Preliminary data

SPP20N60S5
SPB20N60S5

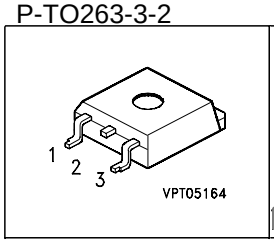
Cool MOS™ Power Transistor

- New revolutionary high voltage technology
- Worldwide best $R_{DS(on)}$ in TO 220
- Ultra low gate charge
- Improved periodic avalanche rating
- Extreme d*v*/d*t* rated
- Optimized capacitances
- Improved noise immunity
- Former development designation:
  SPPx1N60S5/SPBx1N60S5

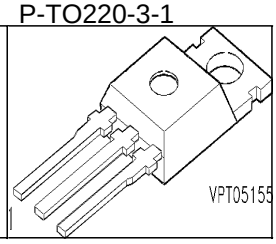
Product Summary

V_{DS} @ T_{jmax}	650	V
$R_{DS(on)}$	0.19	Ω
I_D	20	A

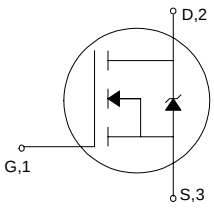
P-TO263-3-2



P-TO220-3-1



Type	Package	Ordering Code	Marking
SPP20N60S5	P-TO220-3-1	Q67040-S4751	20N60S5
SPB20N60S5	P-TO263-3-2	Q67040-S4171	20N60S5



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

Parameter	Symbol	Value	Unit
Continuous drain current T_C=25°C T_C=100°C	I_D	 20 13	A
Pulsed drain current [1)] T_C=25°C	$I_{D\ puls}$	40	
Avalanche energy, single pulse I_D = 10 A, V_{DD} = 50 V	E_{AS}	690	mJ
Avalanche energy (repetitive, limited by T_{jmax}) I_D = 20 A, V_{DD} = 50 V	E_{AR}	1	
Avalanche current (repetitive, limited by T_{jmax})	I_{AR}	20	A
Reverse diode d*v*/d*t* I_S=20A, V_{DS}<V_{DSS}, d*i*/d*t*=100A/µs, T_{jmax}=150°C	d*v*/d*t*	6	kV/µs
Gate source voltage	V_{GS}	±20	V
Power dissipation T_C=25°C	P_{tot}	208	W
Operating and storage temperature	T_j , T_{stg}	-55... +150	°C

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Thermal Characteristics					
Thermal resistance, junction - case	R_{thJC}	-	-	0.6	K/W
Thermal resistance, junction - ambient (Leaded and through-hole packages)	R_{thJA}	-	-	62	
SMD version, device on PCB:	R_{thJA}				
@ min. footprint		-	-	62	
@ 6 cm^2 cooling area [2)]		-	35	-	

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

Drain-source breakdown voltage V_{GS} = 0 V, I_D = 0.25 mA	$V_{(BR)DSS}$	600	-	-	V
Gate threshold voltage, V_{GS} = V_{DS} I_D = 1 mA, T_j = 25 °C	$V_{GS(th)}$	3.5	4.5	5.5	
Zero gate voltage drain current, V_{DS}=V_{DSS}	I_{DSS}				µA
V_{GS} = 0 V, T_j = 25 °C		-	0.5	25	
V_{GS} = 0 V, T_j = 150 °C		-	-	250	
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0 V	I_{GSS}	-	-	100	nA
Drain-source on-state resistance V_{GS} = 10 V, I_D = 13 A	$R_{DS(on)}$	-	0.16	0.19	Ω

[1] current limited by T_{jmax}

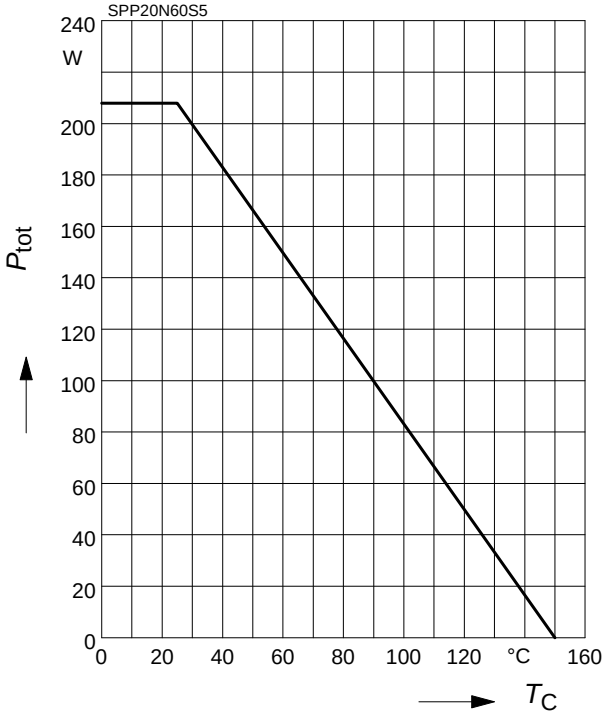
[2] Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6 cm^2 (one layer, 70µm thick) copper area for drain connection. PCB is vertical without blown air.

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic Characteristics						
Transconductance	g_{fs}	$V_{DS}\geq 2*I_D*R_{DS(on)max}$, I_D=13A	-	12	-	S
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	3000	-	pF
Output capacitance	C_{oss}		-	1170	-	
Reverse transfer capacitance	C_{rss}		-	28	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=350V, V_{GS}=10V, I_D=20A, R_G=5.7Ω	-	120	-	ns
Rise time	t_r		-	25	-	
Turn-off delay time	$t_{d(off)}$		-	140	210	
Fall time	t_f		-	30	45	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=350V, I_D=20A	-	21	-	nC
Gate to drain charge	Q_{gd}		-	47	-	
Total gate charge	Q_g	V_{DD}=350V, I_D=20A, V_{GS}=0 to 10V	-	79	103	
Reverse Diode						
Inverse diode continuous forward current	I_S	T_C=25°C	-	-	20	A
Inverse diode direct current,pulsed	I_{SM}		-	-	40	
Inverse diode forward voltage	V_{SD}	V_{GS}=0V, I_F=20A	-	1	1.2	V
Reverse recovery time	t_{rr}	V_R=100V, I_F=I_S, di_F/dt=100A/µs	-	610	-	ns
Reverse recovery charge	Q_{rr}		-	12	-	µC

Power dissipation

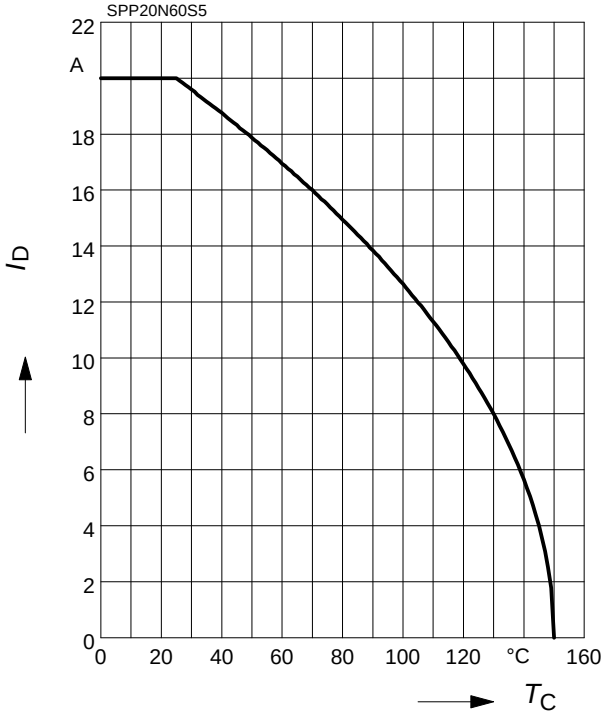
$P_{tot} = f(T_C)$



Drain current

$I_D = f(T_C)$

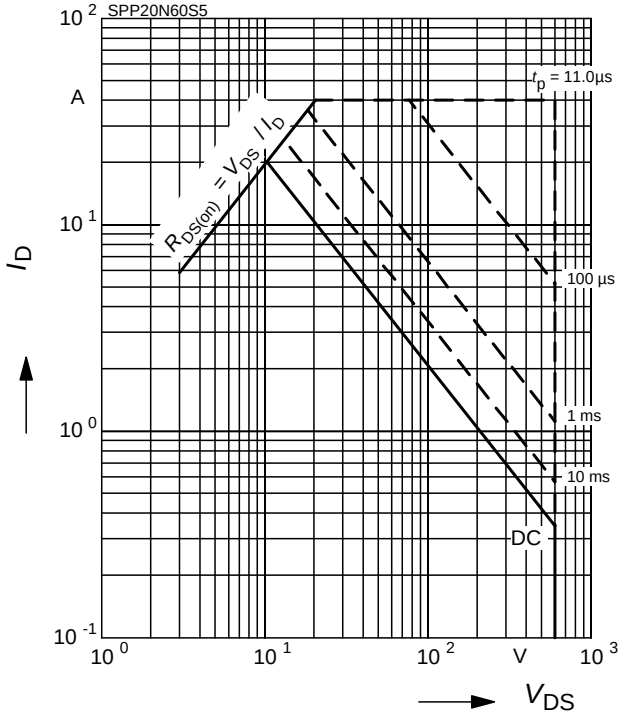
parameter: $V_{GS} \geq 10$ V



Safe operating area

$I_D = f(V_{DS})$

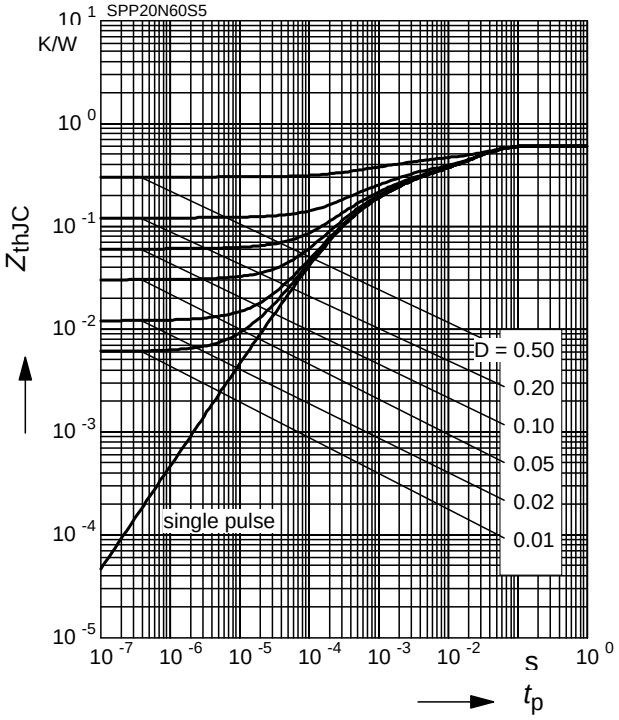
parameter: D=0.01, T_C=25°C



Transient thermal impedance

$Z_{thJC} = f(t_p)$

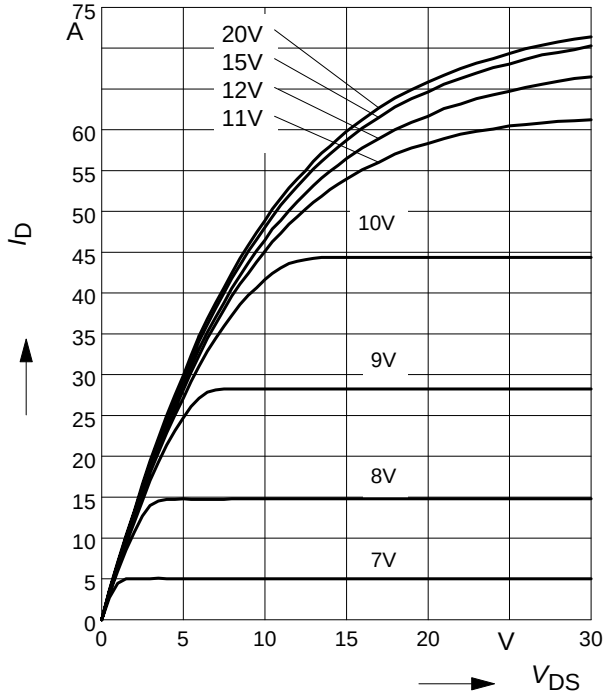
parameter : $D = t_p/T$



Typ. output characteristic

I_D = f (V_{DS})

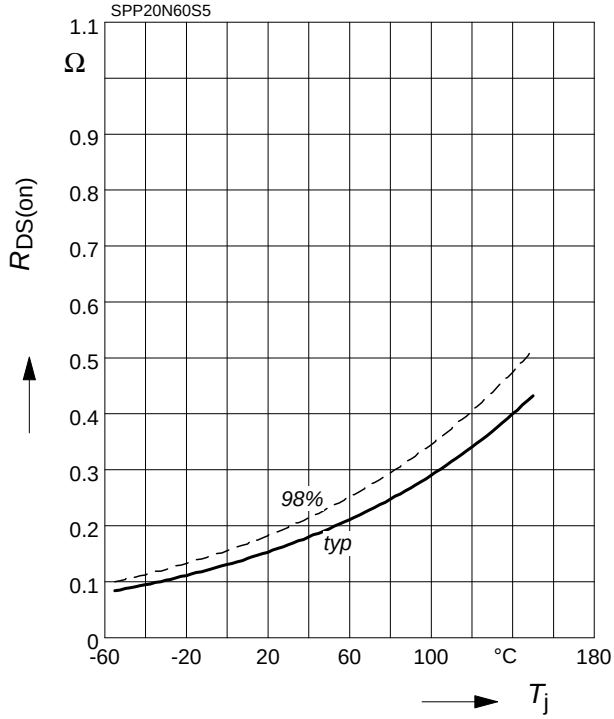
Parameter: V_{GS}, T_j = 25 °C



Drain-source on-resistance

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

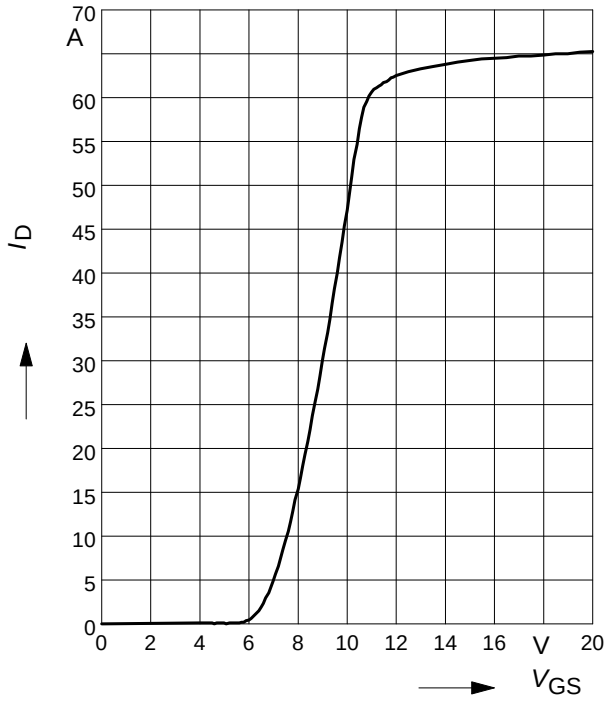
parameter : I_D = 13 A, V_{GS} = 10 V



Typ. transfer characteristics

I_D= f (V_{GS})

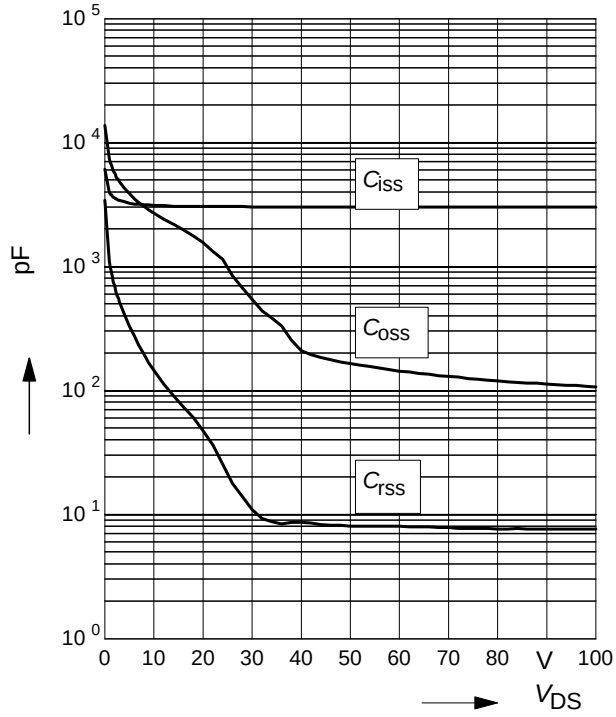
V_{DS}≥ 2 x I_D x $R_{DS(on)max}$



Typ. capacitances

C = f (V_{DS})

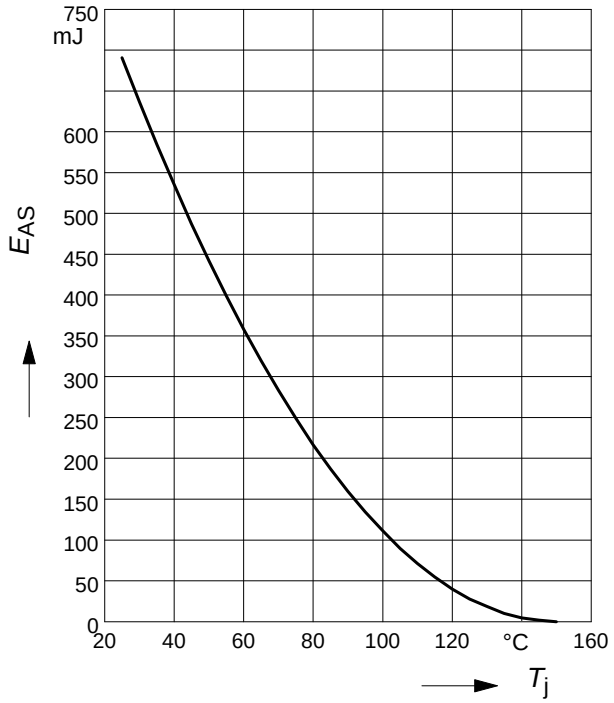
parameter: V_{GS}=0 V, f=1 MHz



Avalanche Energy

$E_{AS} = f(T_j)$

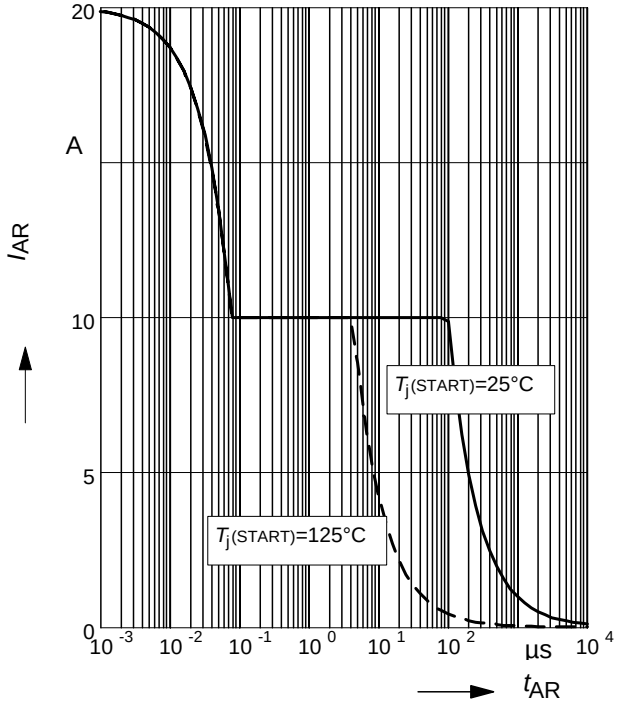
par.: I_D = 10 A, V_{DD} = 50 V



Avalanche SOA

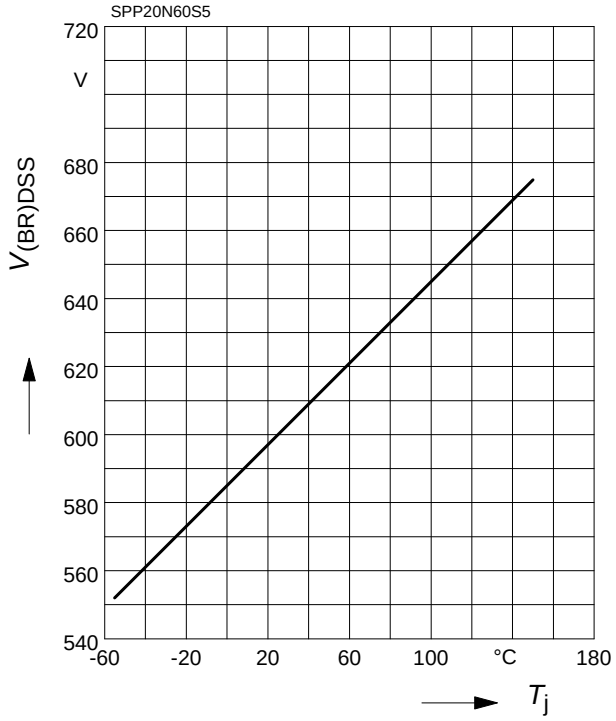
$I_{AR} = f(t_{AR})$

par.: $T_j \leq 150$ °C



Drain-source breakdown voltage

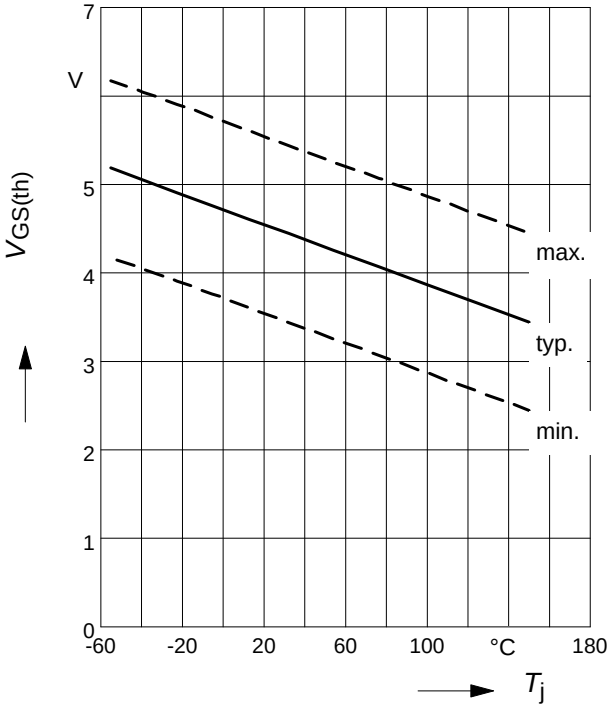
$V_{(BR)DSS}$ = f (T_j)



Gate threshold voltage

$V_{GS(th)} = f(T_j)$

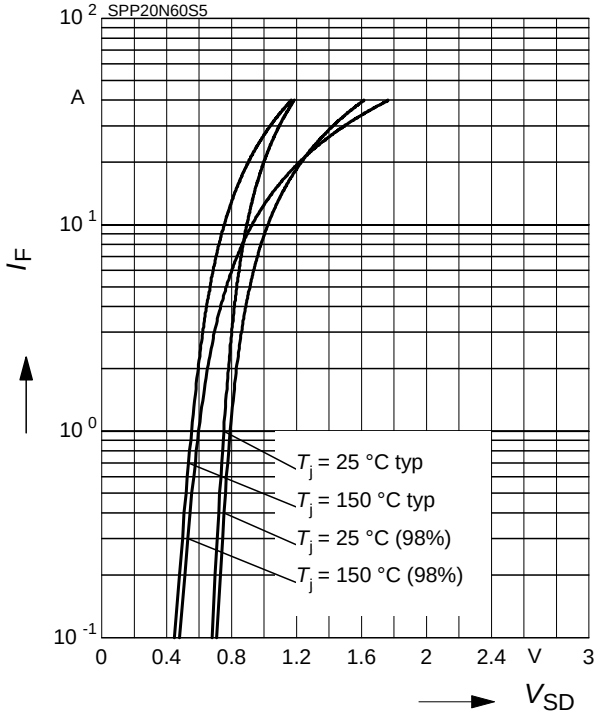
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA



Forward characteristics of reverse diode

$I_F = f(V_{SD})$

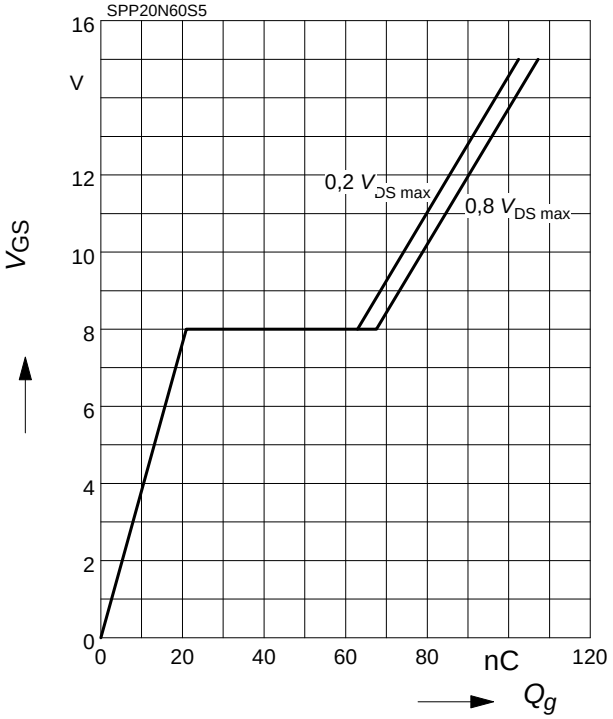
parameter: T_j , tp = 10 µs



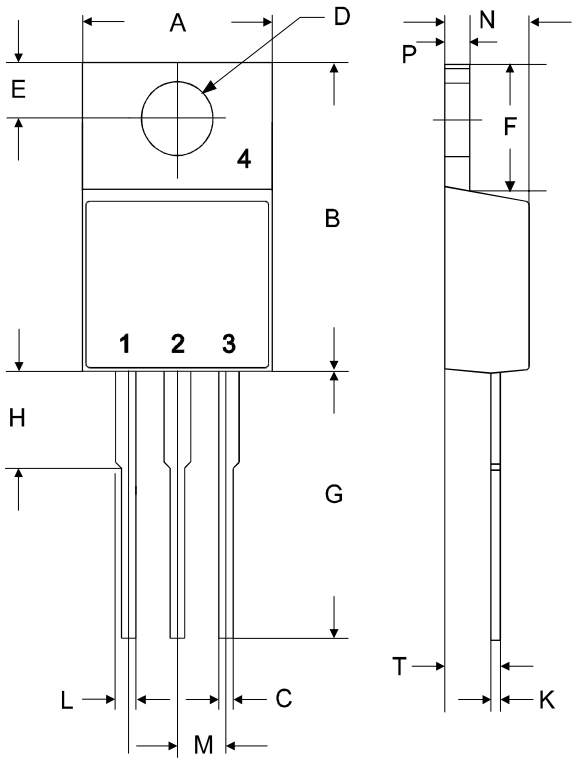
Typ. gate charge

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

parameter: I_{Dpuls} = 20 A

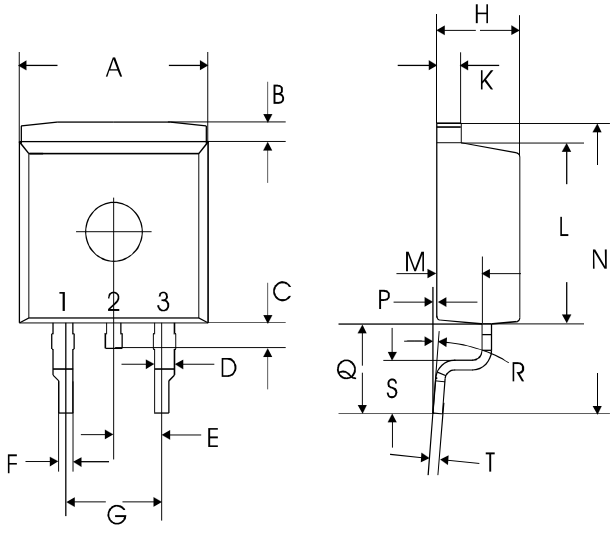


P-TO220-3-1

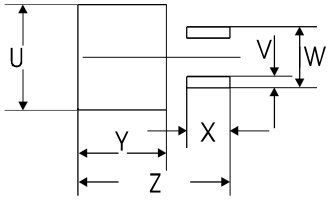


symbol	dimensions			
	[mm]		[inch]	
	min	max	min	max
A	9.70	10.30	0.3819	0.4055
B	14.88	15.95	0.5858	0.6280
C	0.65	0.86	0.0256	0.0339
D	3.55	3.89	0.1398	0.1531
E	2.60	3.00	0.1024	0.1181
F	6.00	6.80	0.2362	0.2677
G	13.00	14.00	0.5118	0.5512
H	4.35	4.75	0.1713	0.1870
K	0.38	0.65	0.0150	0.0256
L	0.95	1.32	0.0374	0.0520
M	2.54 typ.		0.1 typ.	
N	4.30	4.50	0.1693	0.1772
P	1.17	1.40	0.0461	0.0551
T	2.30	2.72	0.0906	0.1071

TO-263 (D²Pak/P-TO220SMD)



Footprint
(dif. scale)



symbol	dimensions			
	[mm]		[inch]	
	min	max	min	max
A	9.80	10.20	0.3858	0.4016
B	0.70	1.30	0.0276	0.0512
C	1.00	1.60	0.0394	0.0630
D	1.03	1.07	0.0406	0.0421
E	2.54 typ.		0.1 typ.	
F	0.65	0.85	0.0256	0.0335
G	5.08 typ.		0.2 typ.	
H	4.30	4.50	0.1693	0.1772
K	1.17	1.37	0.0461	0.0539
L	9.05	9.45	0.3563	0.3720
M	2.30	2.50	0.0906	0.0984
N	15 typ.		0.5906 typ.	
P	0.00	0.20	0.0000	0.0079
Q	4.20	5.20	0.1654	0.2047
R	8° max		8° max	
S	2.40	3.00	0.0945	0.1181
T	0.40	0.60	0.0157	0.0236
U	10.80		0.4252	
V	1.15		0.0453	
W	6.23		0.2453	
X	4.60		0.1811	
Y	9.40		0.3701	
Z	16.15		0.6358	

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