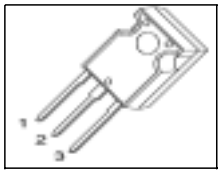
Cool MOS™ Power Transistor

V_{DS}	600	V
$R_{DS(on)}$	0.07	Ω
I_D	47	A

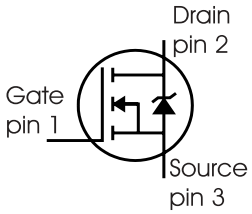
Feature

- 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
- Improved transconductance

P-TO247



Type	Package	Ordering Code	Marking
SPW47N60S5	P-TO247	Q67040-S4240	47N60S5



Maximum Ratings

Parameter	Symbol	Value	Unit
Continuous drain current T_C = 25 °C T_C = 100 °C	I_D	 47 30	A
Pulsed drain current, t_p limited by T_{jmax}	$I_{D\ puls}$	94	
Avalanche energy, single pulse I_D = 10 A, V_{DD} = 50 V	E_{AS}	1800	mJ
Avalanche energy, repetitive t_{AR} limited by T_{jmax}[1] I_D = 20 A, V_{DD} = 50 V	E_{AR}	1	
Avalanche current, repetitive t_{AR} limited by T_{jmax}	I_{AR}	20	A
Gate source voltage	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

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain Source voltage slope V_{DS} = 480 V, I_D = 47 A, T_j = 125 °C	d*v*/d*t*	20	V/ns

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Thermal resistance, junction - case	R_{thJC}	-	-	0.3	K/W
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	45	-	
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	Conditions	Values			Unit
			min.	typ.	max.	
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=0.25mA	600	-	-	V
Drain-Source avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS}=0V, I_D=20A	-	700	-	
Gate threshold voltage	$V_{GS(th)}$	I_D=2700µA, V_{GS}=V_{DS}	3.5	4.5	5.5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600V, V_{GS}=0V, T_j=25°C, T_j=150°C	 - -	 0.5 -	 25 250	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=30A, T_j=25°C T_j=150°C	 - -	 0.06 0.16	 0.07 -	Ω
Gate input resistance	R_G	*f*=1MHz, open Drain	-	8.7	-	

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=30A	-	30	-	S
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	7600	-	pF
Output capacitance	C_{oss}		-	2900	-	
Reverse transfer capacitance	C_{rss}		-	27	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=-V, V_{GS}=0/10V, I_D=47A, R_G=1.3Ω	-	360	-	ns
Rise time	t_r		-	30	-	
Turn-off delay time	$t_{d(off)}$		-	200	300	
Fall time	t_f		-	30	45	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	V_{DD}=-V, I_D=47A	-	56	-	nC
Gate to drain charge	Q_{gd}		-	123	-	
Gate charge total	Q_g	V_{DD}=-V, I_D=47A, V_{GS}=0 to 10V	-	220	286	
Gate plateau voltage	$V_{(plateau)}$	V_{DD}=-V, I_D=47A	-	8	-	V

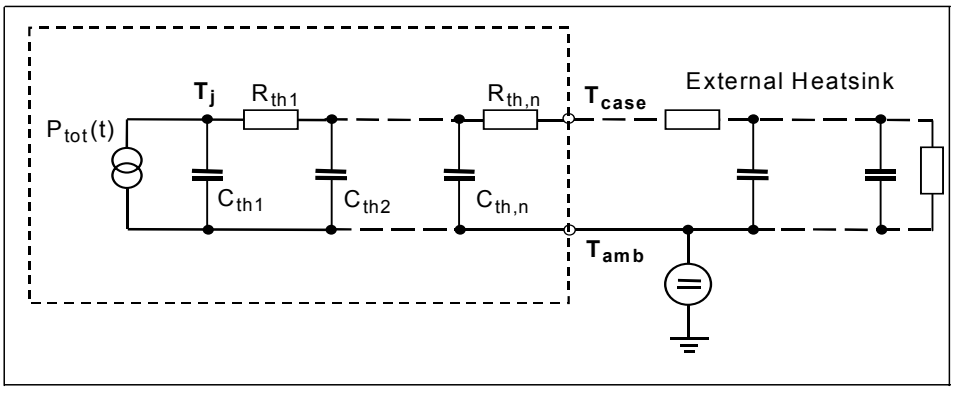
[1]Repetitve avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR}*f$.

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Inverse diode continuous forward current	I_S	T_C=25°C	-	-	47	A
Inverse diode direct current, pulsed	I_{SM}		-	-	94	
Inverse diode forward voltage	V_{SD}	V_{GS}=0V, I_F=I_S	-	1	1.2	V
Reverse recovery time	t_{rr}	V_R=-V, I_F=I_S ,	-	650	1100	ns
Reverse recovery charge	Q_{rr}	di_F/dt=100A/µs	-	24	-	µC

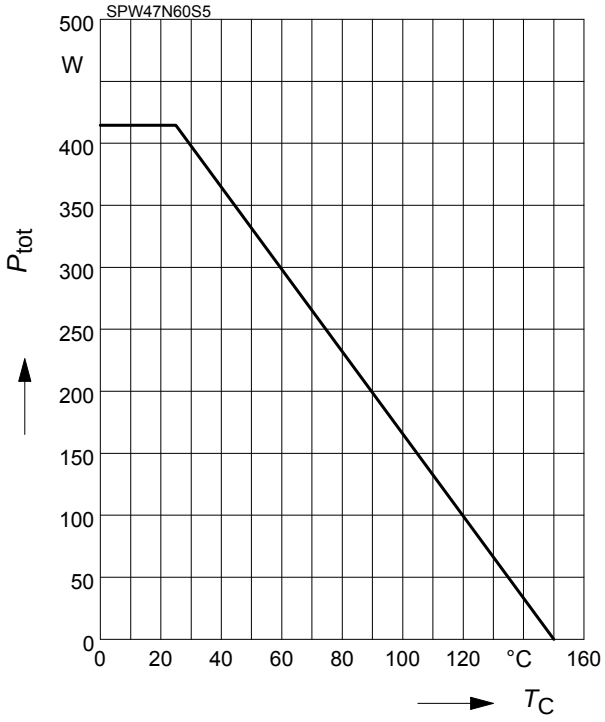
Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
	typ.			typ.	
Thermal resistance			Thermal capacitance		
R_{th1}	0.002689	K/W	C_{th1}	0.001081	Ws/K
R_{th2}	0.005407		C_{th2}	0.004021	
R_{th3}	0.011		C_{th3}	0.005415	
R_{th4}	0.054		C_{th4}	0.014	
R_{th5}	0.071		C_{th5}	0.025	
R_{th6}	0.036		C_{th6}	0.158	



1 Power dissipation

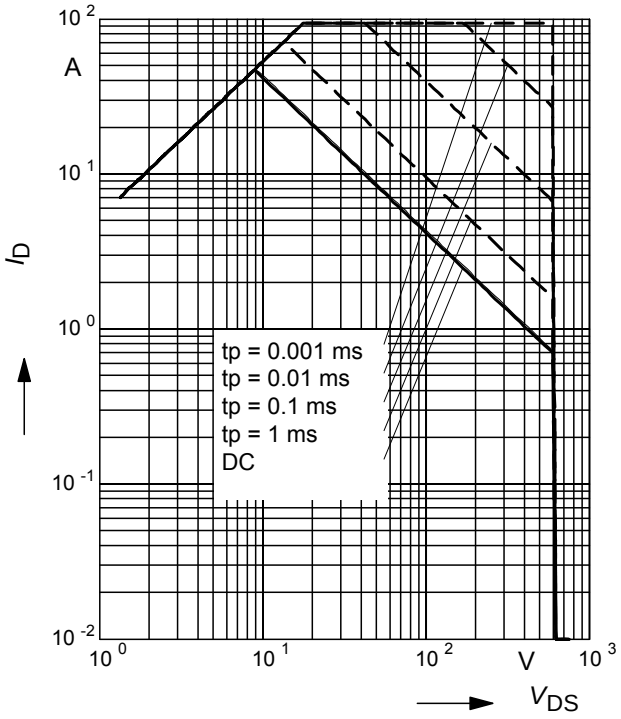
$P_{tot} = f(T_C)$



2 Safe operating area

$I_D = f(V_{DS})$

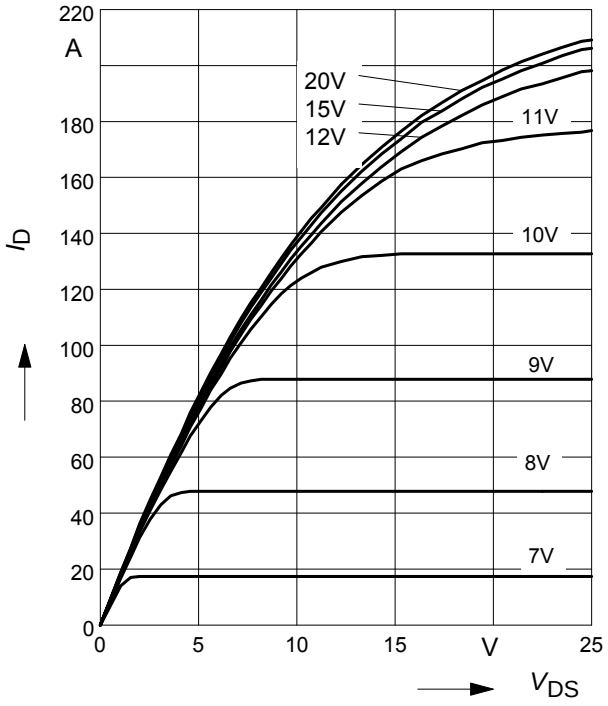
parameter : $D = 0$, $T_C = 25°C$



3 Typ. output characteristic

$I_D = f(V_{DS})$; $T_j = 25°C$

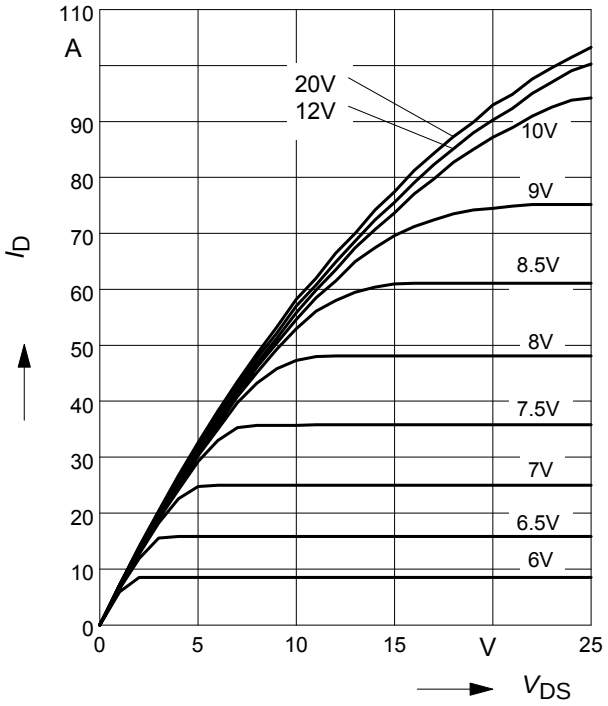
parameter: $t_p = 10$ µs, V_{GS}



4 Typ. output characteristic

$I_D = f(V_{DS})$; $T_j = 150°C$

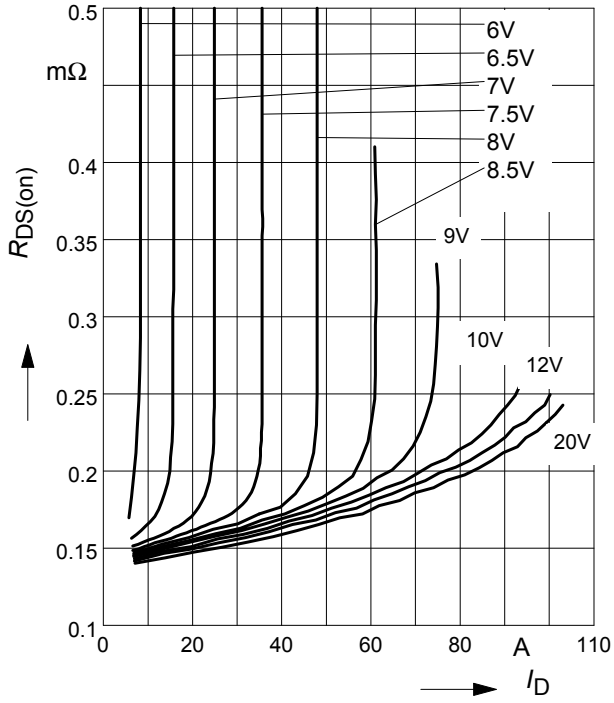
parameter: $t_p = 10$ µs, V_{GS}



5 Typ. drain-source on resistance

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

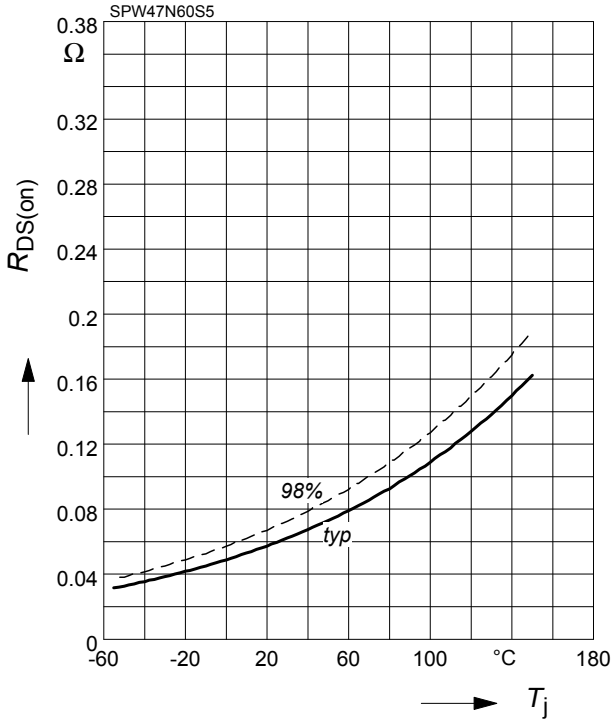
parameter: T_j=150°C, V_{GS}



6 Drain-source on-state resistance

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

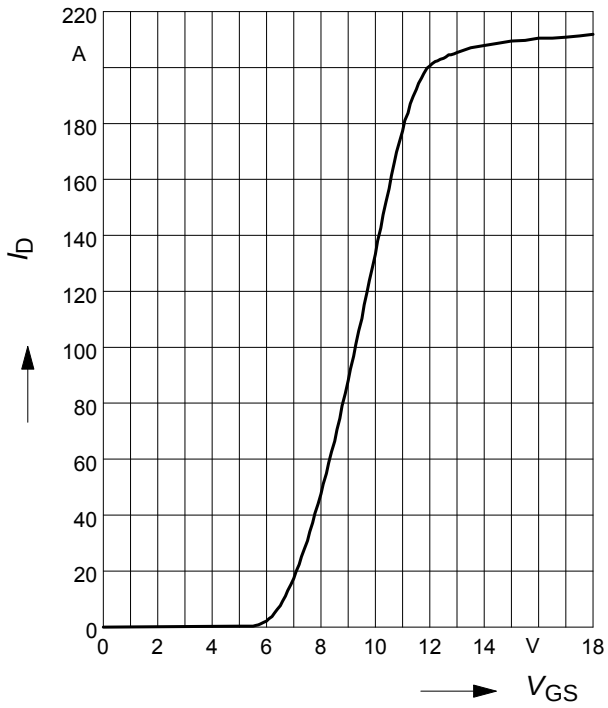
parameter : I_D = 30 A, V_{GS} = 10 V



7 Typ. transfer characteristics

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

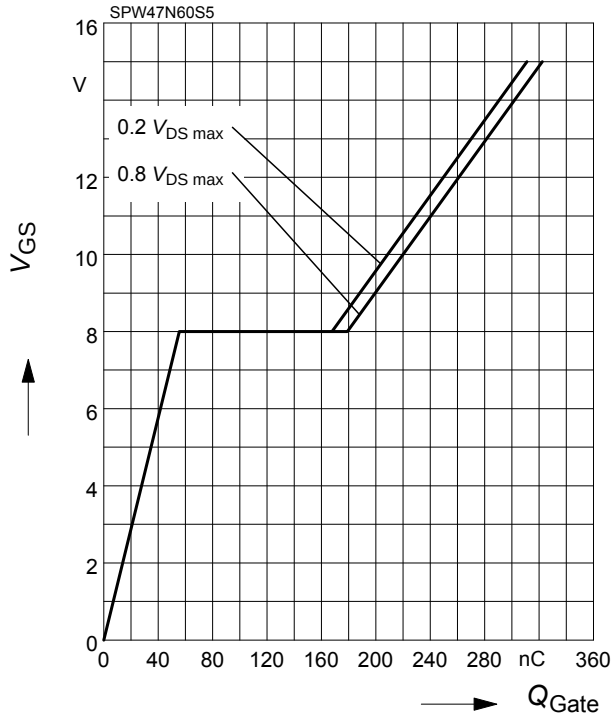
parameter: t_p = 10 µs



8 Typ. gate charge

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

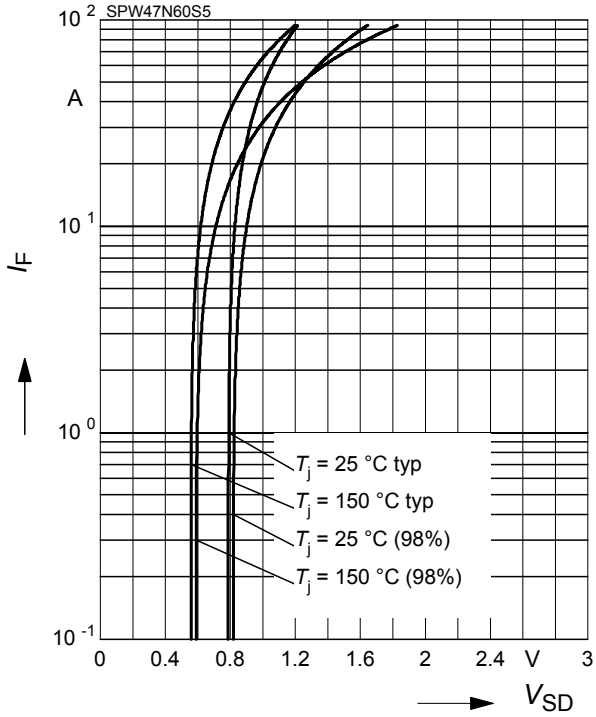
parameter: I_D = 47 A pulsed



9 Forward characteristics of body diode

$I_F = f(V_{SD})$

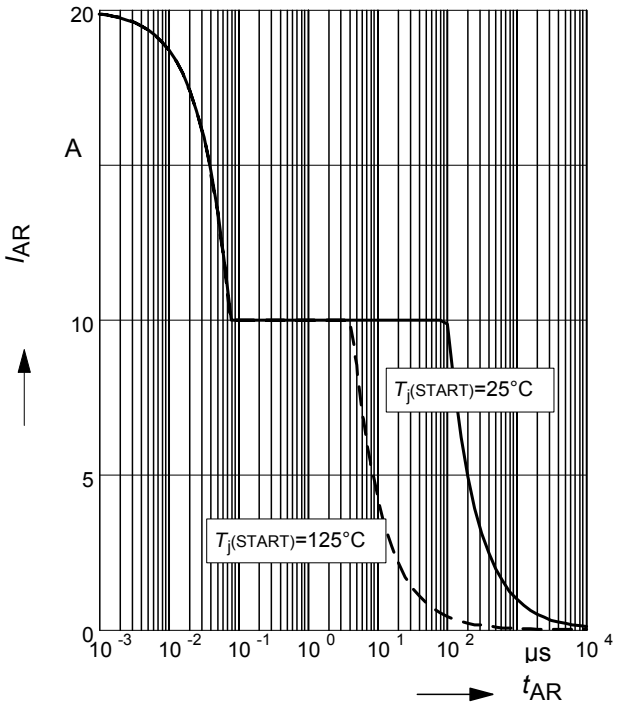
parameter: T_j , tp = 10 µs



10 Avalanche SOA

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

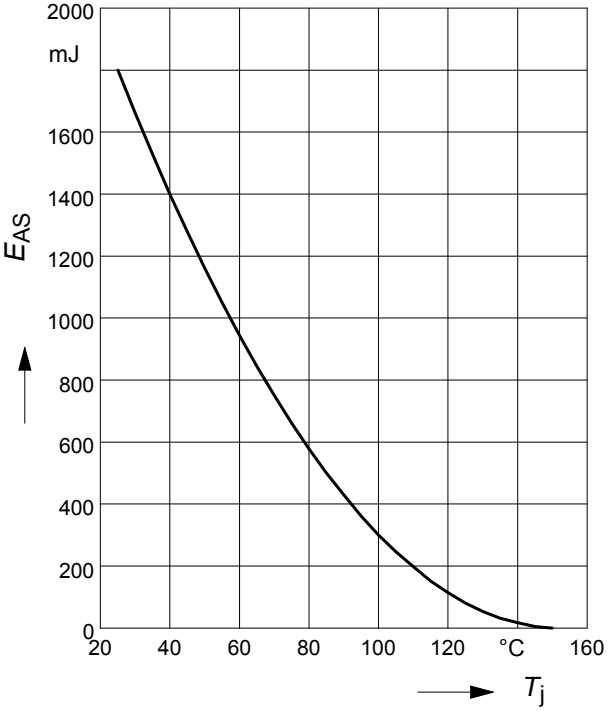
par.: $T_j \leq 150$ °C



11 Avalanche energy

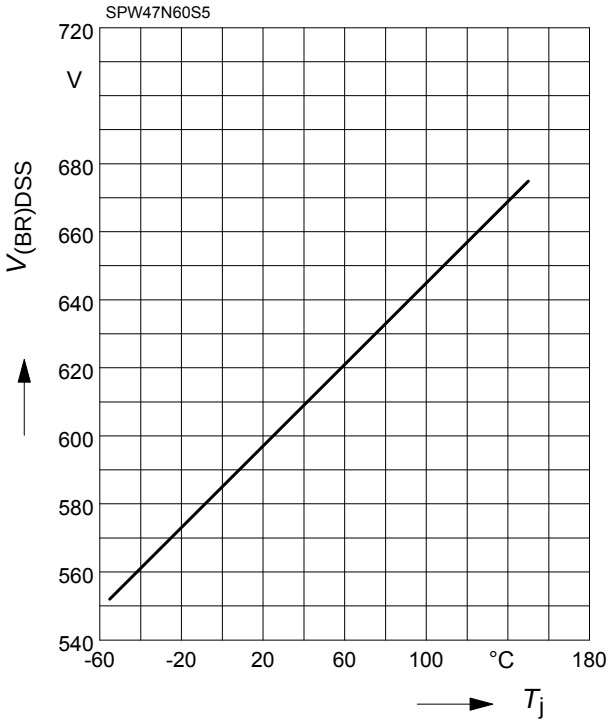
$E_{AS} = f(T_j)$

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



12 Drain-source breakdown voltage

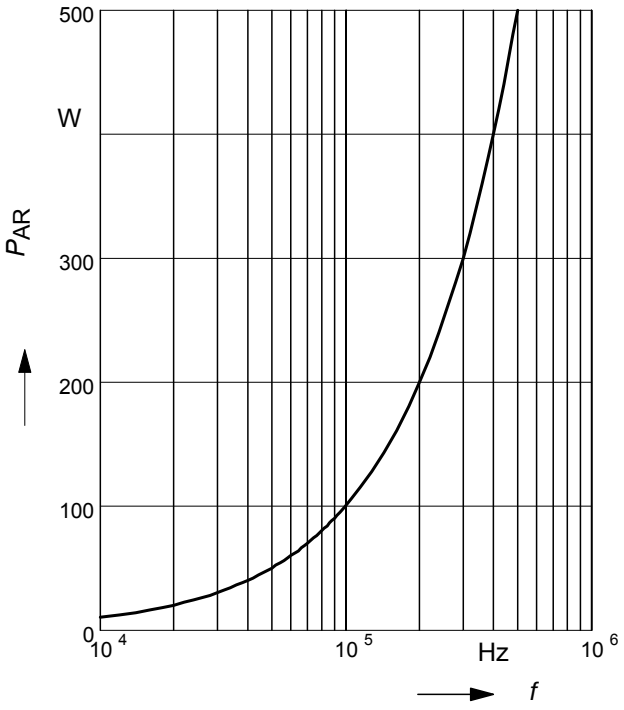
$V_{(BR)DSS} = f(T_j)$



13 Avalanche power losses

$P_{AR} = f(f)$

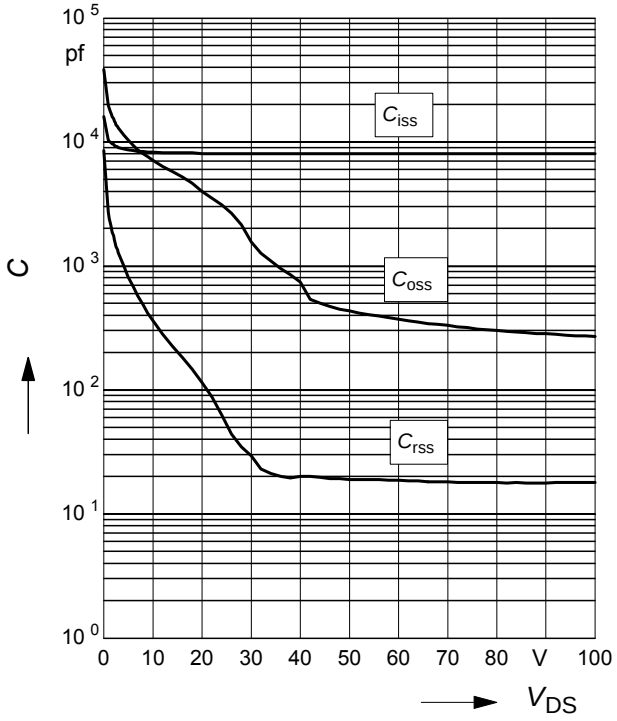
parameter: E_{AR}=1mJ



14 Typ. capacitances

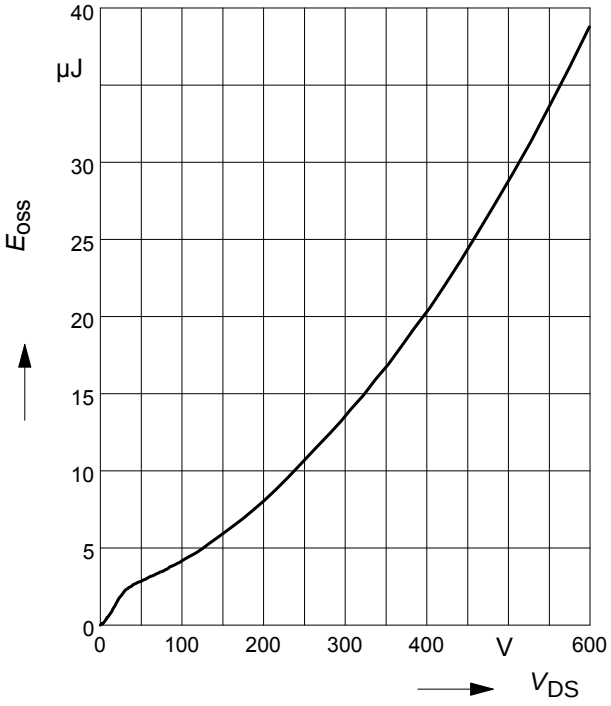
$C = f(V_{DS})$

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

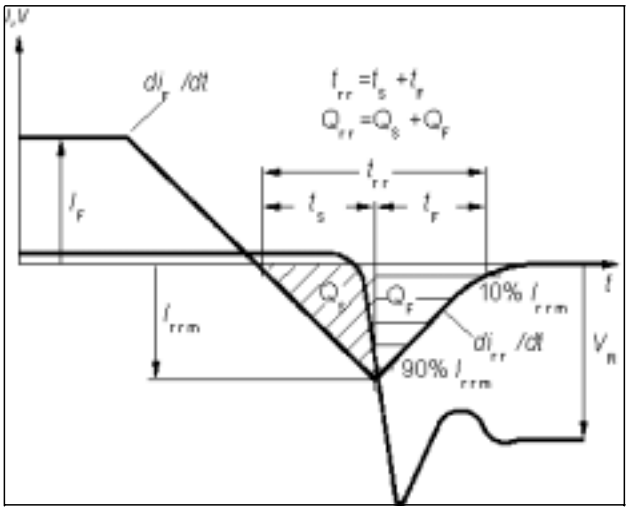


15 Typ. C_{oss} stored energy

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



Definition of diodes switching characteristics



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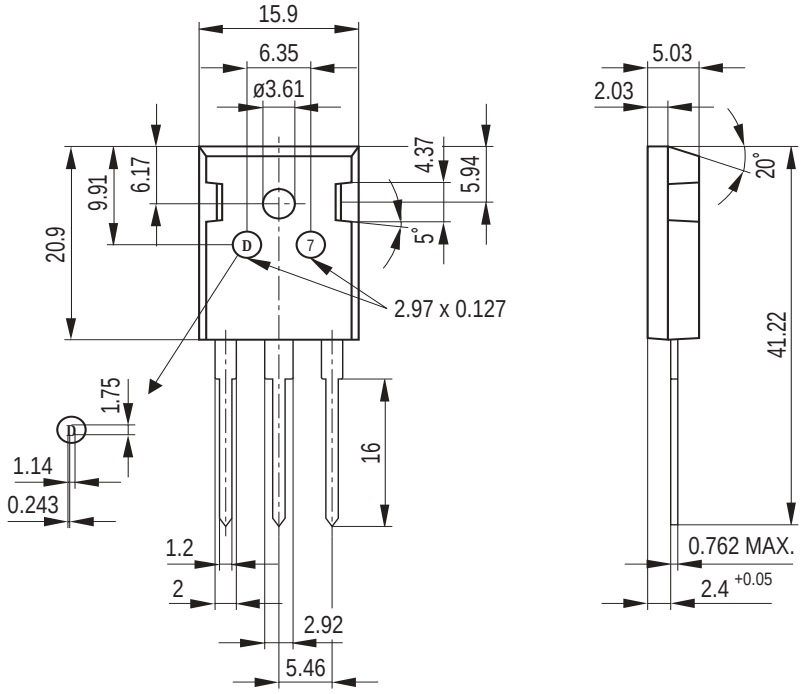

General tolerance unless otherwise specified: Leadframe parts: ±0.05
Package parts: ±0.12

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