MOSFET

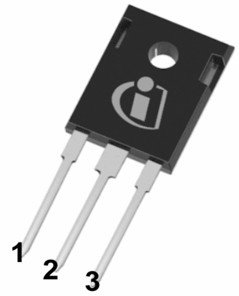
600V CoolMOS™ C7 Power Transistor

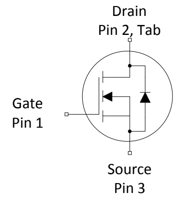
CoolMOS™ C7 is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infineon Technologies.

600V CoolMOS™ C7 series combines the experience of the leading SJ MOSFET supplier with high class innovation.

The 600V C7 is the first technology ever with $R_{DS(on)}$*A below 1Ohm*mm².

TO-247





Features

• Suitable for hard and soft switching (PFC and high performance LLC)
• Increased MOSFET dv/dt ruggedness to 120V/ns
• Increased 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
• Qualified for industrial grade applications according to JEDEC (J-STD20 and JESD22)

Benefits

• Increased economies of scale by use in PFC and PWM topologies in the application
• Higher dv/dt limit enables faster switching leading to higher efficiency
• Enabling higher system efficiency by lower switching losses
• Increased power density solutions due to smaller packages
• Suitable for applications such as server, telecom and solar
• Higher switching frequencies possible without loss in efficiency due to low Eoss and Qg

Applications

PFC stages and PWM stages (TTF, LLC) for high power/performance SMPS e.g. Computing, Server, Telecom, UPS 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} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	17	mΩ
$Q_{g,typ}$	240	nC
$I_{D,pulse}$	495	A
$I_{D,continuous}$ @ T_j<150°C	129	A
E_{oss}@400V	30	µJ
Body diode di/dt	200	A/µs

Type / Ordering Code	Package	Marking	Related Links
IPW60R017C7	PG-TO 247	60C7017	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	- -	- -	109 69	A	T_C=25°C T_C=100°C
Pulsed drain current[2]	$I_{D,pulse}$	-	-	495	A	T_C=25°C
Avalanche energy, single pulse	E_{AS}	-	-	582	mJ	I_D=12.6A; V_{DD}=50V; see table 10
Avalanche energy, repetitive	E_{AR}	-	-	2.91	mJ	I_D=12.6A; V_{DD}=50V; see table 10
Avalanche current, single pulse	I_{AS}	-	-	12.6	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	120	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	-	-	109	A	T_C=25°C
Diode pulse current[2]	$I_{S,pulse}$	-	-	495	A	T_C=25°C
Reverse diode dv/dt[3]	dv/dt	-	-	20	V/ns	V_{DS}=0...400V, I_{SD}<=12.6A, T_j=25°C see table 8
Maximum diode commutation speed	di_f/dt	-	-	200	A/µs	V_{DS}=0...400V, I_{SD}<=12.6A, T_j=25°C see table 8
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

2 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

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	$V_{(BR)DSS}$	600	-	-	V	V_{GS}=0V, I_D=1mA
Gate threshold voltage	$V_{(GS)th}$	3	3.5	4	V	V_{DS}=V_{GS}, I_D=2.91mA
Zero gate voltage drain current	I_{DSS}	- -	- 50	2 -	µA	V_{DS}=600, V_{GS}=0V, T_j=25°C V_{DS}=600, 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	$R_{DS(on)}$	- -	0.015 0.033	0.017 -	Ω	V_{GS}=10V, I_D=58.2A, T_j=25°C V_{GS}=10V, I_D=58.2A, 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}	-	9890	-	pF	V_{GS}=0V, V_{DS}=400V, f=250kHz
Output capacitance	C_{oss}	-	200	-	pF	V_{GS}=0V, V_{DS}=400V, f=250kHz
Effective output capacitance, energy related[1]	$C_{o(er)}$	-	375	-	pF	V_{GS}=0V, V_{DS}=0...400V
Effective output capacitance, time related[2]	$C_{o(tr)}$	-	3840	-	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=58.2A, R_G=1.8Ω; see table 9
Rise time	t_r	-	25	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=58.2A, R_G=1.8Ω; see table 9
Turn-off delay time	$t_{d(off)}$	-	106	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=58.2A, R_G=1.8Ω; see table 9
Fall time	t_f	-	4	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=58.2A, R_G=1.8Ω; see table 9

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	50	-	nC	V_{DD}=400V, I_D=58.2A, V_{GS}=0 to 10V
Gate to drain charge	Q_{gd}	-	85	-	nC	V_{DD}=400V, I_D=58.2A, V_{GS}=0 to 10V
Gate charge total	Q_g	-	240	-	nC	V_{DD}=400V, I_D=58.2A, V_{GS}=0 to 10V
Gate plateau voltage	$V_{plateau}$	-	5.0	-	V	V_{DD}=400V, I_D=58.2A, V_{GS}=0 to 10V

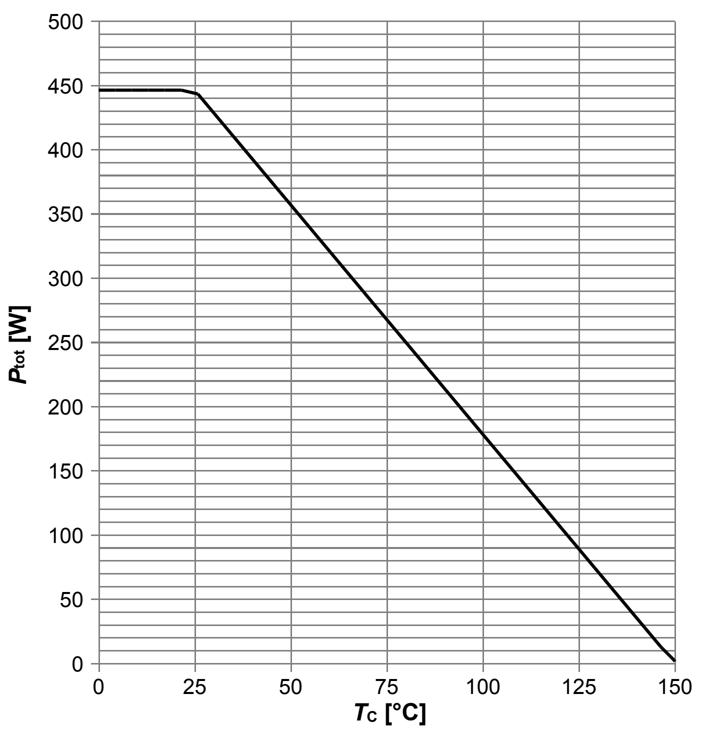
[1] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 400V
[2] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 400V

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=58.2A, T_j=25°C
Reverse recovery time	t_{rr}	-	630	-	ns	V_R=400V, I_F=58.2A, di_F/dt=100A/µs; see table 8
Reverse recovery charge	Q_{rr}	-	18	-	µC	V_R=400V, I_F=58.2A, di_F/dt=100A/µs; see table 8
Peak reverse recovery current	I_{rrm}	-	55	-	A	V_R=400V, I_F=58.2A, di_F/dt=100A/µs; see table 8

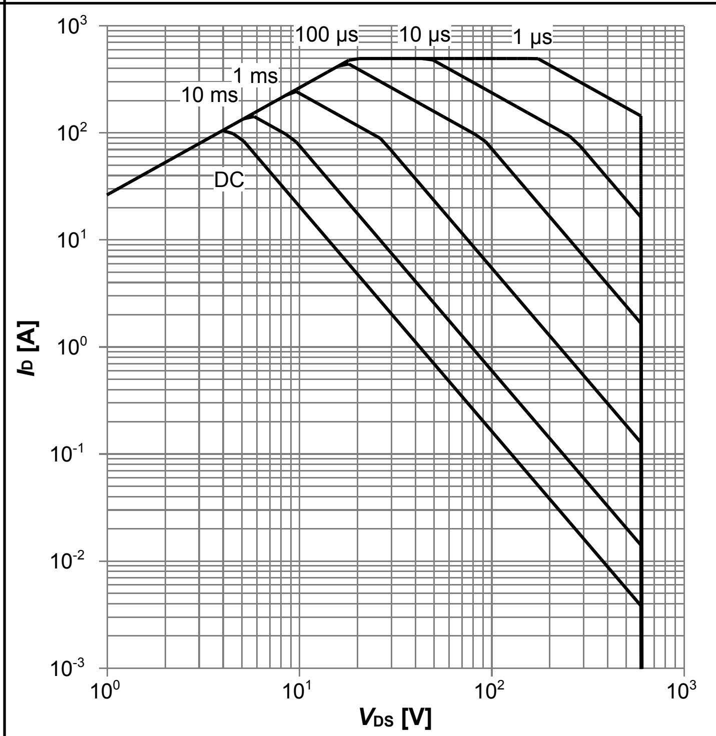
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



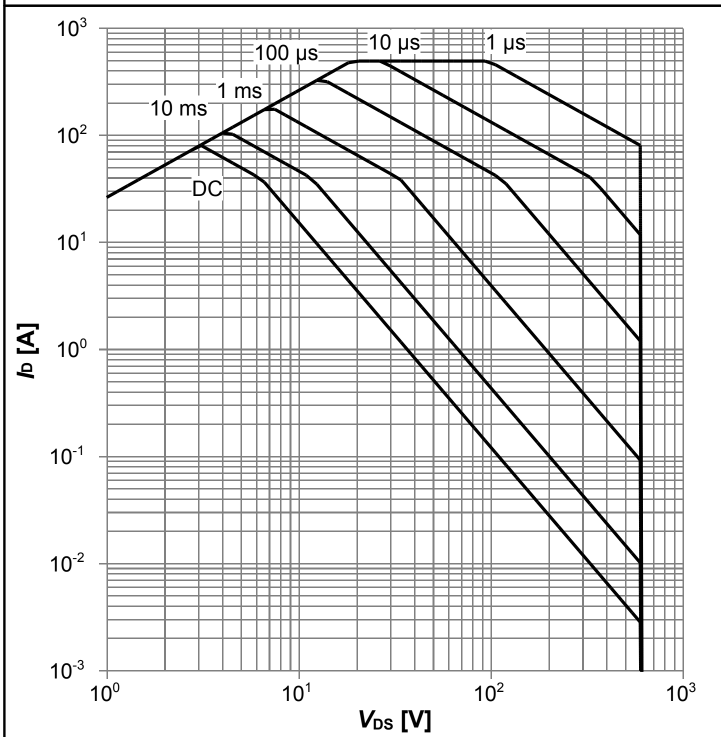
P_{tot}=f(T_C)

Diagram 2: Safe operating area



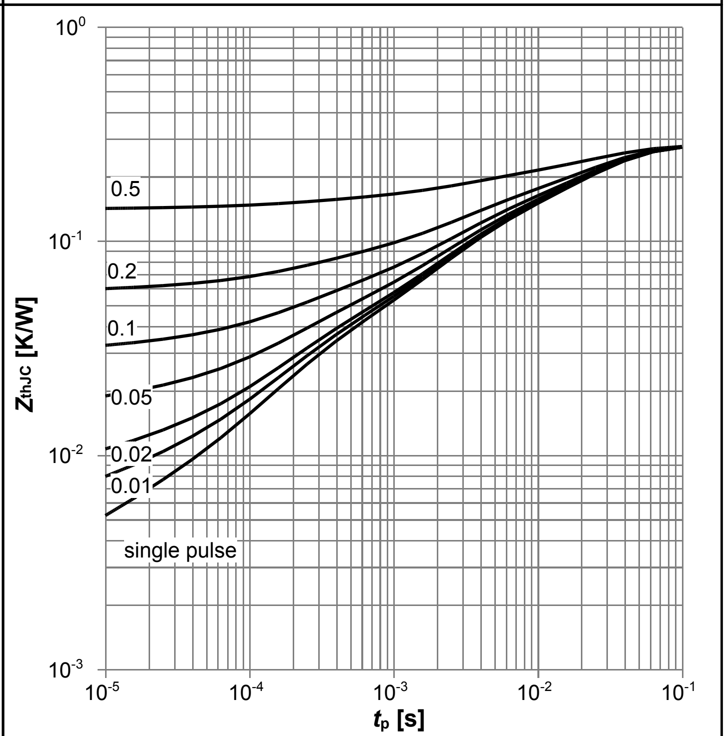
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter: t_p

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

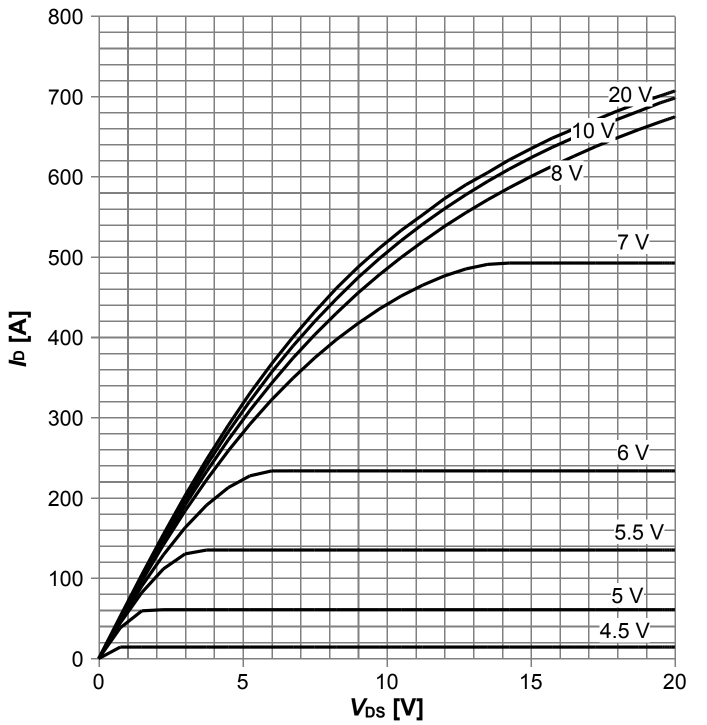
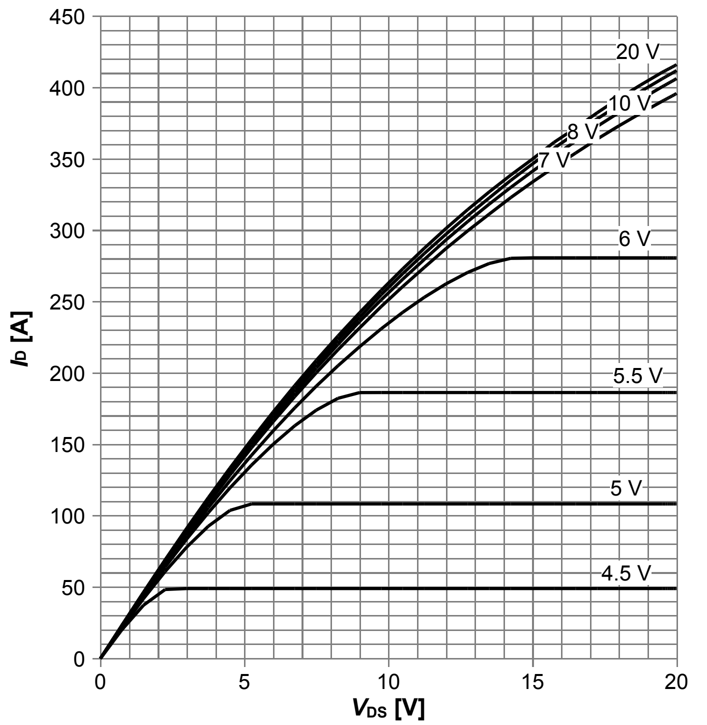
Diagram 5: Typ. output characteristics	Diagram 6: Typ. output characteristics
	
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}	I_D=f(V_{DS}); T_j=125 °C; parameter: V_{GS}

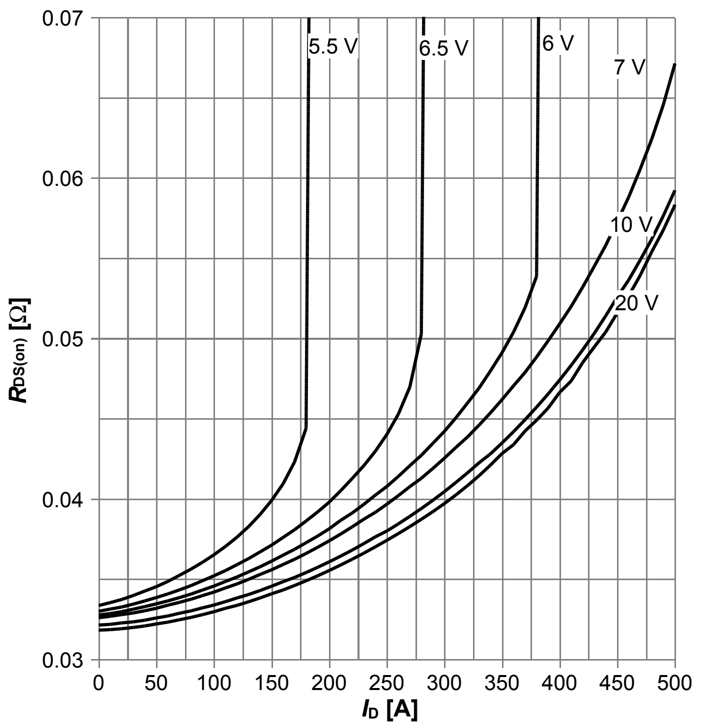
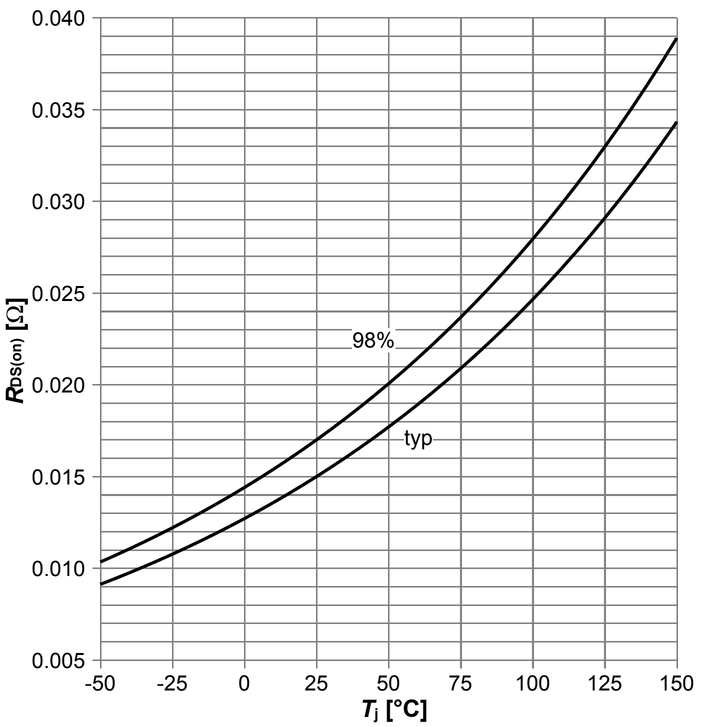
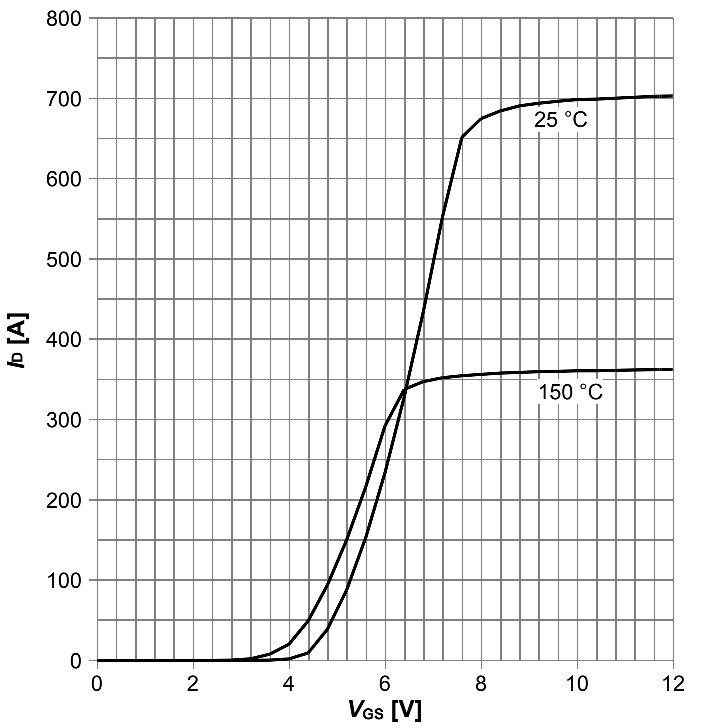
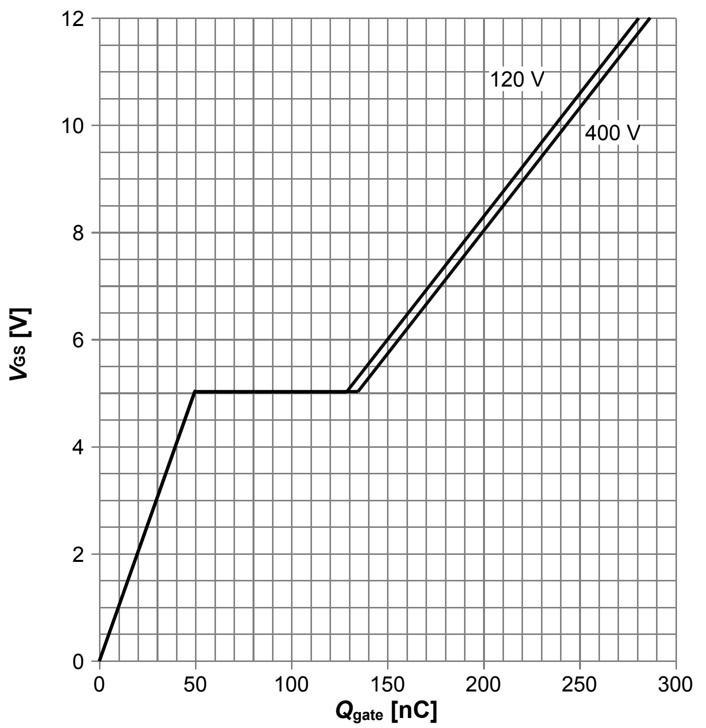
Diagram 7: Typ. drain-source on-state resistance	Diagram 8: Drain-source on-state resistance
	
$R_{DS(on)}$=f(I_D); T_j=125 °C; parameter: V_{GS}	$R_{DS(on)}$=f(T_j); I_D=58.2A; V_{GS}=10 V

Diagram 9: Typ. transfer characteristics



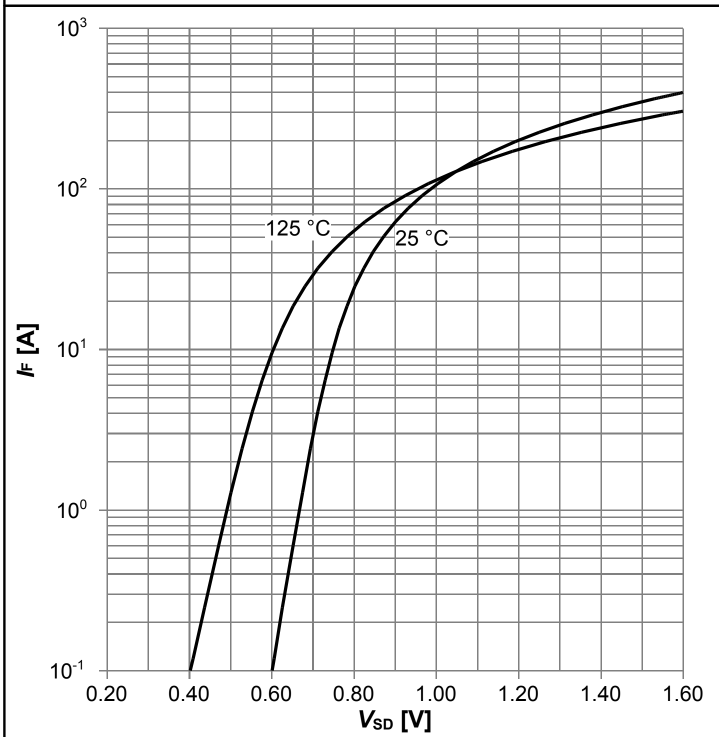
I_D=f(V_{GS}); V_{DS}=20V; parameter: T_j

Diagram 10: Typ. gate charge



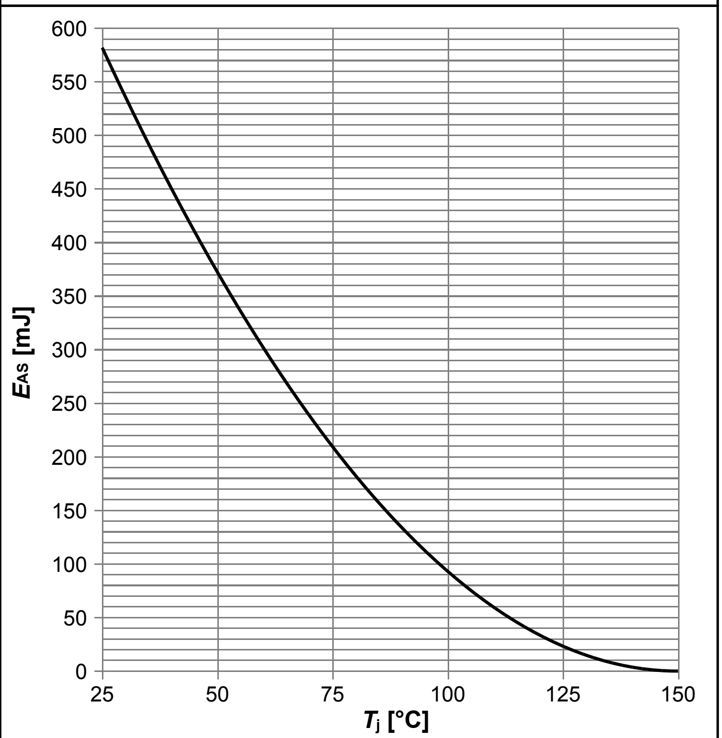
V_{GS}=f(Q_{gate}); I_D=58.2 A pulsed; parameter: V_{DD}

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=12.6 A; V_{DD}=50 V

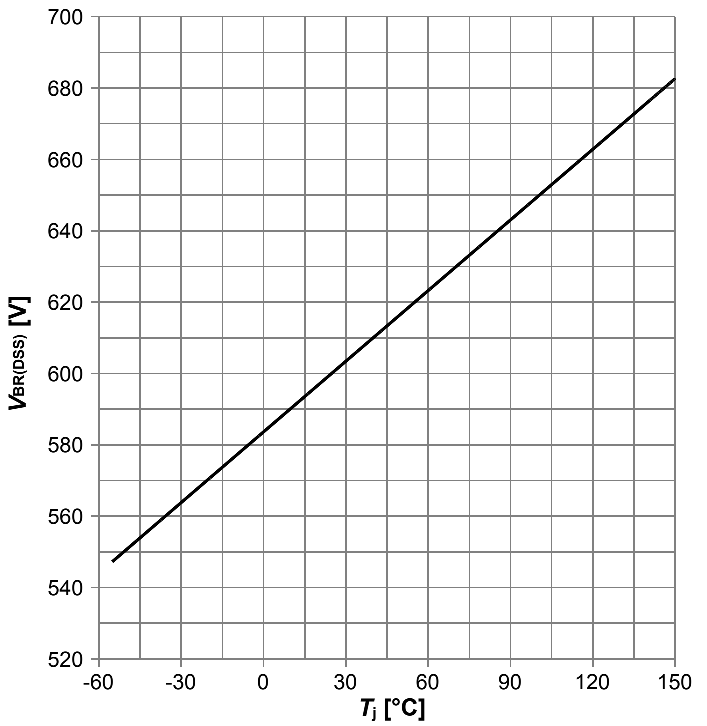
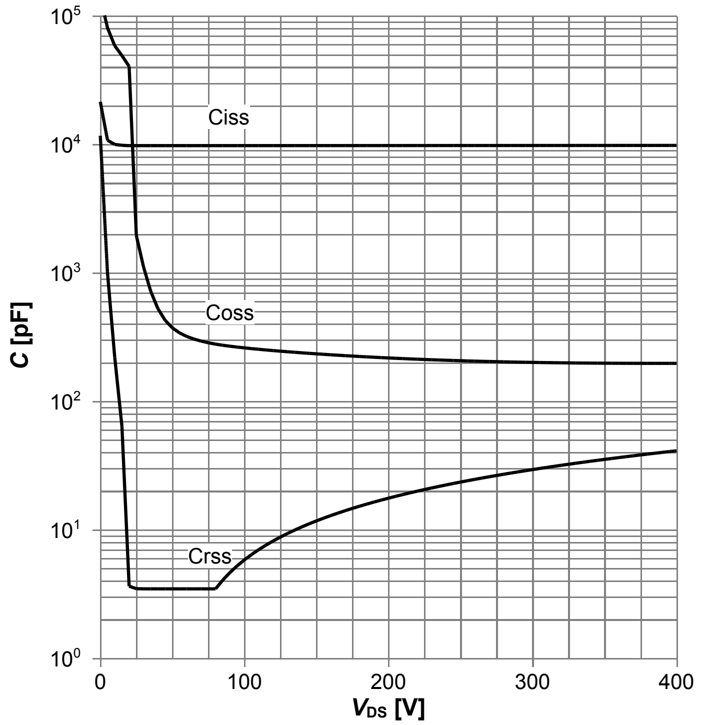
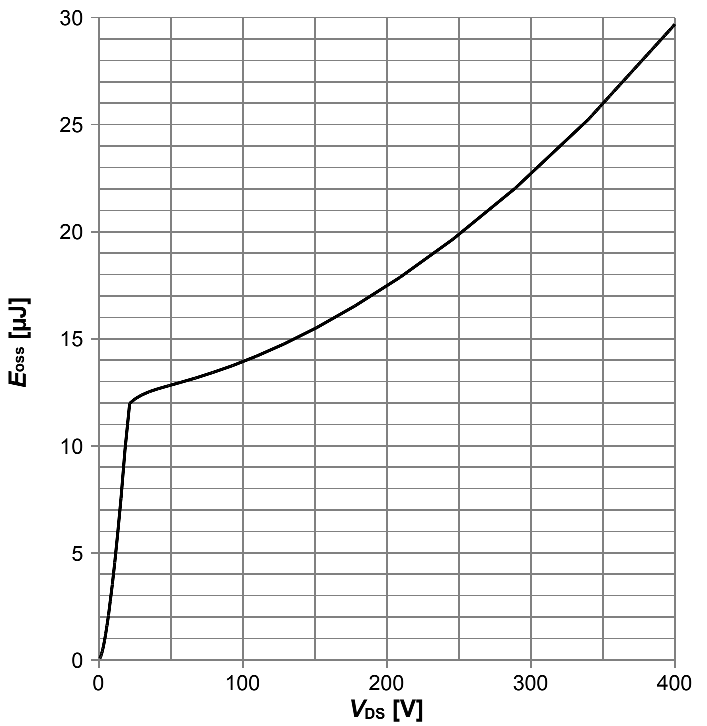
Diagram 13: Drain-source breakdown voltage	Diagram 14: Typ. capacitances
	
$V_{BR(DSS)}$=f(T_j); I_D=1 mA	C=f(V_{DS}); V_{GS}=0 V; f=250 kHz

Diagram 15: Typ. Coss stored energy

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

5 Test Circuits

Table 8 Diode characteristics

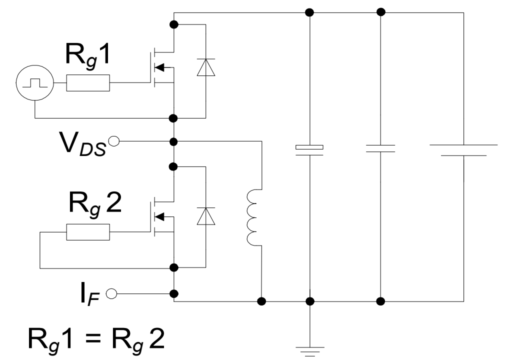
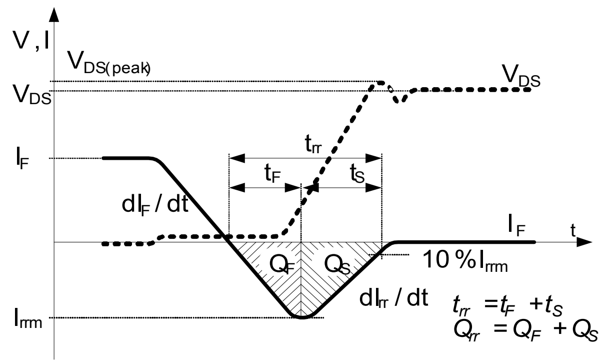
Test circuit for diode characteristics	Diode recovery waveform
	

Table 9 Switching times

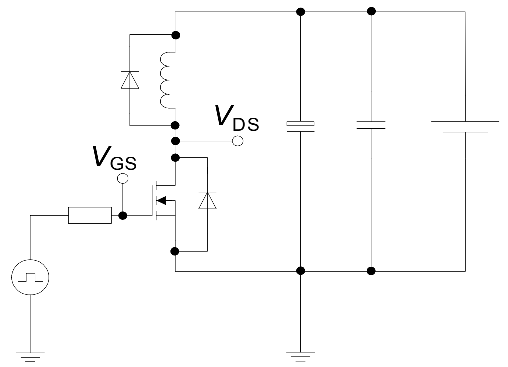
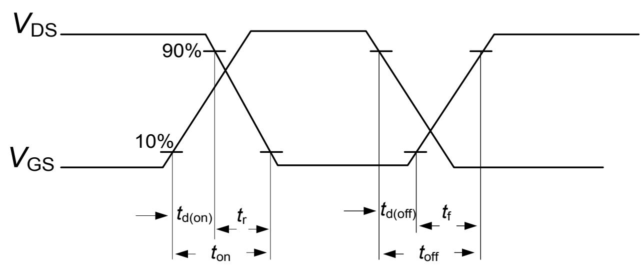
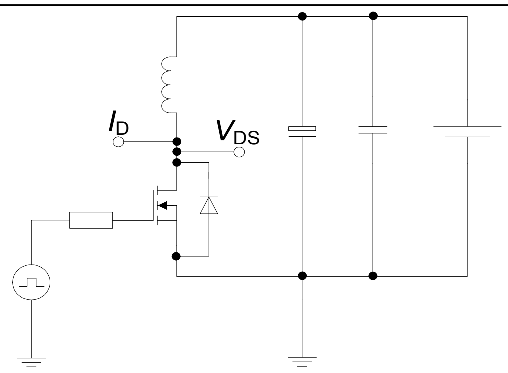
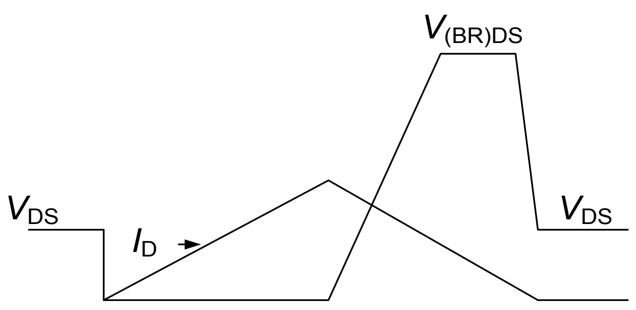
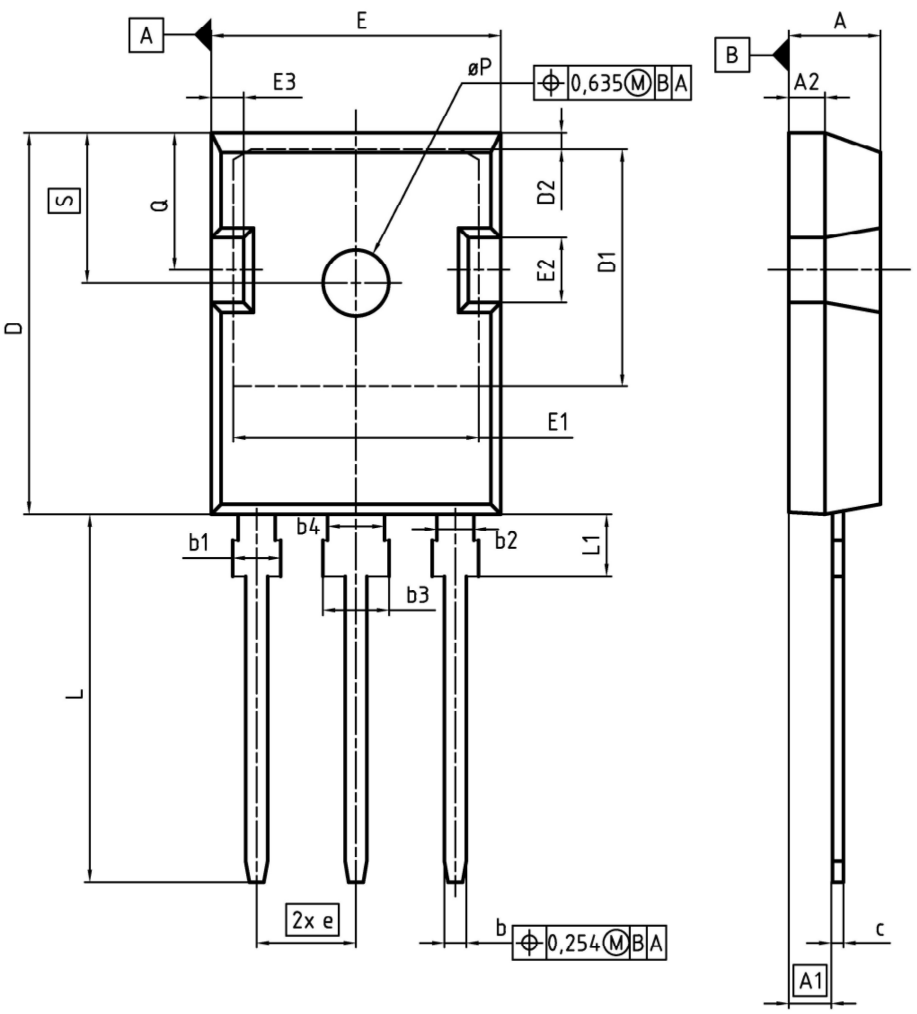
Switching times test circuit for inductive load	Switching times waveform
	

Table 10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

6 Package Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
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	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

DOCUMENT NO.
Z8B00003327

SCALE
0 5 7.5mm

EUROPEAN PROJECTION

ISSUE DATE
09-07-2010

REVISION
05

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

7 Appendix A

Table 11 Related Links

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

Revision History

IPW60R017C7

Revision: 2016-03-01, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2016-03-01	Release of final version

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