

Cool MOS™ Power Transistor

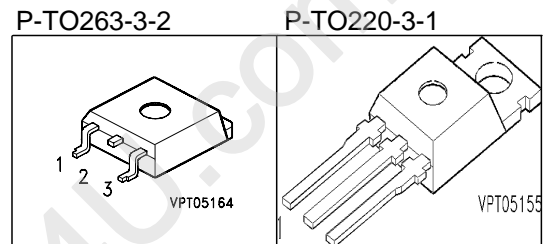


Feature

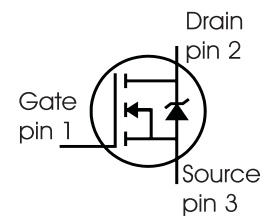
- New revolutionary high voltage technology
- Worldwide best $R_{DS(on)}$ in TO 220
- Ultra low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- Ultra low effective capacitances
- Improved noise immunity

Product Summary

V_{DS}	800	V
$R_{DS(on)}$	290	m Ω
I_D	17	A



Type	Package	Ordering Code	Marking
SPP17N80C2	P-TO220-3-1	Q67040-S4353	SPP17N80C2
SPB17N80C2	P-TO263-3-2	Q67040-S4354	SPB17N80C2



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

Parameter	Symbol	Value	Unit
Continuous drain current	I_D	17	A
$T_C = 25\text{ }^\circ\text{C}$		17	
$T_C = 100\text{ }^\circ\text{C}$		11	
Pulsed drain current, t_p limited by T_{jmax}	$I_{D\text{ puls}}$	51	
Avalanche energy, single pulse	E_{AS}	670	mJ
$I_D=4\text{A}$, $V_{DD}=50\text{V}$			
Avalanche energy, repetitive t_{AR} limited by T_{jmax} ¹⁾	E_{AR}	0.5	
$I_D=17\text{A}$, $V_{DD}=50\text{V}$			
Avalanche current, repetitive t_{AR} limited by T_{jmax}	I_{AR}	17	A
Reverse diode dv/dt	dv/dt	6	V/ns
$I_S=17\text{A}$, $V_{DS} < V_{DD}$, $di/dt=100\text{A}/\mu\text{s}$, $T_{jmax}=150\text{ }^\circ\text{C}$			
Gate source voltage	V_{GS}	± 20	V
Power dissipation	P_{tot}	208	W
$T_C = 25\text{ }^\circ\text{C}$			
Operating and storage temperature	T_j, T_{stg}	-55... +150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Thermal resistance, junction - case	R_{thJC}	-	-	0.6	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}	-	-	62	
		-	35	-	
Linear derating factor		-	-	1.67	W/K
Soldering temperature, 1.6 mm (0.063 in.) from case for 10s	T_{sold}	-	-	260	°C

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

Drain-source breakdown voltage $V_{GS}=0V, I_D=0.25mA$	$V_{(BR)DSS}$	800	-	-	V
Drain-source avalanche breakdown voltage $V_{GS}=0V, I_D=17A$	$V_{(BR)DS}$	-	870	-	
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D=1mA$	$V_{GS(th)}$	2	3	4	
Zero gate voltage drain current $V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, T_j = 25\text{ °C}$ $V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, T_j = 150\text{ °C}$	I_{DSS}	-	0.5	25	μA
		-	-	250	
Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$	I_{GSS}	-	-	100	nA
Drain-source on-state resistance $V_{GS}=10V, I_D=11A, T_j=25\text{ °C}$	$R_{DS(on)}$	-	250	290	mΩ
Gate input resistance $f = 1\text{ MHz}$, open drain	R_G	-	0.7	-	Ω

¹ Repetitive 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.

Preliminary data
**SPP17N80C2
SPB17N80C2**
Electrical Characteristics , at $T_j = 25\text{ }^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Characteristics						
Transconductance	g_{fs}	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 11\text{A}$	-	15	-	S
Input capacitance	C_{iss}	$V_{GS} = 0\text{V}$, $V_{DS} = 25\text{V}$,	-	2320	-	pF
Output capacitance	C_{oss}	$f = 1\text{MHz}$	-	1250	-	
Reverse transfer capacitance	C_{rss}		-	60	-	
Effective output capacitance, ¹⁾ energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}$, $V_{DS} = 0\text{V to } 640\text{V}$	-	59	-	pF
Effective output capacitance, ²⁾ time related	$C_{o(tr)}$		-	124	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 400\text{V}$, $V_{GS} = 0/10\text{V}$,	-	45	-	ns
Rise time	t_r	$I_D = 17\text{A}$, $R_G = 5.6\Omega$,	-	17	-	
Turn-off delay time	$t_{d(off)}$	$T_j = 125^\circ\text{C}$	-	77	88	
Fall time	t_f		-	10	13	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	$V_{DD} = 640\text{V}$, $I_D = 17\text{A}$	-	9	-	nC
Gate to drain charge	Q_{gd}		-	42	-	
Gate charge total	Q_g	$V_{DD} = 640\text{V}$, $I_D = 17\text{A}$, $V_{GS} = 0\text{ to } 10\text{V}$	-	83	107	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 640\text{V}$, $I_D = 17\text{A}$	-	6	-	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 $T_j = 25\text{ }^\circ\text{C}$, unless otherwise specified

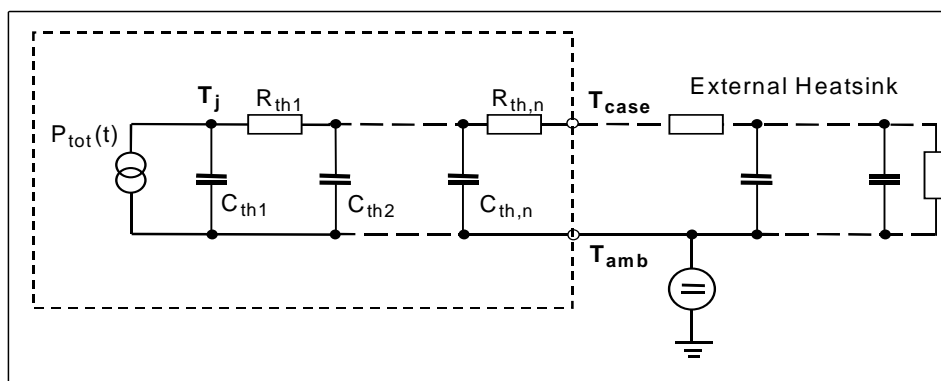
Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Reverse Diode						
Inverse diode continuous forward current	I_S	$T_C=25^\circ\text{C}$	-	-	17	A
Inverse diode direct current, pulsed	I_{SM}		-	-	51	
Inverse diode forward voltage	V_{SD}	$V_{GS}=0\text{V}, I_F=I_S$	-	1	1.2	V
Reverse recovery time	t_{rr}	$V_R=400\text{V}, I_F=I_S,$	-	550	-	ns
Reverse recovery charge	Q_{rr}	$di_F/dt=100\text{A}/\mu\text{s}$	-	13	-	μC
Peak reverse recovery current	I_{rrm}		-	40	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt		-	1200	-	$\text{A}/\mu\text{s}$

Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
	typ.			typ.	

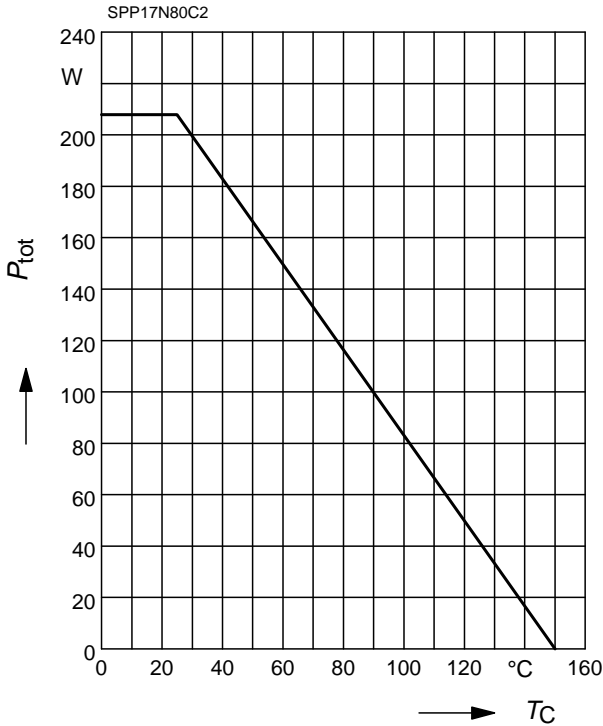
Transient thermal impedance

Thermal resistance			Thermal capacitance		
R_{th1}	0.00716	K/W	C_{th1}	0.000441	Ws/K
R_{th2}	0.01		C_{th2}	0.0014	
R_{th3}	0.022		C_{th3}	0.000985	
R_{th4}	0.065		C_{th4}	0.0045	
R_{th5}	0.083		C_{th5}	0.02	
R_{th6}	0.038		C_{th6}	0.146	



1 Power dissipation

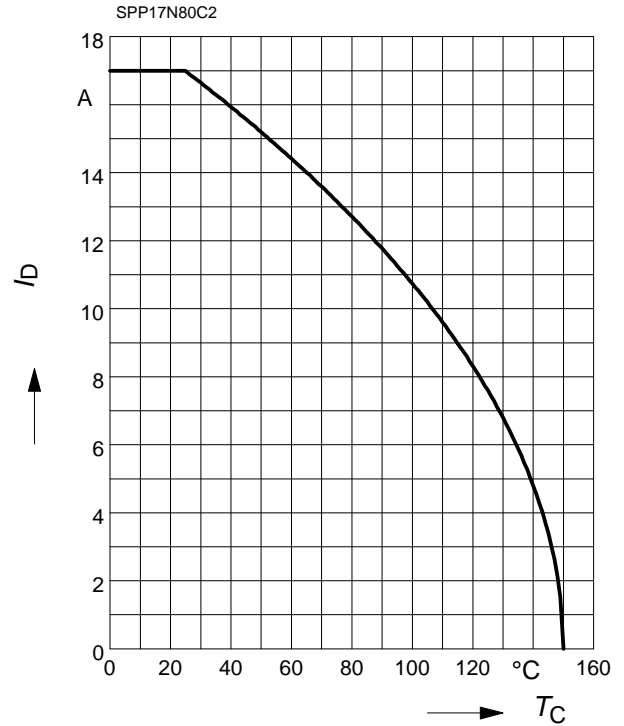
$P_{tot} = f(T_C)$



2 Drain current

$I_D = f(T_C)$

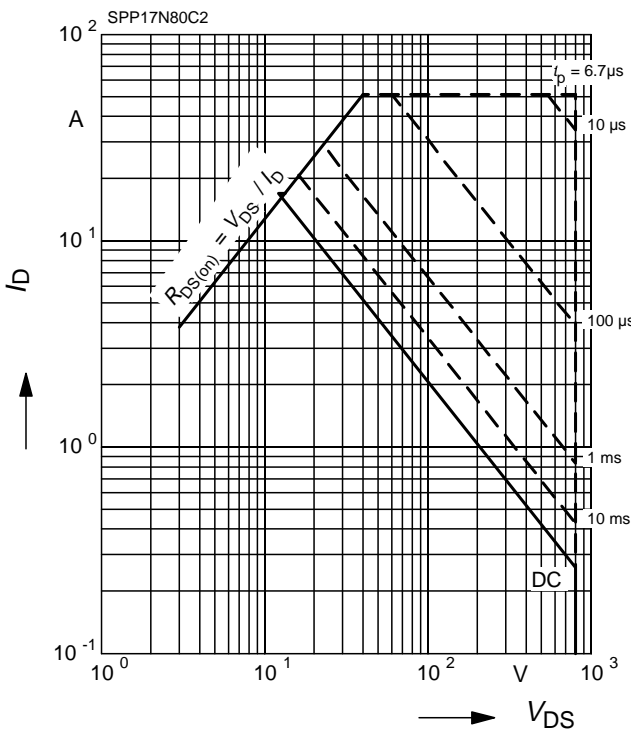
parameter: $V_{GS} \geq 10\text{ V}$



3 Safe operating area

$I_D = f(V_{DS})$

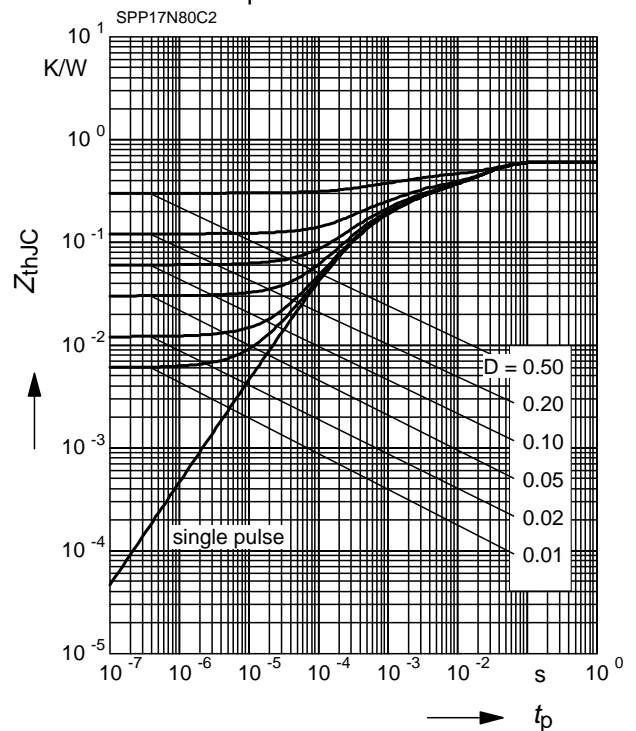
parameter: $D = 0, T_C = 25^\circ\text{C}$



4 Transient thermal impedance

$Z_{thJC} = f(t_p)$

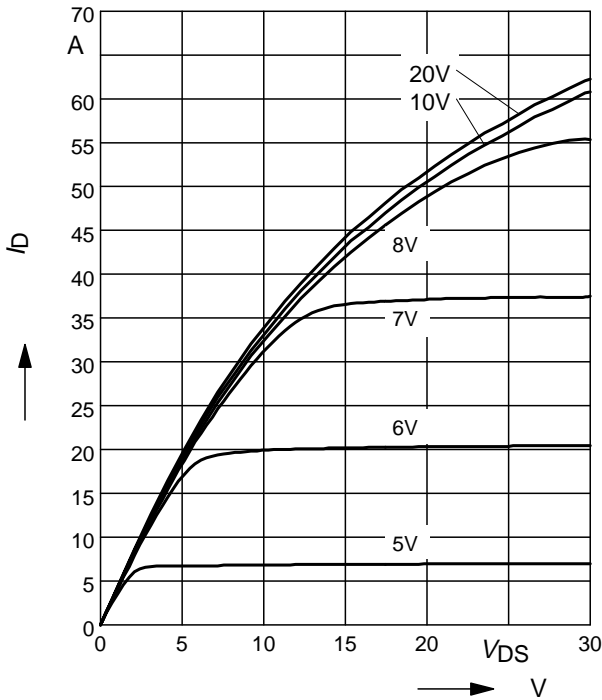
parameter: $D = t_p/T$



5 Typ. output characteristic

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

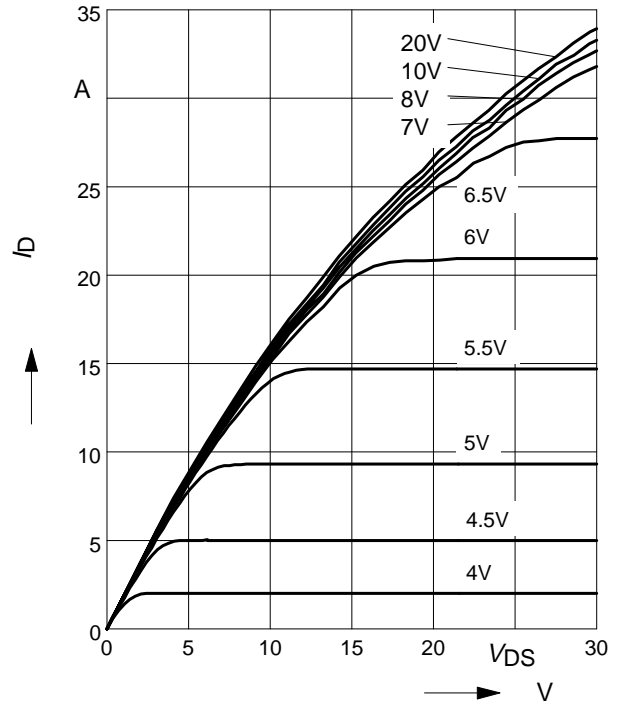
parameter: $t_p = 10 \mu\text{s}, V_{GS}$



6 Typ. output characteristic

$I_D = f(V_{DS}); T_j = 150^\circ\text{C}$

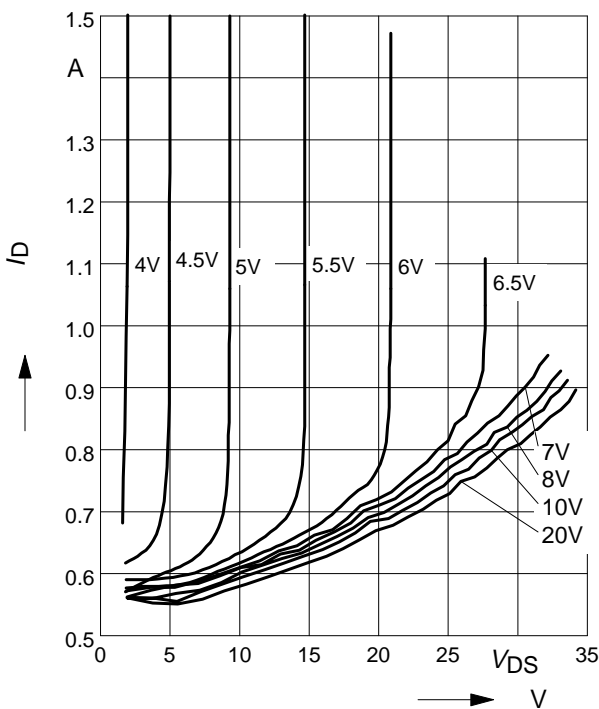
parameter: $t_p = 10 \mu\text{s}, V_{GS}$



7 Typ. drain-source on resistance

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

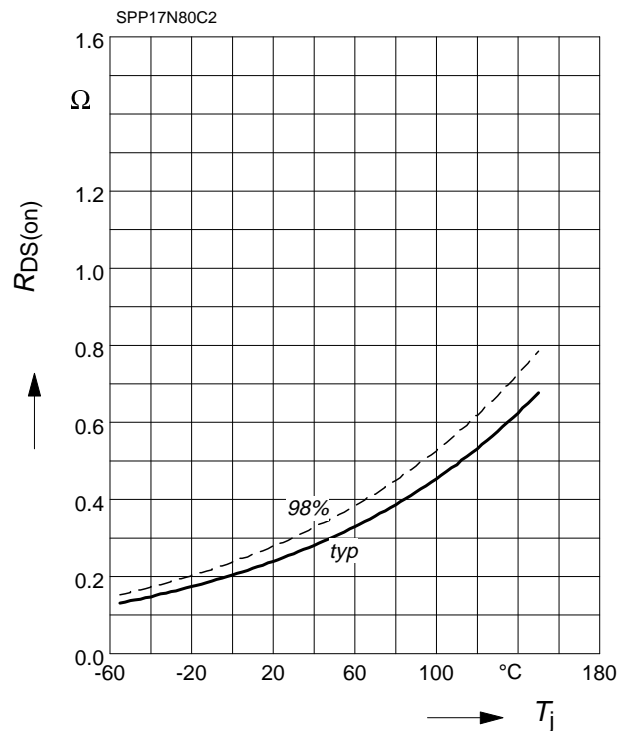
parameter: $T_j = 150^\circ\text{C}, V_{GS}$



8 Drain-source on-state resistance

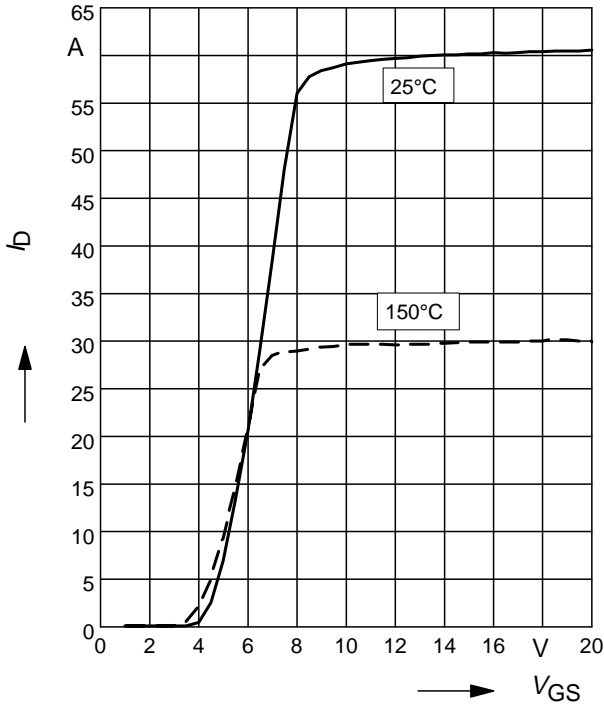
$R_{DS(on)} = f(T_j)$

parameter: $I_D = 11 \text{ A}, V_{GS} = 10 \text{ V}$



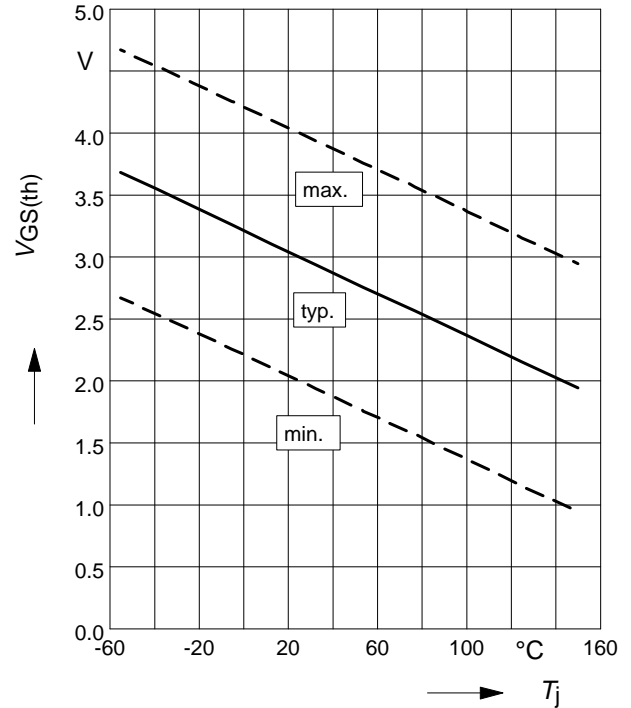
9 Typ. transfer characteristics

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



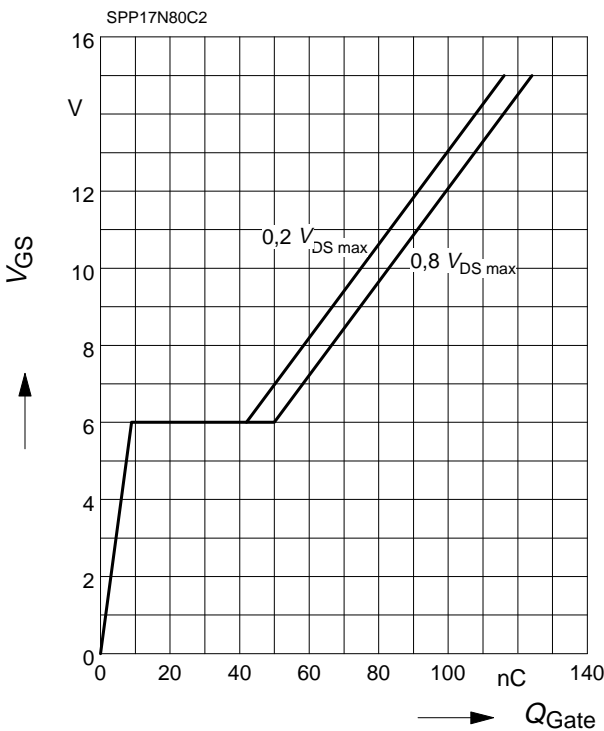
10 Gate threshold voltage

$V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1 \text{ mA}$



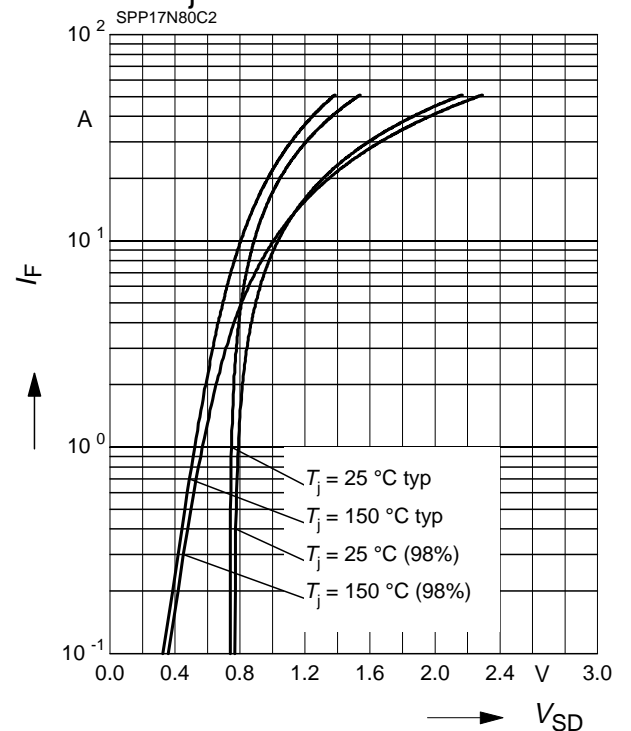
11 Typ. gate charge

$V_{GS} = f(Q_{Gate})$
parameter: $I_D = 17 \text{ A pulsed}$



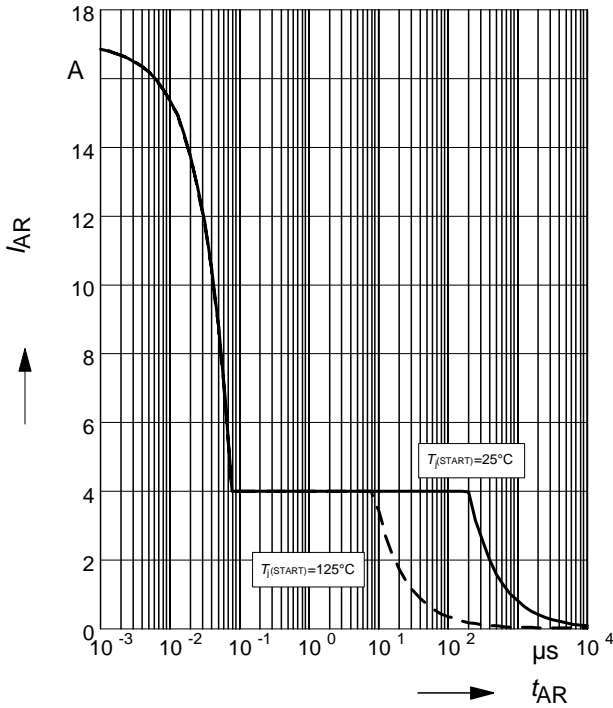
12 Forward characteristics of body diode

$I_F = f(V_{SD})$
parameter: T_j , $t_p = 10 \mu s$



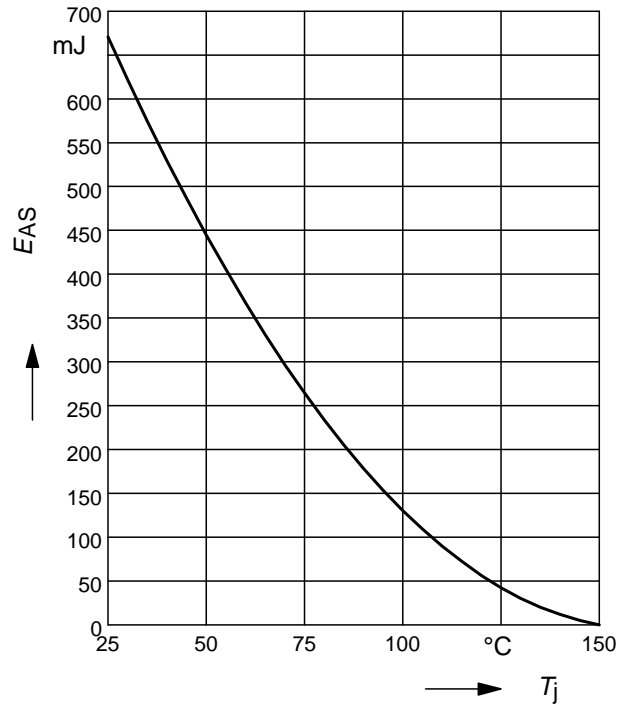
13 Avalanche SOA

$I_{AR} = f(t_{AR})$
par.: $T_j \leq 150\text{ }^\circ\text{C}$



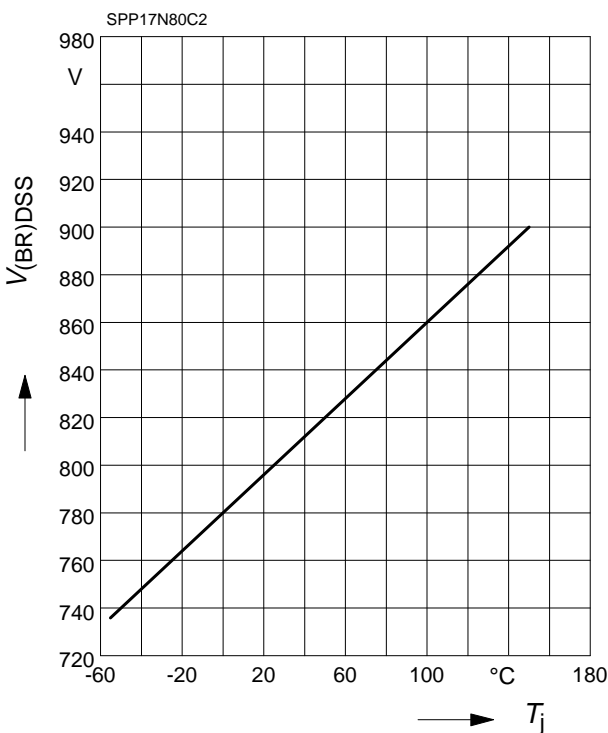
14 Avalanche energy

$E_{AS} = f(T_j)$
par.: $I_D = 4\text{ A}$, $V_{DD} = 50\text{ V}$



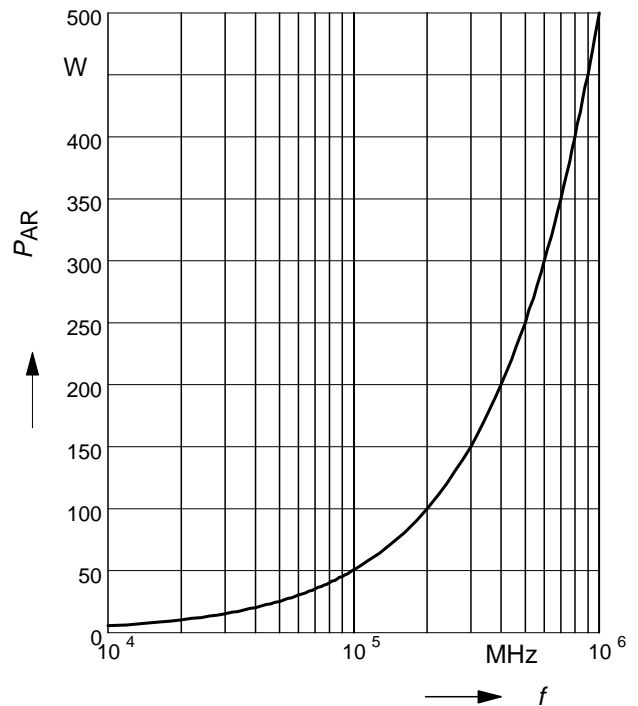
15 Drain-source breakdown voltage

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



16 Avalanche power losses

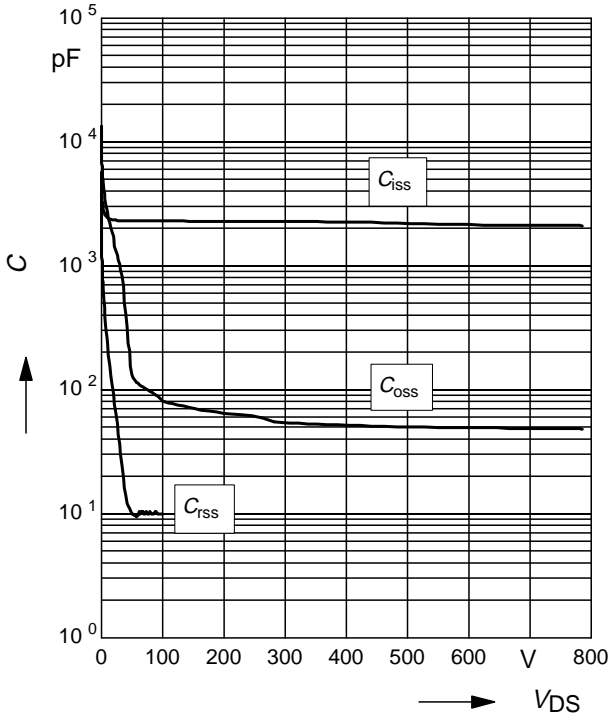
$P_{AR} = f(f)$
parameter: $E_{AR} = 0.5\text{ mJ}$



17 Typ. capacitances

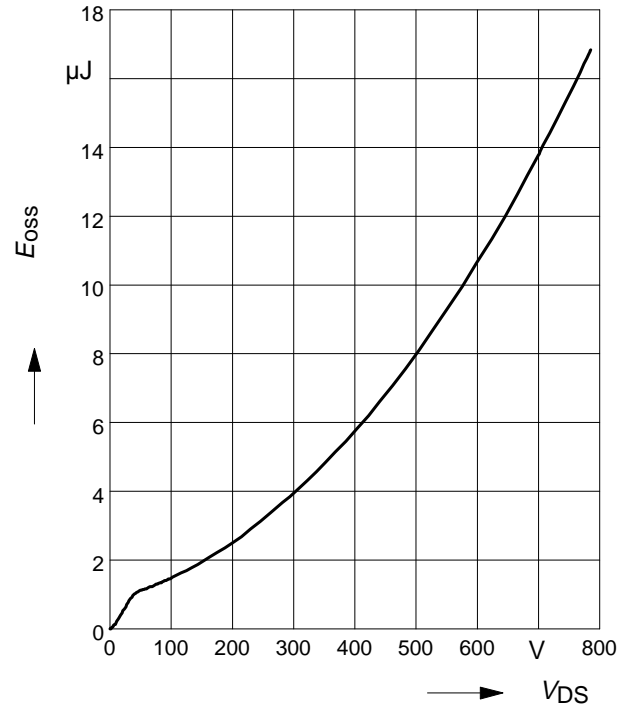
$C = f(V_{DS})$

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

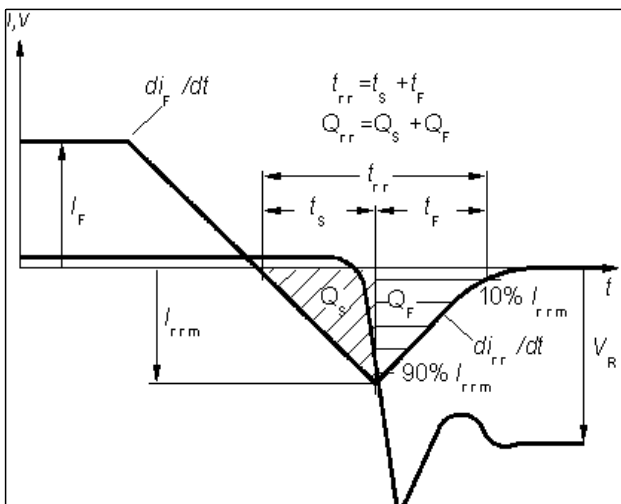


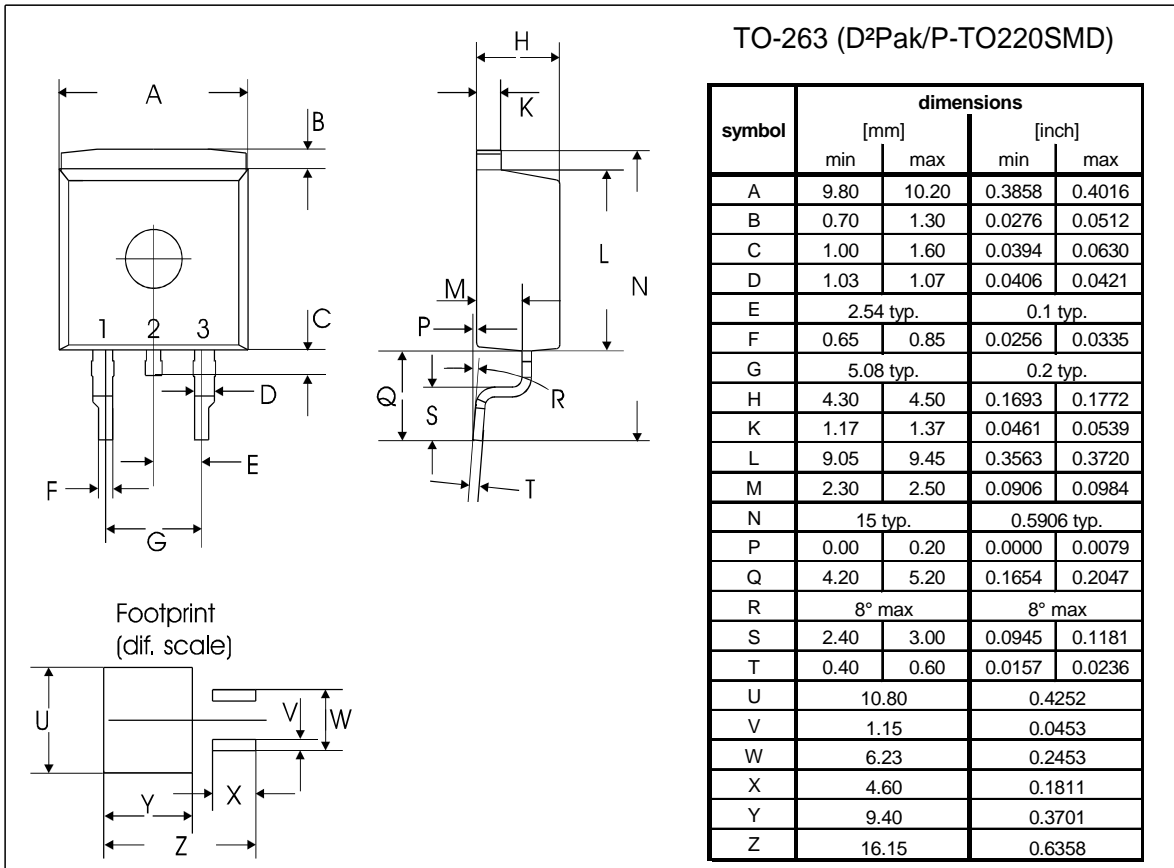
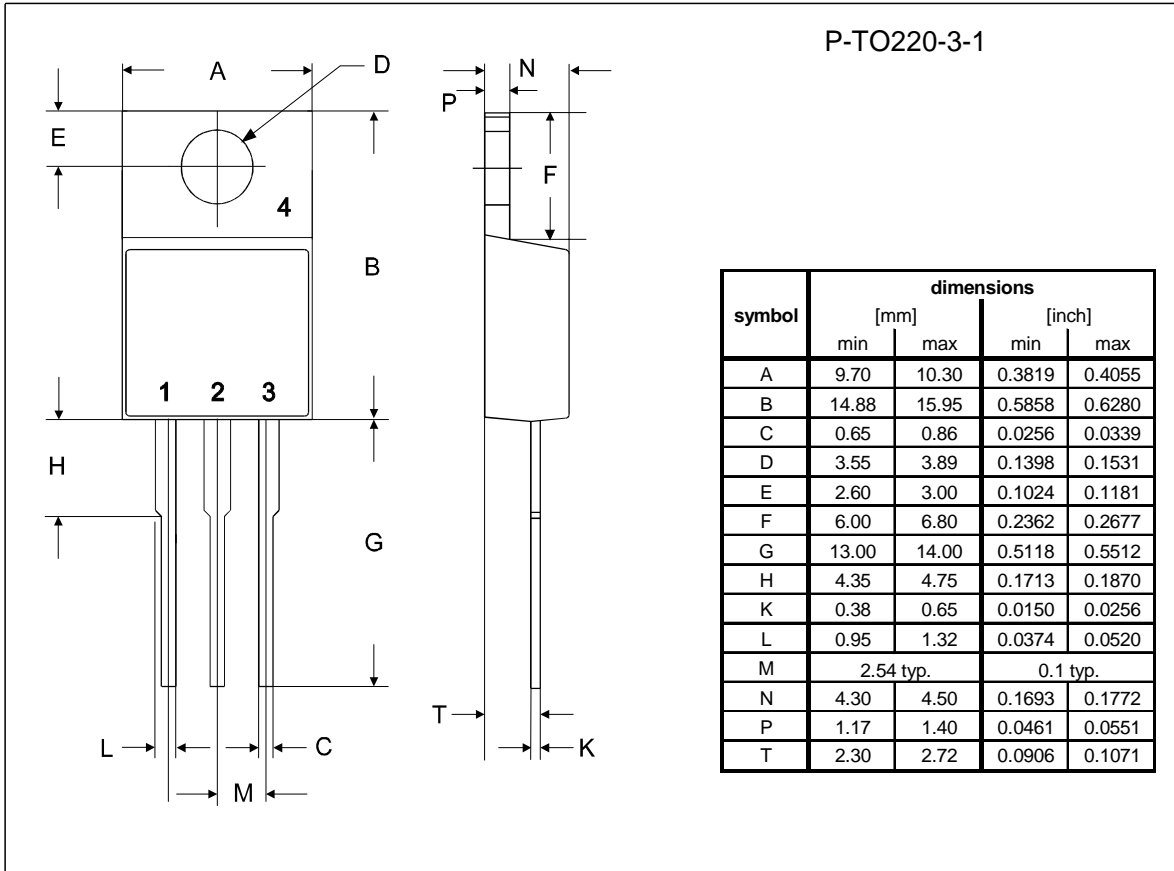
18 Typ. C_{OSS} stored energy

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



Definition of diodes switching characteristics





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