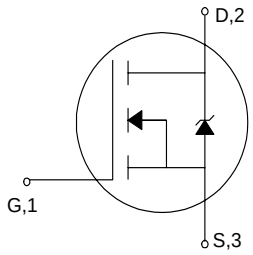
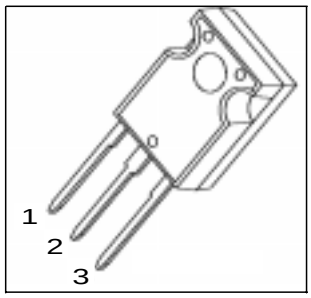
Cool MOS™ Power Transistor

- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche proved
- Extreme d*v*/d*t* rated
- Optimized capacitances
- Improved noise immunity
- Former development designation:
  SPWx1N60S5



COOLMOS Power Semiconductors



Type	V_{DS}	I_D	$R_{DS(on)}$	Package	Marking	Ordering Code
SPW20N60S5	600 V	20 A	0.19 Ω	P-TO247	20N60S5	Q67040-S4238

Maximum Ratings

Parameter	Symbol	Value	Unit
Continuous drain current T_C = 25 °C T_C = 100 °C	I_D	 20 13	A
Pulsed drain current, t_p = 1ms [1)] T_C = 25 °C	$I_{D\ puls}$	40	
Avalanche energy, single pulse I_D = 20 A, V_{DD} = 50 V, R_{GS} = 25 Ω Periodic avalanche energy E_{AR} only limited by T_{jmax}	E_{AS}	690	mJ
Reverse diode d*v*/d*t* I_S = 20 A, V_{DS}<V_{DSS}, d*i*/d*t* = 100 A/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

Parameter at T_j = 25 °C, unless otherwise specified	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	
Static Characteristics					
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} V_{GS} = 0 V, T_j = 25 °C V_{GS} = 0 V, T_j = 150 °C	I_{DSS}	 - -	 0.5 -	 25 250	µA
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}

Electrical Characteristics

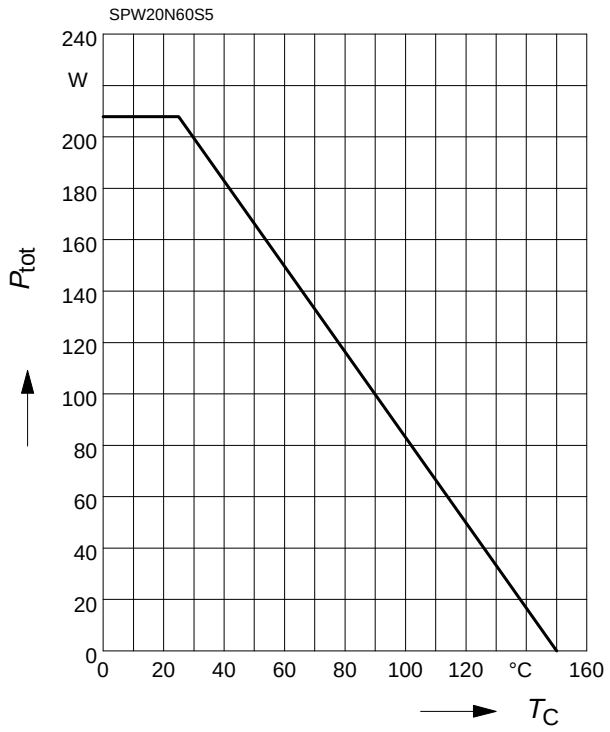
Parameter at T_j = 25 °C, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Transconductance $V_{DS}\geq 2*I_D*R_{DS(on)max}$, I_D = 13 A	g_{fs}	-	12	-	S
Input capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{iss}	-	3000	-	pF
Output capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{oss}	-	1700	-	
Reverse transfer capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{rss}	-	50	-	
Turn-on delay time V_{DD} = 350 V, V_{GS} = 10 V, I_D = 20 A, R_G = 3.6 Ω	$t_{d(on)}$	-	50	-	ns
Rise time V_{DD} = 350 V, V_{GS} = 10 V, I_D = 20 A, R_G = 3.6 Ω	t_r	-	40	-	
Turn-off delay time V_{DD} = 350 V, V_{GS} = 10 V, I_D = 20 A, R_G = 3.6 Ω	$t_{d(off)}$	-	100	-	
Fall time V_{DD} = 350 V, V_{GS} = 10 V, I_D = 20 A, R_G = 3.6 Ω	t_f	-	20	-	

Electrical Characteristics

Parameter at T_j = 25 °C, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Gate Charge Characteristics					
Gate to source charge V_{DD} = 350 V, I_D = 20 A	Q_{gs}	-	16	-	nC
Gate to drain charge V_{DD} = 350 V, I_D = 20 A	Q_{gd}	-	44	-	
Total gate charge V_{DD} = 350 V, I_D = 20 A, V_{GS} = 0 to 10 V	Q_g	-	88	-	
Reverse Diode					
Inverse diode continuous forward current T_C = 25 °C	I_S	-	-	20	A
Inverse diode direct current,pulsed T_C = 25 °C	I_{SM}	-	-	40	
Inverse diode forward voltage V_{GS} = 0 V, I_F = 20 A	V_{SD}	-	1	1.2	V
Reverse recovery time V_R = 350 V, I_F=I_S , di_F/dt = 100 A/µs	t_{rr}	-	610	-	ns
Reverse recovery charge V_R = 350 V, I_F=I_S , di_F/dt = 100 A/µs	Q_{rr}	-	12	-	nC

Power Dissipation

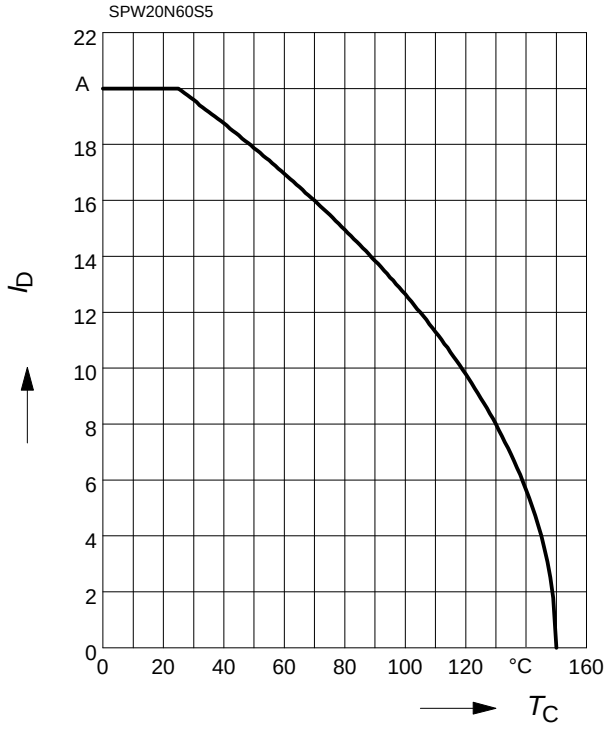
$P_{tot} = f(T_C)$



Drain current

$I_D = f(T_C)$

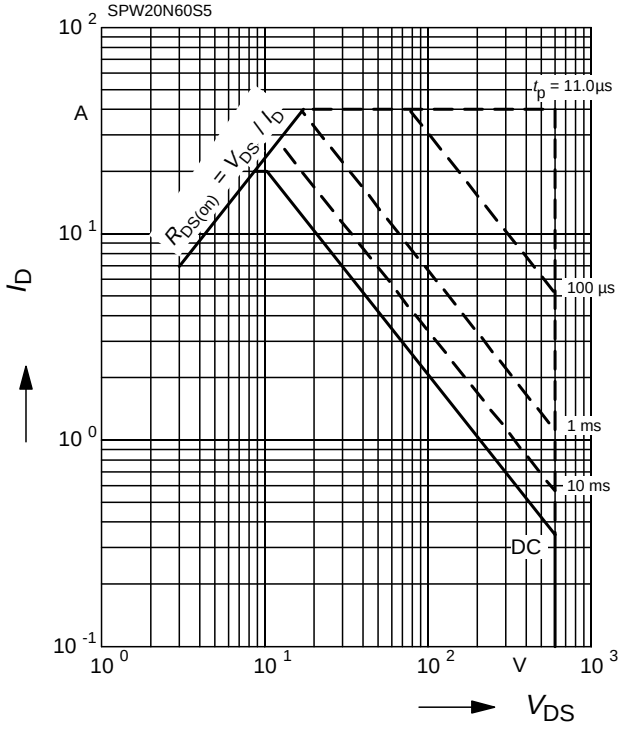
parameter: $V_{GS} \geq 10$ V



Safe operating area

$I_D = f(V_{DS})$

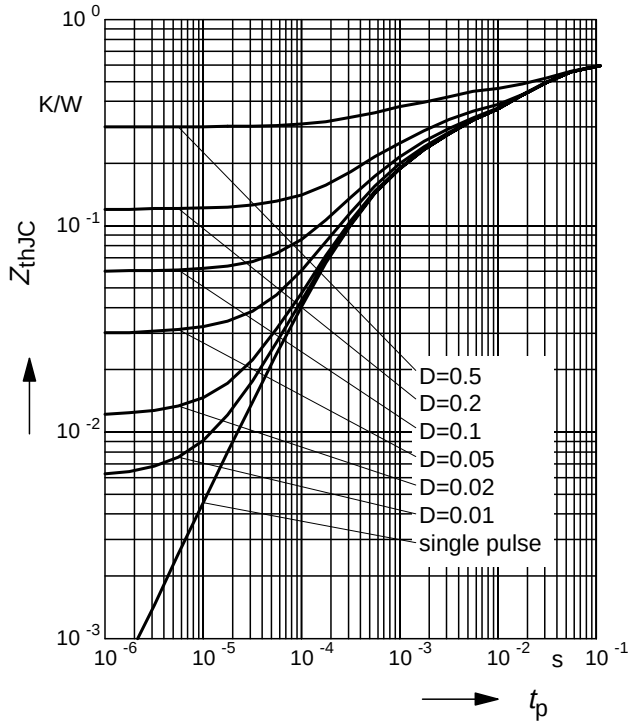
parameter: D=0.01, T_C=25°C



Transient thermal impedance

$Z_{thJC} = f(t_P)$

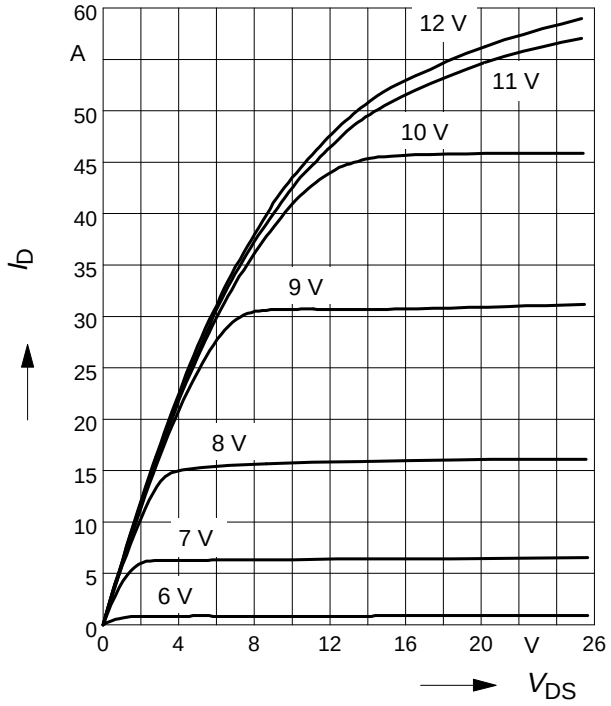
Parameter: $D=t_P/T$



Typ. output characteristic

$I_D = f(V_{DS})$; T_j=25°C

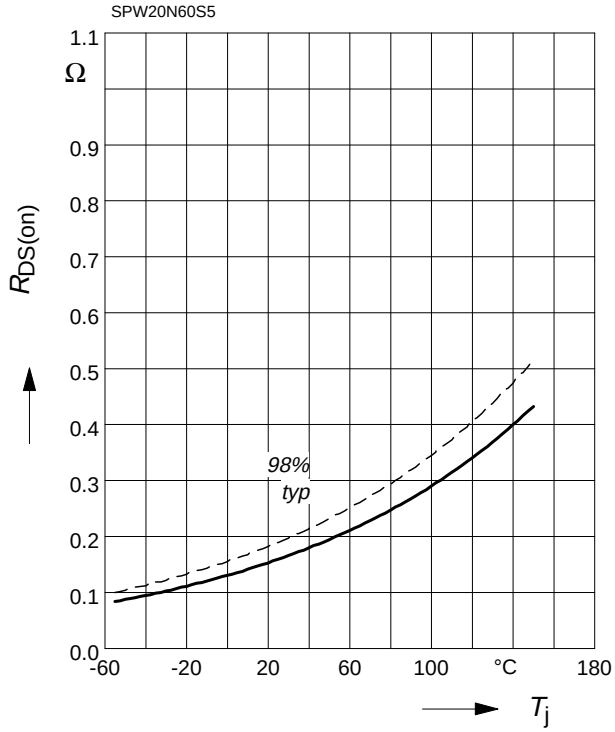
Parameter: V_{GS}



Drain-source on-resistance

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

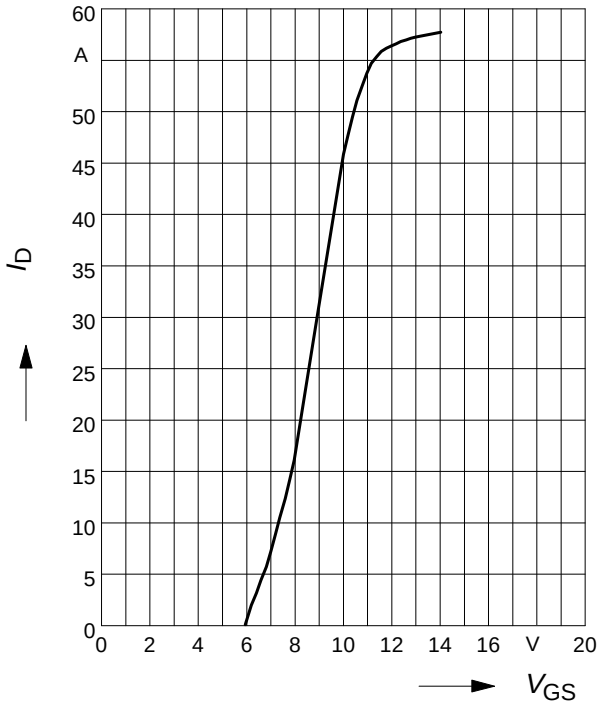
parameter : I_D = 13 A, V_{GS} = 10 V



Typ. transfer characteristics $I_D = f(V_{GS})$

parameter: t_p = 80 µs

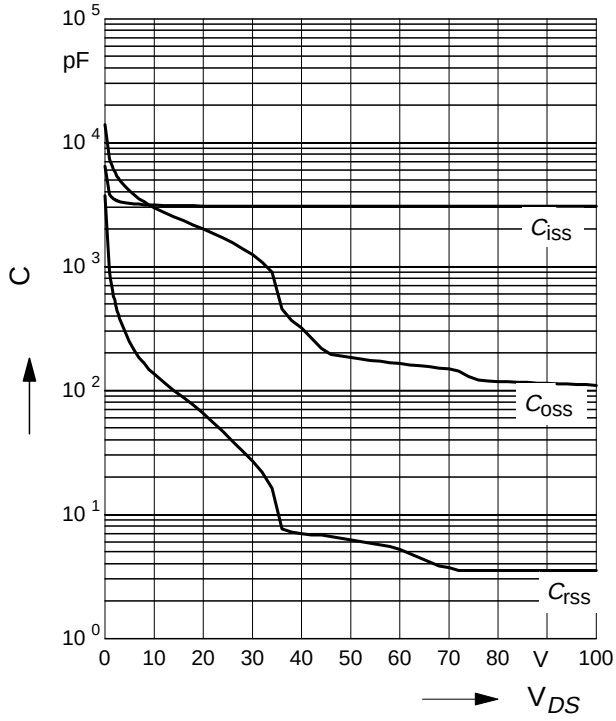
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



Typ. capacitances

$C = f(V_{DS})$

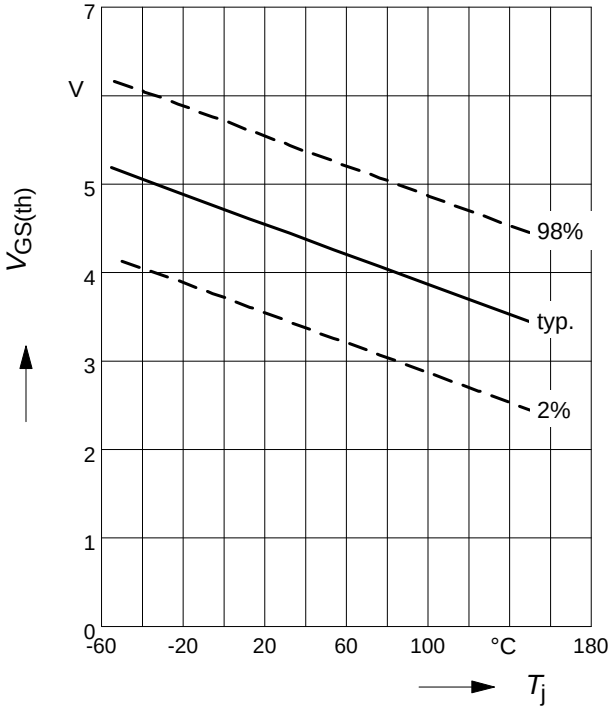
Parameter: V_{GS}=0 V, f=1 MHz



Gate threshold voltage

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

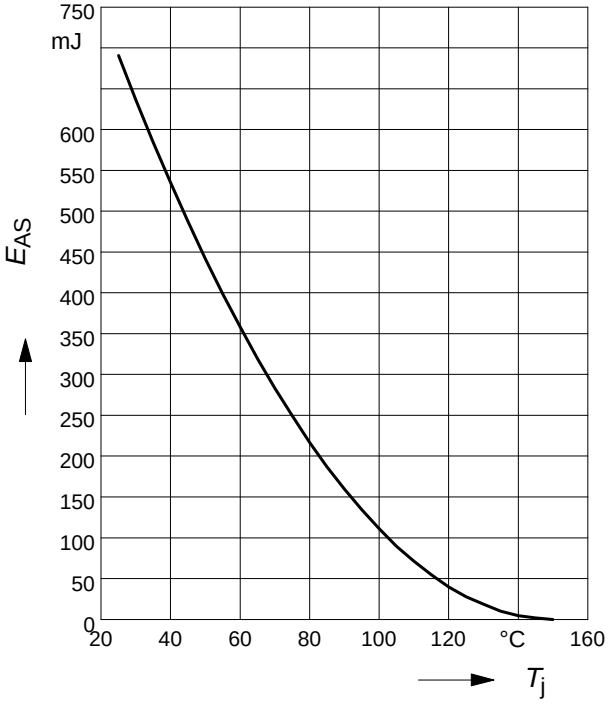
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA



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

parameter: I_D = 20 A, V_{DD} = 50 V

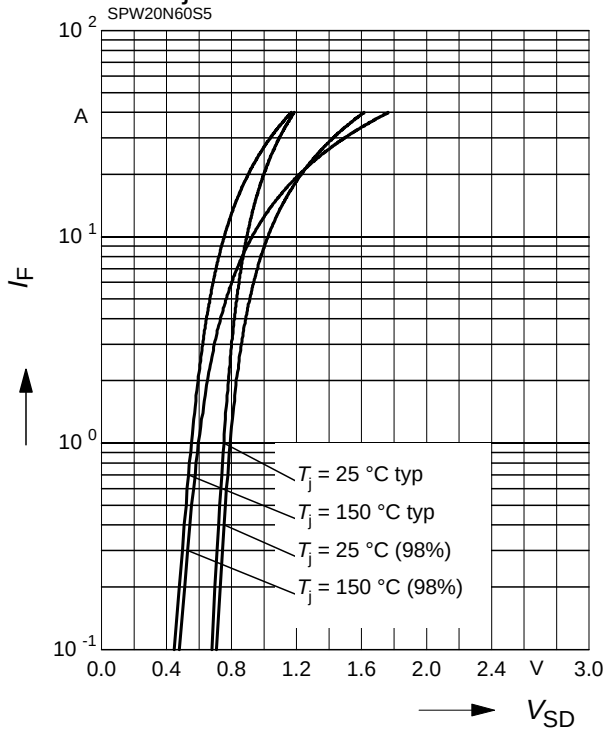
R_{GS} = 25 Ω



Forward characteristics of reverse diode

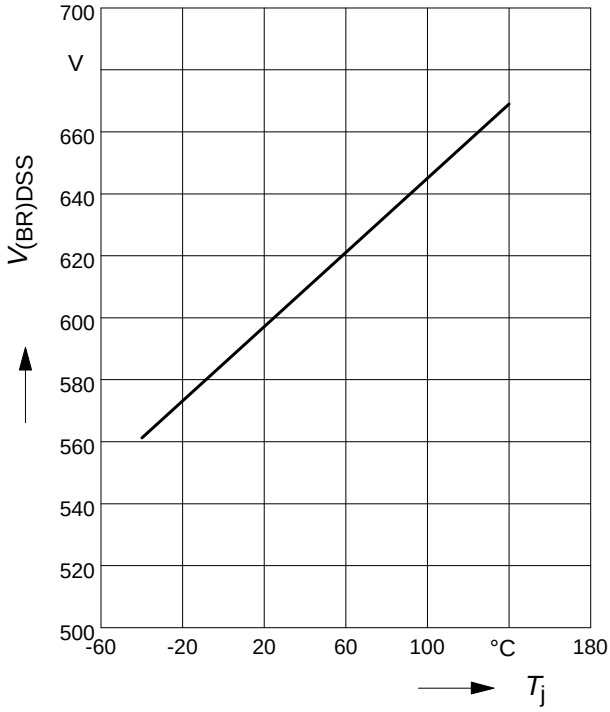
$I_F = f(V_{SD})$

parameter: T_j , tp = 80 µs



Drain-source break down voltage

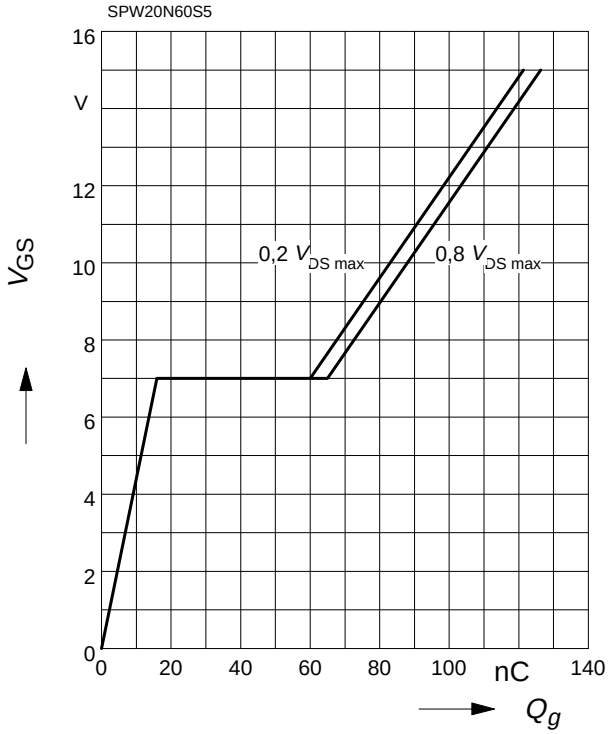
$V_{(BR)DSS} = f(T_j)$



Typ. gate charge

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

parameter: I_{Dpuls} = 20 A



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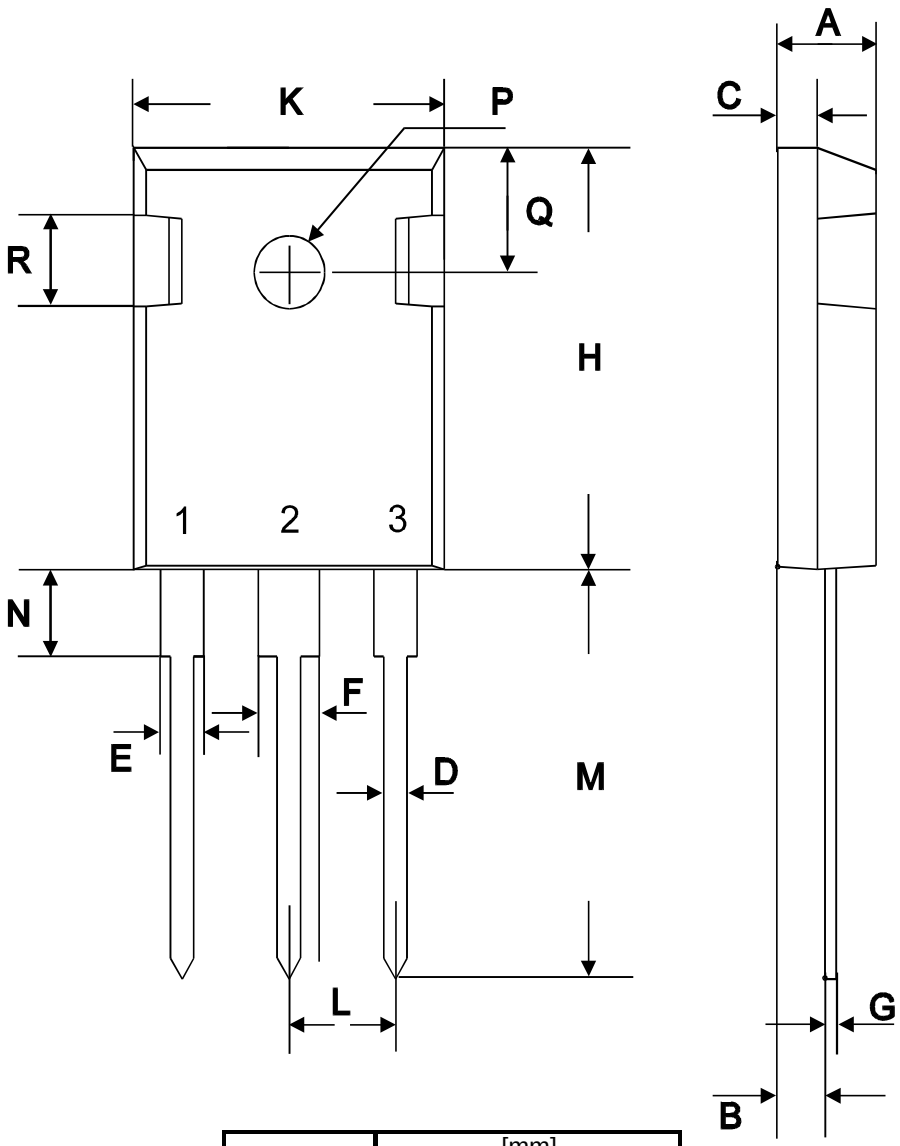

symbol	[mm] min	max
A	4.78	5.28
B	2.29	2.51
C	1.78	2.29
D	1.09	1.32
E	1.73	2.06
F	2.67	3.18
G	0.76 max	
H	20.80	21.16
K	15.65	16.15
L	5.21	5.72
M	19.81	20.68
N	3.560	4.930
∅P	3.61	
Q	6.12	6.22

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