MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CoolMOS™ C7

650V CoolMOS™ C7 Power Transistor
IPZ65R019C7

Data Sheet

Rev. 2.0
Final

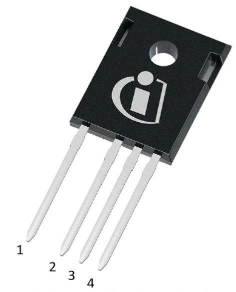
Power Management & Multimarket

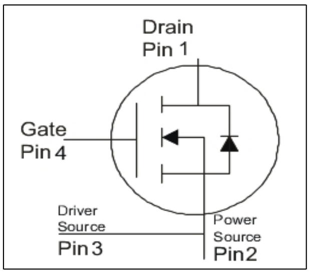
1 Description

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

CoolMOS™ C7 series combines the experience of the leading SJ MOSFET supplier with high class innovation. The product portfolio provides all benefits of fast switching superjunction MOSFETs offering better efficiency, reduced gate charge, easy implementation and outstanding reliability.

PG-TO 247-4





Features

- Increased MOSFET dv/dt ruggedness
- Better efficiency due to best in class FOM $R_{DS(on)}$*E_{oss} and $R_{DS(on)}$*Q_g
- Best in class $R_{DS(on)}$ /package
- Easy to use/drive due to **driver source pin** for better control of the gate.
- Pb-free plating, halogen free mold compound
- Qualified for industrial grade applications according to JEDEC (J-STD20 and JESD22)

Benefits

- Enabling higher system efficiency
- Enabling higher frequency / increased power density solutions
- System cost / size savings due to reduced cooling requirements
- Higher system reliability due to lower operating temperatures

Applications

PFC stages and hard switching PWM stages for e.g. Computing, Server, Telecom, UPS and Solar.

Please note: The source and sense source pins are not exchangeable. Their exchange might lead to malfunction.

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	700	V
$R_{DS(on),max}$	19	mΩ
$Q_{g.typ}$	215	nC
$I_{D,pulse}$	496	A
E_{oss}@400V	27	µJ
Body diode di/dt	70	A/µs

Type / Ordering Code	Package	Marking	Related Links
IPZ65R019C7	PG-TO 247-4	65C7019	see Appendix A

Table of Contents

2 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	- -	- -	75 62	A	T_C=25°C T_C=100°C
Pulsed drain current [2]	$I_{D,pulse}$	-	-	496	A	T_C=25°C
Avalanche energy, single pulse	E_{AS}	-	-	583	mJ	I_D=12.4A; V_{DD}=50V
Avalanche energy, repetitive	E_{AR}	-	-	2.92	mJ	I_D=12.4A; V_{DD}=50V
Avalanche current, single pulse	I_{AS}	-	-	12.4	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	100	V/ns	V_{DS}=0...400V
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	P_{tot}	-	-	446	W	T_C=25°C
Storage temperature	T_{stg}	-55	-	150	°C	-
Operating junction temperature	T_j	-55	-	150	°C	-
Mounting torque	-	-	-	60	Ncm	M3 and M3.5 screws
Continuous diode forward current	I_S	-	-	75	A	T_C=25°C
Diode pulse current [2]	$I_{S,pulse}$	-	-	496	A	T_C=25°C
Reverse diode dv/dt [3]	dv/dt	-	-	1.5	V/ns	V_{DS}=0...400V, I_{SD}<=I_S, T_j=25°C
Maximum diode commutation speed	di_f/dt	-	-	70	A/µs	V_{DS}=0...400V, I_{SD}<=I_S, T_j=25°C
Insulation withstand voltage	V_{ISO}	-	-	n.a.	V	V_{rms}, T_C=25°C, t=1min

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

3 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	0.28	°C/W	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	62	°C/W	leaded
Thermal resistance, junction - ambient for SMD version	R_{thJA}	-	-	-	°C/W	n.a.
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	-	-	260	°C	1.6mm (0.063 in.) from case for 10s

4 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	$V_{(GS)th}$	3	3.5	4	V	V_{DS}=V_{GS}, I_D=2.92mA
Zero gate voltage drain current	I_{DSS}	- -	- 50	5 -	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	$R_{DS(on)}$	- -	0.017 0.040	0.019 -	Ω	V_{GS}=10V, I_D=58.3A, T_j=25°C V_{GS}=10V, I_D=58.3A, T_j=150°C
Gate resistance	R_G	-	0.45	-	Ω	f=1MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	9900	-	pF	V_{GS}=0V, V_{DS}=400V, f=250kHz
Output capacitance	C_{oss}	-	160	-	pF	V_{GS}=0V, V_{DS}=400V, f=250kHz
Effective output capacitance, energy related [1]	$C_{o(er)}$	-	338	-	pF	V_{GS}=0V, V_{DS}=0...400V
Effective output capacitance, time related [2]	$C_{o(tr)}$	-	3320	-	pF	I_D=constant, V_{GS}=0V, V_{DS}=0...400V
Turn-on delay time	$t_{d(on)}$	-	30	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=58.3A, R_G=1.8Ω
Rise time	t_r	-	27	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=58.3A, R_G=1.8Ω
Turn-off delay time	$t_{d(off)}$	-	106	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=58.3A, R_G=1.8Ω
Fall time	t_f	-	5	-	ns	V_{DD}=400V, V_{GS}=13 V, I_D=58.3A, R_G=1.8Ω

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	53	-	nC	V_{DD}=400V, I_D=58.3A, V_{GS}=0 to 10V
Gate to drain charge	Q_{gd}	-	71	-	nC	V_{DD}=400V, I_D=58.3A, V_{GS}=0 to 10V
Gate charge total	Q_g	-	215	-	nC	V_{DD}=400V, I_D=58.3A, V_{GS}=0 to 10V
Gate plateau voltage	$V_{plateau}$	-	5.4	-	V	V_{DD}=400V, I_D=58.3A, 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

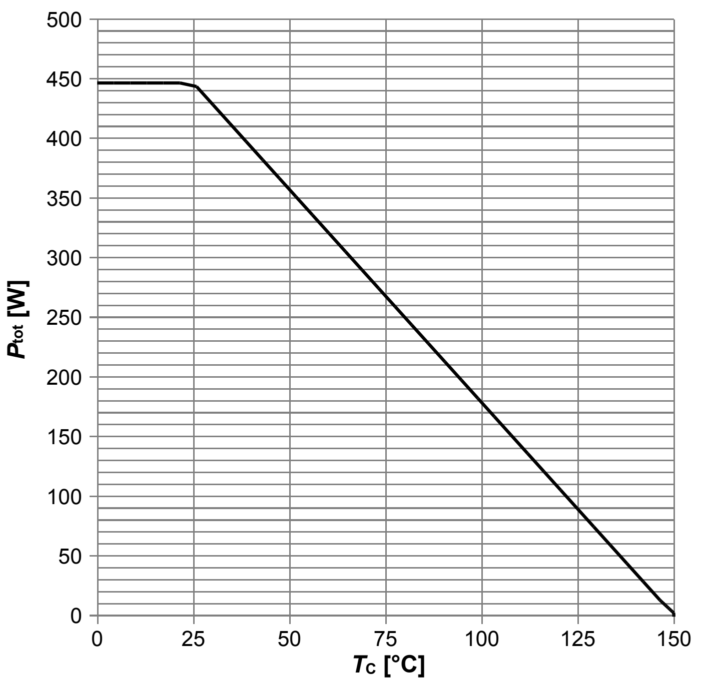
Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	0.9	-	V	V_{GS}=0V, I_F=58.3A, T_j=25°C
Reverse recovery time	t_{rr}	-	760	-	ns	V_R=400V, I_F=75A, di_F/dt=70A/µs
Reverse recovery charge	Q_{rr}	-	20	-	µC	V_R=400V, I_F=75A, di_F/dt=70A/µs
Peak reverse recovery current	I_{rrm}	-	50	-	A	V_R=400V, I_F=75A, di_F/dt=70A/µs

5 Electrical characteristics diagrams

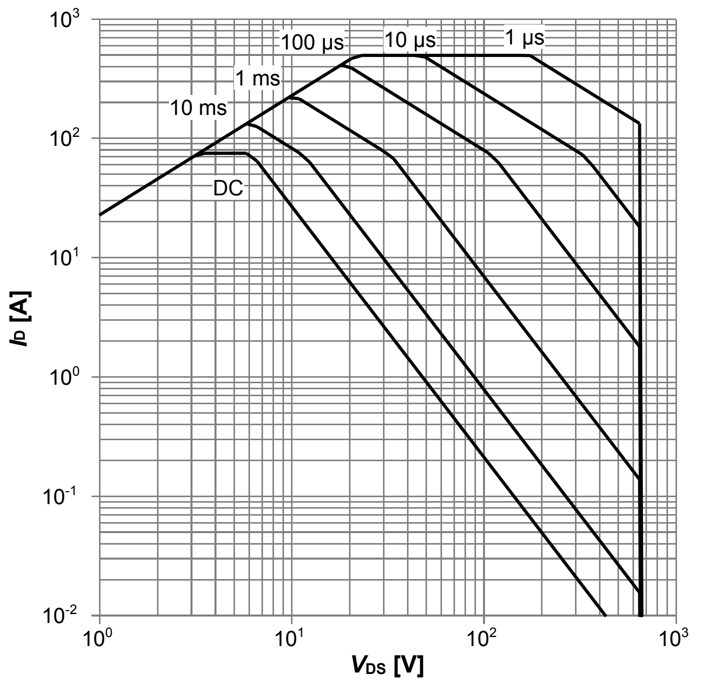
Table 8

Diagram 1: Power dissipation



P_{tot}=f(T_C)

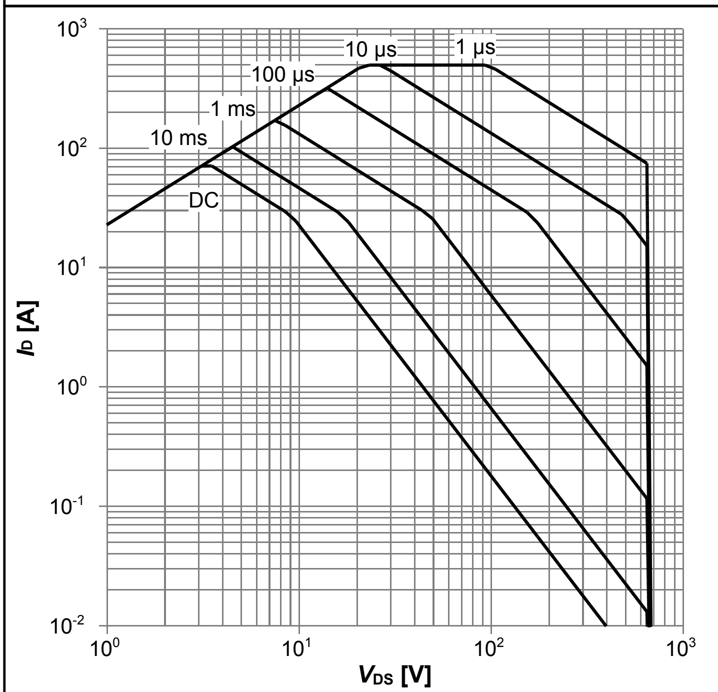
Diagram 2: Safe operating area



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

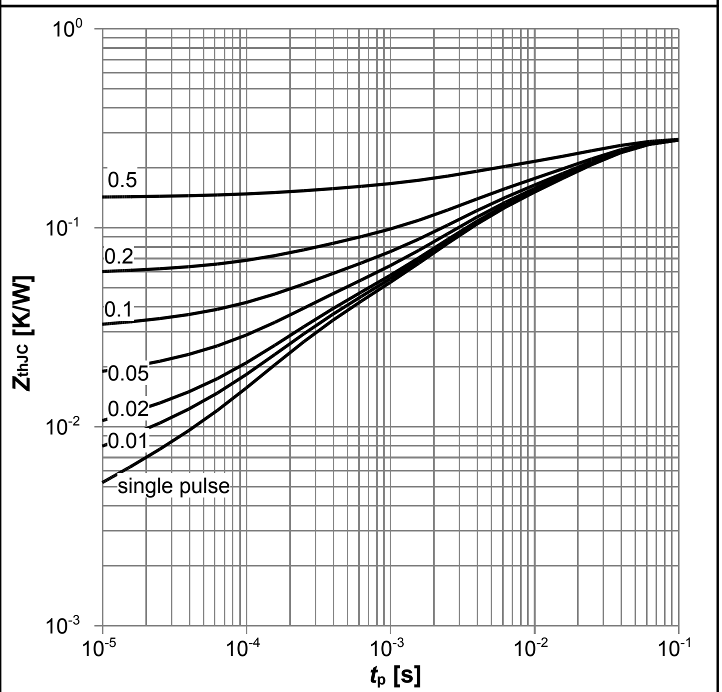
Table 9

Diagram 3: Safe operating area



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

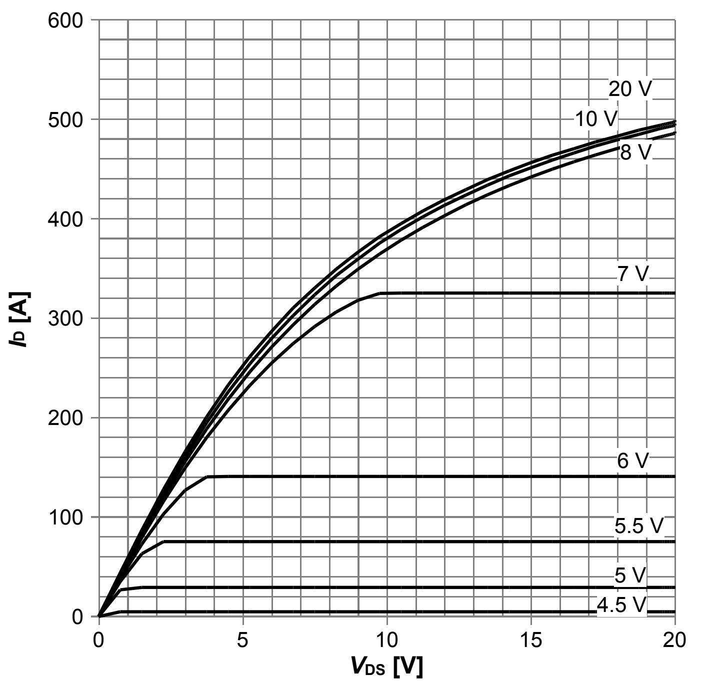
Diagram 4: Max. transient thermal impedance



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

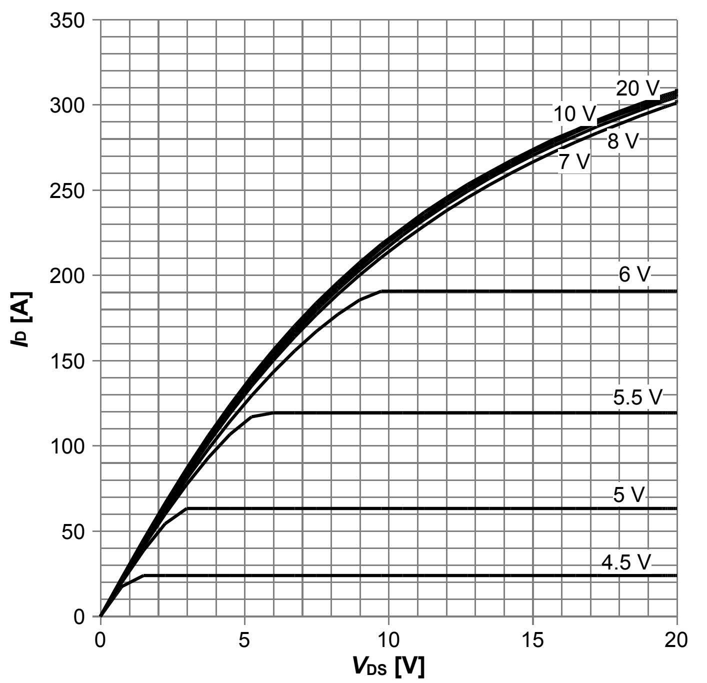
Table 10

Diagram 5: Typ. output characteristics



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

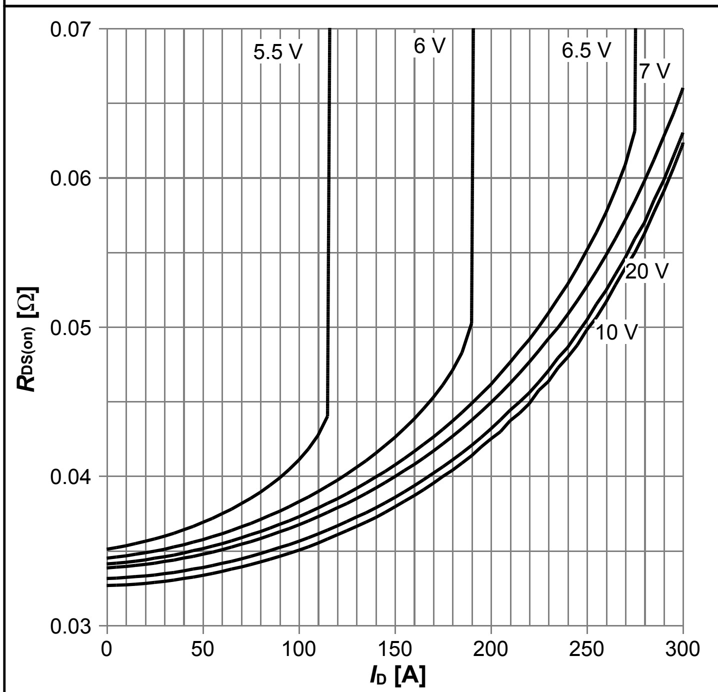
Diagram 6: Typ. output characteristics



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

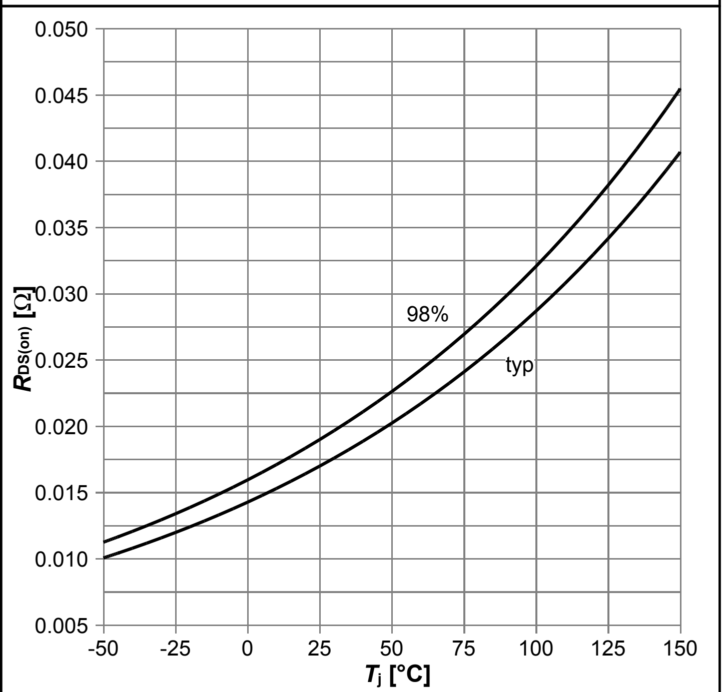
Table 11

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



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

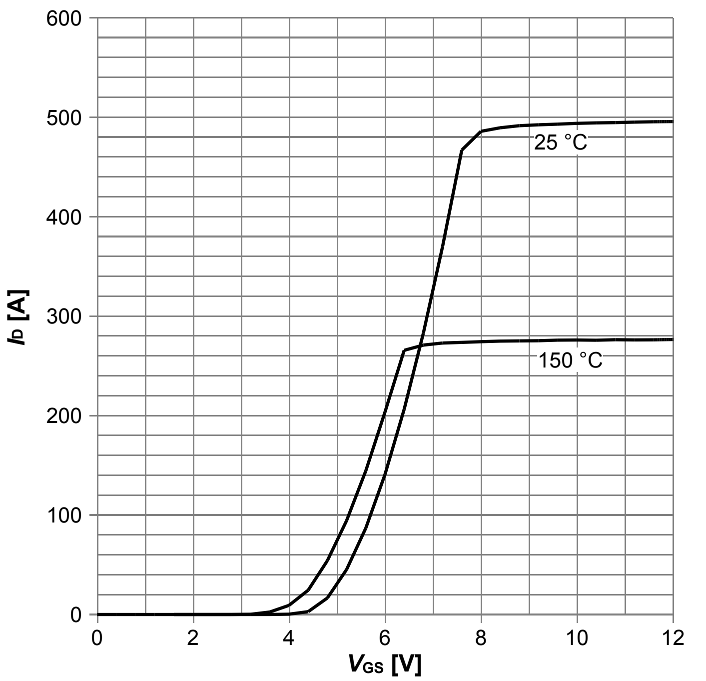
Diagram 8: Drain-source on-state resistance



$R_{DS(on)}$=f(T_j); I_D=58.3 A; V_{GS}=10 V

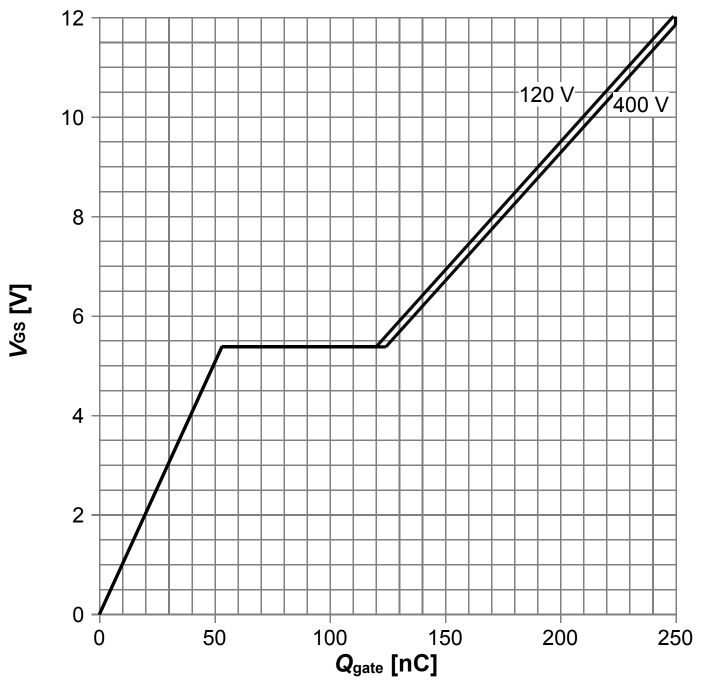
Table 12

Diagram 9: Typ. transfer characteristics



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

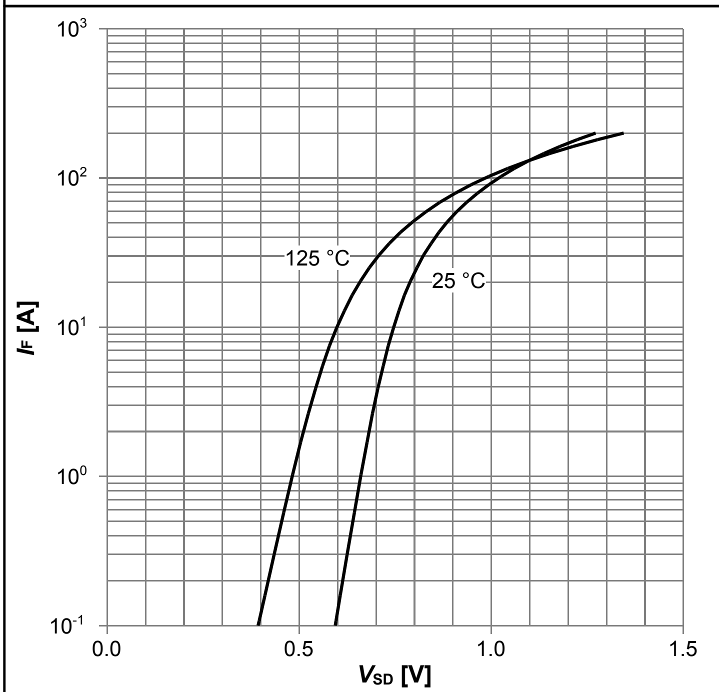
Diagram 10: Typ. gate charge



V_{GS}=f(Q_{gate}); I_D=58.3 A pulsed; parameter: V_{DD}

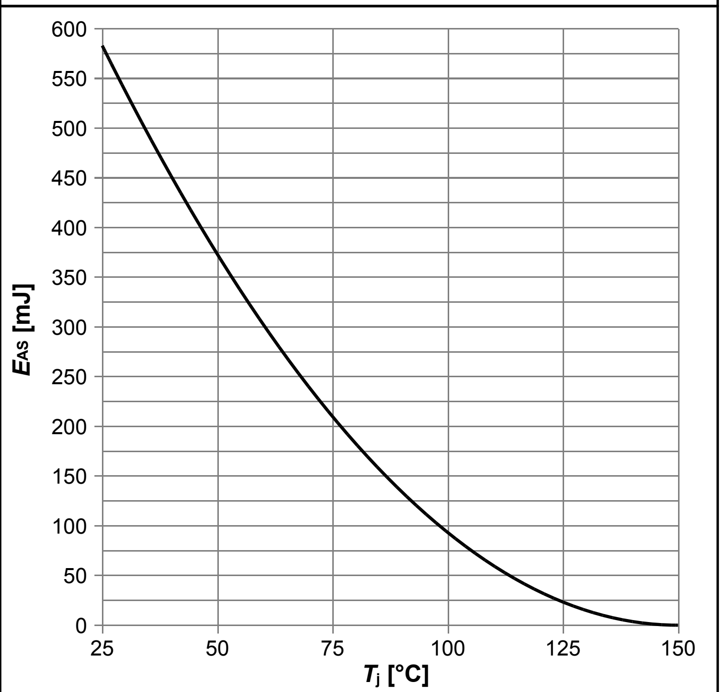
Table 13

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=12.4 A; V_{DD}=50 V

Table 14

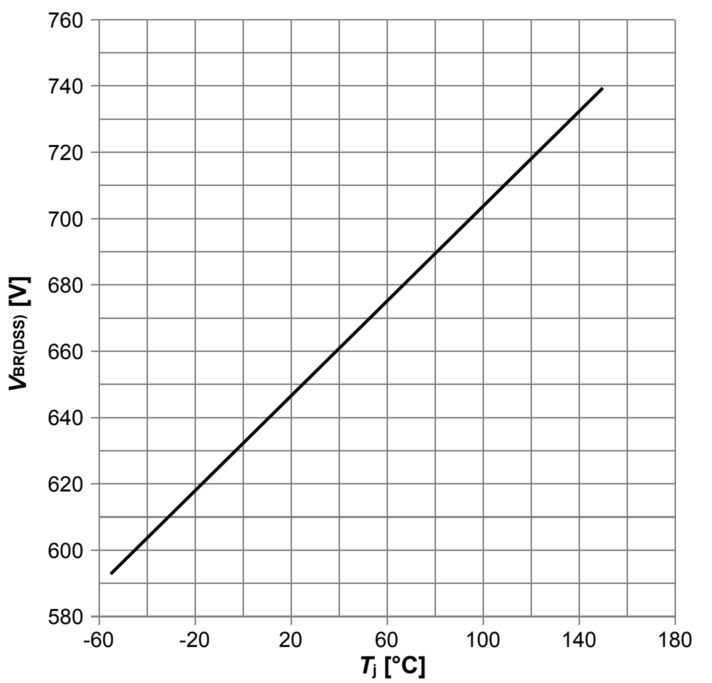
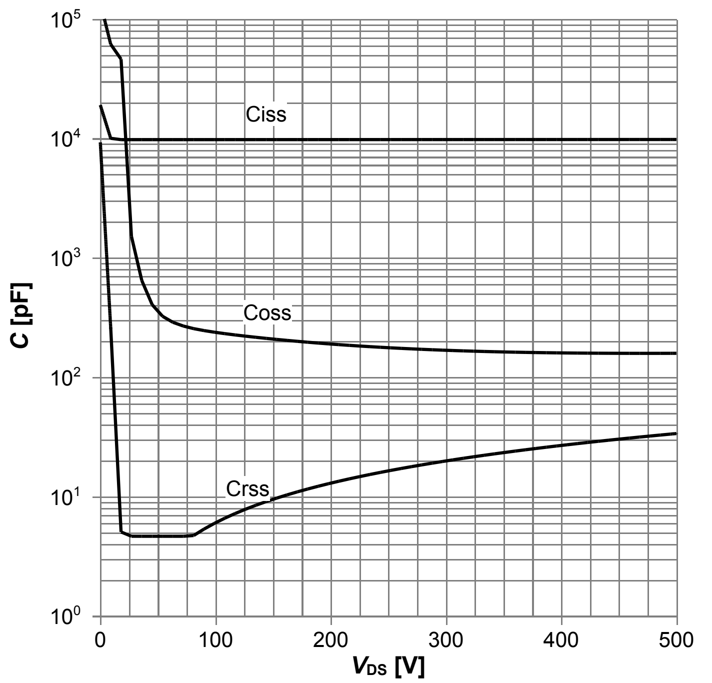
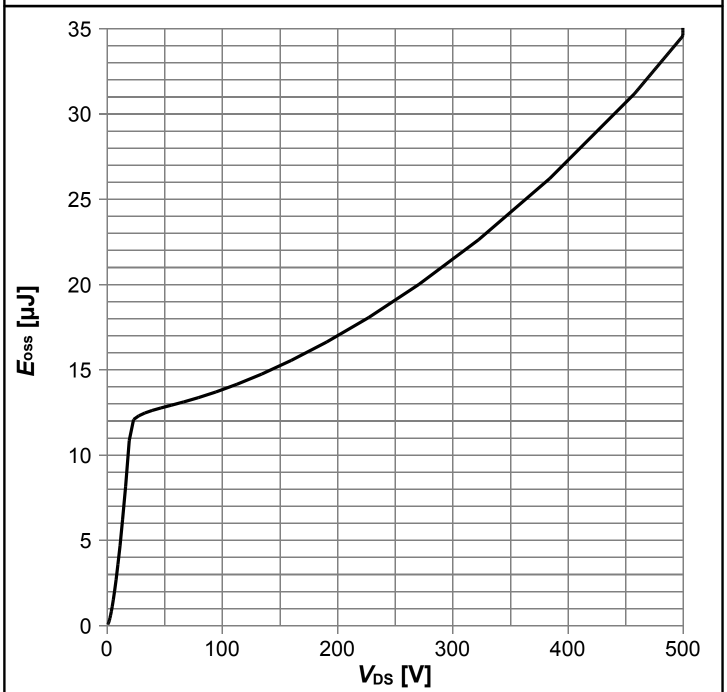
Diagram 13: Drain-source breakdown voltage	Diagram 14: Typ. capacitances
	
$V_{BR(DSS)}$=f(T_j); I_D=1 mA	C=f(V_{DS}); V_{GS}=0 V; f=250 kHz

Table 15

Diagram 15: Typ. Coss stored energy

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

6 Test Circuits

Table 16 Diode characteristics

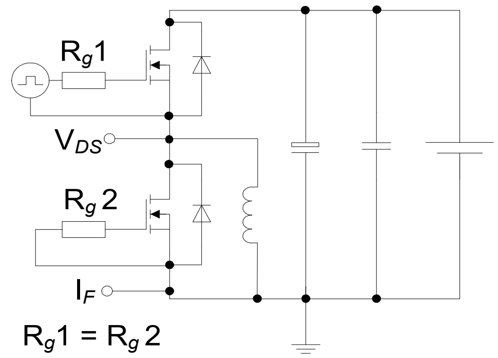
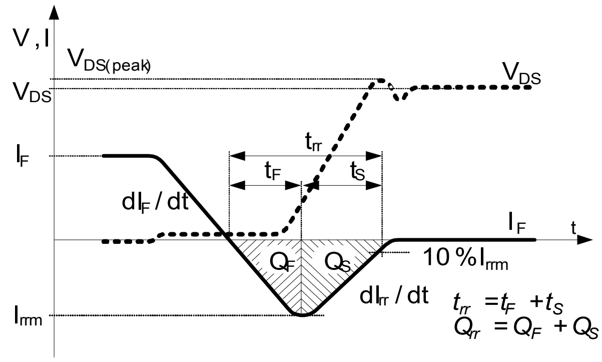
Test circuit for diode characteristics	Diode recovery waveform
	

Table 17 switching times (ss)

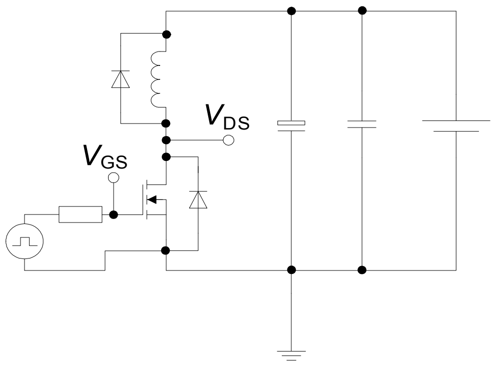
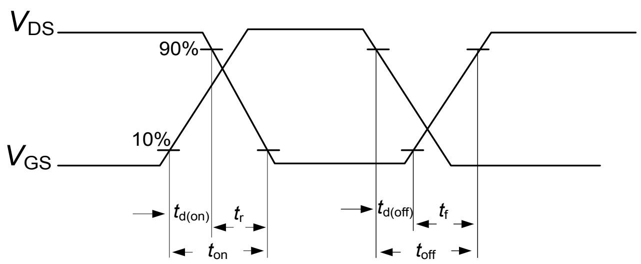
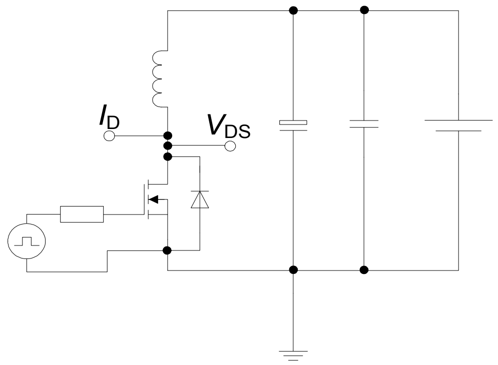
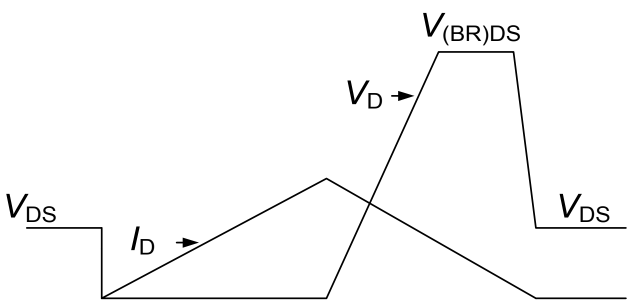
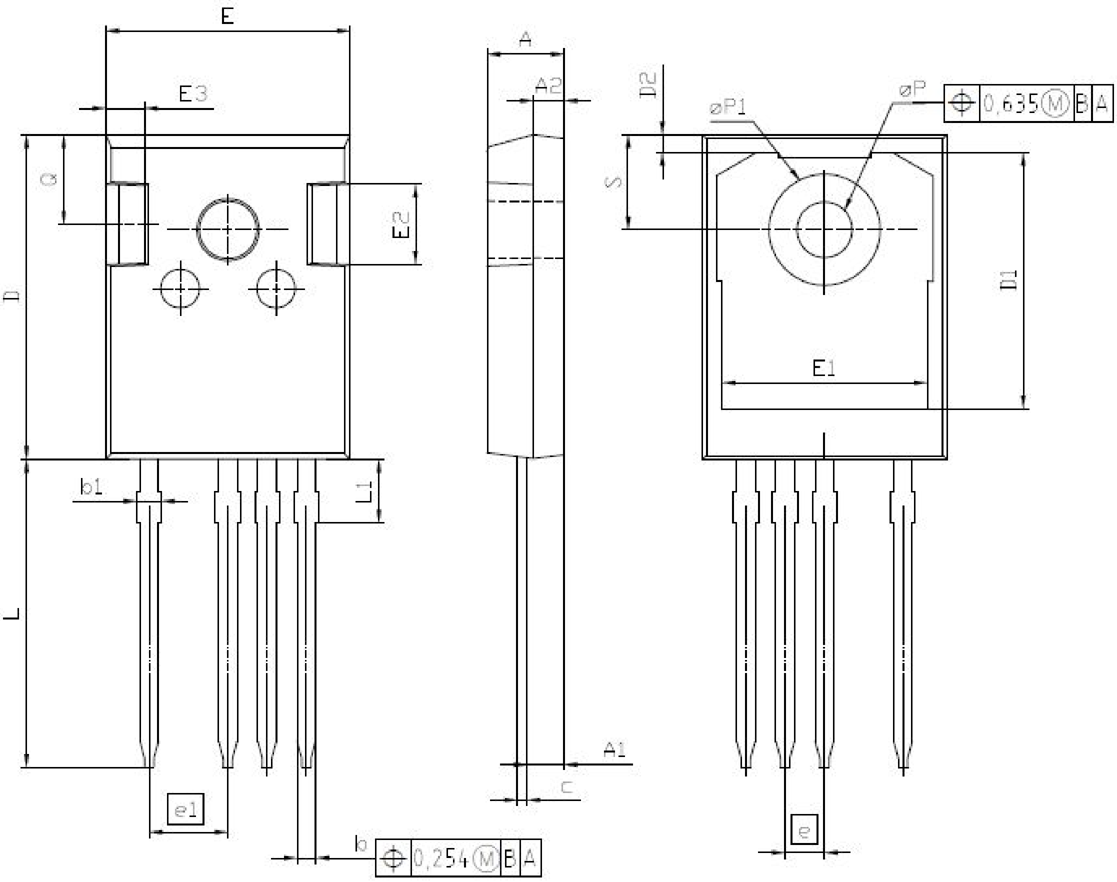
Switching times test circuit for inductive load	Switching times waveform
	

Table 18 Unclamped inductive load (ss)

Unclamped inductive load test circuit	Unclamped inductive waveform
	

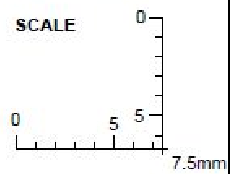
7 Package Outlines



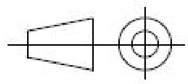
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.29	2.54	0.090	0.100
A2	1.90	2.16	0.075	0.085
b	1.07	1.33	0.042	0.052
b1	1.10	1.70	0.043	0.067
c	0.50	0.70	0.020	0.028
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	2.54 (BSC)		0.100 (BSC)	
e1	5.08		0.200	
N	4		4	
L	19.72	20.32	0.776	0.800
L1	4.02	4.40	0.158	0.173
øP	3.50	3.70	0.138	0.146
øP1	7.00	7.40	0.276	0.291
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

DOCUMENT NO.
Z8B00168124

SCALE



EUROPEAN PROJECTION



ISSUE DATE
29-01-2013

REVISION
1

Figure 1 Outline PG-TO 247-4, dimensions in mm/inches

8 Appendix A

Table 19 Related Links

- **IFX CoolMOS™ C7 Webpage:** www.infineon.com
- **IFX CoolMOS™ C7 application note:** www.infineon.com
- **IFX CoolMOS™ C7 simulation model:** www.infineon.com
- **IFX Design tools:** www.infineon.com

Revision History

IPZ65R019C7		
Revision: 2013-04-30, Rev. 2.0		
Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2013-04-30	Release of final version

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