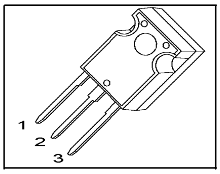
Cool MOS™ Power Transistor

V_{DS} @ T_{jmax}	650	V
$R_{DS(on)}$	0.07	Ω
I_D	47	A

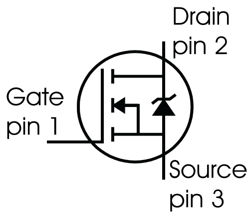
Feature

- New revolutionary high voltage technology
- Worldwide best $R_{DS(on)}$ in TO 247
- Ultra low gate charge
- Periodic avalanche rated
- Extreme d*v*/d*t* rated
- Ultra low effective capacitances

P-TO247



Type	Package	Ordering Code	Marking
SPW47N60C3	P-TO247	Q67040-S4491	47N60C3



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

Parameter	Symbol	Value	Unit
Continuous drain current	I_D		A
T_C = 25 °C		47	
T_C = 100 °C		30	
Pulsed drain current, t_p limited by T_{jmax}	$I_{D\ puls}$	141	
Avalanche energy, single pulse I_D=10A, V_{DD}=50V	E_{AS}	1800	mJ
Avalanche energy, repetitive t_{AR} limited by T_{jmax}[1)] I_D=20A, V_{DD}=50V	E_{AR}	1	
Avalanche current, repetitive t_{AR} limited by T_{jmax}	I_{AR}	20	A
Reverse diode d*v*/d*t* I_S=47A, V_{DS} < V_{DD}, d*i*/d*t*=100A/µs, T_{jmax}=150°C	d*v*/d*t*	6	V/ns
Gate source voltage static	V_{GS}	±20	V
Gate source voltage AC (f >1Hz)	V_{GS}	±30	
Power dissipation, T_C = 25°C	P_{tot}	415	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}	-	-	0.3	K/W
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	-	62	
Linear derating factor		-	-	3.33	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	$V_{(BR)DSS}$	600	-	-	V
Drain-source avalanche breakdown voltage V_{GS}=0V, I_D=20A	$V_{(BR)DS}$	-	700	-	
Gate threshold voltage, $V_{GS} = V_{DS}$ I_D=2.7mA	$V_{GS(th)}$	2.1	3	3.9	
Zero gate voltage drain current	I_{DSS}				µA
V_{DS} = 600 V, V_{GS} = 0 V, T_j = 25 °C		-	0.5	25	
V_{DS} = 600 V, V_{GS} = 0 V, T_j = 150 °C		-	-	250	
Gate-source leakage current V_{GS}=30V, V_{DS}=0V	I_{GSS}	-	-	100	nA
Drain-source on-state resistance V_{GS}=10V, I_D=47A, T_j=25°C	$R_{DS(on)}$	-	0.06	0.07	Ω
Gate input resistance f = 1 MHz, open drain	R_G	-	0.62	-	

[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}≥2*I_D*$R_{DS(on)max}$, I_D=30A	-	40	-	S
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	6800	-	pF
Output capacitance	C_{oss}		-	2200	-	
Reverse transfer capacitance	C_{rss}		-	145	-	
Effective output capacitance,[1] energy related	$C_{o(er)}$	V_{GS}=0V, V_{DS}=0V to 480V	-	193	-	pF
Effective output capacitance,[2] time related	$C_{o(tr)}$		-	412	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=380V, V_{GS}=0/13V, I_D=47A, R_G=1.8Ω, T_j=125	-	18	-	ns
Rise time	t_r		-	27	-	
Turn-off delay time	$t_{d(off)}$		-	111	165	
Fall time	t_f		-	8	12	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	V_{DD}=350V, I_D=47A	-	24	-	nC
Gate to drain charge	Q_{gd}		-	121	-	
Gate charge total	Q_g	V_{DD}=350V, I_D=47A, V_{GS}=0 to 10V	-	252	320	
Gate plateau voltage	$V_{(plateau)}$	V_{DD}=350V, I_D=47A	-	5.5	-	V

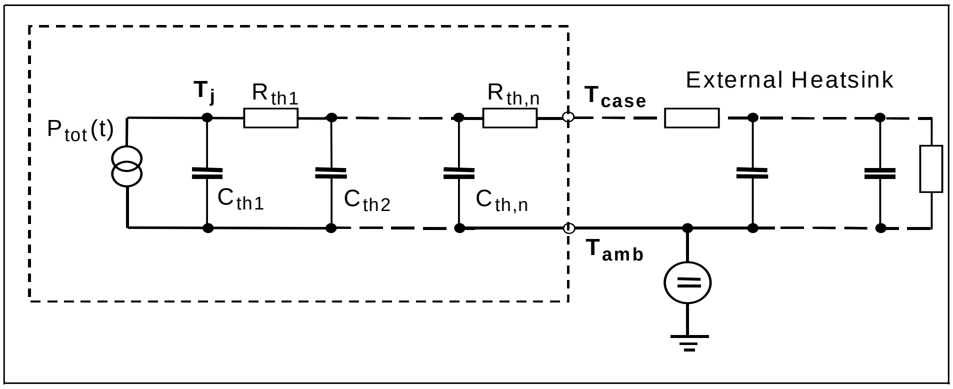
[1] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.
[2] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Characteristics						
Inverse diode continuous forward current	I_S	T_C=25°C	-	-	47	A
Inverse diode direct current, pulsed	I_{SM}		-	-	141	
Inverse diode forward voltage	V_{SD}	V_{GS}=0V, I_F=I_S	-	1	1.2	V
Reverse recovery time	t_{rr}	V_R=350V, I_F=I_S , di_F/dt=100A/µs	-	580	-	ns
Reverse recovery charge	Q_{rr}		-	23	-	µC
Peak reverse recovery current	I_{rrm}		-	73	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt		-	900	-	A/µs

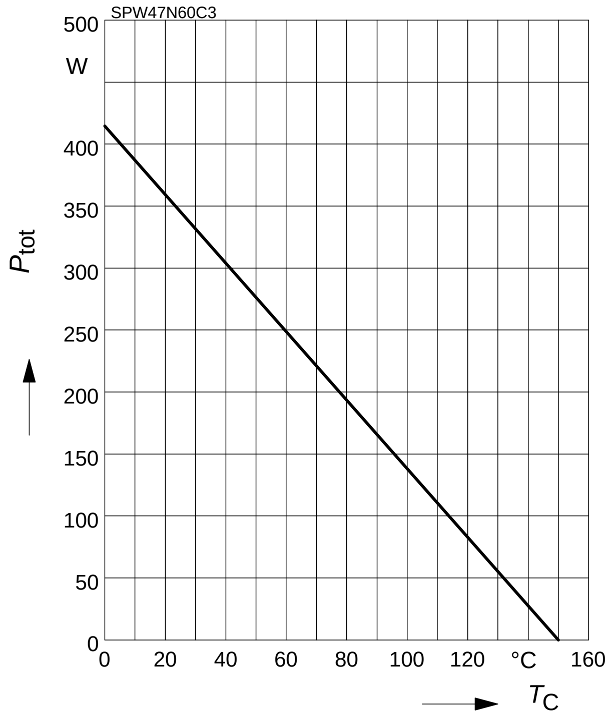
Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
	typ.			typ.	
Thermal resistance			Thermal capacitance		
R_{th1}	0.002695	K/W	C_{th1}	0.00108	Ws/K
R_{th2}	0.005428		C_{th2}	0.00401	
R_{th3}	0.011		C_{th3}	0.005389	
R_{th4}	0.026		C_{th4}	0.014	
R_{th5}	0.034		C_{th5}	0.051	
R_{th6}	0.018		C_{th6}	0.321	



1 Power dissipation

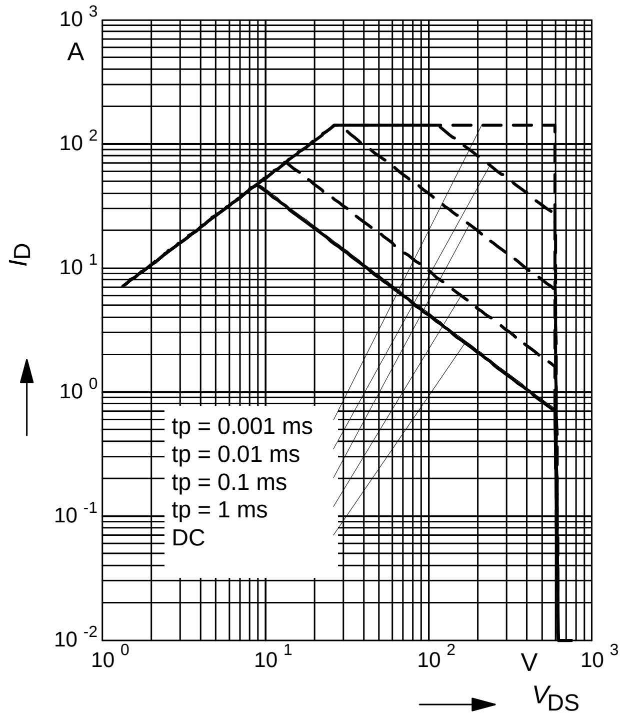
$P_{tot} = f(T_C)$



2 Safe operating area

$I_D = f(V_{DS})$

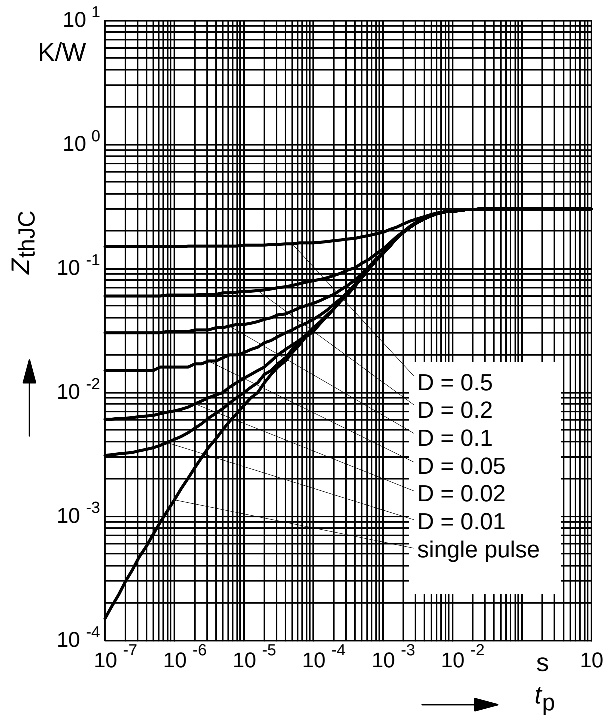
parameter : $D = 0$, T_C=25°C



3 Transient thermal impedance

$Z_{thJC} = f(t_p)$

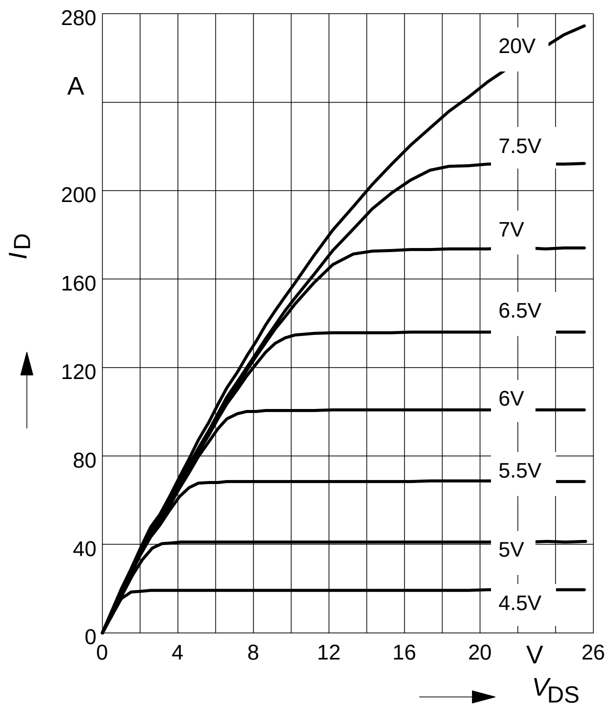
parameter: $D = t_p/T$



4 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=25°C

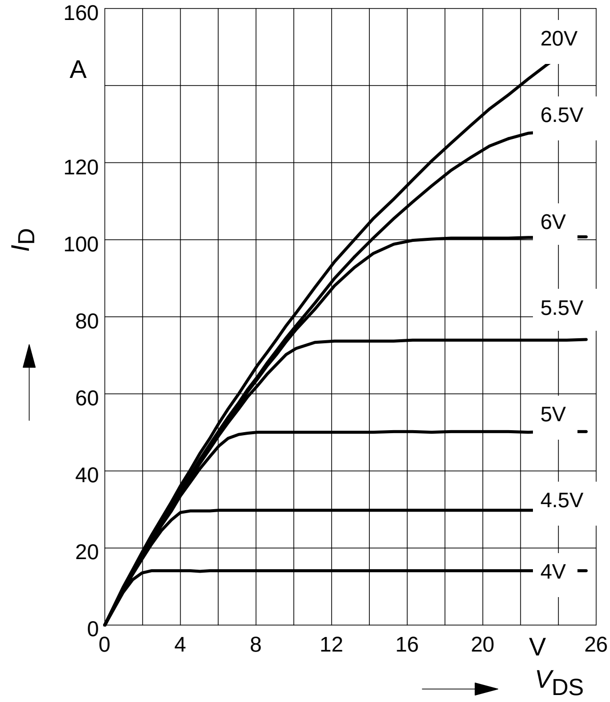
parameter: t_p = 10 µs, V_{GS}



5 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=150°C

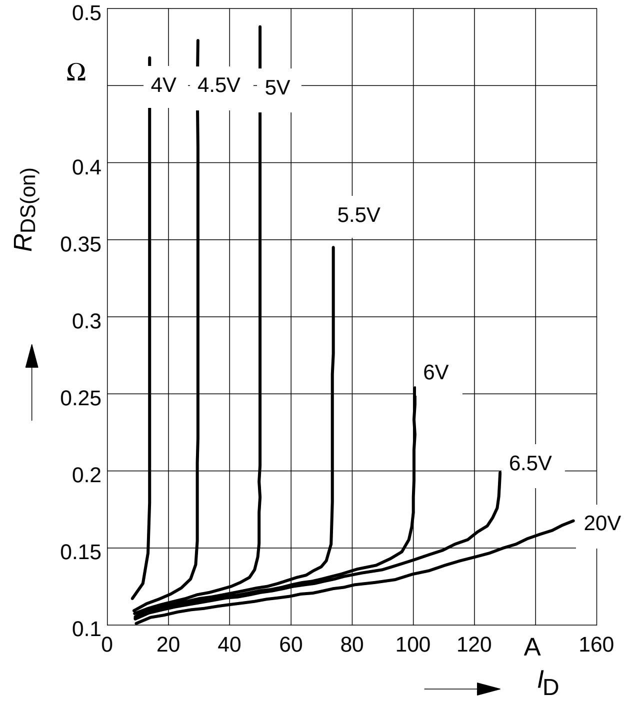
parameter: t_p = 10 µs, V_{GS}



6 Typ. drain-source on resistance

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

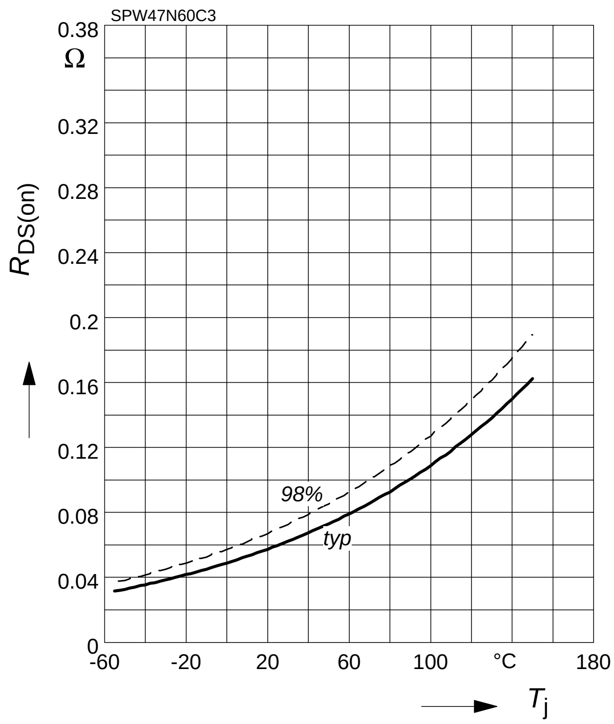
parameter: T_j=150°C, V_{GS}



7 Drain-source on-state resistance

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

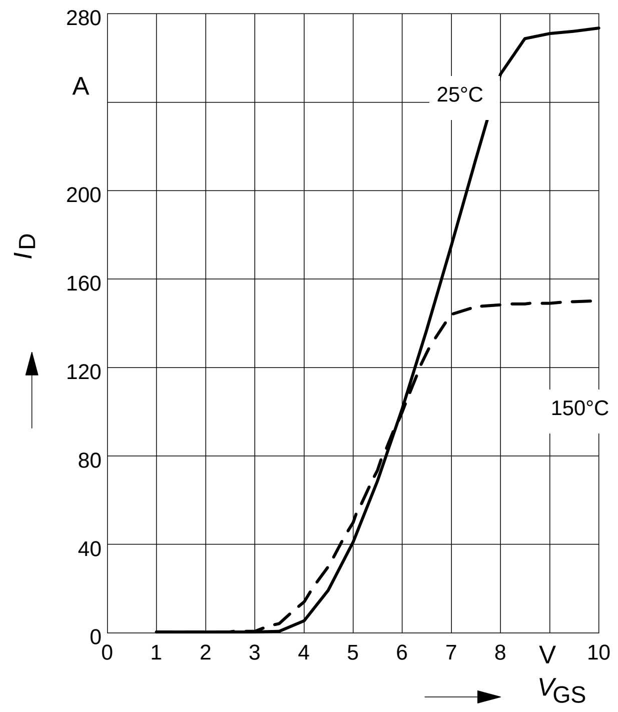
parameter : I_D = 47 A, V_{GS} = 10 V



8 Typ. transfer characteristics

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

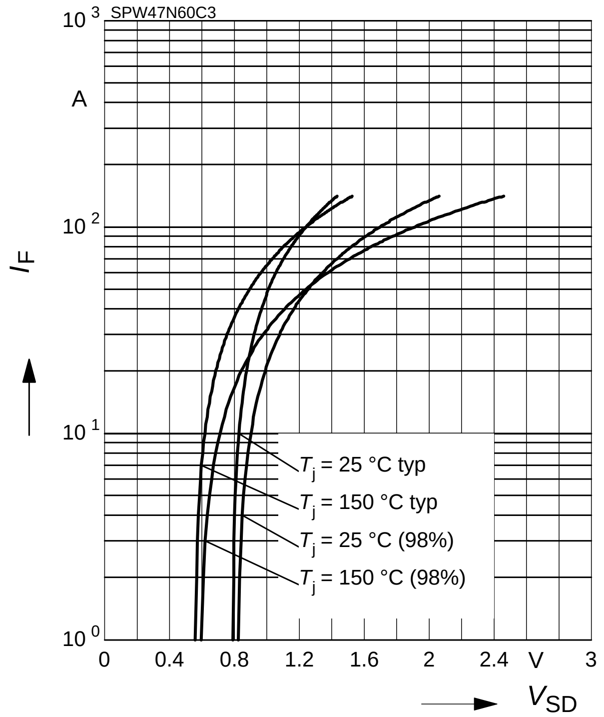
parameter: t_p = 10 µs



9 Forward characteristics of body diode

$I_F = f(V_{SD})$

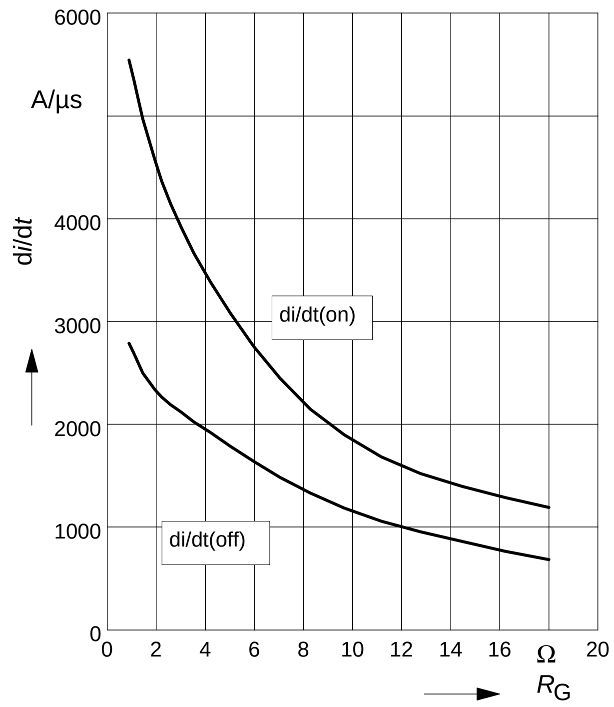
parameter: T_j , t_p = 10 µs



10 Typ. drain current slope

di/dt = f(R_G), inductive load, T_j = 125°C

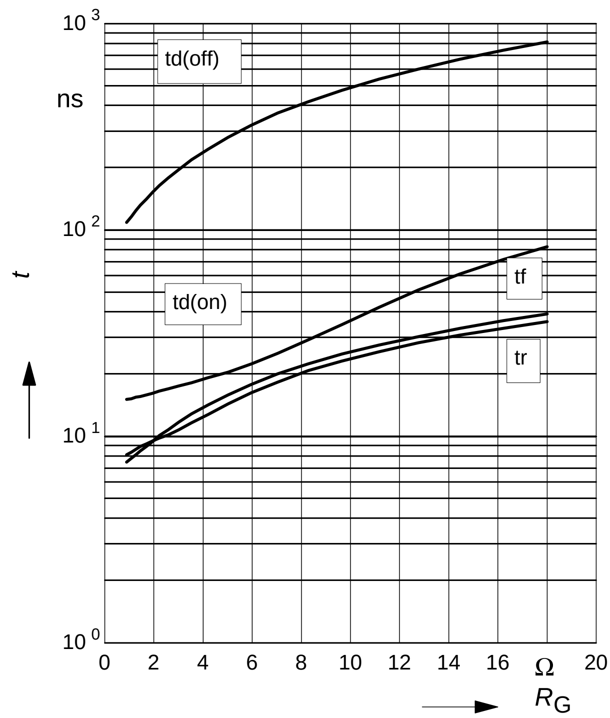
par.: V_{DS}=380V, V_{GS}=0/+13V, I_D=47A



11 Typ. switching time

$t = f(R_G)$, inductive load, T_j=125°C

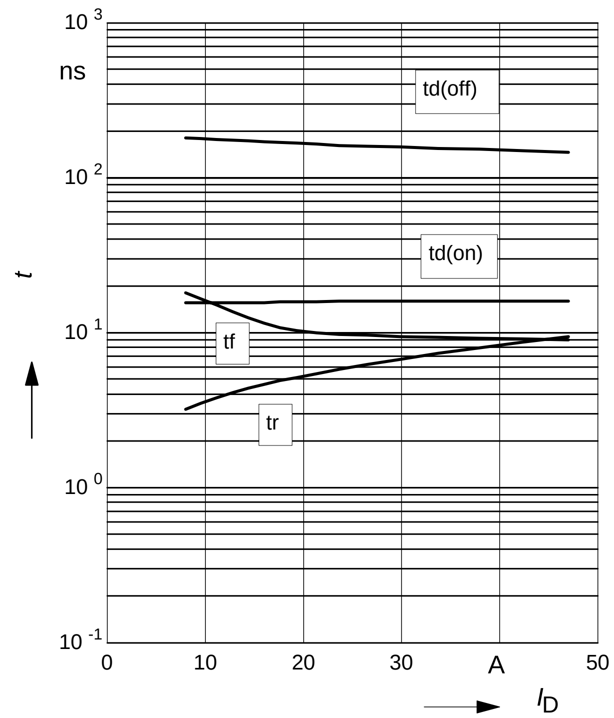
par.: V_{DS}=380V, V_{GS}=0/+13V, I_D=47 A



12 Typ. switching time

$t = f(I_D)$, inductive load, T_j=125°C

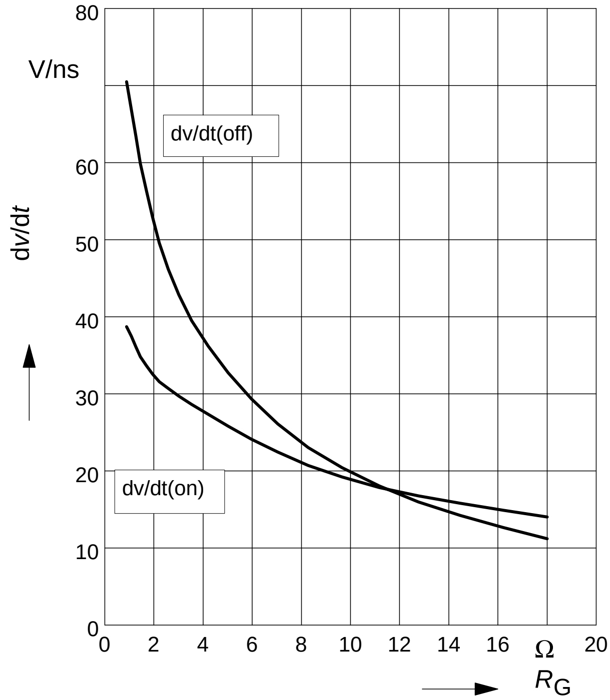
par.: V_{DS}=380V, V_{GS}=0/+13V, R_G=1.8Ω



13 Typ. drain source voltage slope

$dv/dt = f(R_G)$, inductive load, T_j = 125°C

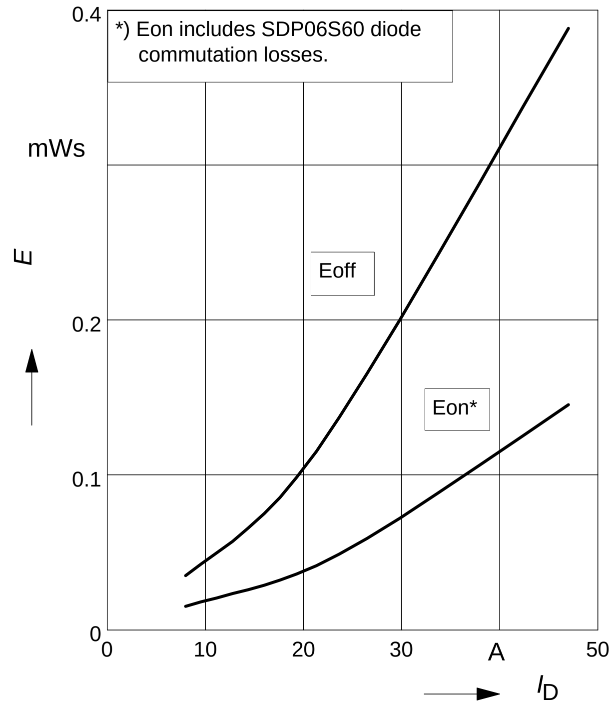
par.: V_{DS}=380V, V_{GS}=0/+13V, I_D=47A



14 Typ. switching losses

$E = f(I_D)$, inductive load, T_j=125°C

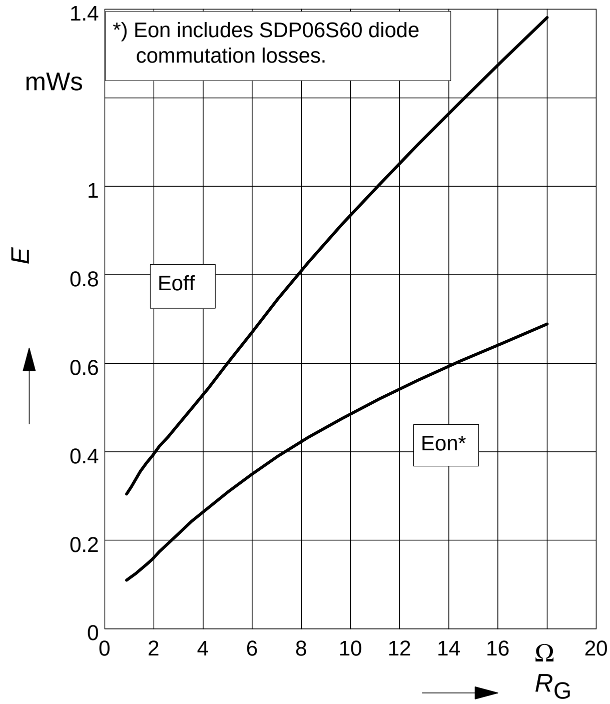
par.: V_{DS}=380V, V_{GS}=0/+13V, R_G=1.8Ω



15 Typ. switching losses

$E = f(R_G)$, inductive load, T_j=125°C

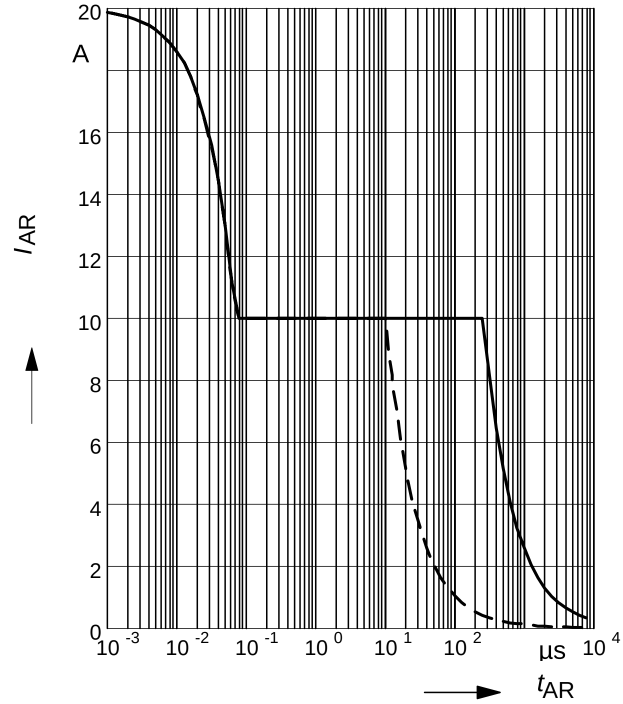
par.: V_{DS}=380V, V_{GS}=0/+13V, I_D=47A



16 Avalanche SOA

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

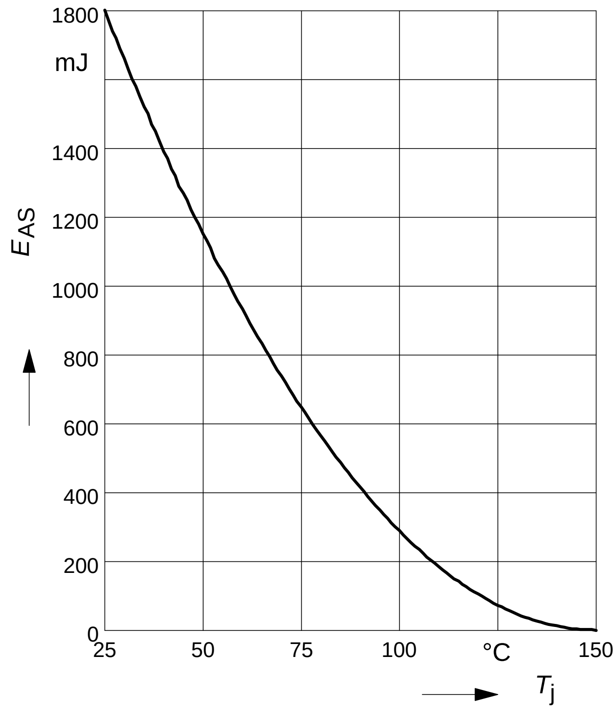
par.: $T_j \leq 150$ °C



17 Avalanche energy

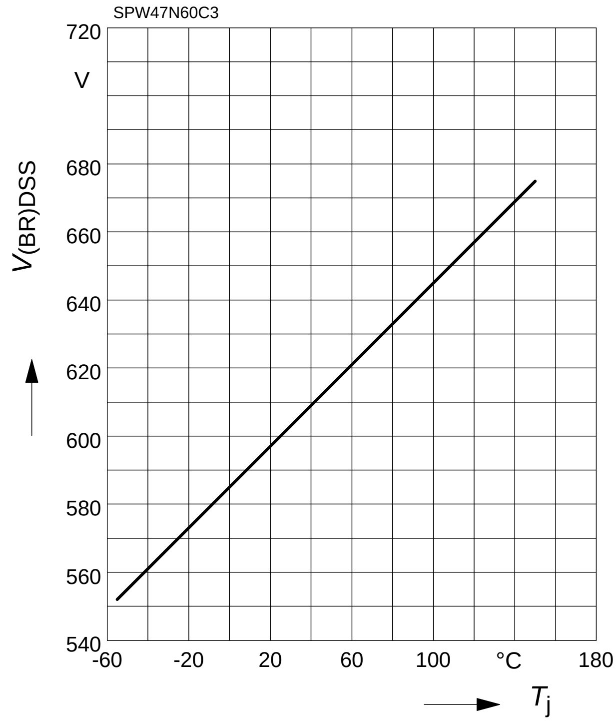
$E_{AS} = f\,(T_j)$

par.: I_D = 10 A, V_{DD} = 50 V



18 Drain-source breakdown voltage

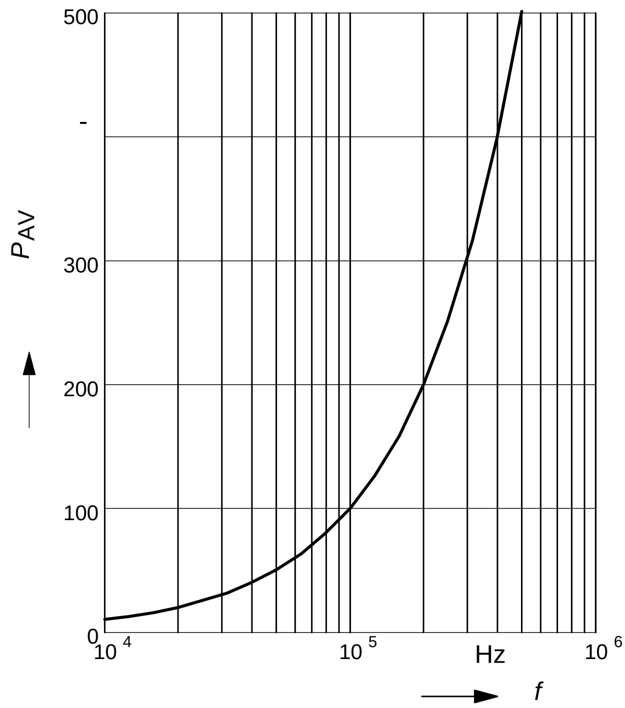
$V_{(BR)DSS} = f\,(T_j)$



19 Avalanche power losses

$P_{AR} = f\,(f\,)$

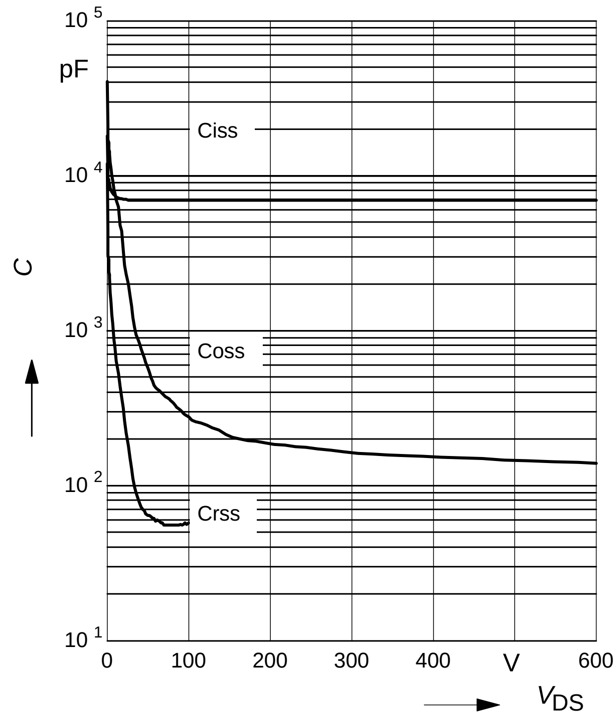
parameter: E_{AR}=1mJ



20 Typ. capacitances

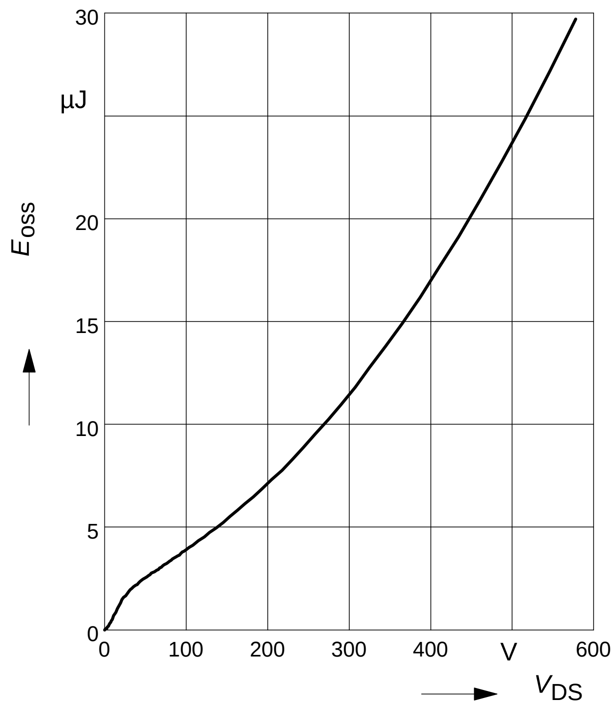
$C = f\,(V_{DS})$

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

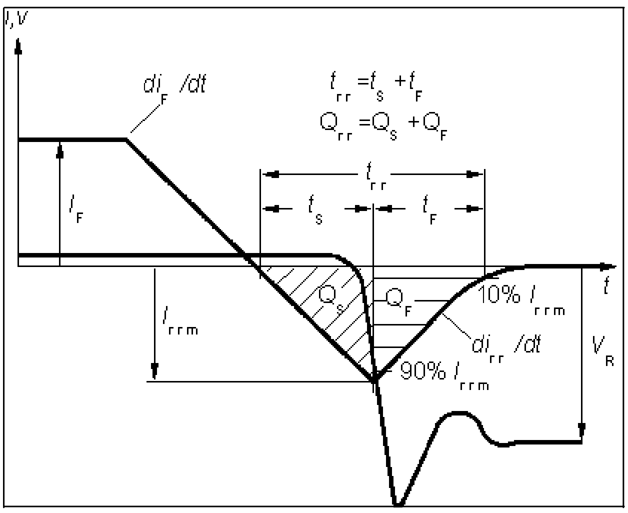


21 Typ. C_{oss} **stored energy**

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



Definition of diodes switching characteristics



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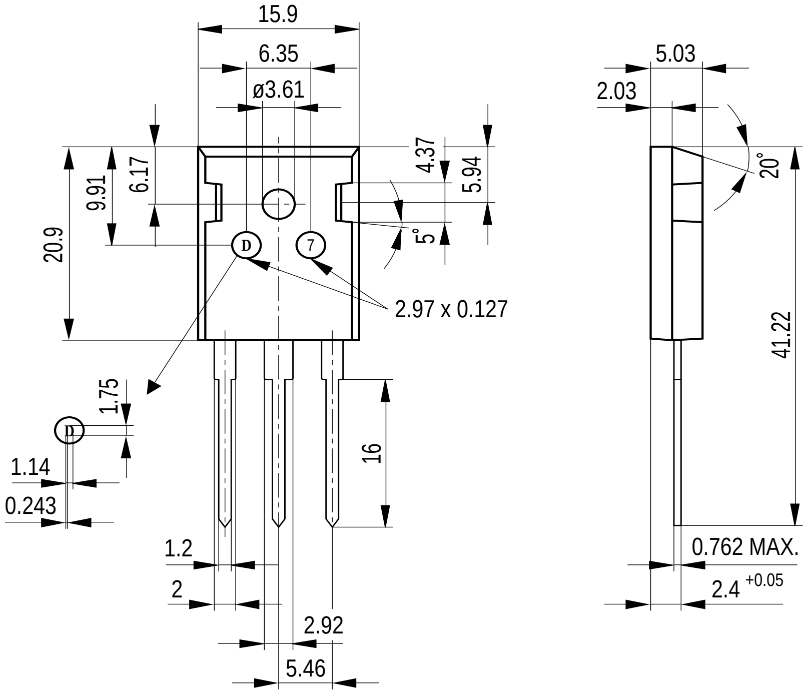

General tolerance unless otherwise specified: Leadframe parts: ±0.05
Package parts: ±0.12

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