MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CFDA Automotive

650V CoolMOS™ CFDA Power Transistor
IPD65R420CFDA

Data Sheet

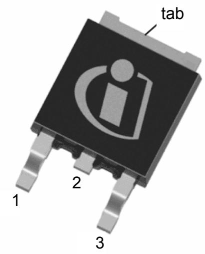
Rev. 2.1
Final

Automotive

1 Description

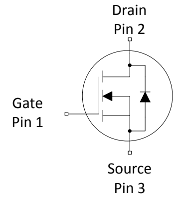
CoolMOS™ is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infineon Technologies. 650V CoolMOS™ CFDA series combines the experience of the leading SJ MOSFET supplier with high class innovation. The resulting devices provide all benefits of a fast switching SJ MOSFET while offering an extremely fast and robust body diode. This combination of extremely low switching, commutation and conduction losses together with highest robustness make especially resonant switching applications more reliable, more efficient, lighter, and cooler.

DPAK



Features

- Ultra-fast body diode
- Very high commutation ruggedness
- Extremely low losses due to very low FOM Rdson*Qg and Eoss
- Easy to use/drive
- Qualified according to AEC Q101
- Green package (RoHS compliant), Pb-free plating, halogen free for mold compound



Applications

650V CoolMOS™ CFDA is designed for switching applications.

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	650	V
RDS(on),max	0.42	Ω
Qg,typ	90	nC
ID,pulse	80	A
Eoss @ 400V	2.8	µJ
Body diode di/dt	500	A/µs
Qrr	0.7	µC
trr	140	ns
Irrm	8.8	A

Type / Ordering Code	Package	Marking	Related Links
IPD65R420CFDA	PG-TO 252	65F420A	-

Table of Contents

Description 2
Table of Contents 3
Maximum ratings 4
Thermal characteristics 5
Electrical characteristics 6
Electrical characteristics diagrams 8
Test Circuits 12
Package Outlines 13
Revision History 14
Disclaimer 14

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			8.7	A	T_C = 25°C
				5.5		T_C = 100°C
Pulsed drain current[2]	$I_{D,pulse}$			27	A	T_C = 25°C
Avalanche energy, single pulse	E_{AS}			227	mJ	I_D = 1.8A, V_{DD} = 50V
Avalanche energy, repetitive	E_{AR}			0.34	mJ	I_D = 1.8A, V_{DD} = 50V
Avalanche current, repetitive	I_{AR}			1.8	A	
MOSFET dv/dt ruggedness	dv/dt			50	V/ns	V_{DS} = 0 ... 400V
Gate source voltage	V_{GS}	-20		20	V	static
		-30		30		AC (f > 1 Hz)
Power dissipation (SMD) DPAK	P_{tot}			83.3	W	T_C = 25°C
Operating and storage temperature	T_j, T_{stg}	-40		150	°C	
Continuous diode forward current	I_S			8.7	A	T_C = 25°C
Diode pulse current	$I_{S,pulse}$			27	A	T_C = 25°C
Reverse diode dv/dt[3]	dv/dt			50	V/ns	V_{DS} = 0 ... 400V, $I_{SD} \leq I_D$, T_j = 25°C
Maximum diode commutation speed	di_f/dt			900	A/µs	

[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

3 Thermal characteristics

Table 3 Thermal characteristics DPAK

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}			1.5	K/W	
Thermal resistance, junction - ambient[1)]	R_{thJA}			62	K/W	SMD version, device on PCB, minimal footprint
			35			SMD version, device on PCB, 6cm² cooling area
Soldering temperature, wave- & reflowsoldering allowed	T_{sold}			260	°C	reflow MSL

[1)] Device on 40mm*40mm*1.5mm one layer epoxy PCB FR4 with 6cm² copper area (thickness 70µm) for drain connection. PCB is vertical without air stream cooling.

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	$V_{GS(th)}$	3.5	4	4.5	V	V_{DS} = V_{GS}, I_D = 0.3445mA
Zero gate voltage drain current	I_{DSS}			5	µA	V_{DS} = 650V, V_{GS} = 0V, T_j = 25°C
			600			V_{DS} = 650V, 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	$R_{DS(on)}$		0.378	0.42	Ω	V_{GS} = 10V, I_D = 3.4A, T_j = 25°C
			0.983			V_{GS} = 10V, I_D = 3.4A, T_j = 150°C
Gate resistance	R_G		4		Ω	f = 1MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}		870		pF	V_{GS} = 0V, V_{DS} = 100V, f = 1MHz
Output capacitance	C_{oss}		45		pF	
Effective output capacitance, energy related[1]	$C_{o(er)}$		36		pF	V_{GS} = 0V, V_{DS} = 0 ... 400V
Effective output capacitance, time related[2]	$C_{o(tr)}$		161		pF	I_D = constant, V_{GS} = 0V, V_{DS} = 0 ... 400V
Turn-on delay time	$t_{d(on)}$		10		ns	V_{DD} = 400V, V_{GS} = 13V, I_D = 5.2A, R_G = 3.4Ω
Rise time	t_r		7		ns	
Turn-off delay time	$t_{d(off)}$		38		ns	
Fall time	t_f		8		ns	

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}		5.5		nC	V_{DD} = 480V, I_D = 5.2A, V_{GS} = 0 to 10V
Gate to drain charge	Q_{gd}		17.5		nC	
Gate charge total	Q_g		32		nC	
Gate plateau voltage	$V_{plateau}$		6.4		V	

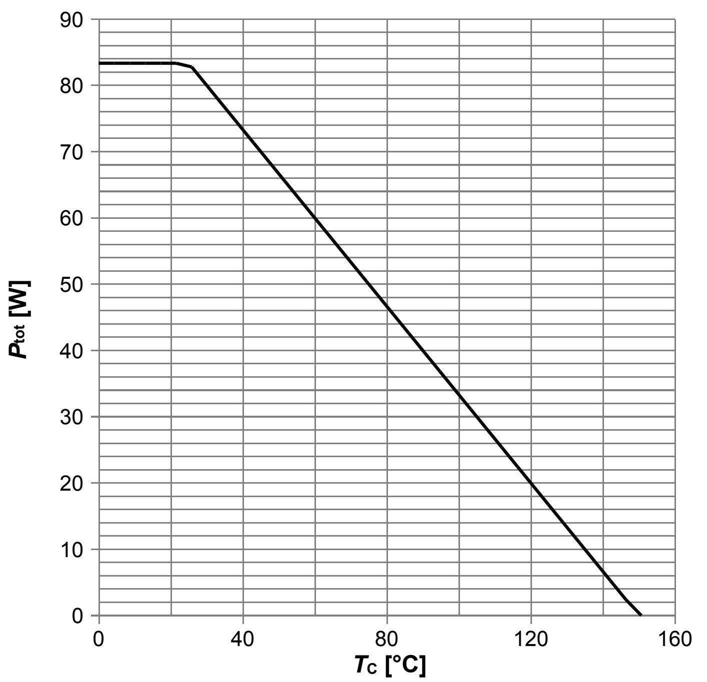
[1] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 400V
[2] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 400V

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 = 5.2A, T_j = 25°C
Reverse recovery time	t_{rr}		90		ns	V_R = 400V, I_F = 5.2A, di_F/dt = 100A/µs (see table 8)
Reverse recovery charge	Q_{rr}		0.3		µC	
Peak reverse recovery current	I_{rrm}		6.2		A	

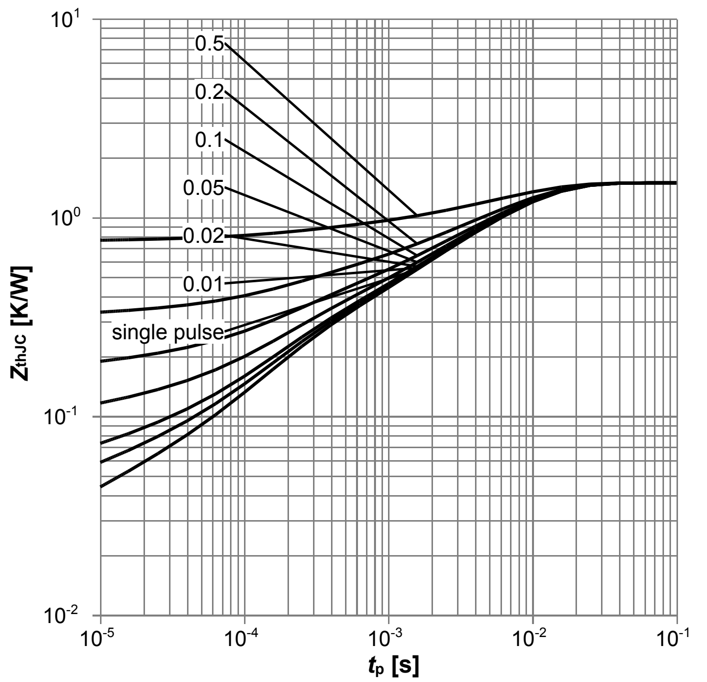
5 Electrical characteristics diagrams

Power dissipation



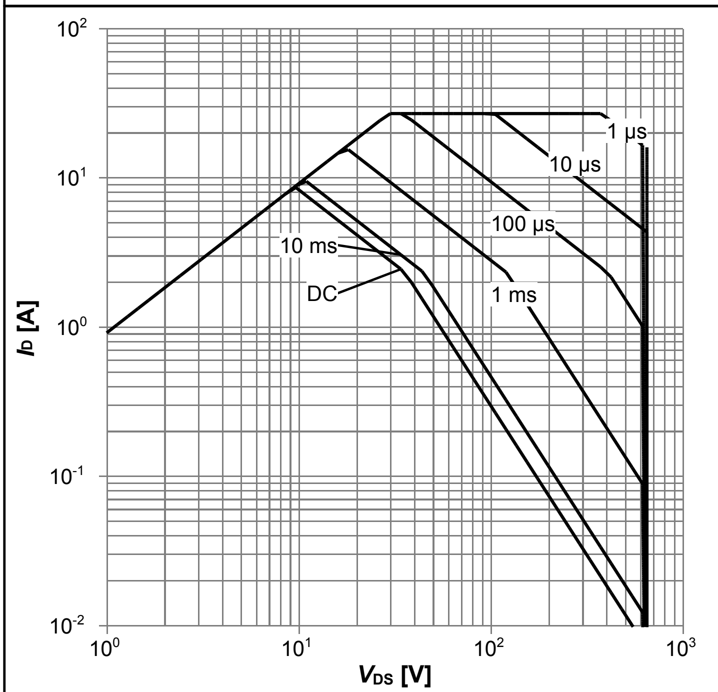
P_{tot}=f(T_C)

Max. transient thermal impedance



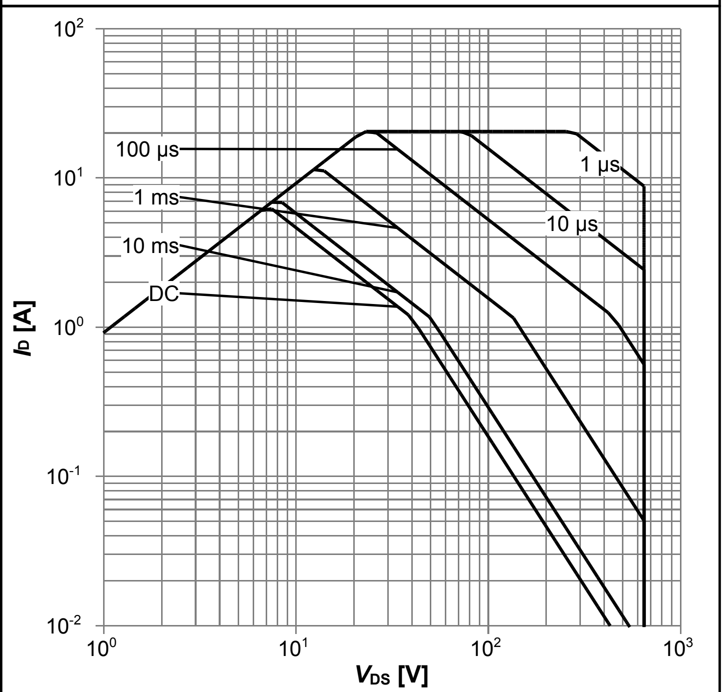
Z_{thJC} =f(t_P); parameter: D=t_p/T

Safe operating area



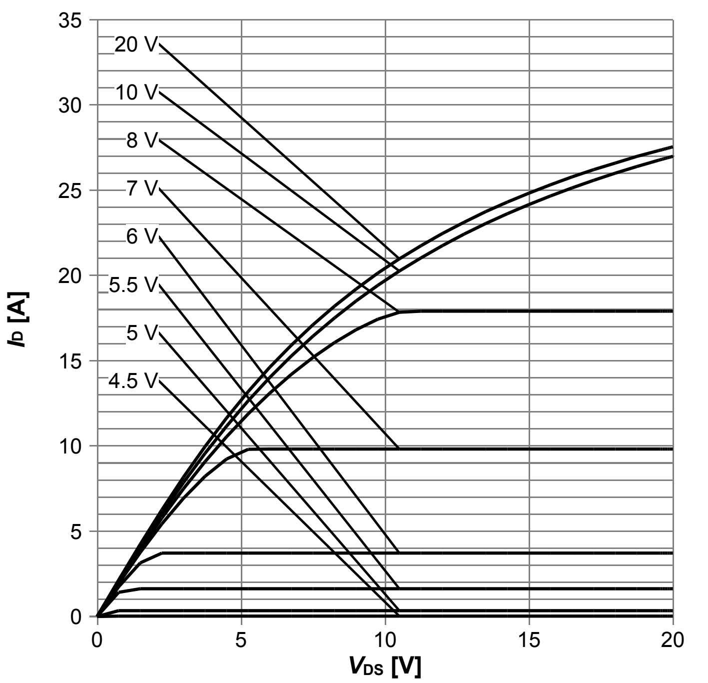
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter: t_p

Safe operating area



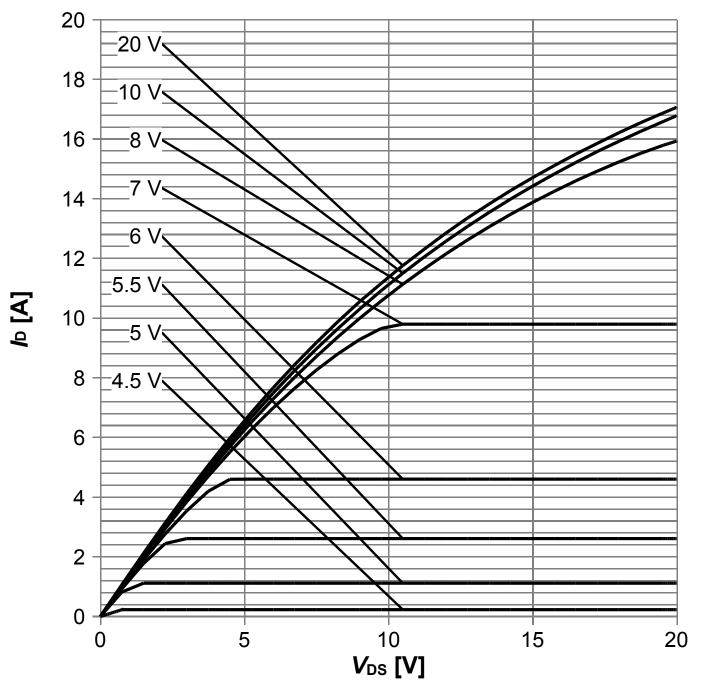
I_D=f(V_{DS}); T_C=80 °C; D=0; parameter: t_p

Typ. output characteristics



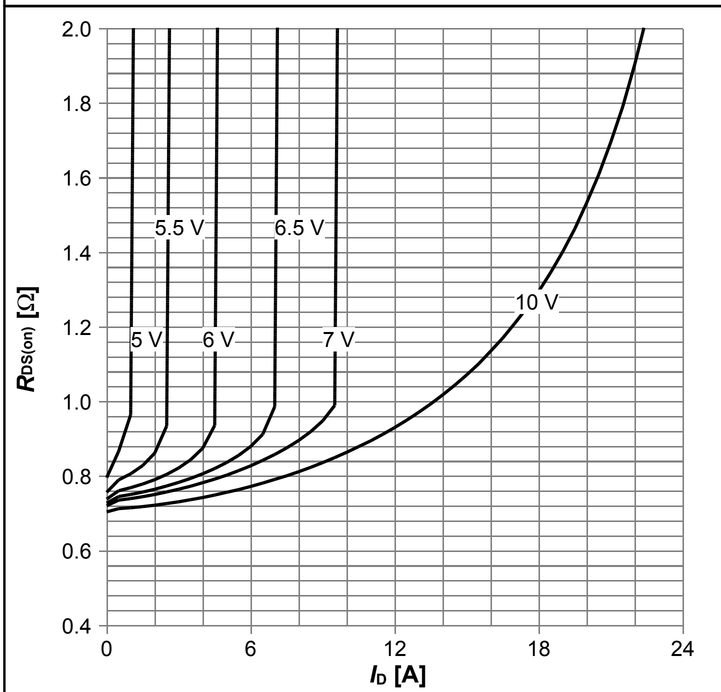
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}

Typ. output characteristics



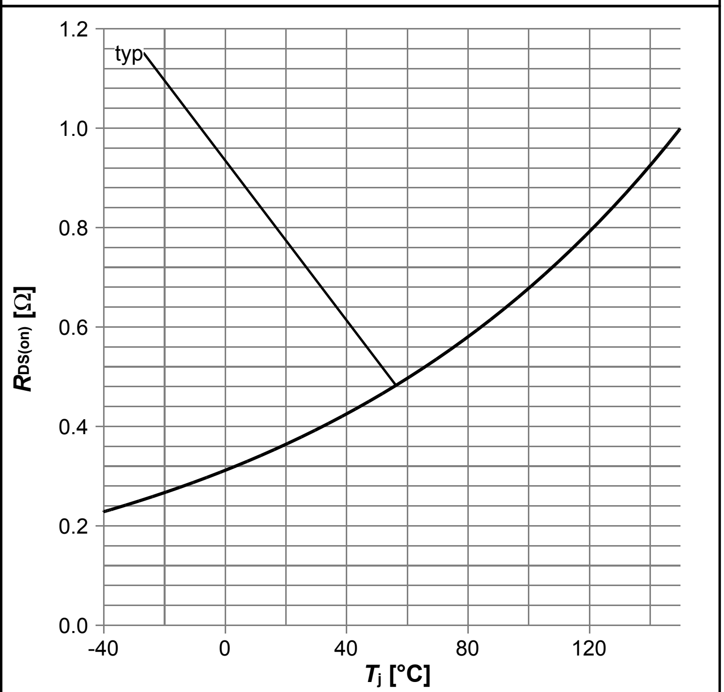
I_D=f(V_{DS}); T_j=125 °C; parameter: V_{GS}

Typ. drain-source on-state resistance



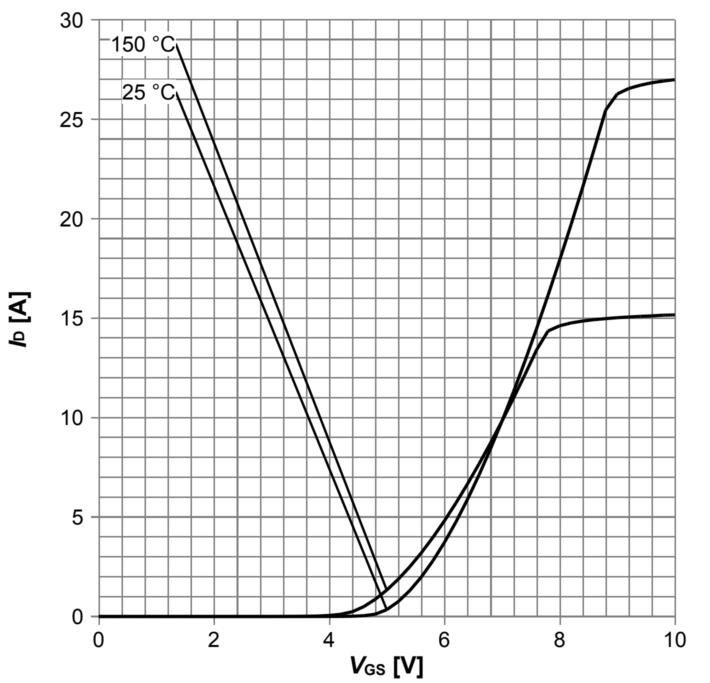
$R_{DS(on)}$=f(I_D); T_j=125 °C; parameter: V_{GS}

Typ. drain-source on-state resistance



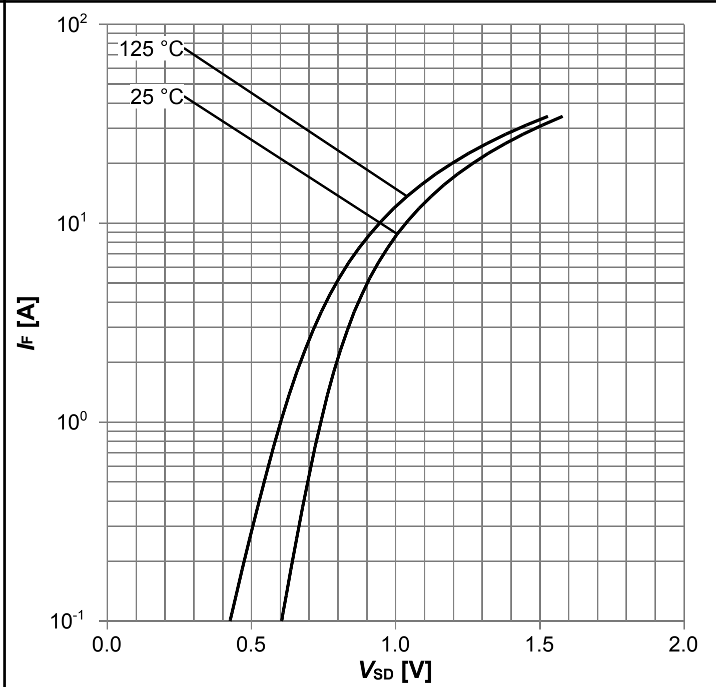
$R_{DS(on)}$=f(T_j); I_D=18.1 A; V_{GS}=10 V

Typ. transfer characteristics



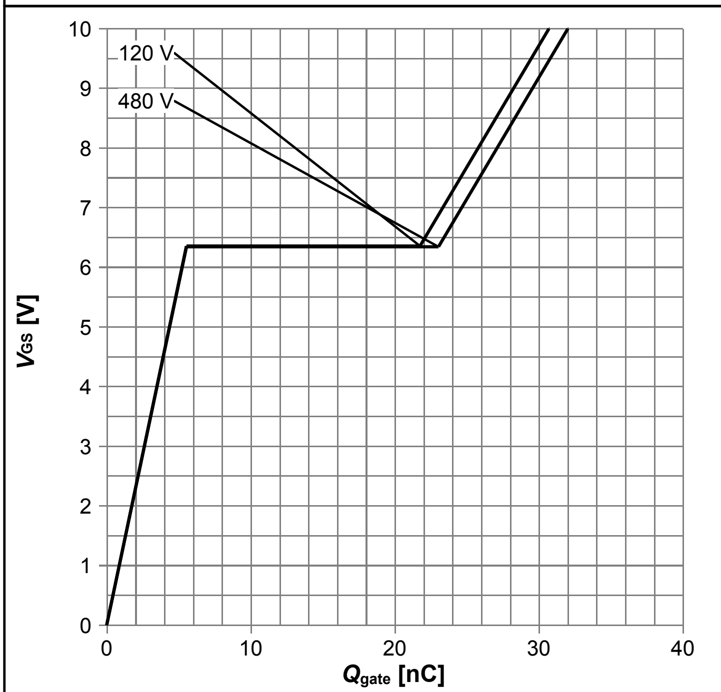
I_D=f(V_{GS}); |V_{DS}|>2|I_D|$R_{DS(on)max}$; parameter: T_j

Typ. forward characteristics of reverse diode



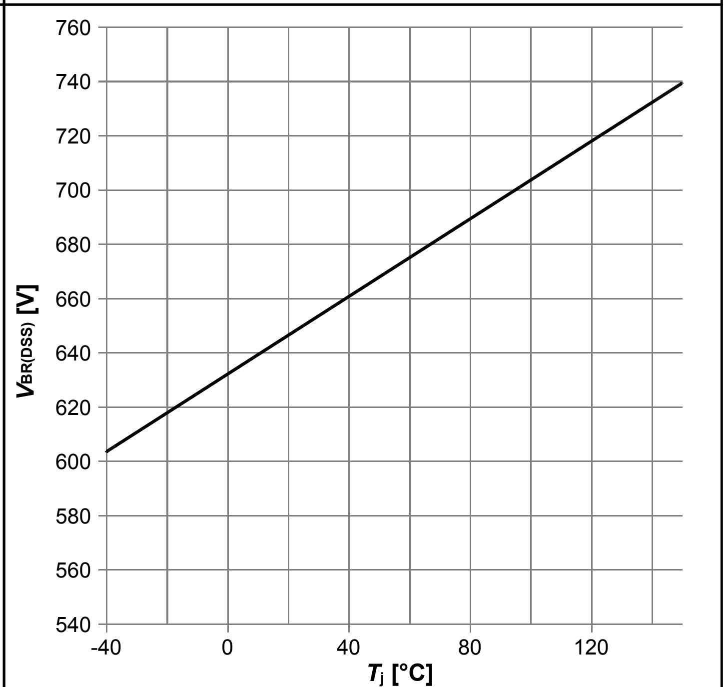
I_F=f(V_{SD}); parameter: T_j

Typ. gate charge



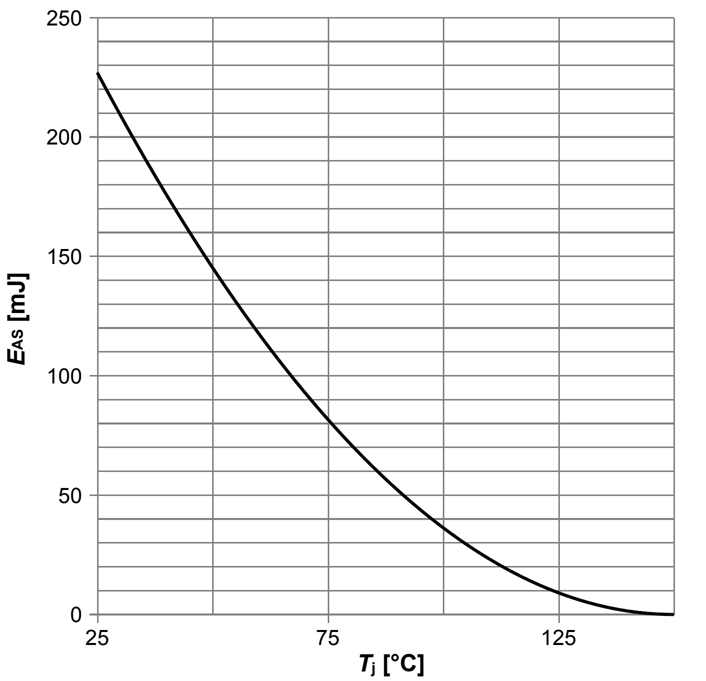
V_{GS}=f(Q_{gate}); I_D=5.1 A pulsed; parameter: V_{DD}

Drain-source breakdown voltage



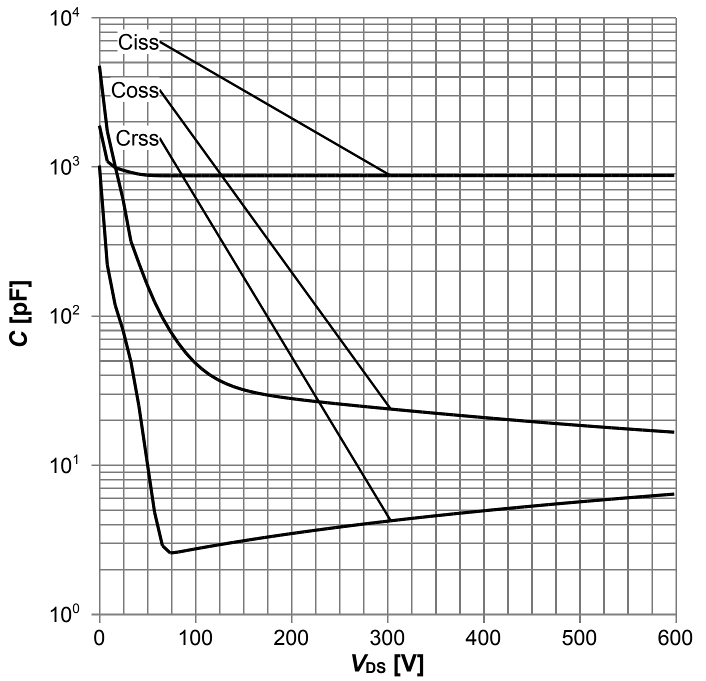
$V_{BR(DSS)}$=f(T_j); I_D=0.25 mA

Avalanche energy



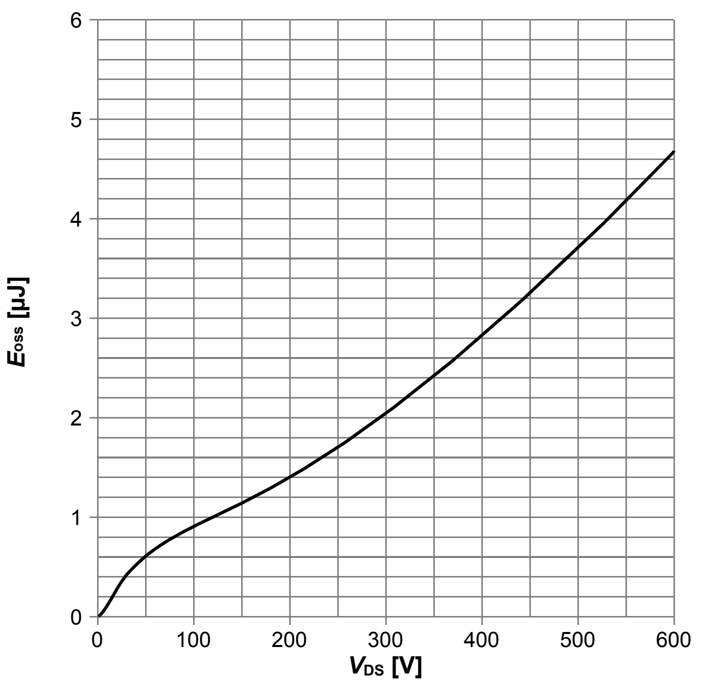
E_{AS}=f(T_j); I_D=1.8 A; V_{DD}=50 V

Typ. capacitances



C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Typ. Coss stored energy



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

6 Test Circuits

Table 8 Diode characteristics

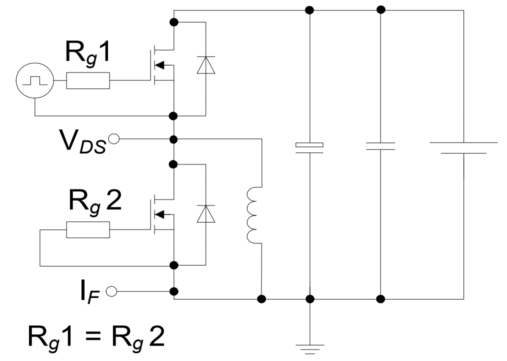
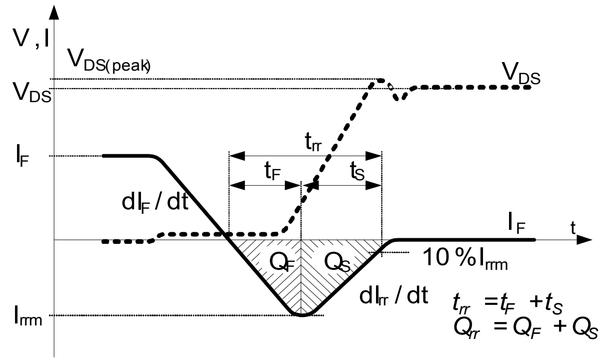
Test circuit for diode characteristics	Diode recovery waveform
	

Table 9 Switching times

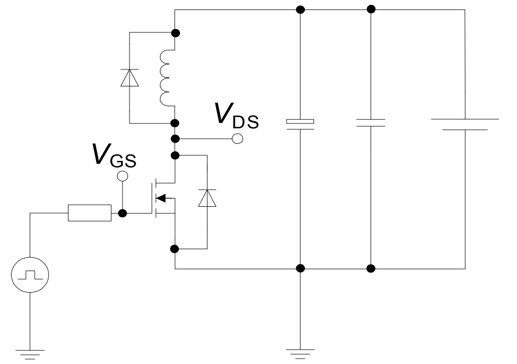
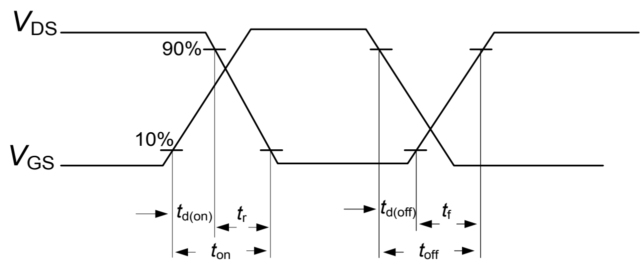
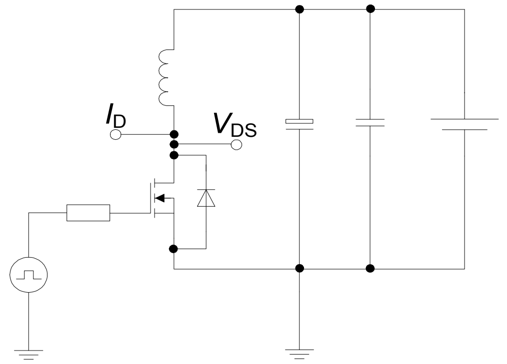
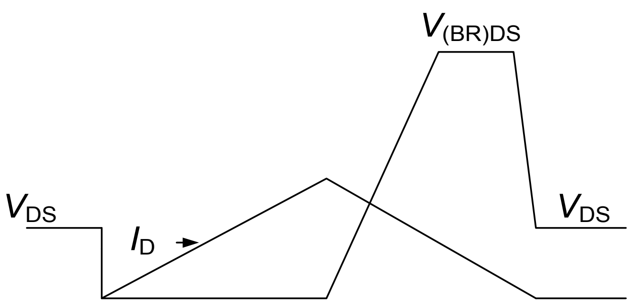
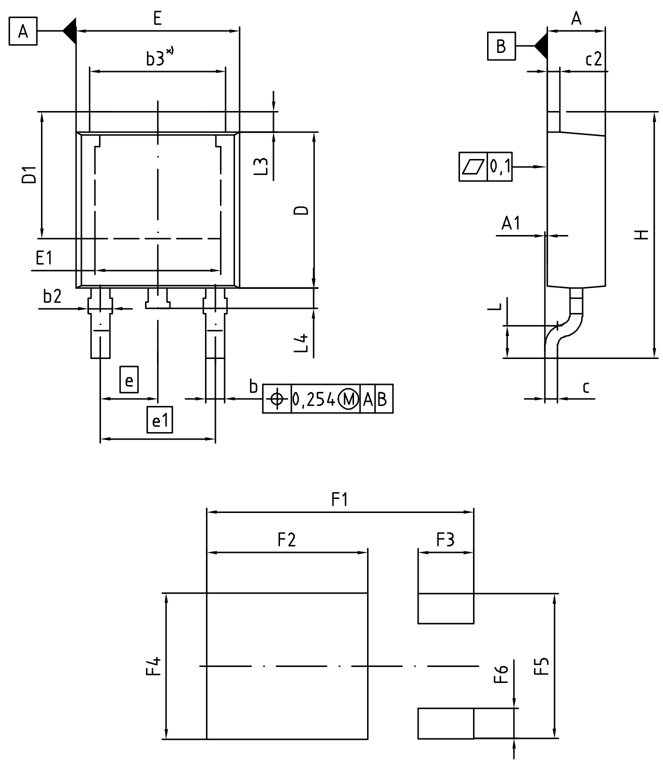
Switching times test circuit for inductive load	Switching times waveform
	

Table 10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

7 Package Outlines

TO252-3 (DPAK)



*) mold flash not included

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.16	2.41	0.085	0.095
A1	0.00	0.15	0.000	0.006
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b3	5.00	5.50	0.197	0.217
c	0.46	0.60	0.018	0.024
c2	0.46	0.98	0.018	0.039
D	5.97	6.22	0.235	0.245
D1	5.02	5.84	0.198	0.230
E	6.40	6.73	0.252	0.265
E1	4.70	5.21	0.185	0.205
e	2.29 (BSC)		0.090 (BSC)	
e1	4.57		0.180	
N	3		3	
H	9.40	10.48	0.370	0.413
L	1.18	1.70	0.046	0.067
L3	0.90	1.25	0.035	0.049
L4	0.51	1.00	0.020	0.039
F1	10.60		0.417	
F2	6.40		0.252	
F3	2.20		0.087	
F4	5.80		0.228	
F5	5.76		0.227	
F6	1.20		0.047	

DOCUMENT NO.
Z8B00003328

SCALE 0 2.0 4mm

EUROPEAN PROJECTION

ISSUE DATE
16-02-2011

REVISION
04

Figure 1 Outline PG-TO 252, dimensions in mm/inches

Revision History

IPD65R420CFDA

Revision: 2015-02-11, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2012-07-12	Preliminary
2.1	2015-02-11	Correction of Marking Code

Disclaimer ATV

We Listen to Your Comments
Any information within this document that you feel is wrong, unclear or missing at all? Your feedback will help us to continuously improve the quality of this document. Please send your proposal (including a reference to this document) to:
erratum@infineon.com

Edition 2011-09-30
Published by
Infineon Technologies AG
81726 München, Germany

Legal Disclaimer
The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie"). With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.
Information
For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office (**www.infineon.com**).

Warnings
Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.
Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life.
If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)
Факс: 8 (812) 320-02-42
Электронная почта: org@eplast1.ru
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.