CoolMOS^{TM} Power Transistor

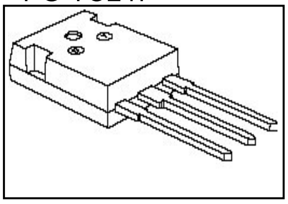
Features

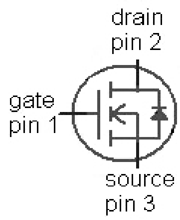
- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- Ultra low effective capacitances
- Improved transconductance
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC[0)] for target applications

Product Summary

V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	0.1	Ω
I_D	34.6	A

PG-TO247





Type	Package	Ordering Code	Marking
SPW35N60C3	PG-TO247	Q67040-S4673	35N60C3

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	34.6	A
		T_C=100 °C	21.9	
Pulsed drain current[1)]	$I_{D,pulse}$	T_C=25 °C	103.8	
Avalanche energy, single pulse	E_{AS}	I_D=17.3 A, V_{DD}=50 V	1500	mJ
Avalanche energy, repetitive t_{AR}[1),2)]	E_{AR}	I_D=34.6 A, V_{DD}=50 V	1.5	
Avalanche current, repetitive t_{AR}[1)]	I_{AR}		34.6	A
Drain source voltage slope	dv/dt	I_D=34.6 A, V_{DS}=480 V, T_j=125 °C	50	V/ns
Gate source voltage	V_{GS}	static	±20	V
	V_{GS}	AC (f>1 Hz)	±30	
Power dissipation	P_{tot}	T_C=25 °C	313	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C
Reverse diode dv/dt [6)]	dv/dt		15	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	0.4	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wavesoldering	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=34.6 A	-	700	-	
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=1.9 mA	2.1	3	3.9	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600 V, V_{GS}=0 V, T_j=25 °C	-	0.1	1	µA
		V_{DS}=600 V, V_{GS}=0 V, T_j=150 °C	-	-	100	
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=21.9 A, T_j=25 °C	-	0.081	0.1	Ω
		V_{GS}=10 V, I_D=21.9 A, T_j=150 °C	-	0.2	-	
Gate resistance	R_G	f=1 MHz, open drain	-	0.6	-	
Transconductance	g_{fs}	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=21.9 A	-	36	-	S

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	-	4500	-	pF
Output capacitance	C_{oss}		-	1500	-	
Reverse transfer capacitance	C_{rss}		-	100	-	
Effective output capacitance, energy related[3)]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	180	-	
Effective output capacitance, time related[4)]	$C_{o(tr)}$		-	324	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=480 V, V_{GS}=10 V, I_D=34.6 A, R_G=3.3 Ω	-	10	-	ns
Rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	70	-	
Fall time	t_f		-	10	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=480 V, I_D=34.6 A, V_{GS}=0 to 10 V	-	18	-	nC
Gate to drain charge	Q_{gd}		-	70	-	
Gate charge total	Q_g		-	150	200	
Gate plateau voltage	$V_{plateau}$		-	5.3	-	V

1) Pulse width limited by maximum temperature $T_{j,max}$ only

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

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

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

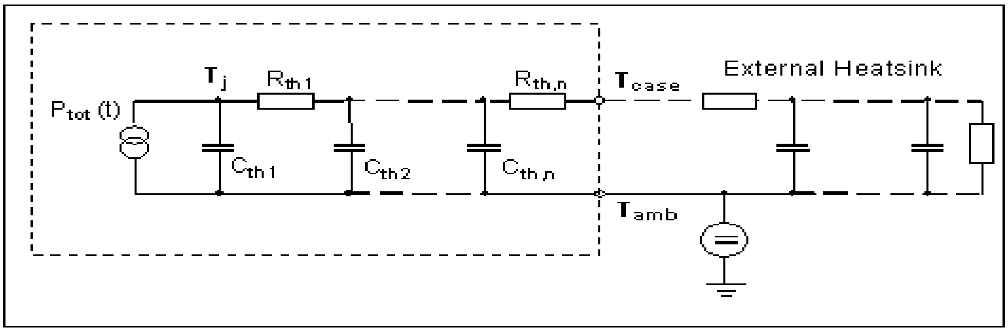
6) I_{SD}<=I_D, di/dt<=200A/us, V_{DClink}=400V, V_{peak}<$V_{BR, DSS}$, T_j<$T_{j,max}$.
Identical low-side and high-side switch.

0) J-STD20 and JESD22

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Reverse Diode						
Diode continuous forward current	I_S	T_C=25 °C	-	-	34.6	A
Diode pulse current	$I_{S,pulse}$		-	-	103.8	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=34.6 A, T_j=25 °C	-	0.95	1.2	V
Reverse recovery time	t_{rr}	V_R=480 V, I_F=I_S, di_F/dt=100 A/µs	-	600	-	ns
Reverse recovery charge	Q_{rr}		-	21	-	µC
Peak reverse recovery current	I_{rrm}		-	90	-	A

Typical Transient Thermal Characteristics

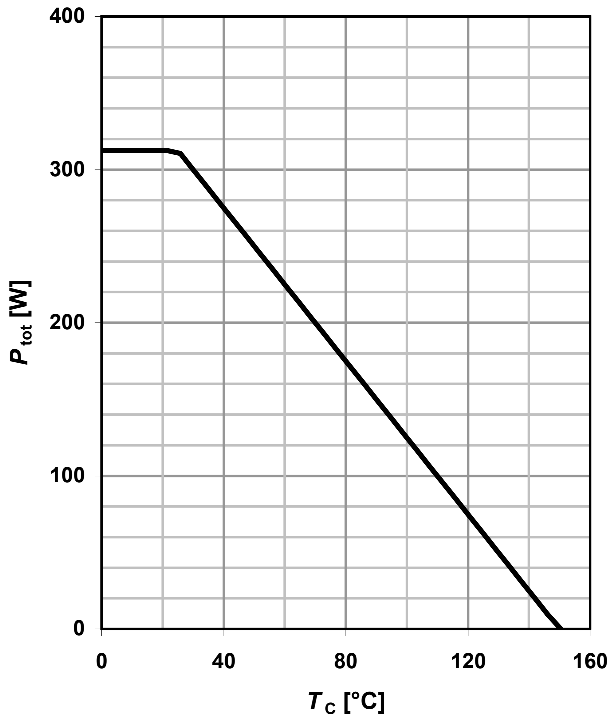
Symbol	Value	Unit	Symbol	Value	Unit
	typ.			typ.	
R_{th1}	0.00441	K/W	C_{th1}	0.00037	Ws/K
R_{th2}	0.00608		C_{th2}	0.00223	
R_{th3}	0.0341		C_{th3}	0.00315	
R_{th4}	0.0602		C_{th4}	0.0179	
R_{th5}	0.0884		C_{th5}	0.098	
			C_{th6}	4.4[5)]	



5) C_{th6} models the additional heat capacitance of the package in case of non-ideal cooling. It is not needed if R_{thCA}=0 K/W.

1 Power dissipation

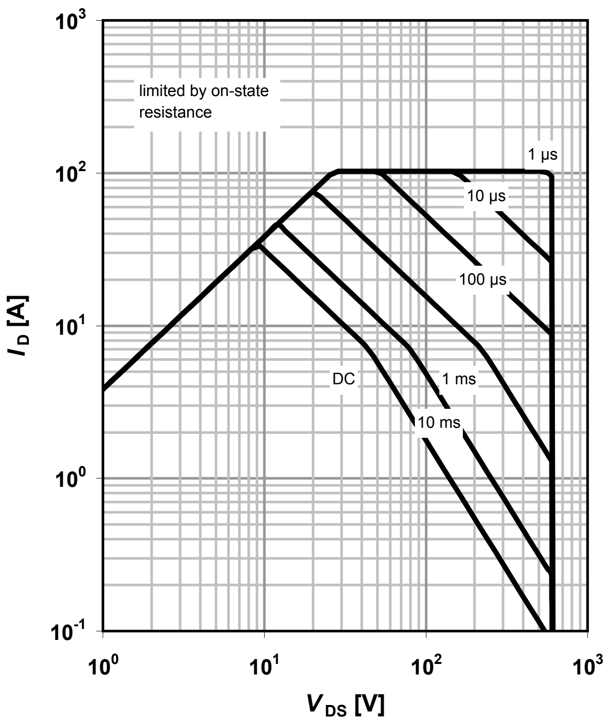
P_{tot}=f(T_C)



2 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

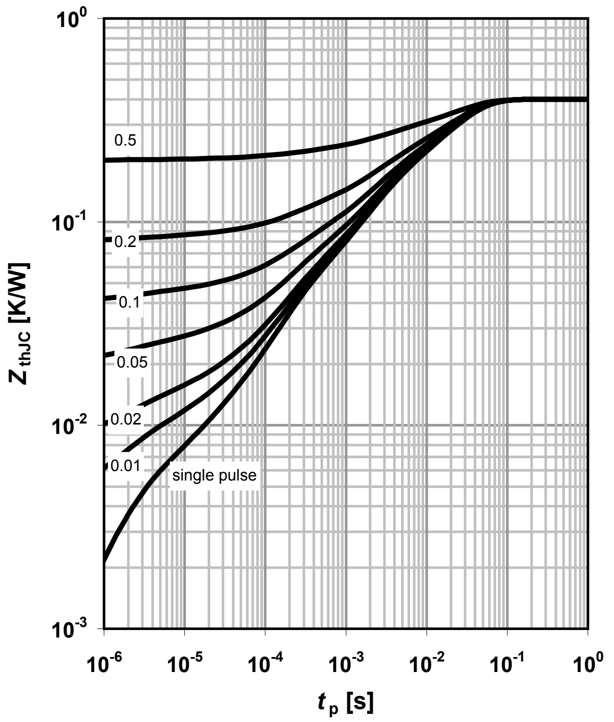
parameter: t_p



3 Max. transient thermal impedance

I_D=f(V_{DS}); T_j=25 °C

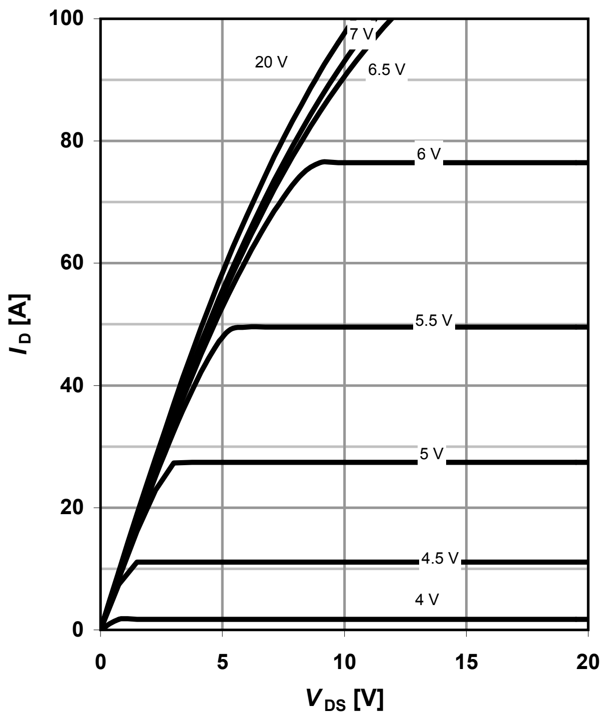
parameter: D=t_p/T



4 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

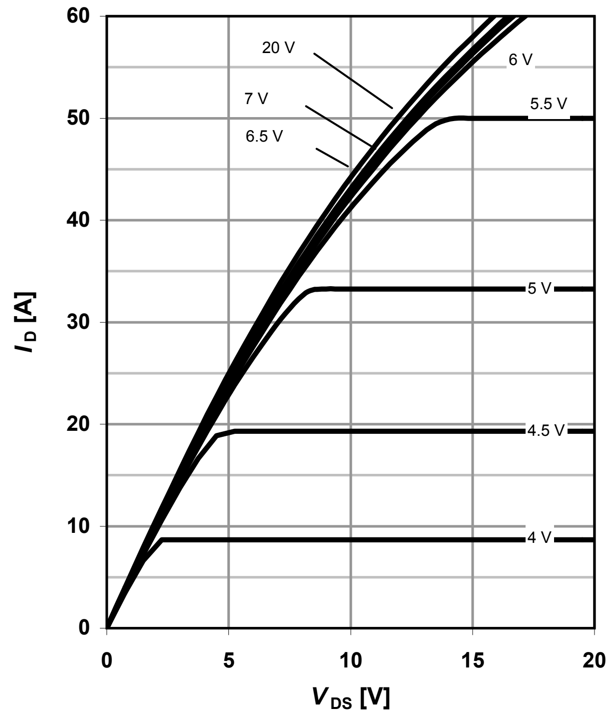
parameter: V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

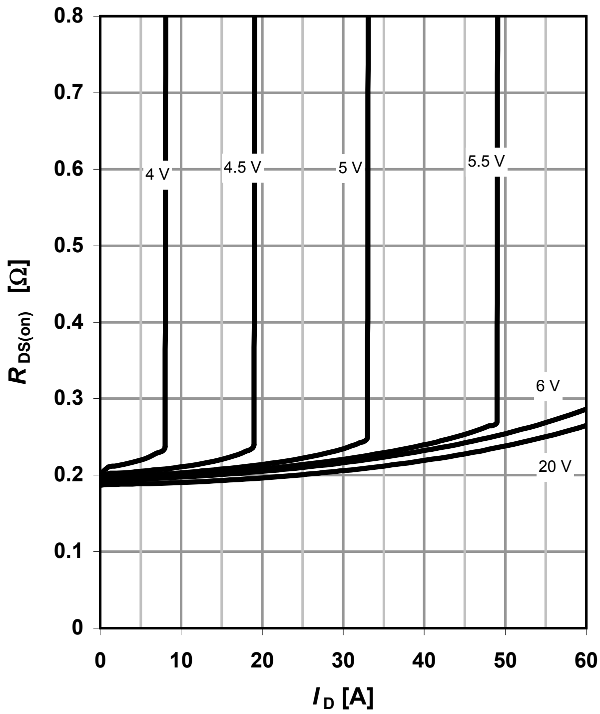
parameter: V_{GS}



6 Typ. drain-source on-state resistance

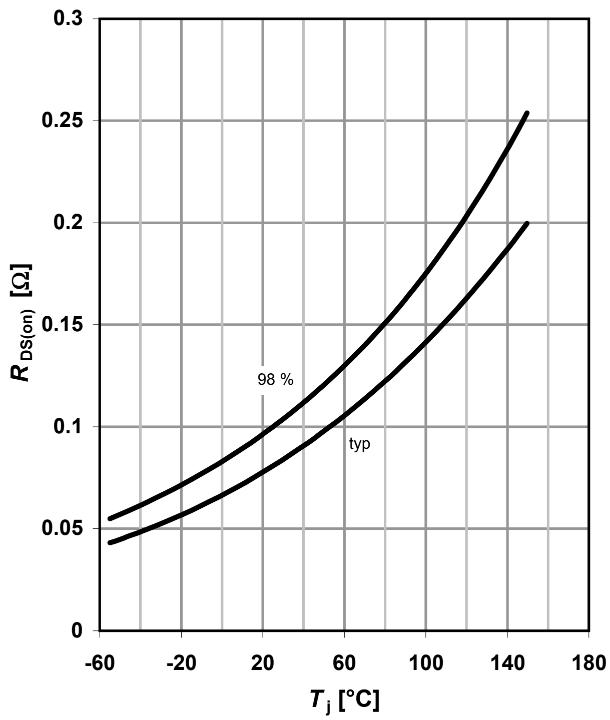
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

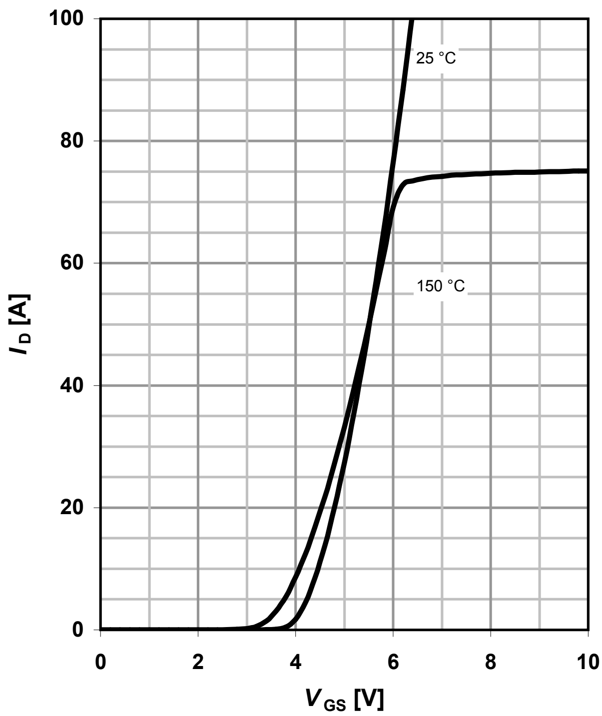
$R_{DS(on)}$=f(T_j); I_D=21.9 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

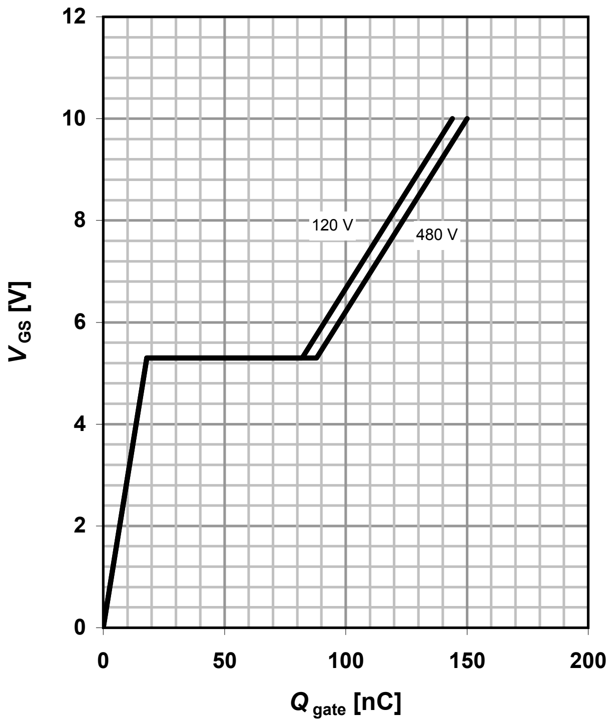
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=34.6 A pulsed

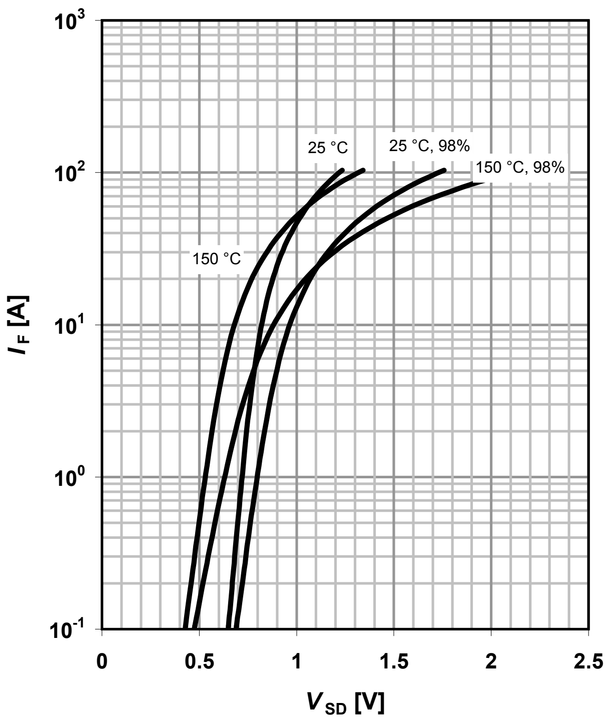
parameter: V_{DD}



10 Forward characteristics of reverse diode

I_F=f(V_{SD})

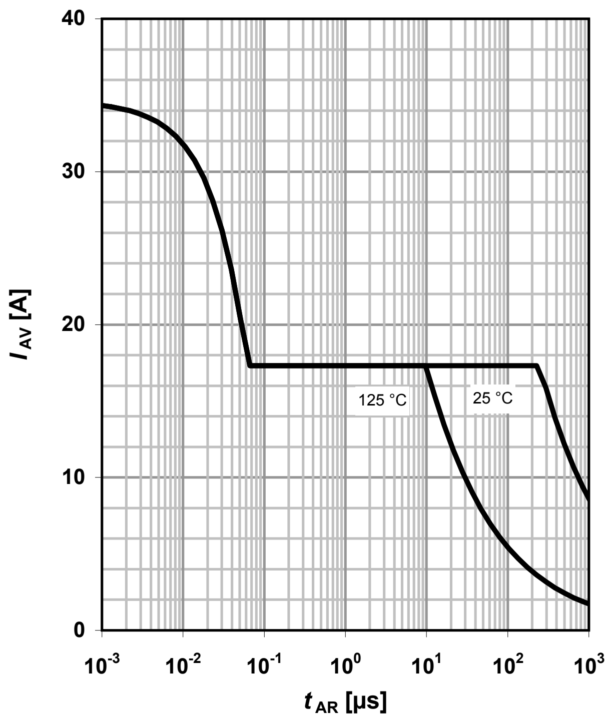
parameter: T_j



11 Avalanche SOA

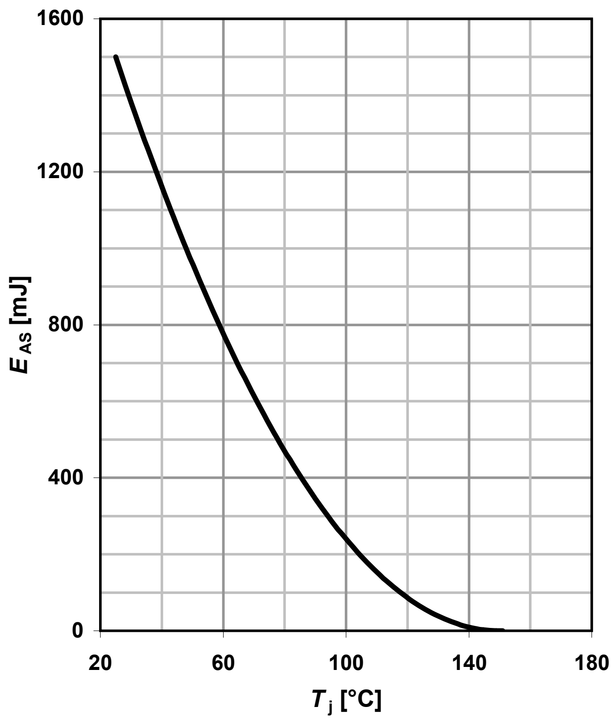
I_{AR}=f(t_{AR})

parameter: $T_{j(start)}$



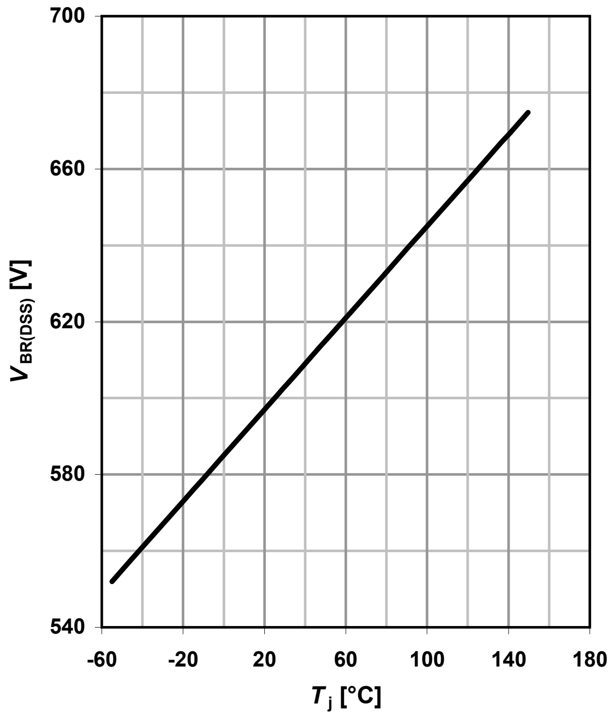
12 Avalanche energy

E_{AS}=f(T_j); I_D=17.3 A; V_{DD}=50 V



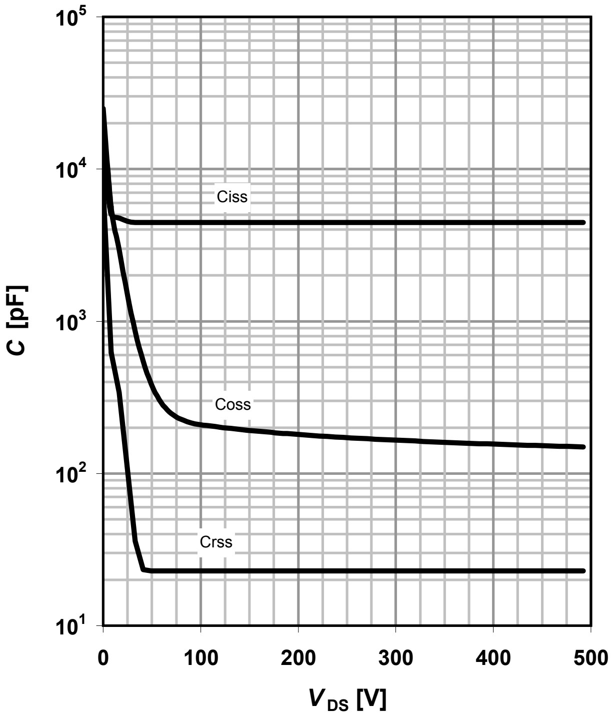
13 Drain-source breakdown voltage

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



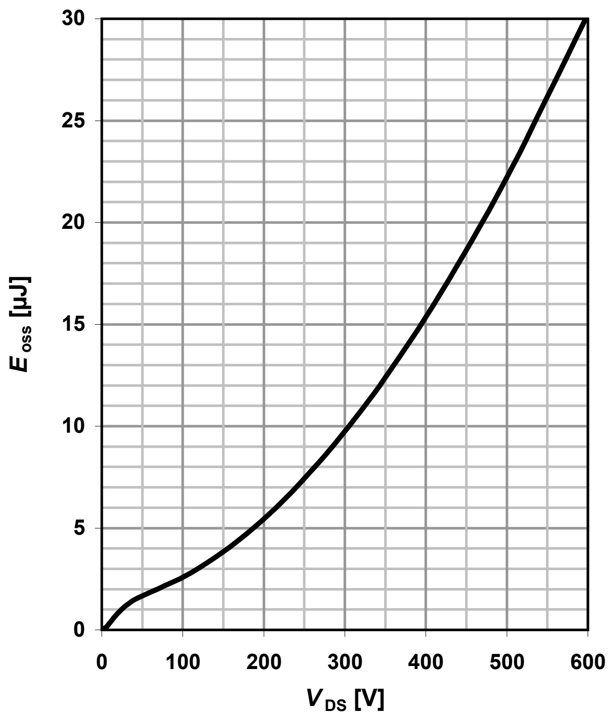
14 Typ. capacitances

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

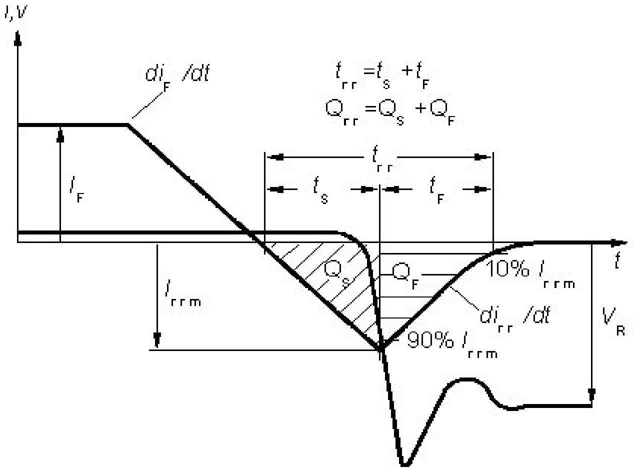


15 Typ. C_{oss} stored energy

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



Definition of diode switching characteristics



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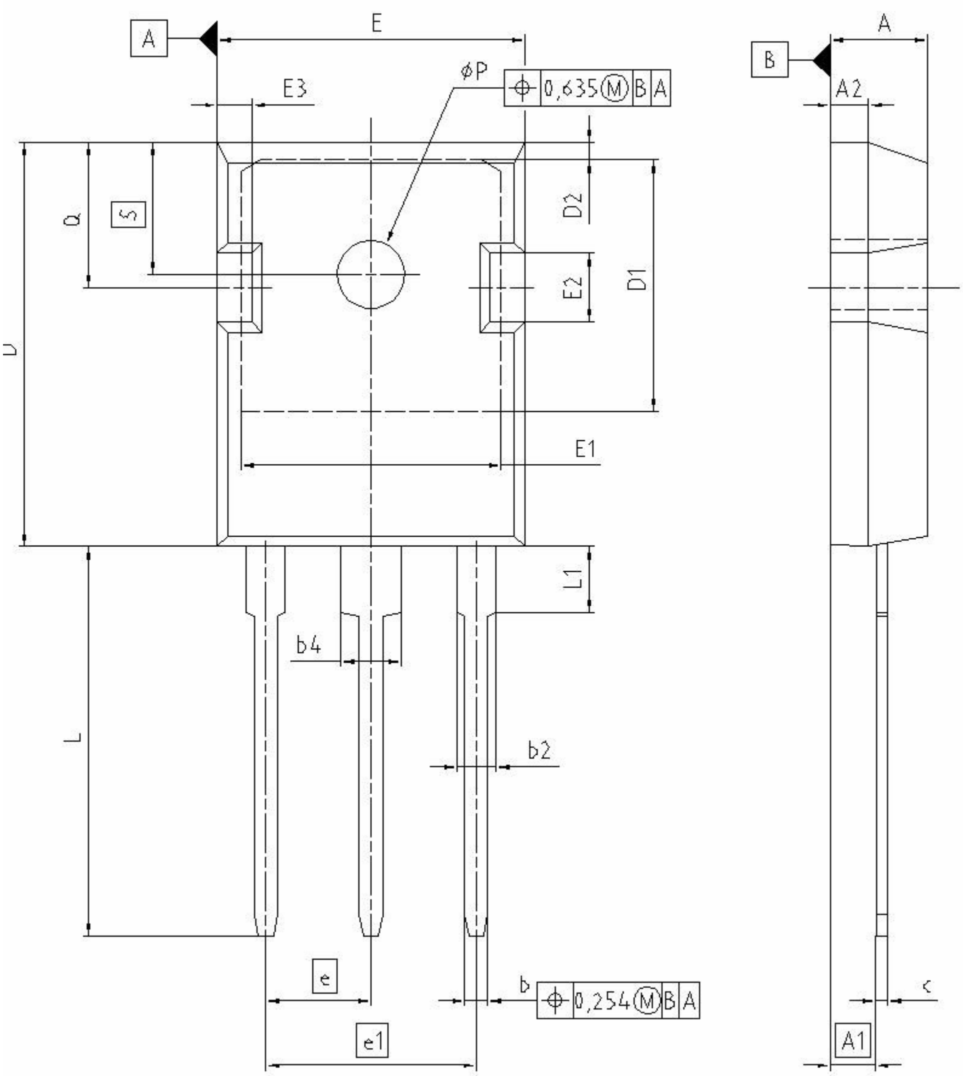
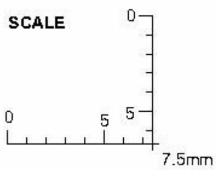


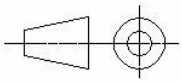
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.903	5.157	0.193	0.203
A1	2.273	2.527	0.092	0.096
A2	1.853	2.107	0.075	0.081
b	1.073	1.327	0.047	0.052
b2	1.903	2.386	0.075	0.094
b4	2.870	3.454	0.113	0.136
c	0.549	0.752	0.024	0.030
D	20.823	21.077	0.820	0.830
D1	17.323	17.831	0.682	0.702
D2	1.063	1.317	0.042	0.052
E	15.773	16.027	0.621	0.631
E1	13.893	14.147	0.547	0.557
E2	3.683	3.937	0.145	0.155
E3	1.683	1.937	0.066	0.076
e	5.450		0.215	
e1	10.900		0.430	
N	3		3	
L	20.053	20.307	0.789	0.799
L1	4.168	4.472	0.164	0.176
øP	3.559	3.661	0.140	0.144
Q	5.493	5.747	0.216	0.226
S	6.043	6.297	0.238	0.248

REFERENCE
JEDEC TO247-AD

SCALE



EUROPEAN PROJECTION



ISSUE DATE
28-06-2005

FILE
TO247_1

Published by
Infineon Technologies AG
81726 München
Germany

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