Cool MOS™ Power Transistor

COOLMOS Power Semiconductors

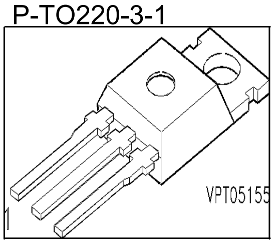
Feature

- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- Ultra low effective capacitances
- Improved noise immunity

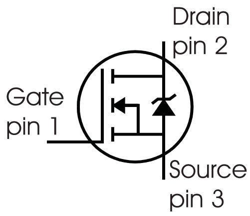
Product Summary

V_{DS}	800	V
$R_{DS(on)}$	900	mΩ
I_D	6	A

P-TO220-3-1



Type	**Package**	**Ordering Code**	**Marking**
SPP06N80C3	P-TO220-3-1	Q67040-S4351	06N80C3



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

Parameter	**Symbol**	**Value**	**Unit**
Continuous drain current	I_D		A
T_C = 25 °C		6	
T_C = 100 °C		3.8	
Pulsed drain current, t_p limited by T_{jmax}	$I_{D\ puls}$	18	
Avalanche energy, single pulse I_D=1.5A, V_{DD}=50V	E_{AS}	230	mJ
Avalanche energy, repetitive t_{AR} limited by T_{jmax} 1) I_D=6A, V_{DD}=50V	E_{AR}	0.2	
Avalanche current, repetitive t_{AR} limited by T_{jmax}	I_{AR}	6	A
Reverse diode dv/dt I_S=6A, $V_{DS} < V_{DD}$, di/dt=100A/µs, T_{jmax}=150°C	dv/dt	6	V/ns
Gate source voltage	V_{GS}	±20	V
Power dissipation T_C = 25 °C	P_{tot}	83	W
Operating and storage temperature	T_j , T_{stg}	-55... +150	°C

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Thermal resistance, junction - case	R_{thJC}	-	-	1.5	K/W
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	-	62	
Linear derating factor		-	-	0.67	W/K
Soldering temperature, 1.6 mm (0.063 in.) from case for 10s	T_{sold}	-	-	260	°C

Electrical Characteristics, at T_j = 25 °C, unless otherwise specified

Parameter	Symbol	min.	typ.	max.	Unit
Static Characteristics					
Drain-source breakdown voltage V_{GS}=0V, I_D=0.25mA	$V_{(BR)DSS}$	800	-	-	V
Drain-source avalanche breakdown voltage V_{GS}=0V, I_D=6A	$V_{(BR)DS}$	-	870	-	
Gate threshold voltage, V_{GS} = V_{DS} I_D=250µA	$V_{GS(th)}$	2	3	4	
Zero gate voltage drain current	I_{DSS}				µA
V_{DS} = 800 V, V_{GS} = 0 V, T_j = 25 °C		-	0.5	10	
V_{DS} = 800 V, V_{GS} = 0 V, T_j = 150 °C		-	-	100	
Gate-source leakage current V_{GS}=20V, V_{DS}=0V	I_{GSS}	-	-	100	nA
Drain-source on-state resistance V_{GS}=10V, I_D=3.8A, T_j=25°C	$R_{DS(on)}$	-	780	900	mΩ
Gate input resistance f = 1 MHz, open drain	R_G	-	0.7	-	Ω

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

Electrical Characteristics , at T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Characteristics						
Transconductance	g_{fs}	$V_{DS} \geq 2*I_D*R_{DS(on)max}$, I_D=3.8A	-	4	-	S
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	785	-	pF
Output capacitance	C_{oss}		-	390	-	
Reverse transfer capacitance	C_{rss}		-	20	-	
Effective output capacitance,[1] energy related	$C_{o(er)}$	V_{GS}=0V, V_{DS}=0V to 640 V	-	22	-	pF
Effective output capacitance,[2] time related	$C_{o(tr)}$		-	42	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400V, V_{GS}=0/10V, I_D=6A, R_G=12Ω, T_j=125°C	-	25	-	ns
Rise time	t_r		-	15	-	
Turn-off delay time	$t_{d(off)}$		-	48	60	
Fall time	t_f		-	8	13	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=640V, I_D=6A	-	2.5	-	nC
Gate to drain charge	Q_{gd}		-	9.8	-	
Gate charge total	Q_g	V_{DD}=640V, I_D=6A, V_{GS}=0 to 10V	-	19.4	25	
Gate plateau voltage	$V_{(plateau)}$	V_{DD}=640V, I_D=6A	-	6	-	V

[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_{DSS}.

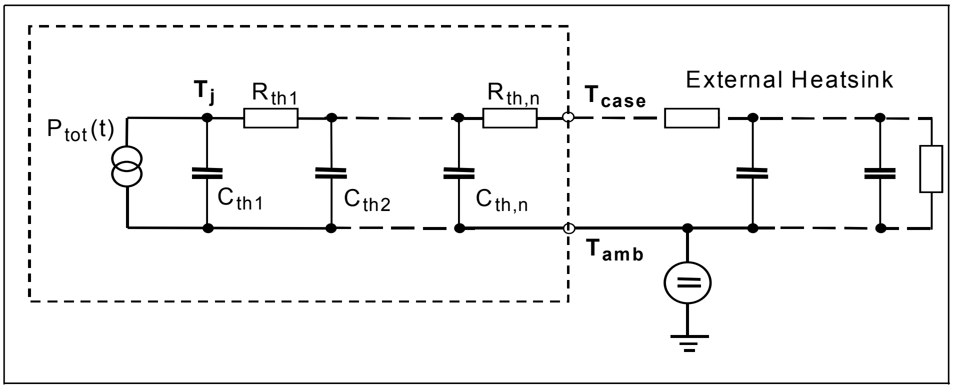
[2] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

Electrical Characteristics, at T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Reverse Diode						
Inverse diode continuous forward current	I_S	T_C=25°C	-	-	6	A
Inverse diode direct current, pulsed	I_{SM}		-	-	18	
Inverse diode forward voltage	V_{SD}	V_{GS}=0V, I_F=I_S	-	1	1.2	V
Reverse recovery time	t_{rr}	V_R=400V, I_F=I_S , di_F/dt=100A/µs	-	520	-	ns
Reverse recovery charge	Q_{rr}		-	5	-	µC
Peak reverse recovery current	I_{rrm}		-	17	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt		-	400	-	A/µs

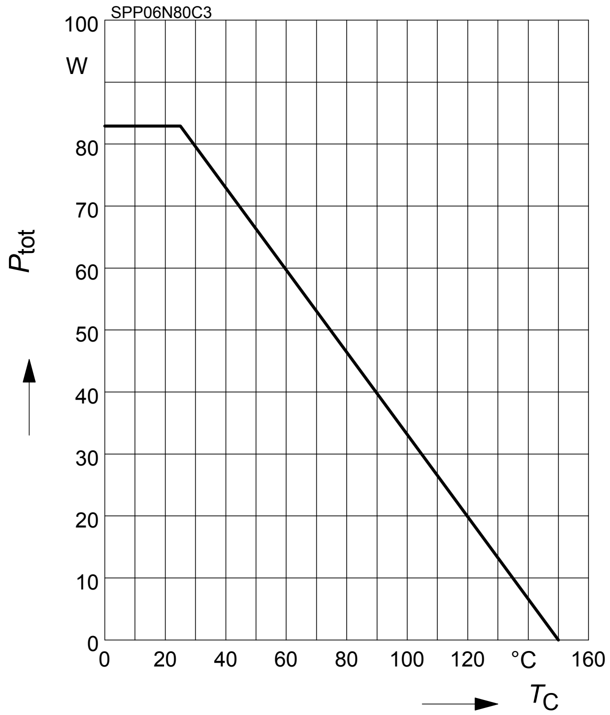
Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
	typ.			typ.	
Transient thermal impedance					
Thermal resistance			Thermal capacitance		
R_{th1}	0.023	K/W	C_{th1}	0.000135	Ws/K
R_{th2}	0.033		C_{th2}	0.000438	
R_{th3}	0.067		C_{th3}	0.000313	
R_{th4}	0.189		C_{th4}	0.00149	
R_{th5}	0.208		C_{th5}	0.00738	
R_{th6}	0.076		C_{th6}	0.068	



1 Power dissipation

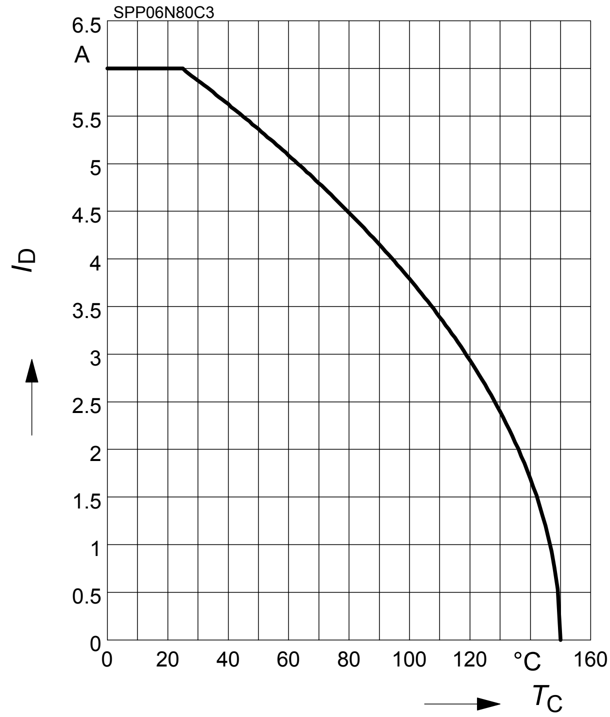
$P_{tot} = f(T_C)$



2 Drain current

$I_D = f(T_C)$

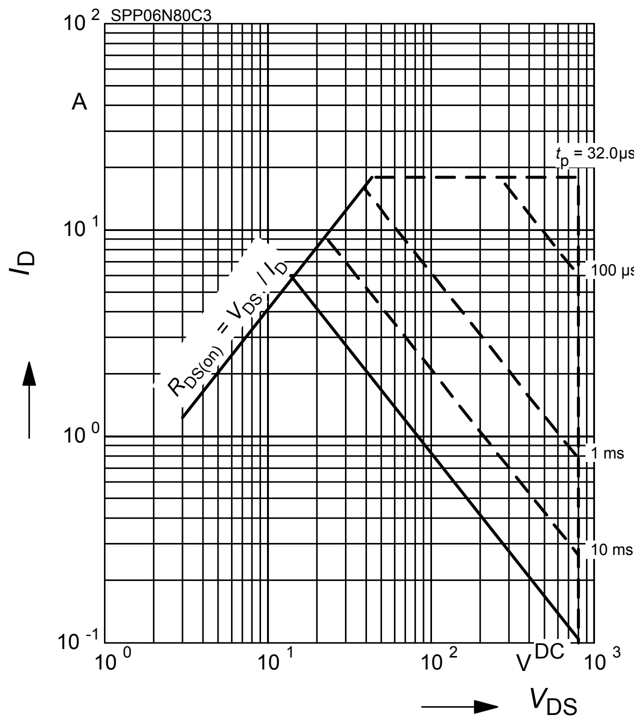
parameter: $V_{GS} \geq 10$ V



3 Safe operating area

$I_D = f(V_{DS})$

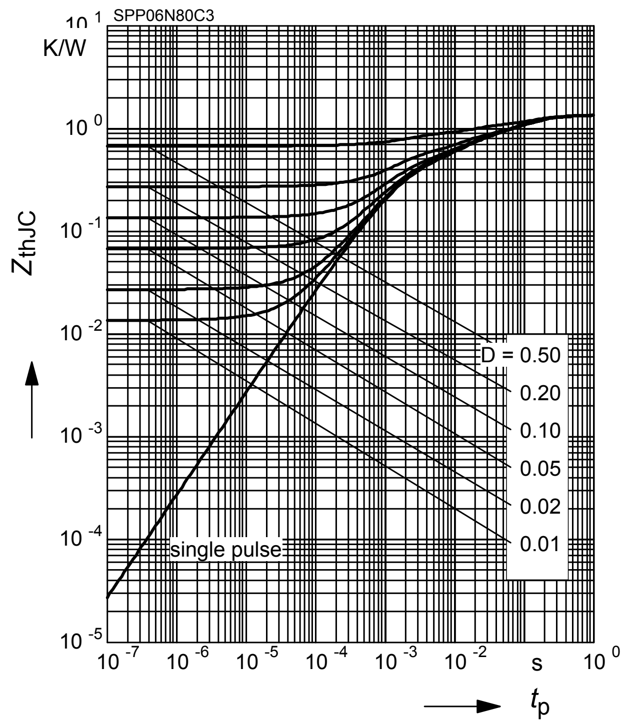
parameter : $D = 0$, T_C=25°C



4 Transient thermal impedance

$Z_{thJC} = f(t_p)$

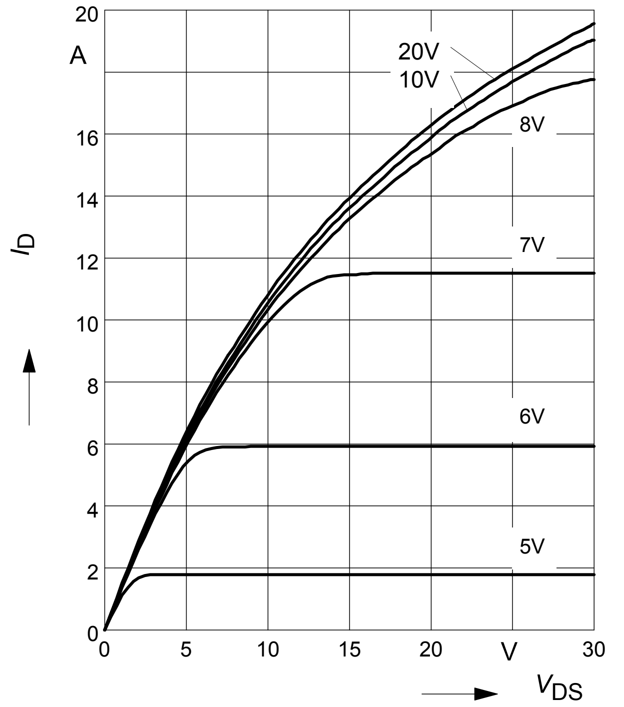
parameter : $D = t_p/T$



5 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=25°C

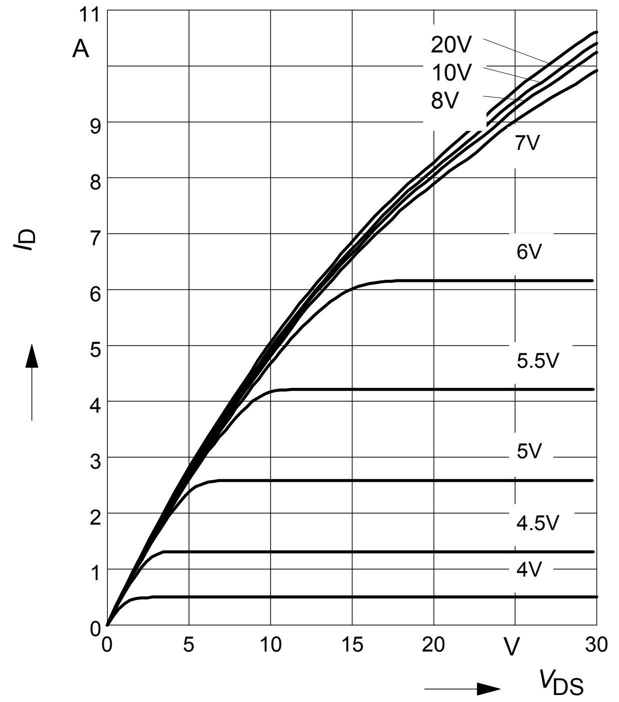
parameter: t_p = 10 µs, V_{GS}



6 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=150°C

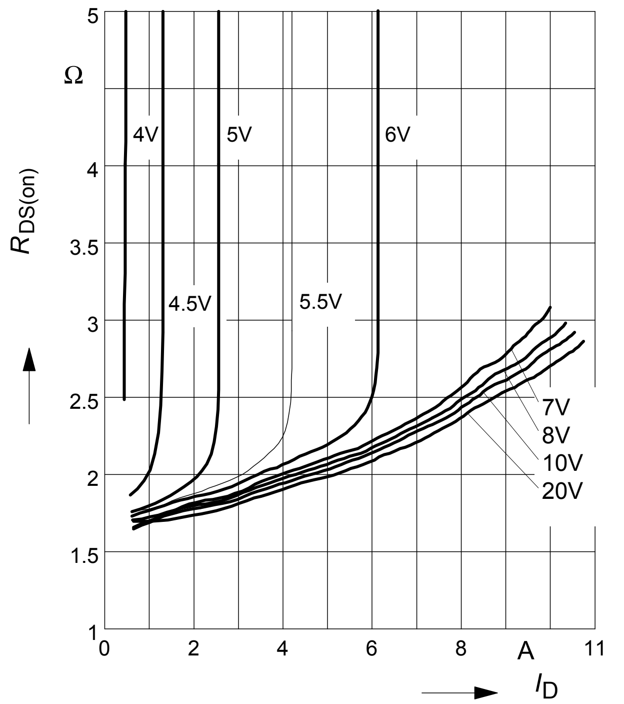
parameter: t_p = 10 µs, V_{GS}



7 Typ. drain-source on resistance

$R_{DS(on)}=f(I_D)$

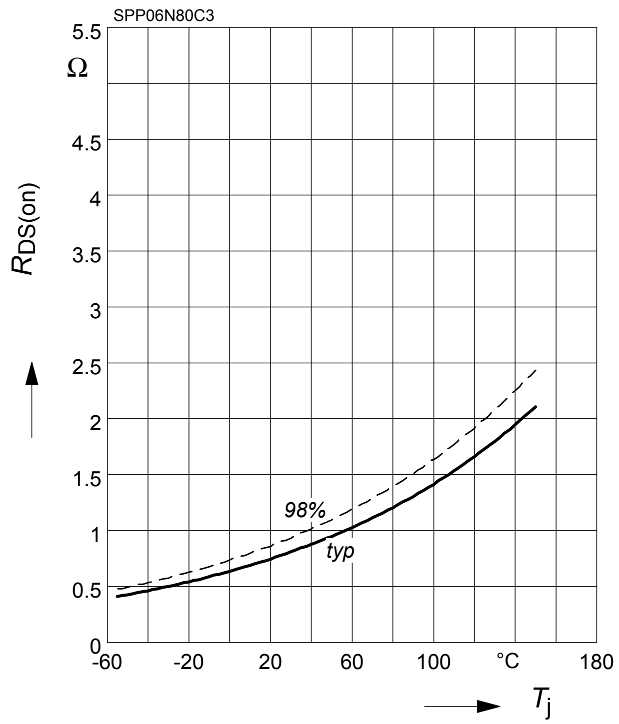
parameter: T_j=150°C, V_{GS}



8 Drain-source on-state resistance

$R_{DS(on)} = f(T_j)$

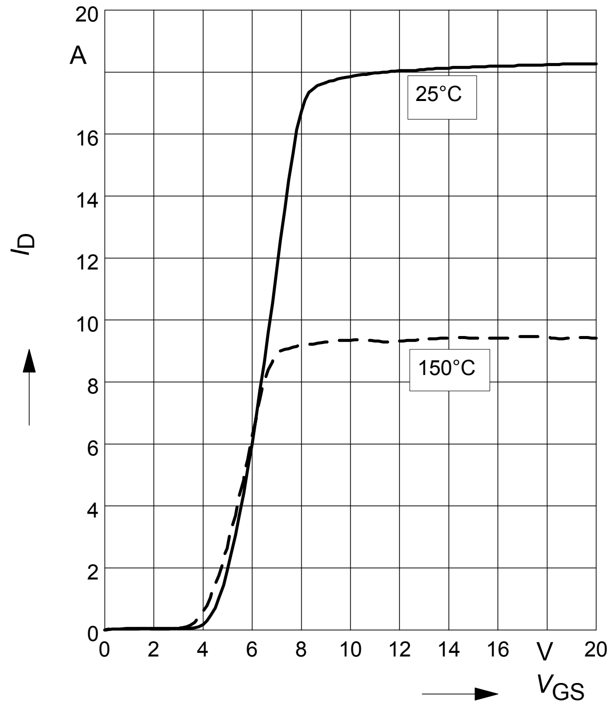
parameter : I_D = 3.8 A, V_{GS} = 10 V



9 Typ. transfer characteristics

$I_D = f(V_{GS})$; $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$

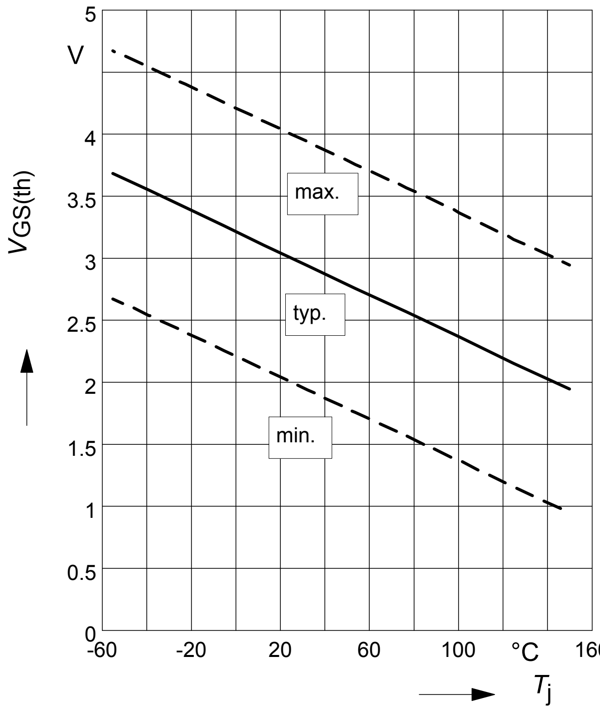
parameter: t_p = 10 µs



10 Gate threshold voltage

$V_{GS(th)} = f(T_j)$

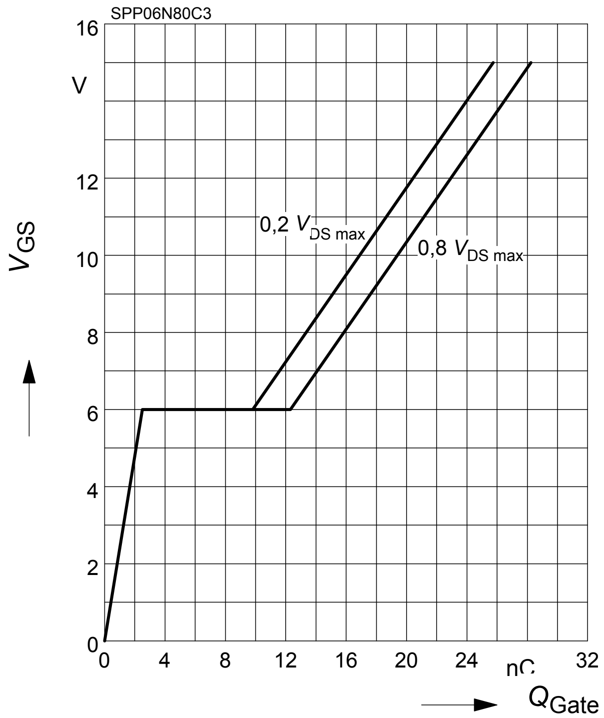
parameter: $V_{GS} = V_{DS}$, I_D = 250 µA



11 Typ. gate charge

$V_{GS} = f(Q_{Gate})$

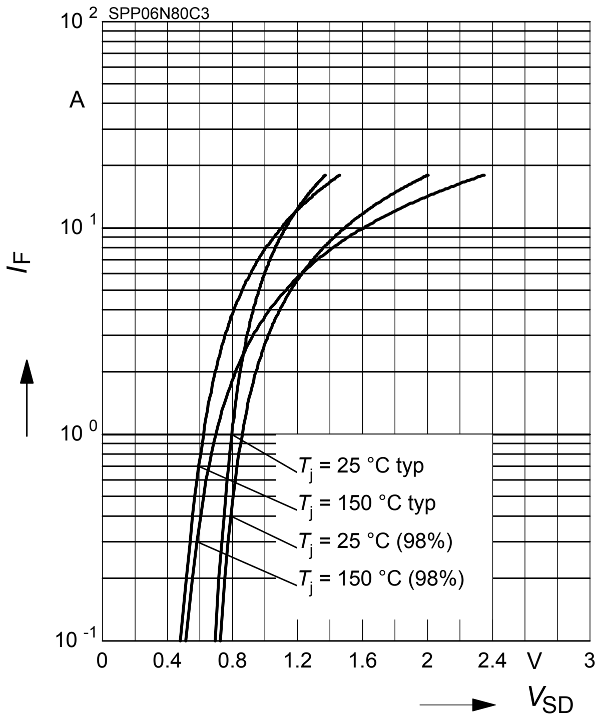
parameter: I_D = 6 A pulsed



12 Forward characteristics of body diode

$I_F = f(V_{SD})$

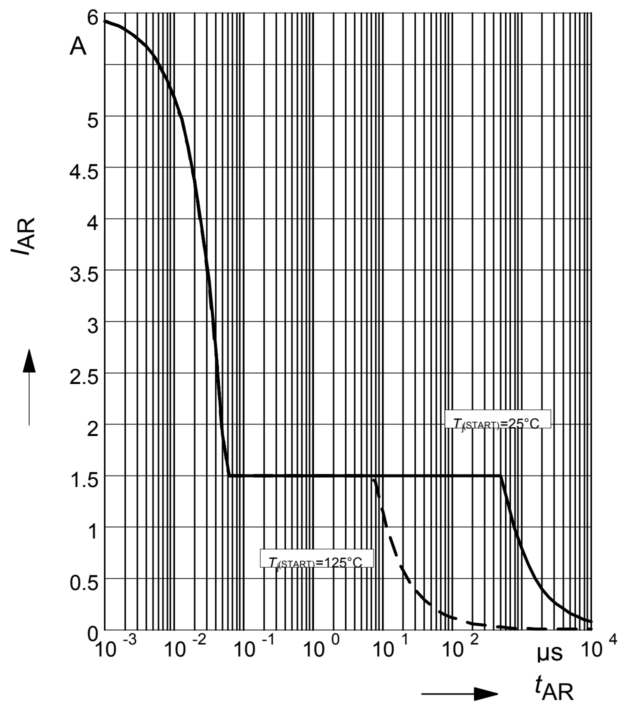
parameter: T_j , t_p = 10 µs



13 Avalanche SOA

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

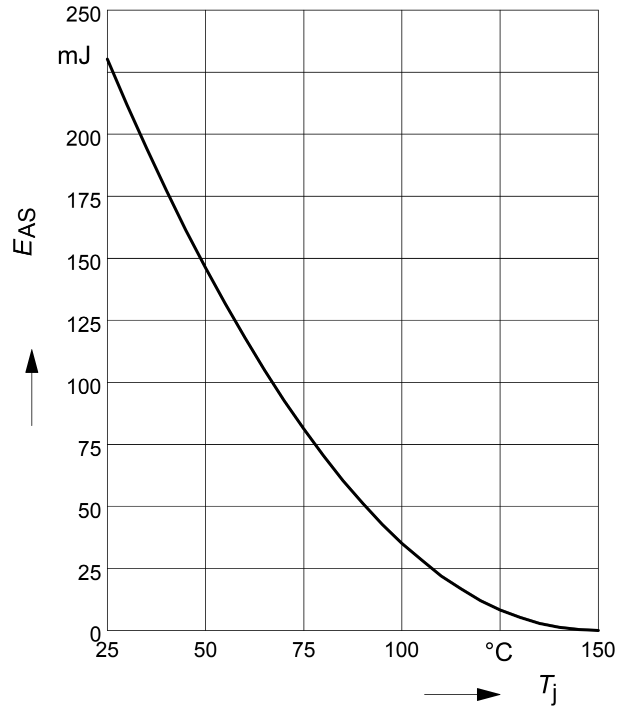
par.: $T_j \leq 150$ °C



14 Avalanche energy

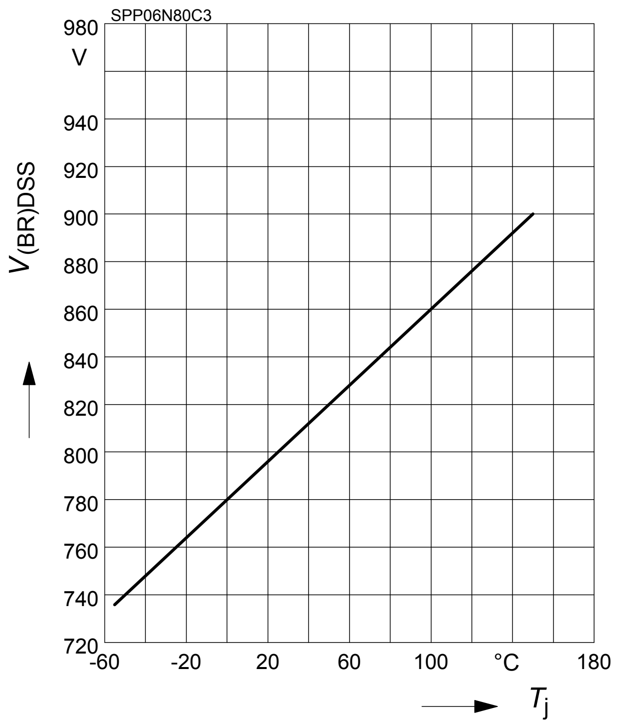
$E_{AS} = f(T_j)$

par.: I_D = 1.5 A, V_{DD} = 50 V



15 Drain-source breakdown voltage

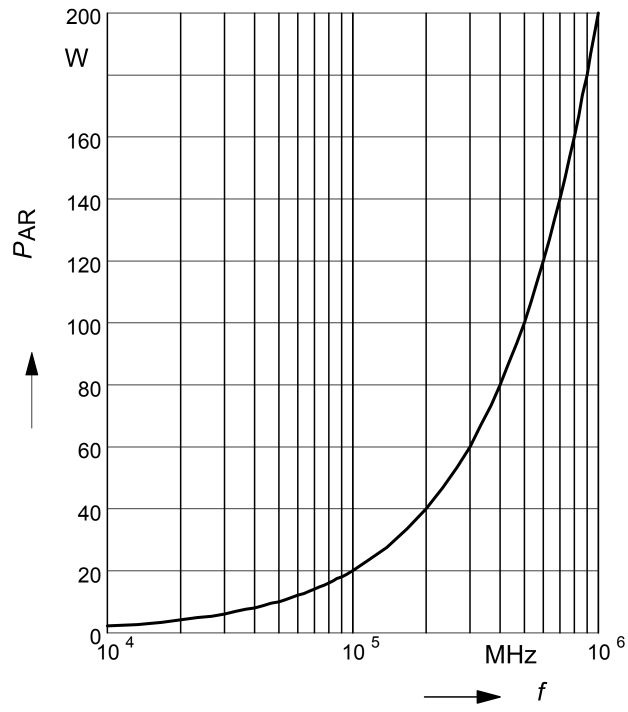
$V_{(BR)DSS} = f(T_j)$



16 Avalanche power losses

$P_{AR} = f(f)$

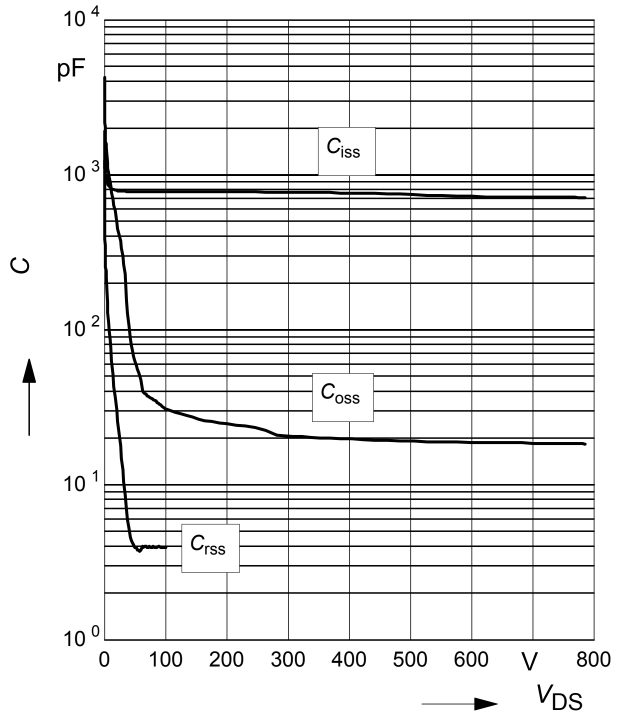
parameter: E_{AR}=0.2mJ



17 Typ. capacitances

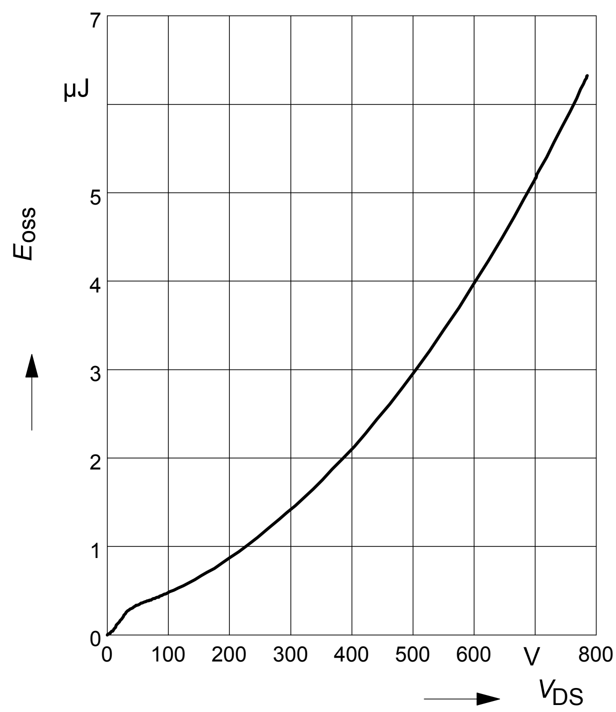
$C = f(V_{DS})$

parameter: V_{GS}=0V, f=1 MHz

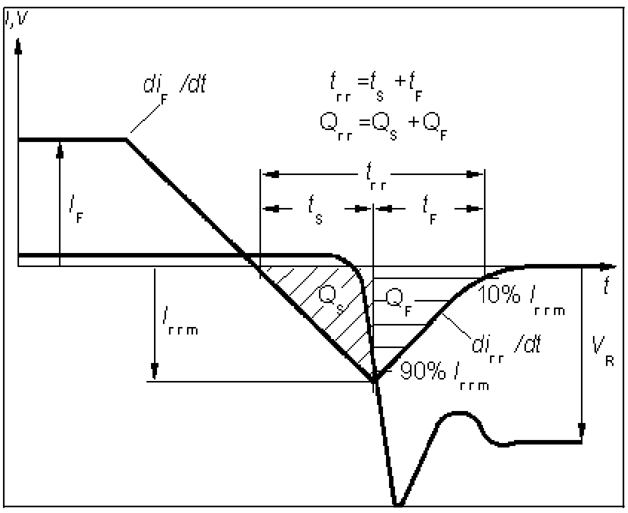


18 Typ. C_{oss} stored energy

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



Definition of diodes switching characteristics



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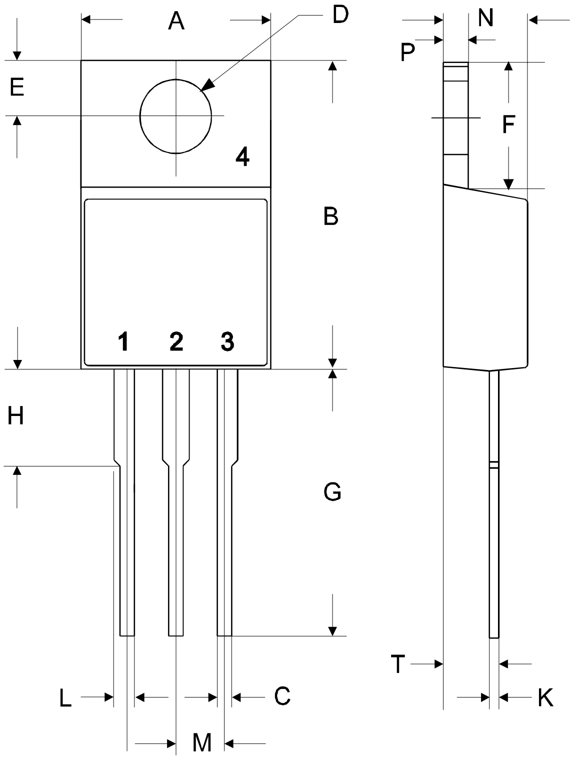

symbol	dimensions			
	[mm]		[inch]	
	min	max	min	max
A	9.70	10.30	0.3819	0.4055
B	14.88	15.95	0.5858	0.6280
C	0.65	0.86	0.0256	0.0339
D	3.55	3.89	0.1398	0.1531
E	2.60	3.00	0.1024	0.1181
F	6.00	6.80	0.2362	0.2677
G	13.00	14.00	0.5118	0.5512
H	4.35	4.75	0.1713	0.1870
K	0.38	0.65	0.0150	0.0256
L	0.95	1.32	0.0374	0.0520
M	2.54 typ.		0.1 typ.	
N	4.30	4.50	0.1693	0.1772
P	1.17	1.40	0.0461	0.0551
T	2.30	2.72	0.0906	0.1071

Published by
Infineon Technologies AG,
Bereichs Kommunikation
St.-Martin-Strasse 53,
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