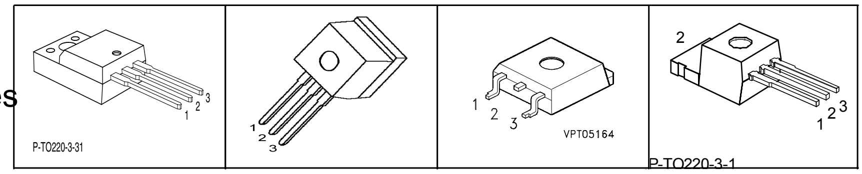
Cool MOS™ Power Transistor

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

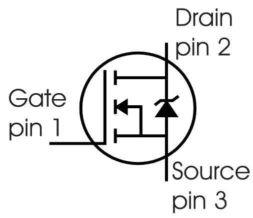
Feature

- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- Ultra low effective capacitances
- Improved transconductance
- P-TO-220-3-31: Fully isolated package (2500 VAC; 1 minute)

P-TO220-3-31 P-TO262 P-TO263-3-2 P-TO220-3-1



Type	Package	Ordering Code	Marking
SPP16N50C3	P-TO220-3-1	Q67040-S4583	16N50C3
SPB16N50C3	P-TO263-3-2	Q67040-S4642	16N50C3
SPI16N50C3	P-TO262	Q67040-S4582	16N50C3
SPA16N50C3	P-TO220-3-31	Q67040-S4581	16N50C3



Maximum Ratings

Parameter	Symbol	Value		Unit
		SPP_B_I	SPA	
Continuous drain current	I_D			A
T_C = 25 °C		16	16[1)]	
T_C = 100 °C		10	10[1)]	
Pulsed drain current, t_p limited by T_{jmax}	$I_{D\ puls}$	48	48	A
Avalanche energy, single pulse I_D=8, V_{DD}=50V	E_{AS}	460	460	mJ
Avalanche energy, repetitive t_{AR} limited by T_{jmax}[2)] I_D=16A, V_{DD}=50V	E_{AR}	0.64	0.64	
Avalanche current, repetitive t_{AR} limited by T_{jmax}	I_{AR}	16	16	A
Gate source voltage	V_{GS}	±20	±20	V
Gate source voltage AC (f >1Hz)	V_{GS}	±30	±30	
Power dissipation, T_C = 25°C	P_{tot}	160	34	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 = 16 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}	-	-	0.78	K/W
Thermal resistance, junction - case, FullPAK	R_{thJC_FP}	-	-	3.7	
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	-	62	
Thermal resistance, junction - ambient, FullPAK	R_{thJA_FP}	-	-	80	
Soldering temperature, 1.6 mm (0.063 in.) from case for 10s[3)]	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	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=675µA, 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=10A T_j=25°C T_j=150°C	 - -	 0.25 0.68	 0.28 -	Ω
Gate input resistance	R_G	f=1MHz, open drain	-	1.5	-	

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=10A	-	14	-	S
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	1600	-	pF
Output capacitance	C_{oss}		-	800	-	
Reverse transfer capacitance	C_{rss}		-	30	-	
Effective output capacitance,[4) energy related	$C_{o(er)}$	V_{GS}=0V, V_{DS}=0V to 400V	-	64	-	
Effective output capacitance,[5) time related	$C_{o(tr)}$		-	124	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=380V, V_{GS}=0/10V, I_D=16A, R_G=4.3Ω	-	10	-	ns
Rise time	t_r		-	8	-	
Turn-off delay time	$t_{d(off)}$		-	50	-	
Fall time	t_f		-	8	-	

Gate Charge Characteristics

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Gate to source charge	Q_{gs}	V_{DD}=380V, I_D=16A	-	7	-	nC
Gate to drain charge	Q_{gd}		-	36	-	
Gate charge total	Q_g	V_{DD}=380V, I_D=16A, V_{GS}=0 to 10V	-	66	-	
Gate plateau voltage	$V_{(plateau)}$	V_{DD}=380V, I_D=16A	-	5	-	V

[1]Limited only by maximum temperature

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

[3]Soldering temperature for TO-263: 220°C, reflow

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

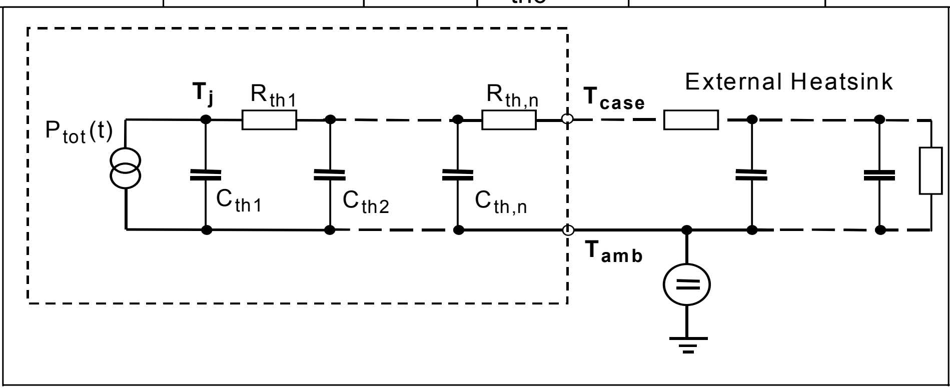
[5]$C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

Electrical Characteristics

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Inverse diode continuous forward current	I_S	T_C=25°C	-	-	16	A
Inverse diode direct current, pulsed	I_{SM}		-	-	48	
Inverse diode forward voltage	V_{SD}	V_{GS}=0V, I_F=I_S	-	1	1.2	V
Reverse recovery time	t_{rr}	V_R=380V, I_F=I_S , di_F/dt=100A/μs	-	420	-	ns
Reverse recovery charge	Q_{rr}		-	7	-	μC
Peak reverse recovery current	I_{rrm}		-	40	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt	T_j=25°C	-	1100	-	A/μs

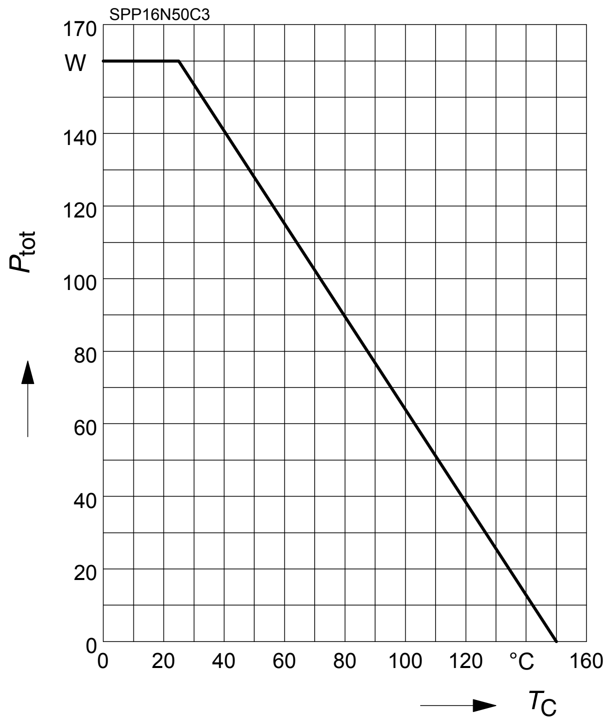
Typical Transient Thermal Characteristics

Symbol	Value		Unit	Symbol	Value		Unit
	SPP_B_I	SPA			SPP_B_I	SPA	
R_{th1}	0.012	0.012	K/W	C_{th1}	0.0002495	0.0002495	Ws/K
R_{th2}	0.023	0.023		C_{th2}	0.0009406	0.0009406	
R_{th3}	0.043	0.043		C_{th3}	0.001298	0.001298	
R_{th4}	0.149	0.176		C_{th4}	0.00362	0.00362	
R_{th5}	0.17	0.371		C_{th5}	0.009484	0.008025	
R_{th6}	0.069	2.522		C_{th6}	0.077	0.412	



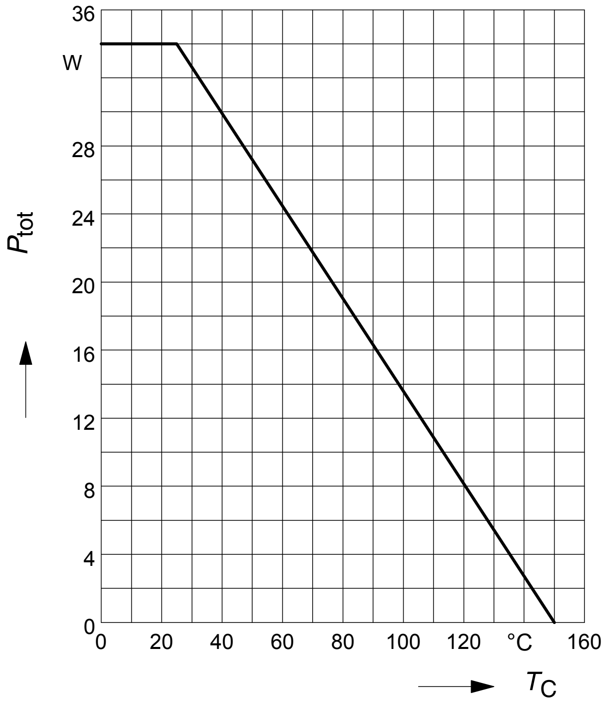
1 Power dissipation

$P_{tot} = f(T_C)$



2 Power dissipation FullPAK

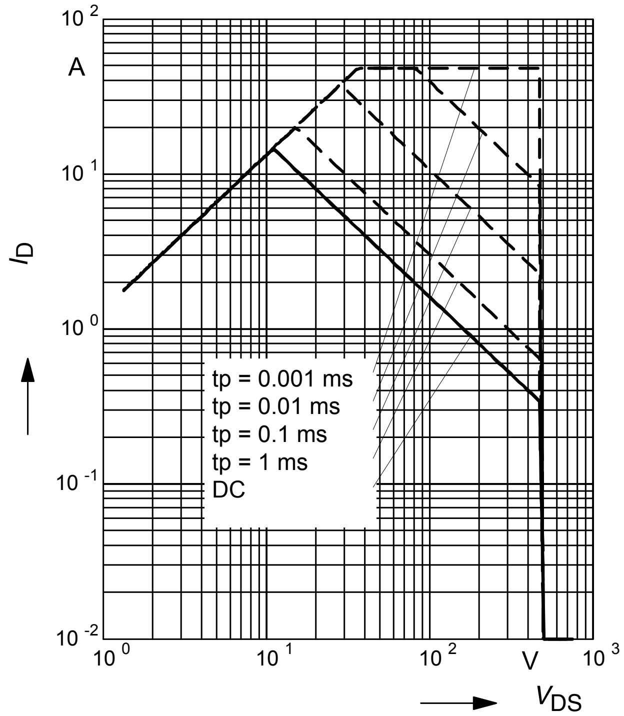
$P_{tot} = f(T_C)$



3 Safe operating area

$I_D = f(V_{DS})$

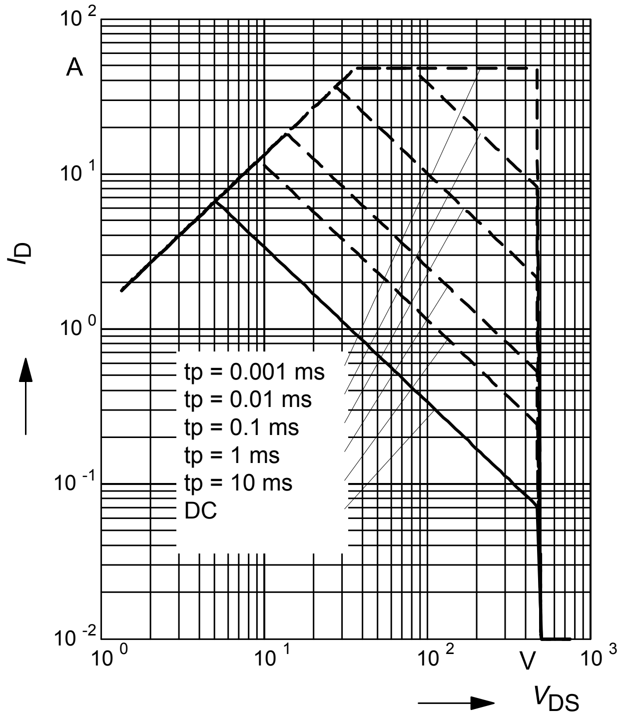
parameter : $D = 0$, T_C=25°C



4 Safe operating area FullPAK

$I_D = f(V_{DS})$

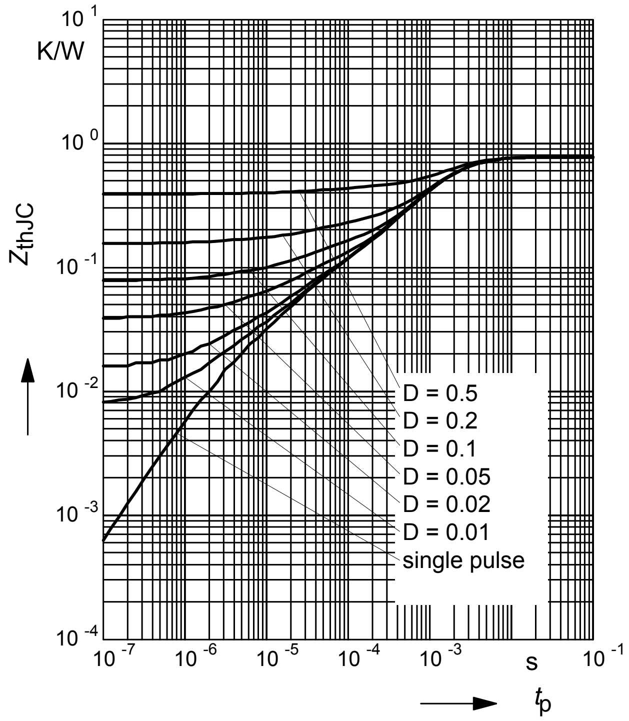
parameter: $D = 0$, T_C = 25°C



5 Transient thermal impedance

$Z_{thJC} = f(t_p)$

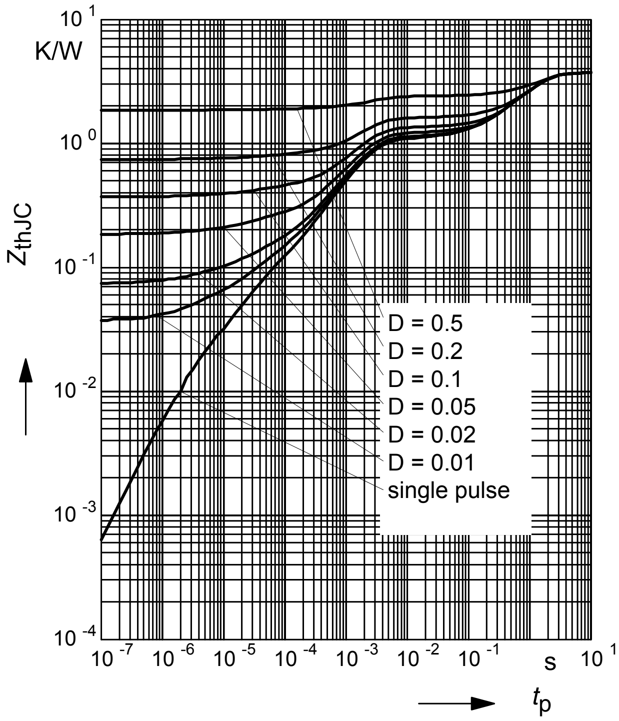
parameter: $D = t_p/T$



6 Transient thermal impedance FullPAK

$Z_{thJC} = f(t_p)$

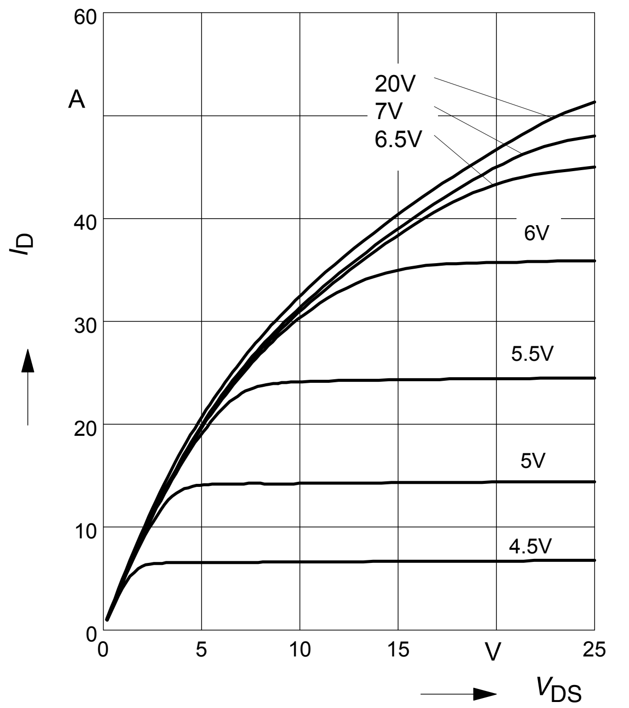
parameter: $D = t_p/t$



7 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=25°C

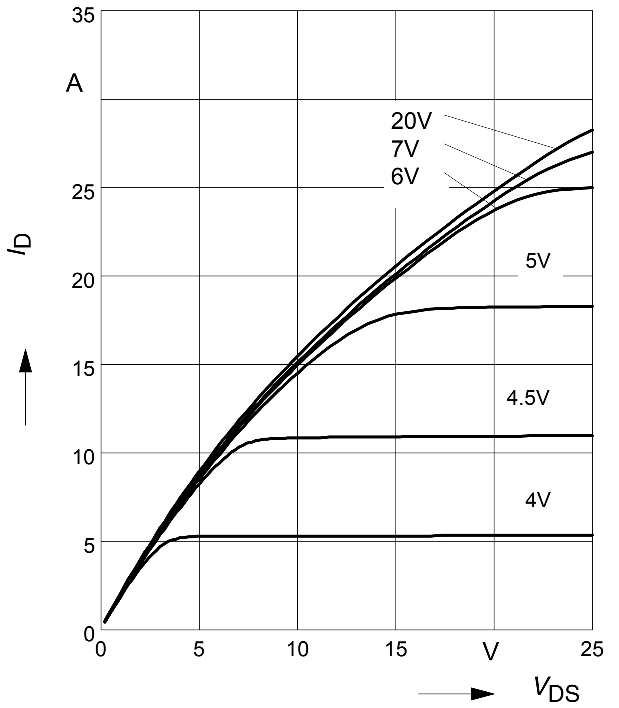
parameter: t_p = 10 µs, V_{GS}



8 Typ. output characteristic

$I_D = f(V_{DS})$; T_j=150°C

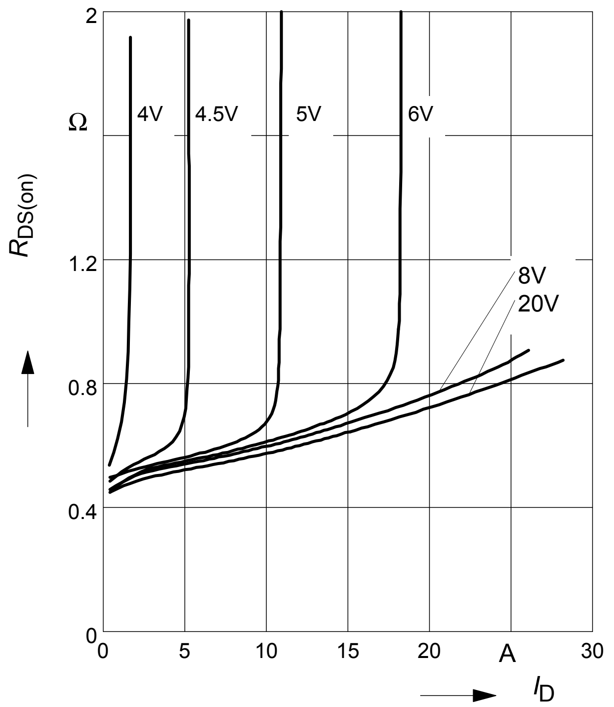
parameter: t_p = 10 µs, V_{GS}



9 Typ. drain-source on resistance

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

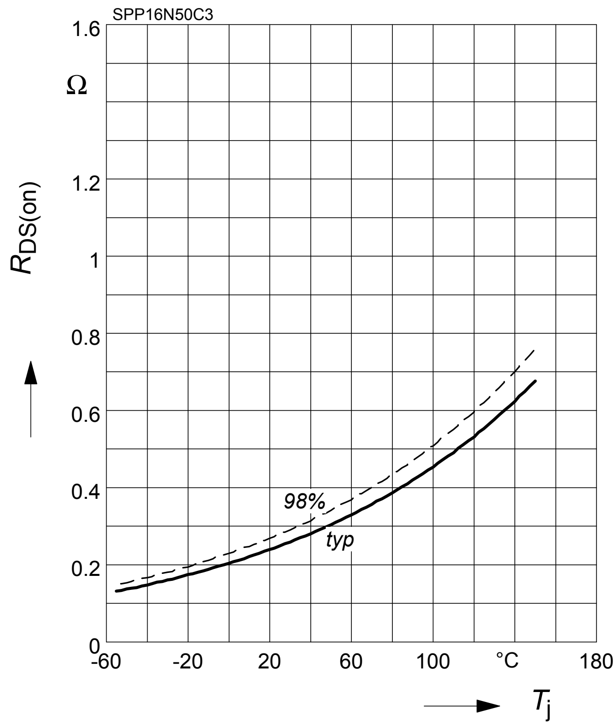
parameter: T_j=150°C, V_{GS}



10 Drain-source on-state resistance

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

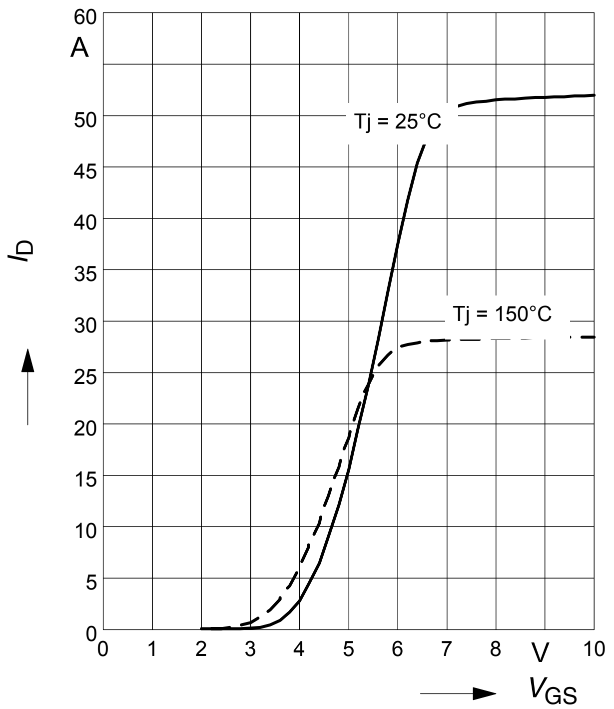
parameter : I_D = 10 A, V_{GS} = 10 V



11 Typ. transfer characteristics

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

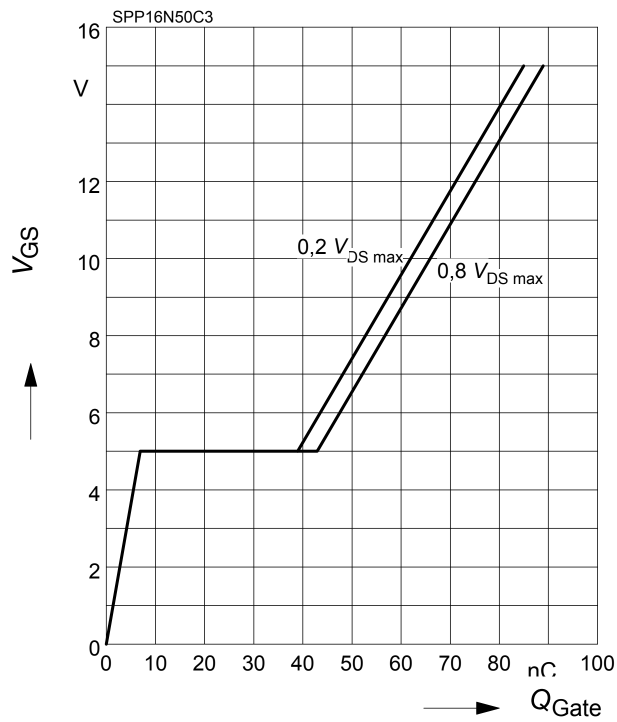
parameter: t_p = 10 µs



12 Typ. gate charge

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

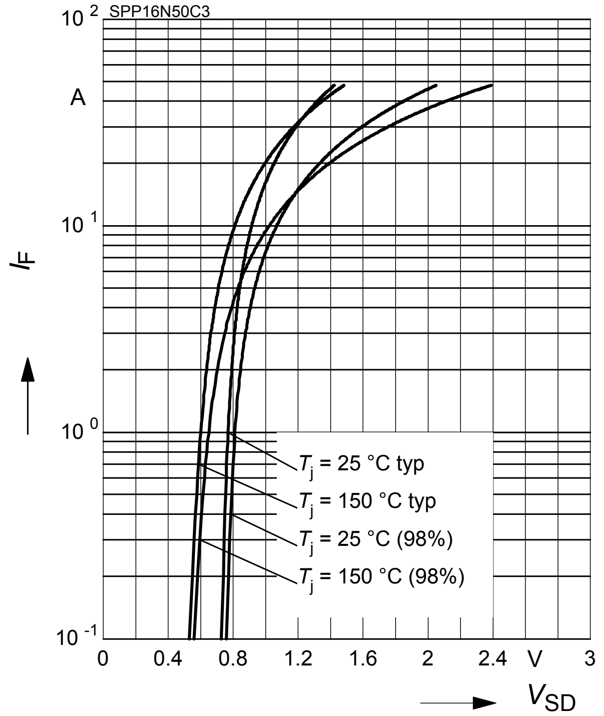
parameter: I_D = 16 A pulsed



13 Forward characteristics of body diode

$I_F = f(V_{SD})$

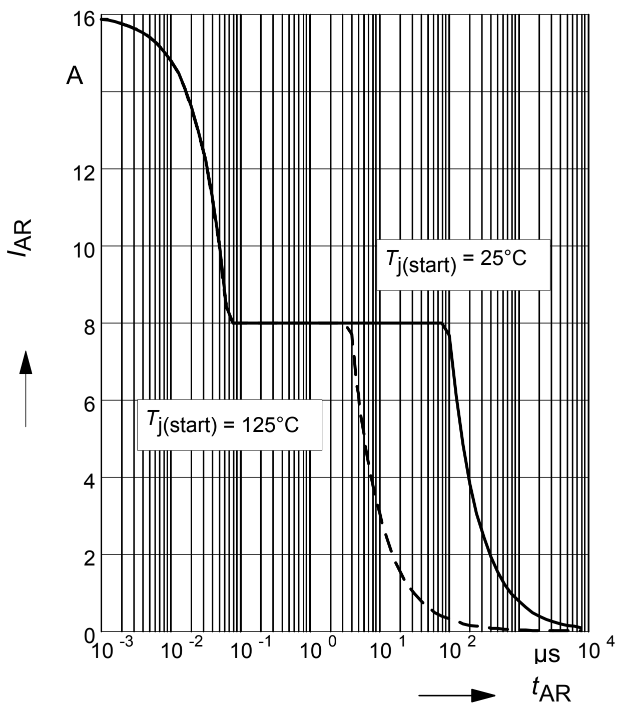
parameter: T_j , tp = 10 µs



14 Avalanche SOA

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

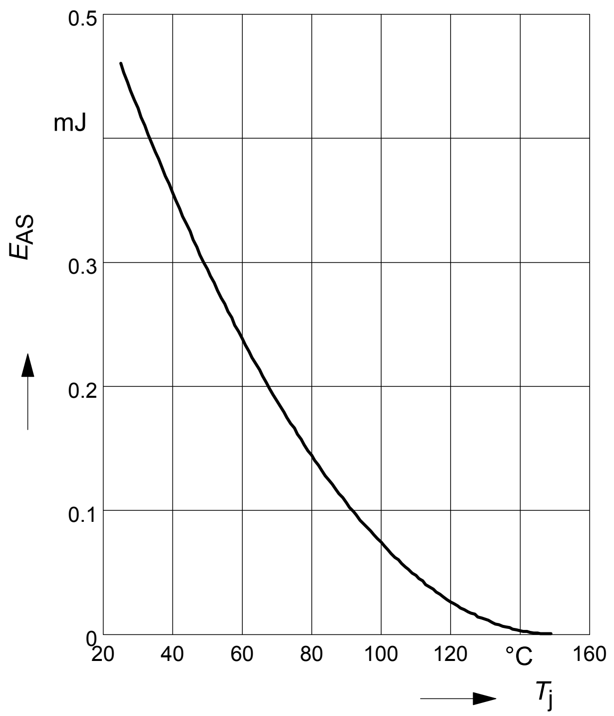
par.: $T_j \le 150$ °C



15 Avalanche energy

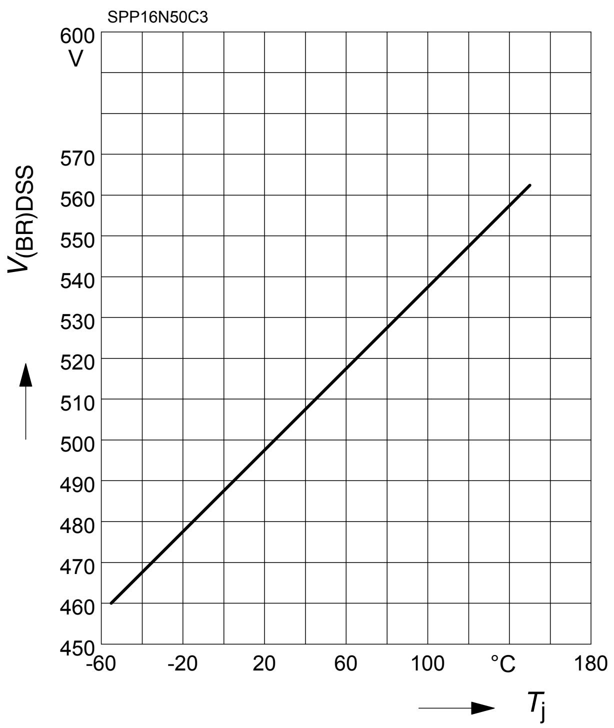
$E_{AS} = f(T_j)$

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



16 Drain-source breakdown voltage

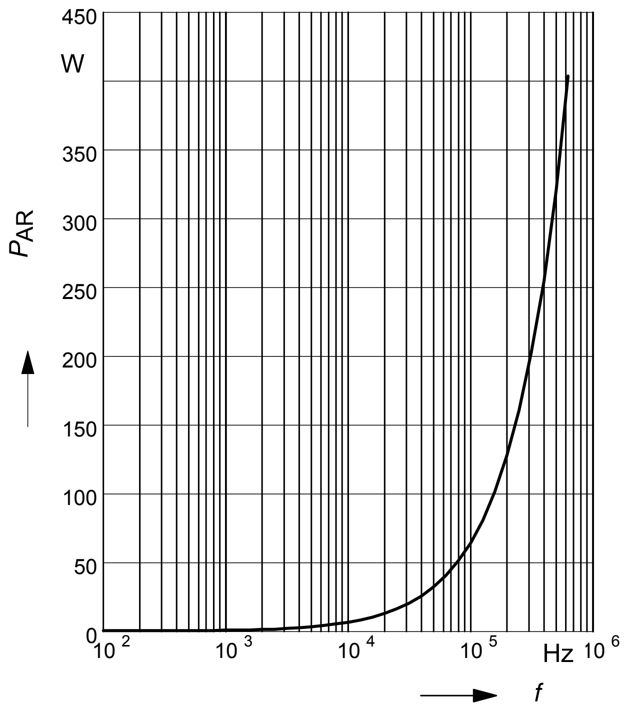
$V_{(BR)DSS} = f(T_j)$



17 Avalanche power losses

$P_{AR} = f(f)$

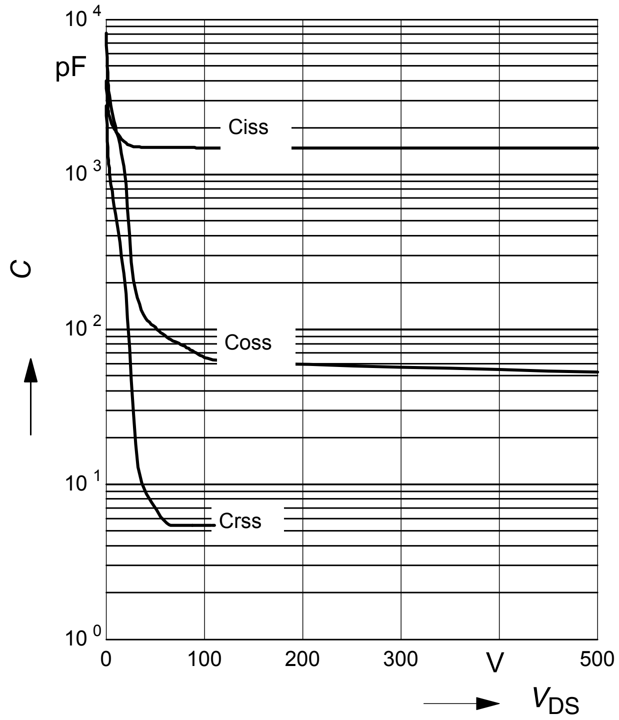
parameter: E_{AR}=0.64mJ



18 Typ. capacitances

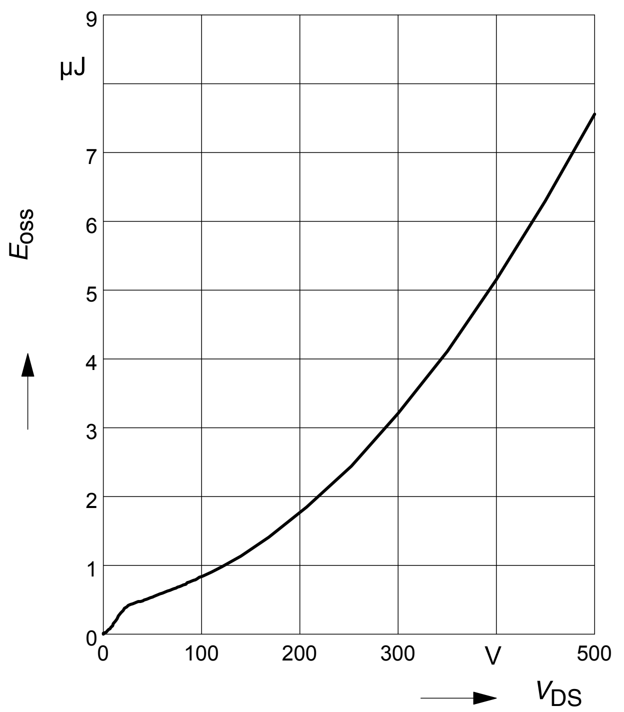
$C = f(V_{DS})$

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

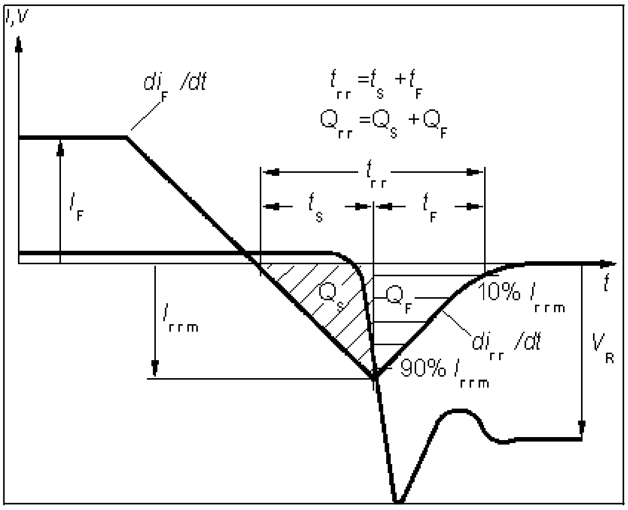


19 Typ. C_{oss} stored energy

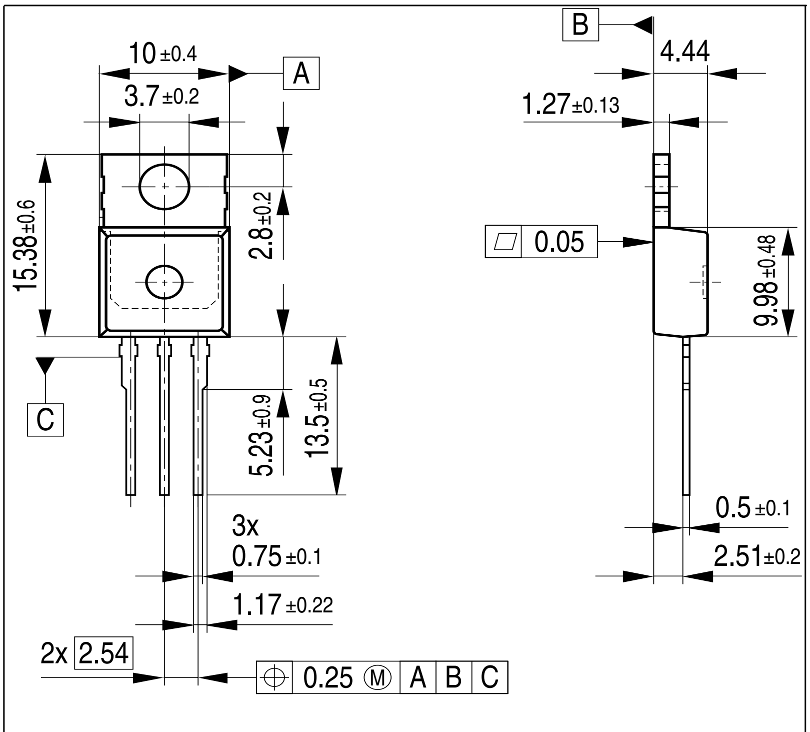
$E_{oss}=f(V_{DS})$



Definition of diodes switching characteristics

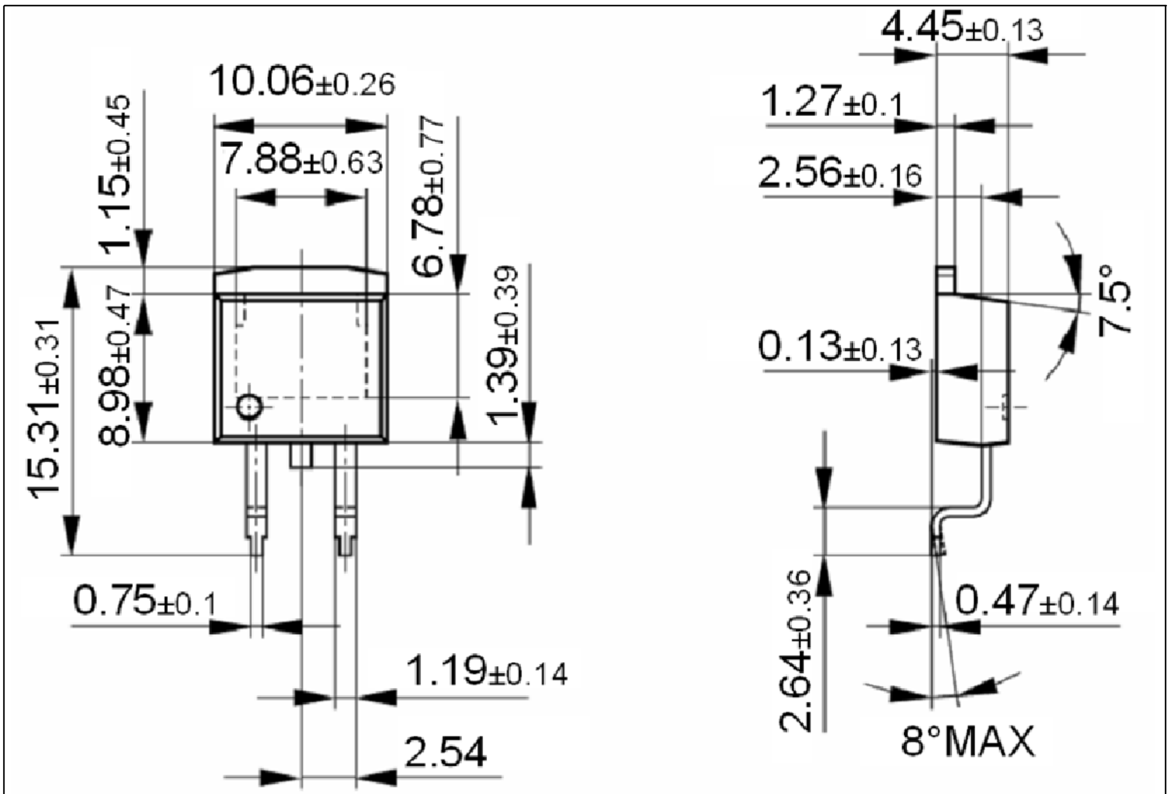


P-TO-220-3-1

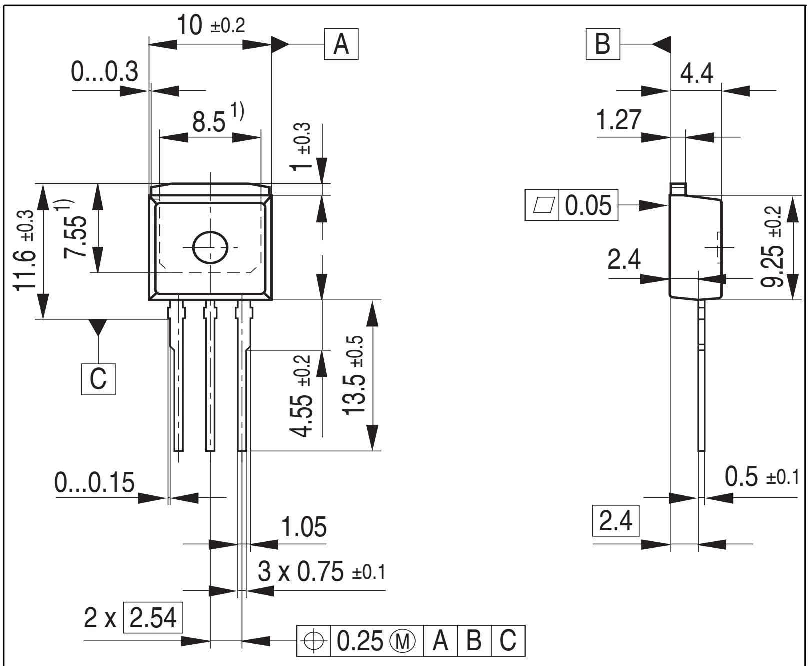


All metal surfaces tin plated, except area of cut.
Metal surface min. x=7.25, y=12.3

P-TO-263-3-2 (D2-PAK)

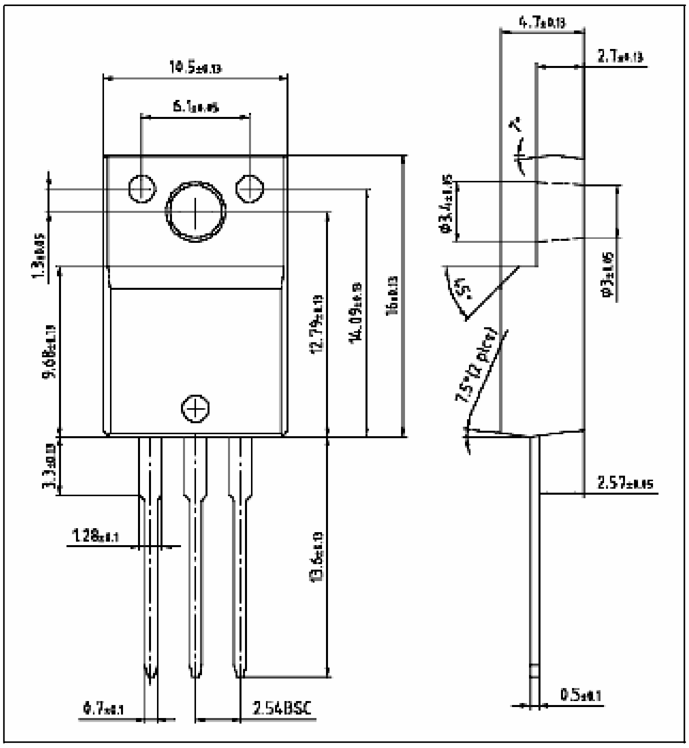


P-TO-262-3-1 (I2-PAK)



1) Typical
Metal surface min. X = 7.25, Y = 6.9
All metal surfaces tin plated, except area of cut.

P-TO-220-3-31 (FullPAK)



Please refer to mounting instructions (application note AN-TO220-3-31-01)

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