MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CoolMOS C6

650V CoolMOS™ C6 Power Transistor
IPW65R070C6

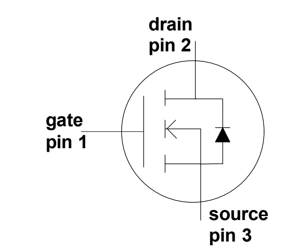
Data Sheet

Rev. 2.0, 2011-03-15
Final

Industrial & Multimarket

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_{dson}*Q_g and E_{oss}
- Very high commutation ruggedness
- Easy to use/drive
- Qualified for industrial grade applications according to JEDEC[1)]
- 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	Ω
$Q_{g,typ}$	170	nC
$I_{D,pulse}$	150	A
E_{oss} @ 400V	13	µJ
Body diode di/dt	300	A/µs

Related Links

- IFX CoolMOS Webpage
- IFX Design tools

Type	Package	Marking
IPW65R070C6	PG-TO247	65C6070

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	-	-	53.5	A	T_C= 25 °C
				33.8		T_C= 100°C
Pulsed drain current[2)]	$I_{D,pulse}$	-	-	150	A	T_C=25 °C
Avalanche energy, single pulse	E_{AS}	-	-	1160	mJ	I_D=9.3 A, V_{DD}=50 V
Avalanche energy, repetitive	E_{AR}	-	-	1.76		I_D=9.3 A, V_{DD}=50 V
Avalanche current, repetitive	I_{AR}	-	-	9.3	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	-	-	46.3	A	T_C=25 °C
Diode pulse current[2)]	$I_{S,pulse}$	-	-	150	A	T_C=25 °C
Reverse diode dv/dt[3)]	dv/dt	-	-	15	V/ns	V_{DS}=0...400 V, $I_{SD} \leq I_D$, T_j=25 °C
Maximum diode commutation speed[3)]	di_f/dt	-	-	300	A/µs	

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 °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=1.0 mA
Gate threshold voltage	$V_{GS(th)}$	2.5	3	3.5		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
		-	50	-		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	$R_{DS(on)}$	-	0.063	0.07	Ω	V_{GS}=10 V, I_D=17.6 A, T_j=25 °C
		-	0.164	-		V_{GS}=10 V, I_D=17.6 A, T_j=150 °C
Gate resistance	R_G	-	0.85	-	Ω	f=1 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 V, V_{DS}=100 V, f=1 MHz
Output capacitance	C_{oss}	-	215	-		
Effective output capacitance, energy related[1)]	$C_{o(er)}$	-	140	-		V_{GS}=0 V, V_{DS}=0...480 V
Effective output capacitance, time related[2)]	$C_{o(tr)}$	-	670	-		I_D=constant, V_{GS}=0 V V_{DS}=0...480V
Turn-on delay time	$t_{d(on)}$	-	17	-	ns	V_{DD}=400 V, V_{GS}=13 V, I_D=26.3 A, R_G= 1.8 Ω
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 V, I_D=26.3 A, V_{GS}=0 to 10 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 V, I_F=26.3 A, T_j=25 °C
Reverse recovery time	t_{rr}	-	730	-	ns	V_R=400 V, I_F=26.3 A, di_F/dt=100 A/µs
Reverse recovery charge	Q_{rr}	-	19	-	µC	
Peak reverse recovery current	I_{rrm}	-	50	-	A	

5 Electrical characteristics diagrams

Table 8

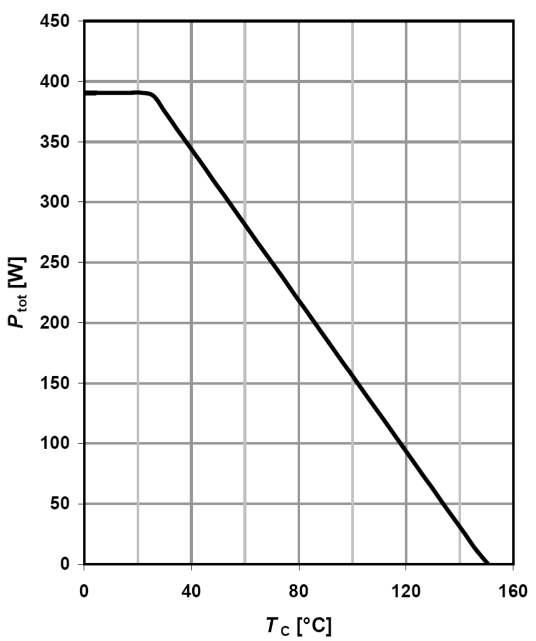
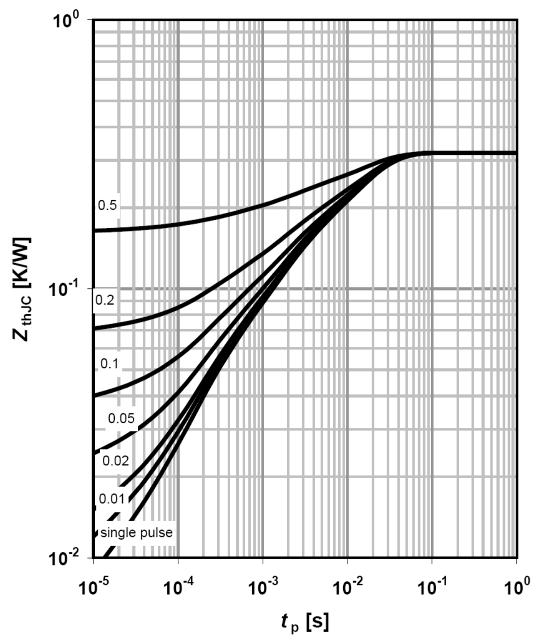
<table>
<tr><th>Power dissipation</th><th>Max. transient thermal impedance</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>$P_{tot} = f(T_C)$</td><td>$Z_{(thJC)}$=f(tp); parameter: D=t_p/T</td></tr>
</table>

Table 9

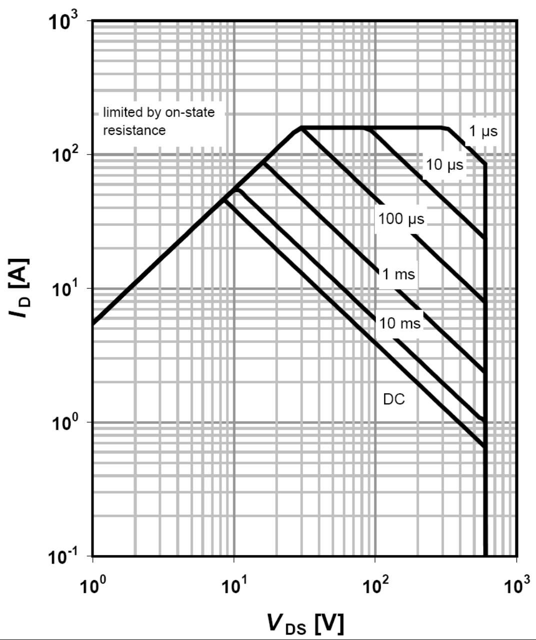
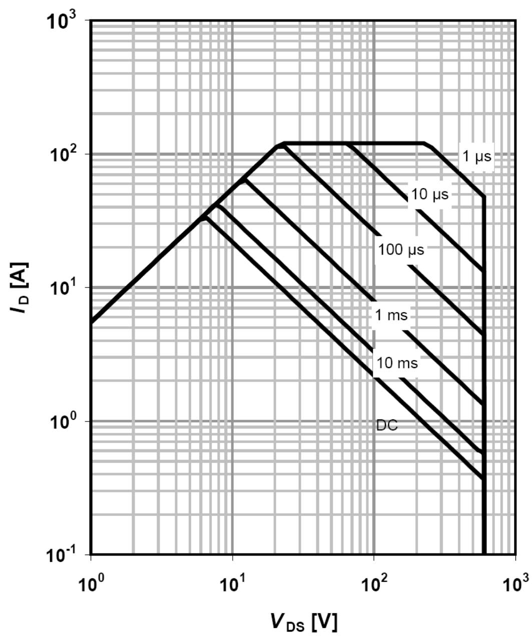
<table>
<tr><th>Safe operating area T_C=25 °C</th><th>Safe operating area T_C=80 °C</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>I_D=f(V_{DS}); T_C=25 °C; V_{GS} > 7V; D=0; parameter t_p</td><td>I_D=f(V_{DS}); T_C=80°C; V_{GS} > 7V; D=0; parameter t_p</td></tr>
</table>

Table 10

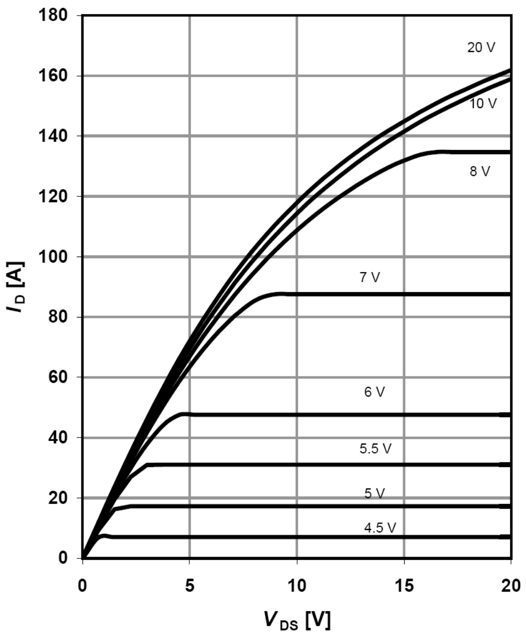
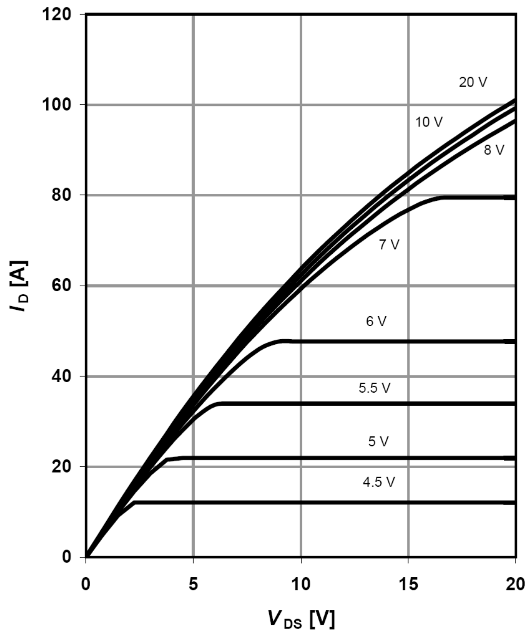
Typ. output characteristics T_j=25 °C	Typ. output characteristics T_j=125 °C
	
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}	I_D=f(V_{DS}); T_j=125 °C; parameter: V_{GS}

Table 11

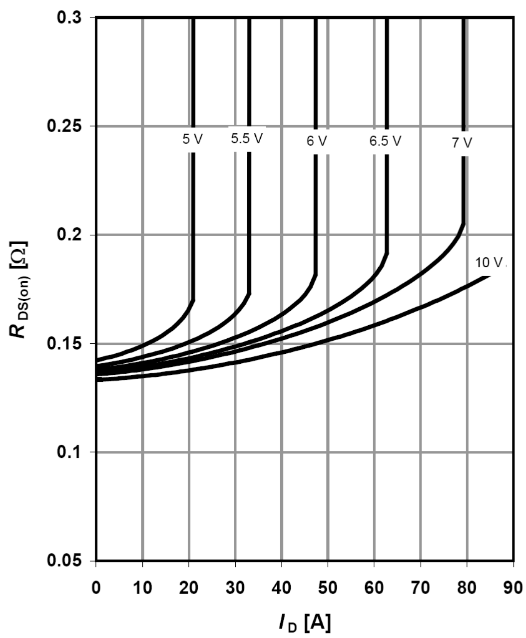
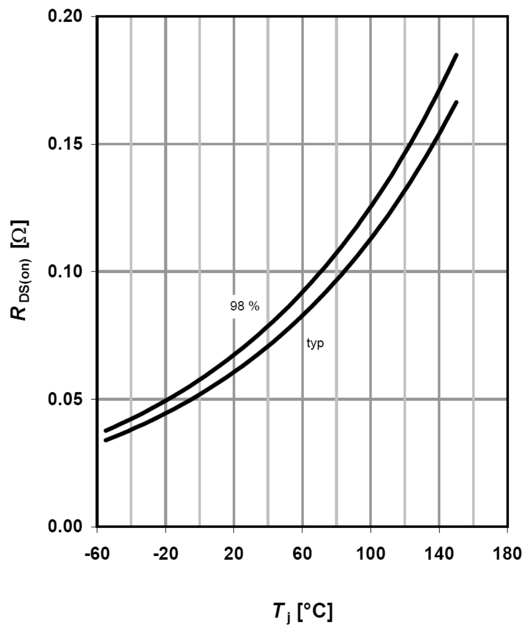
Typ. drain-source on-state resistance	Drain-source on-state resistance
	
$R_{DS(on)}$=f(I_D); T_j=125 °C; parameter: V_{GS}	$R_{DS(on)}$=f(T_j); I_D=17.6 A; V_{GS}=10 V

Table 12

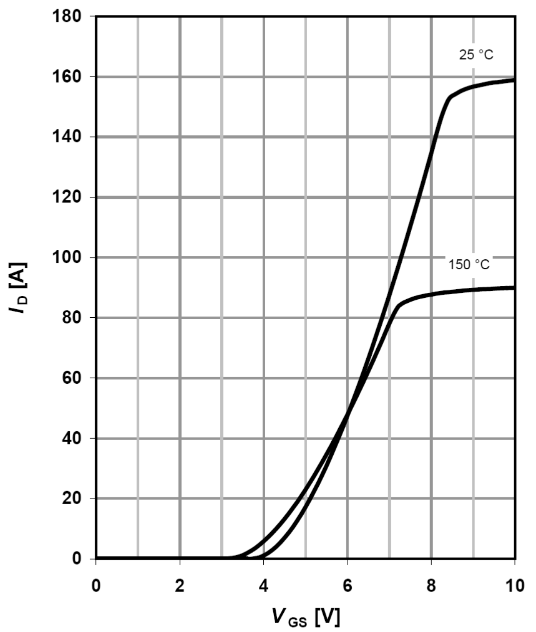
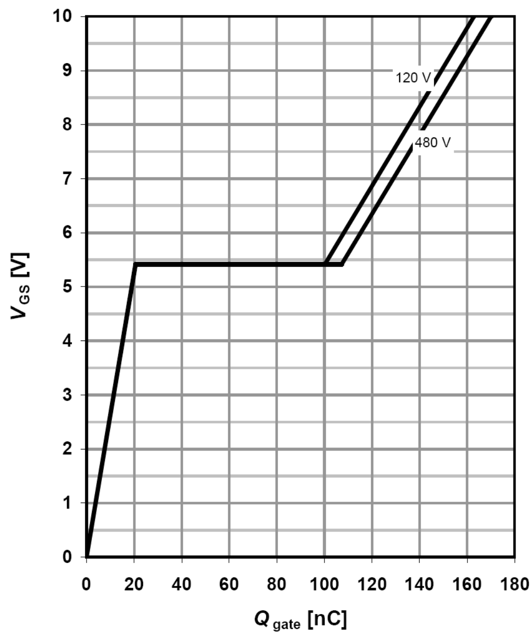
Typ. transfer characteristics	Typ. gate charge
	
I_D=f(V_{GS}); V_{DS}=20V	V_{GS}=f(Q_{gate}), I_D=26.3 A pulsed

Table 13

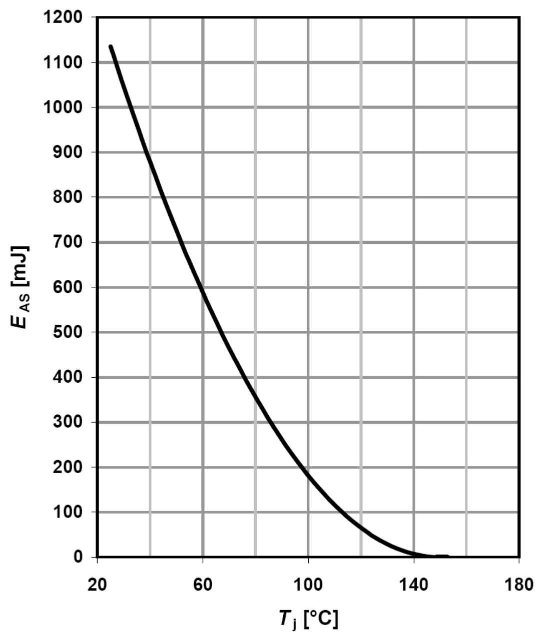
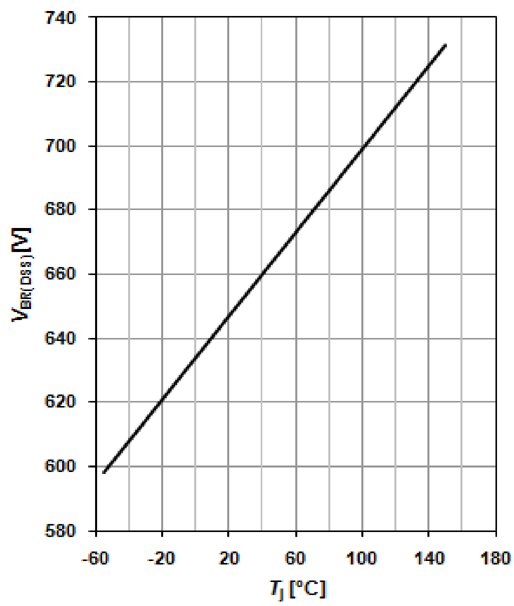
Avalanche energy	Drain-source breakdown voltage
	
E_{AS}=f(T_j); I_D=9.3 A; V_{DD}=50 V	$V_{BR(DSS)}$=f(T_j); I_D=1.0 mA

Table 14

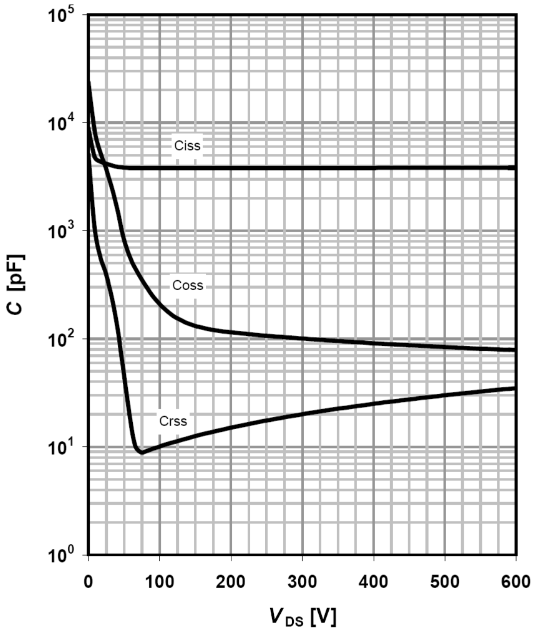
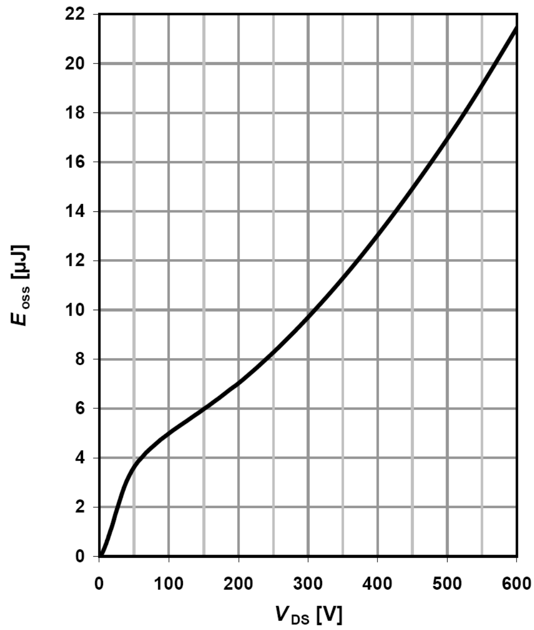
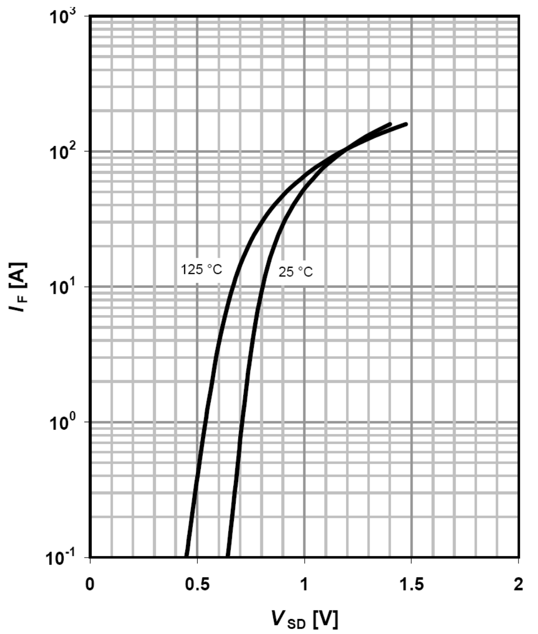
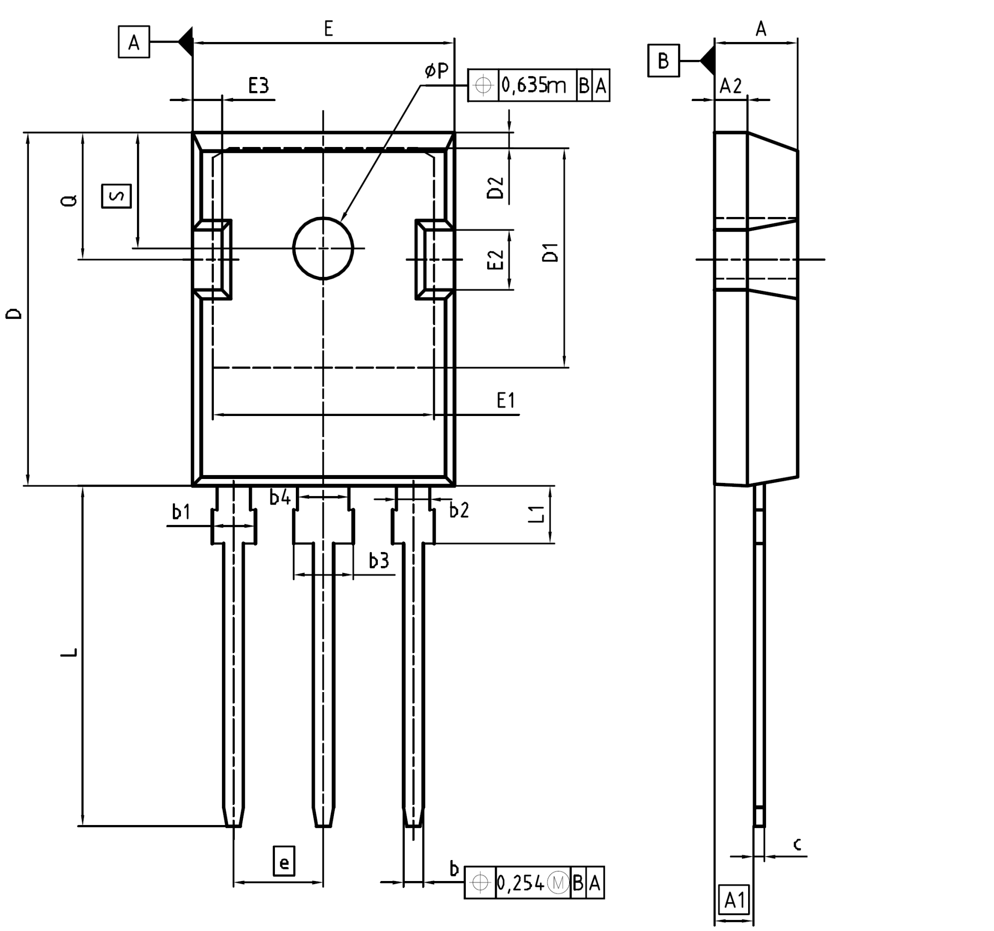
<table>
<tr><th>Typ. capacitances</th><th>Typ. C_{oss} stored energy</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>C=f(V_{DS}); V_{GS}=0 V; f=1 MHz</td><td>E_{oss}=f(V_{DS})</td></tr>
</table>

Table 15

<table>
<tr><th>Forward characteristics of reverse diode</th></tr>
<tr><td>
</td></tr>
<tr><td>I_F=f(V_{SD}); parameter: T_j</td></tr>
</table>

6 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		0.214	
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

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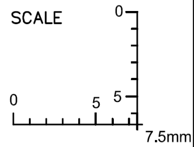
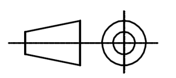


EUROPEAN PROJECTION



ISSUE DATE
01-10-2009

REVISION
04

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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