CoolMOS™ Power Transistor

Features

- Intrinsic fast-recovery body diode
- Extremely low reverse recovery charge
- Ultra low gate charge
- Extreme d*v*/d*t* rated
- High peak current capability
- Qualified according to JEDEC[1] for target applications

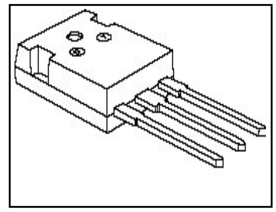
CoolMOS CFD designed for:

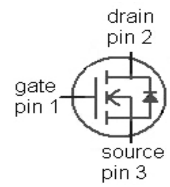
- Softswitching PWM Stages
- LCD & CRT TV

Product Summary

V_{DS} @ Tjmax	650	V
$R_{DS(on),max}$	0.330	Ω
I_D	13.4	A

PG-TO247





Type	Package	Marking
SPW15N60CFD	PG-TO247	15N60CFD

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	13.4	A
		T_C=100 °C	8.4	
Pulsed drain current[2]	$I_{D,pulse}$	T_C=25 °C	33	
Avalanche energy, single pulse	E_{AS}	I_D=6.7 A, V_{DD}=50 V	460	mJ
Avalanche energy, repetitive[2),3)]	E_{AR}	I_D=13.4 A, V_{DD}=50 V	0.8	
Avalanche current, repetitive[2),3)]	I_{AR}		13.4	A
Drain source voltage slope	d*v*/d*t*	I_D=13.4 A, V_{DS}=480 V, T_j=125 °C	80	V/ns
Reverse diode d*v*/d*t*	d*v*/d*t*	I_S=13.4 A, V_{DS}=480 V, T_j=125 °C	40	V/ns
Maximum diode commutation speed	d*i*/d*t*		600	A/µs
Gate source voltage	V_{GS}	static	±20	V
		AC (*f*>1 Hz)	±30	
Power dissipation	P_{tot}	T_C=25 °C	156	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C
Mounting torque		M3 & 3.5 screws	60	Ncm

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	0.8	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wave soldering 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						
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0 V, I_D=250 µA	600	-	-	V
Avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS}=0 V, I_D=13.4 A	-	700	-	
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=750 µA	3	4	5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600 V, V_{GS}=0 V, T_j=25 °C	-	1.4	-	µA
		V_{DS}=600 V, V_{GS}=0 V, T_j=150 °C	-	1200	-	
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=9.4 A, T_j=25 °C	-	0.28	0.33	Ω
		V_{GS}=10 V, I_D=9.4 A, T_j=150 °C	-	0.78	-	
Gate resistance	R_G	f=1 MHz, open drain	-	1.3	-	
Transconductance	g_{fs}	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=9.4 A	-	8	-	S

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=25 V, f=1 MHz	-	1820	-	pF
Output capacitance	C_{oss}		-	520	-	
Reverse transfer capacitance	C_{rss}		-	21	-	
Effective output capacitance, energy related[4]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	61	-	
Effective output capacitance, time related[5]	$C_{o(tr)}$		-	110	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=13.4 A, R_G=3.6 Ω	-	43	-	ns
Rise time	t_r		-	24	-	
Turn-off delay time	$t_{d(off)}$		-	47	-	
Fall time	t_f		-	5	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=480 V, I_D=13.4 A, V_{GS}=0 to 10 V	-	11	-	nC
Gate to drain charge	Q_{gd}		-	38	-	
Gate charge total	Q_g		-	63	84	
Gate plateau voltage	$V_{plateau}$		-	7.3	-	V

[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] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

[5] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

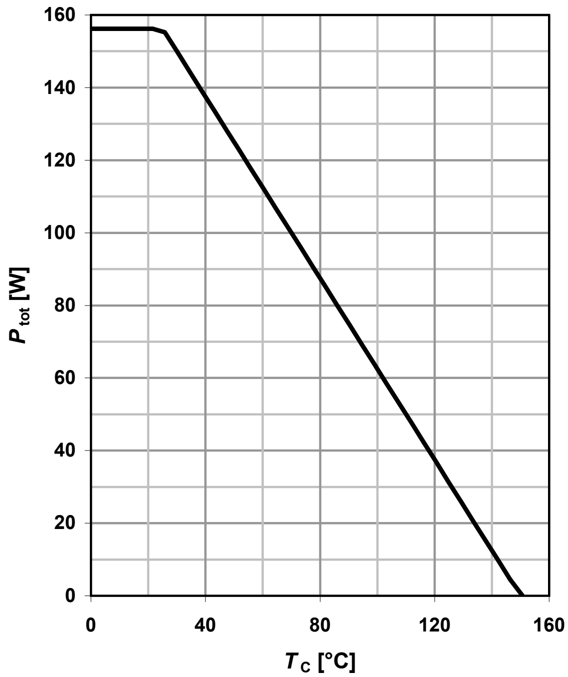
Please note the new package dimensions arccording to PCN 2009-134-A

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Reverse Diode						
Diode continuous forward current	I_S	T_C=25 °C	-	-	13.4	A
Diode pulse current[2)]	$I_{S,pulse}$		-	-	33	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=I_S, T_j=25 °C	-	1.0	1.2	V
Reverse recovery time	t_{rr}	V_R=480 V, I_F=I_S, di_F/dt=100 A/µs	-	147	-	ns
Reverse recovery charge	Q_{rr}		-	1	-	µC
Peak reverse recovery current	I_{rrm}		-	12	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt	T_j=25 °C	-	1200	-	A/µs

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

1 Power dissipation

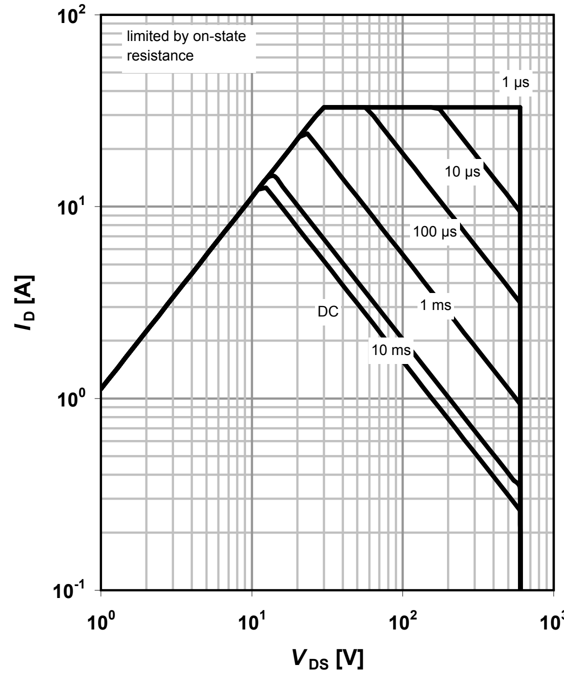
P_{tot}=f(T_C)



2 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

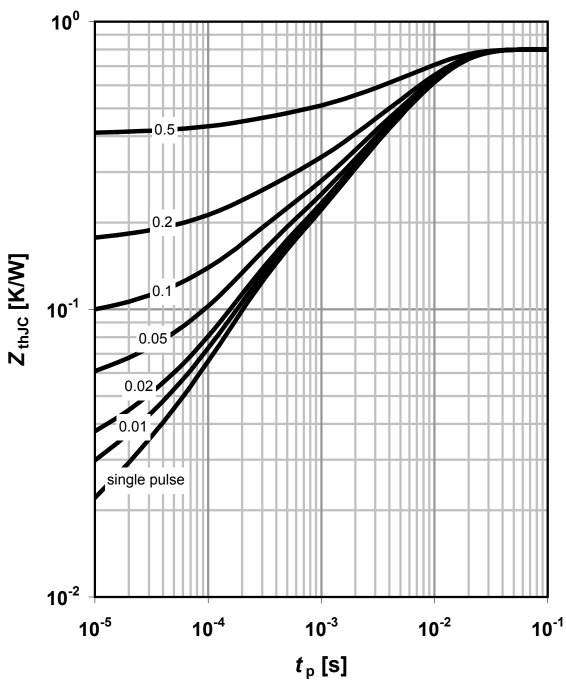
parameter: t_p



3 Max. transient thermal impedance

I_D=f(V_{DS}); T_j=25 °C

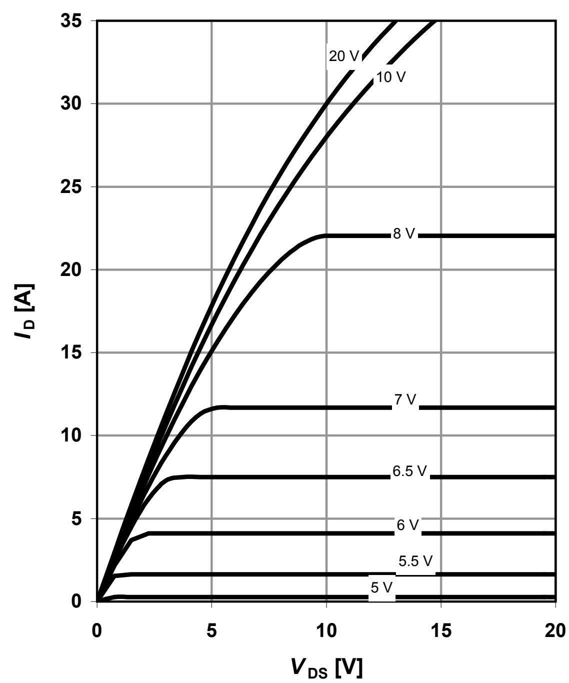
parameter: D=t_p/T



4 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

parameter: V_{GS}

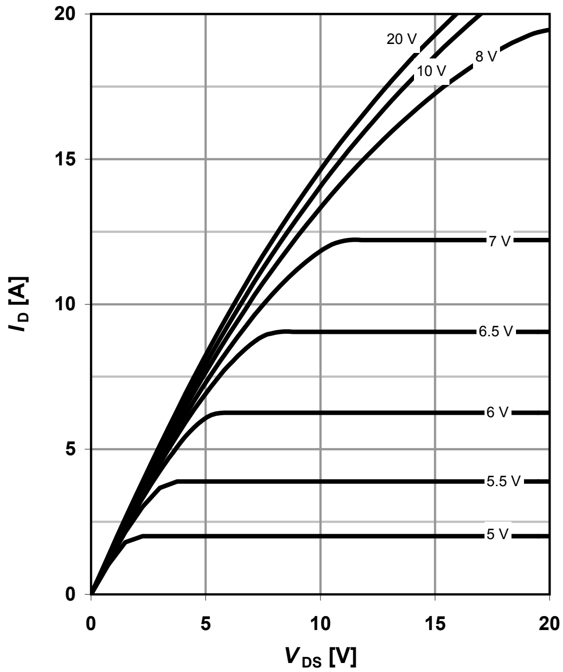


Please note the new package dimensions arccording to PCN 2009-134-A

5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

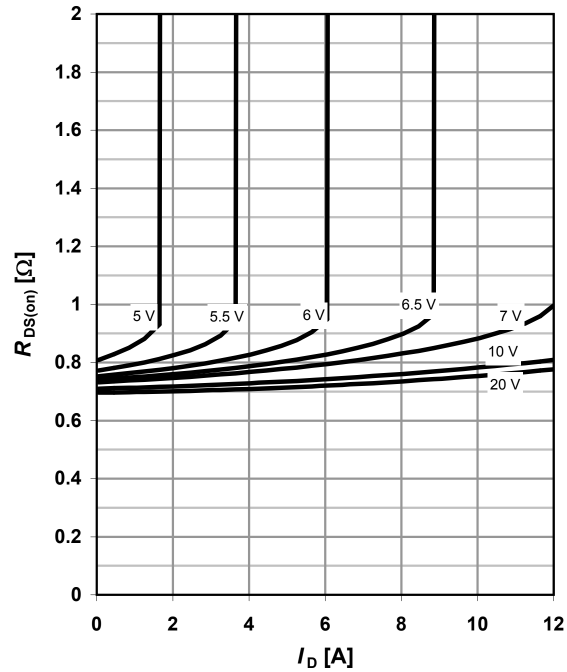
parameter: V_{GS}



6 Typ. drain-source on-state resistance

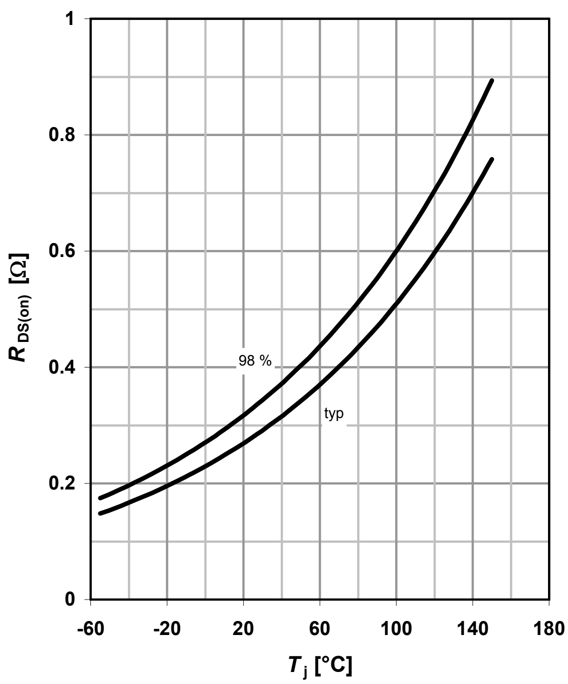
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

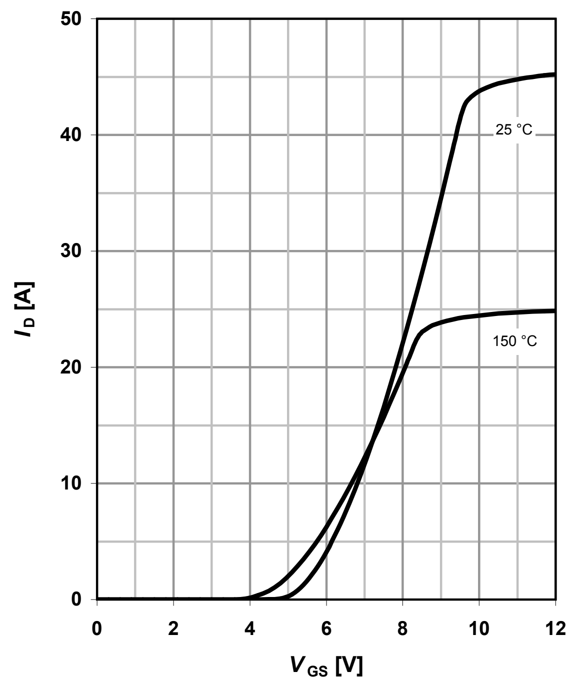
$R_{DS(on)}$=f(T_j); I_D=9.4 A; V_{GS}=10 V



8 Typ. transfer characteristics

I_D=f(V_{GS}); |V_{DS}|>2|I_D|$R_{DS(on)max}$

parameter: T_j

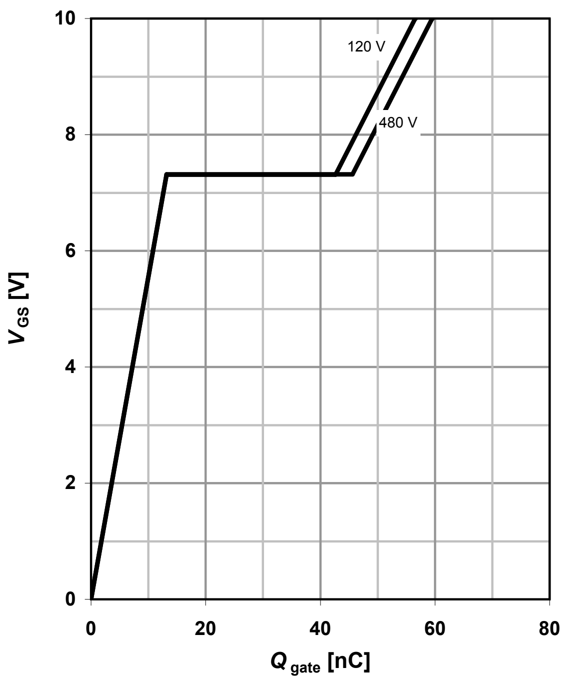


Please note the new package dimensions arccording to PCN 2009-134-A

9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=13.4 A pulsed

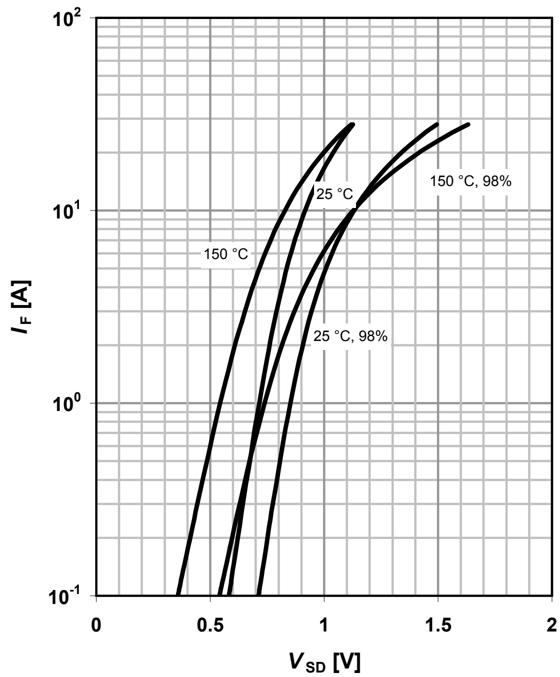
parameter: V_{DD}



10 Forward characteristics of reverse diode

I_F=f(V_{SD})

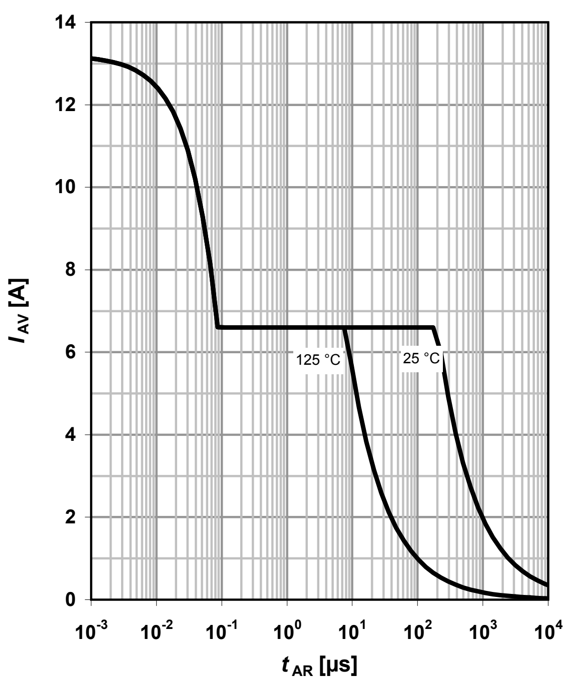
parameter: T_j



11 Avalanche SOA

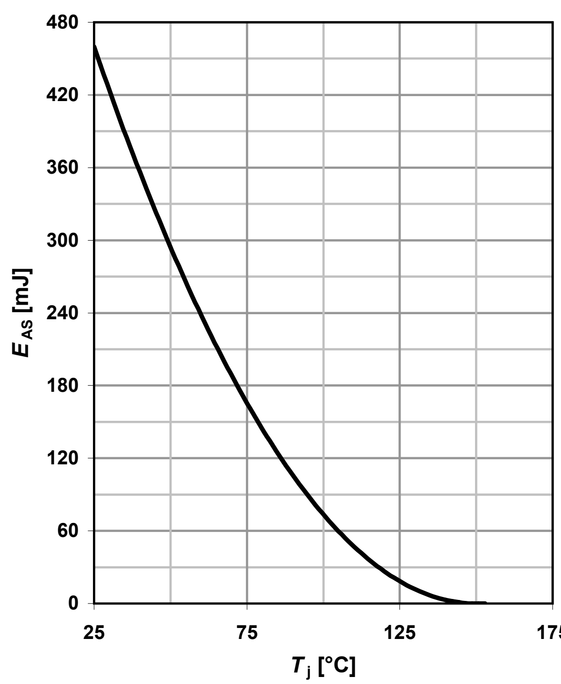
I_{AR}=f(t_{AR})

parameter: $T_{j(start)}$



12 Avalanche energy

E_{AS}=f(T_j); I_D=6.7 A; V_{DD}=50 V



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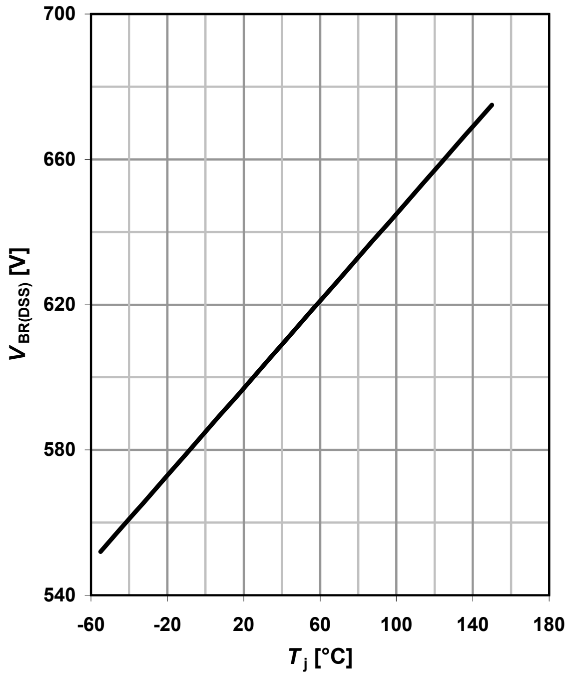
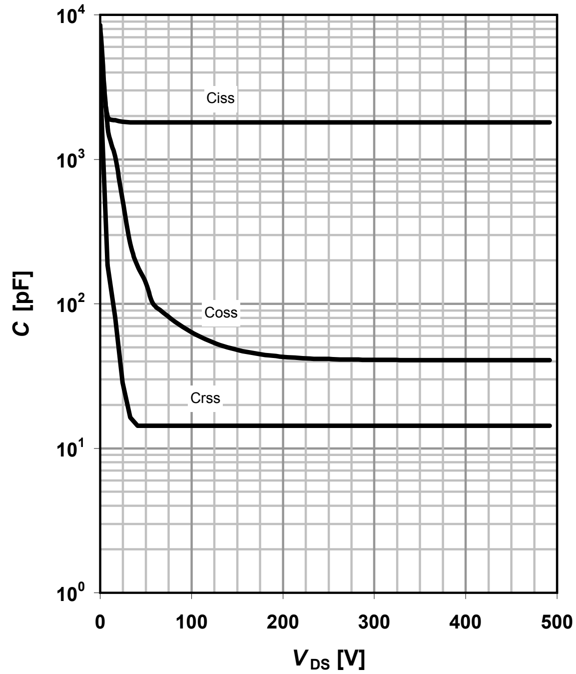
13 Drain-source breakdown voltage

$V_{BR(DSS)}$=f(T_j)



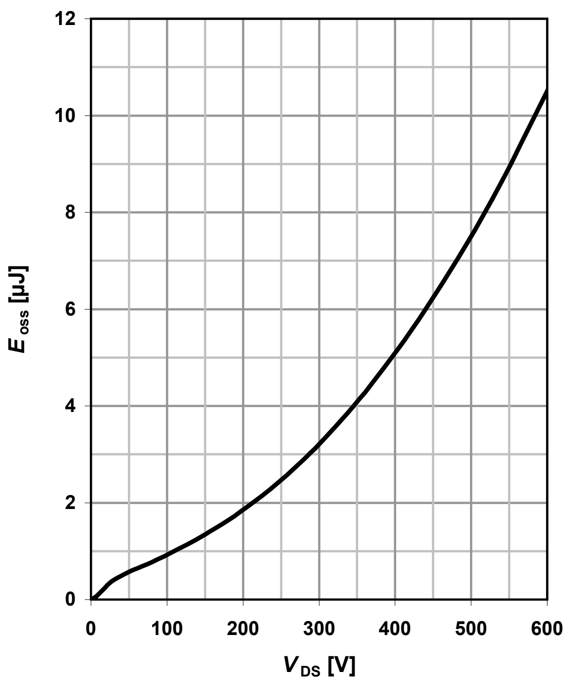
14 Typ. capacitances

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



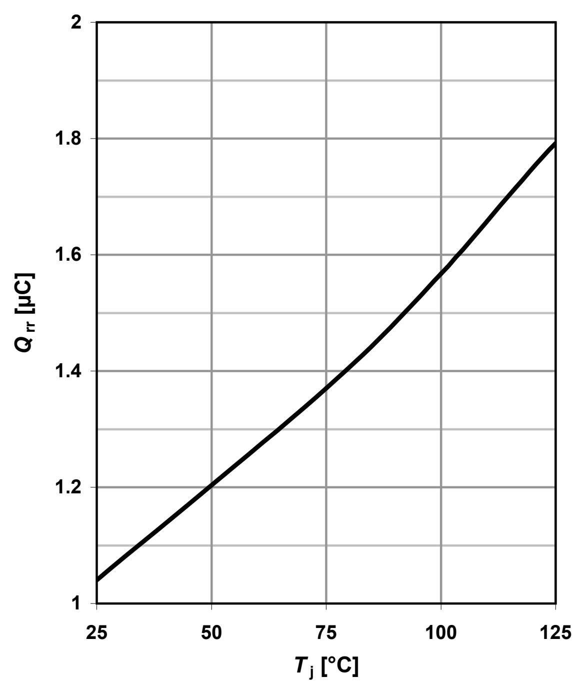
15 Typ. C_{oss} stored energy

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



16 Typ. reverse recovery charge

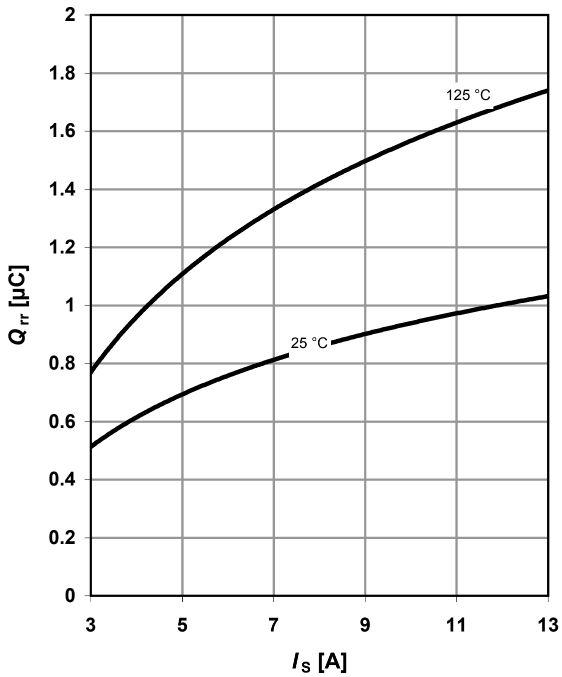
Q_{rr}=f(T_j);parameter: I_D =13.4 A



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

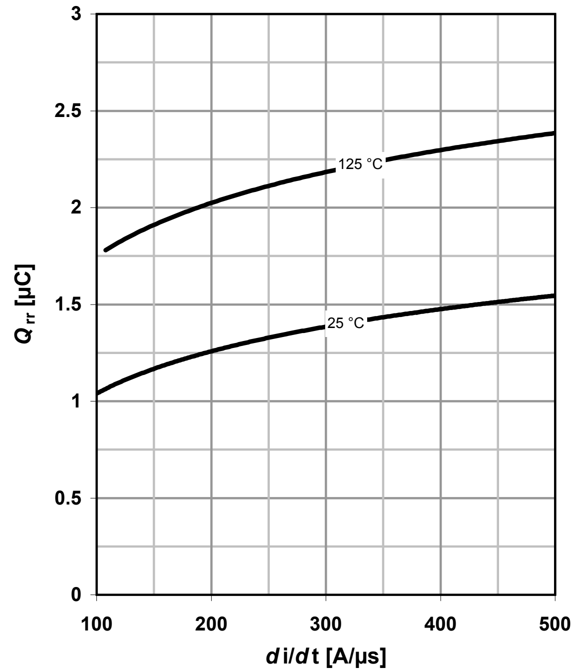
17 Typ. reverse recovery charge

Q_{rr}=f(I_S); parameter: di/dt=100 A/µs



18 Typ. reverse recovery charge

Q_{rr}=f(di/dt); parameter: I_D=13.4 A



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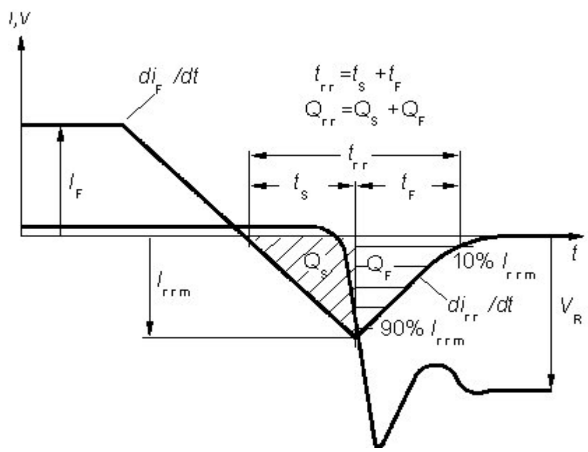
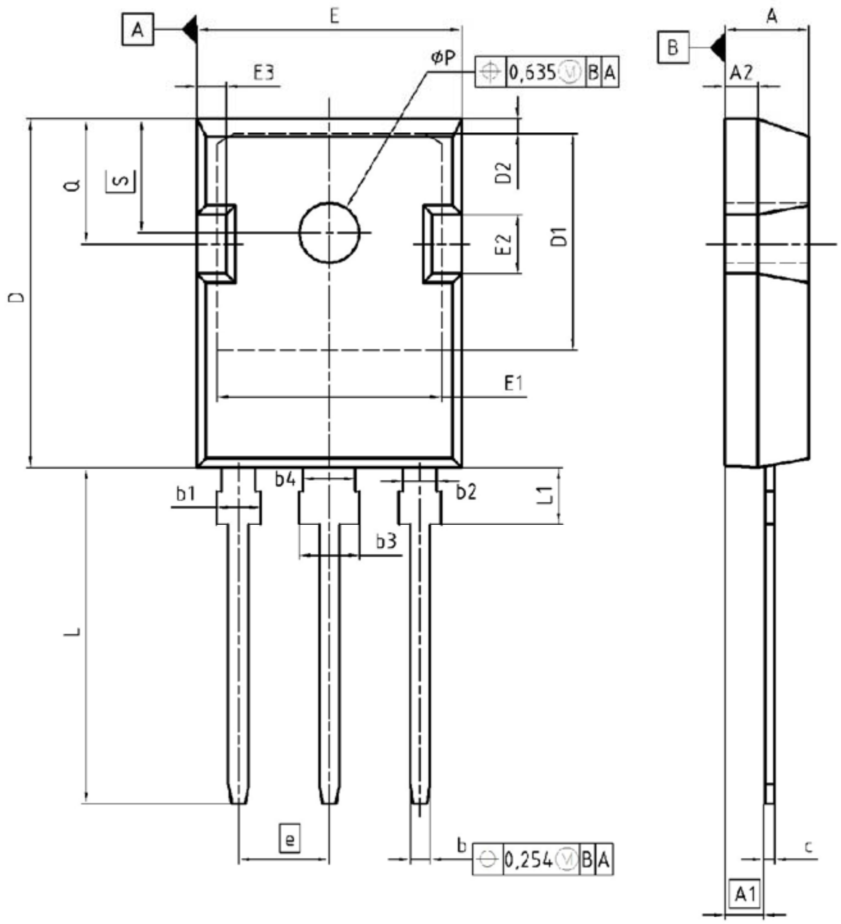
Definition of diode switching characteristics



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

PG-TO-247-3-1

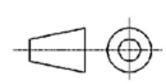


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.16	0.193	0.203
A1	2.27	2.53	0.089	0.099
A2	1.85	2.11	0.073	0.083
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.82	21.10	0.820	0.831
D1	16.25	17.65	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

DOCUMENT NO.
Z8B00003327

SCALE
0 5 7.5mm

EUROPEAN PROJECTION



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03

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

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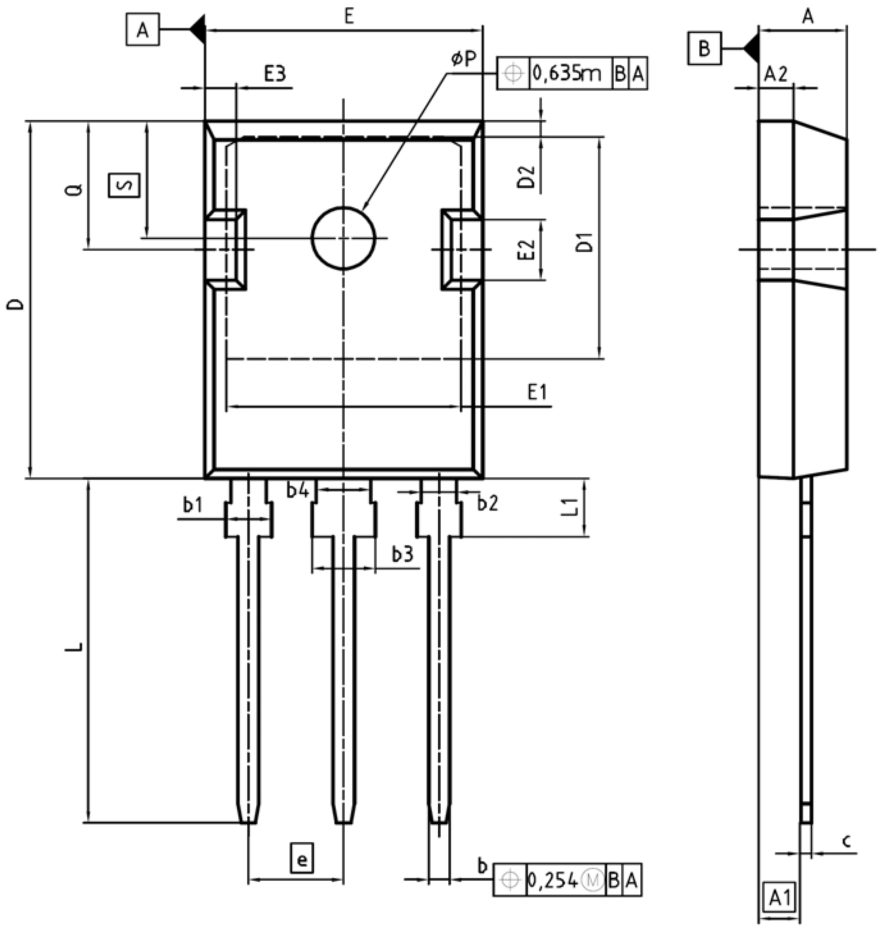
1 New package outlines TO-247

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

DOCUMENT NO.
Z8B00003327

SCALE 0 5 0 5 7.5mm

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04

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