

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 $R_{DS(on)} \cdot Q_g$ and E_{oss}
- Easy to use/drive
- Qualified for industrial grade applications according to JEDEC¹⁾,
- 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.

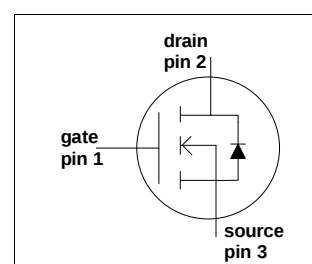


Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	700	V
$R_{DS(on),max}$	0.08	Ω
Body diode di/dt	900	A/ μ s
Q_{rr}	1	μ C
t_{rr}	180	ns
I_{rrm}	10	A
$Q_{g,typ}$	170	nC
$I_{D,pulse}$	137	A
$E_{oss} @ 400V$	12.5	μ J

Related Links

[IFX CoolMOS Webpage](#)
[IFX Design tools](#)

Type	Package	Marking
IPW65R080CFD	PG-TO247	65F6080

1) J-STD20 and JESD22

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2 Maximum ratings

at $T_j = 25\text{ °C}$, unless otherwise specified.

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current ¹⁾	I_D	-	-	43.3	A	$T_C = 25\text{ °C}$
				27.4		$T_C = 100\text{ °C}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	137	A	$T_C = 25\text{ °C}$
Avalanche energy, single pulse	E_{AS}	-	-	1160	mJ	$I_D = 8.7\text{ A}, V_{DD} = 50\text{ V}$
Avalanche energy, repetitive	E_{AR}	-	-	1.76		
Avalanche current, repetitive	I_{AR}	-	-	8.7	A	
MOSFET dv/dt ruggedness	dv/dt	-	-	50	V/ns	$V_{DS} = 0 \dots 480\text{ V}$
Gate source voltage	V_{GS}	-20	-	20	V	static
		-30		30		AC ($f > 1\text{ Hz}$)
Power dissipation	P_{tot}	-	-	391	W	$T_C = 25\text{ °C}$
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	$T_C = 25\text{ °C}$
Diode pulse current ²⁾	$I_{S,pulse}$	-	-	140	A	$T_C = 25\text{ °C}$
Reverse diode dv/dt ³⁾	dv/dt	-	-	50	V/ns	$V_{DS} = 0 \dots 400\text{ V}, I_{SD} \leq I_D, T_j = 25\text{ °C}$
Maximum diode commutation speed ³⁾	di/dt	-	-	900	A/μs	

1) Limited by $T_{j,max}$.

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

3) $I_{SD} \leq I_D$, $di/dt \leq 900\text{ A/μs}$, $V_{DClk} = 400\text{ V}$, $V_{peak} < V_{(BR)DSS}$, $T_j < T_{j,max}$, 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		lead
Soldering temperature, wavesoldering only allowed at leads	T_{sld}	-	-	260	°C	1.6 mm (0.063 in.) from case for 10 s

4 Electrical characteristics

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

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	5030	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=100\text{ V}$, $f=1\text{ MHz}$
Output capacitance	C_{oss}	-	215	-		
Effective output capacitance, energy related ¹⁾	$C_{o(er)}$	-	135	-		$V_{GS}=0\text{ V}$, $V_{DS}=0\dots480\text{ V}$
Effective output capacitance, time related ²⁾	$C_{o(tr)}$	-	675	-		$I_D=\text{constant}$, $V_{GS}=0\text{ V}$ $V_{DS}=0\dots480\text{ V}$
Turn-on delay time	$t_{d(on)}$	-	20	-	ns	$V_{DD}=400\text{ V}$, $V_{GS}=13\text{ V}$, $I_D=26.3\text{ A}$, $R_G=1.8\text{ }\Omega$
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	$V_{DD}=480\text{ V}$, $I_D=26.3\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
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	$V_{GS}=0\text{ V}$, $I_F=26.3\text{ A}$, $T_j=25\text{ °C}$
Reverse recovery time	t_{rr}	-	180	-	ns	$V_R=400\text{ V}$, $I_F=26.3\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}	-	1	-	μC	
Peak reverse recovery current	I_{rrm}	-	10	-	A	

5 Electrical characteristics diagrams

Table 8

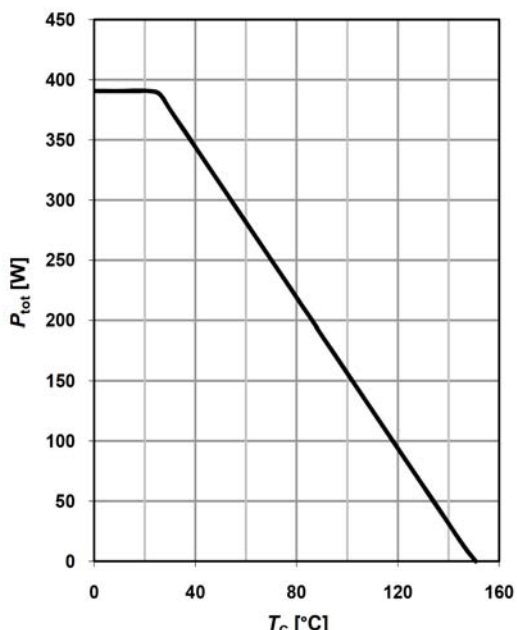
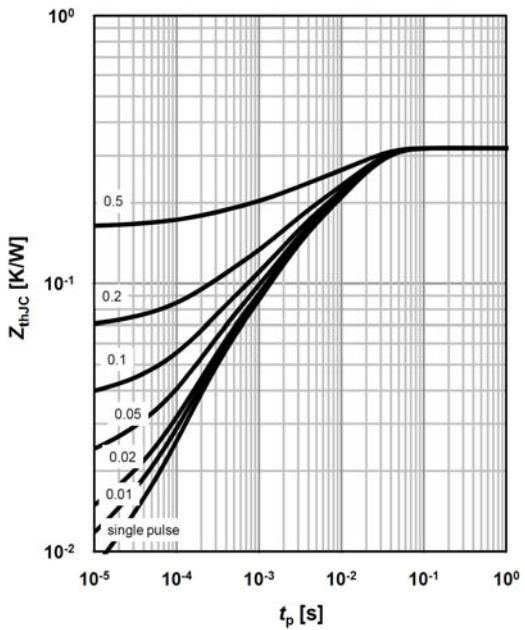
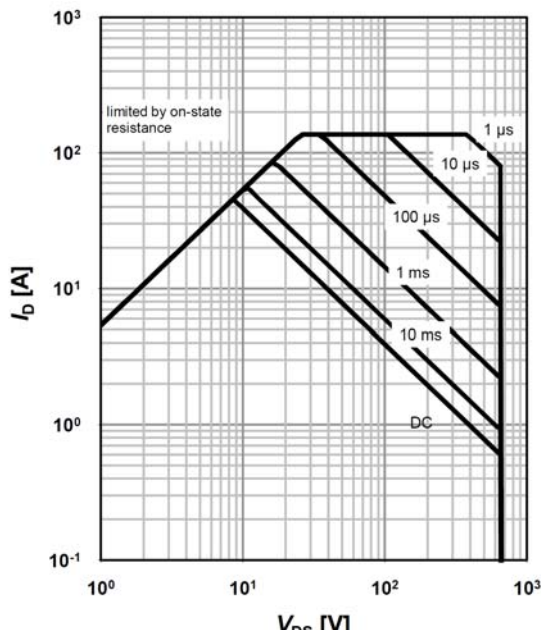
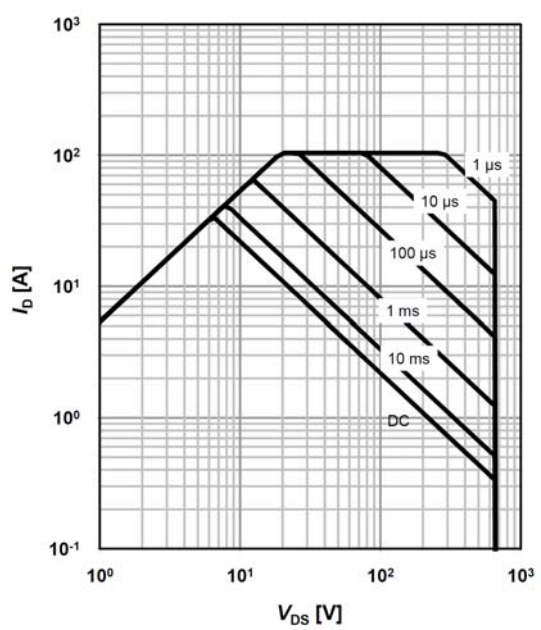
Power dissipation	Max. transient thermal impedance
 $P_{\text{tot}} = f(T_c)$	 $Z_{\text{thJC}} = f(t_p)$; parameter: $D = t_p / T$

Table 9

Safe operating area $T_c = 25^\circ\text{C}$	Safe operating area $T_c = 80^\circ\text{C}$
 $I_D = f(V_{DS})$; $V_{GS} > 7.5\text{V}$; $T_c = 25^\circ\text{C}$; $D = 0$; parameter t_p	 $I_D = f(V_{DS})$; $V_{GS} > 7.5\text{V}$; $T_c = 80^\circ\text{C}$; $D = 0$; parameter t_p

Electrical characteristics diagrams

Table 10

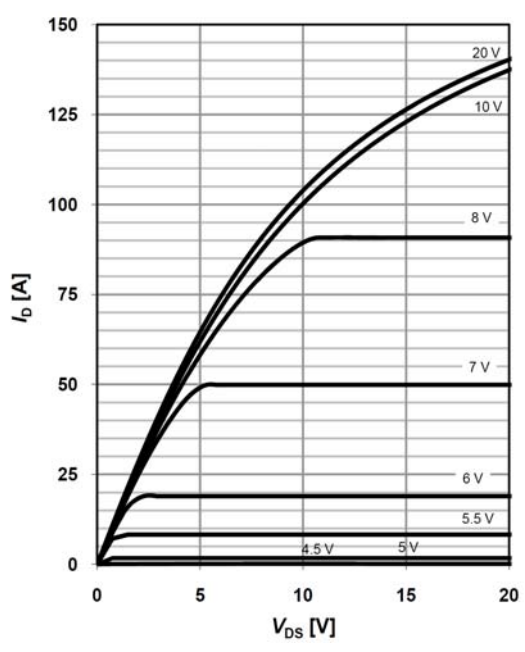
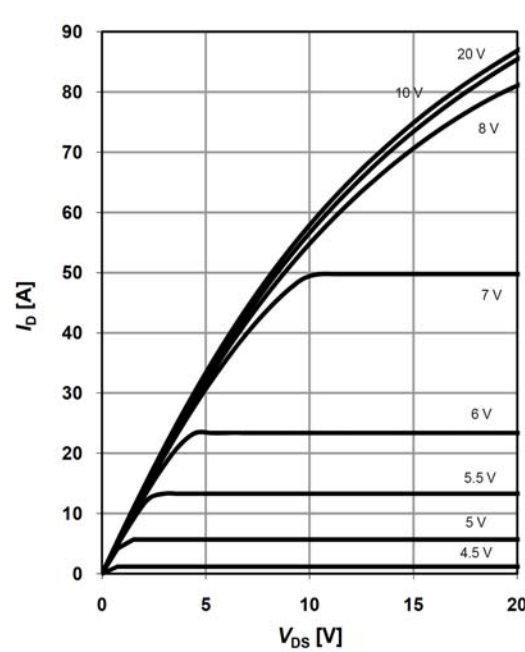
Typ. output characteristics $T_J=25\text{ }^{\circ}\text{C}$	Typ. output characteristics $T_J=125\text{ }^{\circ}\text{C}$
	
$I_D=f(V_{DS}); T_J=25\text{ }^{\circ}\text{C}; \text{parameter: } V_{GS}$	$I_D=f(V_{DS}); T_J=125\text{ }^{\circ}\text{C}; \text{parameter: } V_{GS}$

Table 11

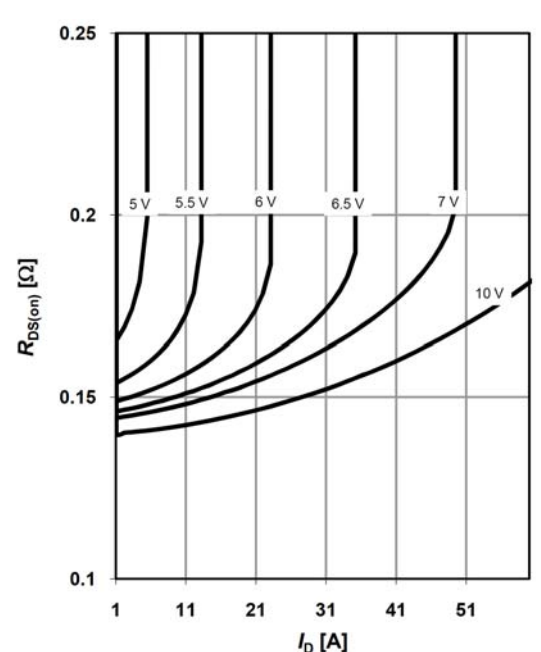
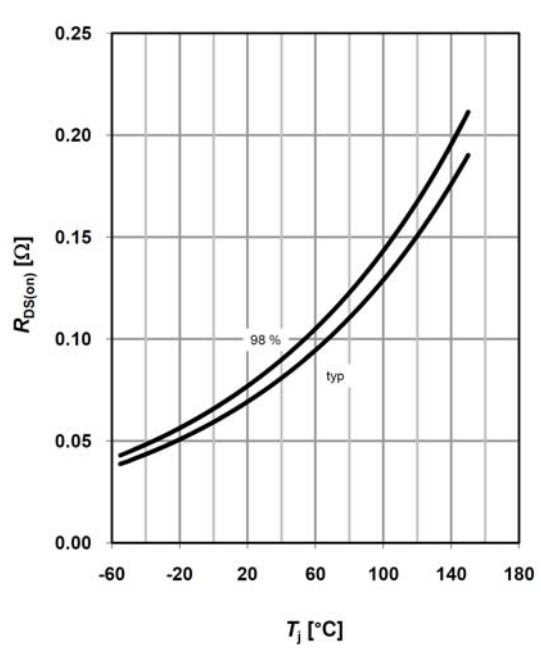
Typ. drain-source on-state resistance	Drain-source on-state resistance
	
$R_{DS(on)}=f(I_D); T_J=125\text{ }^{\circ}\text{C}; \text{parameter: } V_{GS}$	$R_{DS(on)}=f(T_J); I_D=17.6\text{ A}; V_{GS}=10\text{ V}$

Table 12

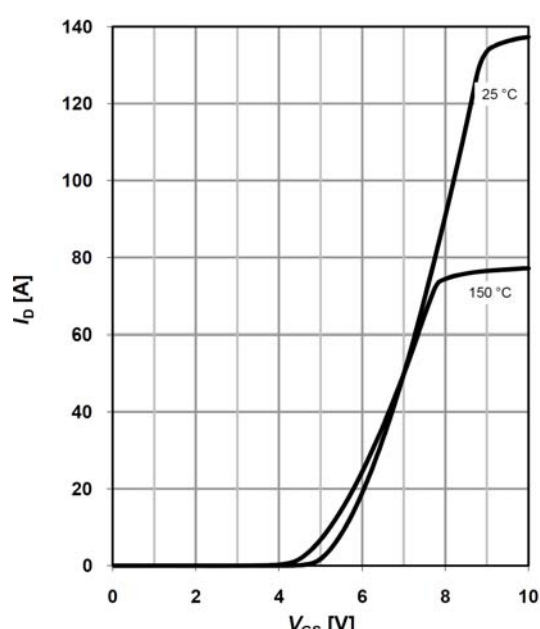
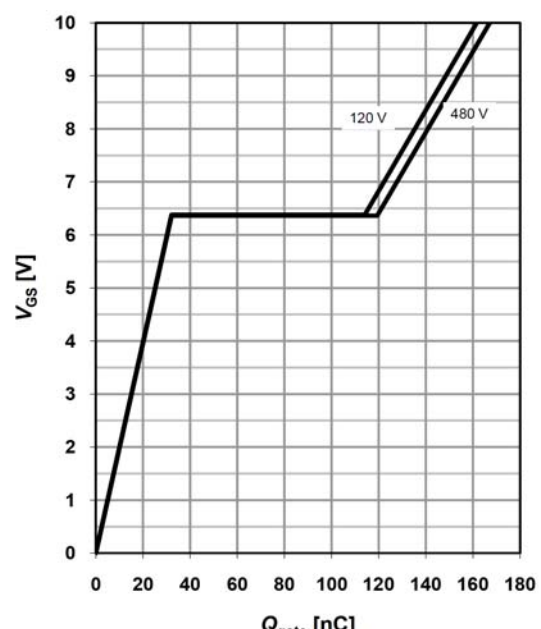
Typ. transfer characteristics	Typ. gate charge
	
$I_D = f(V_{GS}); V_{DS} = 20V$	$V_{GS} = f(Q_{gate}), I_D = 26.3 \text{ A pulsed}$

Table 13

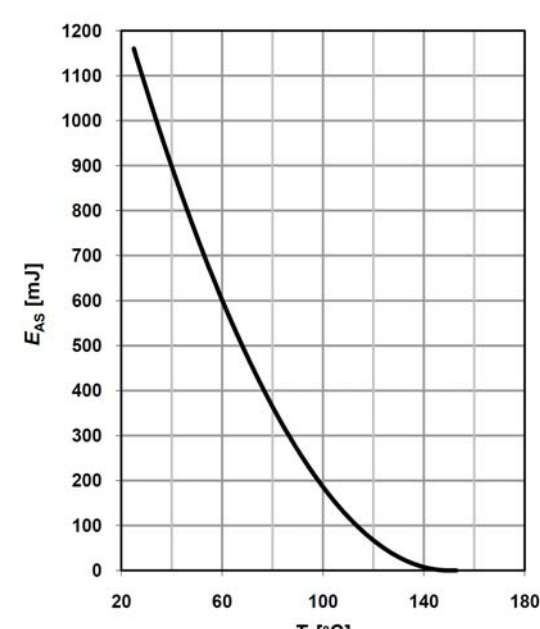
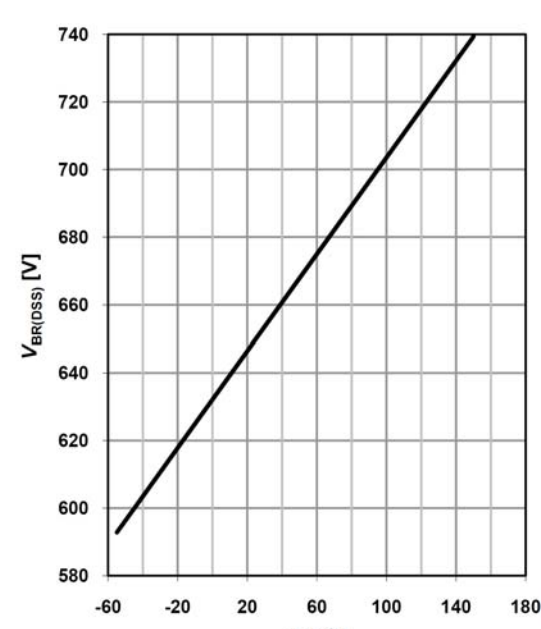
Avalanche energy	Drain-source breakdown voltage
	
$E_{AS} = f(T_j); I_D = 8.7 \text{ A}; V_{DD} = 50 \text{ V}$	$V_{BR(DSS)} = f(T_j); I_D = 1.0 \text{ mA}$

Table 14

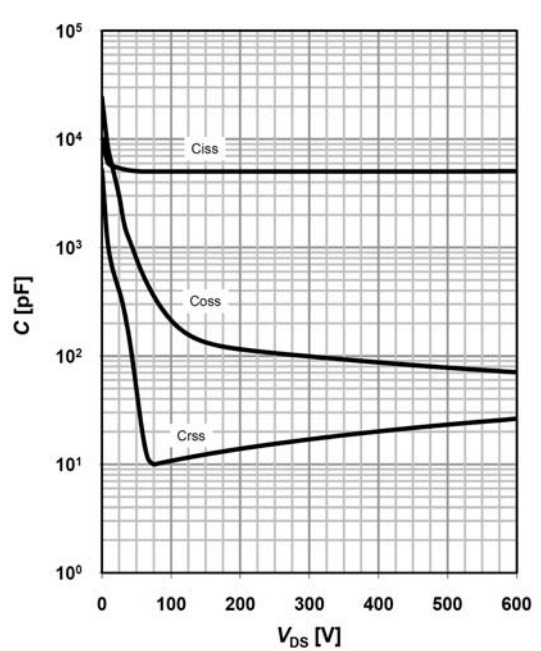
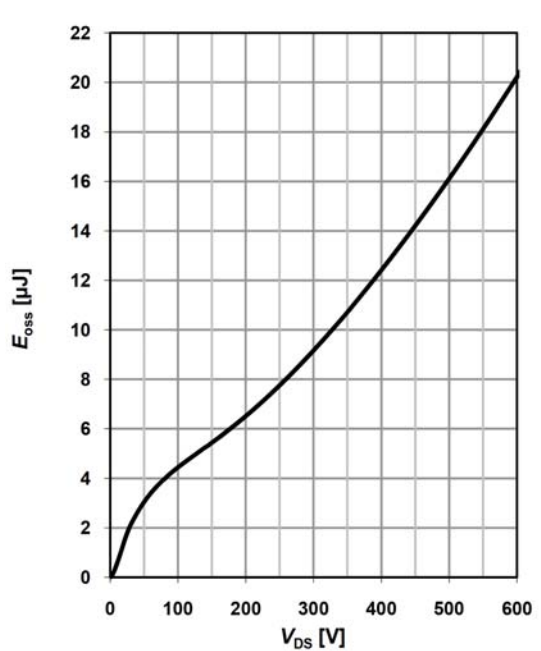
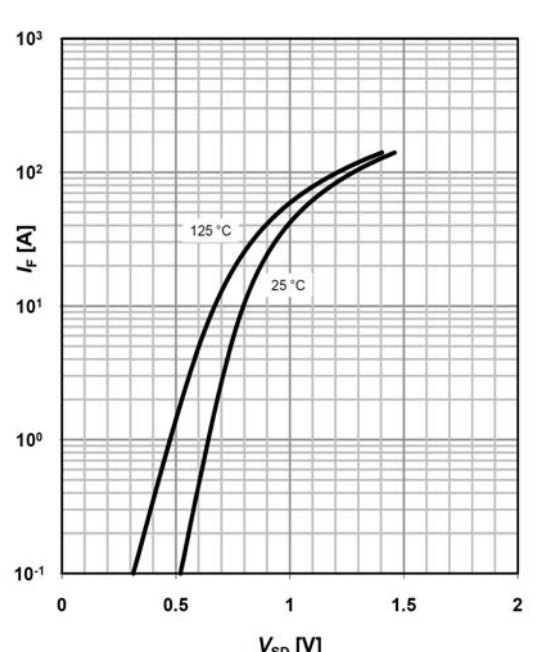
Typ. capacitances	Typ. C_{oss} stored energy
	
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$	$E_{oss}=f(V_{DS})$

Table 15

Forward characteristics of reverse diode

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

6 Package outlines

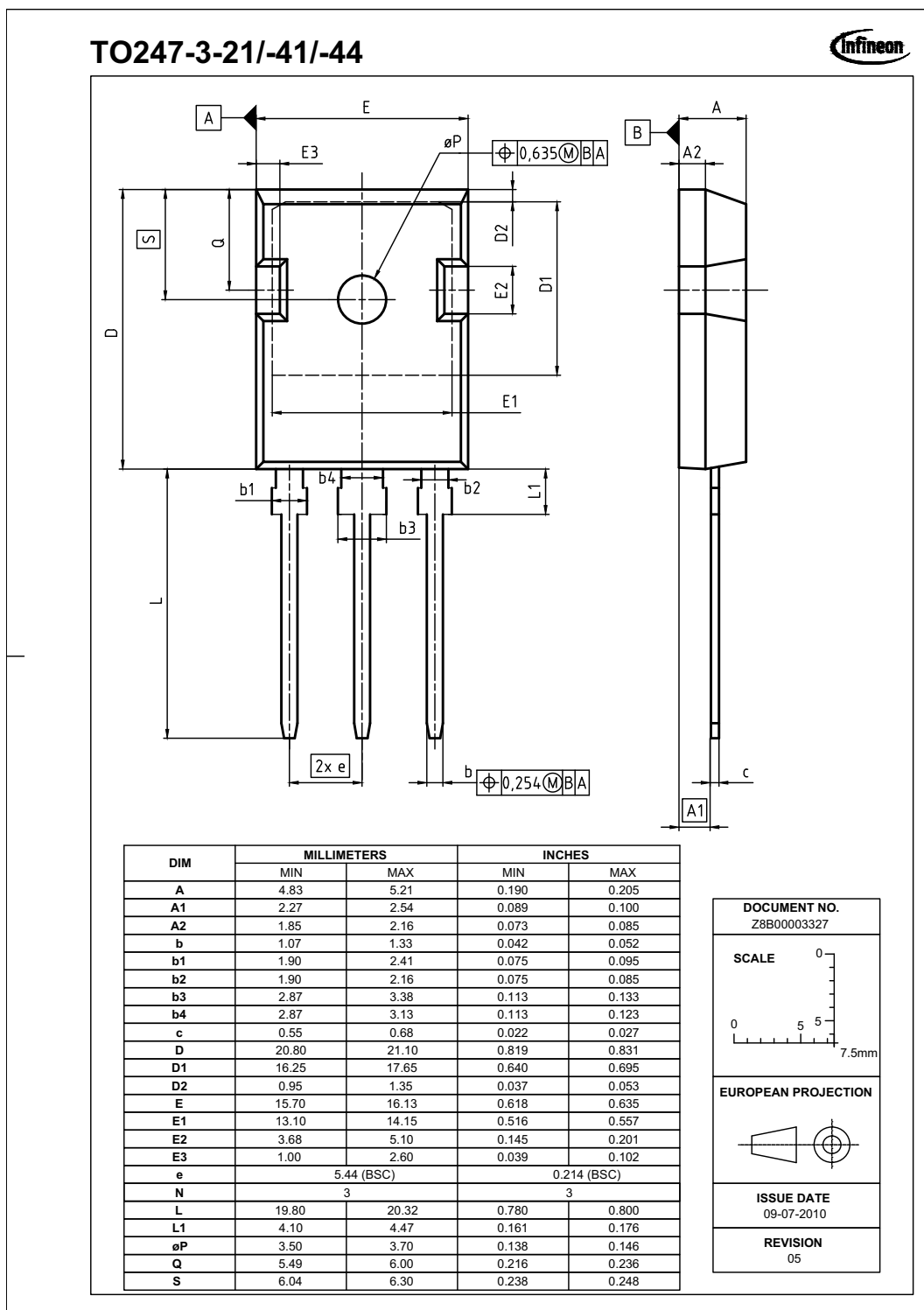


Figure 1 Outlines TO-247, dimensions in mm/inches

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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