CoolMOS™ Power Transistor

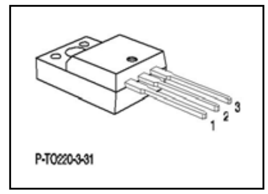
Features

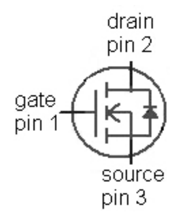
- New revolutionary high voltage technology
- Intrinsic fast-recovery body diode
- Extremely low reverse recovery charge
- Ultra low gate charge
- Extreme d*v*/d*t* rated
- High peak current capability
- Periodic avalanche rated
- Qualified according to JEDEC[0)] for target applications

Product Summary

V_{DS}	600	V
$R_{DS(on),max}$	0.44	Ω
I_D[1)]	11	A

PG-TO220-3-31





Type	Package	Ordering Code	Marking
SPA11N60CFD	TO-220-3-31	SP000216317	11N60CFD

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current[1)]	I_D	T_C=25 °C	11	A
		T_C=100 °C	7	
Pulsed drain current[2)]	$I_{D,pulse}$	T_C=25 °C	28	
Avalanche energy, single pulse	E_{AS}	I_D=5.5 A, V_{DD}=50 V	340	mJ
Avalanche energy, repetitive[2),3)]	E_{AR}	I_D=11 A, V_{DD}=50 V	0.6	
Avalanche current, repetitive[2),3)]	I_{AR}		11	A
Drain source voltage slope	d*v*/d*t*	I_D=11 A, V_{DS}=480 V, T_j=125 °C	80	V/ns
Reverse diode d*v*/d*t*	d*v*/d*t*	I_S=11 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	33	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	3.8	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wave soldering	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=11 A	-	700	-	
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=1.9 mA	3	4	5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600 V, V_{GS}=0 V, T_j=25 °C	-	1.1	-	µA
		V_{DS}=600 V, V_{GS}=0 V, T_j=150 °C	-	900	-	
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=7 A, T_j=25 °C	-	0.38	0.44	Ω
		V_{GS}=10 V, I_D=7 A, T_j=150 °C	-	1.02	-	
Gate resistance	R_G	f=1 MHz, open drain	-	0.86	-	
Transconductance	g_{fs}	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=7 A	-	8.3	-	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	-	1200	-	pF
Output capacitance	C_{oss}		-	390	-	
Reverse transfer capacitance	C_{rss}		-	30	-	
Effective output capacitance, energy related[4)]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	45	-	
Effective output capacitance, time related[5)]	$C_{o(tr)}$		-	85	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=480 V, V_{GS}=10 V, I_D=11 A, R_G=6.8 Ω	-	34	-	ns
Rise time	t_r		-	18	-	
Turn-off delay time	$t_{d(off)}$		-	43	-	
Fall time	t_f		-	7	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=480 V, I_D=11 A, V_{GS}=0 to 10 V	-	9	-	nC
Gate to drain charge	Q_{gd}		-	23	-	
Gate charge total	Q_g		-	48	64	
Gate plateau voltage	$V_{plateau}$		-	7.5	-	V

0) J-STD20 and JESD22

1) Limited only by maximum temperature.

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

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

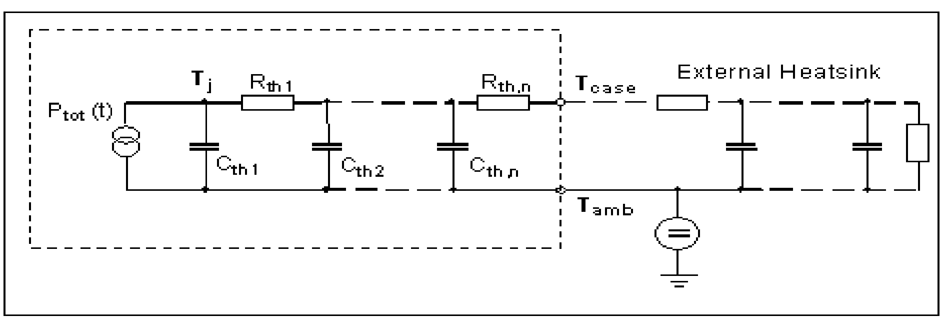
4) $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

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}.

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Reverse Diode						
Diode continuous forward current[1)]	I_S	T_C=25 °C	-	-	11	A
Diode pulse current[2)]	$I_{S,pulse}$		-	-	28	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=11 A, 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	-	140	-	ns
Reverse recovery charge	Q_{rr}		-	0.7	-	µC
Peak reverse recovery current	I_{rrm}		-	11	-	A

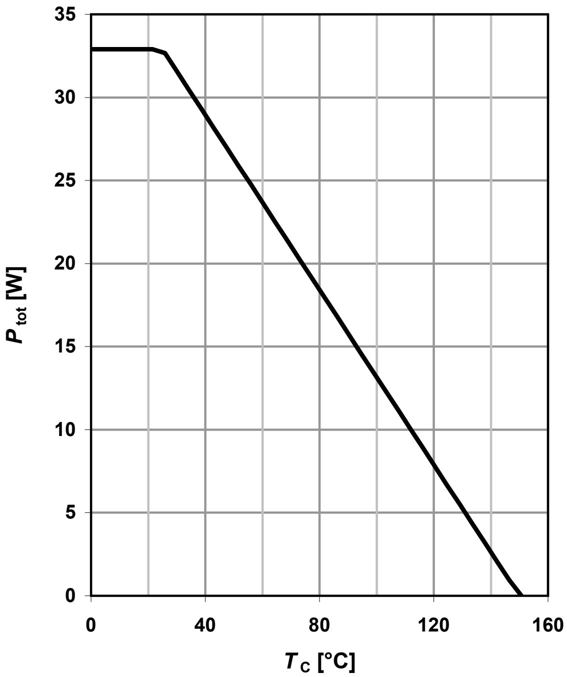
Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
	typ.			typ.	
R_{th1}	0.0178	K/W	C_{th1}	0.0000989	Ws/K
R_{th2}	0.0931		C_{th2}	0.000939	
R_{th3}	0.228		C_{th3}	0.00303	
R_{th4}	0.559		C_{th4}	0.0245	
R_{th5}	1.58		C_{th5}	0.951	



1 Power dissipation

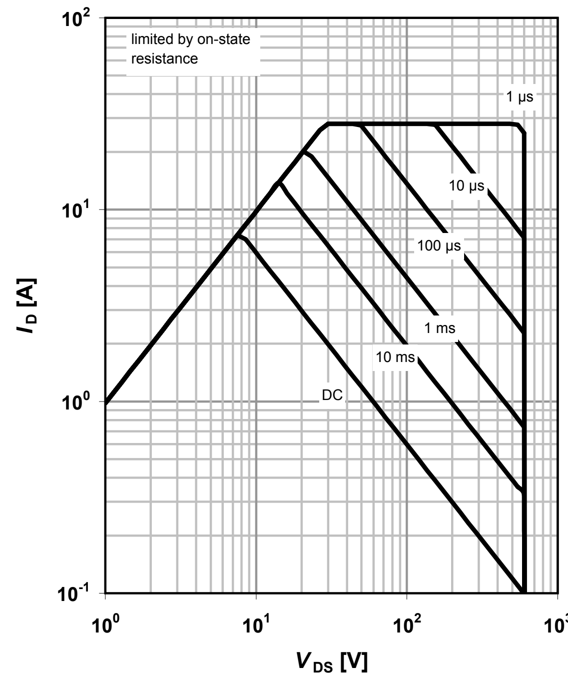
P_{tot}=f(T_C)



2 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

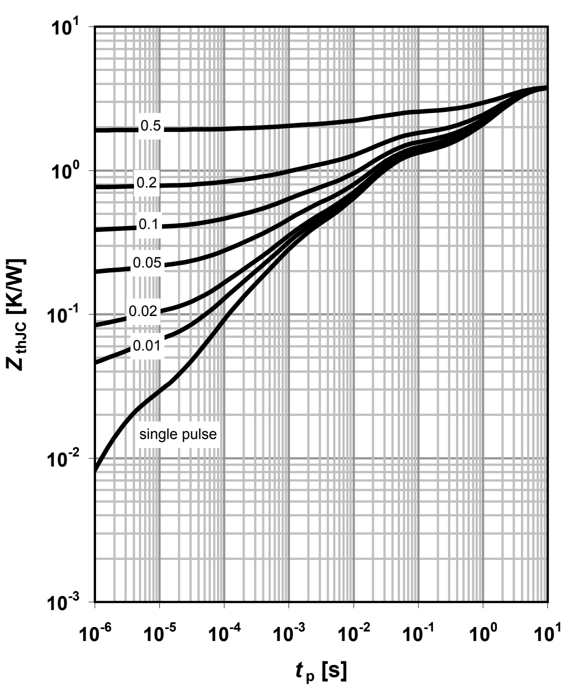
parameter: t_p



3 Max. transient thermal impedance

I_D=f(V_{DS}); T_j=25 °C

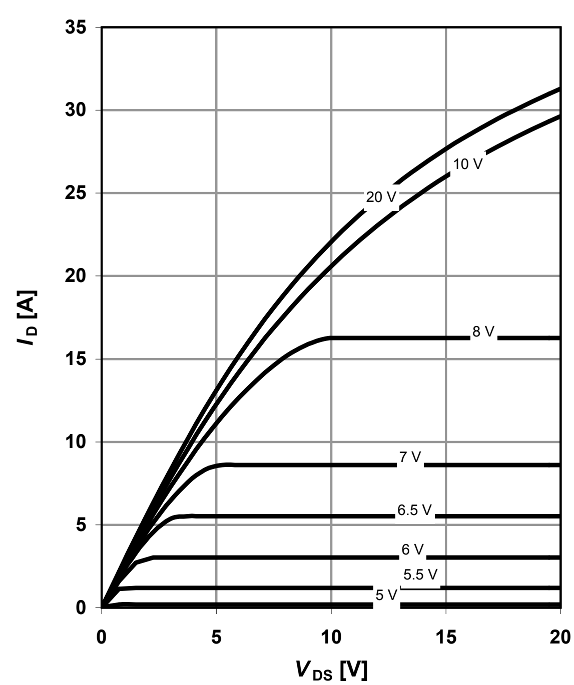
parameter: $D=t_p/T$



4 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

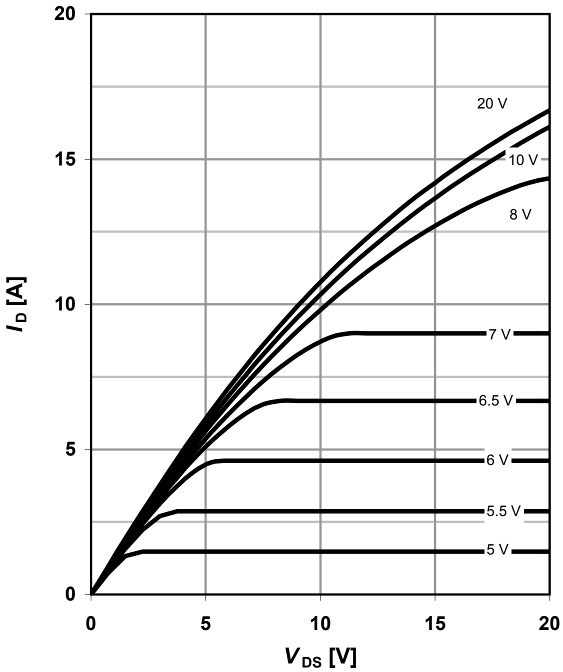
parameter: t_p = 10µs V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

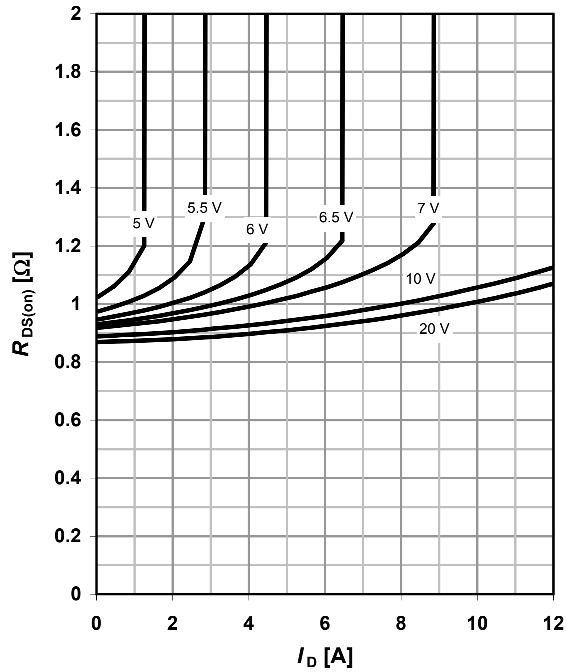
parameter: t_p = 10µs V_{GS}



6 Typ. drain-source on-state resistance

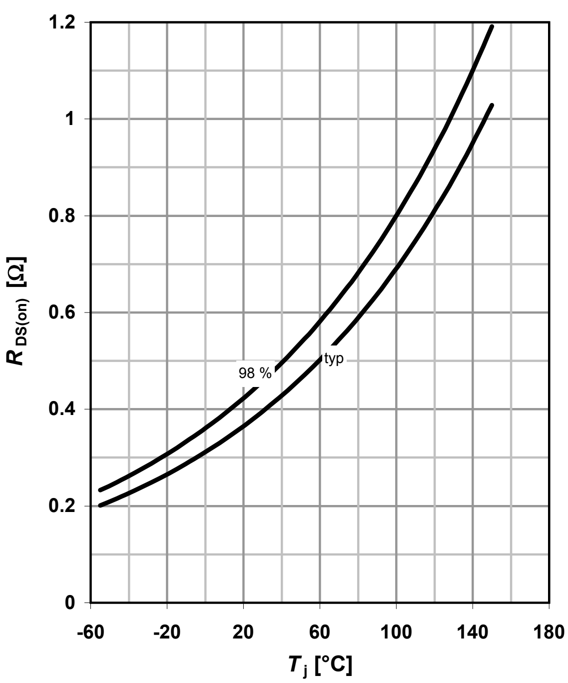
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

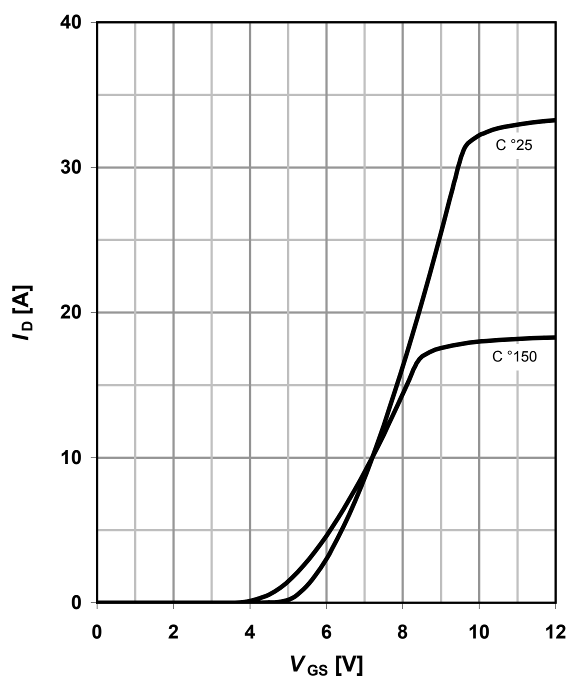
$R_{DS(on)}$=f(T_j); I_D=7 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

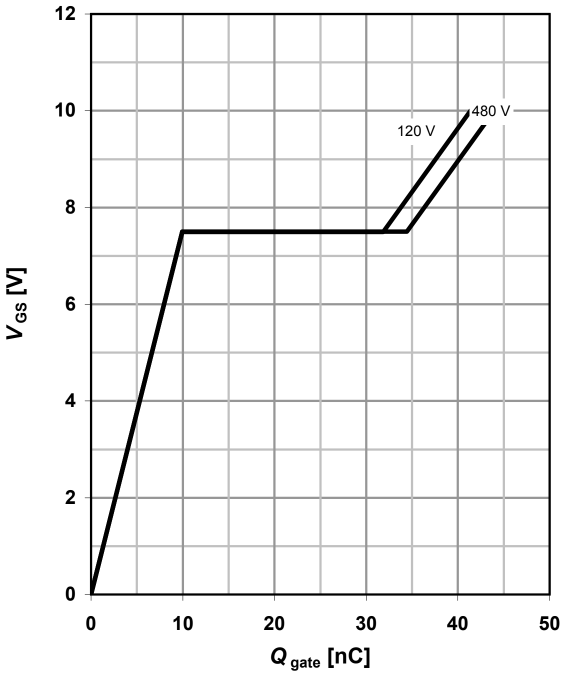
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=11 A pulsed

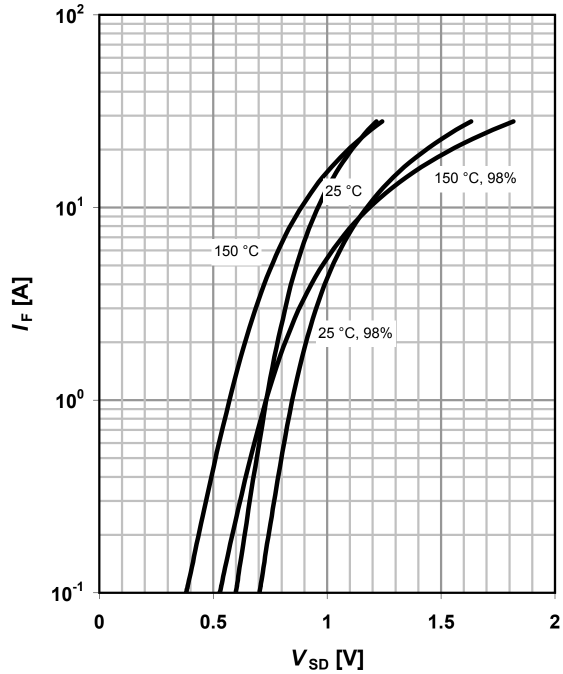
parameter: V_{DD}



10 Forward characteristics of reverse diode

I_F=f(V_{SD})

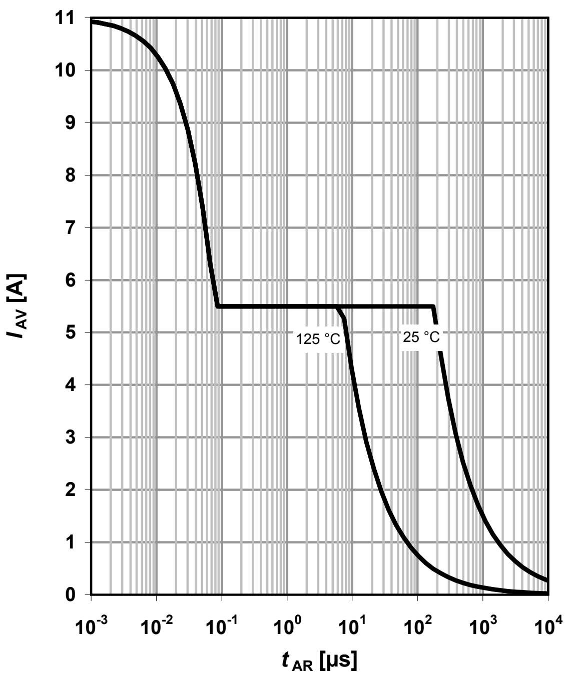
parameter: T_j



11 Avalanche SOA

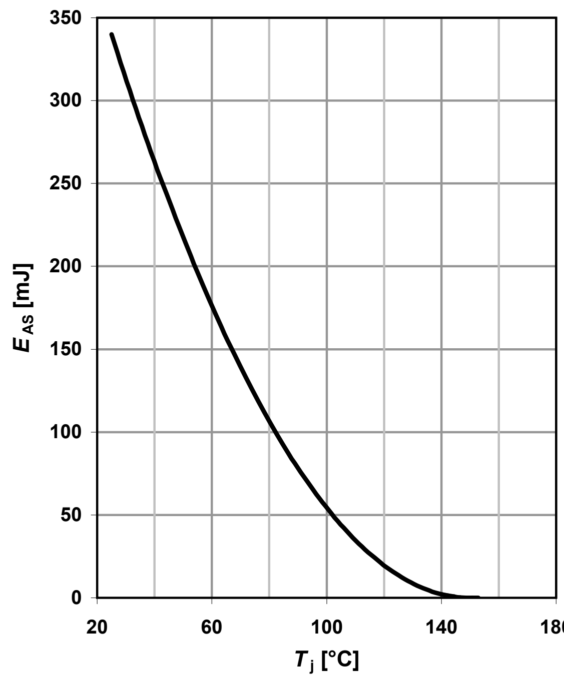
I_{AR}=f(t_{AR})

parameter: $T_{j(start)}$



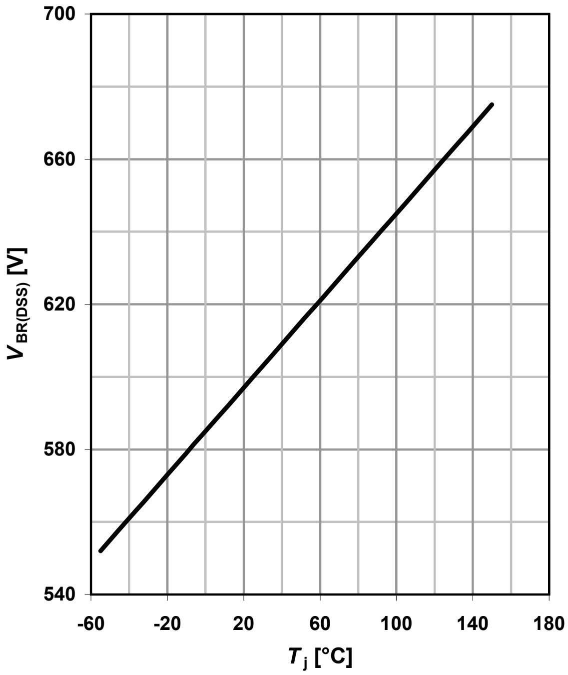
12 Avalanche energy

E_{AS}=f(T_j); I_D=5.5 A; V_{DD}=50 V



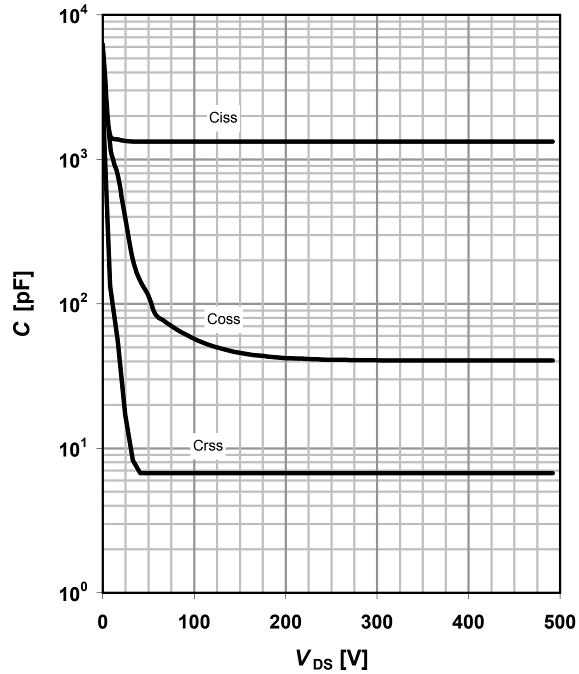
13 Drain-source breakdown voltage

$V_{BR(DSS)}$=f(T_j); I_D=10 mA



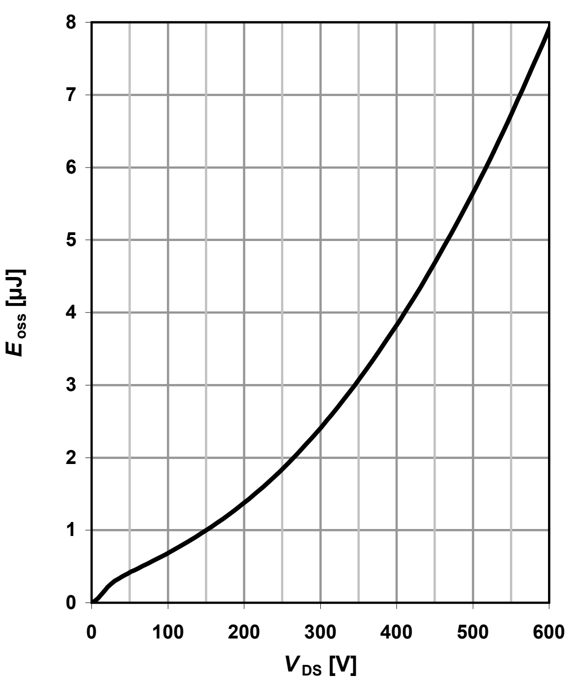
14 Typ. capacitances

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



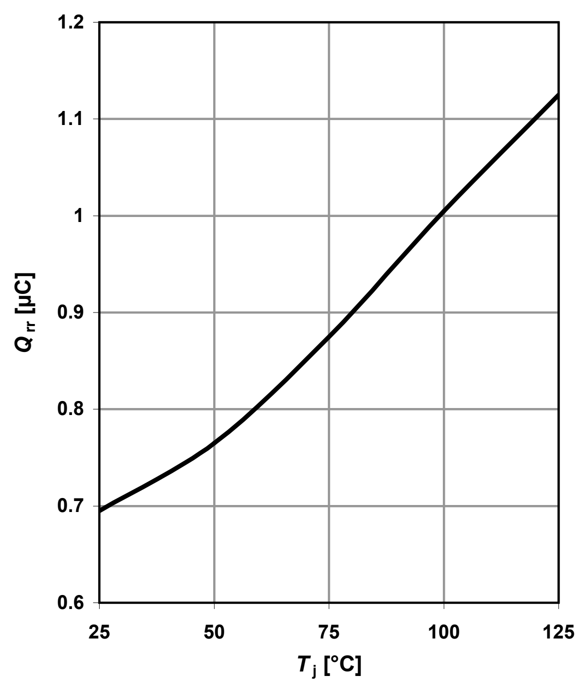
15 Typ. C_{oss} stored energy

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



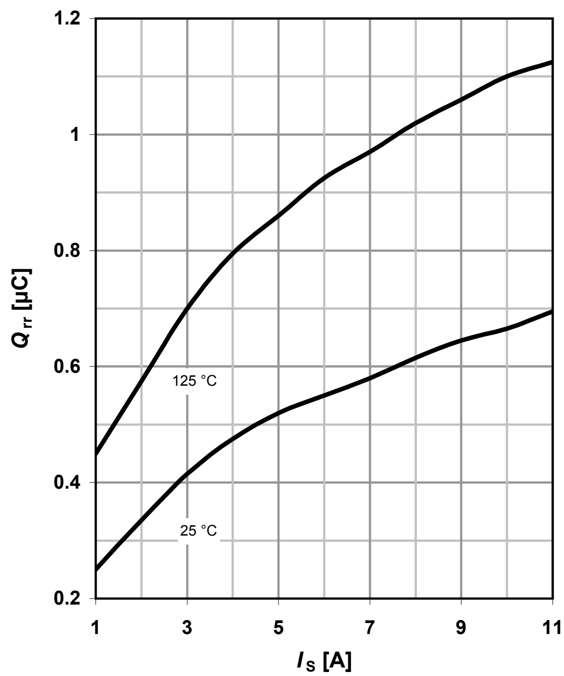
16 Typ. reverse recovery charge

Q_{rr}=f(T_j);parameter: I_D =11 A



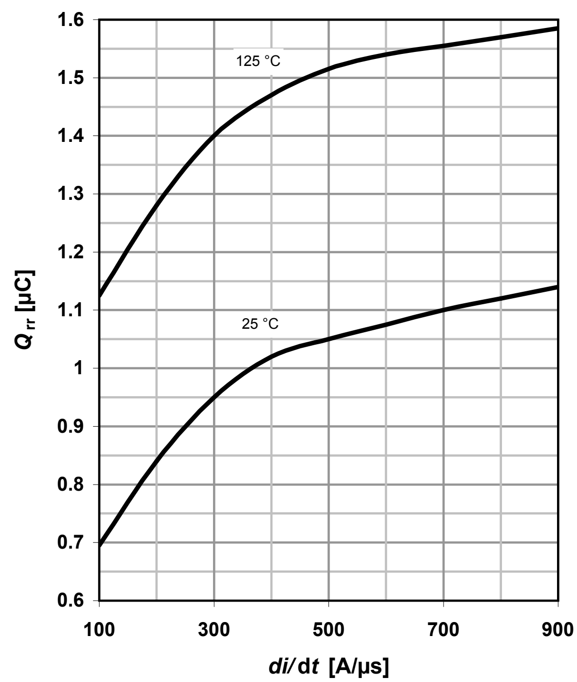
17 Typ. reverse recovery charge

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

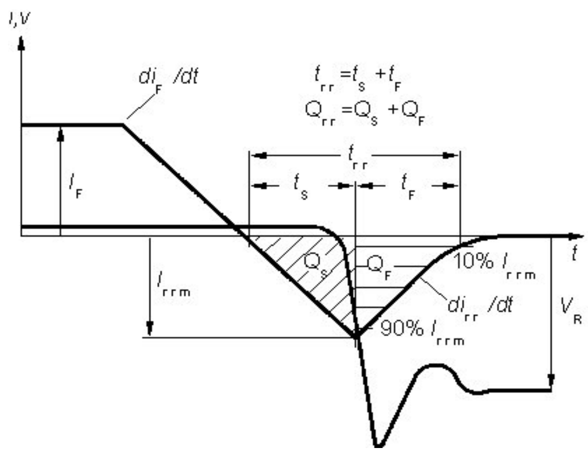


18 Typ. reverse recovery charge

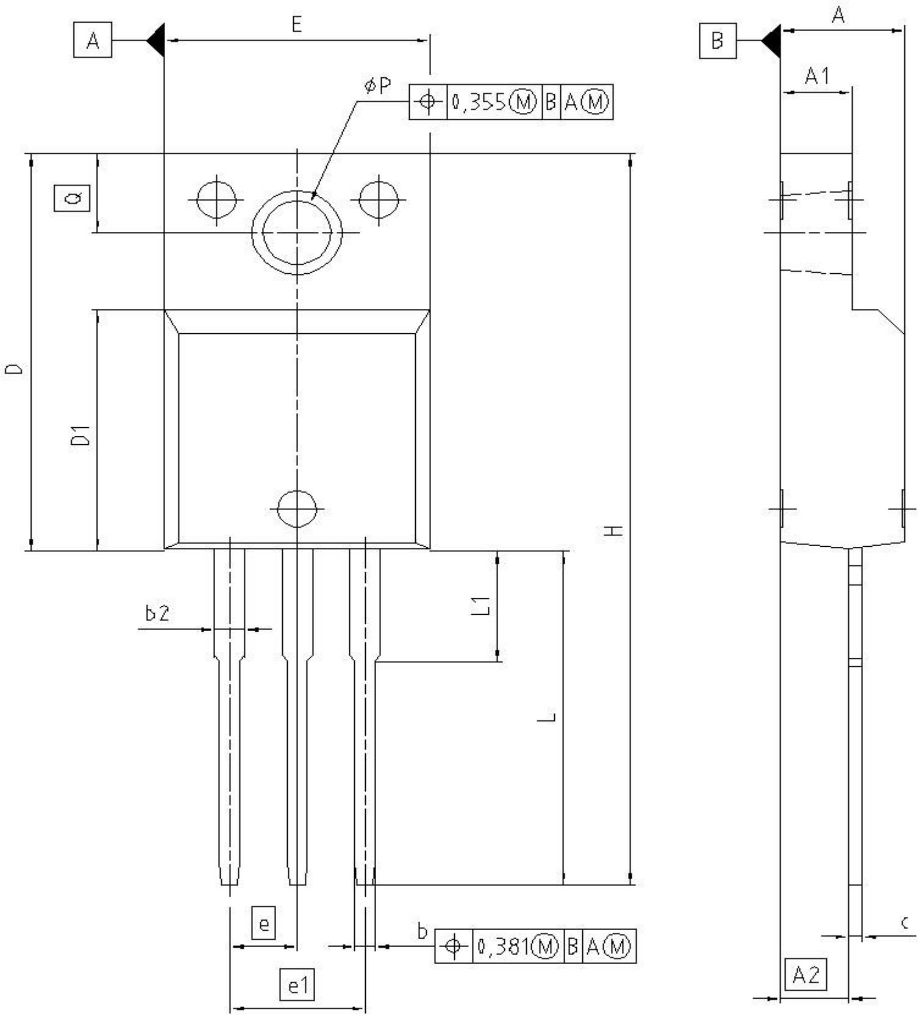
Q_{rr}=f(di/dt); parameter: I_D=11 A



Definition of diode switching characteristics



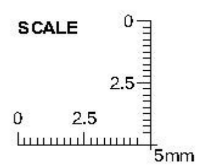
PG-TO-220-3-31 (FullPAK)



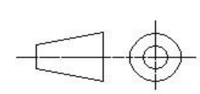
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.572	4.826	0.180	0.190
A1	2.573	2.827	0.101	0.111
A2	2.514	2.616	0.099	0.103
b	0.649	0.776	0.025	0.030
b2	1.143	1.778	0.045	0.070
c	0.449	0.627	0.017	0.027
D	15.863	16.117	0.624	0.634
D1	9.554	9.808	0.376	0.386
E	10.373	10.627	0.408	0.418
e	2.540		0.100	
e1	5.080		0.200	
N	3		3	
H	29.463	29.717	1.160	1.170
L	13.473	13.727	0.530	0.540
L1	3.175	3.429	0.125	0.135
øP	2.949	3.025	0.119	0.116
Q	3.149	3.251	0.124	0.128

REFERENCE
../..

SCALE



EUROPEAN PROJECTION



ISSUE DATE
01-06-2005

FILE
TO220_2

Published by
Infineon Technologies AG
D-81726 München, Germany

Attention please!
The information herein is given to describe certain components and shall not be considered as warranted characteristics.

Terms of delivery and rights to technical change reserved.

We hereby disclaim any and all warranties, including but not limited to warranties of non-infringement, regarding circuits, descriptions and charts stated herein.

Infineon Technologies is an approved CECC manufacturer.

Information
For further information on technology, delivery terms and conditions and prices, please contact your nearest Infineon Technologies office in Germany or our Infineon Technologies representatives worldwide (see address list).

Warnings
Due to technical requirements, components may contain dangerous substances.
For information on the types in question, please contact your nearest Infineon Technologies office.

Infineon Technologies' components may only be used in life-support devices or systems with the expressed written approval of Infineon Technologies if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.