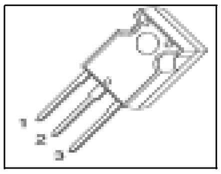
Cool MOS™ Power Transistor

V_{DS} @ T_{jmax}	560	V
$R_{DS(on)}$	0.38	Ω
I_D	11.6	A

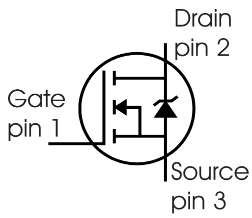
Feature

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

PG-TO247



Type	Package	Ordering Code	Marking
SPW12N50C3	PG-TO247	Q67040-S4580	12N50C3



Maximum Ratings

Parameter	Symbol	Value	Unit
Continuous drain current	I_D		A
T_C = 25 °C		11.6	
T_C = 100 °C		7	
Pulsed drain current, t_p limited by T_{jmax}	$I_{D\ puls}$	34.8	
Avalanche energy, single pulse I_D = 5.5 A, V_{DD} = 50 V	E_{AS}	340	mJ
Avalanche energy, repetitive t_{AR} limited by T_{jmax}[1)] I_D = 11.6 A, V_{DD} = 50 V	E_{AR}	0.6	
Avalanche current, repetitive t_{AR} limited by T_{jmax}	I_{AR}	11.6	A
Reverse diode d*v*/d*t* [5)]	d*v*/d*t*	15	V/ns
Gate source voltage	V_{GS}	±20	V
Gate source voltage AC (f >1Hz)	V_{GS}	±30	
Power dissipation, T_C = 25°C	P_{tot}	125	W
Operating and storage temperature	T_j , T_{stg}	-55... +150	°C

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain Source voltage slope V_{DS} = 400 V, I_D = 11.6 A, T_j = 125 °C	dv/dt	50	V/ns

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Thermal resistance, junction - case	R_{thJC}	-	-	1	K/W
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	-	62	
SMD version, device on PCB: @ min. footprint @ 6 cm^2 cooling area [2)]	R_{thJA}	 - -	 - 35	 62 -	
Soldering temperature, wavesoldering 1.6 mm (0.063 in.) from case for 10s	T_{sold}	-	-	260	°C

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=0.25mA	500	-	-	V
Drain-Source avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS}=0V, I_D=11.6A	-	600	-	
Gate threshold voltage	$V_{GS(th)}$	I_D=500µA, V_{GS}=V_{DS}	2.1	3	3.9	
Zero gate voltage drain current	I_{DSS}	V_{DS}=500V, V_{GS}=0V, T_j=25°C, T_j=150°C	 - -	 0.1 -	 1 100	µA
Gate-source leakage current	I_{GSS}	V_{GS}=20V, V_{DS}=0V	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10V, I_D=7A, T_j=25°C T_j=150°C	 - -	 0.34 0.92	 0.38 -	Ω
Gate input resistance	R_G	f=1MHz, open Drain	-	1.4	-	

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Transconductance	g_{fs}	$V_{DS} \geq 2 * I_D * R_{DS(on)max}$, I_D=7A	-	8	-	S
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	1200	-	pF
Output capacitance	C_{oss}		-	400	-	
Reverse transfer capacitance	C_{rss}		-	30	-	
Effective output capacitance,[3] energy related	$C_{o(er)}$	V_{GS}=0V, V_{DS}=0V to 400V	-	45	-	pF
Effective output capacitance,[4] time related	$C_{o(tr)}$		-	92	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=380V, V_{GS}=0/10V, I_D=11.6A, R_G=6.8Ω	-	10	-	ns
Rise time	t_r		-	8	-	
Turn-off delay time	$t_{d(off)}$		-	45	-	
Fall time	t_f		-	8	-	

Gate Charge Characteristics

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Gate to source charge	Q_{gs}	V_{DD}=400V, I_D=11.6A	-	5	-	nC
Gate to drain charge	Q_{gd}		-	26	-	
Gate charge total	Q_g	V_{DD}=400V, I_D=11.6A, V_{GS}=0 to 10V	-	49	-	
Gate plateau voltage	$V_{(plateau)}$	V_{DD}=400V, I_D=11.6A	-	5	-	V

[0]J-STD20 and JESD22

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

[2]Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 µm thick) copper area for drain connection. PCB is vertical without blown air.

[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}.

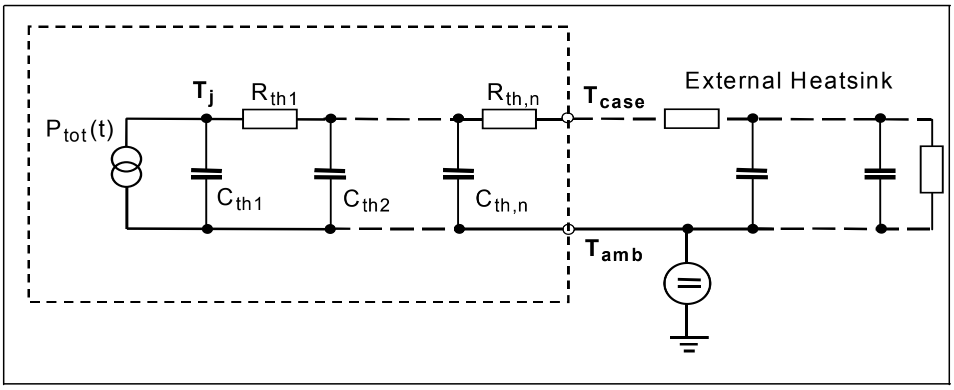
[5]I_{SD}<=I_D, di/dt<=400A/us, V_{DClink}=400V, V_{peak}<$V_{BR, DSS}$, T_j<$T_{j,max.}$
Identical low-side and high-side switch.

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Inverse diode continuous forward current	I_S	T_C=25°C	-	-	11.6	A
Inverse diode direct current, pulsed	I_{SM}		-	-	34.8	
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 ,	-	380	-	ns
Reverse recovery charge	Q_{rr}	di_F/dt=100A/µs	-	5.5	-	µC
Peak reverse recovery current	I_{rrm}		-	38	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt		-	1100	-	A/µs

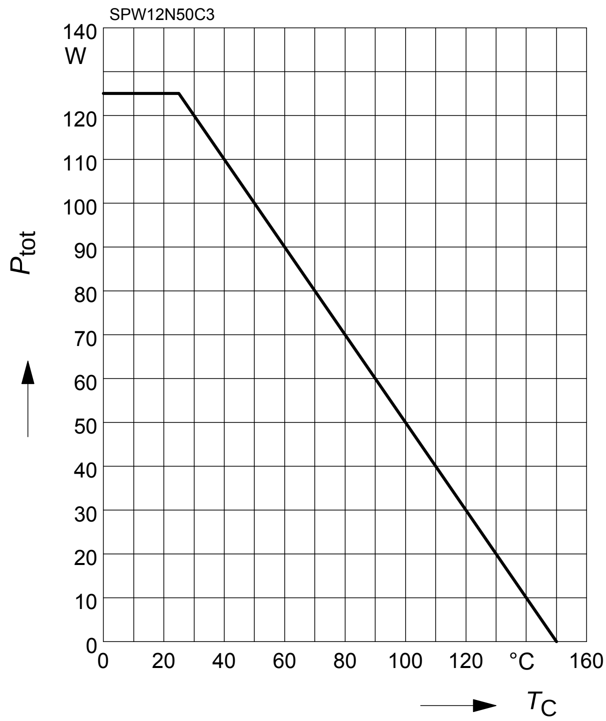
Typical Transient Thermal Characteristics

Symbol	Value typ.	Unit	Symbol	Value typ.	Unit
Thermal resistance			Thermal capacitance		
R_{th1}	0.015	K/W	C_{th1}	0.0001878	Ws/K
R_{th2}	0.03		C_{th2}	0.0007106	
R_{th3}	0.056		C_{th3}	0.000988	
R_{th4}	0.197		C_{th4}	0.002791	
R_{th5}	0.216		C_{th5}	0.007285	
R_{th6}	0.083		C_{th6}	0.063	



1 Power dissipation

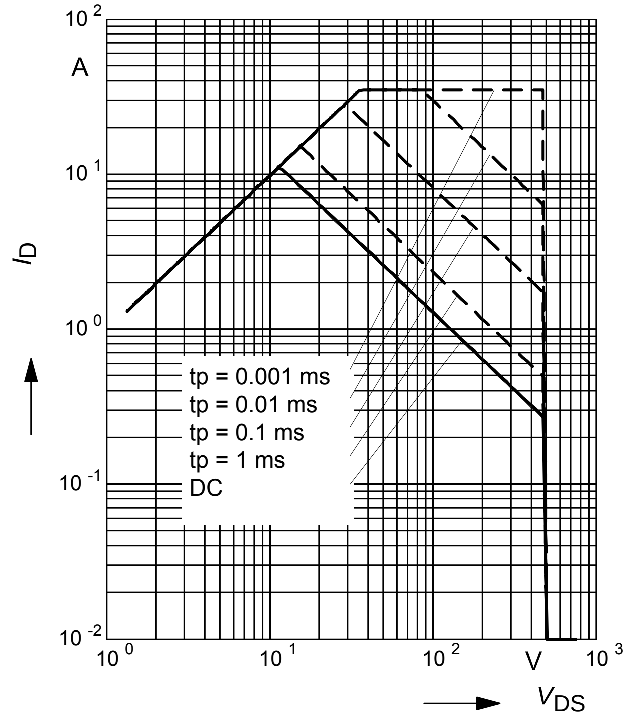
$P_{tot} = f(T_C)$



2 Safe operating area

$I_D = f(V_{DS})$

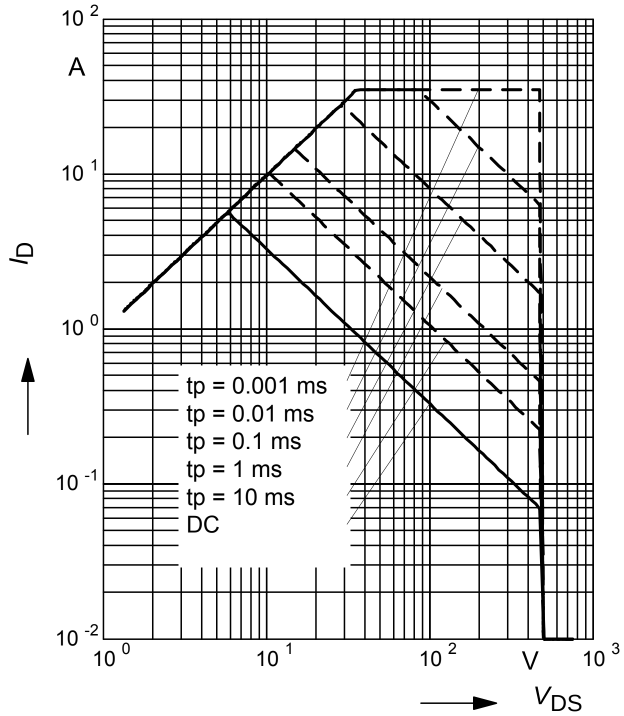
parameter : $D = 0$, T_C=25°C



3 Safe operating area FullPAK

$I_D = f(V_{DS})$

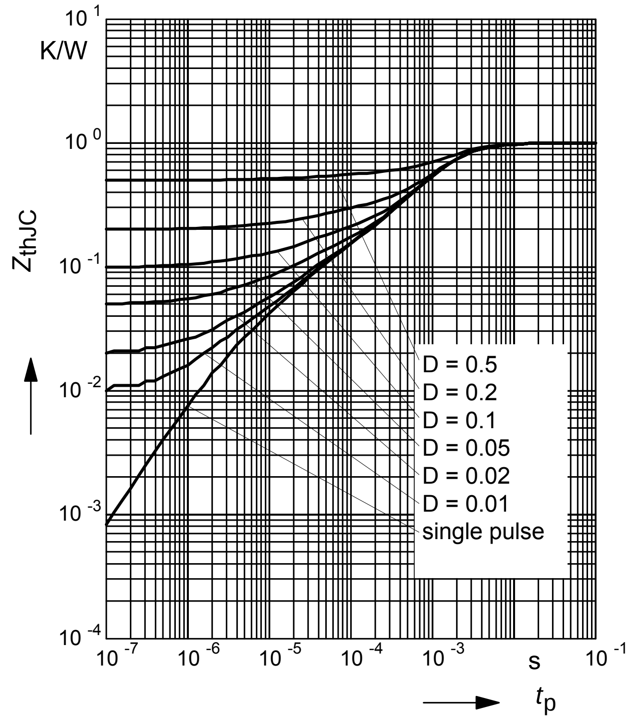
parameter: $D = 0$, $T_C = 25°C$



4 Transient thermal impedance

$Z_{thJC} = f(t_p)$

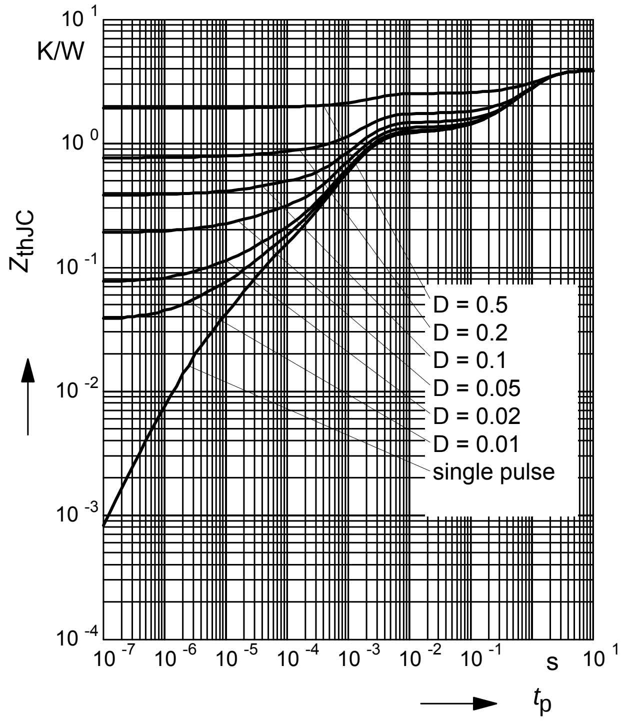
parameter: $D = t_p/T$



5 Transient thermal impedance FullPAK

$Z_{thJC} = f(t_p)$

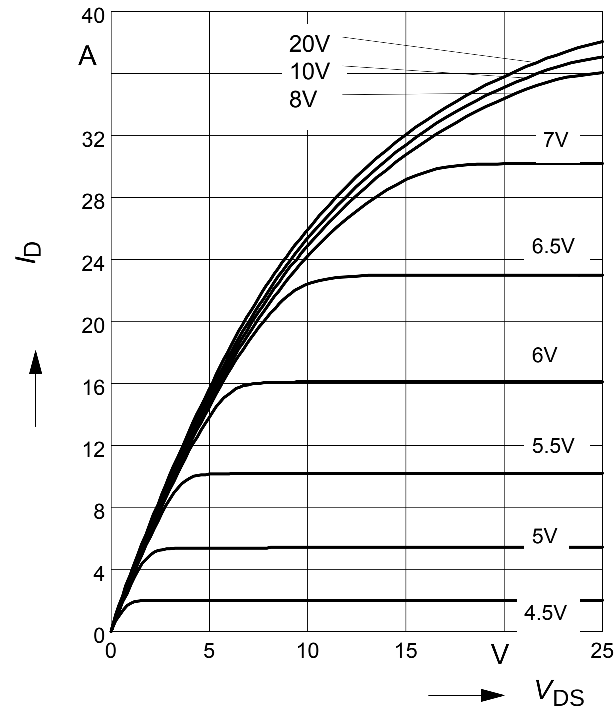
parameter: $D = t_p/t$



6 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=25°C

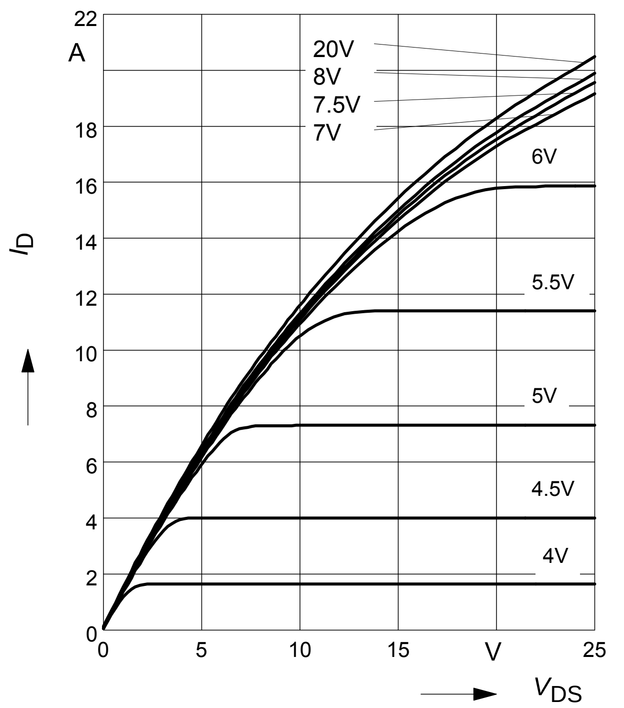
parameter: t_p = 10 µs, V_{GS}



7 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=150°C

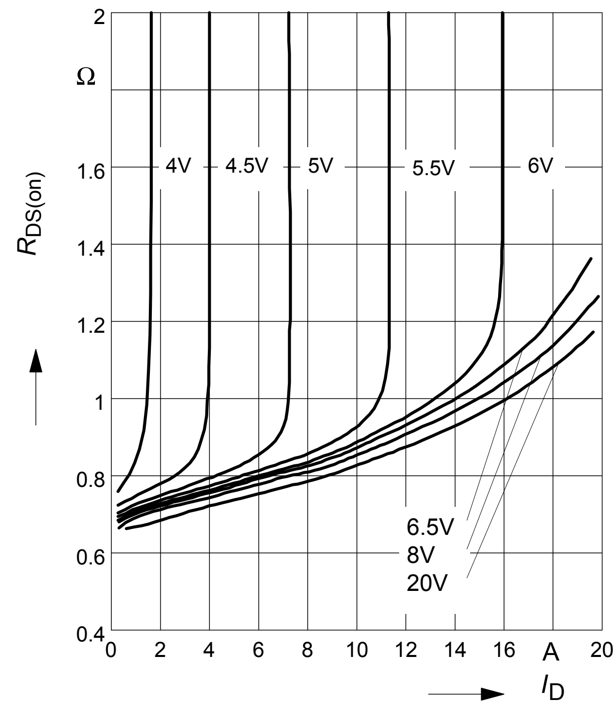
parameter: t_p = 10 µs, V_{GS}



8 Typ. drain-source on resistance

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

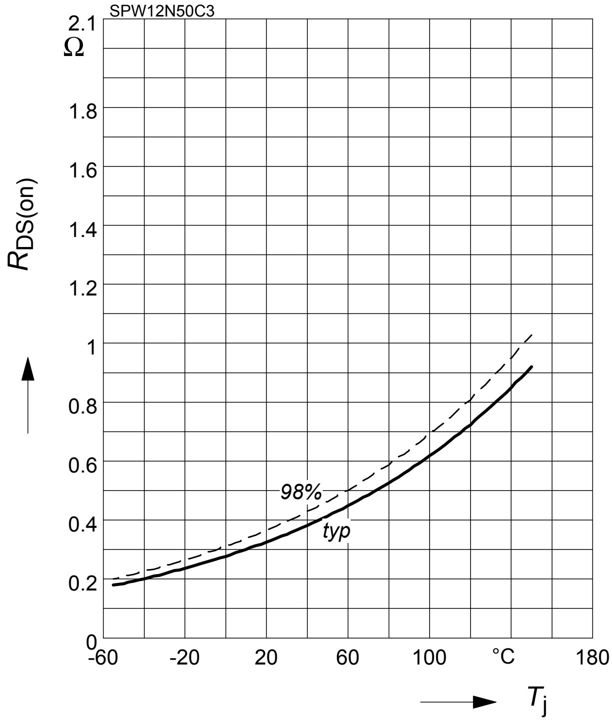
parameter: T_j=150°C, V_{GS}



9 Drain-source on-state resistance

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

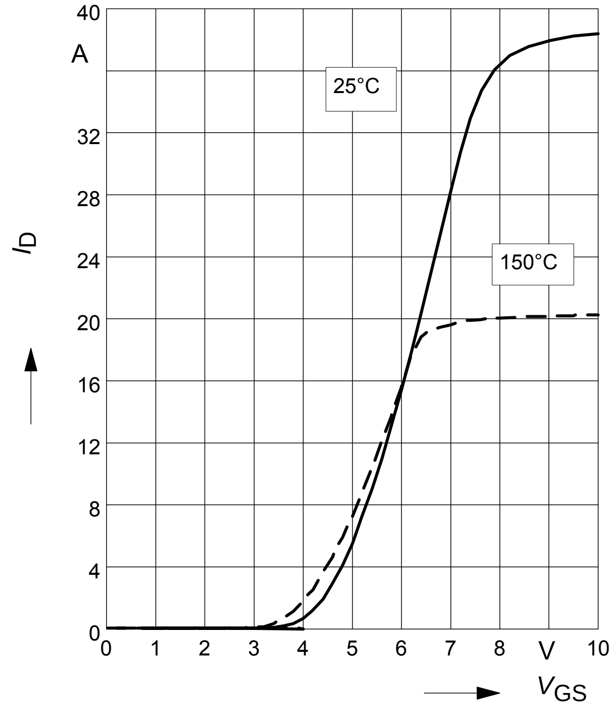
parameter : I_D = 7 A, V_{GS} = 10 V



10 Typ. transfer characteristics

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

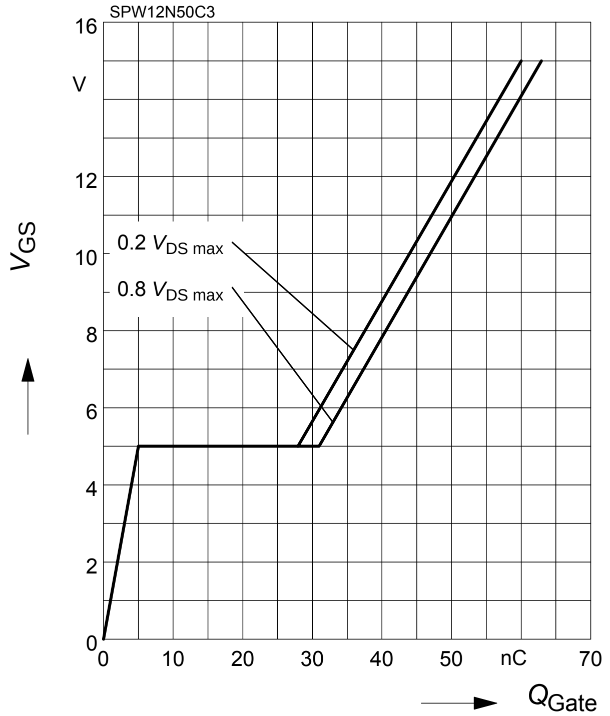
parameter: t_p = 10 µs



11 Typ. gate charge

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

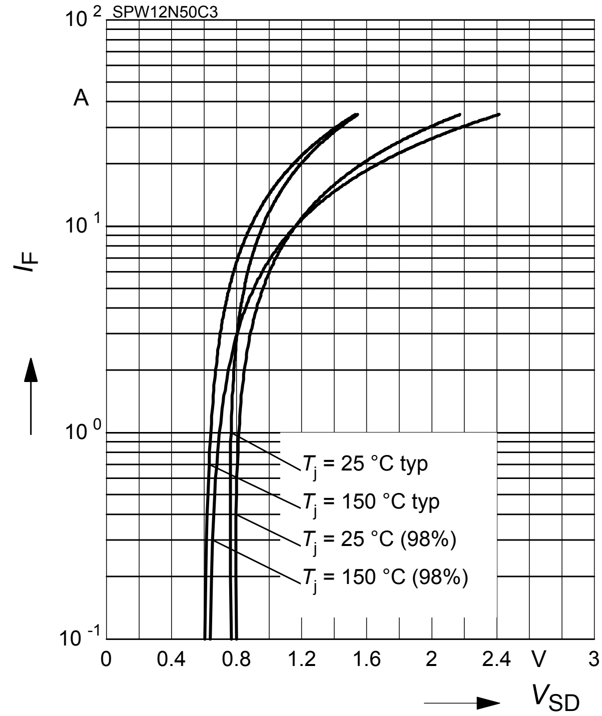
parameter: I_D = 11.6 A pulsed



12 Forward characteristics of body diode

$I_F = f(V_{SD})$

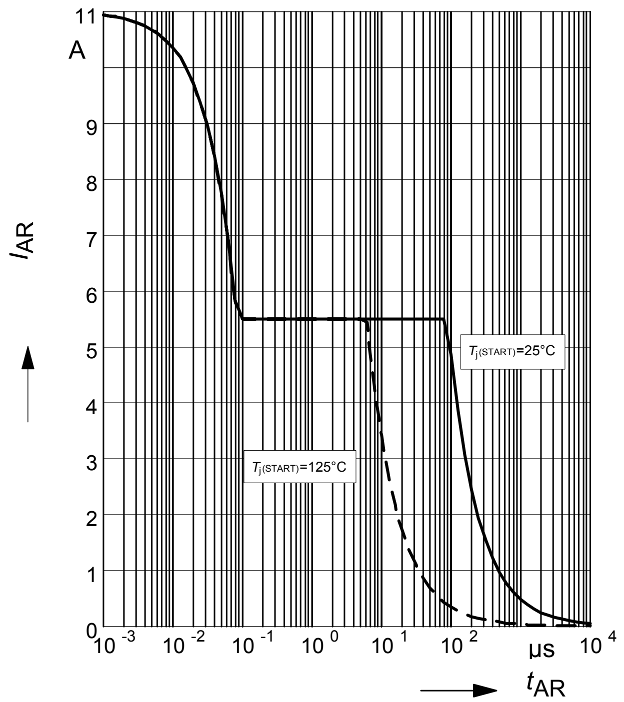
parameter: T_j , t_p = 10 µs



13 Avalanche SOA

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

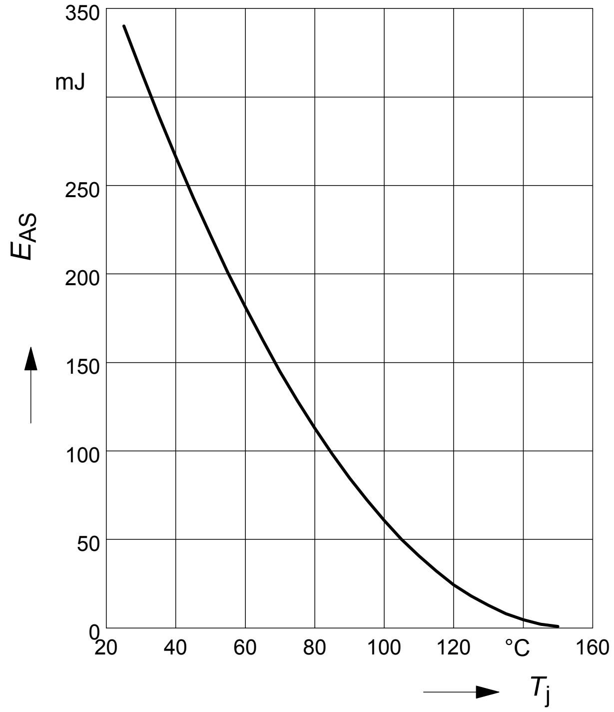
par.: $T_j \leq 150$ °C



14 Avalanche energy

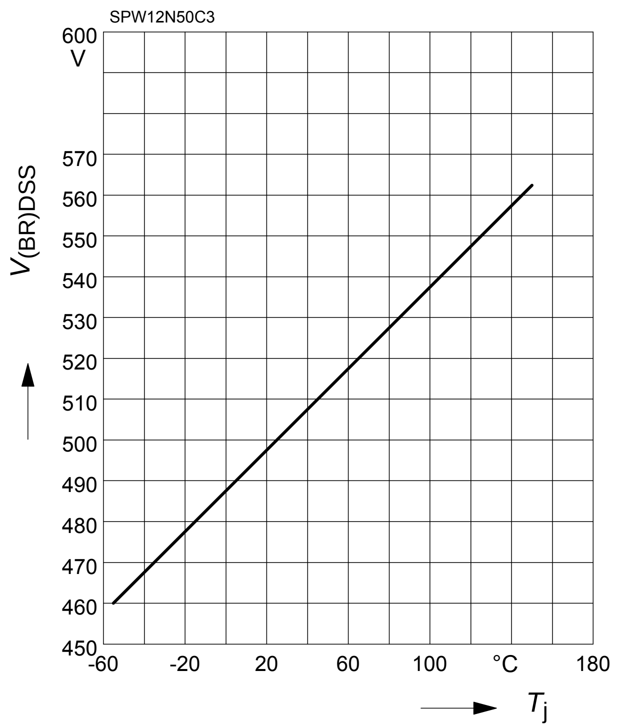
$E_{AS} = f(T_j)$

par.: I_D = 5.5 A, V_{DD} = 50 V



15 Drain-source breakdown voltage

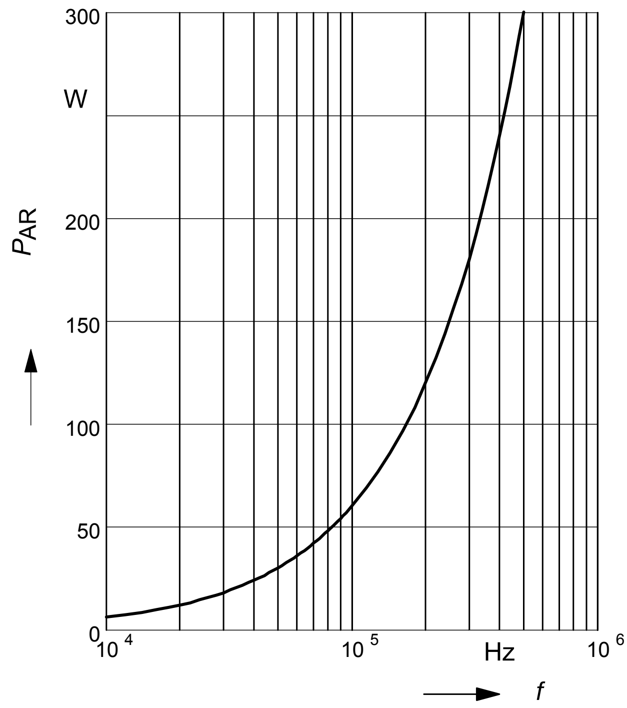
$V_{(BR)DSS} = f(T_j)$



16 Avalanche power losses

$P_{AR} = f(f)$

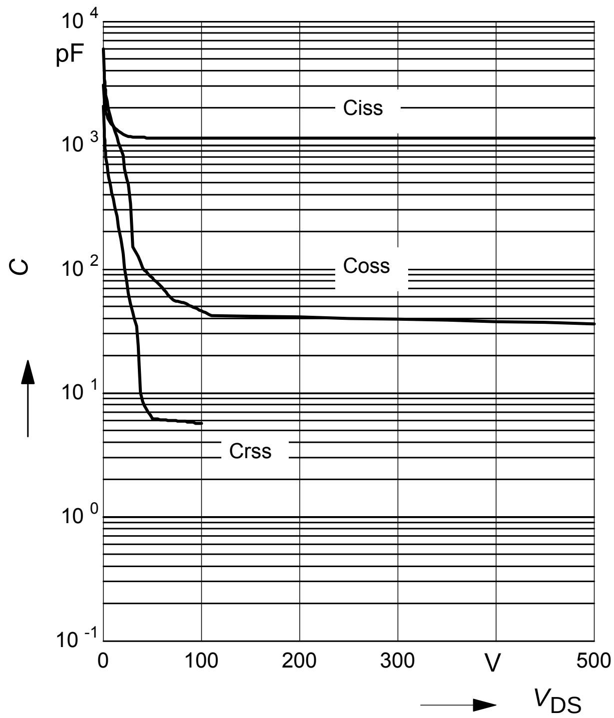
parameter: E_{AR}=0.6mJ



17 Typ. capacitances

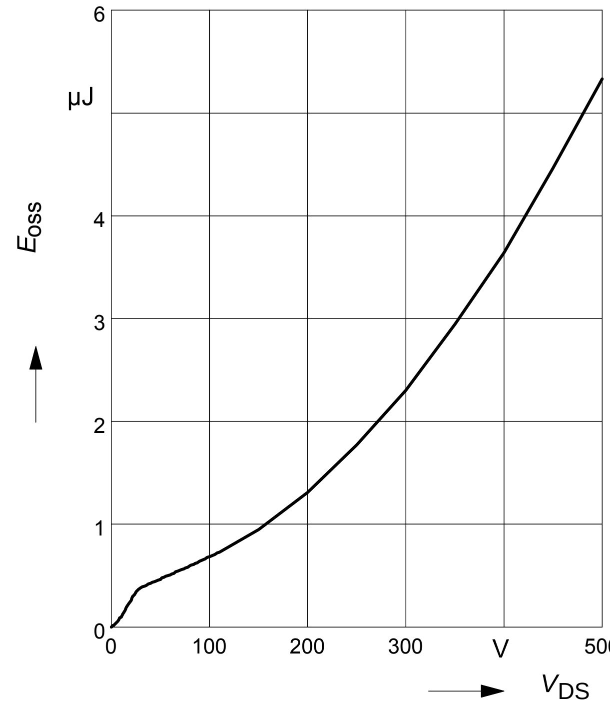
$C = f(V_{DS})$

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

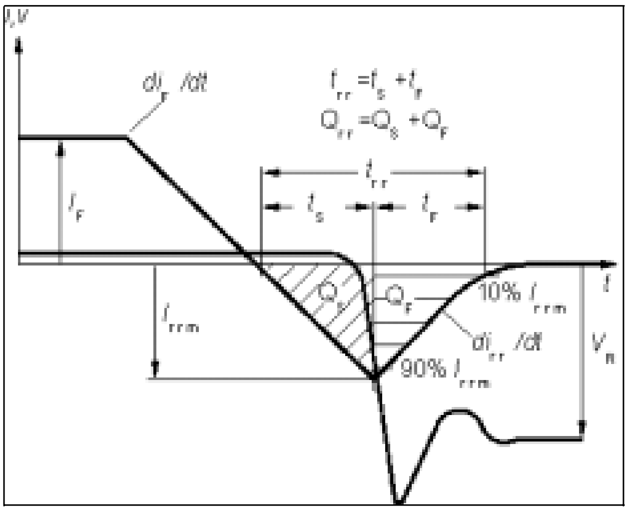


18 Typ. C_{oss} stored energy

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



Definition of diodes switching characteristics



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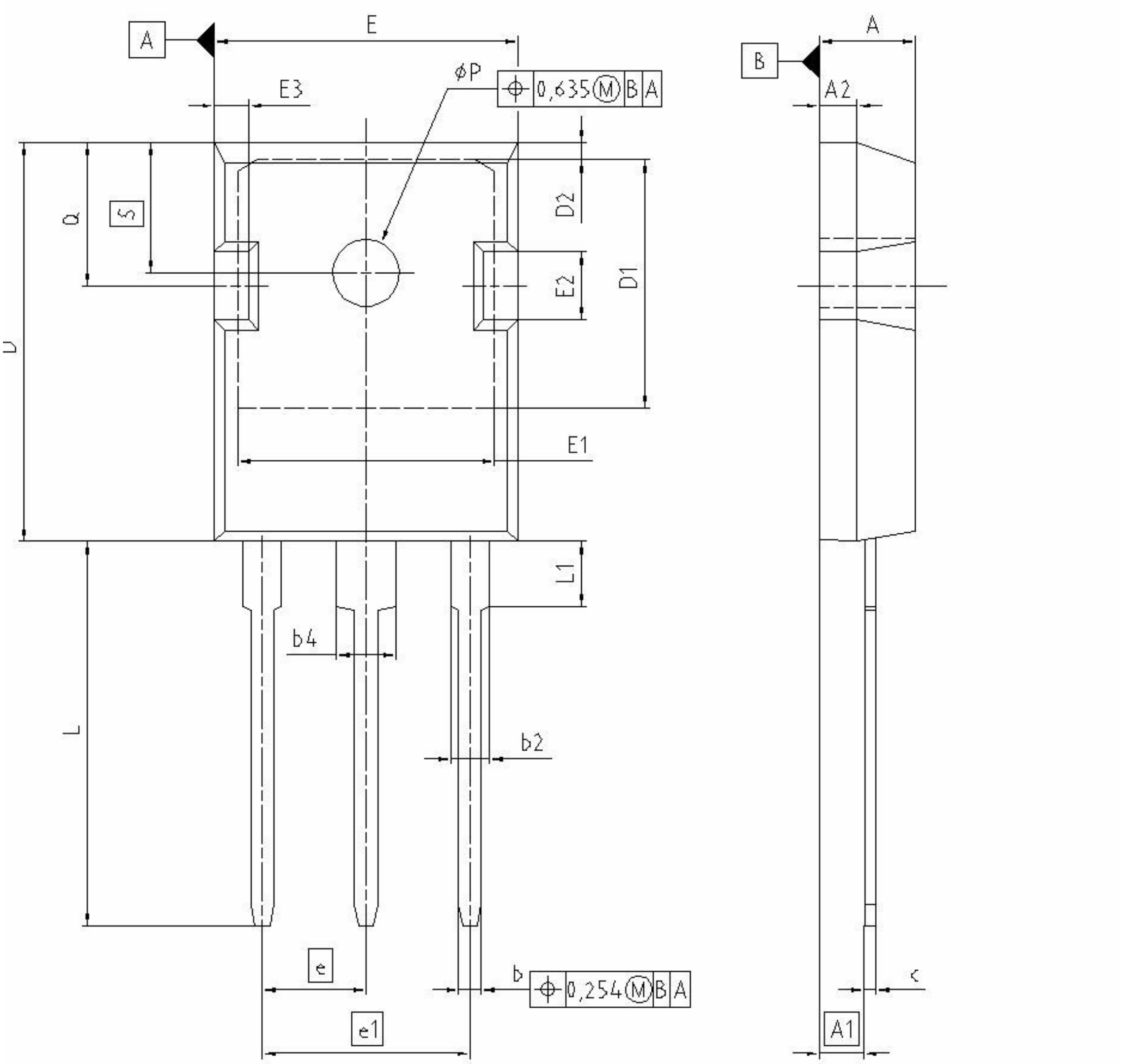
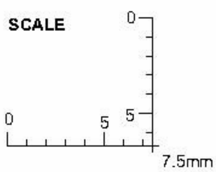


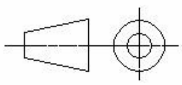
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.903	5.157	0.193	0.203
A1	2.273	2.527	0.092	0.096
A2	1.853	2.107	0.075	0.081
b	1.073	1.327	0.047	0.052
b2	1.903	2.386	0.075	0.094
b4	2.870	3.454	0.113	0.136
c	0.549	0.752	0.024	0.030
D	20.823	21.077	0.820	0.830
D1	17.323	17.831	0.682	0.702
D2	1.063	1.317	0.042	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



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