

# MOSFET

Metal Oxide Semiconductor Field Effect Transistor

## CoolMOS C6

650V CoolMOS™ C6 Power Transistor  
IPW65R070C6

## Data Sheet

Rev. 2.0, 2011-03-15  
Final

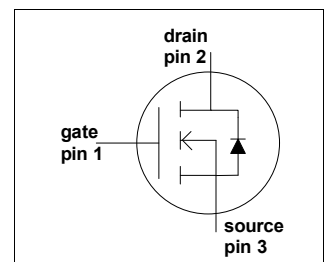
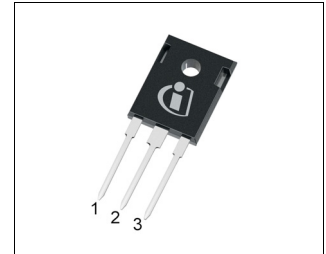
Industrial & Multimarket

## 650V CoolMOS™ C6 Power Transistor

IPW65R070C6

### 1 Description

CoolMOS™ is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infineon Technologies. CoolMOS™ C6 series combines the experience of the leading SJ MOSFET supplier with high class innovation. The offered devices provide all benefits of a fast switching SJ MOSFET while not sacrificing ease of use. Extremely low switching and conduction losses make switching applications even more efficient, more compact, lighter, and cooler.



#### Features

- Extremely low losses due to very low FOM  $R_{DS(on)} \cdot Q_g$  and  $E_{oss}$
- Very high commutation ruggedness
- Easy to use/drive
- Qualified for industrial grade applications according to JEDEC<sup>1)</sup>
- Pb-free plating, Halogen free mold compound

#### Applications

PFC stages, hard switching PWM stages and resonant switching PWM stages for e.g. PC Silverbox, LCD & PDP TV, Lighting, Server, Telecom, UPS 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
$R_{DS(on),max}$	0.07	$\Omega$
$Q_{g,typ}$	170	nC
$I_{D,pulse}$	150	A
$E_{oss} @ 400V$	13	$\mu J$
Body diode $di/dt$	300	A/ $\mu s$

#### Related Links

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

Type	Package	Marking
IPW65R070C6	PG-TO247	65C6070

1) J-STD20 and JESD22

## Table of Contents

1	Description .....	2
	Table of Contents .....	3
2	Maximum ratings .....	4
3	Thermal characteristics .....	4
4	Electrical characteristics .....	5
5	Electrical characteristics diagrams .....	7
6	Package outlines .....	11
7	Revision History .....	12

## 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 <sup>1)</sup>	$I_D$	-	-	53.5	A	$T_C = 25\text{ °C}$
				33.8		$T_C = 100\text{ °C}$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	150	A	$T_C = 25\text{ °C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	1160	mJ	$I_D = 9.3\text{ A}, V_{DD} = 50\text{ V}$
Avalanche energy, repetitive	$E_{AR}$	-	-	1.76		$I_D = 9.3\text{ A}, V_{DD} = 50\text{ V}$
Avalanche current, repetitive	$I_{AR}$	-	-	9.3	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	$I_S$	-	-	46.3	A	$T_C = 25\text{ °C}$
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$	-	-	150	A	$T_C = 25\text{ °C}$
Reverse diode dv/dt <sup>3)</sup>	dv/dt	-	-	15	V/ns	$V_{DS} = 0 \dots 400\text{ V}, I_{SD} \leq I_D, T_j = 25\text{ °C}$
Maximum diode commutation speed <sup>3)</sup>	di/dt	-	-	300	A/ $\mu$ s	

1) Limited by  $T_{j,max}$ . Maximum duty cycle  $D = 0.75$

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

3) Identical low side and high side switch with identical  $R_G$ ;  $V_{peak} < V_{(BR)DSS}$ ;  $T_j < T_{j,max}$

## 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  $T_j=25\text{ °C}$ , 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	$V_{GS}=0\text{ V}$ , $I_D=1.0\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	2.5	3	3.5		$V_{DS}=V_{GS}$ , $I_D=1.76\text{ mA}$
Zero gate voltage drain current	$I_{DSS}$	-	-	1	$\mu\text{A}$	$V_{DS}=650\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$
		-	50	-		$V_{DS}=650\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=150\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	-	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.063	0.07	$\Omega$	$V_{GS}=10\text{ V}$ , $I_D=17.6\text{ A}$ , $T_j=25\text{ °C}$
		-	0.164	-		$V_{GS}=10\text{ V}$ , $I_D=17.6\text{ A}$ , $T_j=150\text{ °C}$
Gate resistance	$R_G$	-	0.85	-	$\Omega$	$f=1\text{ MHz}$ , open drain

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition	
		Min.	Typ.	Max.			
Input capacitance	$C_{iss}$	-	3900	-	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 <sup>1)</sup>	$C_{o(er)}$	-	140	-			$V_{GS}=0\text{ V}$ , $V_{DS}=0\dots480\text{ V}$
Effective output capacitance, time related <sup>2)</sup>	$C_{o(tr)}$	-	670	-			$I_D=\text{constant}$ , $V_{GS}=0\text{ V}$ $V_{DS}=0\dots480\text{ V}$
Turn-on delay time	$t_{d(on)}$	-	17	-	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	$t_r$	-	17	-			
Turn-off delay time	$t_{d(off)}$	-	90	-			
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	$Q_{gs}$	-	20	-	nC	$V_{DD}=480\text{ V}$ , $I_D=26.3\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge	$Q_{gd}$	-	85	-		
Gate charge total	$Q_g$	-	170	-		
Gate plateau voltage	$V_{plateau}$	-	5.5	-	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	$t_{rr}$	-	730	-	ns	$V_R=400\text{ V}$ , $I_F=26.3\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$	-	19	-	$\mu\text{C}$	
Peak reverse recovery current	$I_{rrm}$	-	50	-	A	

5 Electrical characteristics diagrams

Table 8

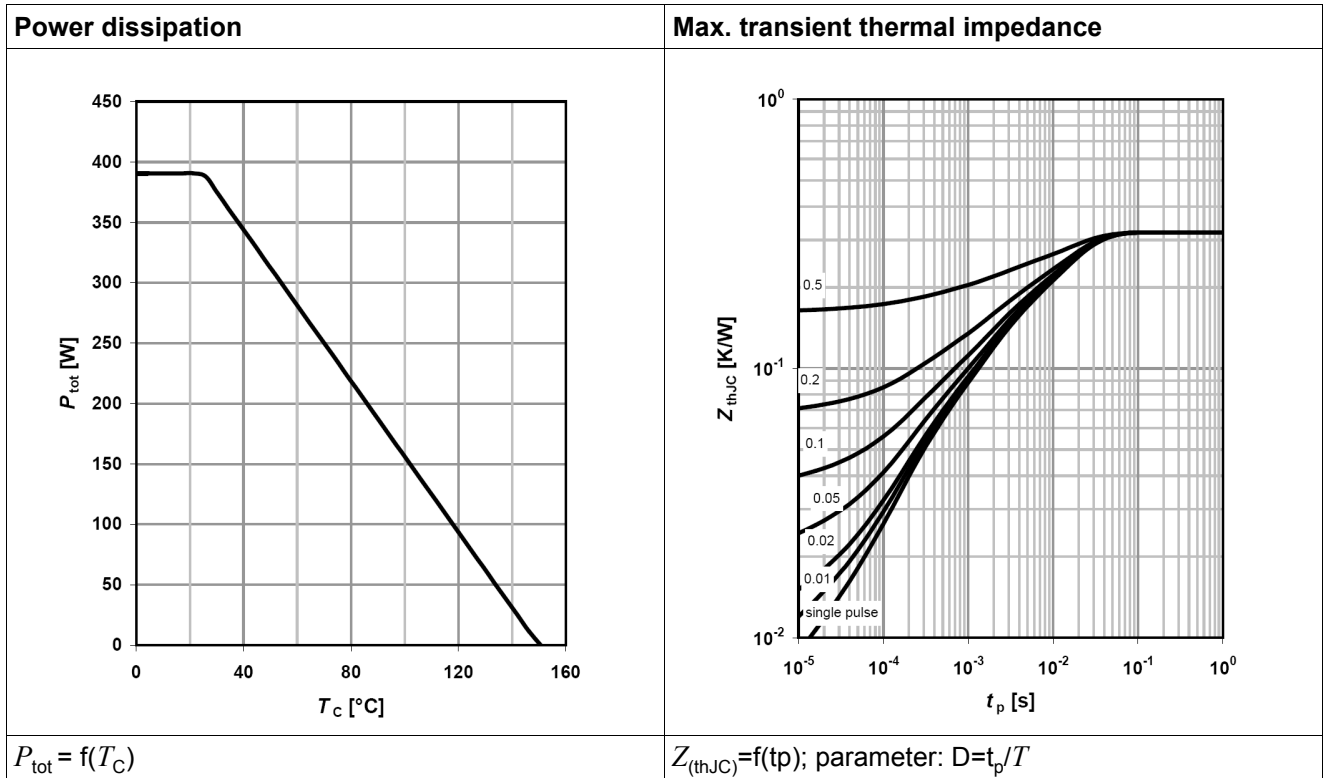


Table 9

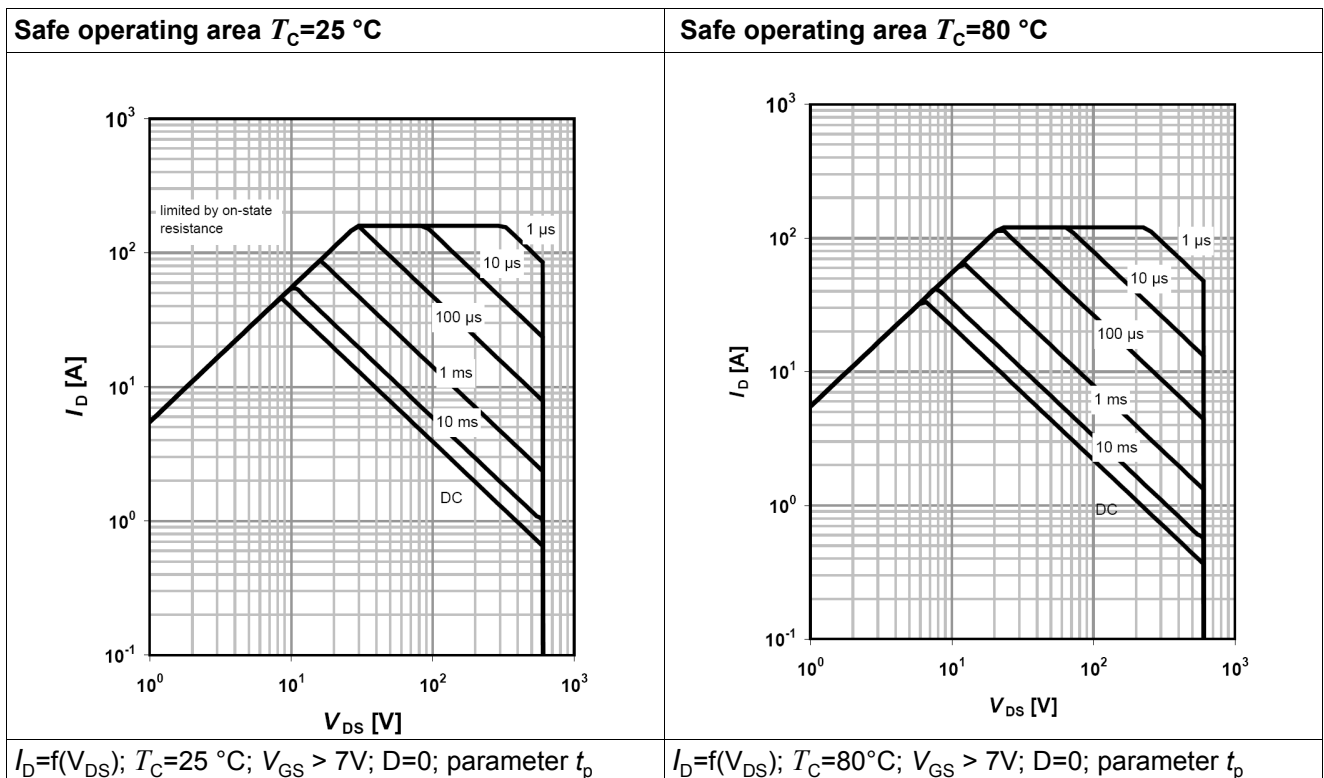




Table 10

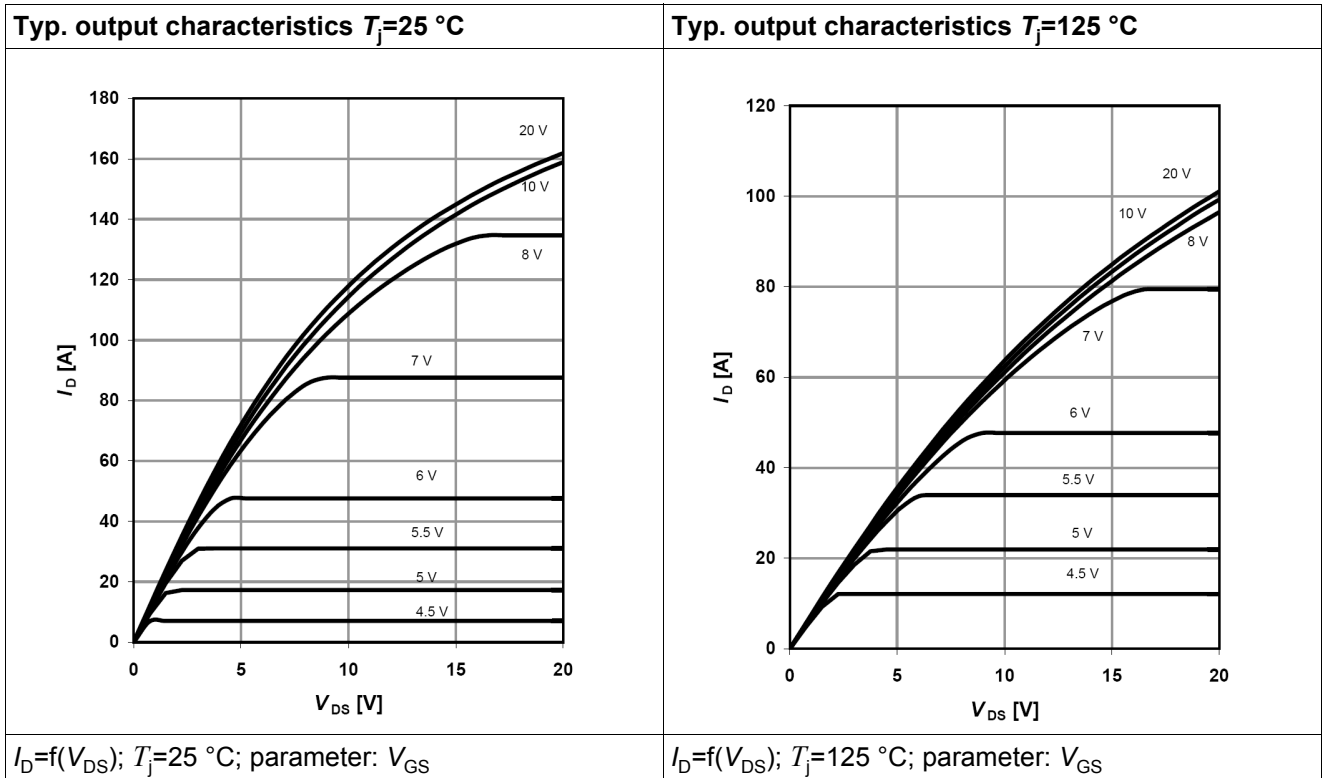


Table 11

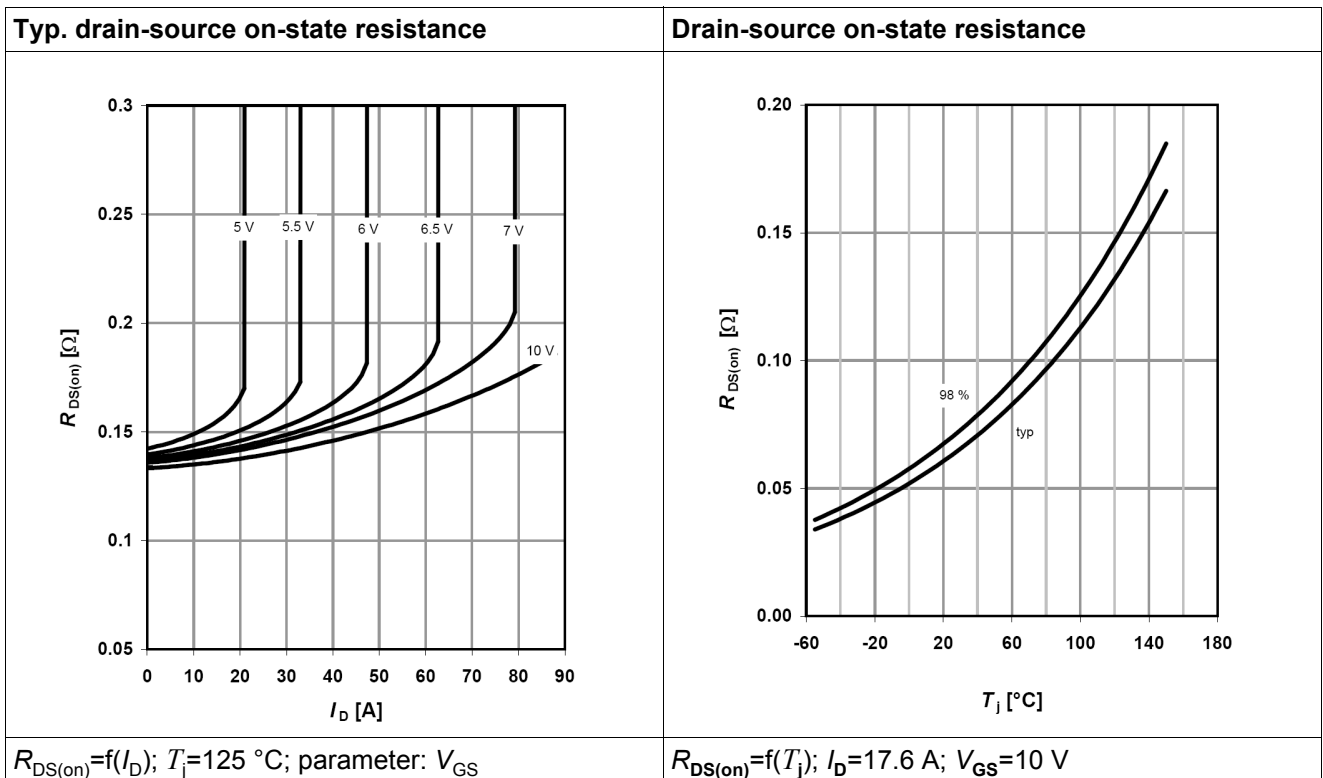




Table 12

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
$E_{AS} = f(T_j); I_D = 9.3 \text{ A}; V_{DD} = 50 \text{ V}$	$V_{BR(DSS)} = f(T_j); I_D = 1.0 \text{ mA}$

Table 14

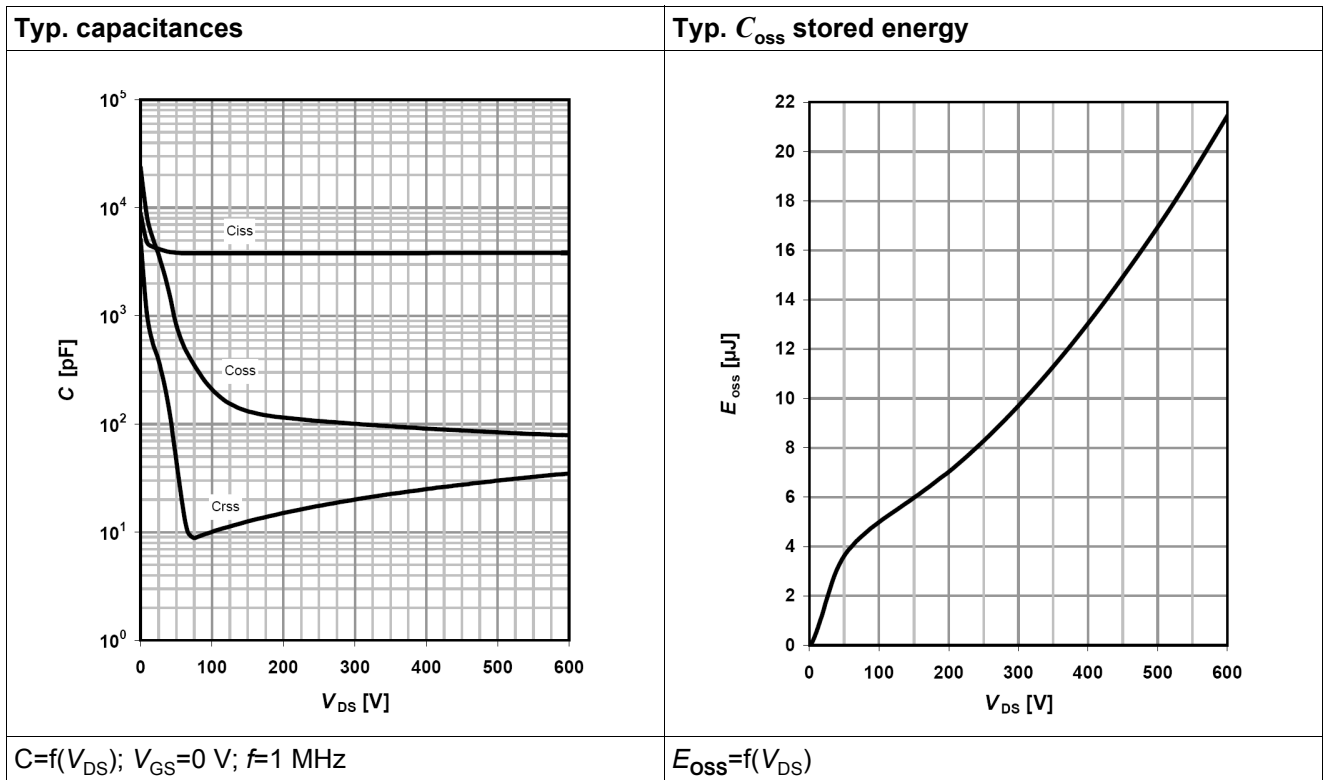
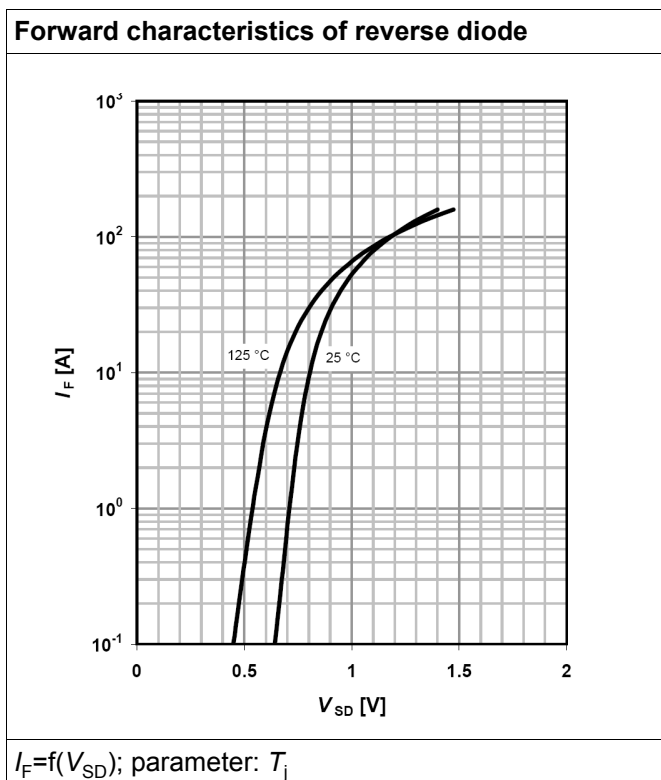


Table 15



6 Package outlines

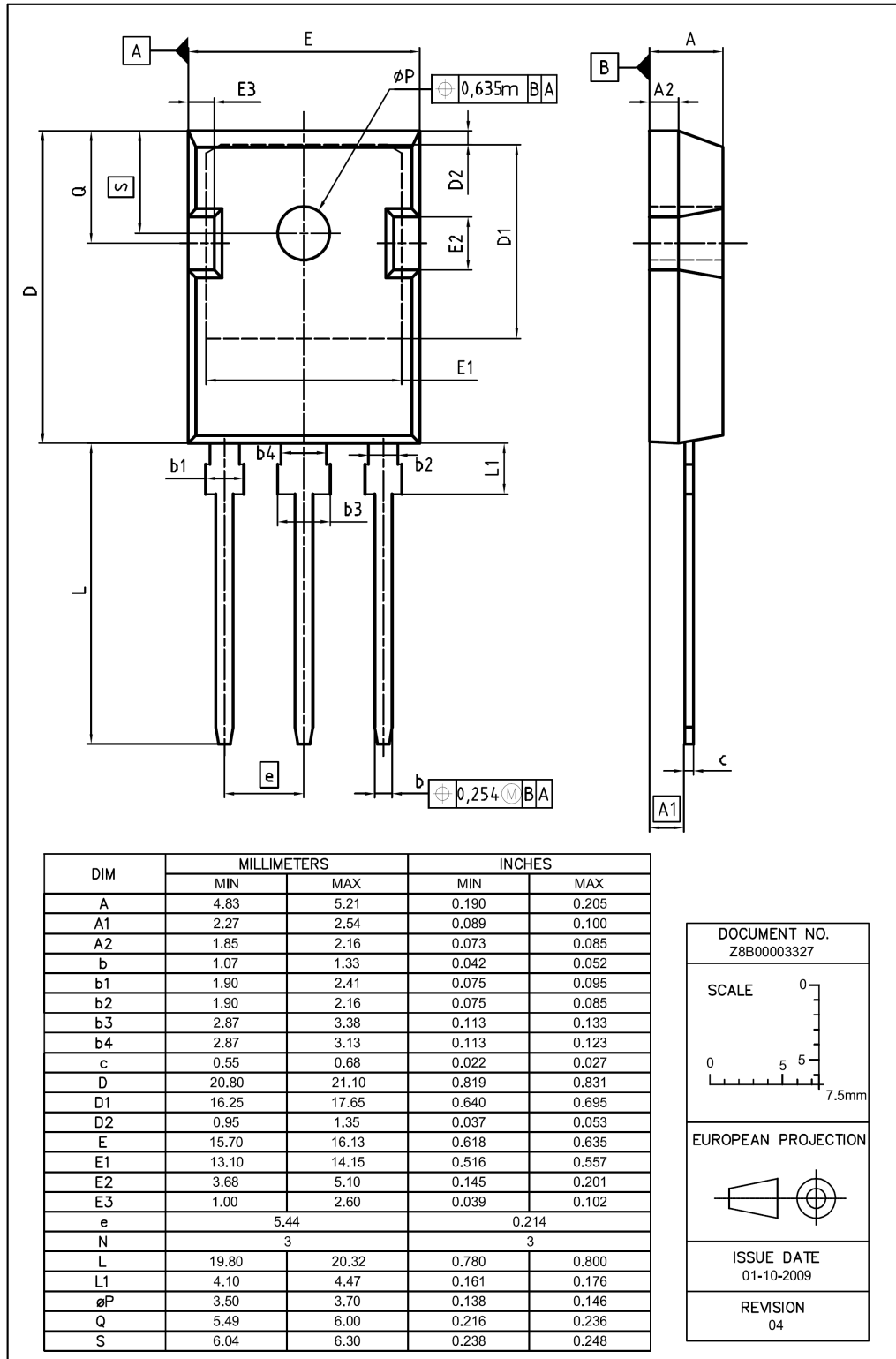


Figure 1 Outlines TO-247, dimensions in mm/inches

## 7 Revision History

Revision History: 2011-03-15, Rev. 2.0

Previous Revision:

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

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