MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CFDA Automotive

650V CoolMOS™ CFDA Power Transistor
IPW65R080CFDA

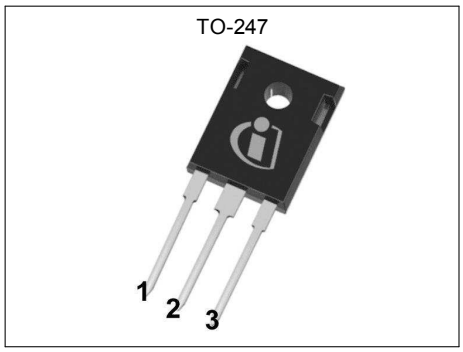
Data Sheet

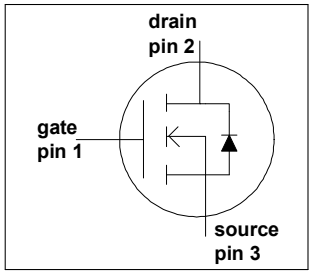
Rev. 2.0
Final

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.





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	0.08	Ω
Qg,typ	161	nC
ID,pulse	137	A
Eoss @ 400V	12.5	µJ
Body diode di/dt	900	A/µs
Qrr	1.2	µC
trr	180	ns
Irrm	10	A

Type / Ordering Code	Package	Marking	Related Links
IPW65R080CFDA	PG-TO 247	65F6080A	-

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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			43.3	A	T_C = 25°C
				27.4		T_C = 100°C
Pulsed drain current[2]	$I_{D,pulse}$			137	A	T_C = 25°C
Avalanche energy, single pulse	E_{AS}			1160	mJ	I_D = 8.7A, V_{DD} = 50V (see table 18)
Avalanche energy, repetitive	E_{AR}			1.76	mJ	I_D = 8.7A, V_{DD} = 50V
Avalanche current, repetitive	I_{AR}			8.7	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 (non FullPAK) TO-247	P_{tot}			391	W	T_C = 25°C
Operating and storage temperature	T_j, T_{stg}	-40		150	°C	
Mounting torque (non FullPAK) TO-247				60	Ncm	M3 and M3.5 screws
Continuous diode forward current	I_S			43.3	A	T_C = 25°C
Diode pulse current	$I_{S,pulse}$			140	A	T_C = 25°C
Reverse diode dv/dt[3]	dv/dt			50	V/ns	V_{DS} = 0 ... 400V, $I_{SD} \le I_D$, T_j = 25°C (see table 16)
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 TO-247

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}			0.32	K/W	
Thermal resistance, junction - ambient	R_{thJA}			62	K/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[1]	$V_{(BR)DSS}$	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 = 1.76mA
Zero gate voltage drain current	I_{DSS}			2	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	$R_{DS(on)}$		0.072	0.08	Ω	V_{GS} = 10V, I_D = 17.6A, T_j = 25°C
			0.19			V_{GS} = 10V, I_D = 17.6A, T_j = 150°C
Gate resistance	R_G		0.75		Ω	f = 1MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}		4440		pF	V_{GS} = 0V, V_{DS} = 100V, f = 1MHz
Output capacitance	C_{oss}		210		pF	
Effective output capacitance, energy related[2]	$C_{o(er)}$		160		pF	V_{GS} = 0V, V_{DS} = 0 ... 400V
Effective output capacitance, time related[3]	$C_{o(tr)}$		754		pF	I_D = constant, V_{GS} = 0V, V_{DS} = 0 ... 400V
Turn-on delay time	$t_{d(on)}$		20		ns	V_{DD} = 400V, V_{GS} = 13V, I_D = 26.3A, R_G = 1.8Ω (see table 17)
Rise time	t_r		18		ns	
Turn-off delay time	$t_{d(off)}$		85		ns	
Fall time	t_f		6		ns	

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}		28		nC	V_{DD} = 480V, I_D = 26.3A, V_{GS} = 0 to 10V
Gate to drain charge	Q_{gd}		87		nC	
Gate charge total	Q_g		161		nC	
Gate plateau voltage	$V_{plateau}$		6.4		V	

[1] For applications with applied blocking voltage > 65% of the specified blocking voltage, we recommend to evaluate the impact of the cosmic radiation effect in early design phase. For assessment please contact local Infineon sales office.

[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

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 = 26.3A, T_j = 25°C
Reverse recovery time	t_{rr}		180		ns	V_R = 400V, I_F = 26.3A, di_F/dt = 100A/µs (see table 16)
Reverse recovery charge	Q_{rr}		1.2		µC	
Peak reverse recovery current	I_{rrm}		10		A	

5 Electrical characteristics diagrams

Table 8

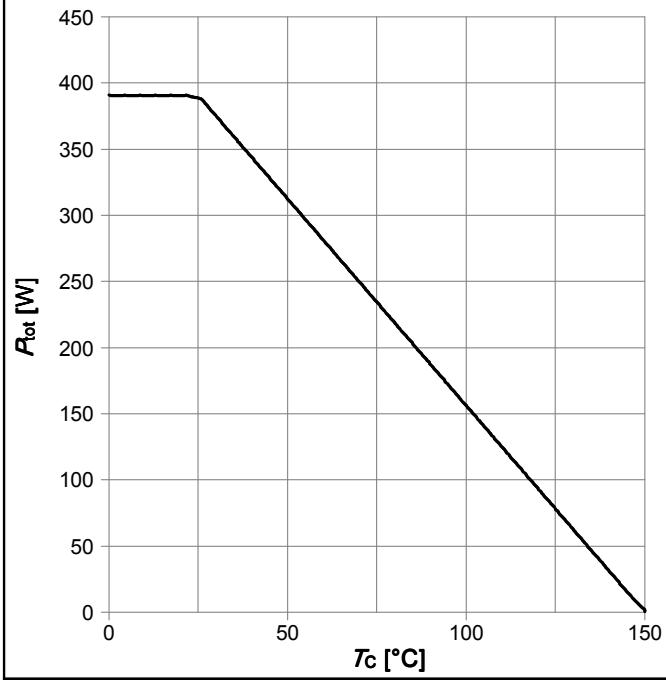
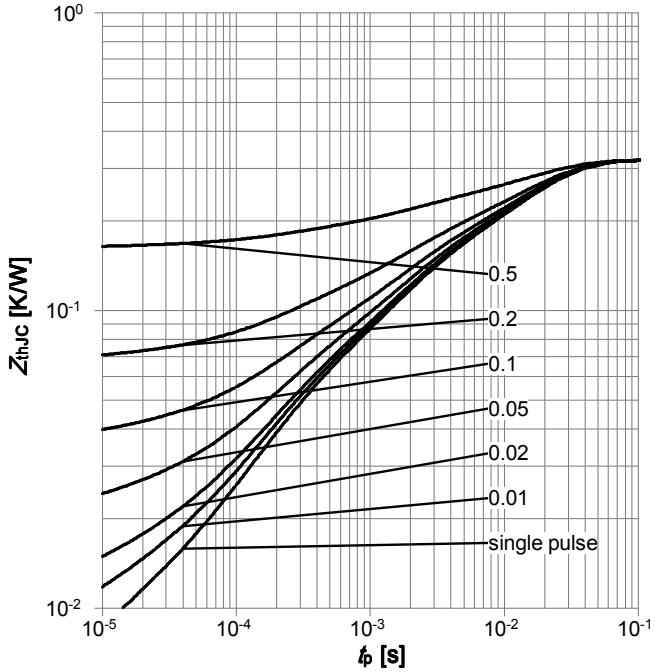
Power dissipation	Max. transient thermal impedance
	
$P_{tot}=f(T_C)$	$Z_{thJC}=f(t_P)$; parameter: $D=t_p/T$

Table 9

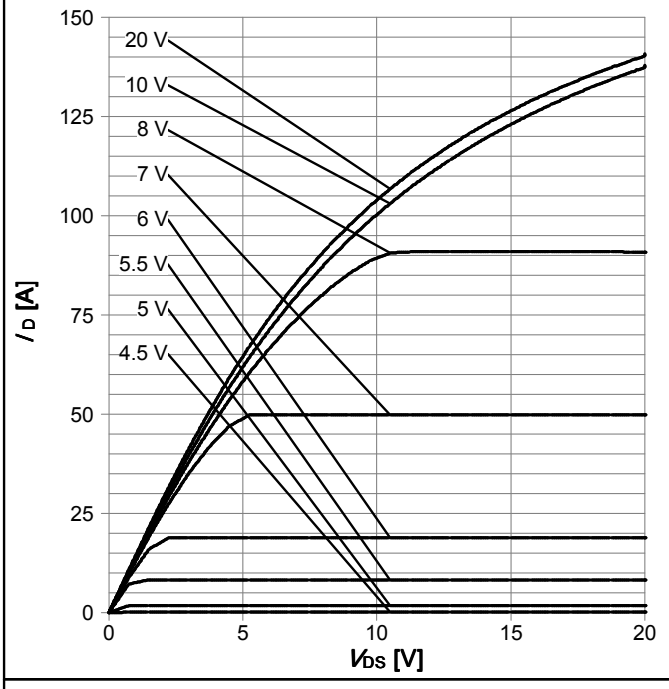
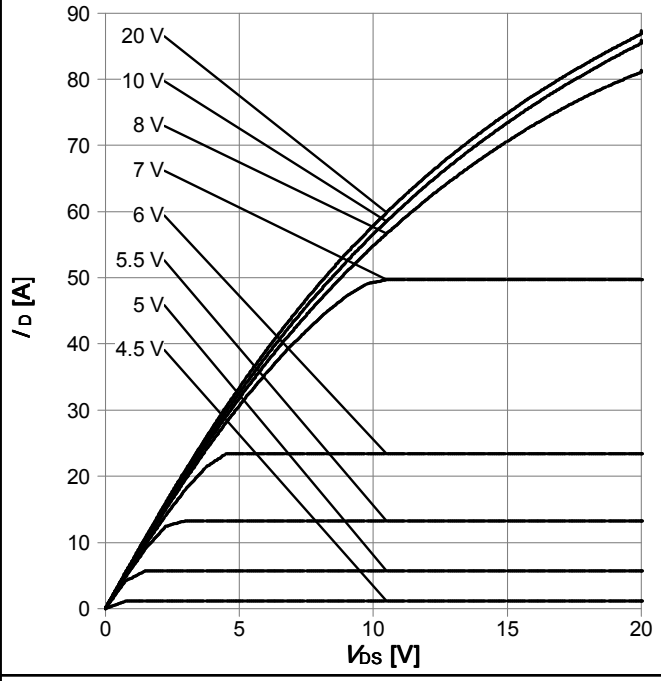
Typ. output characteristics	Typ. output characteristics
	
$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: V_{GS}	$I_D=f(V_{DS})$; $T_j=125$ °C; parameter: V_{GS}

Table 10

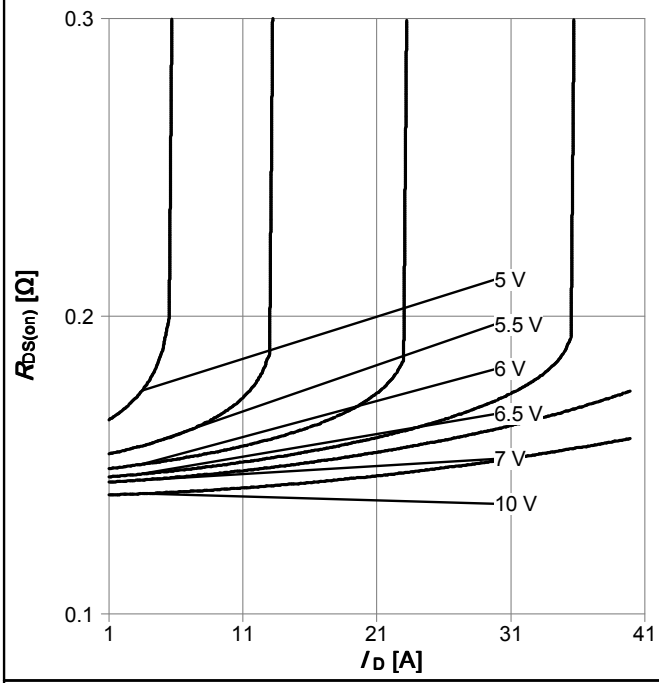
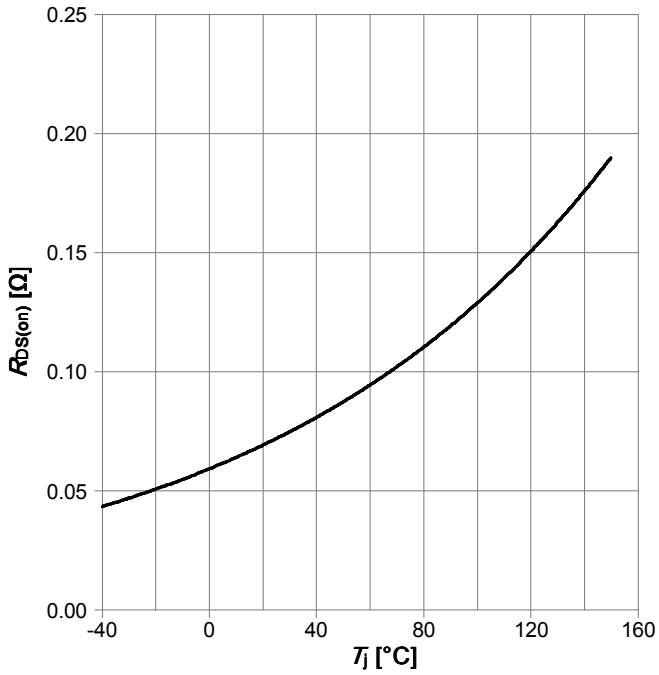
Typ. drain-source on-state resistance	Typ. drain-source on-state resistance
	
$R_{DS(on)}=f(I_D)$; T_j=125 °C; parameter: V_{GS}	$R_{DS(on)}=f(T_j)$; I_D=18.1 A; V_{GS}=10 V

Table 11

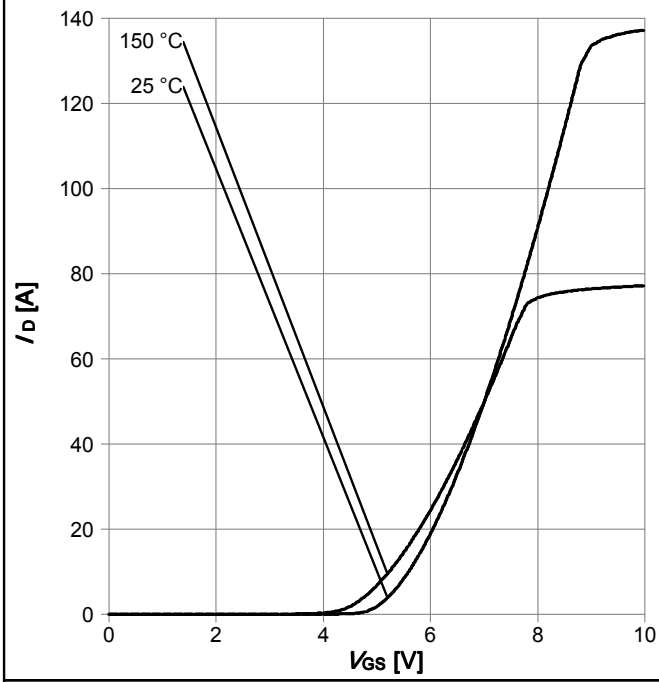
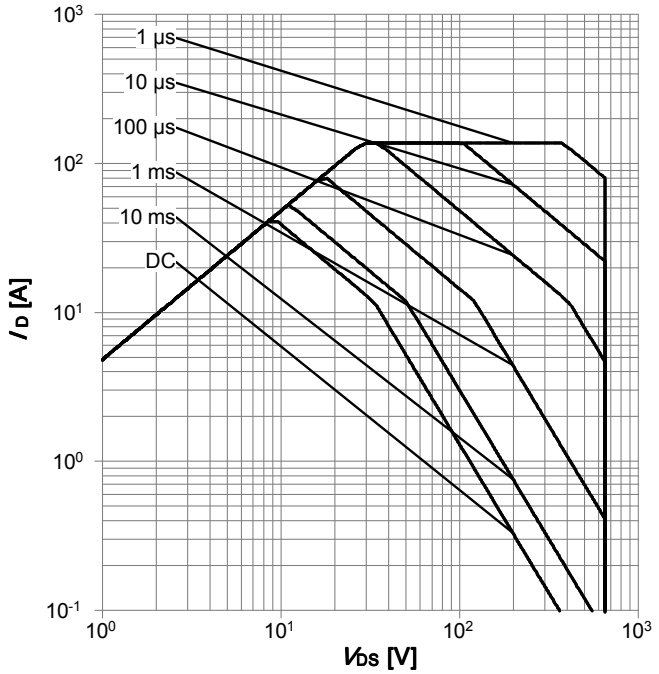
Typ. transfer characteristics	Safe operating area
	
$I_D=f(V_{GS})$; $\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$; parameter: T_j	$I_D=f(V_{DS})$; T_C=25 °C; D=0; parameter: t_p

Table 12

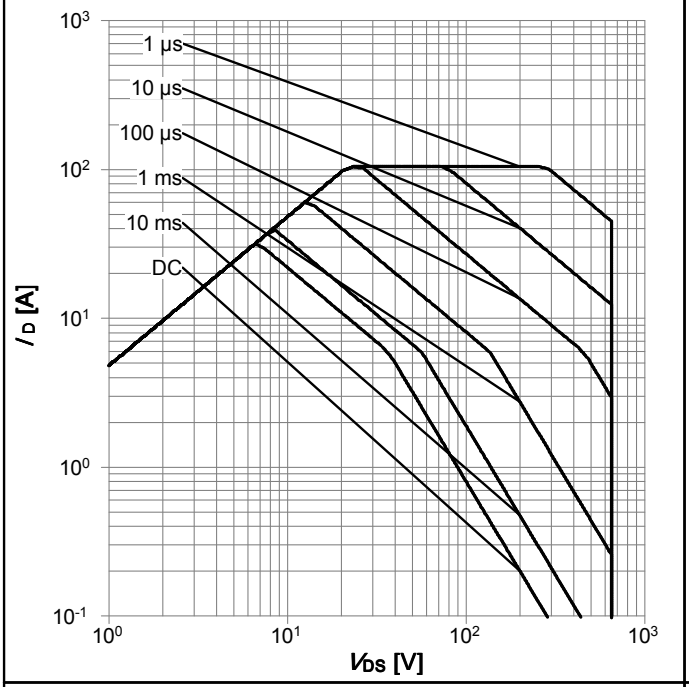
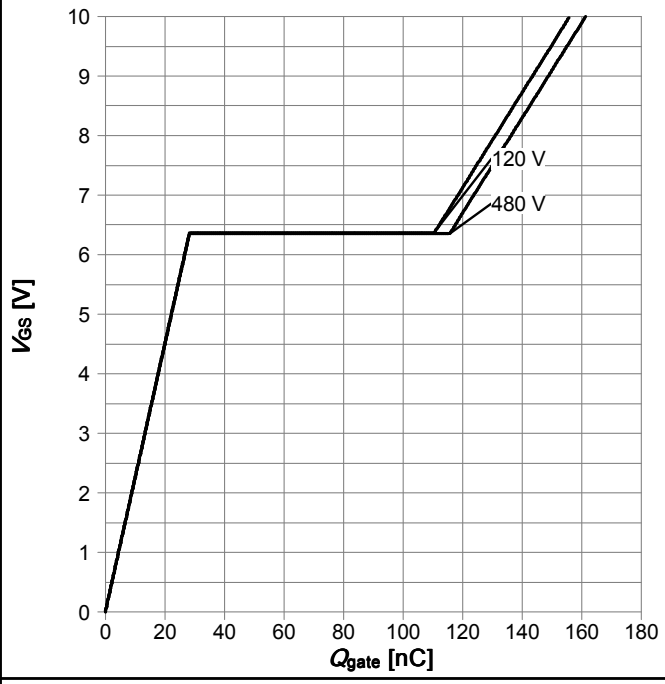
Safe operating area	Typ. gate charge
	
$I_D=f(V_{DS})$; T_C=80 °C; D=0; parameter: t_p	$V_{GS}=f(Q_{gate})$; I_D=6.5 A pulsed; parameter: V_{DD}

Table 13

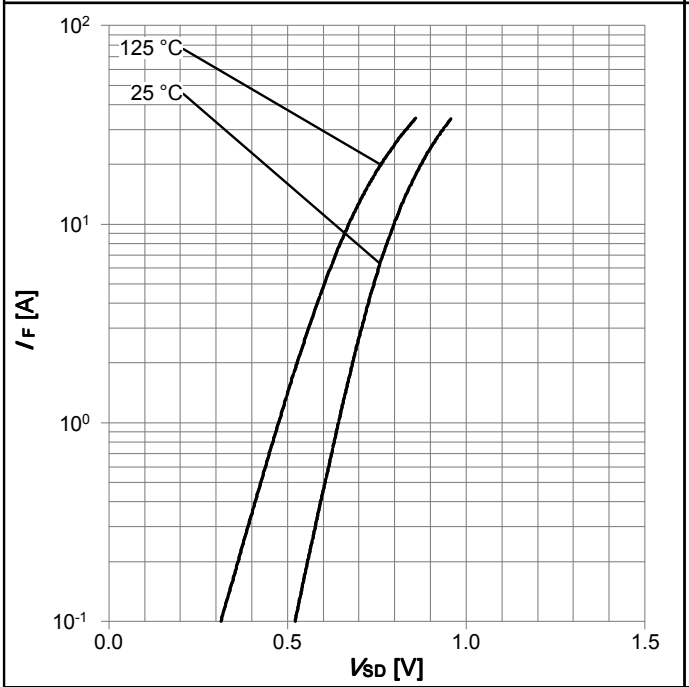
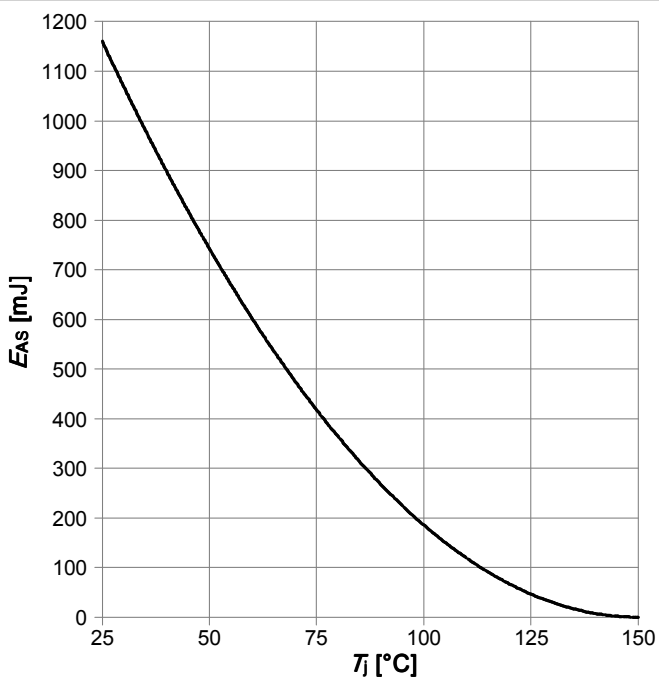
Typ. forward characteristics of reverse diode	Avalanche energy
	
$I_F=f(V_{SD})$; parameter: T_j	$E_{AS}=f(T_j)$; I_D=6.6 A; V_{DD}=50 V

Table 14

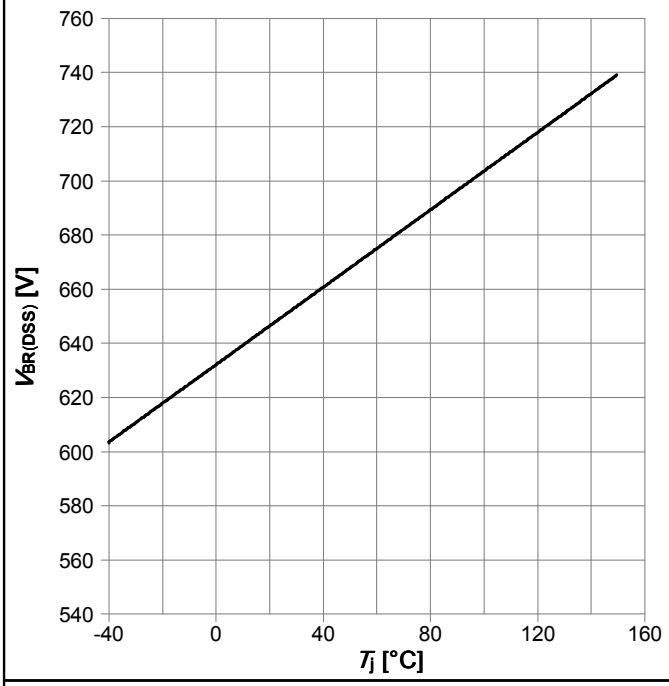
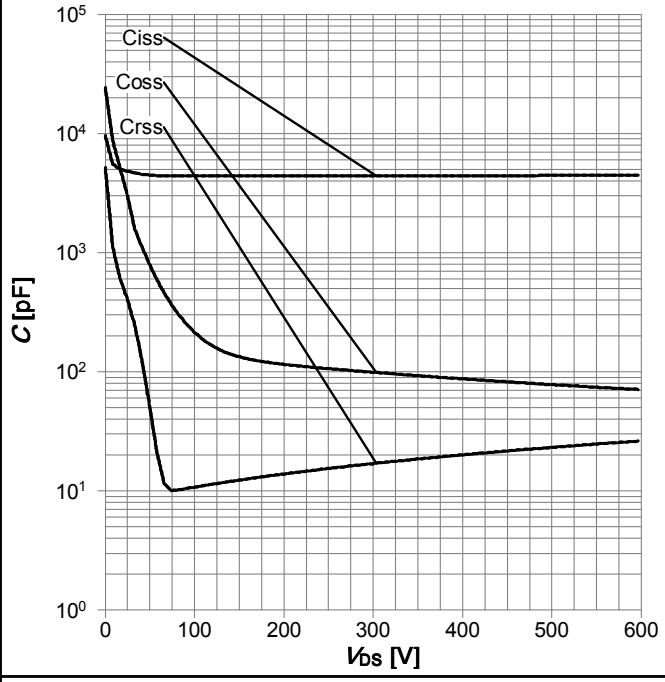
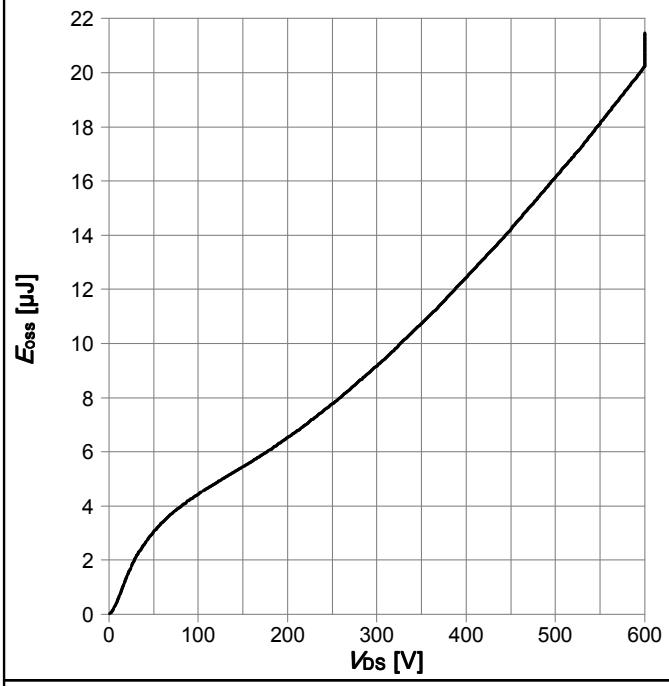
Drain-source breakdown voltage	Typ. capacitances
	
$V_{BR(DSS)}$=f(T_j); I_D=0.25 mA	C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Table 15

Typ. Coss stored energy

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

6 Test Circuits

Table 16 Diode characteristics

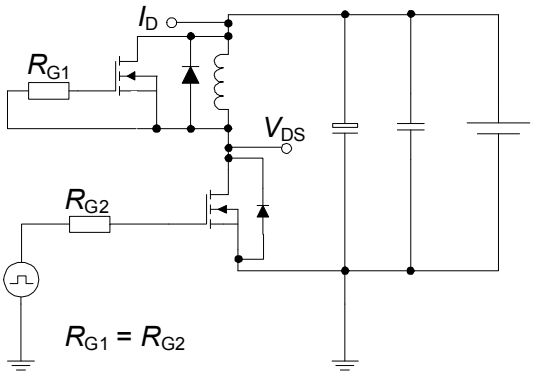
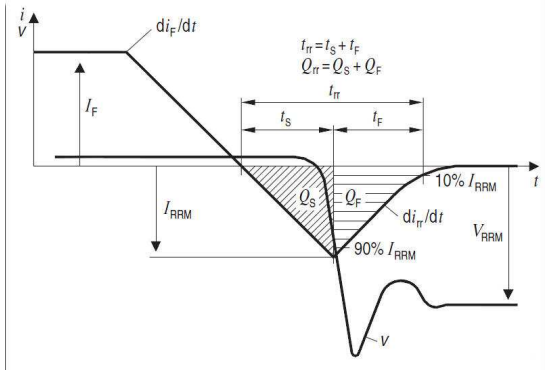
Test circuit for diode characteristics	Diode recovery waveform
	

Table 17 Switching times

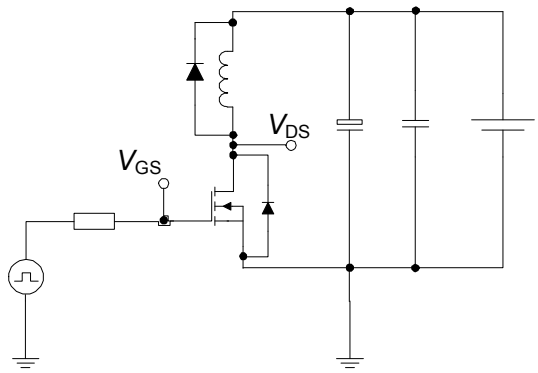
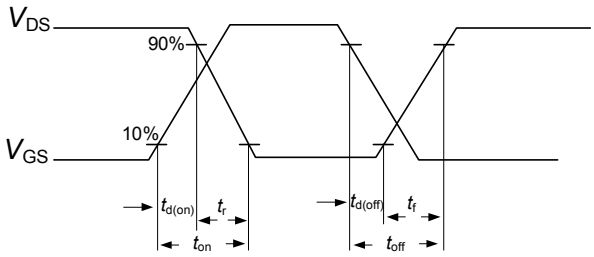
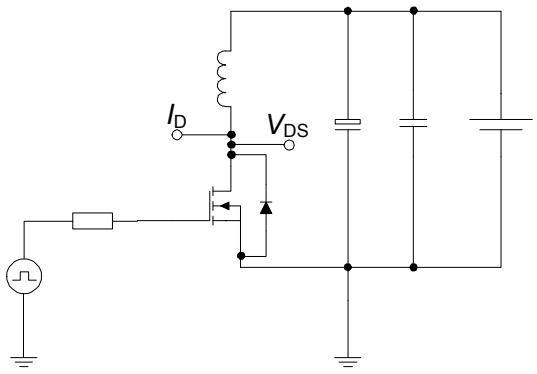
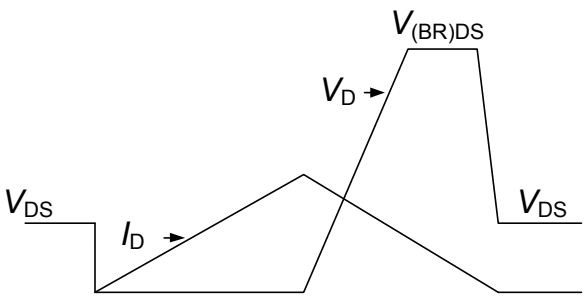
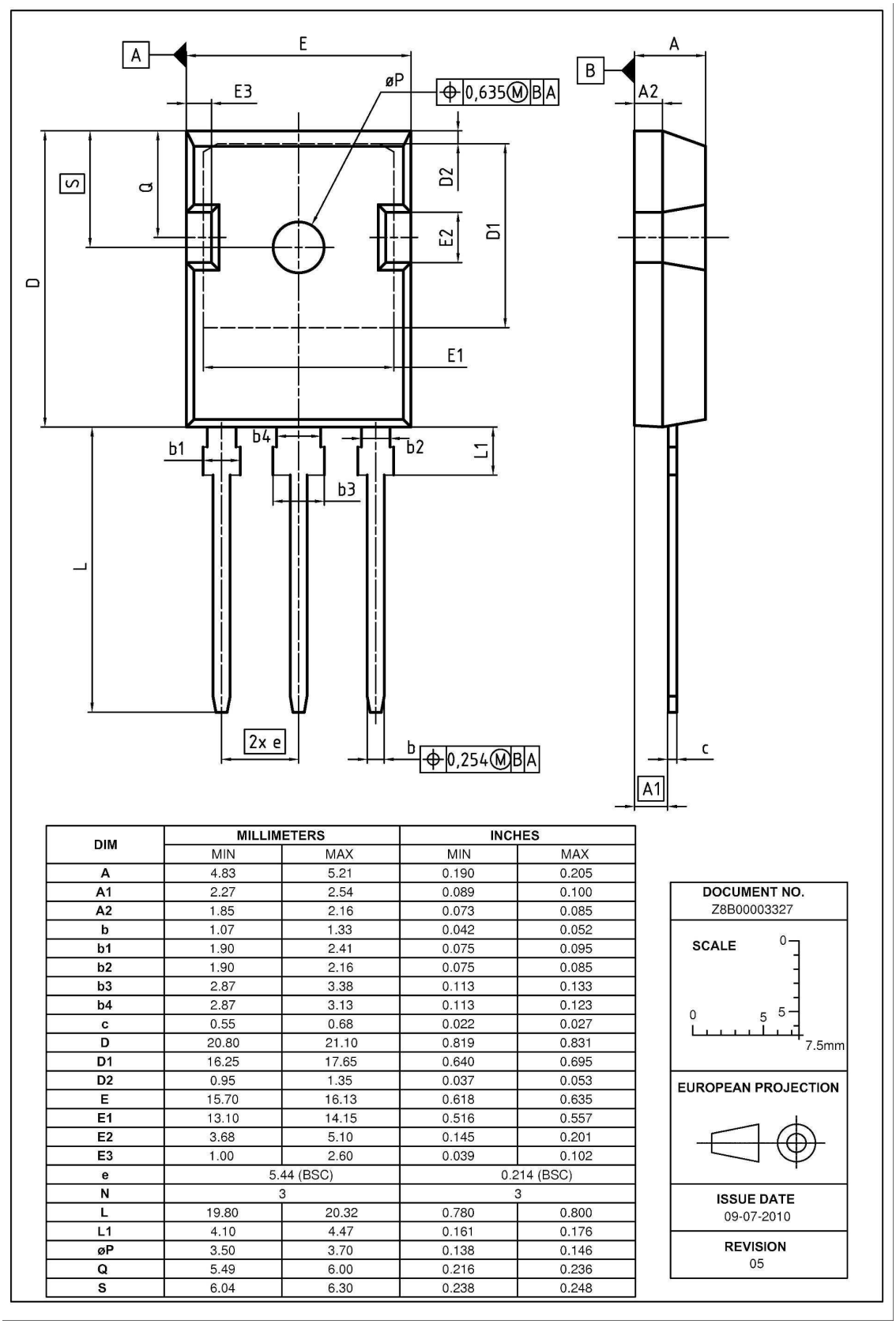
Switching times test circuit for inductive load	Switching times waveform
	

Table 18 Unclamped inductive

Unclamped inductive load test circuit	Unclamped inductive waveform
	

7 Package Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

DOCUMENT NO.
Z8B00003327

SCALE
0 5 5 7.5mm

EUROPEAN PROJECTION

ISSUE DATE
09-07-2010

REVISION
05

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

Revision History

IPW65R080CFDA

Revision: 2012-03-28, Rev. 2.0

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2012-03-28	Final datasheet

Disclaimer ATV

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