MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CoolMOS CFD

650V CoolMOS™ CFD Power Transistor
IPW65R080CFD

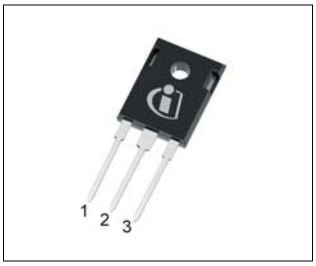
Data Sheet

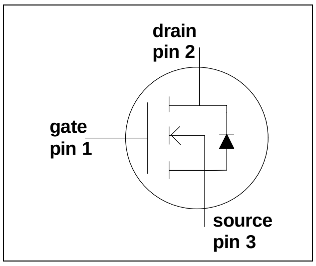
Rev. 2.0, 2011-02-02
Final

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. 650V CoolMOS™ CFD 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 R_{dson}*Q_g and E_{oss}
- Easy to use/drive
- Qualified for industrial grade applications according to JEDEC[1)],
- Pb-free plating, Halogen free mold compound

Applications

650V CoolMOS™ CFD is especially suitable for resonant switching PWM stages for e.g. PC Silverbox, LCD TV, Lighting, Server,Telecom, 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
$R_{DS(on),max}$	0.08	Ω
Body diode di/dt	900	A/µs
Q_{rr}	1	µC
t_{rr}	180	ns
I_{rrm}	10	A
$Q_{g,typ}$	170	nC
$I_{D,pulse}$	137	A
E_{oss} @ 400V	12.5	µJ

Related Links
IFX CoolMOS Webpage
IFX Design tools

Type	Package	Marking
IPW65R080CFD	PG-TO247	65F6080

1) J-STD20 and JESD22

Table of Contents

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=8.7 A, V_{DD}=50 V
Avalanche energy, repetitive	E_{AR}	-	-	1.76		
Avalanche current, repetitive	I_{AR}	-	-	8.7	A	
MOSFET dv/dt ruggedness	dv/dt	-	-	50	V/ns	V_{DS}=0...480 V
Gate source voltage	V_{GS}	-20	-	20	V	static
		-30		30		AC (f>1 Hz)
Power dissipation	P_{tot}	-	-	391	W	T_C=25 °C
Operating and storage temperature	T_j, T_{stg}	-55	-	150	°C	
Mounting torque		-	-	60	Ncm	M3 and M3.5 screws
Continuous diode forward current	I_S	-	-	43.3	A	T_C=25 °C
Diode pulse current[2]	$I_{S,pulse}$	-	-	140	A	T_C=25 °C
Reverse diode dv/dt[3]	dv/dt	-	-	50	V/ns	V_{DS}=0...400 V, $I_{SD} \leq I_D$, T_j=25 °C
Maximum diode commutation speed[3]	di_f/dt	-	-	900	A/µs	

1) Limited by $T_{j,max.}$
2) Pulse width t_p limited by $T_{j,max}$
3) $I_{SD} \leq I_D$, di/dt≤900A/µs, V_{DClink}=400V, $V_{peak} < V_{(BR)DSS}$, $T_j < T_{jmax}$, identical low and high side switch

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	°C/W	
Thermal resistance, junction - ambient	R_{thJA}	-	-	62		leaded
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	-	-	260	°C	1.6 mm (0.063 in.) from case for 10 s

4 Electrical characteristics

Electrical characteristics, at Tj=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}=0 V, I_D=1 mA
Gate threshold voltage	$V_{GS(th)}$	3.5	4	4.5		V_{DS}=V_{GS}, I_D=1.76 mA
Zero gate voltage drain current	I_{DSS}	-	-	1	µA	V_{DS}=650 V, V_{GS}=0 V, T_j=25 °C
		-	500	-		V_{DS}=650 V, V_{GS}=0 V, T_j=150 °C
Gate-source leakage current	I_{GSS}	-	-	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	-	0.072	0.08	Ω	V_{GS}=10 V, I_D=17.6 A, T_j=25 °C
		-	0.19	-		V_{GS}=10 V, I_D=17.6 A, T_j=150 °C
Gate resistance	R_G	-	0.75	-	Ω	f=1 MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	5030	-	pF	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz
Output capacitance	C_{oss}	-	215	-		
Effective output capacitance, energy related[1)]	$C_{o(er)}$	-	135	-		V_{GS}=0 V, V_{DS}=0...480 V
Effective output capacitance, time related[2)]	$C_{o(tr)}$	-	675	-		I_D=constant, V_{GS}=0 V V_{DS}=0...480V
Turn-on delay time	$t_{d(on)}$	-	20	-	ns	V_{DD}=400 V, V_{GS}=13 V, I_D=26.3 A, R_G= 1.8 Ω
Rise time	t_r	-	18	-		
Turn-off delay time	$t_{d(off)}$	-	85	-		
Fall time	t_f	-	6	-		

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% $V_{(BR)DSS}$

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 80% $V_{(BR)DSS}$

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	25	-	nC	V_{DD}=480 V, I_D=26.3 A, V_{GS}=0 to 10 V
Gate to drain charge	Q_{gd}	-	120	-		
Gate charge total	Q_g	-	170	-		
Gate plateau voltage	$V_{plateau}$	-	6.4	-	V	

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}=0 V, I_F=26.3 A, T_j=25 °C
Reverse recovery time	t_{rr}	-	180	-	ns	V_R=400 V, I_F=26.3 A, di_F/dt=100 A/µs
Reverse recovery charge	Q_{rr}	-	1	-	µC	
Peak reverse recovery current	I_{rrm}	-	10	-	A	

5 Electrical characteristics diagrams

Table 8

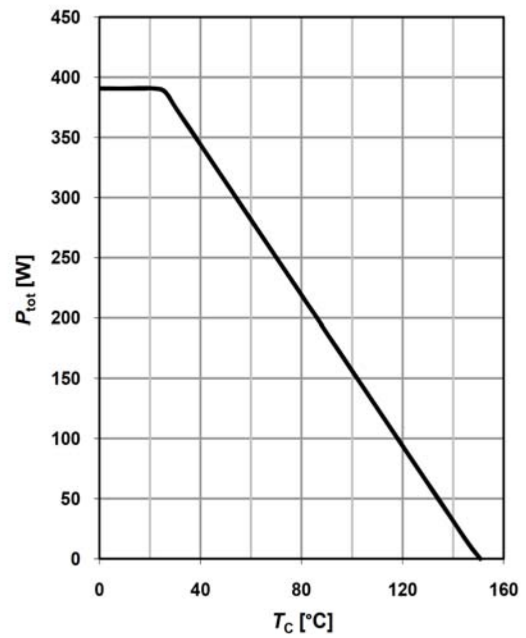
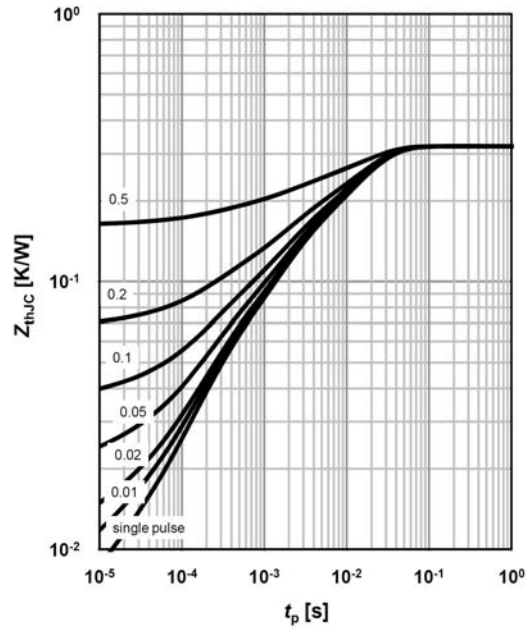
Power dissipation	**Max. transient thermal impedance**
	
P_{tot} = f(T_C)	$Z_{(thJC)}$=f(tp); parameter: D=t_p/T

Table 9

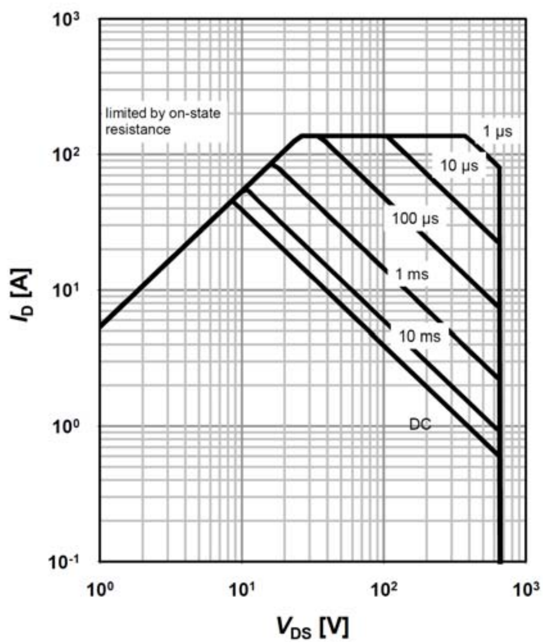
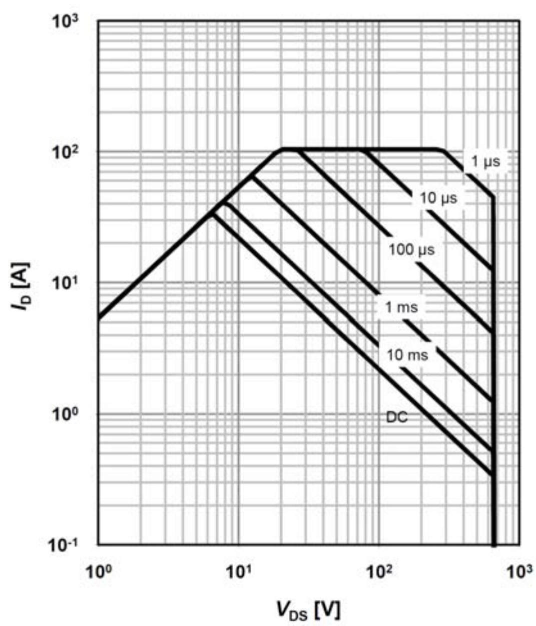
Safe operating area T_C=25 °C	**Safe operating area T_C=80 °C**
	
I_D=f(V_{DS}); V_{GS} > 7,5V; T_C=25 °C; D=0; parameter t_p	I_D=f(V_{DS}); V_{GS} > 7,5V; T_C=80 °C; D=0; parameter t_p

Table 10

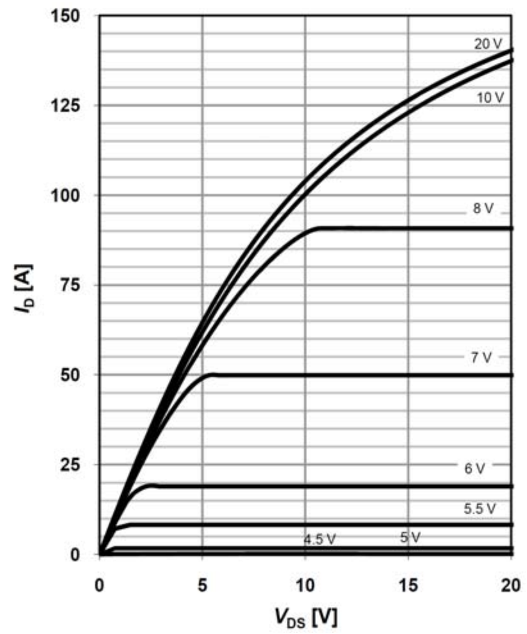
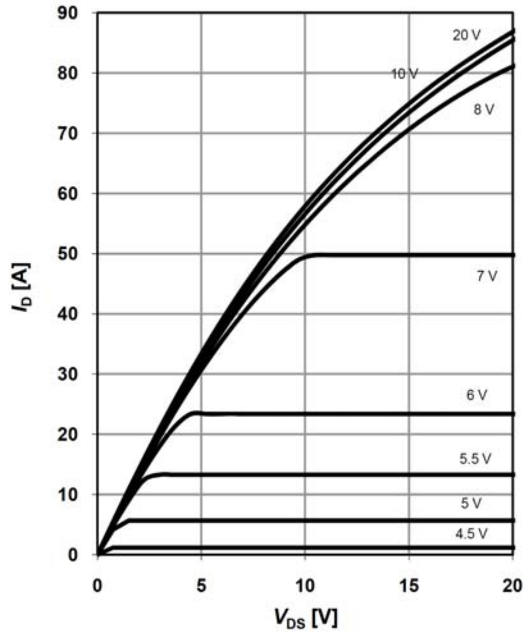
Typ. output characteristics T_j=25 °C	**Typ. output characteristics T_j=125 °C**
	
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}	I_D=f(V_{DS}); T_j=125 °C; parameter: V_{GS}

Table 11

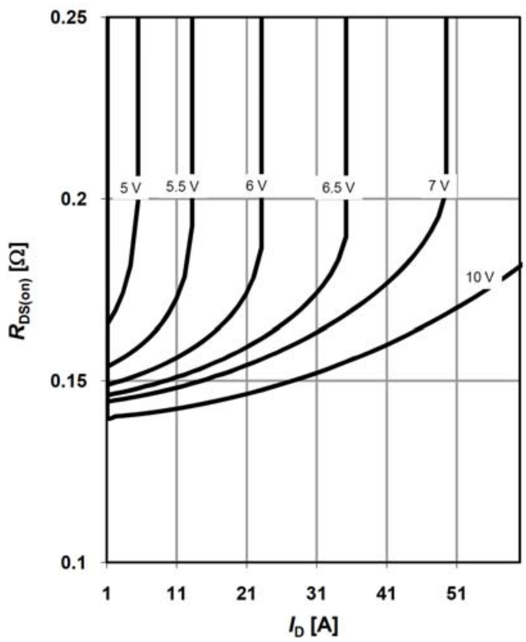
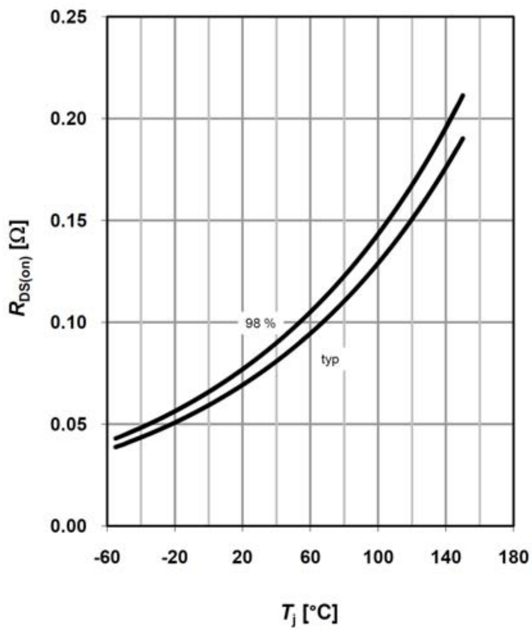
Typ. drain-source on-state resistance	**Drain-source on-state resistance**
	
$R_{DS(on)}$=f(I_D); T_j=125 °C; parameter: V_{GS}	$R_{DS(on)}$=f(T_j); I_D=17.6 A; V_{GS}=10 V

Table 12

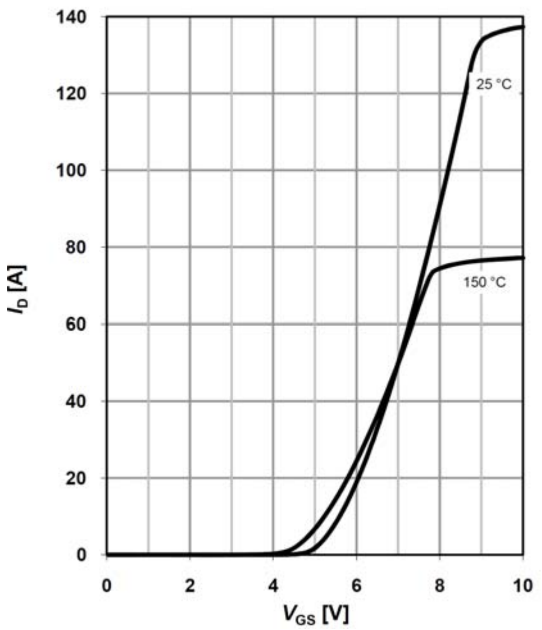
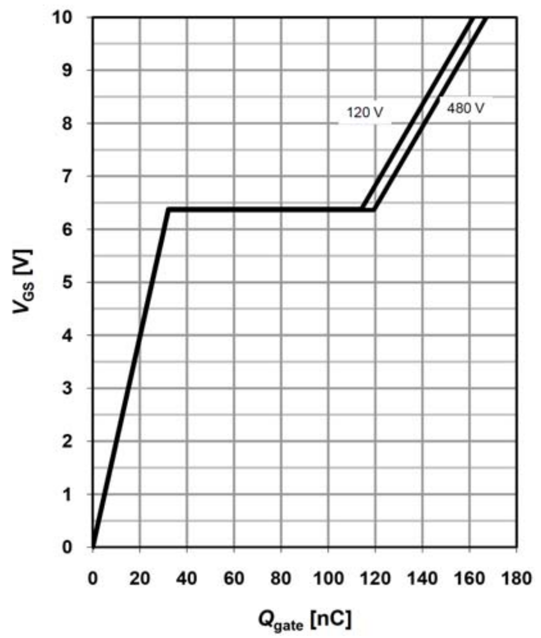
Typ. transfer characteristics	Typ. gate charge
	
I_D=f(V_{GS}); V_{DS}=20V	V_{GS}=f(Q_{gate}), I_D=26.3 A pulsed

Table 13

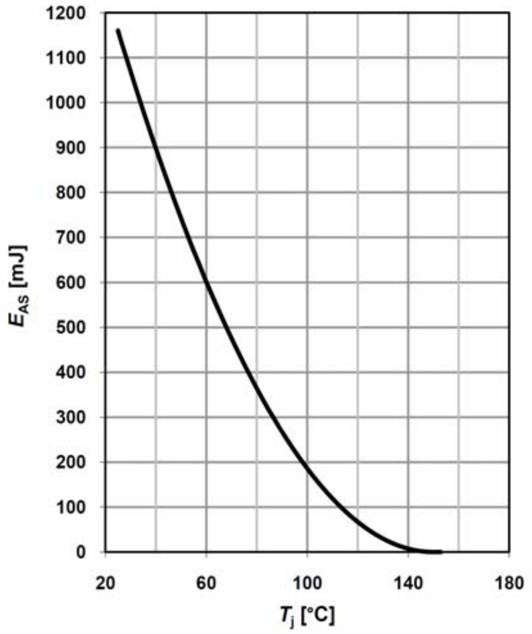
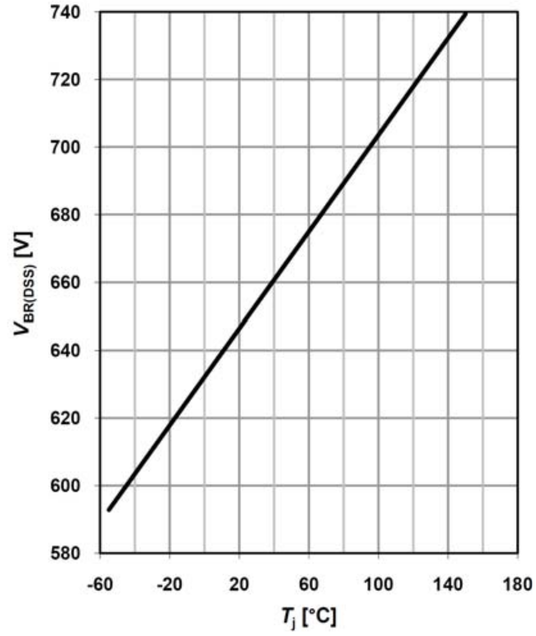
Avalanche energy	Drain-source breakdown voltage
	
E_{AS}=f(T_j); I_D=8.7 A; V_{DD}=50 V	$V_{BR(DSS)}$=f(T_j); I_D=1.0 mA

Table 14

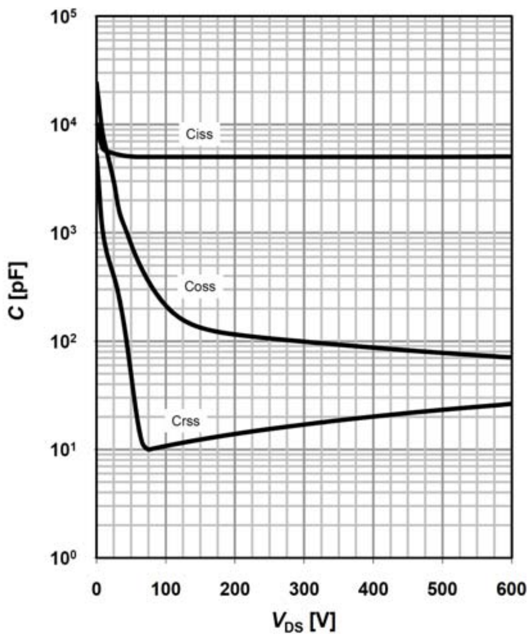
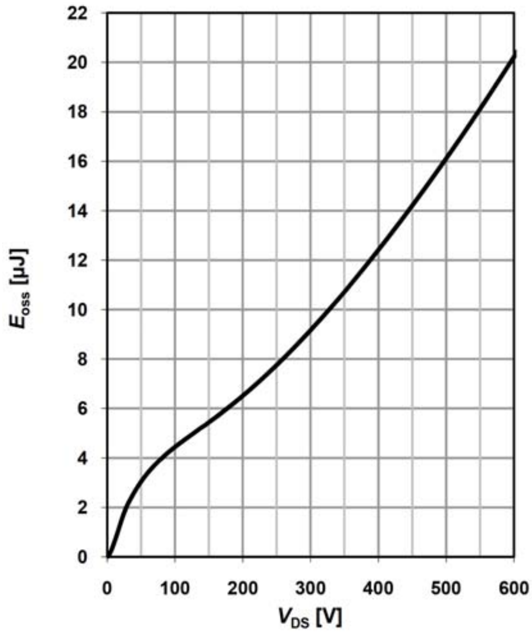
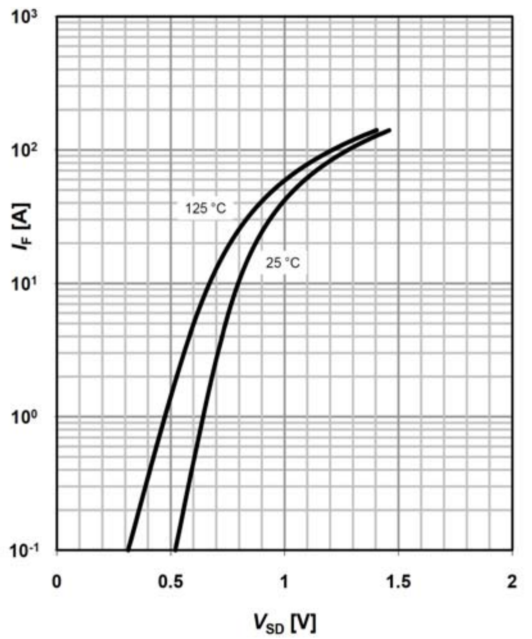
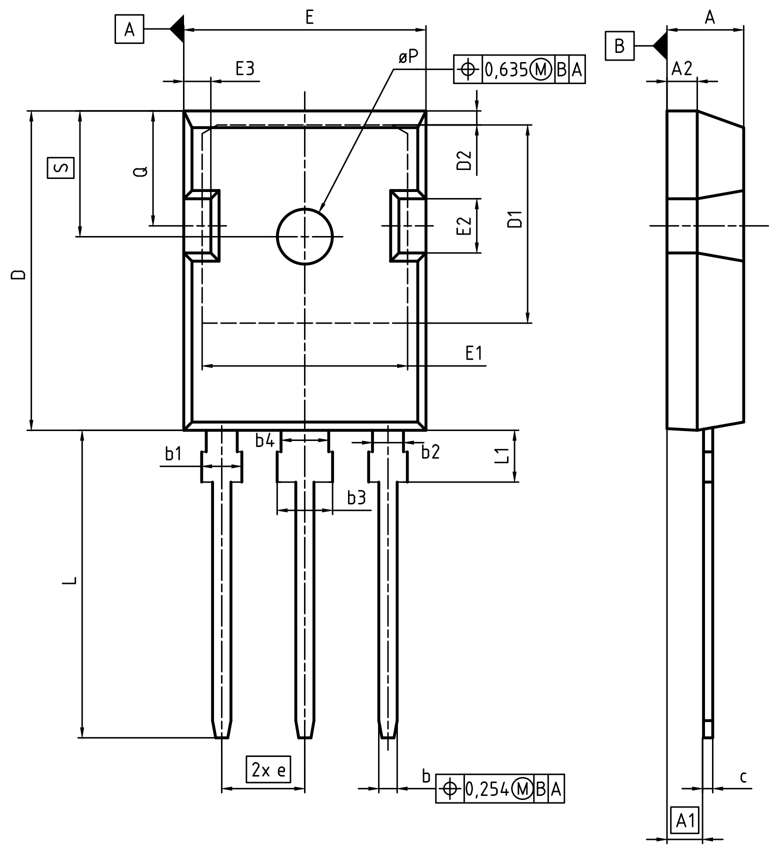
Typ. capacitances	Typ. C_{oss} stored energy
	
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz	E_{oss}=f(V_{DS})

Table 15

Forward characteristics of reverse diode

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

6 Package outlines

TO247-3-21/-41/-44



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 7.5mm

EUROPEAN PROJECTION

ISSUE DATE
09-07-2010

REVISION
05

Figure 1 Outlines TO-247, dimensions in mm/inches

7 Revision History

Revision History: 2011-02-02, Rev. 2.0

Previous Revision:

Revision	Subjects (major changes since last revision)
2.0	Release of final data sheet

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Edition 2011-02-02

Published by
Infineon Technologies AG
81726 Munich, Germany

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