 Package Outlines



*) mold flash not included

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	5.00	5.50	0.197	0.217
c	0.46	0.60	0.018	0.024
c2	0.46	0.98	0.018	0.039
D	5.97	6.22	0.235	0.245
D1	5.02	5.84	0.198	0.230
E	6.40	6.73	0.252	0.265
E1	4.70	5.60	0.185	0.220
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	1.70	0.046	0.067
L3	0.90	1.25	0.035	0.049
L4	0.51	1.00	0.020	0.039
F1	10.60		0.417	
F2	6.40		0.252	
F3	2.20		0.087	
F4	5.80		0.228	
F5	5.76		0.227	
F6	1.20		0.047	

DOCUMENT NO.
Z8B00003328

SCALE 0 2.0 0 2.0 4mm

EUROPEAN PROJECTION

ISSUE DATE
01-09-2015

REVISION
05

Figure 1 Outline PG-TO 252, 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

Revision History

IPD65R1K0CE

Revision: 2016-02-26, Rev. 2.0

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2016-02-26	Release of final version

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Published by
Infineon Technologies AG
81726 München, Germany

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