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MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CoolMOS™ C6 650V

650V CoolMOS™ C6 Power Transistor
IPS65R950C6

Data Sheet

Rev. 2.0
Final



650V CoolMOS™ C6 Power Transistor

IPS65R950C6

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.

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
- 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 and UPS.

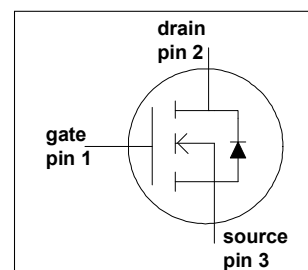


Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j \max}$	700	V
$R_{DS(on), \max}$	0.95	Ω
Q_g, typ	15.3	nC
I_D, pulse	12	A
$E_{oss} @ 400V$	1.5	μJ
Body diode di/dt	500	A/ μs

Type / Ordering Code	Package	Marking	Related Links
IPS65R950C6	PG-TO 251	65C6950	see Appendix A



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2 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			4.5	A	$T_C = 25^\circ\text{C}$
				2.8		$T_C = 100^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$			12	A	$T_C = 25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}			50	mJ	$I_D = 1.0\text{A}$, $V_{DD} = 50\text{V}$ (see table 18)
Avalanche energy, repetitive	E_{AR}			0.15	mJ	$I_D = 1.0\text{A}$, $V_{DD} = 50\text{V}$
Avalanche current, repetitive	I_{AR}			1.0	A	
MOSFET dv/dt ruggedness	dv/dt			50	V/ns	$V_{DS} = 0 \dots 480\text{V}$
Gate source voltage	V_{GS}	-20		20	V	static
		-30		30		AC ($f > 1\text{ Hz}$)
Operating and storage temperature	T_j, T_{stg}	-55		150	$^\circ\text{C}$	
Continuous diode forward current	I_S			3.9	A	$T_C = 25^\circ\text{C}$
Diode pulse current	$I_{S,pulse}$			12	A	$T_C = 25^\circ\text{C}$
Reverse diode dv/dt ³⁾	dv/dt			15	V/ns	$V_{DS} = 0 \dots 400\text{V}$, $I_{SD} \leq I_D$, $T_j = 25^\circ\text{C}$ (see table 16)
Maximum diode commutation speed	di/dt			500	A/ μs	
Power dissipation	P_{tot}			37	W	$T_C = 25^\circ$

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

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



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3 Thermal characteristics

Table 3 Thermal characteristics IPAK SL

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}			3.4	°C/W	
Thermal resistance, junction - ambient	R_{thJA}			62	°C/W	leaded
			35			
Soldering temperature, wave- & reflowsoldering allowed	T_{sold}			260	°C	1.6 mm (0.063 in.) from case for 10s



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4 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	$V_{(BR)DSS}$	650			V	$V_{GS} = 0V, I_D = 1mA$
Gate threshold voltage	$V_{GS(th)}$	2.5	3	3.5	V	$V_{DS} = V_{GS}, I_D = 0.2mA$
Zero gate voltage drain current	I_{DSS}			1	μA	$V_{DS} = 650V, V_{GS} = 0V, T_j = 25^\circ C$
			10			$V_{DS} = 650V, V_{GS} = 0V, T_j = 150^\circ C$
Gate-source leakage current	I_{GSS}			100	nA	$V_{GS} = 20V, V_{DS} = 0V$
Drain-source on-state resistance	$R_{DS(on)}$		0.855	0.95	Ω	$V_{GS} = 10V, I_D = 1.5A, T_j = 25^\circ C$
			2.223			$V_{GS} = 10V, I_D = 1.5A, T_j = 150^\circ C$
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	
Effective output capacitance, energy related ¹⁾	$C_{o(er)}$		14		pF	$V_{GS} = 0V, V_{DS} = 0 \dots 480V$
Effective output capacitance, time related ²⁾	$C_{o(tr)}$		58.5		pF	$I_D = \text{constant}, V_{GS} = 0V, V_{DS} = 0 \dots 480V$
Turn-on delay time	$t_{d(on)}$		6.6		ns	$V_{DD} = 400V, V_{GS} = 13V, I_D = 2.2A, R_G = 10.2\Omega$ (see table 17)
Rise time	t_r		5.2		ns	
Turn-off delay time	$t_{d(off)}$		41		ns	
Fall time	t_f		13.6		ns	

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}		1.8		nC	$V_{DD} = 480V, I_D = 2.2A, V_{GS} = 0 \text{ to } 10V$
Gate to drain charge	Q_{gd}		8		nC	
Gate charge total	Q_g		15.3		nC	
Gate plateau voltage	$V_{plateau}$		5.1		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% $V_{(BR)DSS}$



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Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}		0.9		V	$V_{GS} = 0V, I_F = 2.2A, T_j = 25^\circ C$
Reverse recovery time	t_{rr}		226		ns	$V_R = 400V, I_F = 2.2A,$ $di_F/dt = 100A/\mu s$ (see table 16)
Reverse recovery charge	Q_{rr}		1.3		μC	
Peak reverse recovery current	I_{rrm}		9.9		A	



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5 Electrical characteristics diagrams

Table 8

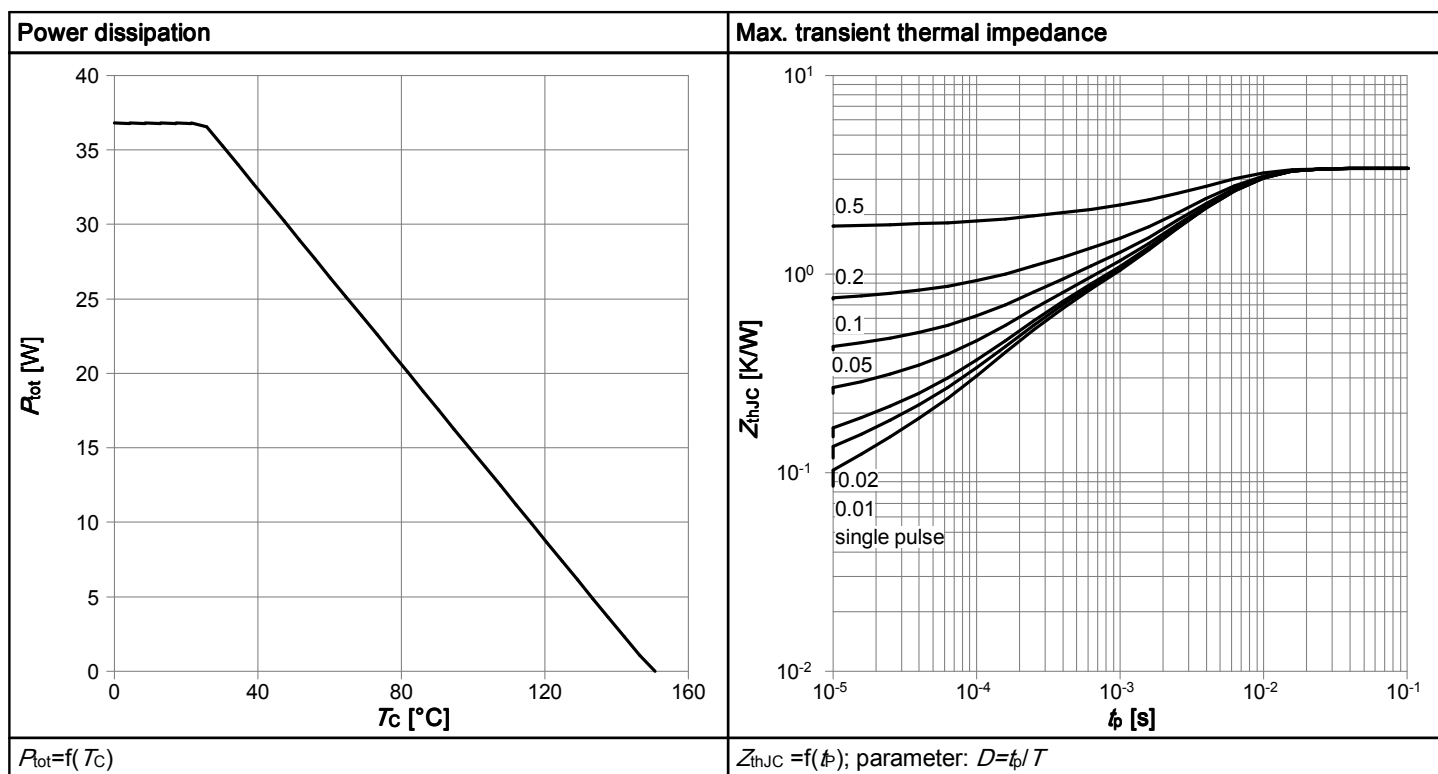
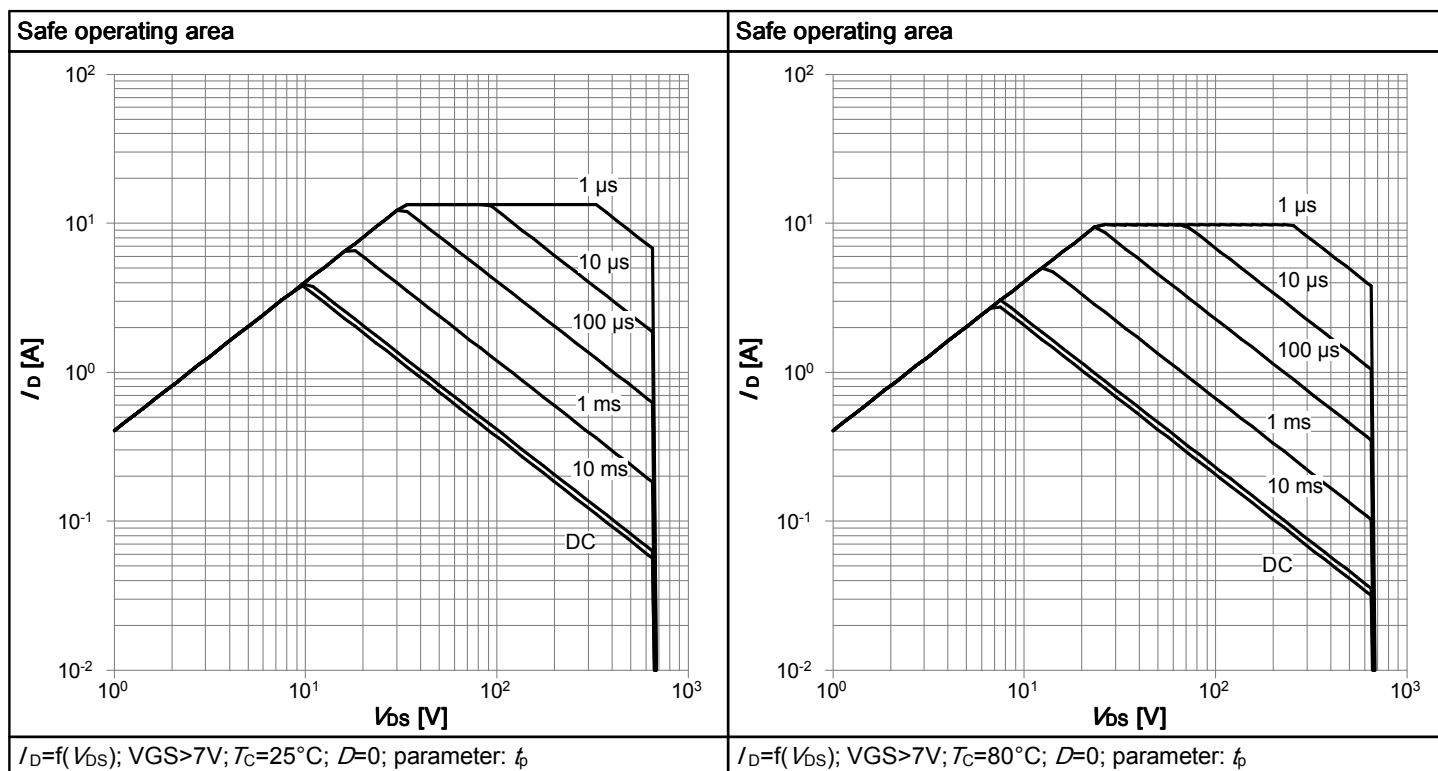


Table 9





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Table 10

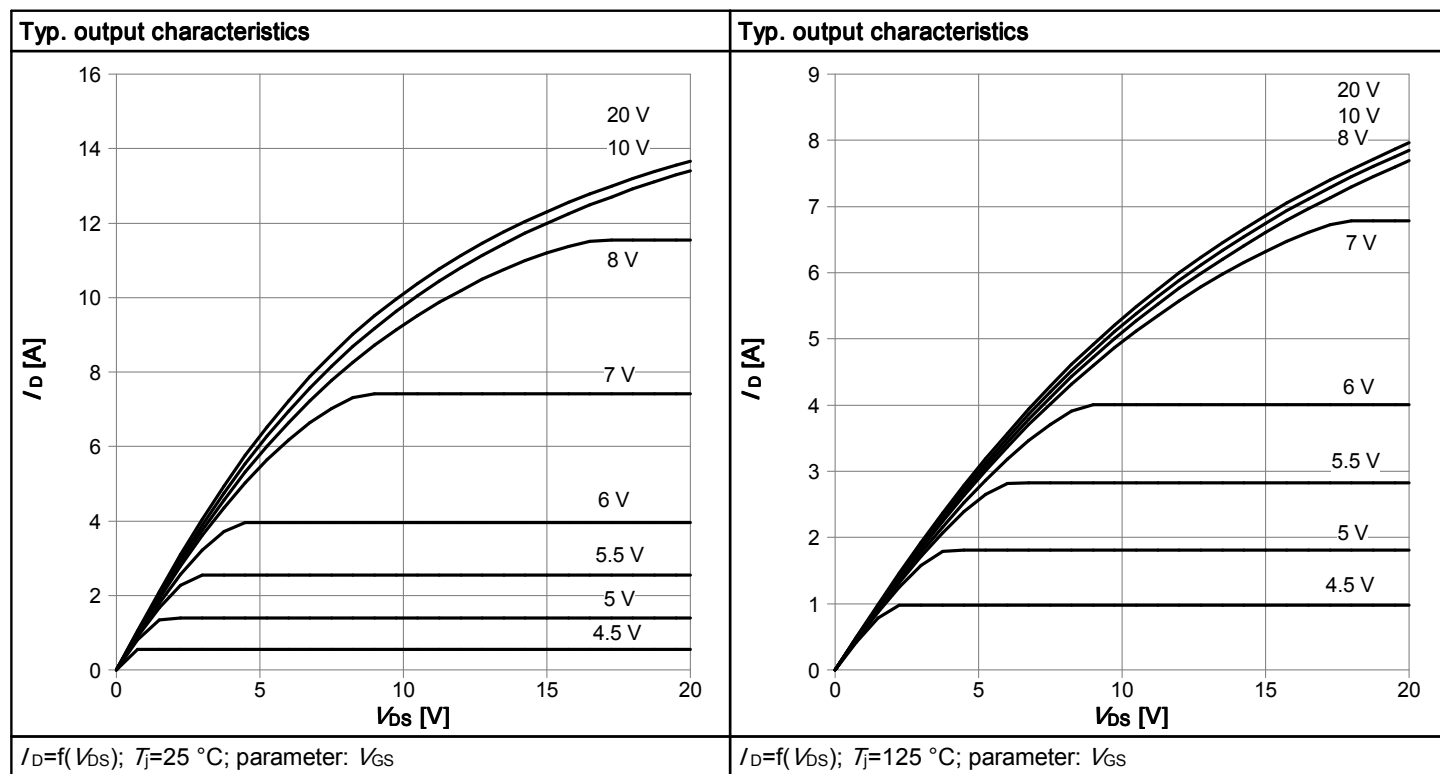
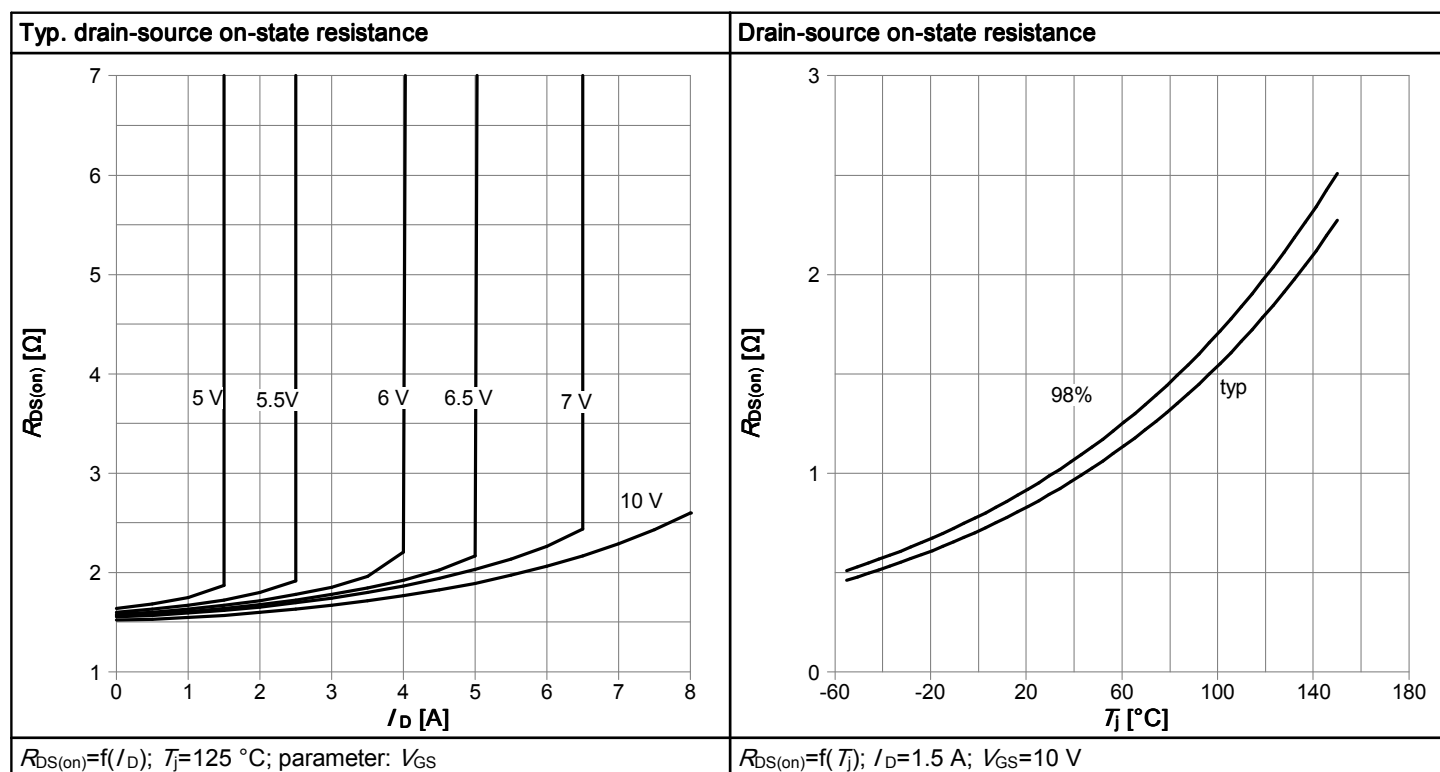


Table 11





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Table 12

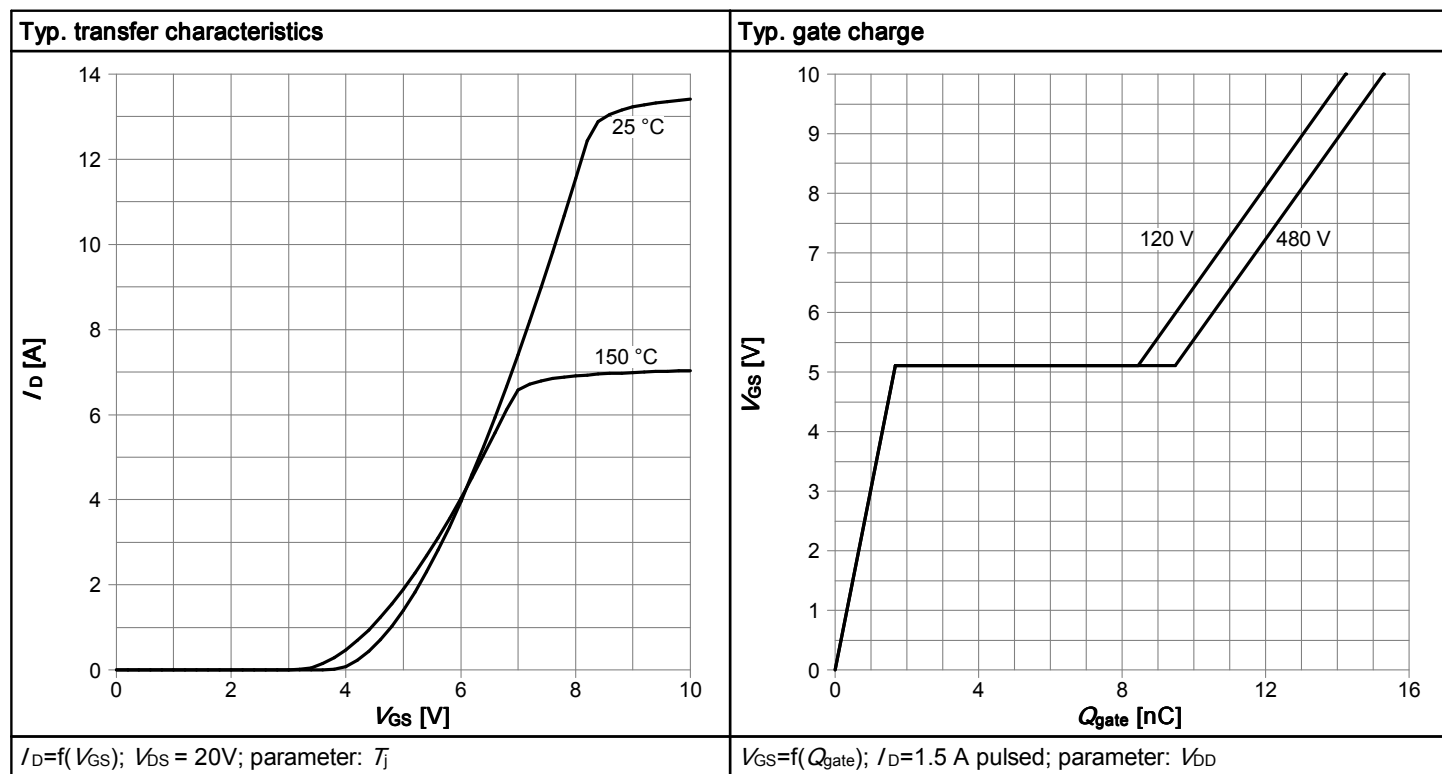
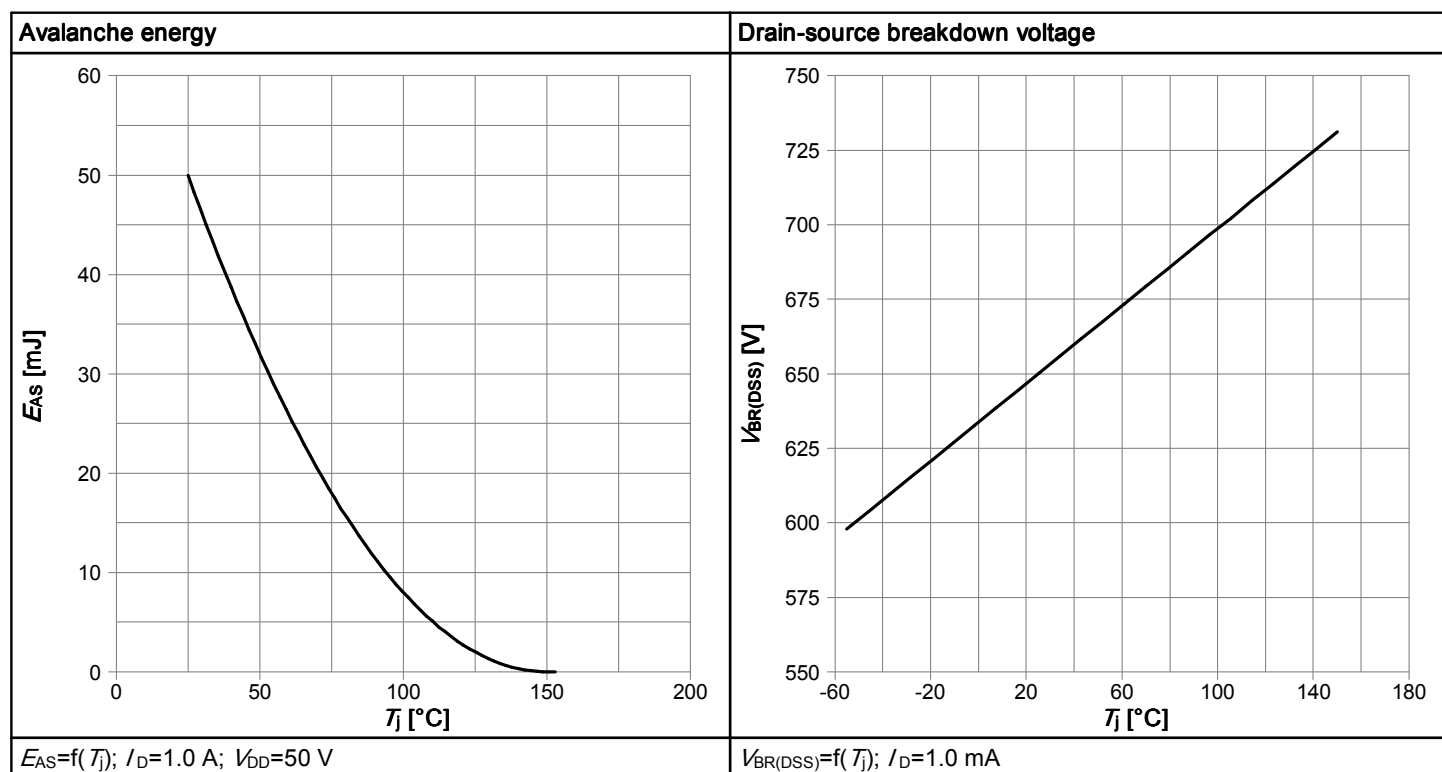


Table 13





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Table 14

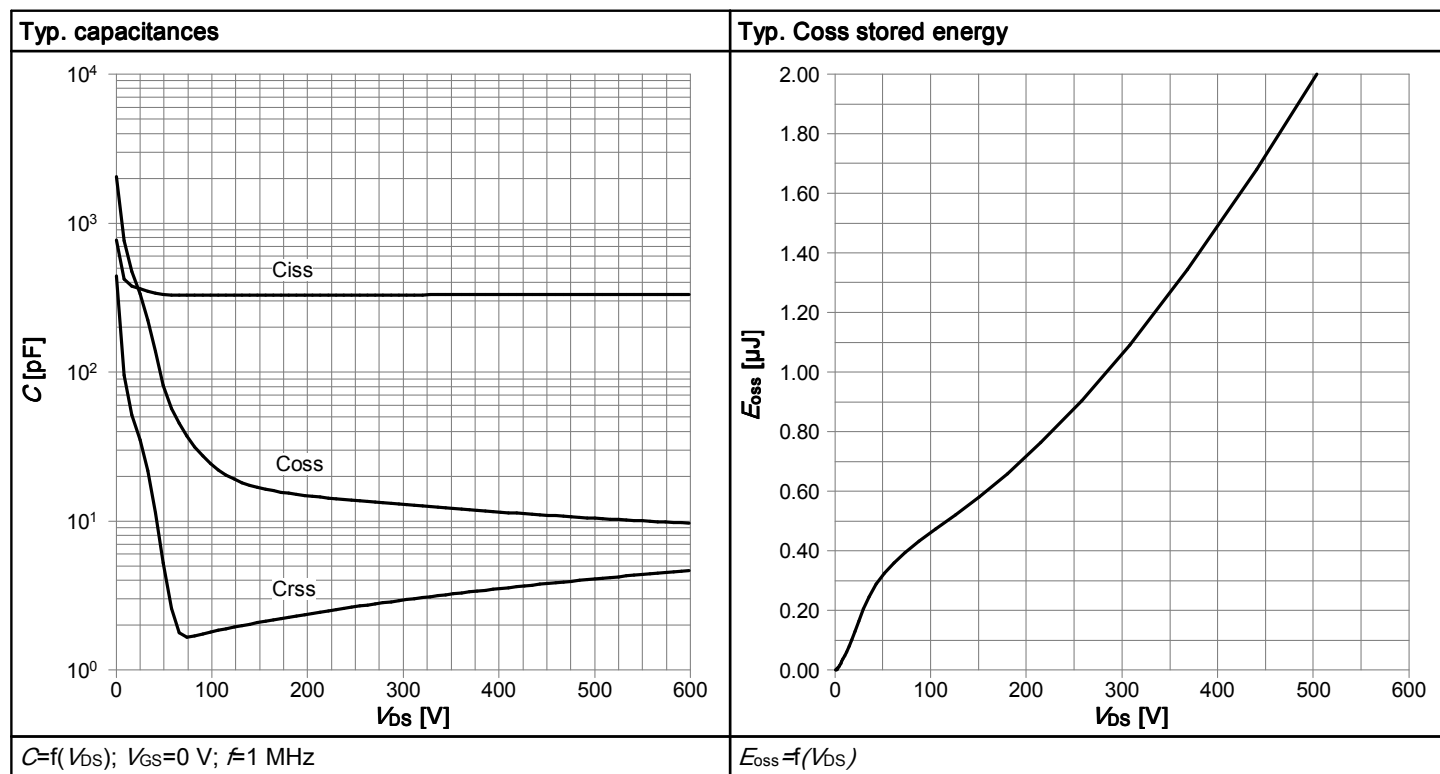
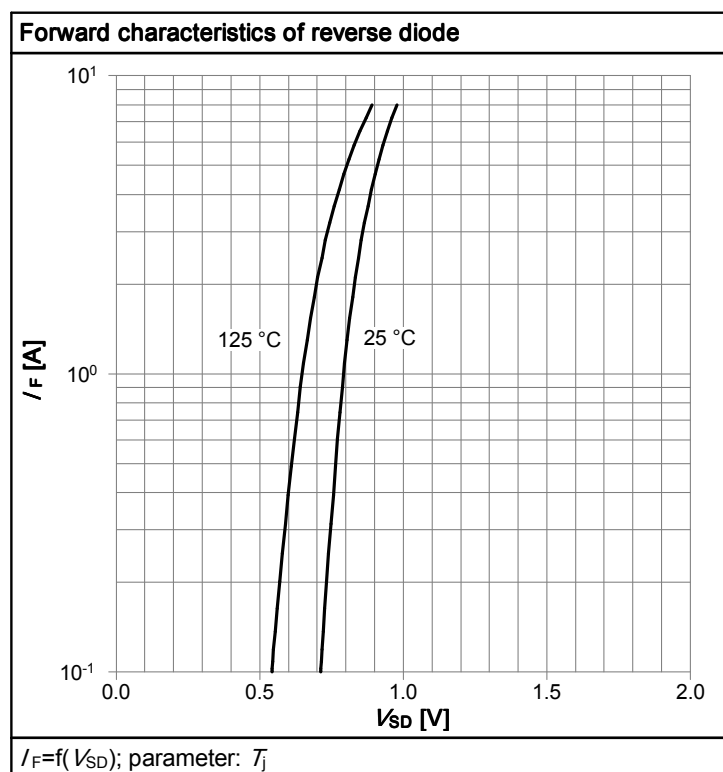


Table 15





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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

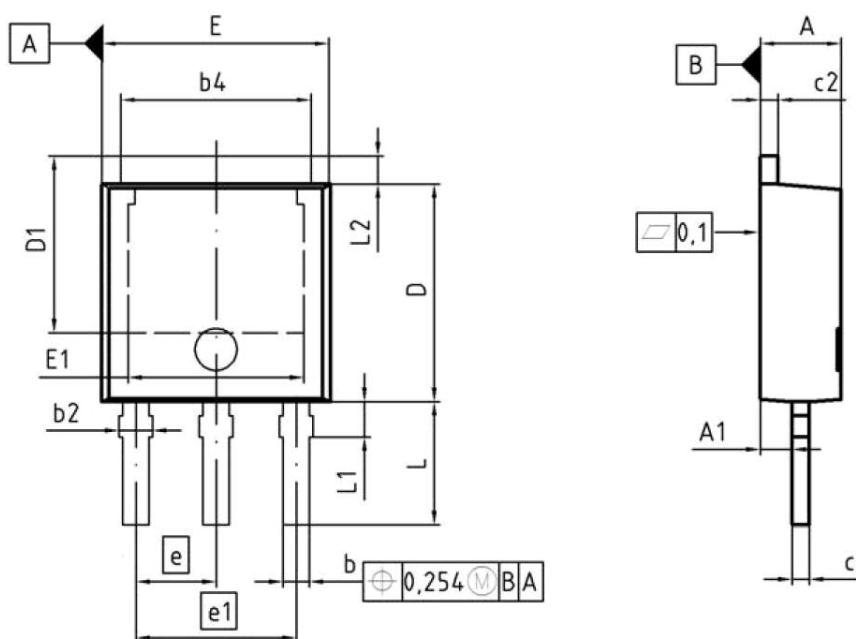
Unclamped inductive load test circuit	Unclamped inductive waveform



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7 Package Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.18	2.39	0.086	0.094
A1	0.80	1.14	0.031	0.045
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b4	4.95	5.50	0.195	0.217
c	0.46	0.58	0.018	0.023
c2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	5.04	5.44	0.198	0.214
E	6.35	6.73	0.250	0.265
E1	4.90	5.10	0.193	0.201
e	2.29		0.090	
e1	4.57		0.180	
N	3		3	
L	3.30	3.50	0.130	0.138
L1	0.90	1.10	0.035	0.043
L2	0.90	1.10	0.035	0.043

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REVISION 04

Figure 1 Outline PG-TO 251, dimensions in mm/inches



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8 Appendix A

Table 19 Related Links

- **IFX C6 Product Brief:**

<http://www.infineon.com/dgdl/Product+Brief+600V+CoolMOS+C6+.pdf?folderId=db3a3043156fd5730115939eb6b506db&fileId=6503156fd5730115939eb6b506db&fromView=detail>

- **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>



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Revision History

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Revision: 2012-07-06, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
0.9	2011-12-19	Release of target datasheet
2.0	2012-07-06	Release of final version

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