

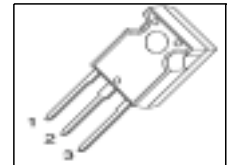
Cool MOS™ Power Transistor

Feature

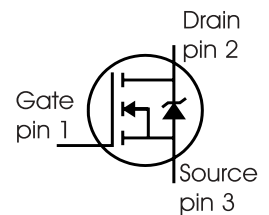
- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- Ultra low effective capacitances
- Improved transconductance

$V_{DS} @ T_{jmax}$	560	V
$R_{DS(on)}$	0.28	Ω
I_D	16	A

P-TO247



Type	Package	Ordering Code	Marking
SPW16N50C3	P-TO247	Q67040-S4584	16N50C3



Maximum Ratings

Parameter	Symbol	Value	Unit
Continuous drain current $T_C = 25\text{ }^\circ\text{C}$ $T_C = 100\text{ }^\circ\text{C}$	I_D	16 10	A
Pulsed drain current, t_p limited by T_{jmax}	$I_{D\text{ puls}}$	48	
Avalanche energy, single pulse $I_D = 8\text{ A}$, $V_{DD} = 50\text{ V}$	E_{AS}	460	mJ
Avalanche energy, repetitive t_{AR} limited by T_{jmax} ¹ $I_D = 16\text{ A}$, $V_{DD} = 50\text{ V}$	E_{AR}	0.64	
Avalanche current, repetitive t_{AR} limited by T_{jmax}	I_{AR}	16	A
Reverse diode dv/dt $I_S = 16\text{ A}$, $V_{DS} = 480\text{ V}$, $T_j = 125\text{ }^\circ\text{C}$	dv/dt	6	V/ns
Gate source voltage	V_{GS}	± 20	V
Gate source voltage AC ($f > 1\text{ Hz}$)	V_{GS}	± 30	
Power dissipation, $T_C = 25\text{ }^\circ\text{C}$	P_{tot}	160	W
Operating and storage temperature	T_j, T_{stg}	-55... +150	$^\circ\text{C}$

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain Source voltage slope $V_{DS} = 400\text{ V}, I_D = 16\text{ A}, T_j = 125\text{ }^\circ\text{C}$	dv/dt	50	V/ns

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Thermal resistance, junction - case	R_{thJC}	-	-	0.78	K/W
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	-	62	
Soldering temperature, 1.6 mm (0.063 in.) from case for 10s	T_{sold}	-	-	260	$^\circ\text{C}$

Electrical Characteristics, at $T_j=25^\circ\text{C}$ 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	$V_{(BR)DS}$	$V_{GS}=0V, I_D=16A$	-	600	-	
Gate threshold voltage	$V_{GS(th)}$	$I_D=675\mu A, V_{GS}=V_{DS}$	2.1	3	3.9	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=500V, V_{GS}=0V,$ $T_j=25^\circ\text{C},$ $T_j=150^\circ\text{C}$	- -	0.1 -	1 100	μA
Gate-source leakage current	I_{GSS}	$V_{GS}=20V, V_{DS}=0V$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=10A,$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$	- -	0.25 0.68	0.28 -	Ω
Gate input resistance	R_G	$f=1MHz, \text{open Drain}$	-	1.5	-	

Electrical Characteristics , at $T_j = 25\text{ }^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Transconductance	g_{fs}	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 10\text{A}$	-	14	-	S
Input capacitance	C_{iss}	$V_{GS} = 0\text{V}$, $V_{DS} = 25\text{V}$, $f = 1\text{MHz}$	-	1600	-	pF
Output capacitance	C_{oss}		-	800	-	
Reverse transfer capacitance	C_{rss}		-	30	-	
Effective output capacitance, ²⁾ energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}$, $V_{DS} = 0\text{V to } 400\text{V}$	-	64	-	pF
Effective output capacitance, ³⁾ time related	$C_{o(tr)}$		-	124	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 380\text{V}$, $V_{GS} = 0/10\text{V}$, $I_D = 16\text{A}$, $R_G = 4.3\Omega$	-	10	-	ns
Rise time	t_r		-	8	-	
Turn-off delay time	$t_{d(off)}$		-	50	-	
Fall time	t_f		-	8	-	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	$V_{DD} = 380\text{V}$, $I_D = 16\text{A}$	-	7	-	nC
Gate to drain charge	Q_{gd}		-	36	-	
Gate charge total	Q_g	$V_{DD} = 380\text{V}$, $I_D = 16\text{A}$, $V_{GS} = 0\text{ to } 10\text{V}$	-	66	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 380\text{V}$, $I_D = 16\text{A}$	-	5	-	V

¹ Repetitive avalanche causes additional power losses that can be calculated as $P_{AV} = E_{AR} \cdot f$.

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

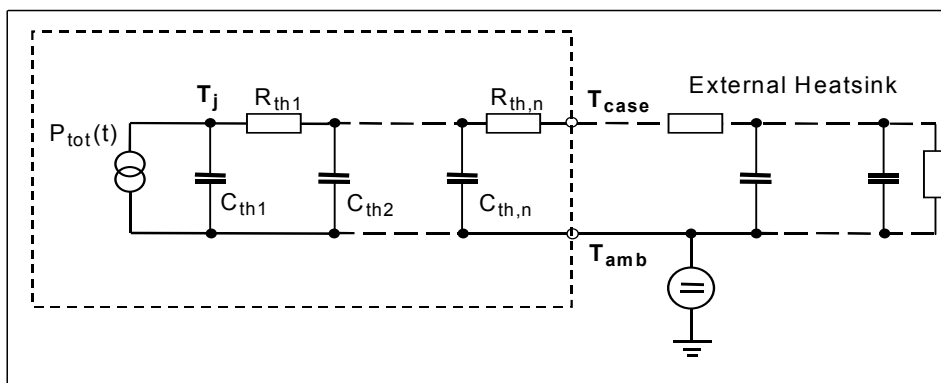
³ $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

Electrical Characteristics, at $T_j = 25\text{ }^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Inverse diode continuous forward current	I_S	$T_C=25^\circ\text{C}$	-	-	16	A
Inverse diode direct current, pulsed	I_{SM}		-	-	48	
Inverse diode forward voltage	V_{SD}	$V_{GS}=0\text{V}, I_F=I_S$	-	1	1.2	V
Reverse recovery time	t_{rr}	$V_R=380\text{V}, I_F=I_S,$	-	420	-	ns
Reverse recovery charge	Q_{rr}	$di_F/dt=100\text{A}/\mu\text{s}$	-	7	-	μC
Peak reverse recovery current	I_{rrm}		-	40	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt		-	tbd	-	$\text{A}/\mu\text{s}$

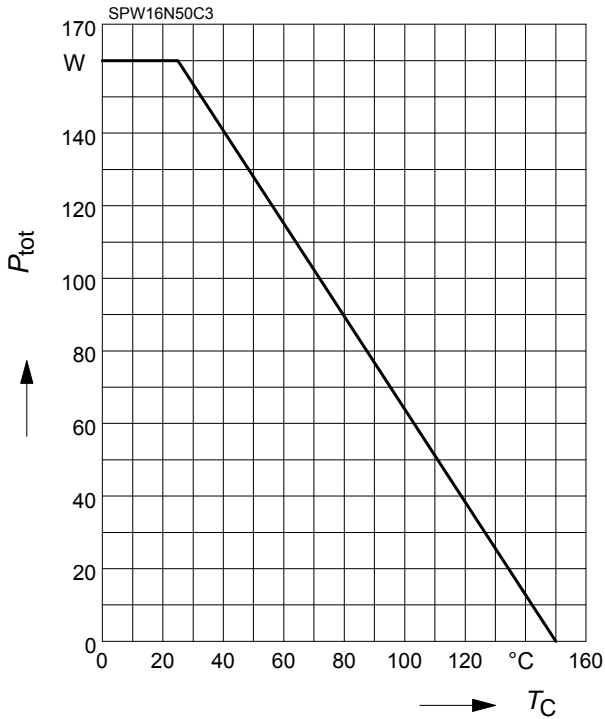
Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
	typ.			typ.	
Thermal resistance			Thermal capacitance		
R_{th1}	0.012	K/W	C_{th1}	0.0002495	Ws/K
R_{th2}	0.023		C_{th2}	0.0009406	
R_{th3}	0.043		C_{th3}	0.001298	
R_{th4}	0.149		C_{th4}	0.00362	
R_{th5}	0.17		C_{th5}	0.009484	
R_{th6}	0.069		C_{th6}	0.077	



1 Power dissipation

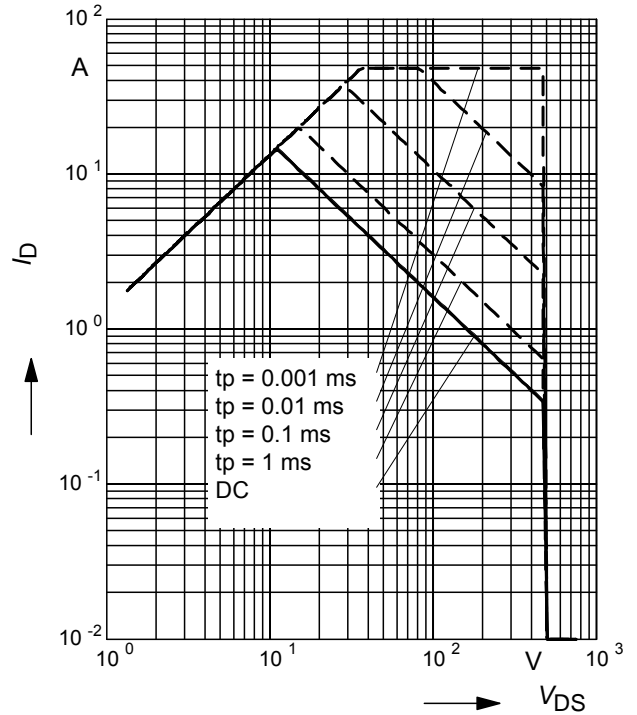
$P_{tot} = f(T_C)$



2 Safe operating area

$I_D = f(V_{DS})$

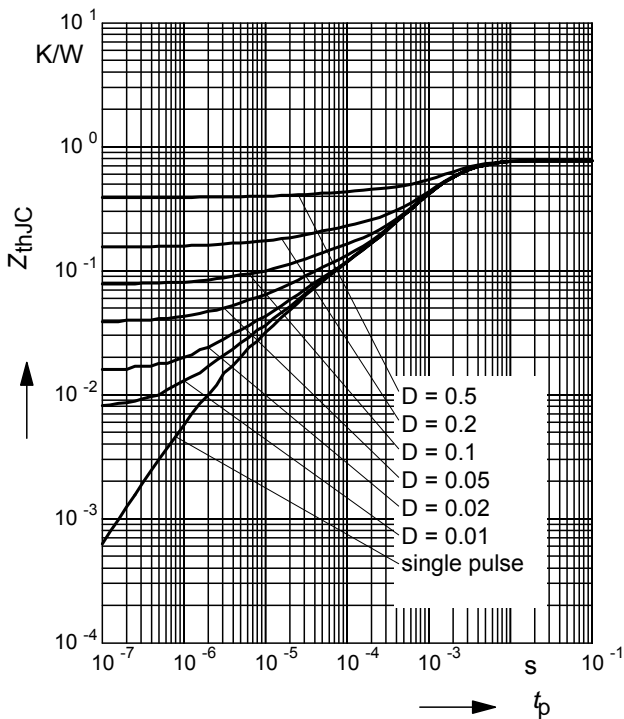
parameter : $D = 0$, $T_C = 25^\circ\text{C}$



3 Transient thermal impedance

$Z_{thJC} = f(t_p)$

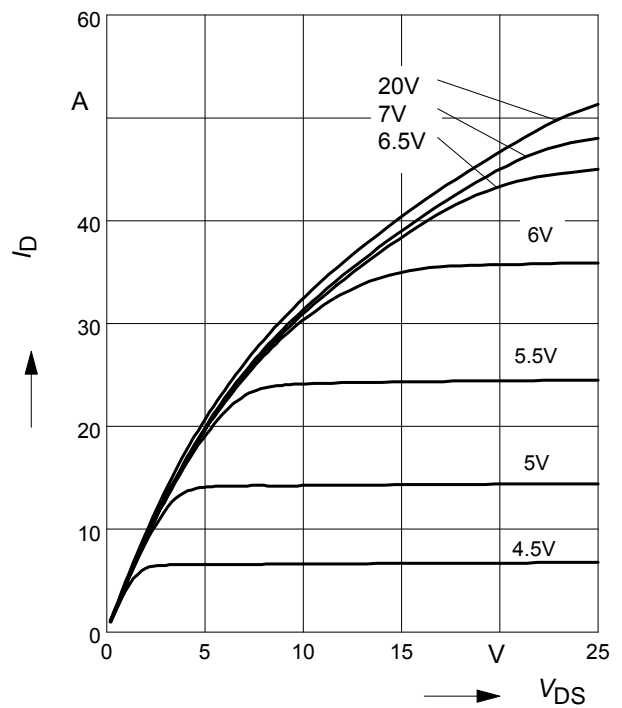
parameter: $D = t_p/T$



4 Typ. output characteristic

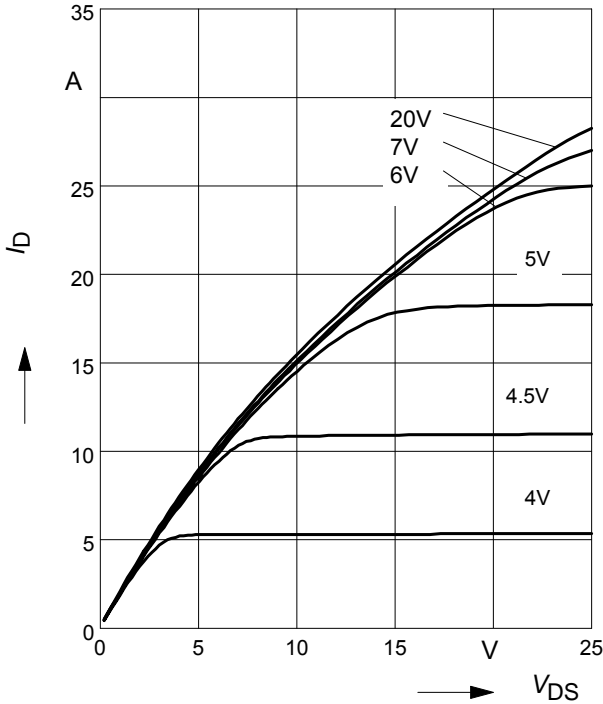
$I_D = f(V_{DS})$; $T_j = 25^\circ\text{C}$

parameter: $t_p = 10 \mu\text{s}$, V_{GS}



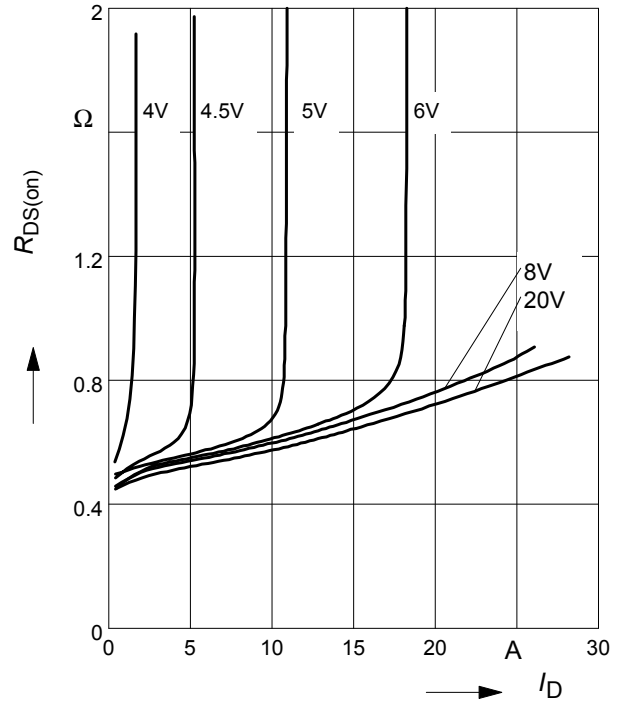
5 Typ. output characteristic

$I_D = f(V_{DS}); T_j = 150^\circ\text{C}$
 parameter: $t_p = 10 \mu\text{s}, V_{GS}$



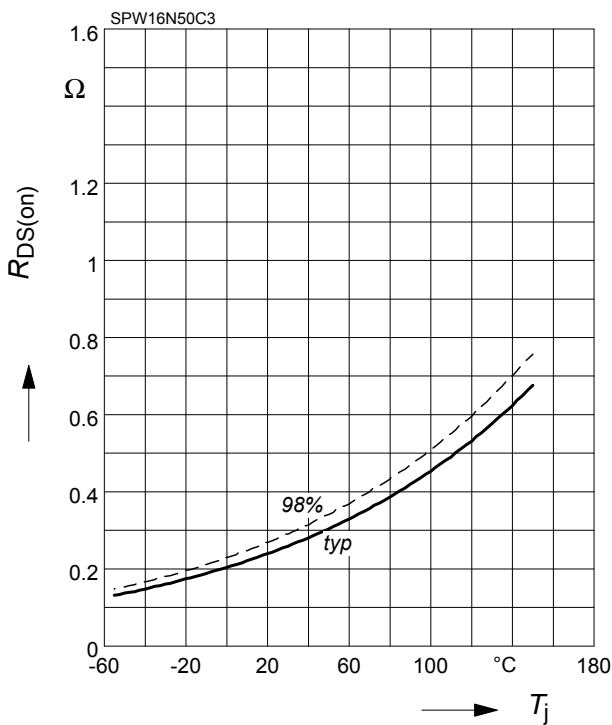
6 Typ. drain-source on resistance

$R_{DS(on)} = f(I_D)$
 parameter: $T_j = 150^\circ\text{C}, V_{GS}$



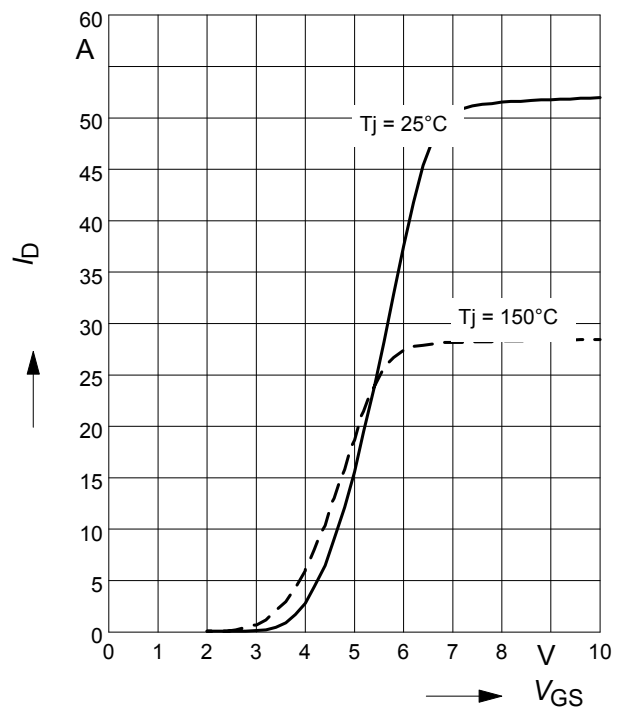
7 Drain-source on-state resistance

$R_{DS(on)} = f(T_j)$
 parameter: $I_D = 10 \text{ A}, V_{GS} = 10 \text{ V}$



8 Typ. transfer characteristics

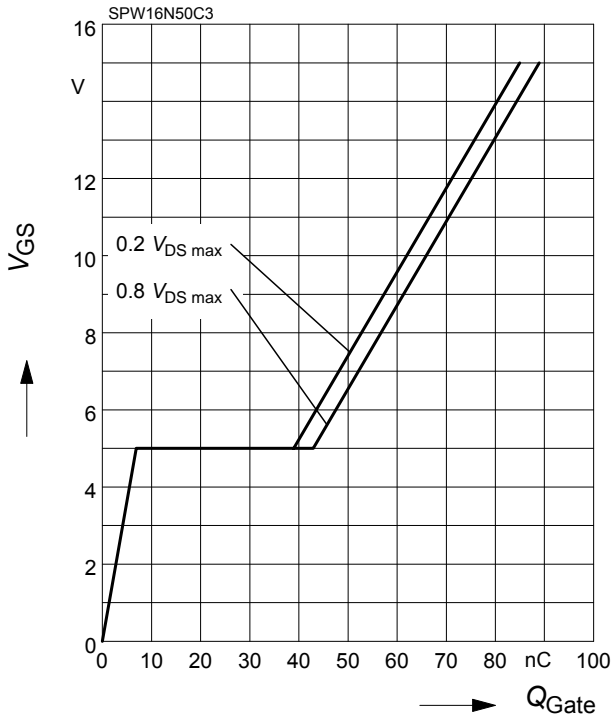
$I_D = f(V_{GS}); V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$
 parameter: $t_p = 10 \mu\text{s}$



9 Typ. gate charge

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

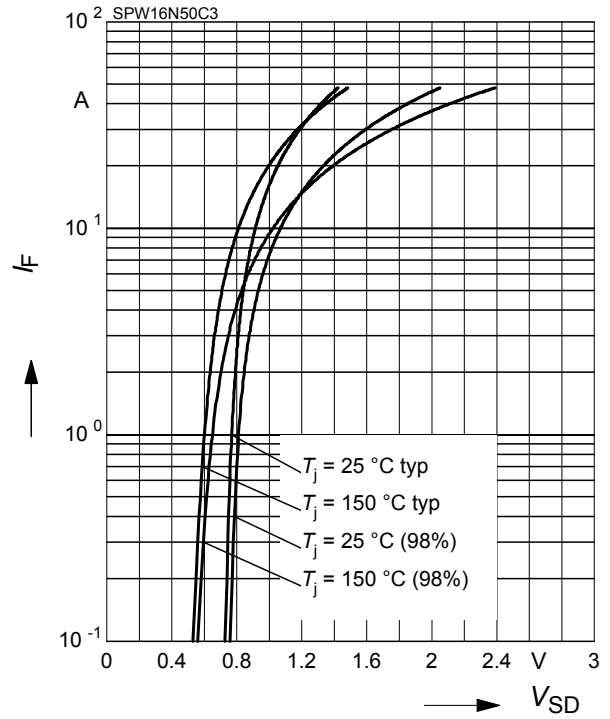
parameter: $I_D = 16$ A pulsed



10 Forward characteristics of body diode

$$I_F = f(V_{SD})$$

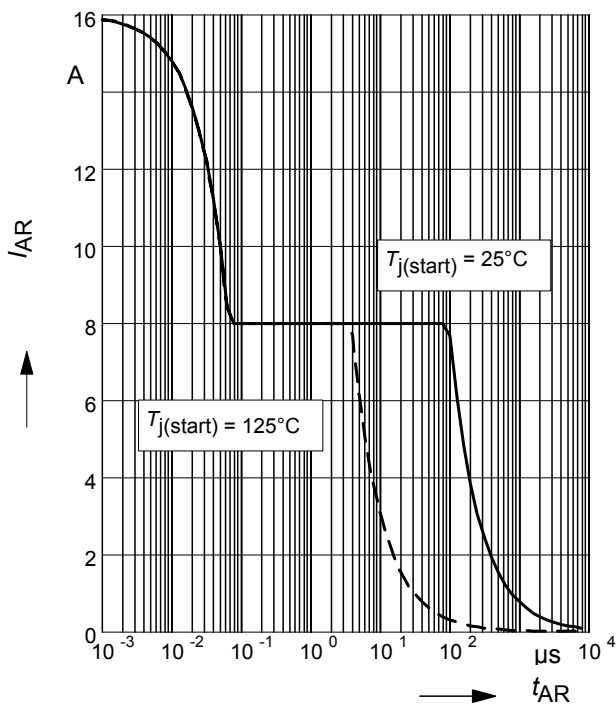
parameter: $T_j, t_p = 10 \mu s$



11 Avalanche SOA

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

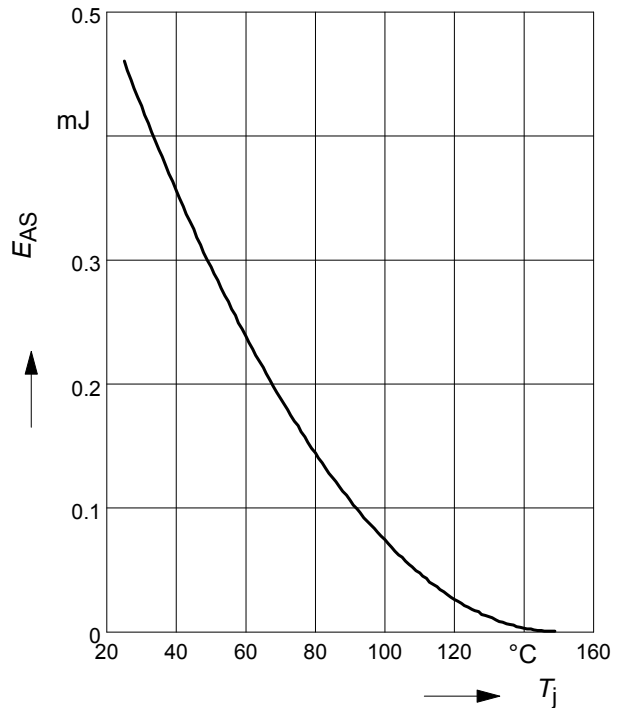
par.: $T_j \leq 150 \text{ °C}$



12 Avalanche energy

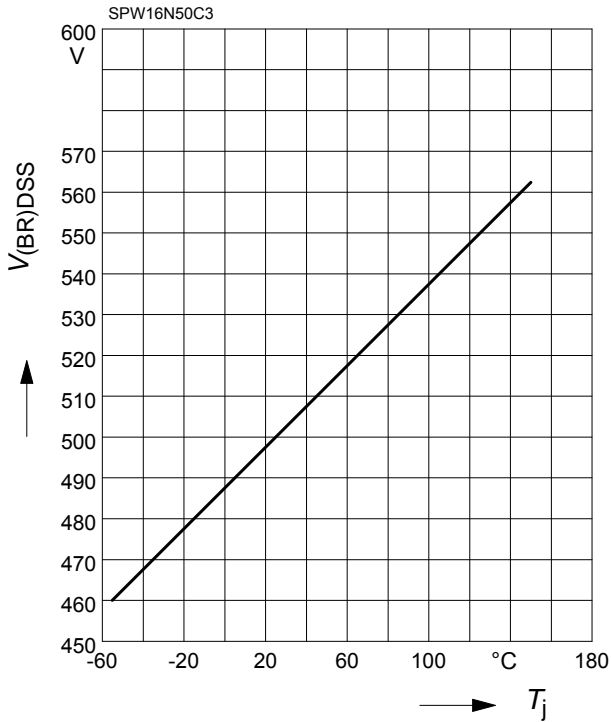
$$E_{AS} = f(T_j)$$

par.: $I_D = 8, V_{DD} = 50$ V



13 Drain-source breakdown voltage

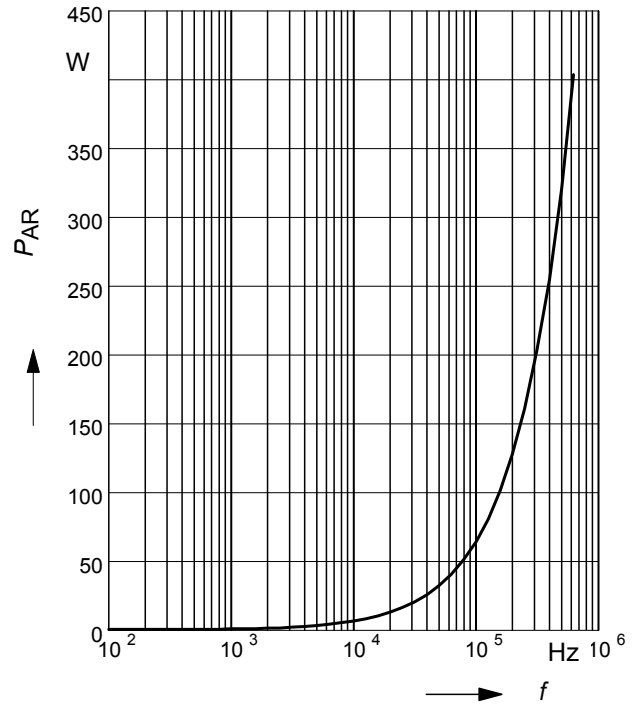
$$V_{(BR)DSS} = f(T_j)$$



14 Avalanche power losses

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

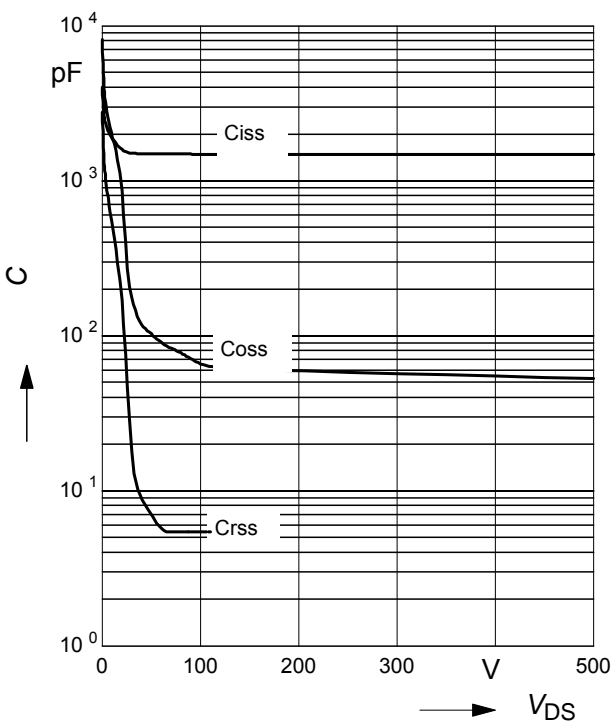
parameter: $E_{AR}=0.64mJ$



15 Typ. capacitances

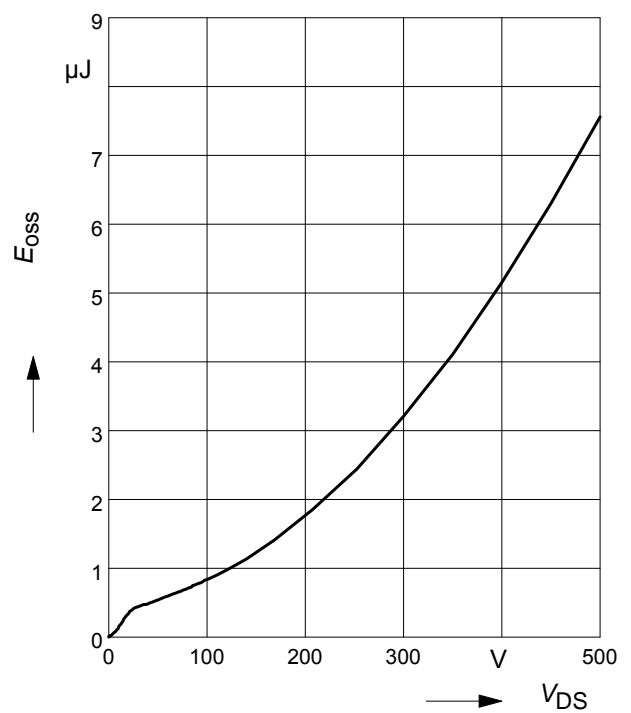
$$C = f(V_{DS})$$

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

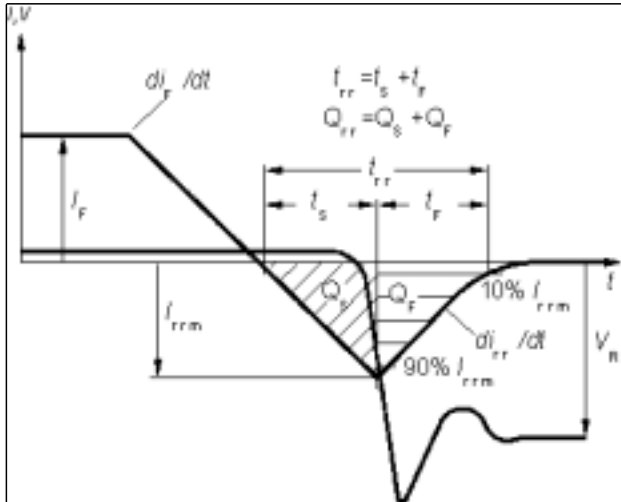


16 Typ. C_{OSS} stored energy

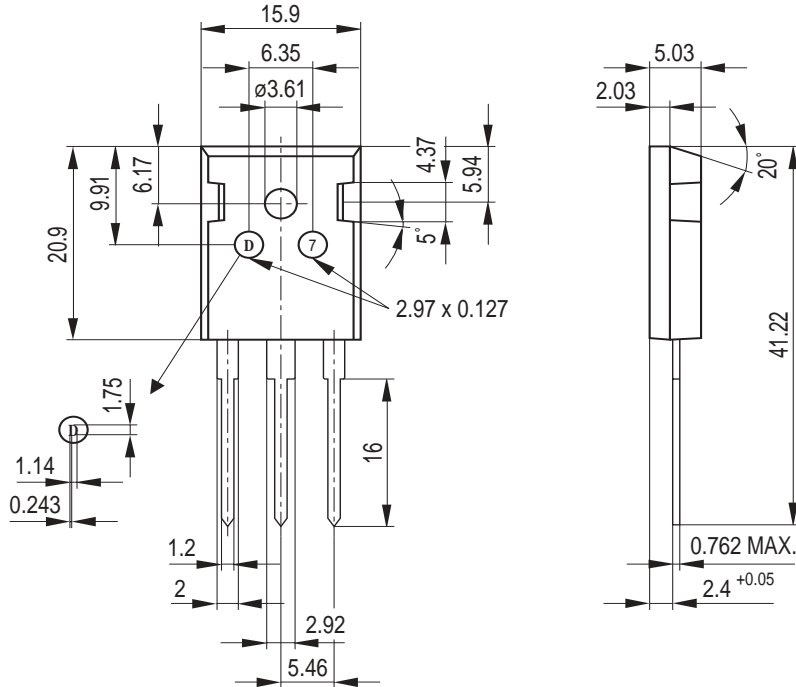
$$E_{OSS} = f(V_{DS})$$



Definition of diodes switching characteristics



P-TO-247-3-1



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

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