MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CoolMOS™ C6 650V

650V CoolMOS™ C6 Power Transistor
IPP65R074C6

Data Sheet

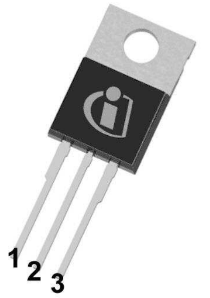
Rev. 2.1
Final

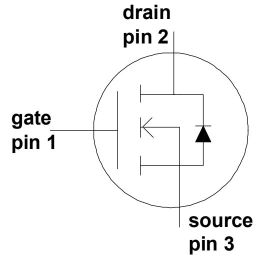
Industrial & Multimarket

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™ C6 series combines the experience of the leading SJ MOSFET supplier with high class innovation. The resulting devices provide all benefits of a fast switching SJ MOSFET while not sacrificing ease of use. Extremely low switching and conduction losses make switching applications even more efficient, more compact, lighter and cooler.

TO-220





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 industrial grade applications according to JEDEC (J-STD20 and JESD22)

Applications

PFC stages, hard switching PWM stages and resonant switching PWM stages for e.g. PC Silverbox, Adapter, LCD & PDP TV, Lighting, Server, Telecom, UPS and Solar.

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j\ max}$	700	V
RDS(on),max	0.074	Ω
Qg,typ	138	nC
ID,pulse	151	A
Eoss @ 400V	10.8	µJ
Body diode di/dt	300	A/µs

Type / Ordering Code	Package	Marking	Related Links
IPP65R074C6	PG-TO 220	65C6074	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			57.7	A	T_C = 25°C
				31.6		T_C = 100°C
Pulsed drain current[2]	$I_{D,pulse}$			151	A	T_C = 25°C
Avalanche energy, single pulse	E_{AS}			915	mJ	I_D = 8.1A, V_{DD} = 50V
Avalanche energy, repetitive	E_{AR}			1.40	mJ	I_D = 8.1A, V_{DD} = 50V
Avalanche current, repetitive	I_{AR}			8.1	A	
MOSFET dv/dt ruggedness	dv/dt			50	V/ns	V_{DS} = 0 ... 480V
Gate source voltage	V_{GS}	-20		20	V	static
		-30		30		AC (f > 1 Hz)
Power dissipation (non FullPAK) TO-220	P_{tot}			480.8	W	T_C = 25°C
Operating and storage temperature	T_j, T_{stg}	-55		150	°C	
Mounting torque (non FullPAK) TO-220				60	Ncm	M3 and M3.5 screws
Continuous diode forward current	I_S			50.0	A	T_C = 25°C
Diode pulse current	$I_{S,pulse}$			151	A	T_C = 25°C
Reverse diode dv/dt[3]	dv/dt			15	V/ns	V_{DS} = 0 ... 400V, $I_{SD} \leq I_D$, T_j = 25°C
Maximum diode commutation speed	di_f/dt			300	A/µs	

1) Limited by $T_{j\ max}$. Maximum duty cycle D=0.75
2) Pulse width t_p limited by $T_{j\ max}$
3) V_{peak}<$V_{(BR)DSS}$, T_j<$T_{j\ max}$, identical low side and high side switch with same Rg

3 Thermal characteristics

Table 3 Thermal characteristics TO-220

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}			0.26	°C/W	
Thermal resistance, junction - ambient	R_{thJA}			62	°C/W	leaded
Soldering temperature, wavesoldering only allowed at leads	T_{sold}			260	°C	1.6 mm (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	$V_{GS(th)}$	2.5	3	3.5	V	V_{DS} = V_{GS}, I_D = 1.4mA
Zero gate voltage drain current	I_{DSS}			5	µA	V_{DS} = 650V, V_{GS} = 0V, T_j = 25°C
			50			V_{DS} = 650V, V_{GS} = 0V, T_j = 150°C
Gate-source leakage current	I_{GSS}			100	nA	V_{GS} = 20V, V_{DS} = 20V
Drain-source on-state resistance	$R_{DS(on)}$		0.067	0.074	Ω	V_{GS} = 10V, I_D = 13.9A, T_j = 25°C
			0.173			V_{GS} = 10V, I_D = 13.9A, T_j = 150°C
Gate resistance	R_G		0.6		Ω	f = 1MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}		3020		pF	V_{GS} = 0V, V_{DS} = 100V, f = 1MHz
Output capacitance	C_{oss}		170		pF	
Effective output capacitance, energy related[1]	$C_{o(er)}$		118		pF	V_{GS} = 0V, V_{DS} = 0 ... 480V
Effective output capacitance, time related[2]	$C_{o(tr)}$		580		pF	I_D = constant, V_{GS} = 0V, V_{DS} = 0 ... 480V
Turn-on delay time	$t_{d(on)}$		11		ns	V_{DD} = 400V, V_{GS} = 13V, I_D = 20.8A, R_G = 1.8Ω
Rise time	t_r		7		ns	
Turn-off delay time	$t_{d(off)}$		56		ns	
Fall time	t_f		4		ns	

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}		17		nC	V_{DD} = 480V, I_D = 20.8A, V_{GS} = 0 to 10V
Gate to drain charge	Q_{gd}		71		nC	
Gate charge total	Q_g		138		nC	
Gate plateau voltage	$V_{plateau}$		5.5		V	

[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 = 20.8A, T_j = 25°C
Reverse recovery time	t_{rr}		560		ns	V_R = 400V, I_F = 20.8A, di_F/dt = 100A/µs
Reverse recovery charge	Q_{rr}		12		µC	
Peak reverse recovery current	I_{rrm}		40		A	

5 Electrical characteristics diagrams

Table 8

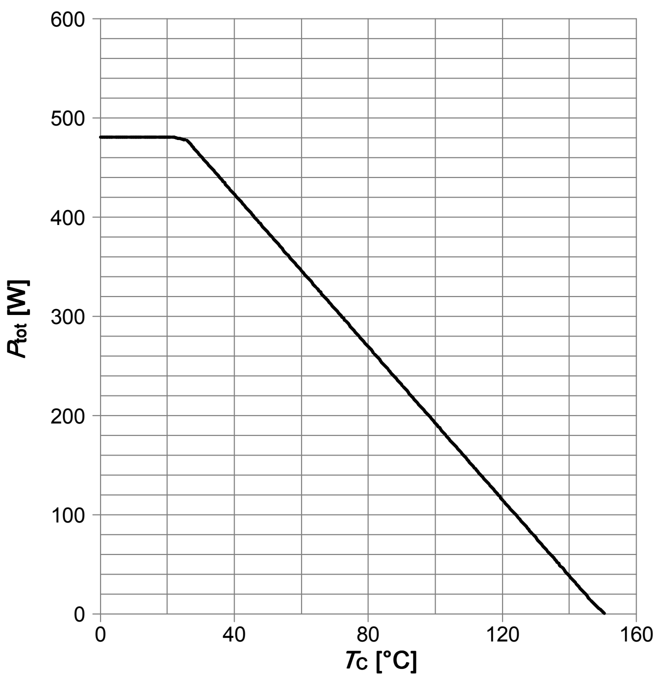
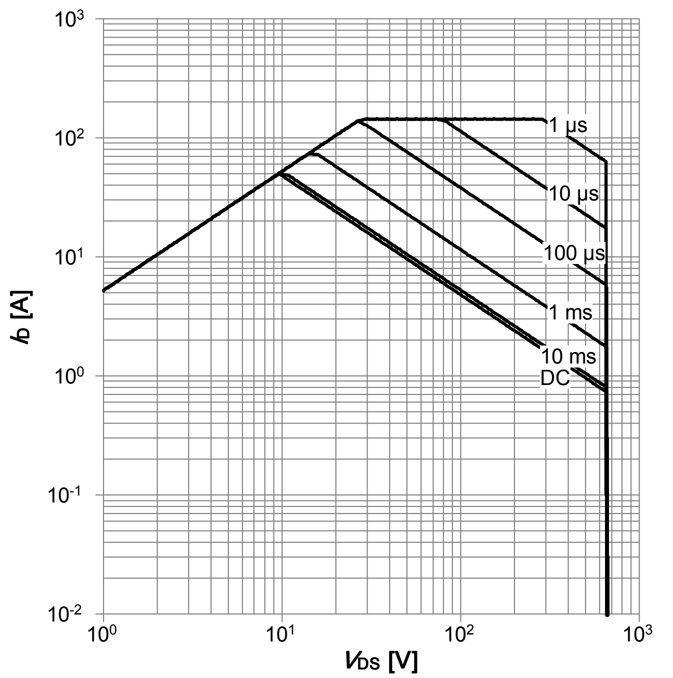
Power dissipation	Safe operating area
	
P_{tot}=f(T_C)	I_D=f(V_{DS}); VGS>7V; T_C=25 °C; D=0; parameter: t_p

Table 9

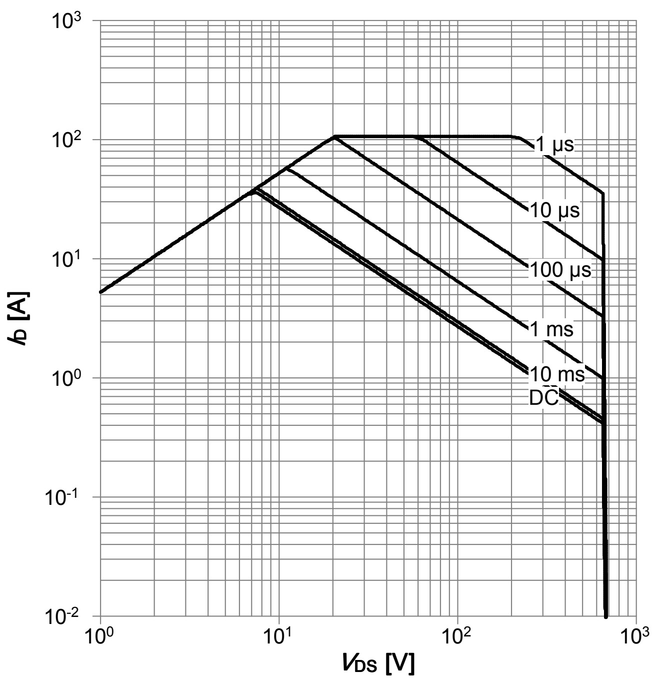
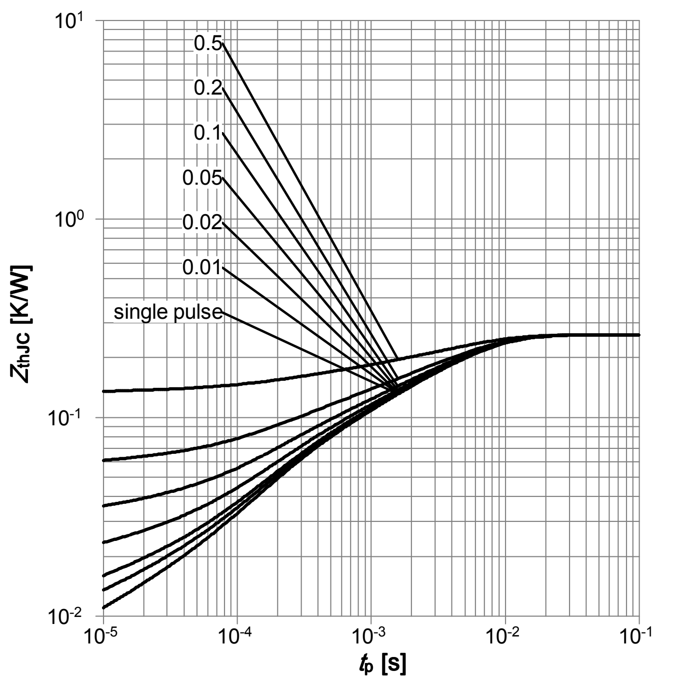
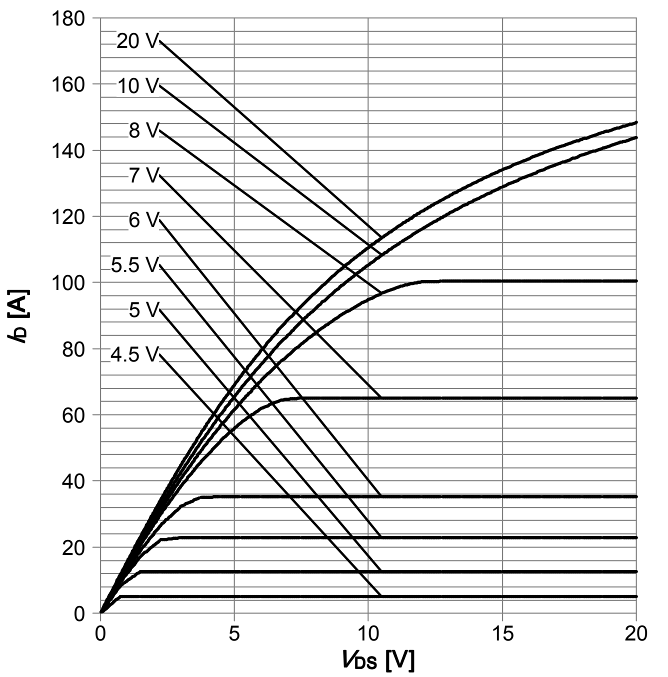
Safe operating area	Max. transient thermal impedance
	
I_D=f(V_{DS});VGS>7V; T_C=80 °C; D=0; parameter: t_p	Z_{thJC} =f(t_P); parameter: D=t_p/ T

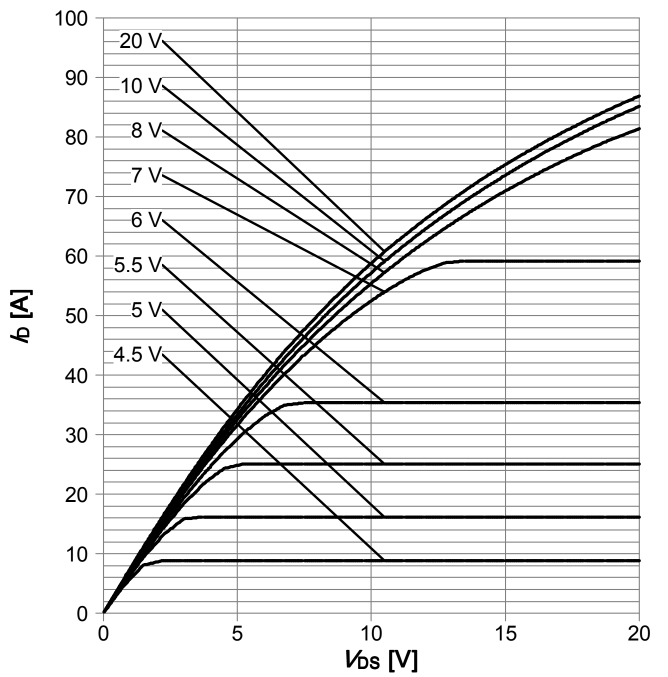
Table 10

Typ. output characteristics



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

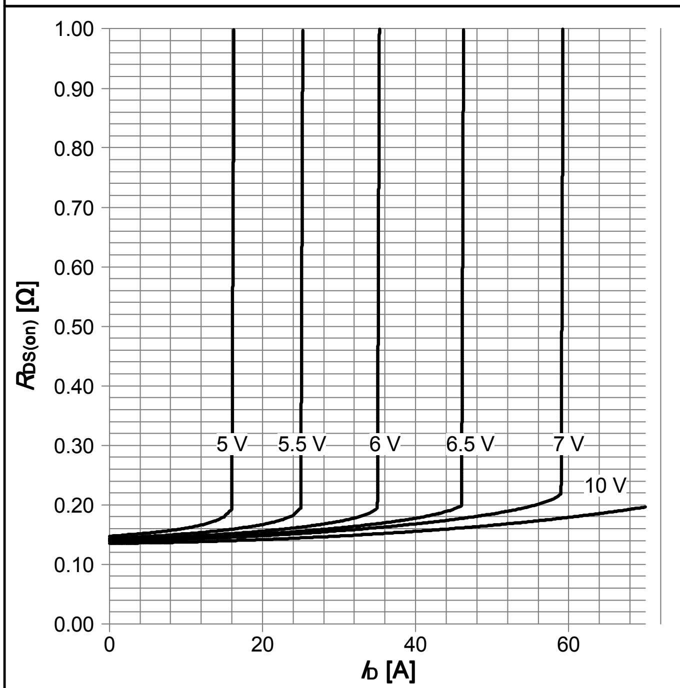
Typ. output characteristics



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

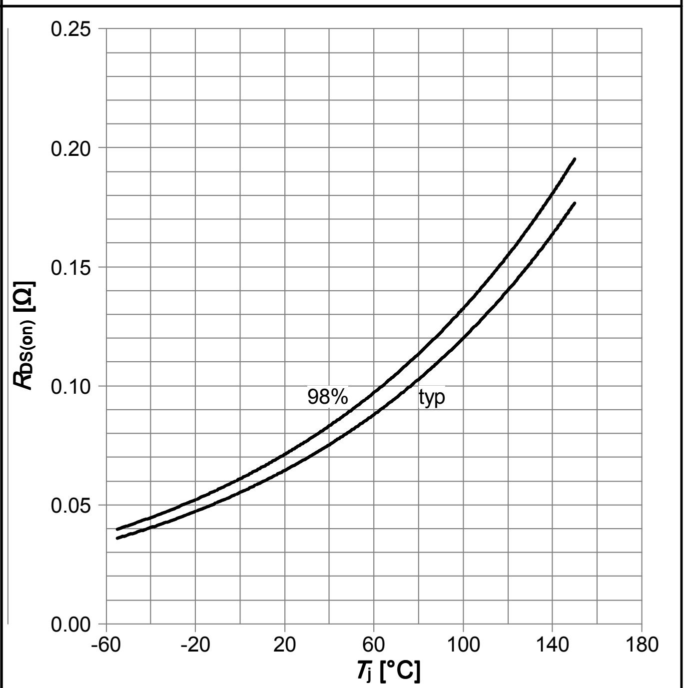
Table 11

Typ. drain-source on-state resistance



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

Drain-source on-state resistance



$R_{DS(on)}$=f(T_j); I_D=13.9 A; V_{GS}=10 V

Table 12

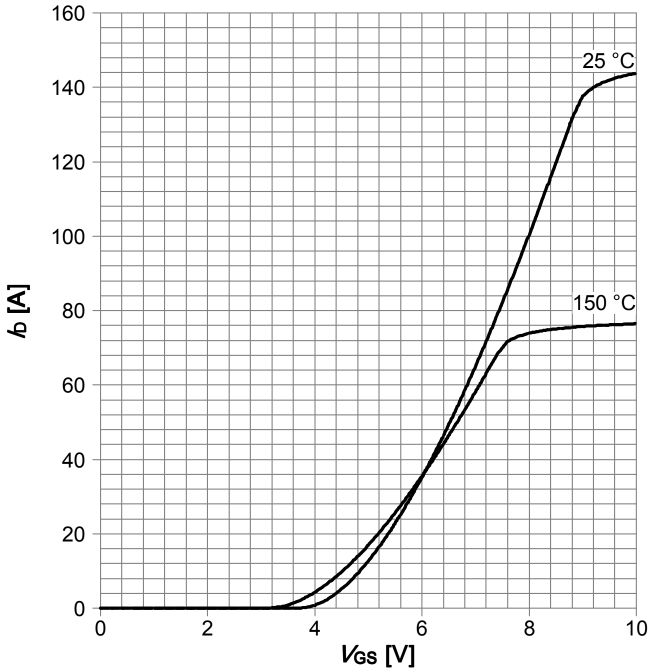
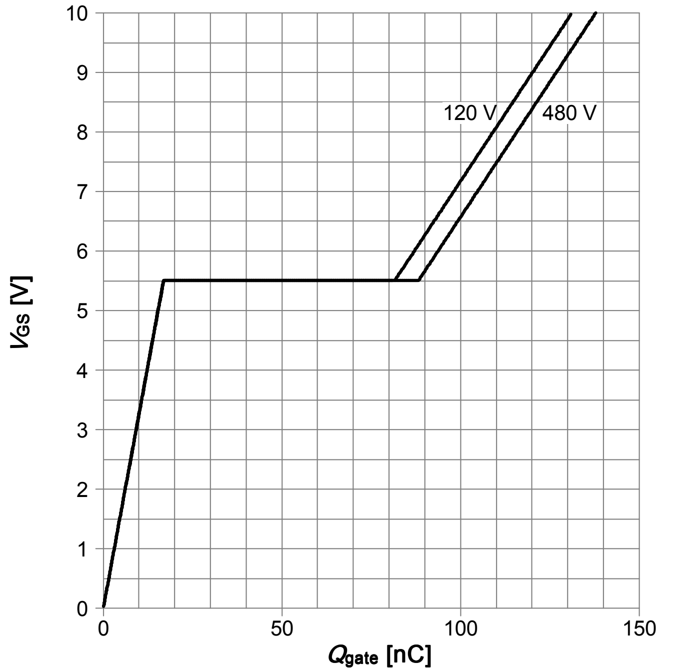
Typ. transfer characteristics	Typ. gate charge
	
I_D=f(V_{GS}); |V_{DS}|>2|I_D|$R_{DS(on)max}$; parameter: T_j	V_{GS}=f(Q_{gate}); I_D=20.8 A pulsed; parameter: V_{DD}

Table 13

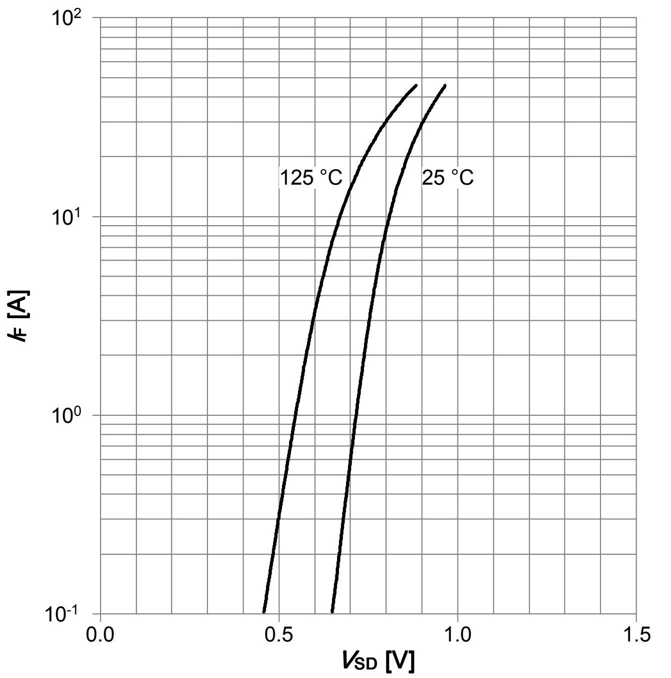
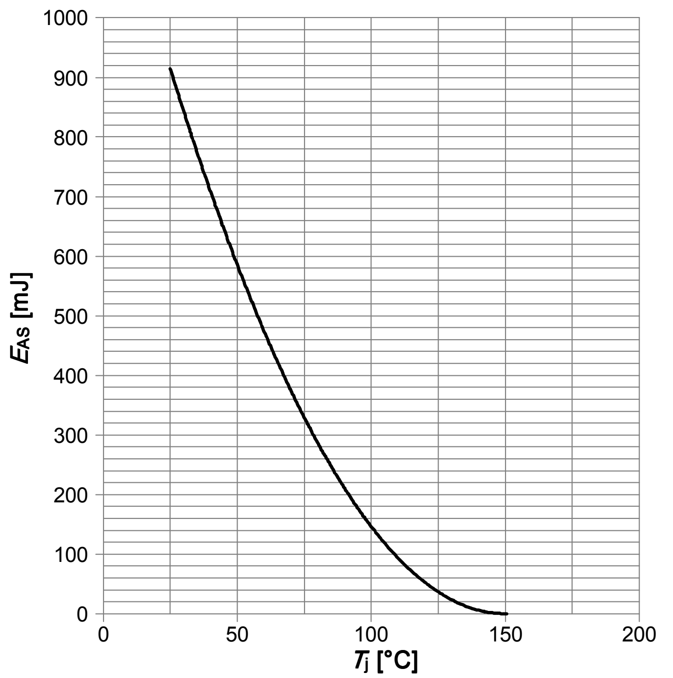
Forward characteristics of reverse diode	Avalanche energy
	
I_F=f(V_{SD}); parameter: T_j	E_{AS}=f(T_j); I_D=8.1 A; V_{DD}=50 V

Table 14

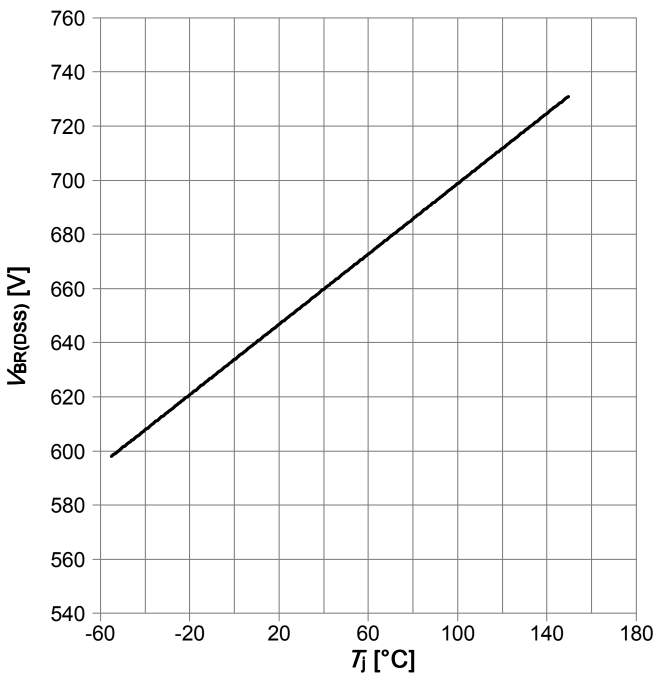
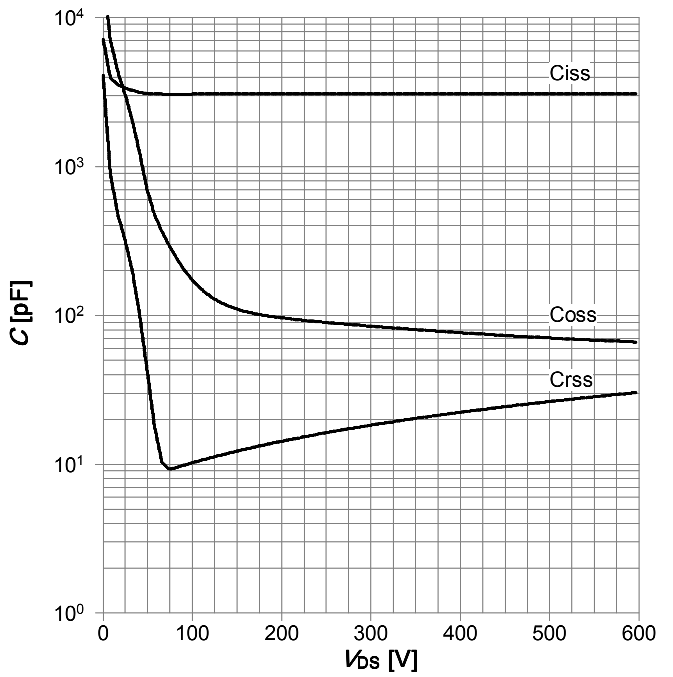
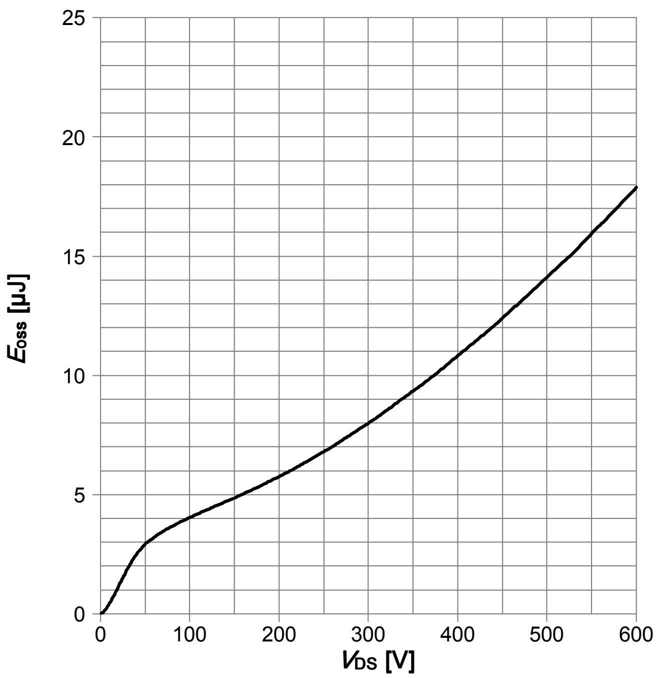
Drain-source breakdown voltage	Typ. capacitances
	
$V_{BR(DSS)}$=f(T_j); I_D=1 mA	C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Table 15

Typ. Coss stored energy

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

6 Test Circuits

Table 16 Diode_characteristics

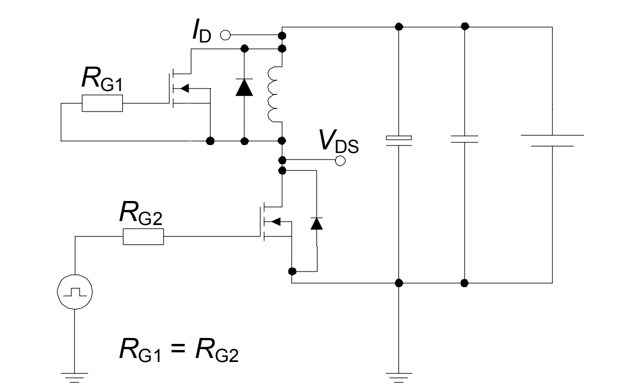
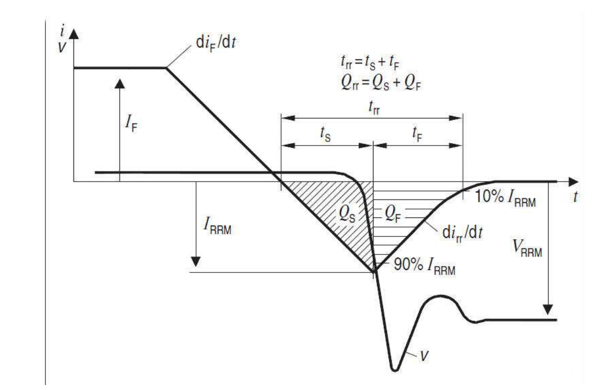
Test circuit for diode characteristics	Diode recovery waveform
	

Table 17 Switching_times

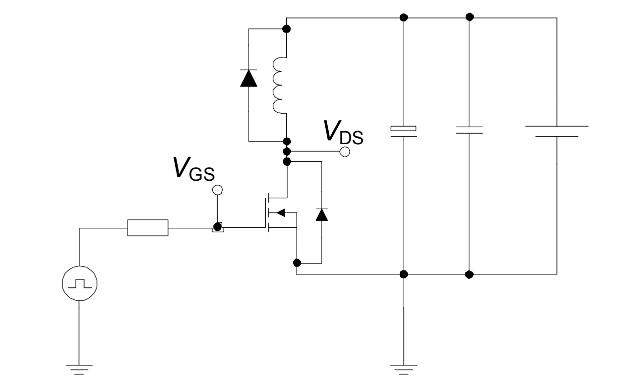
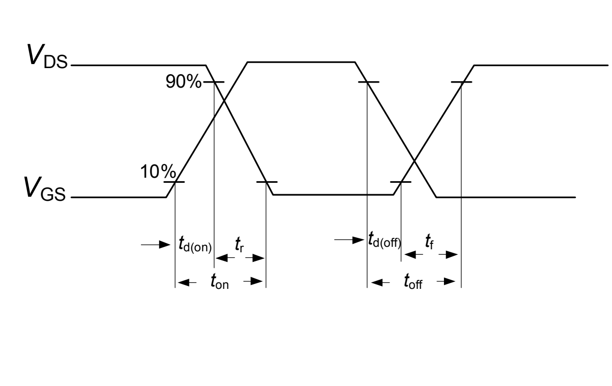
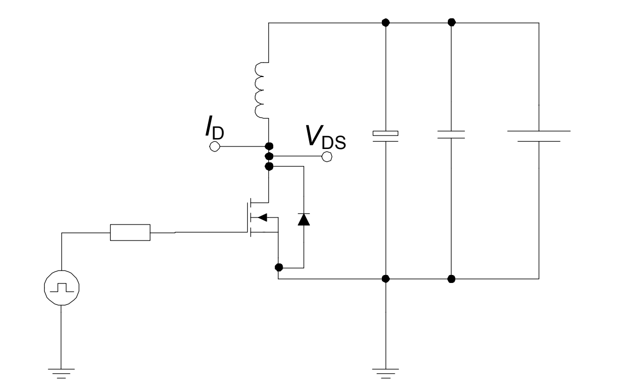
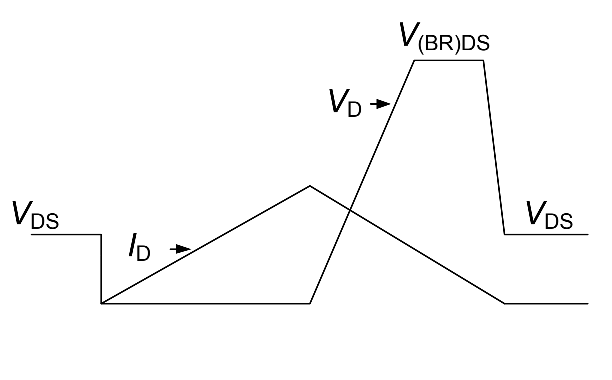
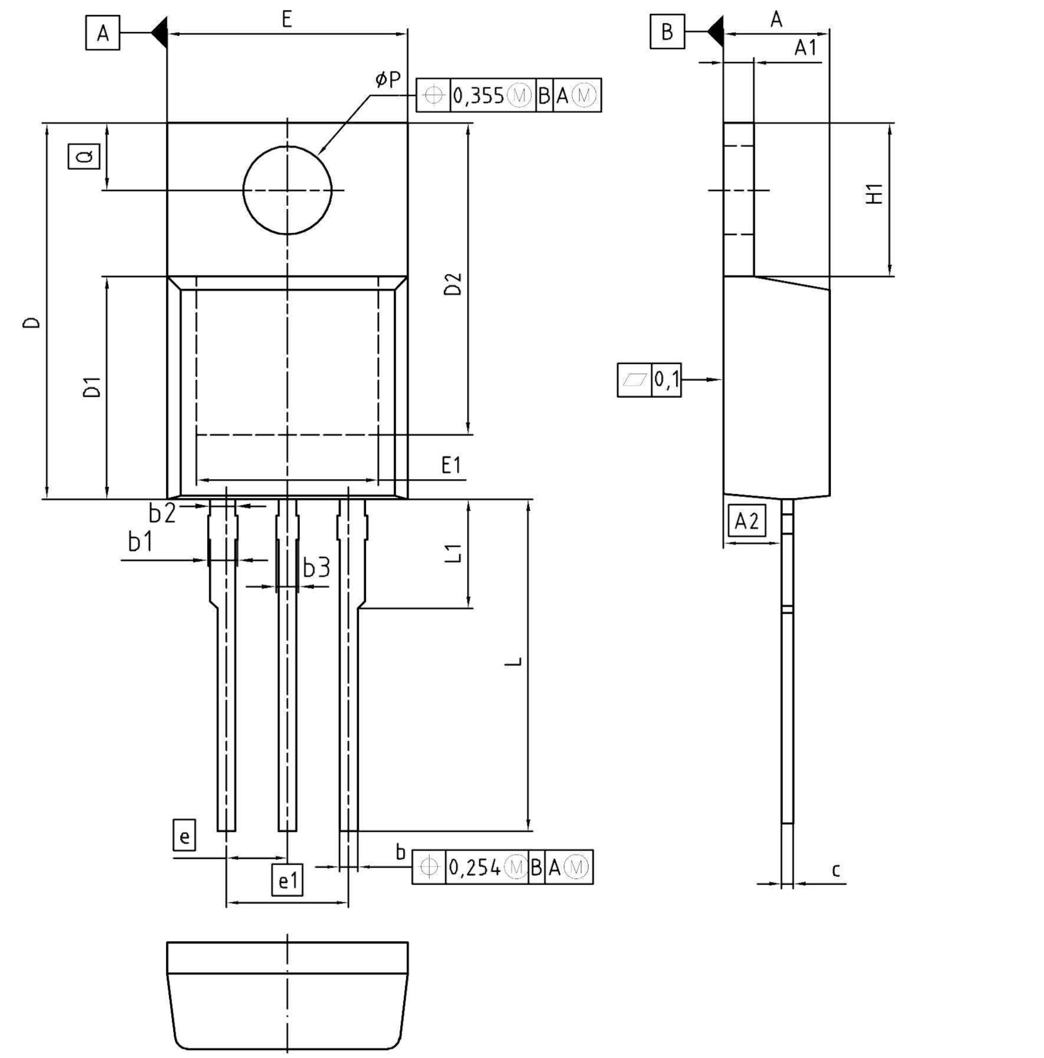
Switching times test circuit for inductive load	Switching times waveform
	

Table 18 Unclamped_inductive

Unclamped inductive load test circuit	Unclamped inductive waveform
	

7 Package Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.65	1.15	0.026	0.045
c	0.33	0.60	0.013	0.024
D	14.81	15.95	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	0.480	0.516
E	9.70	10.36	0.382	0.408
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	-	4.80	-	0.189
øP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

DOCUMENT NO.
Z8B00003318

SCALE
0 2.5 5mm

EUROPEAN PROJECTION

ISSUE DATE
30-07-2009

REVISION
06

Figure 1 Outline PG-TO 220, dimensions in mm/inches

8 Appendix A

Table 19 Related Links

- **IFX C6 Product Brief:**

  http://www.infineon.com/dgdl/Product+Brief+600V+CoolMOS+C6+.pdf?folderId=db3a3043156fd5730115939eb6b506db

- **IFX C6 Portfolio:**
  http://www.infineon.com/cms/en/product/findProductTypeByName.html?q=ip*c6

- **IFX CoolMOS Webpage:**
  http://www.infineon.com/cms/en/product/channel.html?channel=ff80808112ab681d0112ab6a628704d8

- **IFX Design Tools:**
  http://www.infineon.com/cms/en/product/promopages/designtools/index.html

Revision History

IPP65R074C6

Revision: 2011-09-14, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2011-09-14	Final Datasheet Release

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