IPL60R160CFD7AUMA1 Datasheet

https://www.DiGi-Electronics.com

DiGi Electronics Part Number	IPL60R160CFD7AUMA1-DG
Manufacturer	Infineon Technologies
Manufacturer Product Number	IPL60R160CFD7AUMA1
Description	MOSFET N CH
Detailed Description	N-Channel 600 V 16A (Tc) 95W (Tc) Surface Mount PG-VSON-4-1

Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

Purchase and inquiry

Manufacturer Product Number:	Manufacturer:
IPL60R160CFD7AUMA1	Infineon Technologies
Series:	Product Status:
CoolMOS™ CFD7	Active
FET Type:	Technology:
N-Channel	MOSFET (Metal Oxide)
Drain to Source Voltage (Vdss):	Current - Continuous Drain (Id) @ 25°C:
600 V	16A (Tc)
Drive Voltage (Max Rds On, Min Rds On):	Rds On (Max) @ Id, Vgs:
10V	160mOhm @ 6.8A, 10V
Vgs(th) (Max) @ Id:	Gate Charge (Qg) (Max) @ Vgs:
4.5V @ 340µA	31 nC @ 10 V
Vgs (Max):	Input Capacitance (Ciss) (Max) @ Vds:
±20V	1330 pF @ 400 V
FET Feature:	Power Dissipation (Max):
-	95W (Tc)
Operating Temperature:	Mounting Type:
-40°C ~ 150°C (TJ)	Surface Mount
Supplier Device Package:	Package / Case:
PG-VSON-4-1	4-PowerTSFN
Base Product Number:	
IPL60R	

Environmental & Export classification

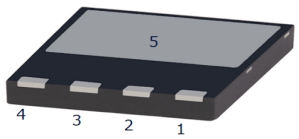
RoHS Status:	Moisture Sensitivity Level (MSL):
ROHS3 Compliant	2A (4 Weeks)
REACH Status:	ECCN:
REACH Unaffected	EAR99
HTSUS:	
8541.29.0095	

IPL60R160CFD7

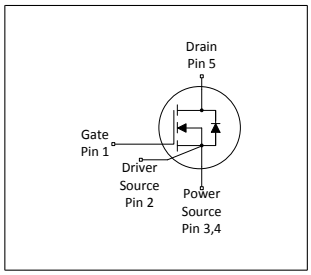
MOSFET

600V CoolMOS™ CFD7 Power Transistor

ThinPAK 8x8



CoolMOS™ is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infeneon Technologies. The latest CoolMOS™ CFD7 is the successor to the CoolMOS™ CFD2 series and is an optimized platform tailored to target soft switching applications such as phase-shift full-bridge (ZVS) and LLC. Resulting from reduced gate charge (Q_g), best-in-class reverse recovery charge (Q_{rr}) and improved turn off behavior CoolMOS™ CFD7 offers highest efficiency in resonant topologies. As part of Infineon's fast body diode portfolio, this new product series blends all advantages of a fast switching technology together with superior hard commutation robustness, without sacrificing easy implementation in the design-in process. The CoolMOS™ CFD7 technology meets highest efficiency and reliability standards and furthermore supports high power density solutions. Altogether, CoolMOS™ CFD7 makes resonant switching topologies more efficient, more reliable, lighter and cooler.



Features

- Ultra-fast body diode
- Low gate charge
- Best-in-class reverse recovery charge (Q_{rr})
- Improved MOSFET reverse diode dv/dt and di_F/dt ruggedness
- Lowest FOM $R_{DS(on)}$*Q_g and $R_{DS(on)}$*E_{oss}
- Best-in-class $R_{DS(on)}$ in SMD and THD packages

Benefits

- Excellent hard commutation ruggedness
- Highest reliability for resonant topologies
- Highest efficiency with outstanding ease-of-use / performance tradeoff
- Enabling increased power density solutions

Potential applications

Suiteable for Soft Switching topologies
Optimized for phase-shift full-bridge (ZVS), LLC Applications – Server, Telecom, EV Charging

Product Validation: Fully qualified according to JEDEC for Industrial Applications

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
$R_{DS(on),max}$	160	mΩ
$Q_{g,typ}$	31	nC
$I_{D,pulse}$	58	A
E_{oss} @ 400V	3.6	µJ
Body diode di_F/dt	1300	A/µs

Type / Ordering Code	Package	Marking	Related Links
IPL60R160CFD7	PG-VSON-4	60R160F7	see Appendix A

600V CoolMOS™ CFD7 Power Transistor
IPL60R160CFD7

Table of Contents

600V CoolMOS™ CFD7 Power Transistor
IPL60R160CFD7

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	- -	- -	16 10.0	A	T_C=25°C T_C=100°C
Pulsed drain current[2)]	$I_{D,pulse}$	-	-	58	A	T_C=25°C
Avalanche energy, single pulse	E_{AS}	-	-	68	mJ	I_D=4.1A; V_{DD}=50V; see table 10
Avalanche energy, repetitive	E_{AR}	-	-	0.34	mJ	I_D=4.1A; V_{DD}=50V; see table 10
Avalanche current, single pulse	I_{AS}	-	-	4.1	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}	-	-	95	W	T_C=25°C
Storage temperature	T_{stg}	-40	-	150	°C	-
Operating junction temperature	T_j	-40	-	150	°C	-
Mounting torque	-	-	-	-	Ncm	-
Continuous diode forward current	I_S	-	-	16	A	T_C=25°C
Diode pulse current[2)]	$I_{S,pulse}$	-	-	58	A	T_C=25°C
Reverse diode dv/dt[3)]	dv/dt	-	-	70	V/ns	V_{DS}=0...400V, I_{SD}<=16A, T_j=25°C see table 8
Maximum diode commutation speed	di_F/dt	-	-	1300	A/µs	V_{DS}=0...400V, I_{SD}<=16A, 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 with identical R_G

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	1.32	°C/W	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	62	°C/W	device on PCB, minimal footprint
Thermal resistance, junction - ambient for SMD version	R_{thJA}	-	35	45	°C/W	Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70µm thickness) copper area for drain connection and cooling. PCB is vertical without air stream cooling.
Soldering temperature, wave- & reflow soldering allowed	T_{sold}	-	-	260	°C	reflow MSL2A

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	$V_{(GS)th}$	3.5	4	4.5	V	V_{DS}=V_{GS}, I_D=0.34mA
Zero gate voltage drain current[1]	I_{DSS}	- -	- 7	1 37	µA	V_{DS}=600V, V_{GS}=0V, T_j=25°C V_{DS}=600V, V_{GS}=0V, T_j=125°C
Gate-source leakage current	I_{GSS}	-	-	100	nA	V_{GS}=20V, V_{DS}=0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	0.130 0.295	0.16 -	Ω	V_{GS}=10V, I_D=6.8A, T_j=25°C V_{GS}=10V, I_D=6.8A, T_j=150°C
Gate resistance	R_G	-	10	-	Ω	f=1MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	1330	-	pF	V_{GS}=0V, V_{DS}=400V, f=250kHz
Output capacitance	C_{oss}	-	24	-	pF	V_{GS}=0V, V_{DS}=400V, f=250kHz
Effective output capacitance, energy related[2]	$C_{o(er)}$	-	44	-	pF	V_{GS}=0V, V_{DS}=0...400V
Effective output capacitance, time related[3]	$C_{o(tr)}$	-	453	-	pF	I_D=constant, V_{GS}=0V, V_{DS}=0...400V
Turn-on delay time	$t_{d(on)}$	-	25	-	ns	V_{DD}=400V, V_{GS}=10V, I_D=7.3A, R_G=5.3Ω; see table 9
Rise time	t_r	-	12.5	-	ns	V_{DD}=400V, V_{GS}=10V, I_D=7.3A, R_G=5.3Ω; see table 9
Turn-off delay time	$t_{d(off)}$	-	84	-	ns	V_{DD}=400V, V_{GS}=10V, I_D=7.3A, R_G=5.3Ω; see table 9
Fall time	t_f	-	5	-	ns	V_{DD}=400V, V_{GS}=10V, I_D=7.3A, R_G=5.3Ω; see table 9

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	8	-	nC	V_{DD}=400V, I_D=7.3A, V_{GS}=0 to 10V
Gate to drain charge	Q_{gd}	-	10	-	nC	V_{DD}=400V, I_D=7.3A, V_{GS}=0 to 10V
Gate charge total	Q_g	-	31	-	nC	V_{DD}=400V, I_D=7.3A, V_{GS}=0 to 10V
Gate plateau voltage	$V_{plateau}$	-	5.7	-	V	V_{DD}=400V, I_D=7.3A, V_{GS}=0 to 10V

[1] Maximum specification is defined by calculated six sigma upper confidence bound
[2] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 400V
[3] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 400V

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Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	1.0	-	V	V_{GS}=0V, I_F=6.8A, T_j=25°C
Reverse recovery time	t_{rr}	-	103	153	ns	V_R=400V, I_F=7.3A, di_F/dt=100A/µs; see table 8
Reverse recovery charge	Q_{rr}	-	0.45	0.9	µC	V_R=400V, I_F=7.3A, di_F/dt=100A/µs; see table 8
Peak reverse recovery current	I_{rrm}	-	7.8	-	A	V_R=400V, I_F=7.3A, di_F/dt=100A/µs; see table 8

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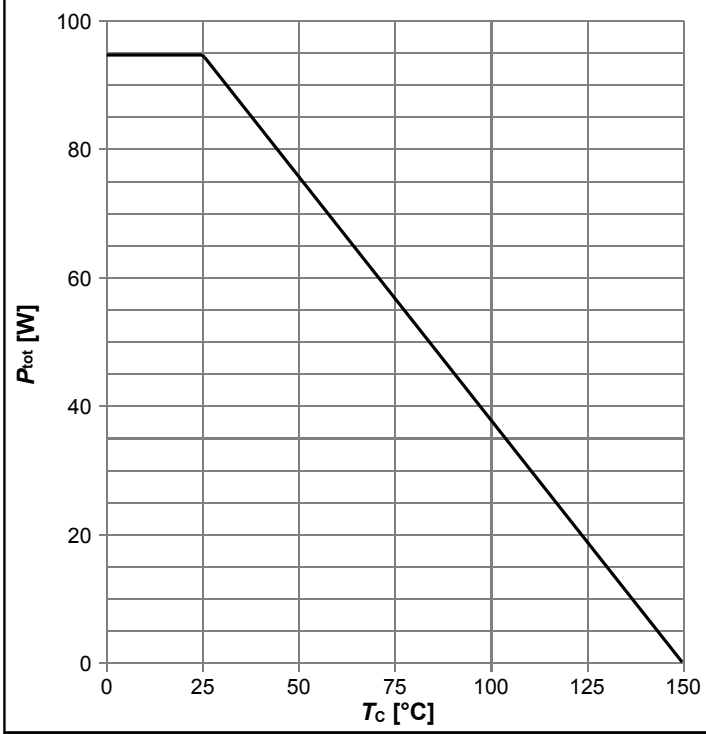
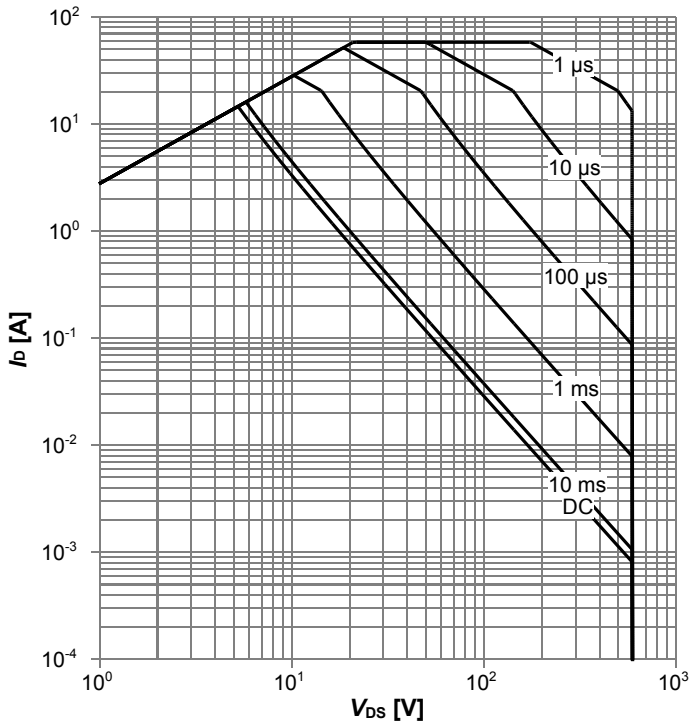
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



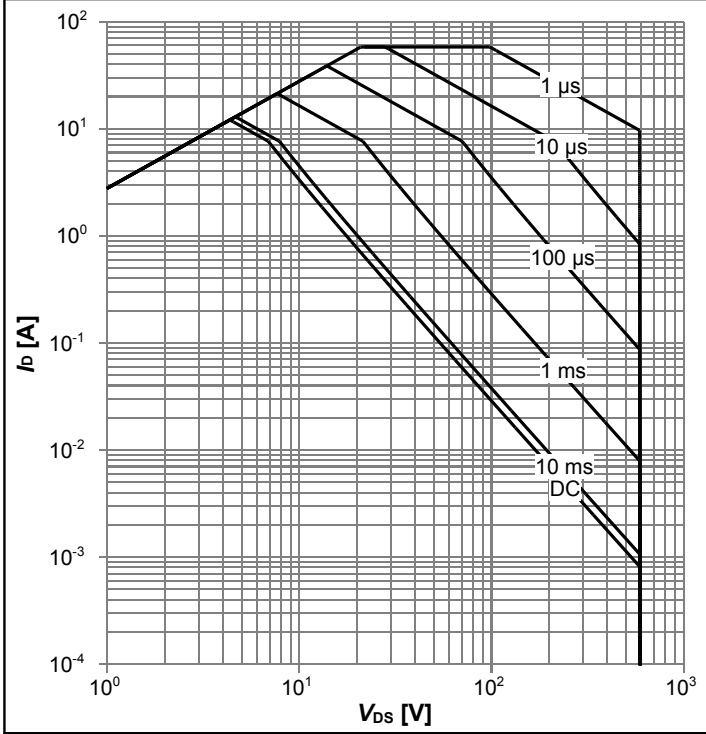
P_{tot}=f(T_C)

Diagram 2: Safe operating area



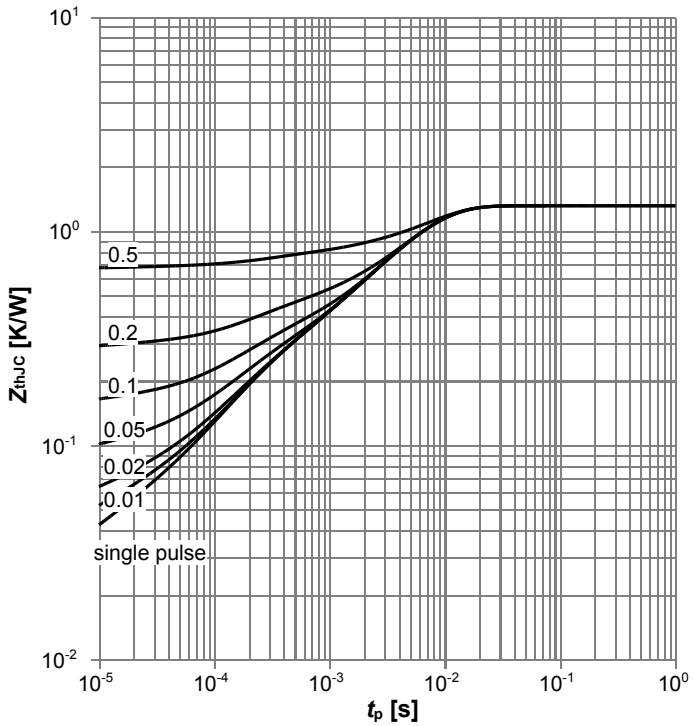
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter: t_p

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

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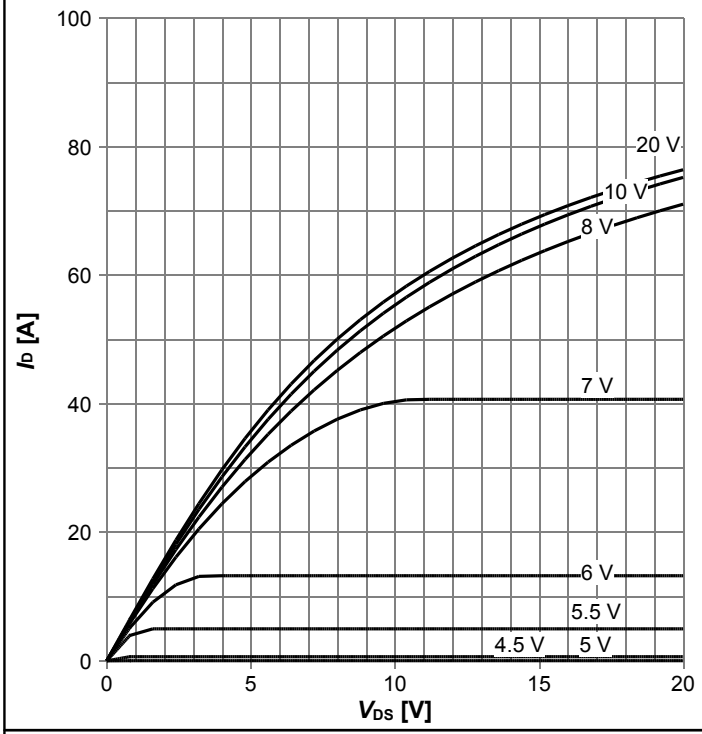
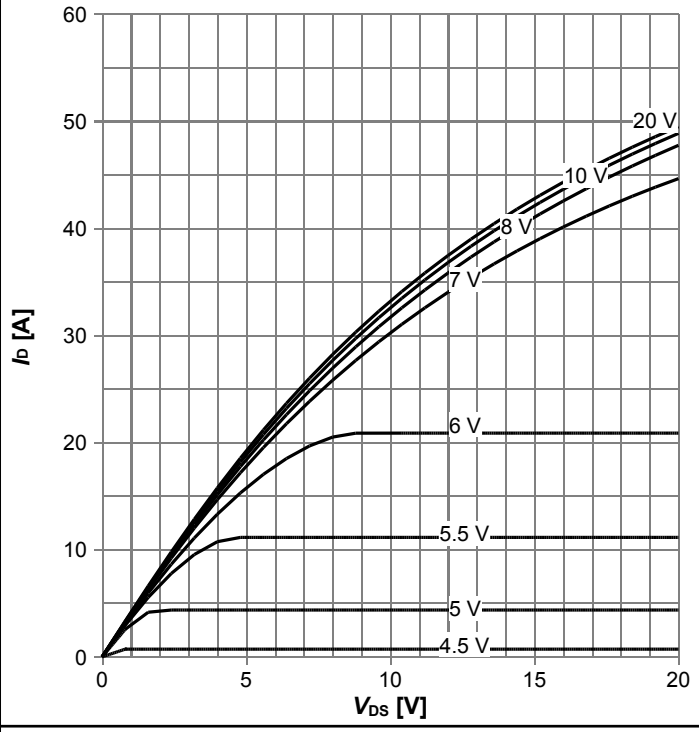
Diagram 5: Typ. output characteristics



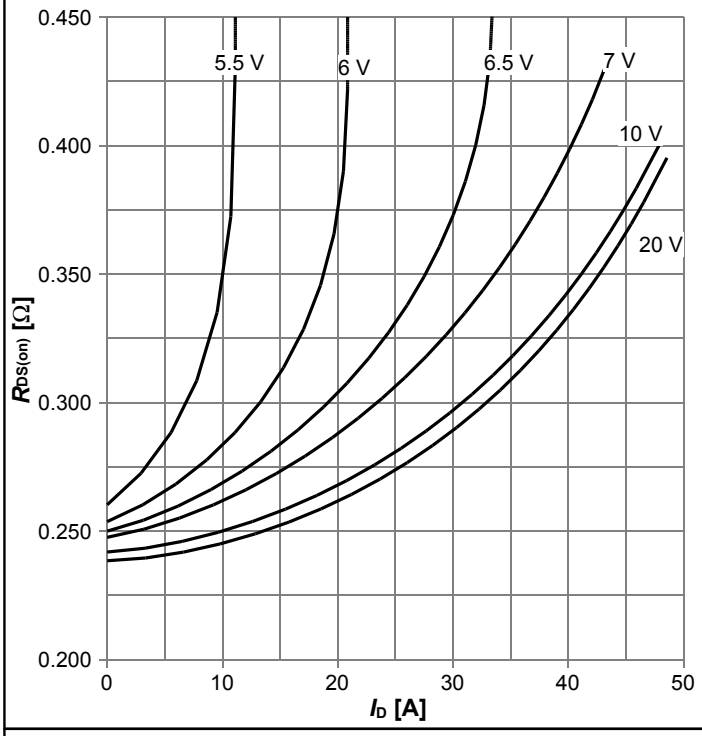
$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. output characteristics



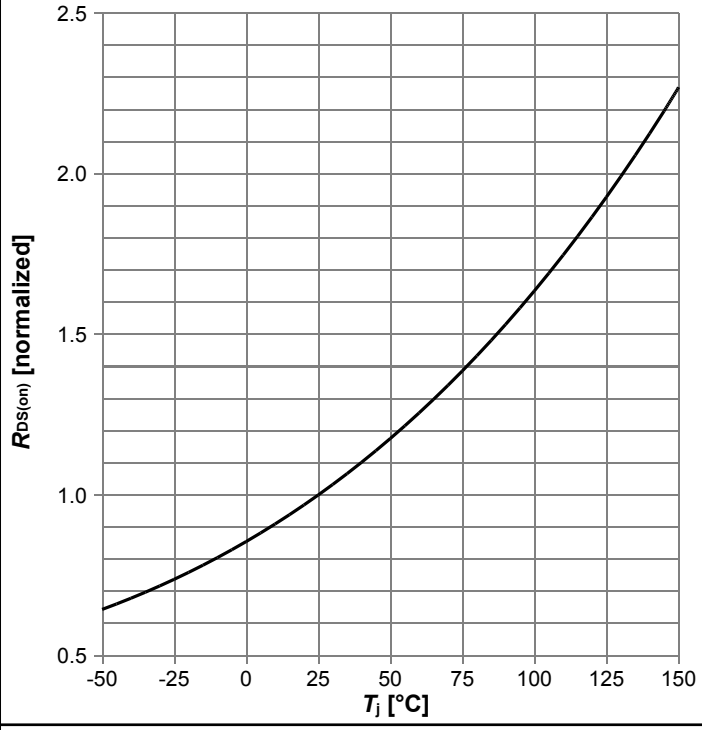
$I_D=f(V_{DS})$; $T_j=125$ °C; parameter: V_{GS}

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



$R_{DS(on)}=f(T_j)$; $I_D=6.8$ A; $V_{GS}=10$ V

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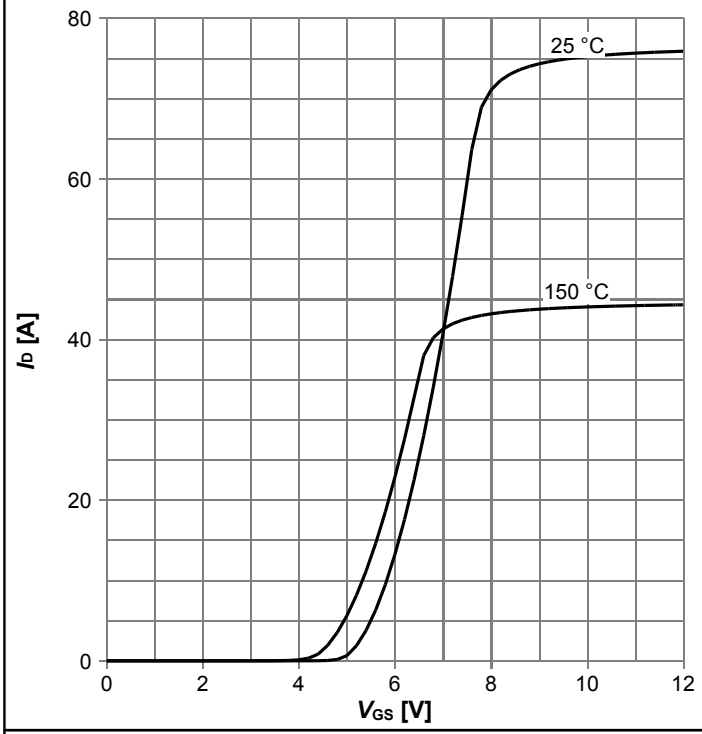
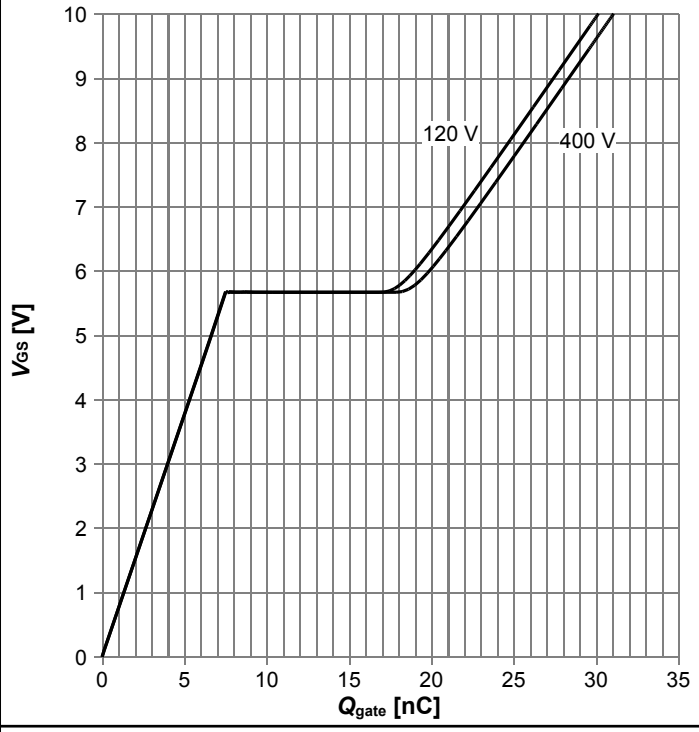
Diagram 9: Typ. transfer characteristics



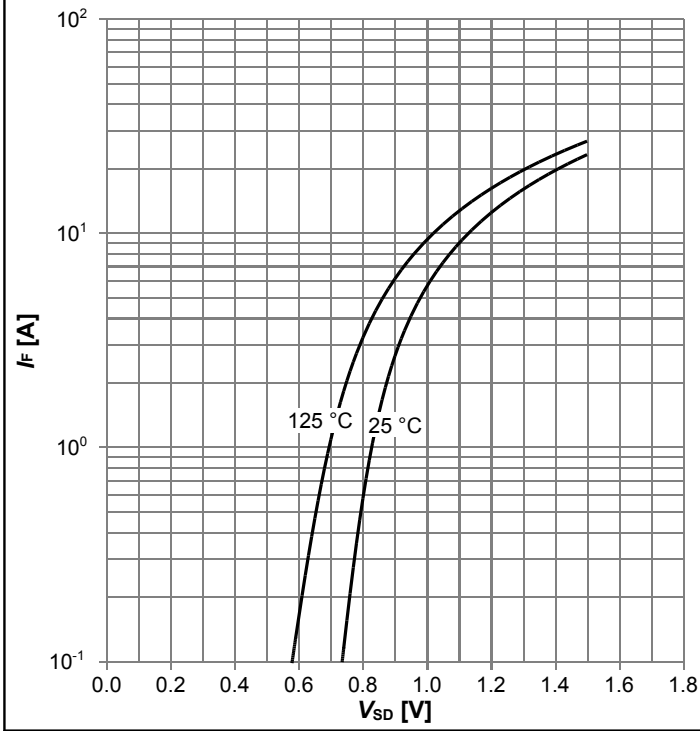
I_D=f(V_{GS}); V_{DS}=20V; parameter: T_j

Diagram 10: Typ. gate charge



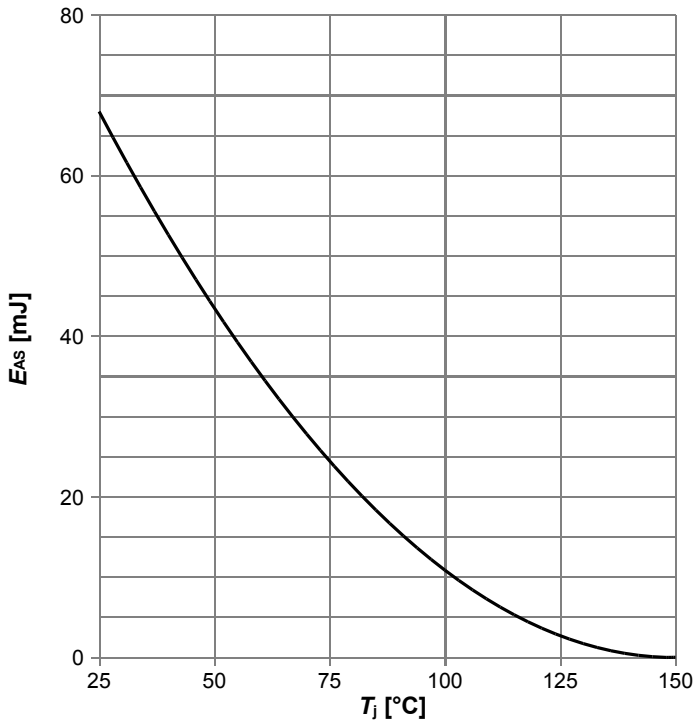
V_{GS}=f(Q_{gate}); I_D=7.3 A pulsed; parameter: V_{DD}

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=4.1 A; V_{DD}=50 V

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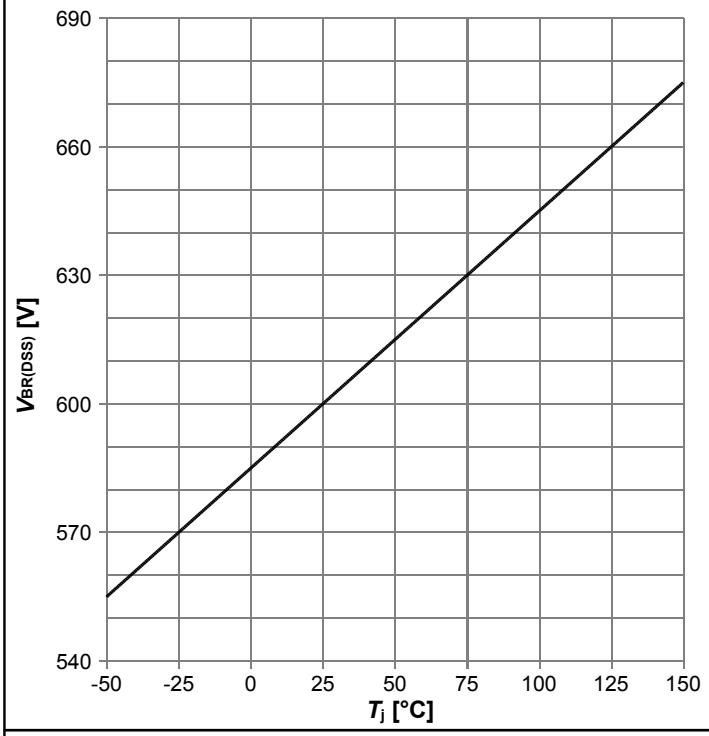
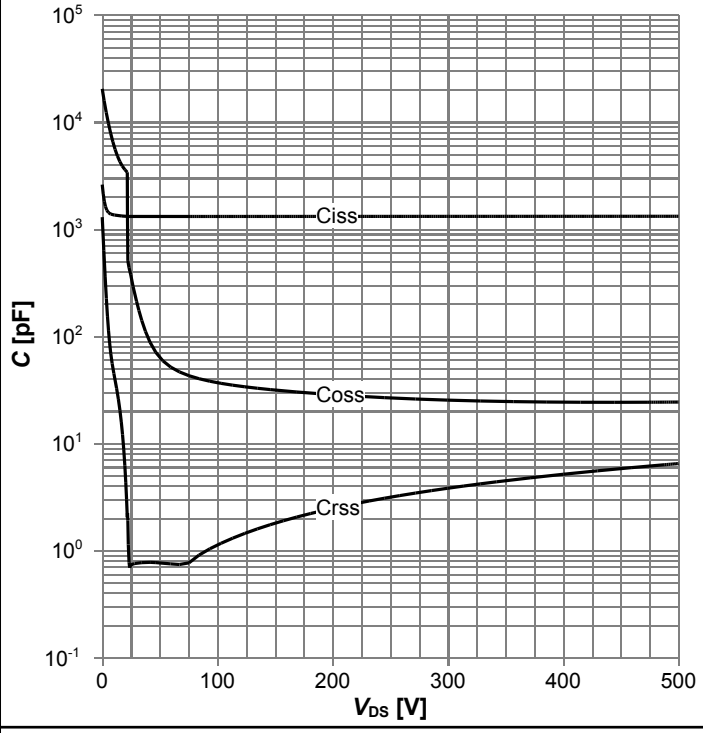
Diagram 13: Drain-source breakdown voltage



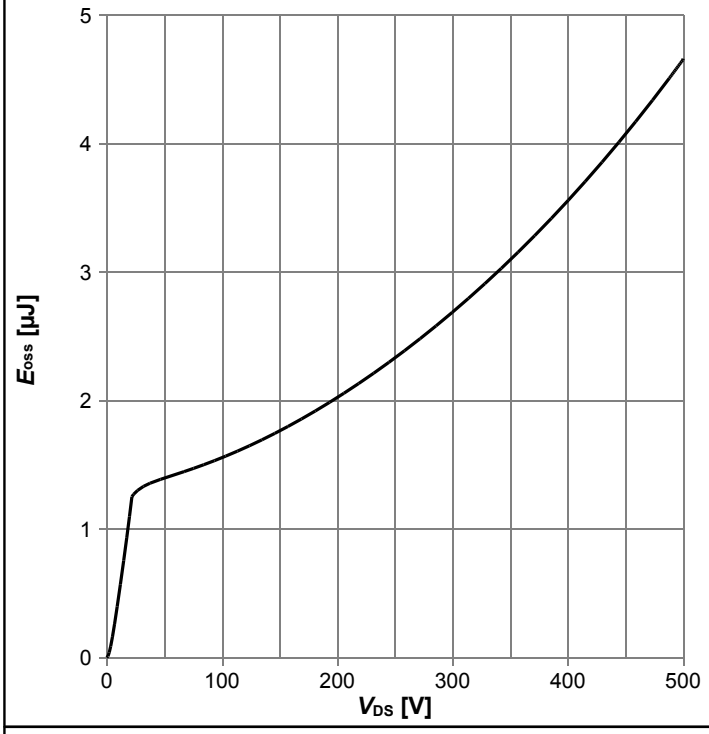
$V_{BR(DSS)}$=f(T_j); I_D=1 mA

Diagram 14: Typ. capacitances



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

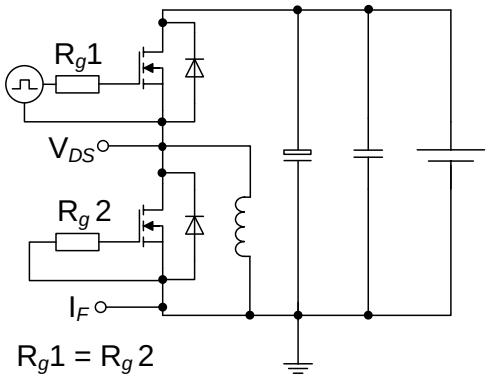
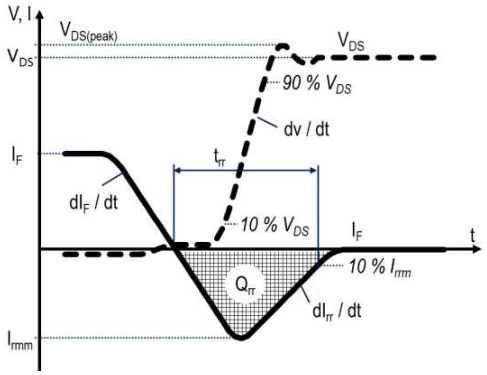
Test circuit for diode characteristics	Diode recovery waveform
	

Table 9 Switching times

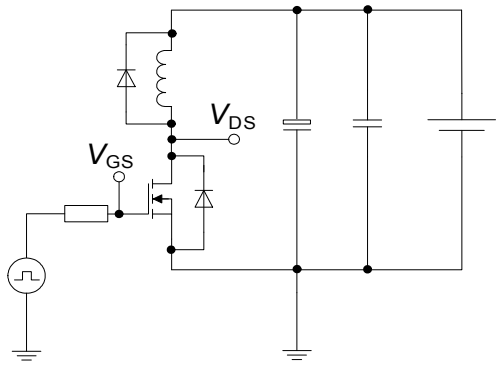
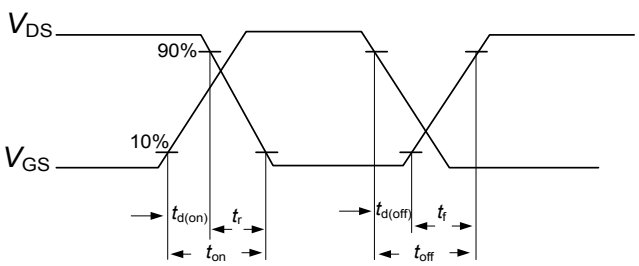
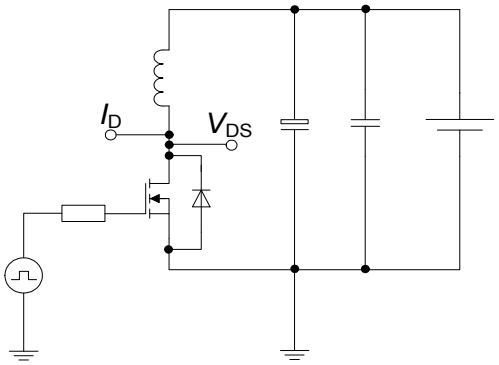
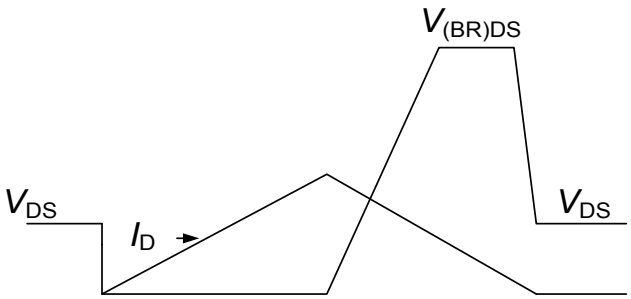
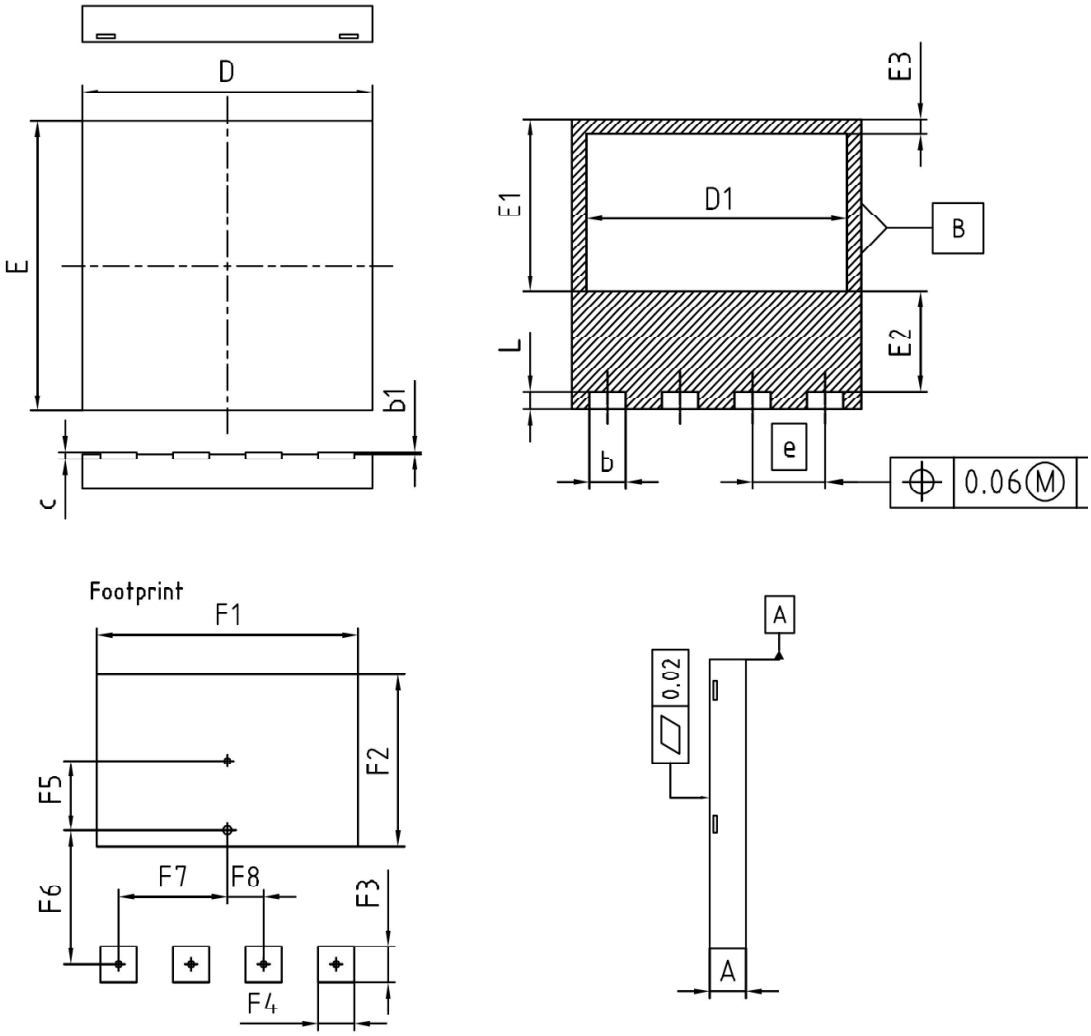
Switching times test circuit for inductive load	Switching times waveform
	

Table 10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

6 Package Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.10	0.035	0.043
b	0.90	1.10	0.035	0.043
b1	0.00	0.05	0.000	0.002
c	0.10	0.30	0.004	0.012
D	7.90	8.10	0.311	0.319
D1	7.10	7.30	0.280	0.287
E	7.90	8.10	0.311	0.319
E1	4.65	4.85	0.183	0.191
E2	2.65	2.85	0.104	0.112
E3	0.30	0.50	0.012	0.020
e	2.00 (BSC)		0.079 (BSC)	
L	0.40	0.60	0.016	0.024
N	4		4	
F1	7.20		0.283	
F2	4.75		0.187	
F3	1.00		0.039	
F4	1.00		0.039	
F5	1.43		0.056	
F6	4.20		0.165	
F7	3.00		0.118	
F8	1.00		0.039	

DOCUMENT NO.
Z8B00156707

SCALE 0 2.5 0 2.5 5mm

EUROPEAN PROJECTION

ISSUE DATE
05-04-2010

REVISION
01

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

7 Appendix A

Table 11 Related Links

- **IFX CoolMOS CFD7 Webpage:** www.infineon.com
- **IFX CoolMOS CFD7 application note:** www.infineon.com
- **IFX CoolMOS CFD7 simulation model:** www.infineon.com
- **IFX Design tools:** www.infineon.com

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IPL60R160CFD7

Revision History

IPL60R160CFD7

Revision: 2018-11-05, Rev. 2.1

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2018-04-20	Release of final version
2.1	2018-11-05	Table 7: Reduced trr,max value; Change of qualification grade nomenclature

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