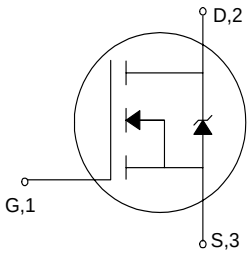
SIEMENS

Preliminary data

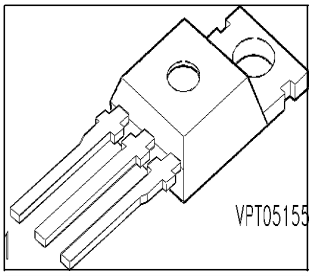
SPP04N60S5
SPB04N60S5

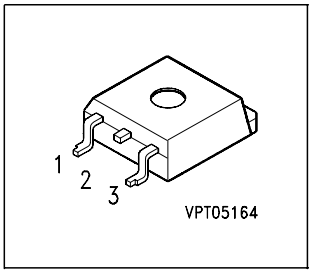
Cool MOS™ Power Transistor

- 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:
  SPPx6N60S5/SPBx6N60S5



COOLMOS
Power Semiconductors





Type	V_{DS}	I_D	$R_{DS(on)}$	Package	Marking	Ordering Code
SPP04N60S5	600 V	4.5 A	0.95 Ω	P-TO220-3-1	04N60S5	Q67040-S4200
SPB04N60S5				P-TO263-3-2	04N60S5	Q67040-S4201

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	 4.5 2.8	A
Pulsed drain current, t_p = 1ms [1)] T_C = 25 °C	$I_{D\ puls}$	7.7	
Avalanche energy, single pulse I_D = 4.5 A, V_{DD} = 50 V, R_{GS} = 25 Ω Periodic avalanche energy E_{AR} only limited by T_{jmax}	E_{AS}	130	mJ
Reverse diode d*v*/d*t* I_S = 4.5 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}	50	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}	-	-	2.5	K/W
Thermal resistance, junction - ambient (Leaded and through-hole packages)	R_{thJA}	-	-	62	
SMD version, device on PCB: @ min. footprint @ 6 cm^2 cooling area [2)]	R_{thJA}	 - -	 - 35	 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 = 200 µA, 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 -	 1 50	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 = 2.8 A	$R_{DS(on)}$	-	0.85	0.95	Ω

[1] current limited by T_{jmax}

[2] Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6 cm2 (one layer, 70µm thick) copper area for drain connection. PCB is vertical without blown air.

Electrical Characteristics

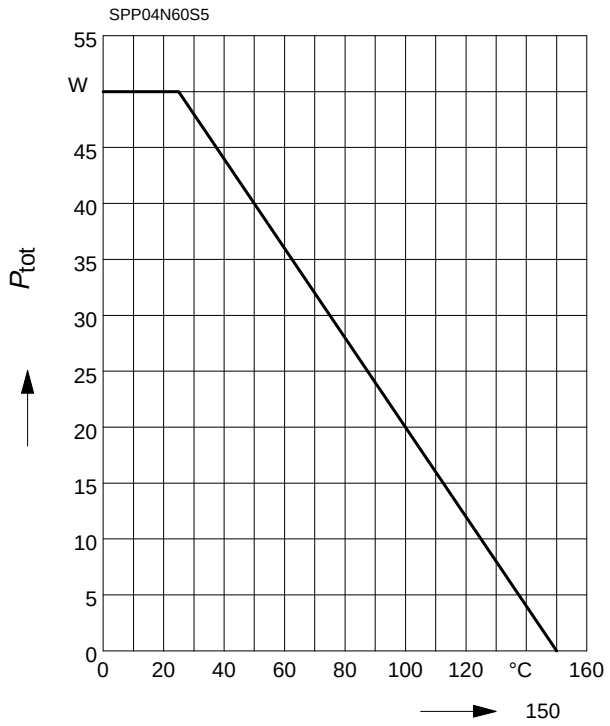
Parameter at T_j = 25 °C, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Transconductance $V_{DS}\geq 2*I_D*R_{DS(on)max}$, I_D = 2.8 A	g_{fs}	-	2.5	-	S
Input capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{iss}	-	600	-	pF
Output capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{oss}	-	325	-	
Reverse transfer capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{rss}	-	15	-	
Turn-on delay time V_{DD} = 350 V, V_{GS} = 10 V, I_D = 4.5 A, R_G = 18 Ω	$t_{d(on)}$	-	40	-	ns
Rise time V_{DD} = 350 V, V_{GS} = 10 V, I_D = 4.5 A, R_G = 18 Ω	t_r	-	20	-	
Turn-off delay time V_{DD} = 350 V, V_{GS} = 10 V, I_D = 4.5 A, R_G = 18 Ω	$t_{d(off)}$	-	60	-	
Fall time V_{DD} = 350 V, V_{GS} = 10 V, I_D = 4.5 A, R_G = 18 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-source charge I_D = 4.5 A, V_{DD} = 350 V	Q_{gs}	-	4.1	-	nC
Gate-drain charge I_D = 4.5 A, V_{DD} = 350 V	Q_{gd}	-	9.2	-	
Total gate charge V_{DD} = 350 V, I_D = 4.5 A, V_{GS} = 0 to 10 V	Q_g	-	17	-	
Reverse Diode					
Inverse diode continuous forward current T_C = 25 °C	I_S	-	-	4.5	A
Inverse diode direct current,pulsed T_C = 25 °C	I_{SM}	-	-	7.7	
Inverse diode forward voltage V_{GS} = 0 V, I_F = 4.5 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}	-	900	-	ns
Reverse recovery charge V_R = 350 V, I_F=I_S , di_F/dt = 100 A/µs	Q_{rr}	-	3.2	-	µC

Power Dissipation

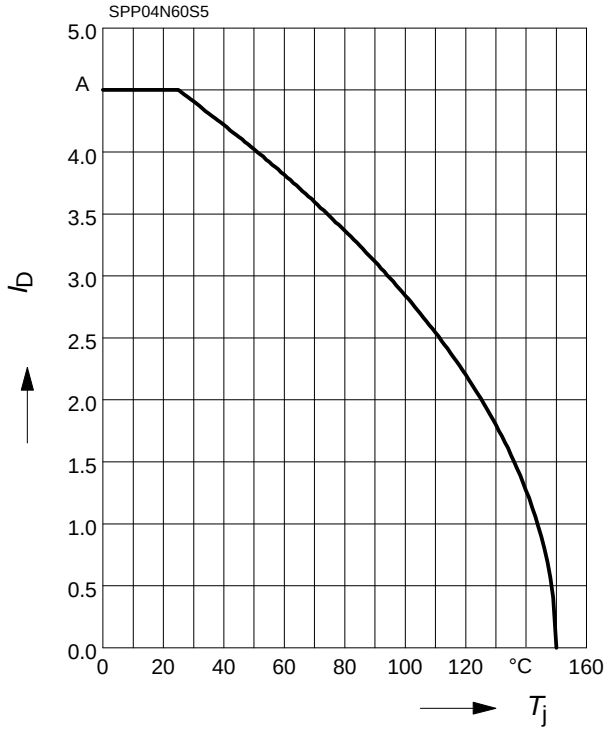
$P_{tot} = f(T_C)$



Drain current

$I_D = f(T_C)$

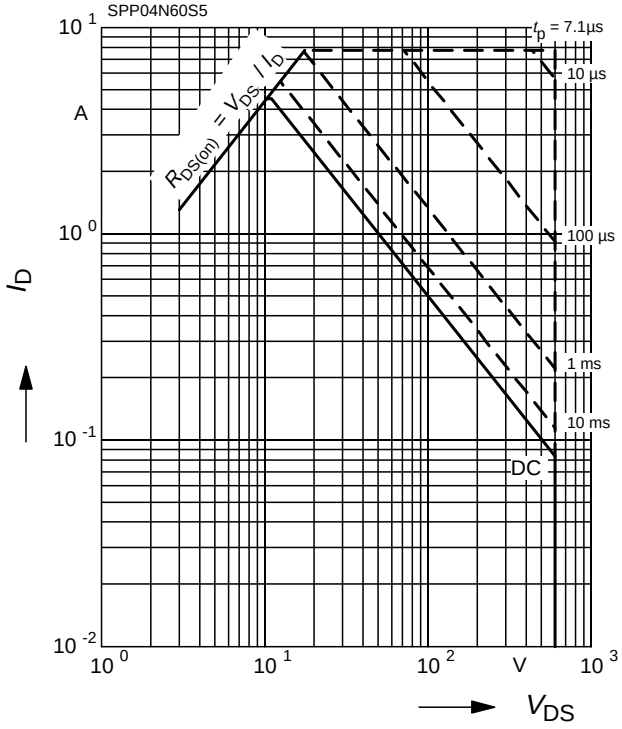
parameter: $V_{GS} \geq 10$ V



Safe operating area

$I_D = f(T_C)$

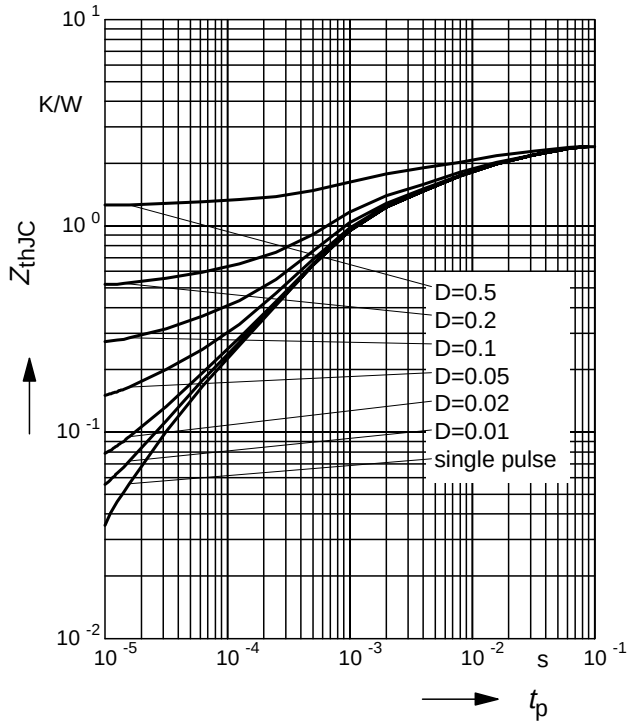
parameter: D=0.01, T_C=25°C



Transient thermal impedance

$Z_{thJC} = f(t_P)$

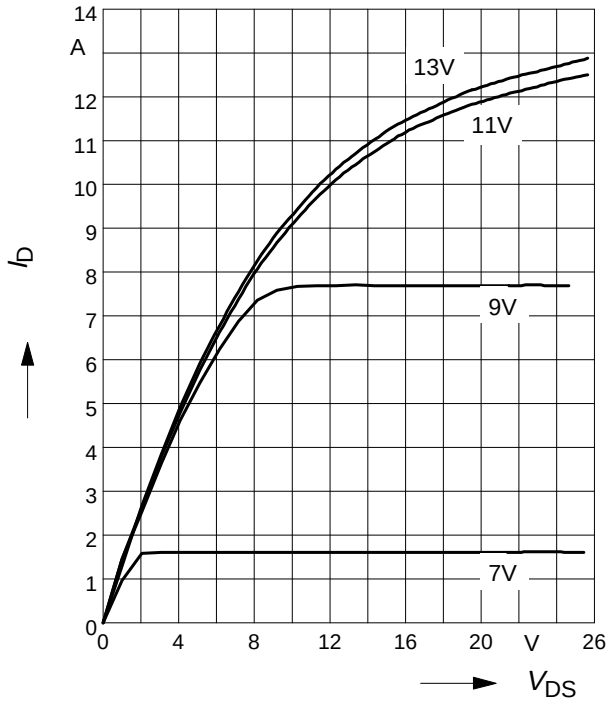
Parameter: D=t_P/T



Typ. output characteristic

$I_D = f(V_{DS})$; T_j=25°C

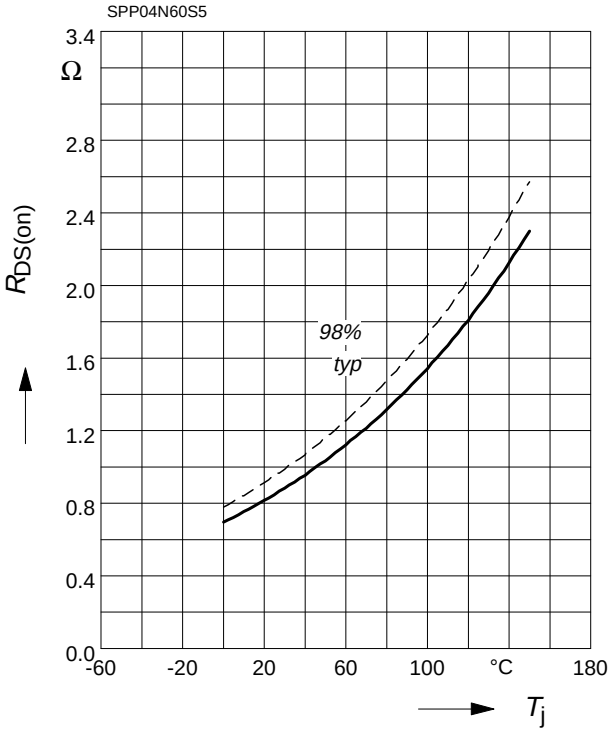
Parameter: V_{GS}



Drain-source on-resistance

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

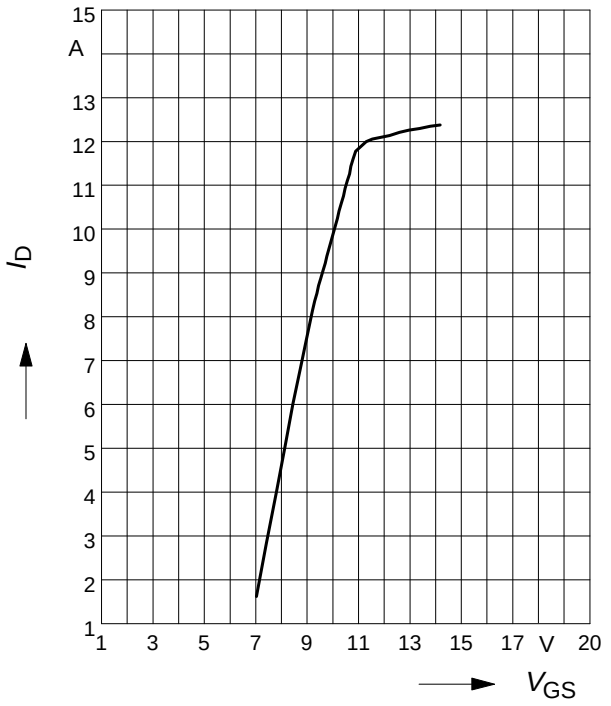
parameter : I_D = 2.8 A, V_{GS} = 10 V



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

parameter: t_p = 80 µs

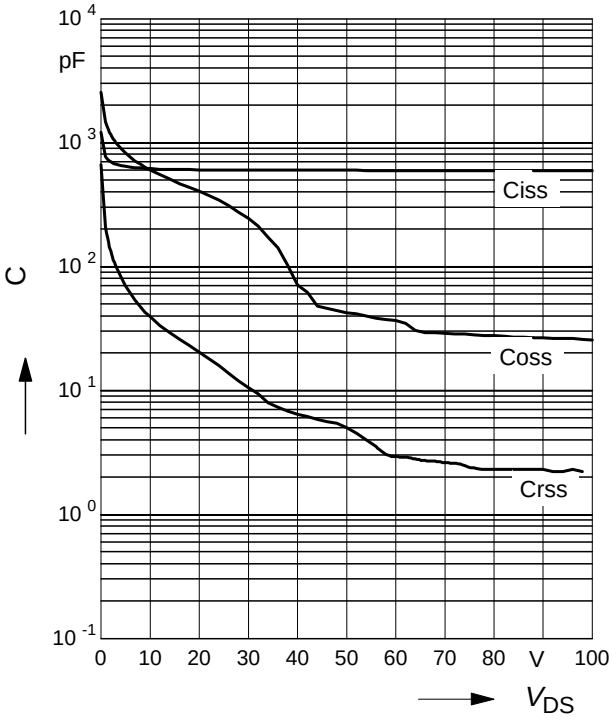
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



Typ. capacitances

$C = f(V_{DS})$

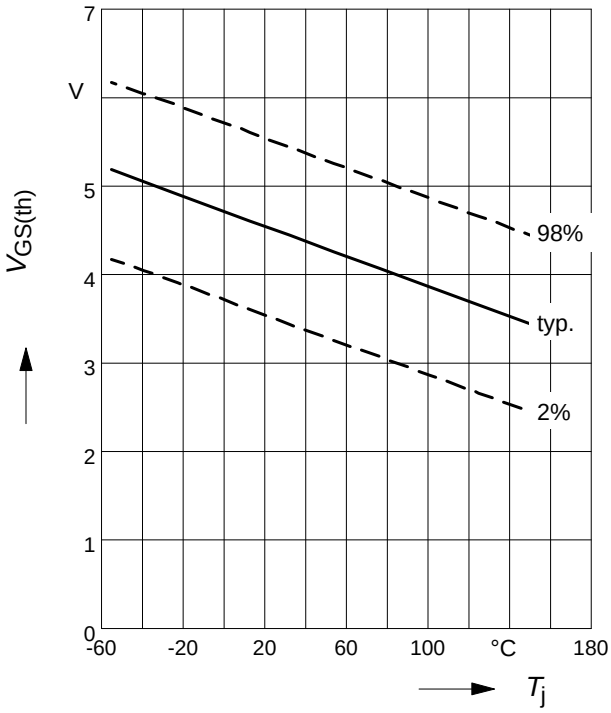
Parameter: V_{GS}=0 V, f=1 MHz



Gate threshold voltage

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

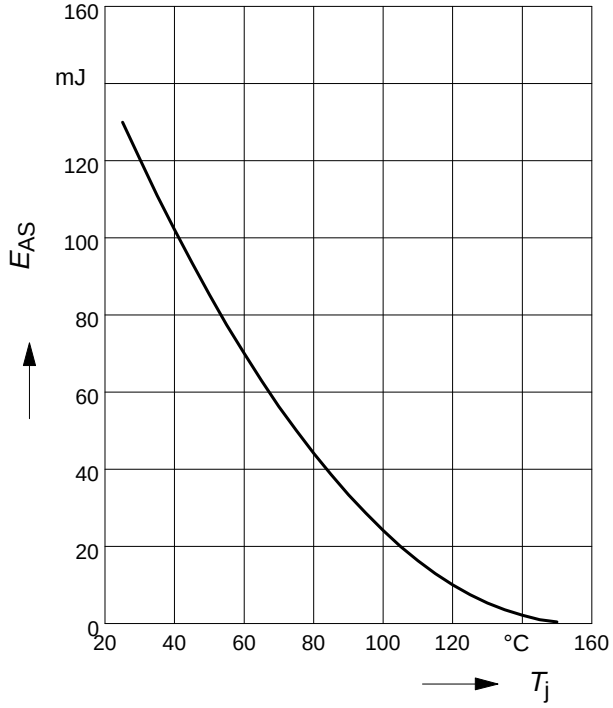
parameter: $V_{GS} = V_{DS}$, I_D = 200 µA



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

parameter: I_D = 4.5 A, V_{DD} = 50 V

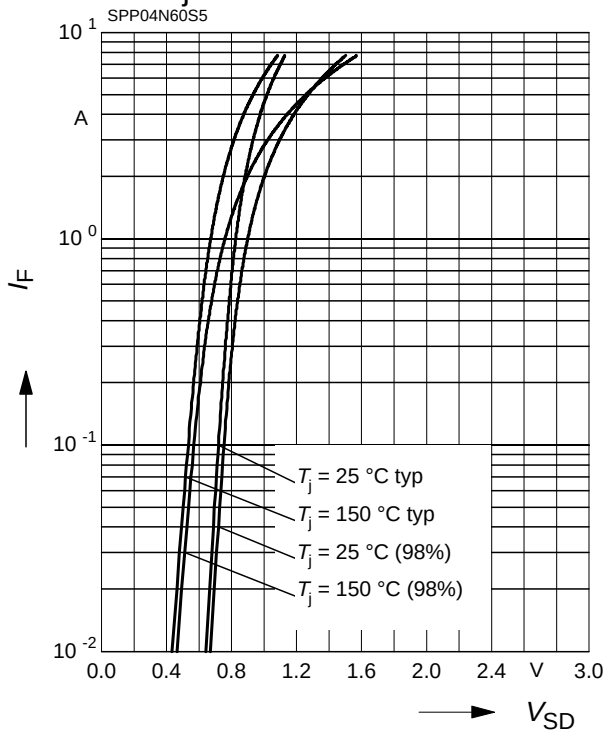
R_{GS} = 25 Ω



Forward characteristics of reverse diode

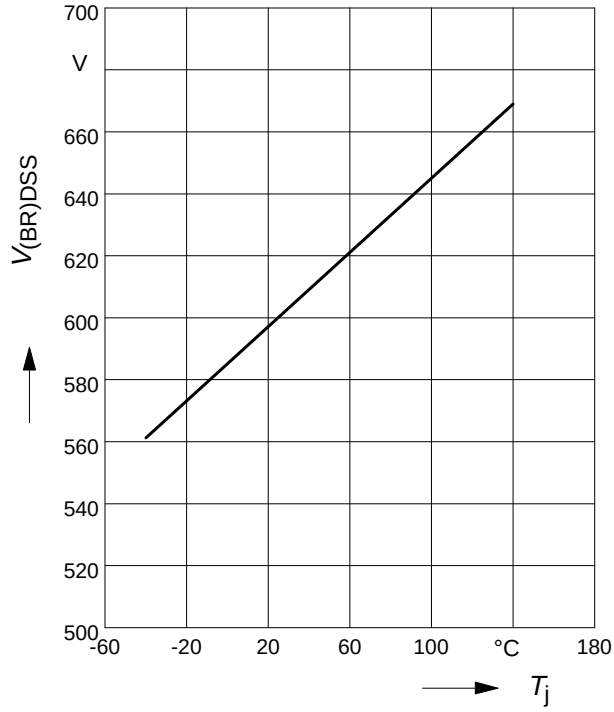
$I_F = f(V_{SD})$

parameter: T_j , tp = 80 µs



Drain-source break down voltage

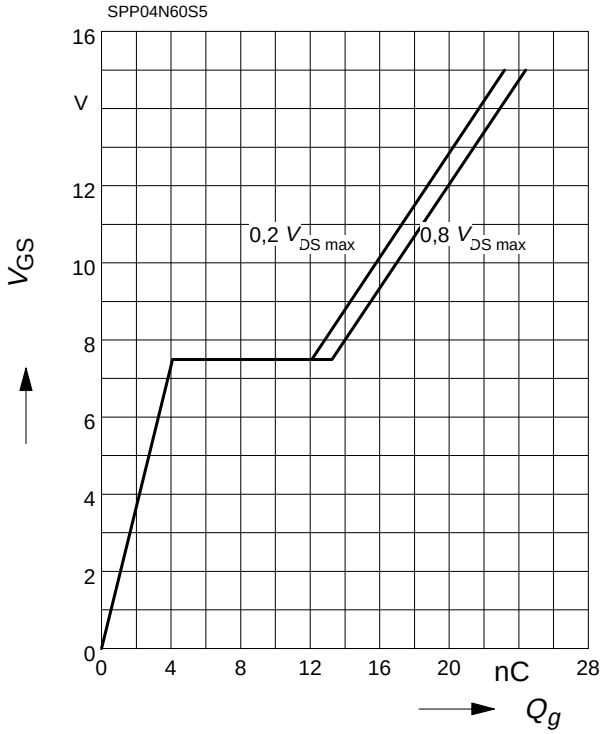
$V_{(BR)DSS} = f(T_j)$



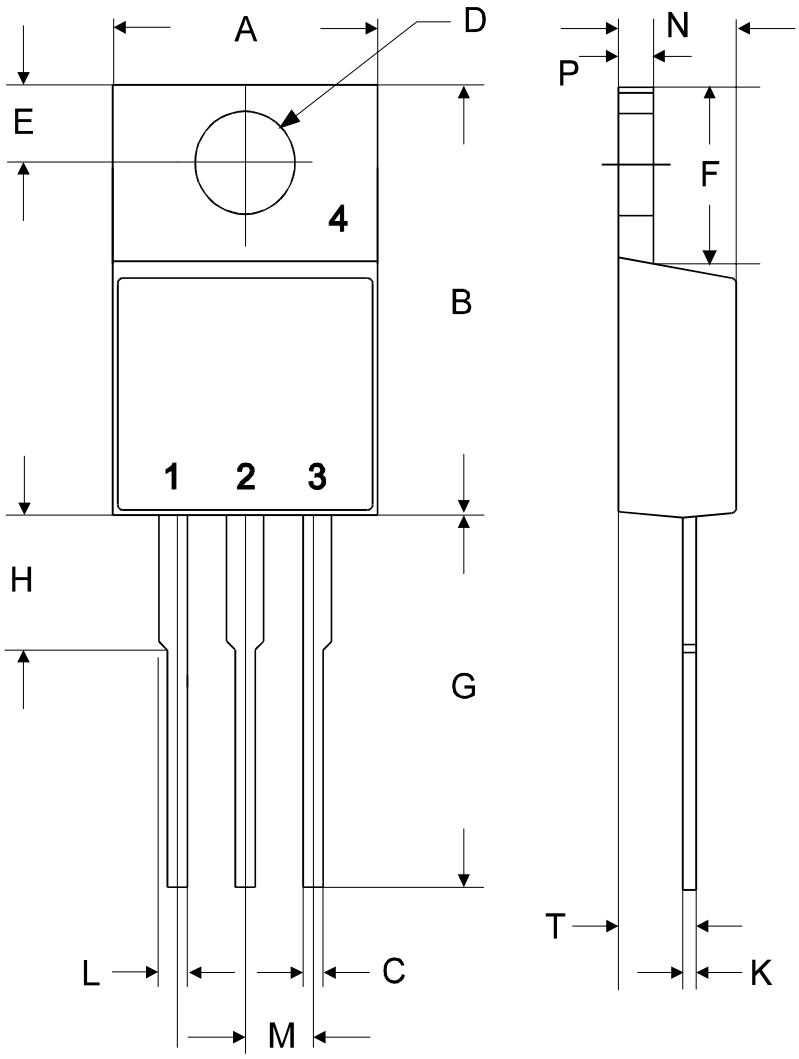
Typ. gate charge

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

parameter: I_{Dpuls} = 4.5 A

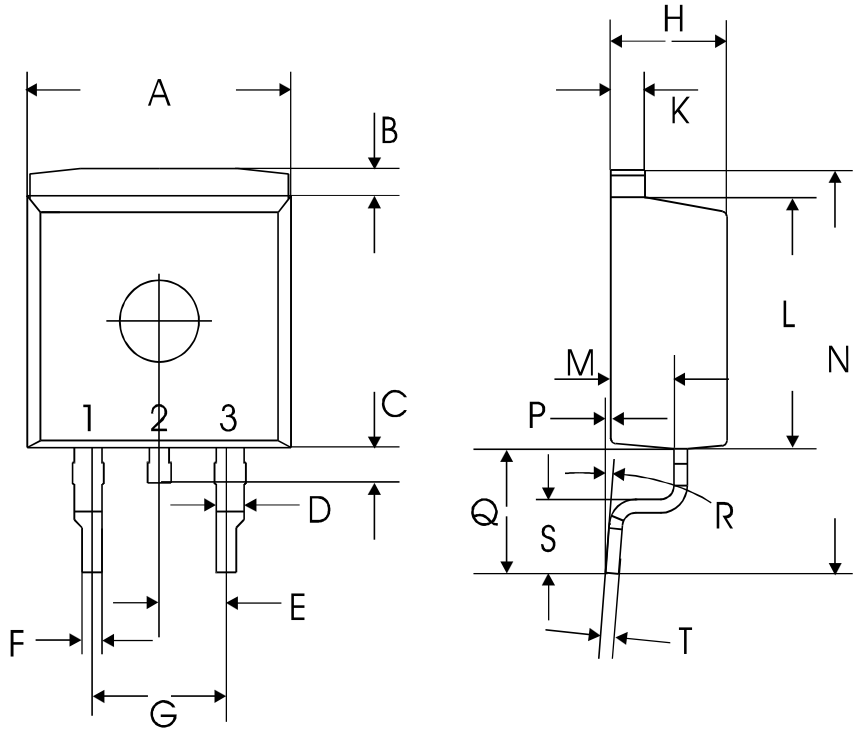


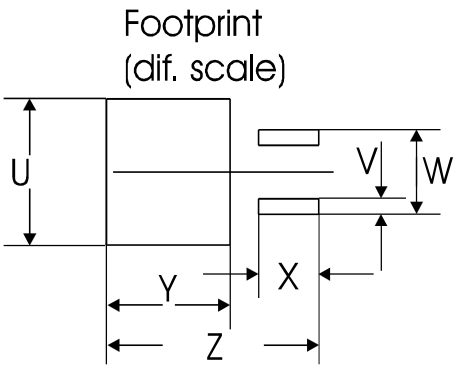
P-TO220-3-1



	dimensions	
	[mm]	
symbol	min	max
A	9.70	10.30
B	14.88	15.95
C	0.65	0.86
D	3.55	3.89
E	2.60	3.00
F	6.00	6.80
G	13.00	14.00
H	4.35	4.75
K	0.38	0.65
L	0.95	1.32
M	2.54 typ.	
N	4.30	4.50
P	1.17	1.40
T	2.30	2.72

P-TO263-3-2





	dimensions	
	[mm]	
symbol	min	max
A	9.80	10.20
B	0.70	1.30
C	1.00	1.60
D	1.03	1.07
E	2.54 typ.	
F	0.65	0.85
G	5.08 typ.	
H	4.30	4.50
K	1.17	1.37
L	9.05	9.45
M	2.30	2.50
N	15 typ.	
P	0.00	0.20
Q	4.20	5.20
R	8° max	
S	2.40	3.00
T	0.40	0.60
U	10.80	
V	1.15	
W	6.23	
X	4.60	
Y	9.40	
Z	16.15	

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