CoolMOS™ Power Transistor

Features

- Lowest figure-of-merit R_{ON} x Q_g
- Extreme dv/dt rated
- High peak current capability
- Qualified for industrial grade applications according to JEDEC[1)]
- Pb-free lead plating; RoHS compliant
- Ultra low gate charge

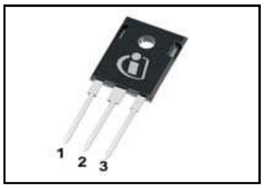
CoolMOS™ 900V is designed for:

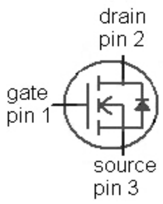
- Quasi Resonant Flyback / Forward topologies
- PC Silverbox and consumer applications
- Industrial SMPS

Product Summary

V_{DS} @ T_J=25°C	900	V
$R_{DS(on),max}$ @ T_J=25°C	1.2	Ω
$Q_{g,typ}$	28	nC

PG-TO247





Type	Package	Marking
IPW90R1K2C3	PG-TO247	9R1K2C

Maximum ratings, at T_J=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	5.1	A
		T_C=100 °C	3.2	
Pulsed drain current [2)]	$I_{D,pulse}$	T_C=25 °C	10	
Avalanche energy, single pulse	E_{AS}	I_D=0.92 A, V_{DD}=50 V	68	mJ
Avalanche energy, repetitive t_{AR} [2),3)]	E_{AR}	I_D=0.92 A, V_{DD}=50 V	0.31	
Avalanche current, repetitive t_{AR} [2),3)]	I_{AR}		0.92	A
MOSFET dv/dt ruggedness	dv/dt	V_{DS}=0...400 V	50	V/ns
Gate source voltage	V_{GS}	static	±20	V
		AC (f>1 Hz)	±30	
Power dissipation	P_{tot}	T_C=25 °C	83	W
Operating and storage temperature	T_J, T_{stg}		-55 ... 150	°C
Mounting torque		M3 and M3.5 screws	60	Ncm

Please note the new package dimensions arccording to PCN 2009-134-A

Maximum ratings, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous diode forward current	I_S	T_C=25 °C	2.8	A
Diode pulse current [2)]	$I_{S,pulse}$		11	
Reverse diode dv/dt [4)]	*dv/dt*		4	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	1.5	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	1.6 mm (0.063 in.) from case for 10 s	-	-	260	°C

Electrical characteristics, at T_J=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0 V, I_D=250 µA	900	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=0.31 mA	2.5	3	3.5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=900 V, V_{GS}=0 V, T_j=25 °C	-	-	1	µA
		V_{DS}=900 V, V_{GS}=0 V, T_j=150 °C	-	10	-	
Gate-source leakage current	I_{GSS}	V_{GS}=20 V, V_{DS}=0 V	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10 V, I_D=2.8 A, T_j=25 °C	-	0.94	1.2	Ω
		V_{GS}=10 V, I_D=2.8 A, T_j=150 °C	-	2.5	-	
Gate resistance	R_G	*f*=1 MHz, open drain	-	1.3	-	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz	-	710	-	pF
Output capacitance	C_{oss}		-	35	-	
Effective output capacitance, energy related [5]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 500 V	-	23	-	
Effective output capacitance, time related [6]	$C_{o(tr)}$		-	86	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=2.8 A, R_G=81.3 Ω	-	70	-	ns
Rise time	t_r		-	20	-	
Turn-off delay time	$t_{d(off)}$		-	400	-	
Fall time	t_f		-	40	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=400 V, I_D=2.8 A, V_{GS}=0 to 10 V	-	3.2	-	nC
Gate to drain charge	Q_{gd}		-	12	-	
Gate charge total	Q_g		-	28	tbd	
Gate plateau voltage	$V_{plateau}$		-	4.6	-	V
Reverse Diode						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=2.8 A, T_j=25 °C	-	0.8	1.2	V
Reverse recovery time	t_{rr}	V_R=400 V, I_F=I_S, di_F/dt=100 A/µs	-	310	-	ns
Reverse recovery charge	Q_{rr}		-	3.7	-	µC
Peak reverse recovery current	I_{rrm}		-	19	-	A

[1] J-STD20 and JESD22

[2] Pulse width t_p limited by $T_{J,max}$

[3] Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR}*f$.

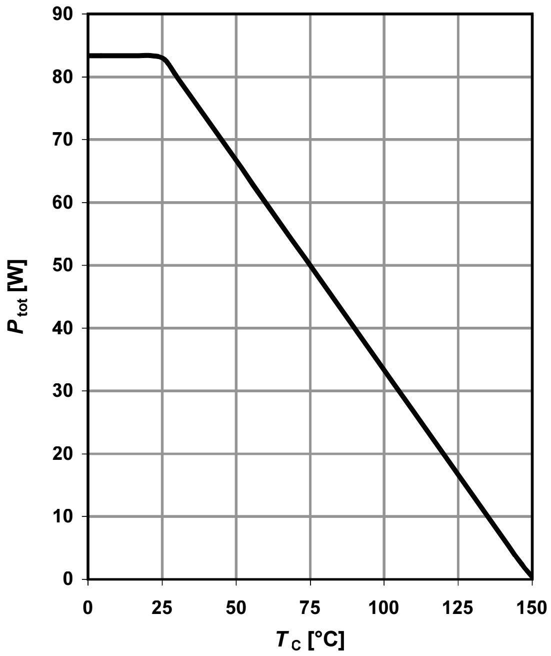
[4] $I_{SD} \le I_D$, di/dt≤200A/µs, V_{DClink}=400V, $V_{peak}<V_{(BR)DSS}$, $T_J<T_{J,max}$, identical low side and high side switch

[5] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 50% V_{DSS}.

[6] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 50% V_{DSS}.

1 Power dissipation

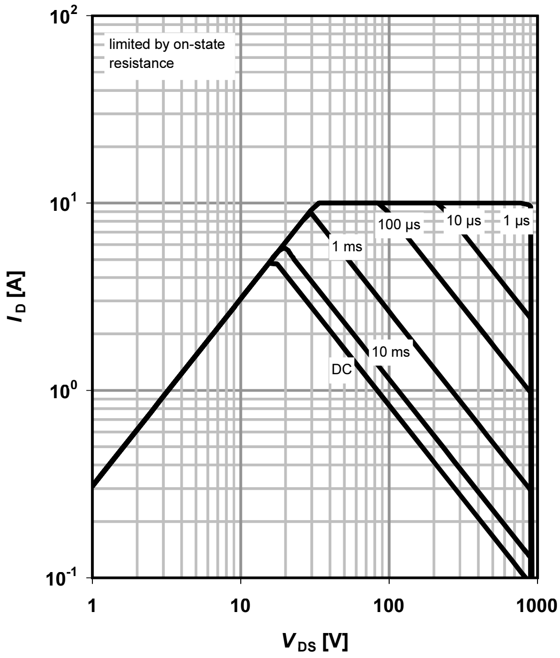
P_{tot}=f(T_C)



2 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

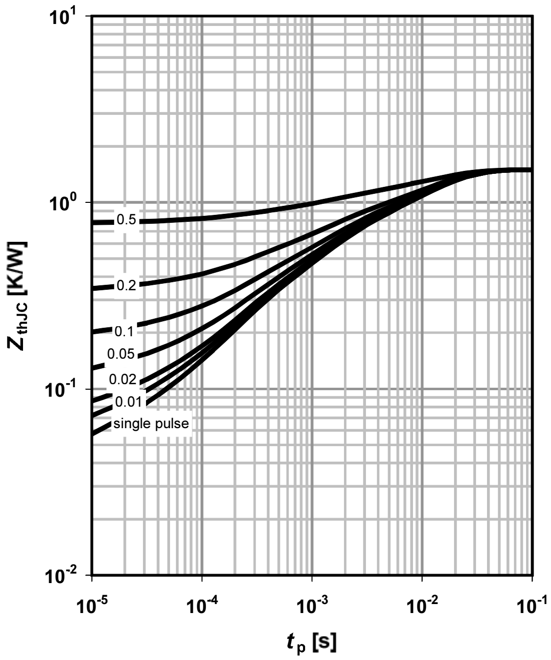
parameter: t_p



3 Max. transient thermal impedance

Z_{thJC}=f(t_P)

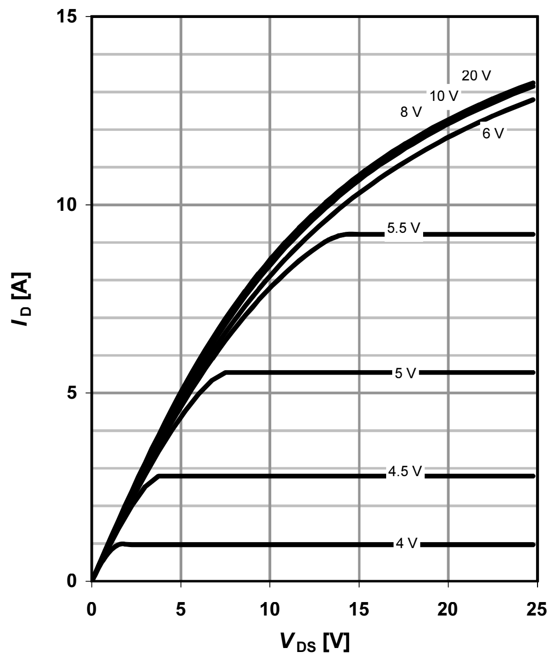
parameter: $D=t_p/T$



4 Typ. output characteristics

I_D=f(V_{DS}); T_J=25 °C

parameter: V_{GS}

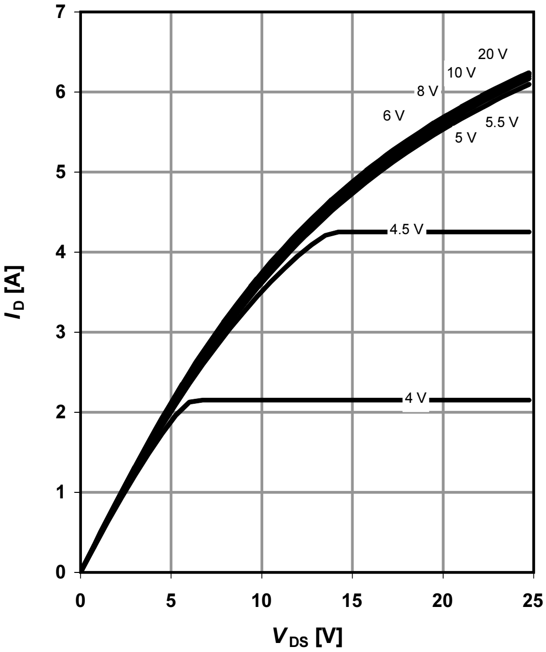


Please note the new package dimensions arccording to PCN 2009-134-A

5 Typ. output characteristics

I_D=f(V_{DS}); T_J=150 °C

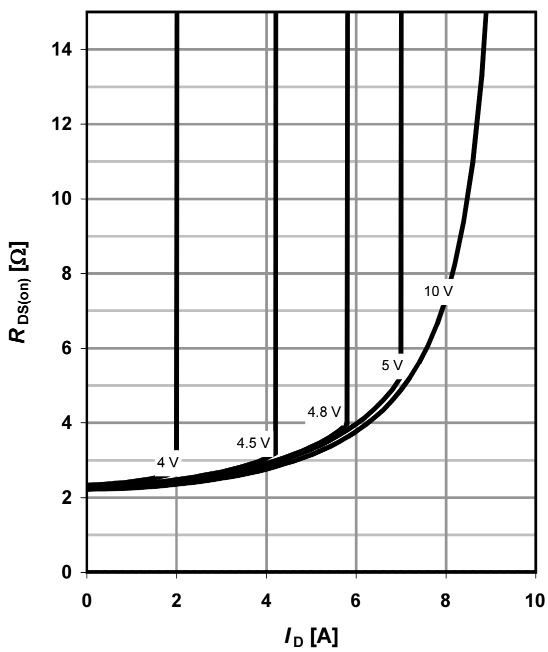
parameter: V_{GS}



6 Typ. drain-source on-state resistance

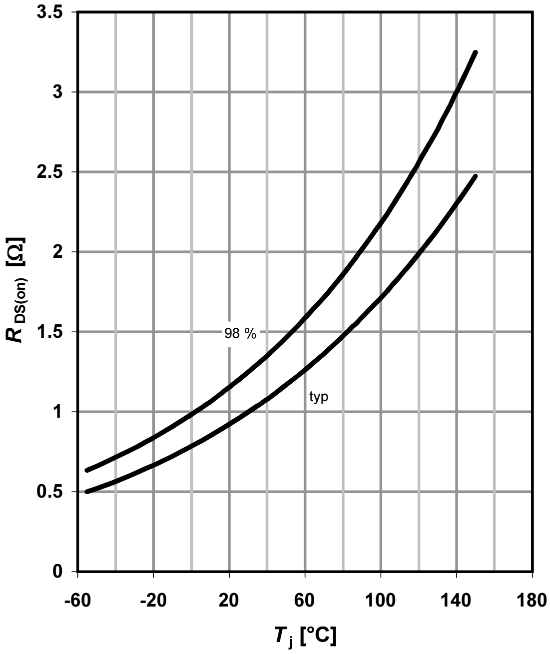
$R_{DS(on)}$=f(I_D); T_J=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

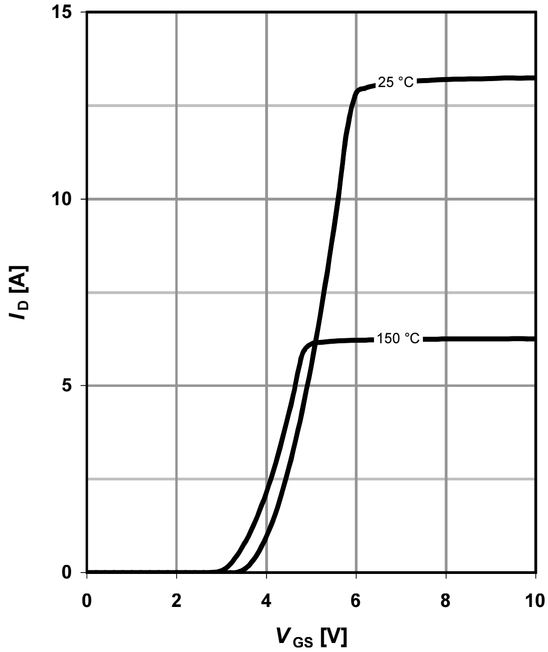
$R_{DS(on)}$=f(T_J); I_D=2.8 A; V_{GS}=10 V



8 Typ. transfer characteristics

I_D=f(V_{GS}); V_{DS}=20V

parameter: T_J

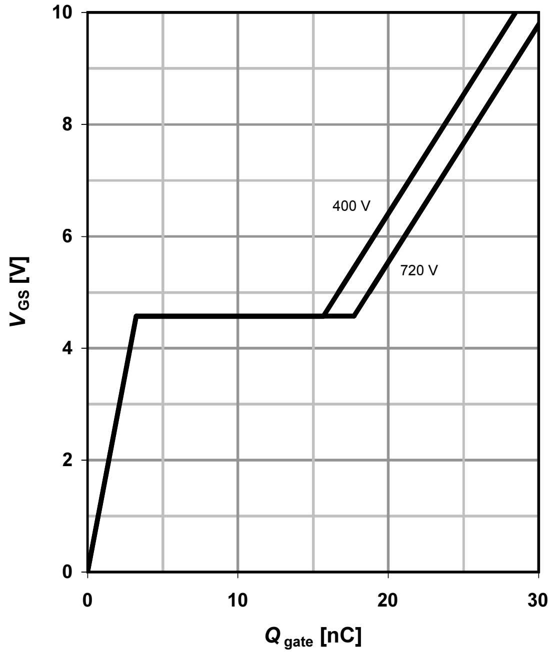


Please note the new package dimensions arccording to PCN 2009-134-A

9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=2.8 A pulsed

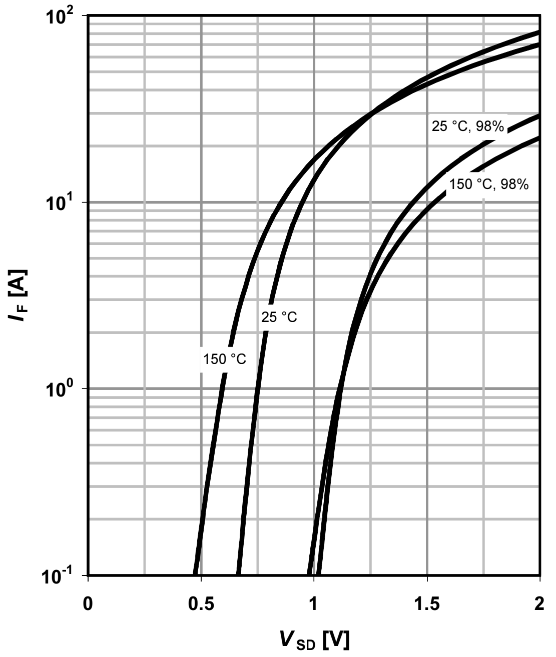
parameter: V_{DD}



10 Forward characteristics of reverse diode

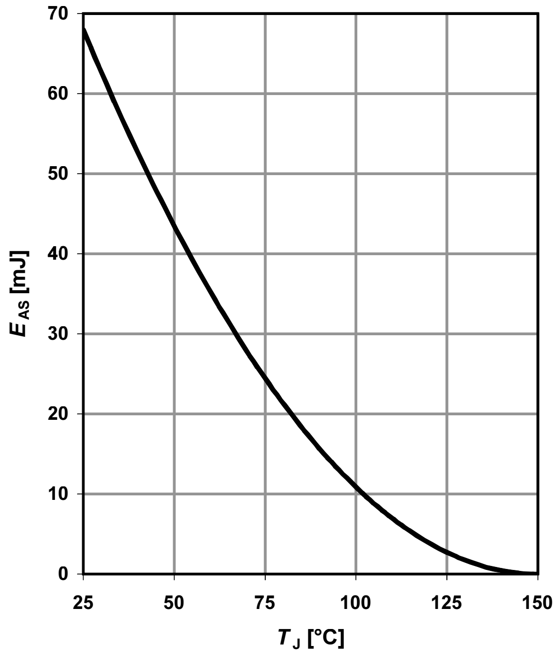
I_F=f(V_{SD})

parameter: T_J



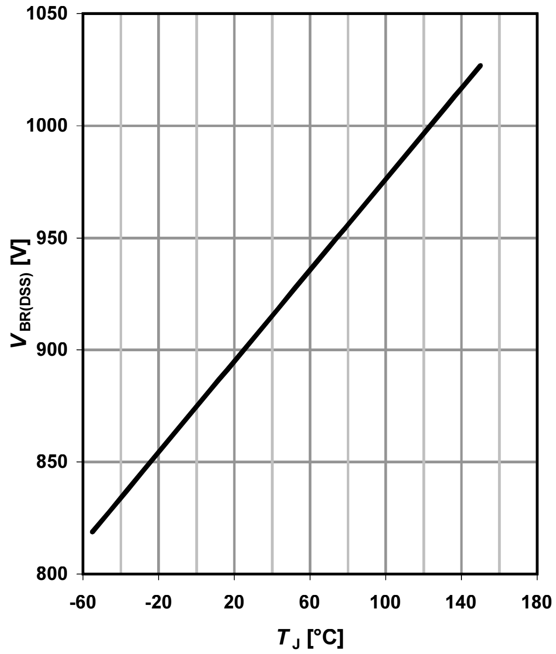
11 Avalanche energy

E_{AS}=f(T_j); I_D=0.92 A; V_{DD}=50 V



12 Drain-source breakdown voltage

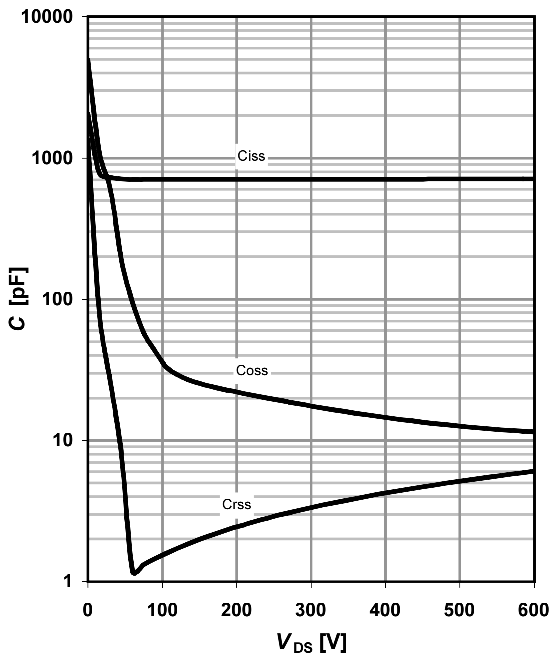
$V_{BR(DSS)}$=f(T_j); I_D=0.25 mA



Please note the new package dimensions arccording to PCN 2009-134-A

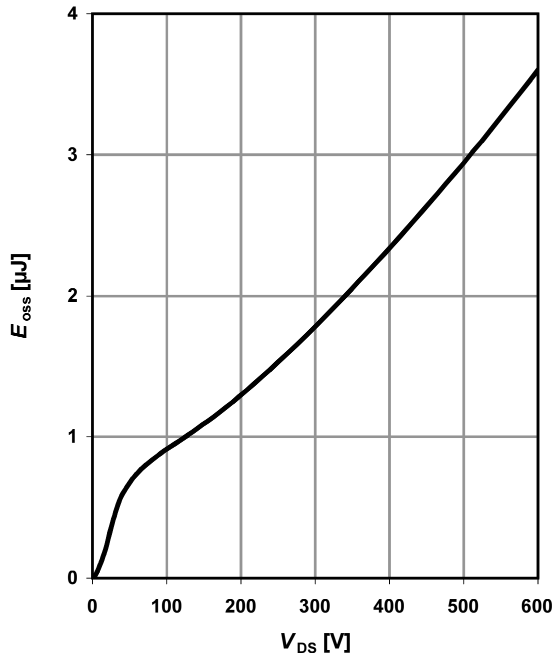
13 Typ. capacitances

C=f(V_{DS}); V_{GS}=0 V; f=1 MHz



14 Typ. C_{oss} stored energy

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



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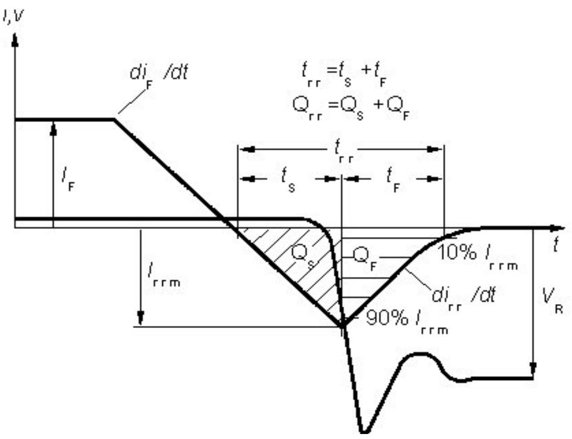
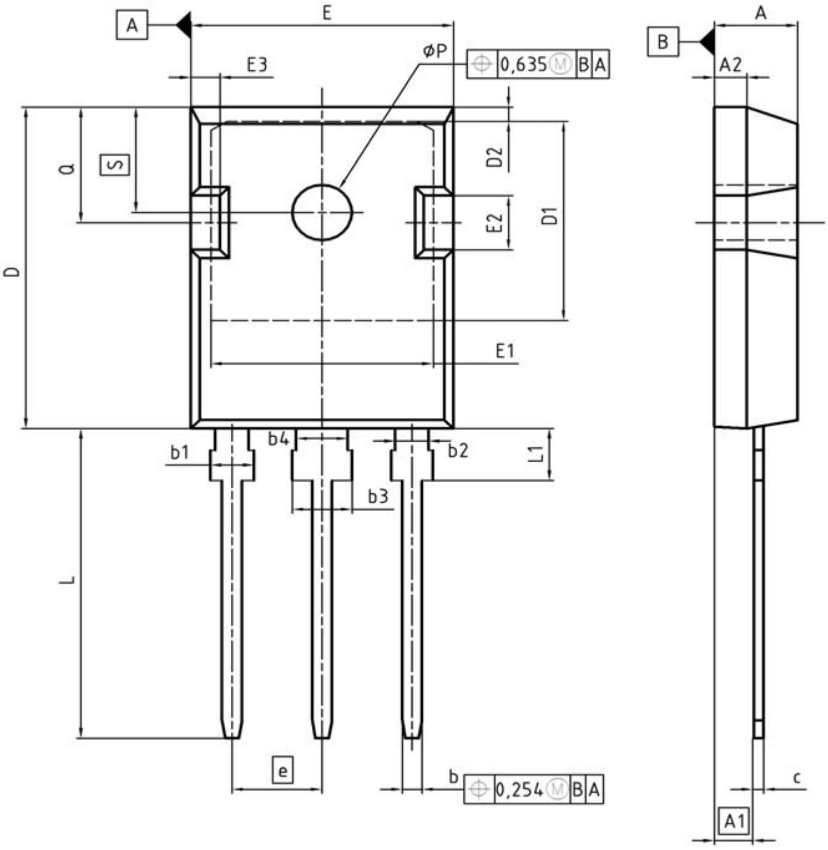
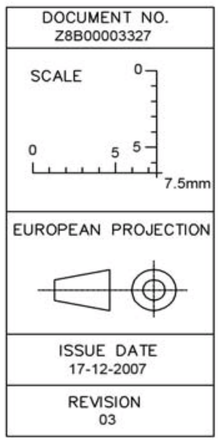
Definition of diode switching characteristics



PG-TO247 Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.16	0.193	0.203
A1	2.27	2.53	0.089	0.099
A2	1.85	2.11	0.073	0.083
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	20.82	21.10	0.820	0.831
D1	16.25	17.65	0.640	0.695
D2	1.05	1.35	0.041	0.053
E	15.70	16.03	0.618	0.631
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.68	2.60	0.066	0.102
e	5.44		0.214	
N	3		3	
L	19.80	20.31	0.780	0.799
L1	4.17	4.47	0.164	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



Dimensions in mm/inches

Please note the new package dimensions arccording to PCN 2009-134-A

Published by
Infineon Technologies AG
81726 Munich, Germany

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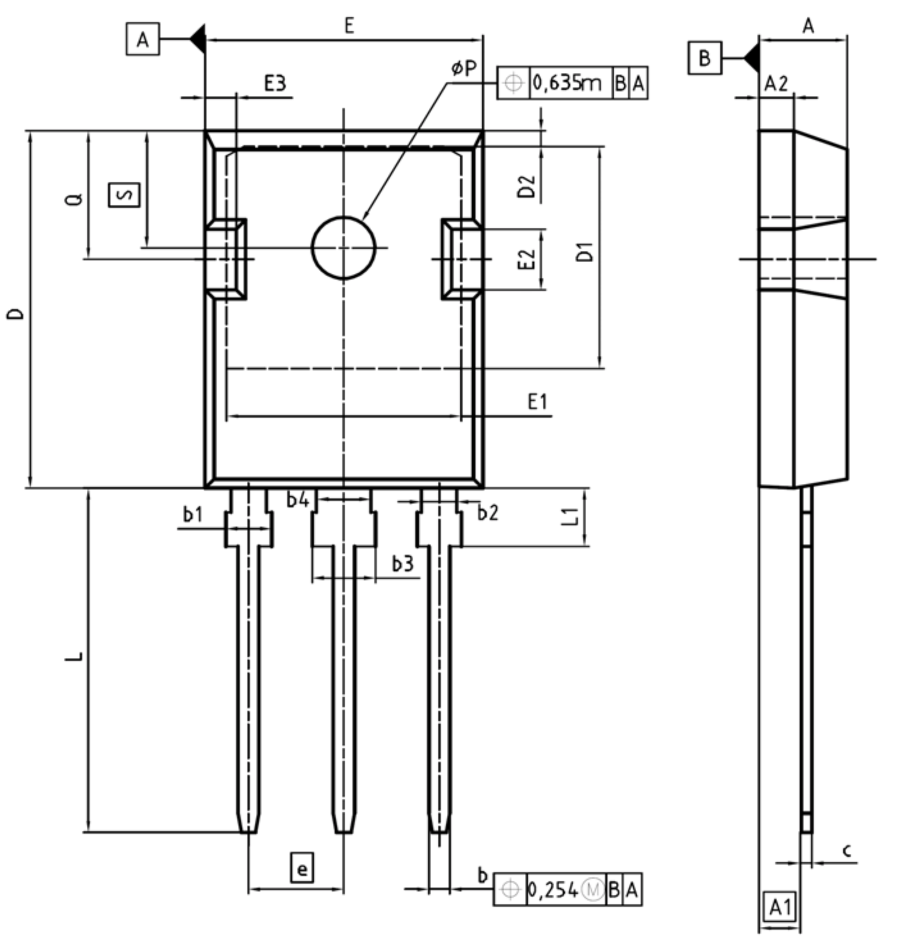
1 New package outlines TO-247

Assembly capacity extension for CoolMOSTM technology products assembled in lead-free package PG-TO247-3 at subcontractor ASE (Weihai) Inc., China (Changes are marked in blue.)



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

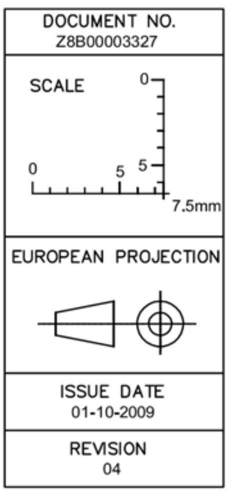


Figure 1 Outlines TO-247, dimensions in mm/inches