

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CoolMOS™ C6 650V

650V CoolMOS™ C6 Power Transistor
IPW65R037C6

Data Sheet

Rev. 2.0
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.

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, UPS and Solar.

Please note: For MOSFET paralleling the use of ferrite beads on the gate or separate totem poles is generally recommended.

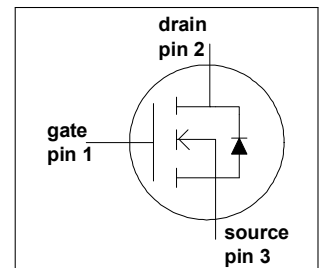
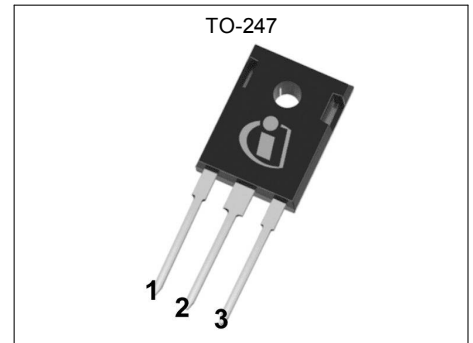


Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j \max}$	700	V
$R_{DS(on),max}$	0.037	Ω
Q_g, typ	330	nC
$I_D, pulse$	297	A
$E_{oss} @ 400V$	24.5	μJ
Body diode di/dt	300	A/ μs

Type / Ordering Code	Package	Marking	Related Links
IPW65R037C6	PG-TO 247	65C6037	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			83.2	A	$T_C = 25^\circ\text{C}$
				52.6		$T_C = 100^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$			297	A	$T_C = 25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}			2185	mJ	$I_b = 14.4\text{A}$, $V_{DD} = 50\text{V}$
Avalanche energy, repetitive	E_{AR}			3.31	mJ	$I_b = 14.4\text{A}$, $V_{DD} = 50\text{V}$
Avalanche current, repetitive	I_{AR}			14.4	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 ($f > 1\text{ Hz}$)
Power dissipation (non FullPAK) TO-247	P_{tot}			500.0	W	$T_C = 25^\circ\text{C}$
Operating and storage temperature	T_j, T_{stg}	-55		150	$^\circ\text{C}$	
Mounting torque (non FullPAK) TO-247				60	Ncm	M3 and M3.5 screws
Continuous diode forward current	I_S			72.1	A	$T_C = 25^\circ\text{C}$
Diode pulse current	$I_{S,pulse}$			297	A	$T_C = 25^\circ\text{C}$
Reverse diode dv/dt ³⁾	dv/dt			15	V/ns	$V_{DS} = 0 \dots 400\text{V}$, $I_{SD} \leq I_b$, $T_j = 25^\circ\text{C}$
Maximum diode commutation speed	di _r /dt			300	A/ μs	

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

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

³⁾ $V_{peak} < V_{(BR)DSS}$, $T_j < T_{j\text{ max}}$, identical low and high side switch with same R_g

3 Thermal characteristics

Table 3 Thermal characteristics TO-247

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}			0.25	°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 $T_j = 25^\circ\text{C}$, 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	$V_{DS} = V_{GS}$, $I_D = 3.3mA$
Zero gate voltage drain current	I_{DSS}			2	μA	$V_{DS} = 650V$, $V_{GS} = 0V$, $T_j = 25^\circ\text{C}$
			50			$V_{DS} = 650V$, $V_{GS} = 0V$, $T_j = 150^\circ\text{C}$
Gate-source leakage current	I_{GSS}			100	nA	$V_{GS} = 20V$, $V_{DS} = 0V$
Drain-source on-state resistance	$R_{DS(on)}$		0.033	0.037	Ω	$V_{GS} = 10V$, $I_D = 33.1A$, $T_j = 25^\circ\text{C}$
			0.086			$V_{GS} = 10V$, $I_D = 33.1A$, $T_j = 150^\circ\text{C}$
Gate resistance	R_G		0.7		Ω	$f = 1MHz$, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}		7240		pF	$V_{GS} = 0V$, $V_{DS} = 100V$, $f = 1MHz$
Output capacitance	C_{oss}		380		pF	
Effective output capacitance, energy related ¹⁾	$C_{o(er)}$		270		pF	$V_{GS} = 0V$, $V_{DS} = 0 \dots 480V$
Effective output capacitance, time related ²⁾	$C_{o(tr)}$		1360		pF	$I_D = \text{constant}$, $V_{GS} = 0V$, $V_{DS} = 0 \dots 480V$
Turn-on delay time	$t_{d(on)}$		22		ns	$V_{DD} = 400V$, $V_{GS} = 13V$, $I_D = 49.6A$, $R_G = 1.7\Omega$
Rise time	t_r		32		ns	
Turn-off delay time	$t_{d(off)}$		140		ns	
Fall time	t_f		7		ns	

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}		40		nC	$V_{DD} = 480V$, $I_D = 49.6A$, $V_{GS} = 0 \text{ to } 10V$
Gate to drain charge	Q_{gd}		170		nC	
Gate charge total	Q_g		330		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 480V

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 480V

Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}		0.85		V	$V_{GS} = 0V$, $I_F = 49.6A$, $T_J = 25^\circ C$
Reverse recovery time	t_{rr}		1020		ns	$V_R = 400V$, $I_F = 49.6A$, $dI_F/dt = 100A/\mu s$
Reverse recovery charge	Q_{rr}		36		μC	
Peak reverse recovery current	I_{rrm}		67		A	

5 Electrical characteristics diagrams

Table 8

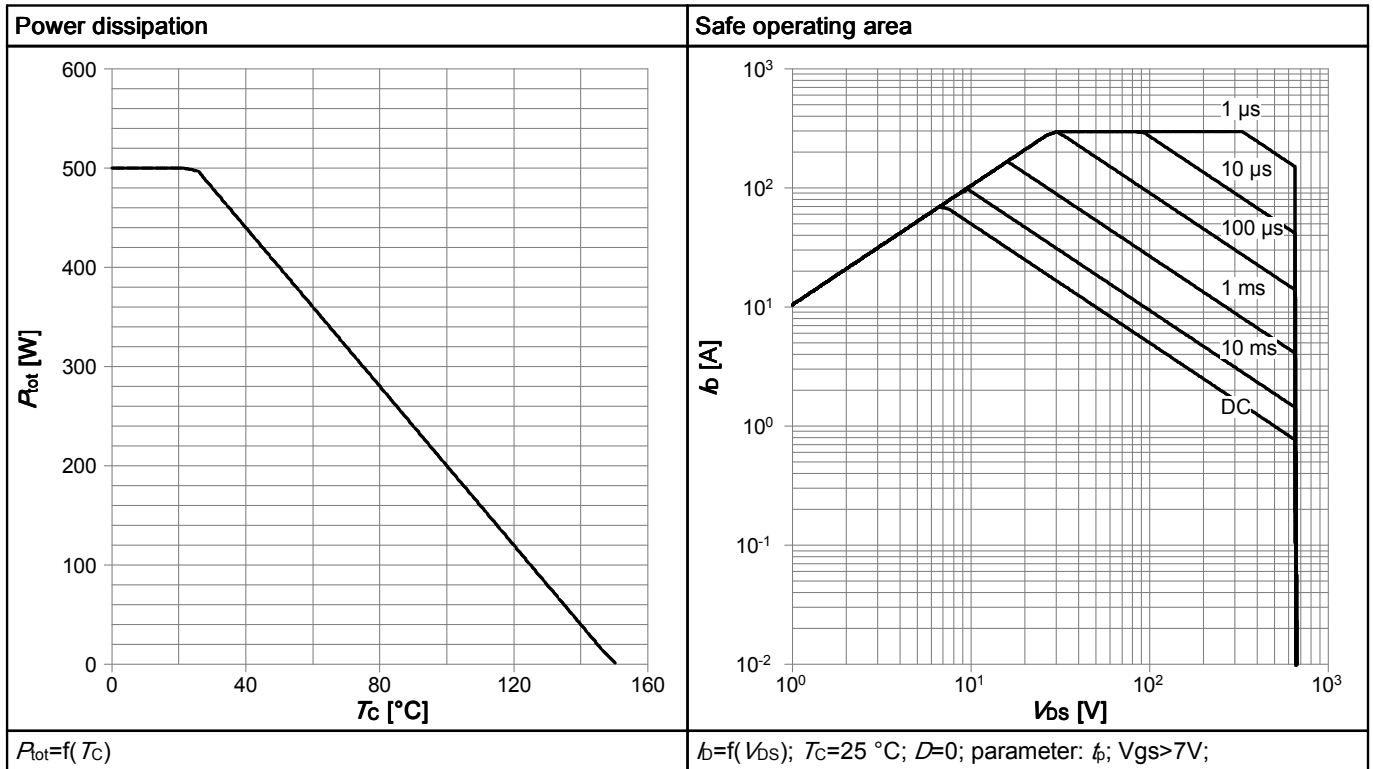


Table 9

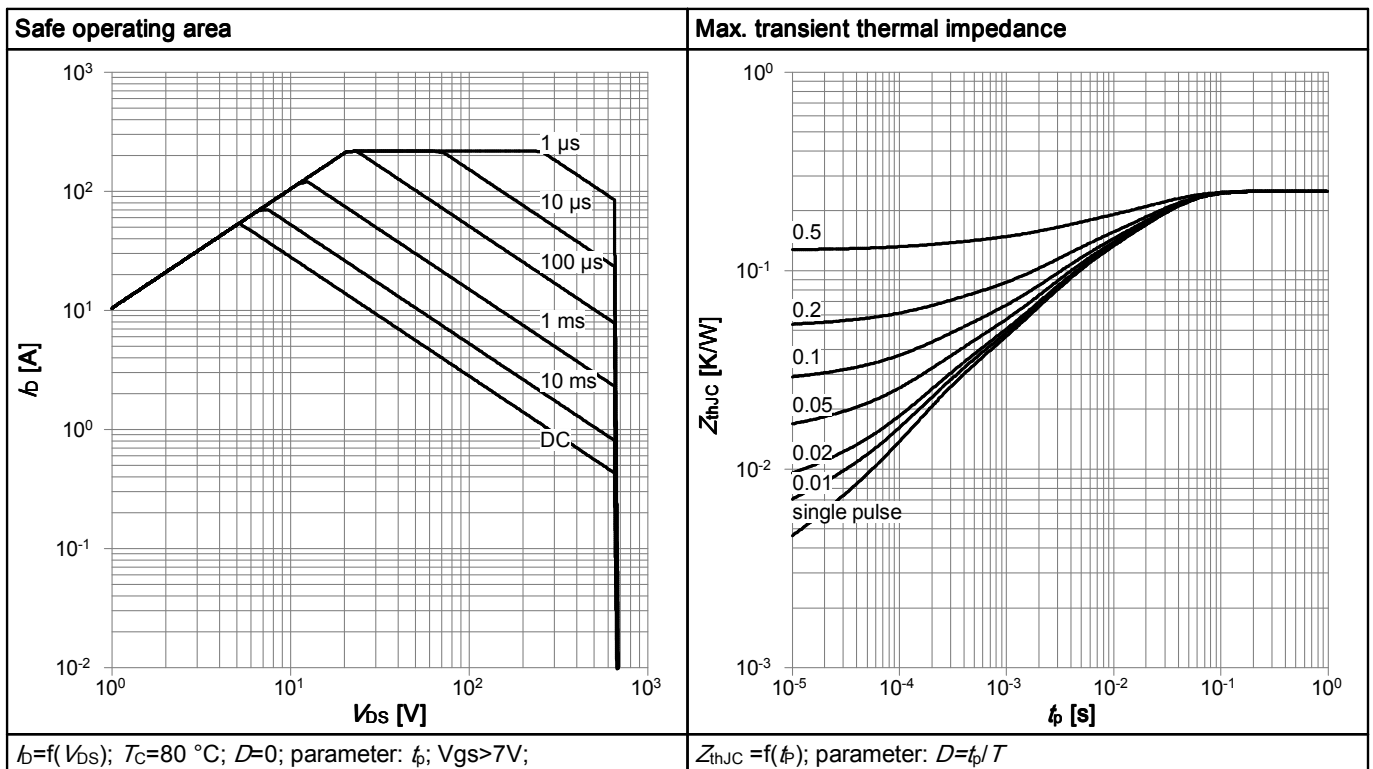


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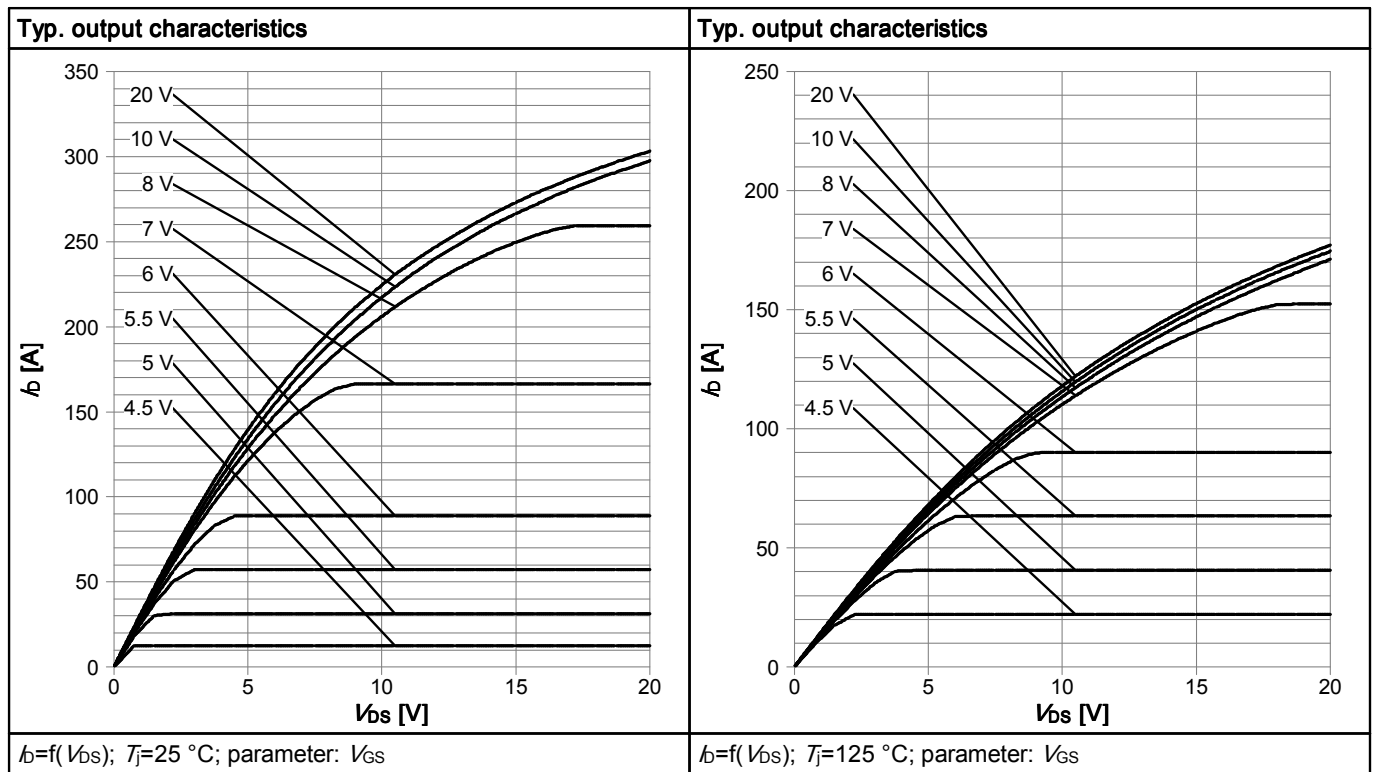


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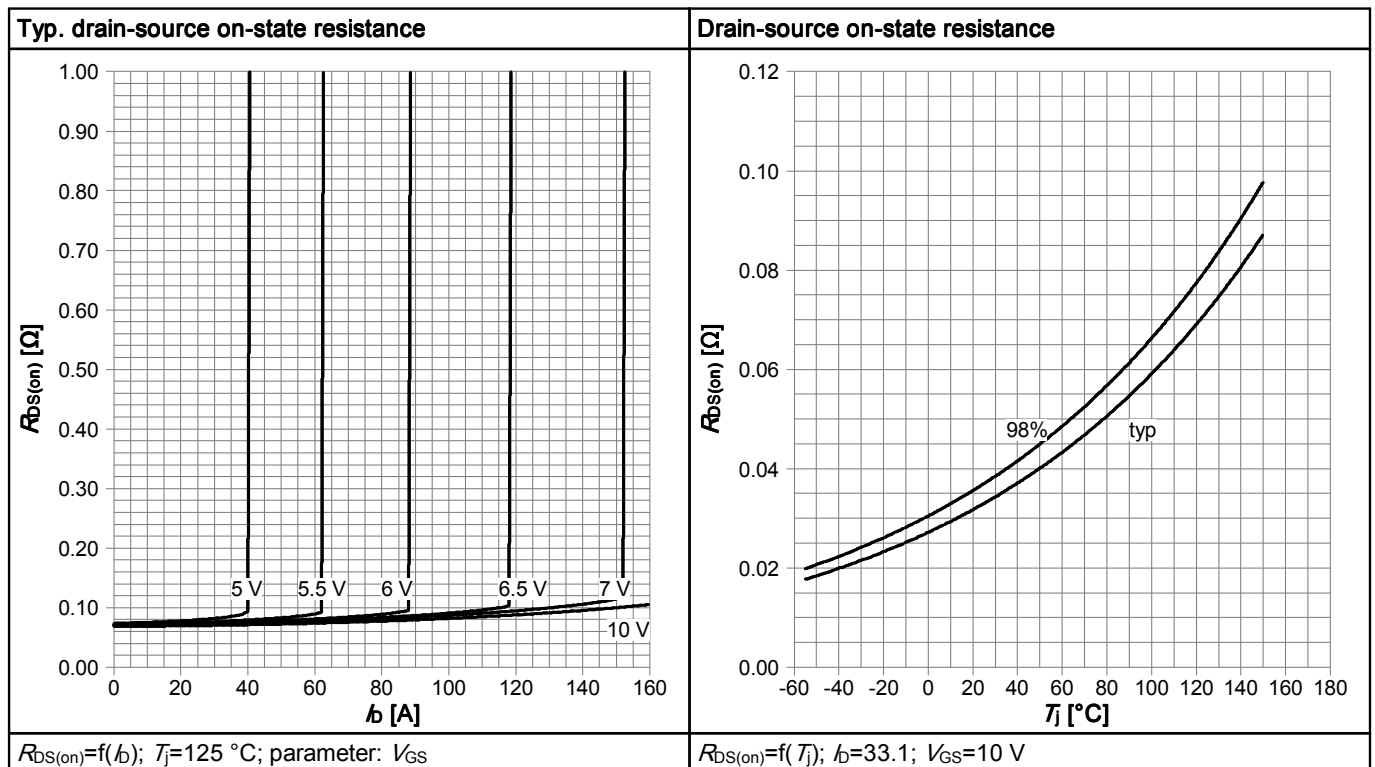


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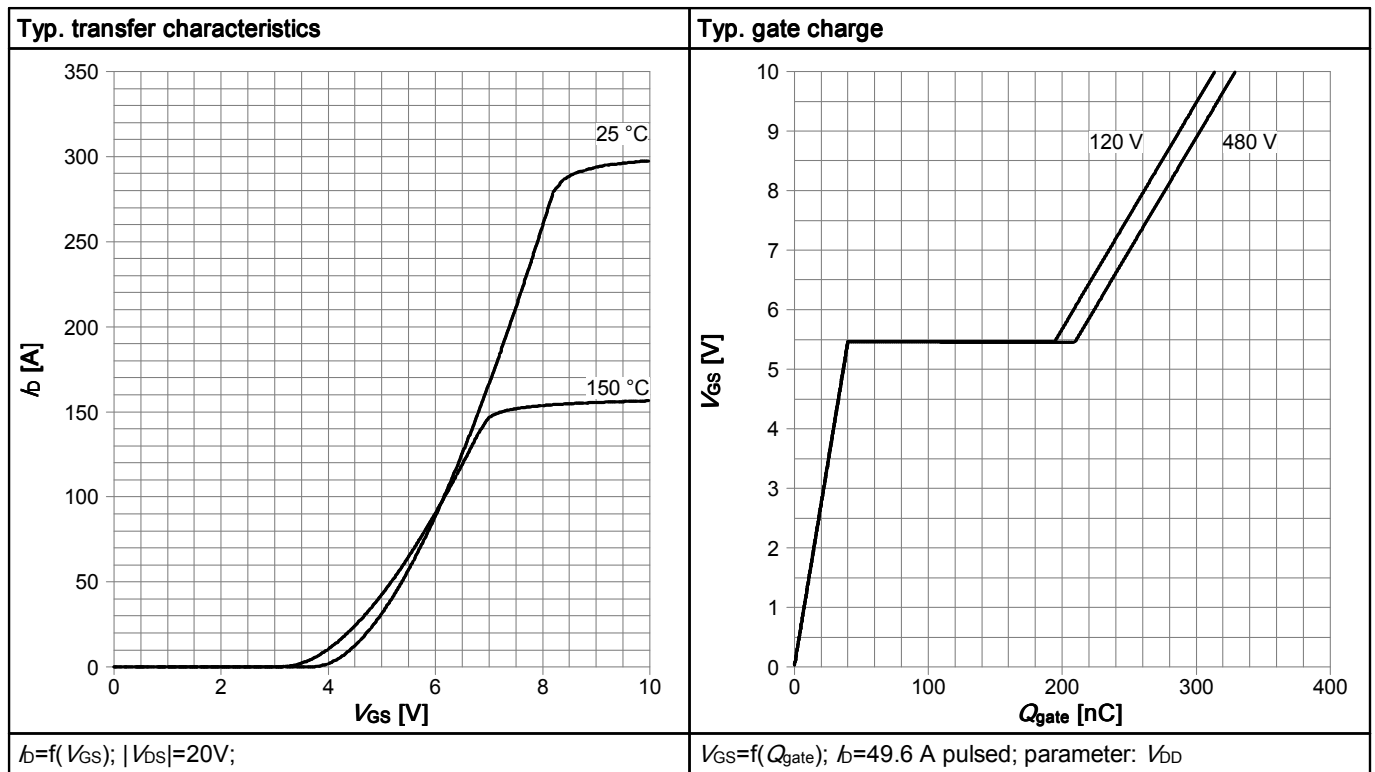


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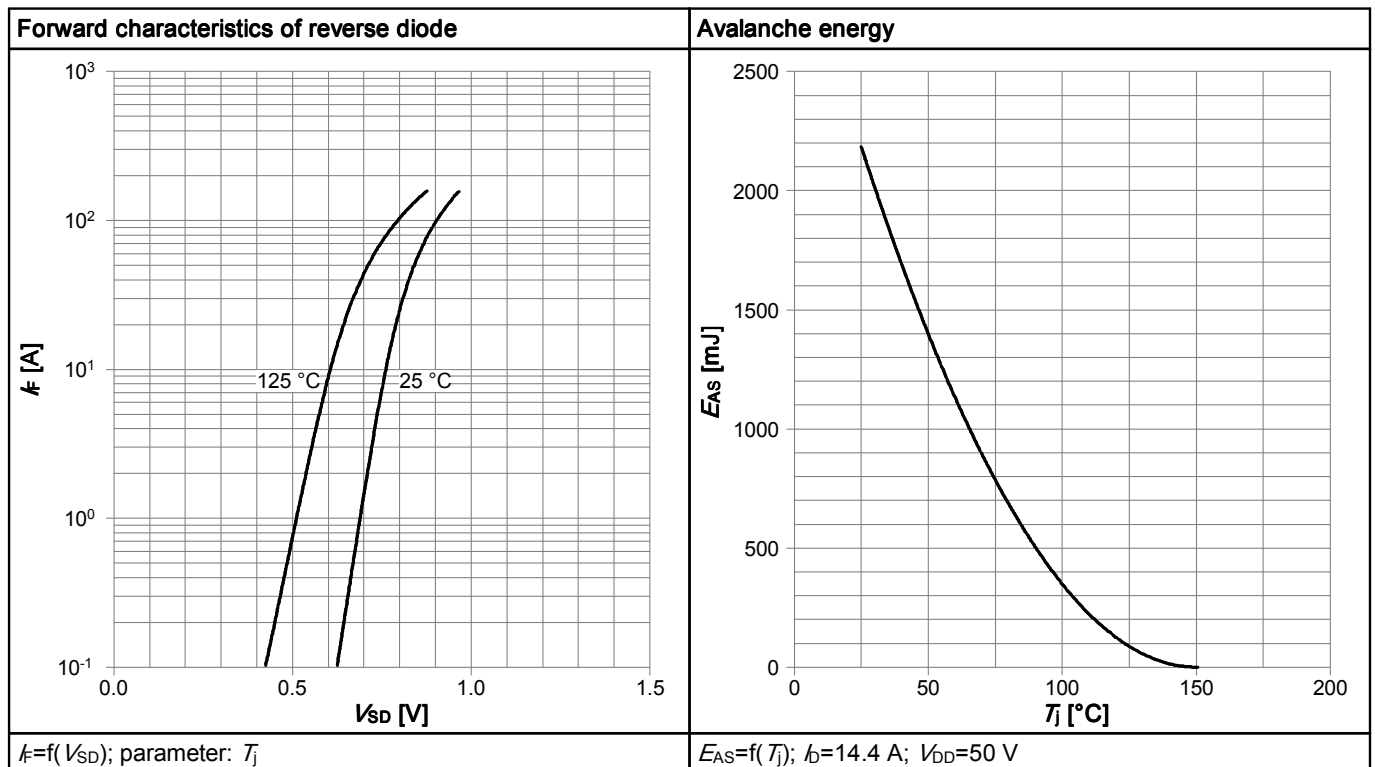


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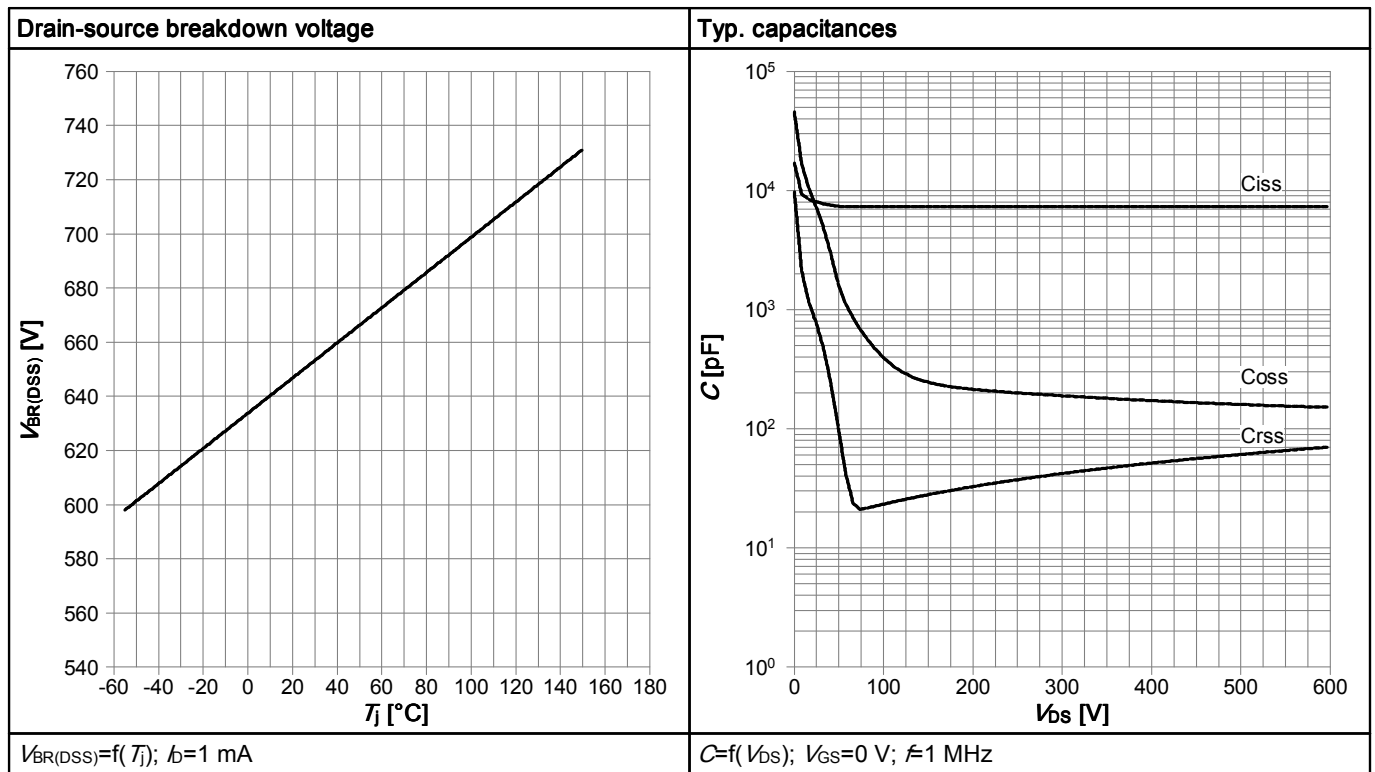
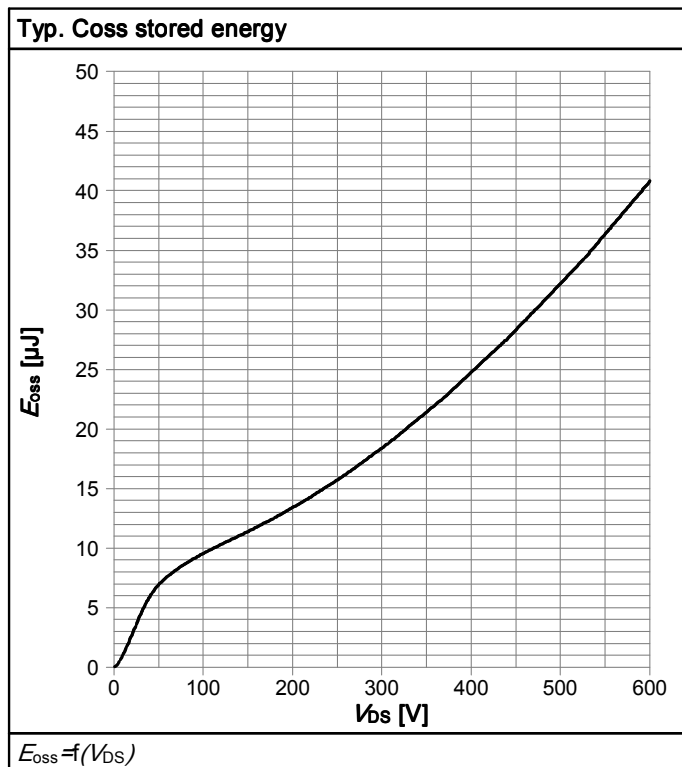


Table 15



6 Test Circuits

Table 16 Diode_characteristics

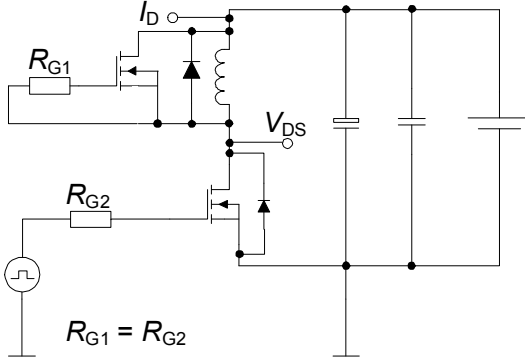
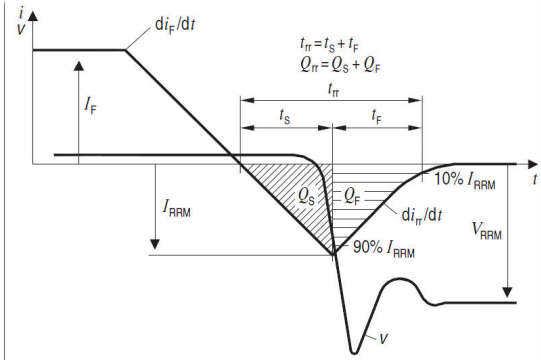
Test circuit for diode characteristics	Diode recovery waveform
 $R_{G1} = R_{G2}$	 $t_{tr} = t_s + t_f$ $Q_{rr} = Q_s + Q_F$

Table 17 Switching_times

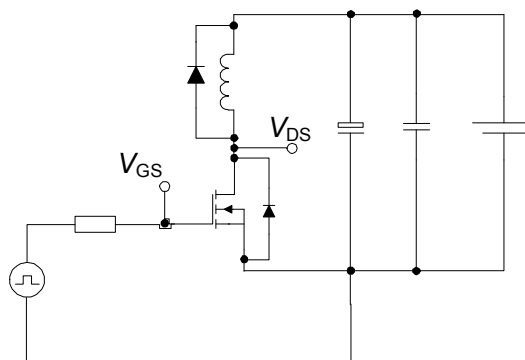
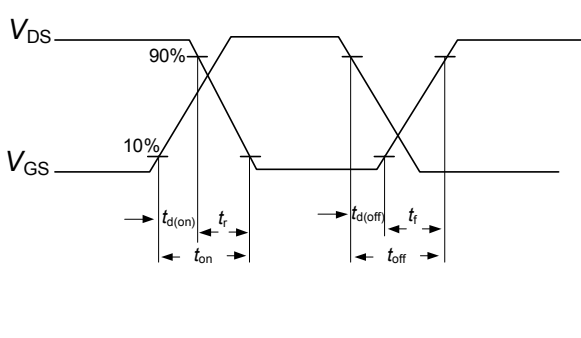
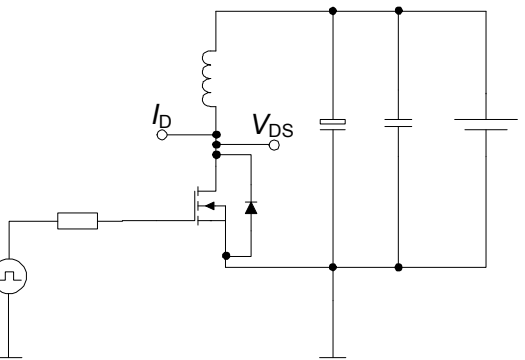
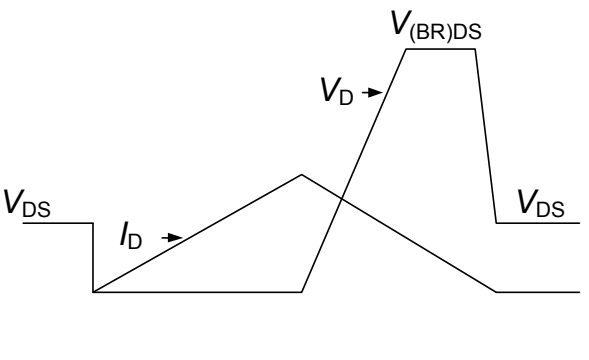
Switching times test circuit for inductive load	Switching times waveform
	

Table 18 Unclamped_inductive

Unclamped inductive load test circuit	Unclamped inductive waveform
	

7 Package Outlines

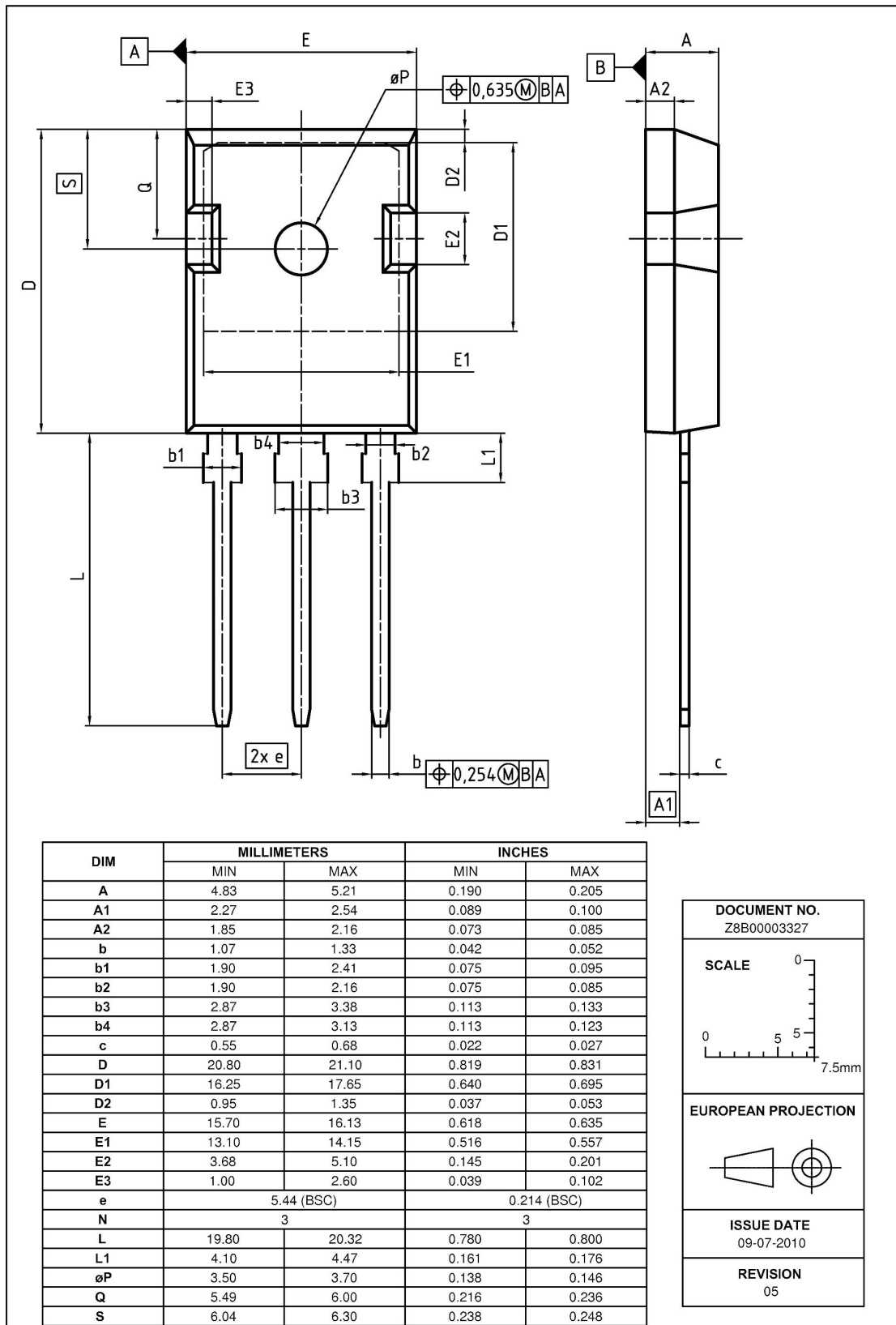


Figure 1 Outline PG-TO 247, dimensions in mm/inches

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

IPW65R037C6

Revision: 2011-10-13, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
1.9	2011-09-29	release of preliminary datasheet
2.0	2011-10-13	release of final datasheet

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