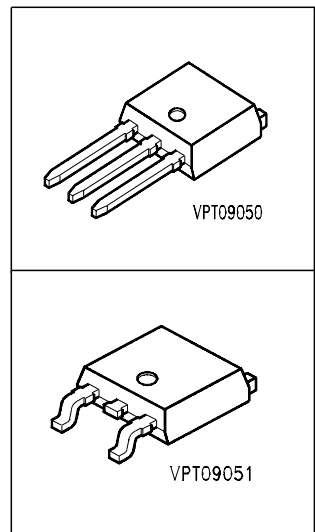
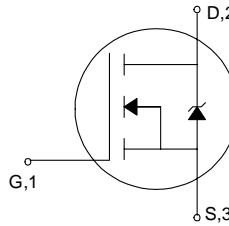


Cool MOS™ Power-Transistor

- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- Optimized capacitances
- Improved noise immunity
- Former development designation:
SPUx7N60S5/SPDx7N60S5



Type	V_{DS}	I_D	$R_{DS(on)}$	Package	Marking	Ordering Code
SPU01N60S5	600 V	0.8 A	6 Ω	P-TO251-3-1	01N60S5	Q67040-S4193
SPD01N60S5				P-TO252	01N60S5	Q67040-S4188

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

Parameter	Symbol	Value	Unit
Continuous drain current $T_C = 25\text{ }^\circ\text{C}$ $T_C = 100\text{ }^\circ\text{C}$	I_D	0.8 0.5	A
Pulsed drain current, $t_p = 1\text{ ms}^1)$ $T_C = 25\text{ }^\circ\text{C}$	$I_{D\text{ puls}}$	1.6	
Avalanche energy, single pulse $I_D = 0.8\text{ A}$, $V_{DD} = 50\text{ V}$, $R_{GS} = 25\text{ }\Omega$ Periodic avalanche energy E_{AR} only limited by T_{jmax}	E_{AS}	20	mJ
Reverse diode dv/dt $I_S = 0.8\text{ A}$, $V_{DS} < V_{DSS}$, $di/dt = 100\text{ A}/\mu\text{s}$, $T_{jmax} = 150\text{ }^\circ\text{C}$	dv/dt	6	kV/ μs
Gate source voltage	V_{GS}	± 20	V
Power dissipation $T_C = 25\text{ }^\circ\text{C}$	P_{tot}	11	W
Operating and storage temperature	T_j, T_{stg}	-55 ... +150	$^\circ\text{C}$

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Thermal Characteristics

Thermal resistance, junction - case	R_{thJC}	-	-	11	K/W
Thermal resistance, junction - ambient (Leaded and through-hole packages)	R_{thJA}	-	-	75	
SMD version, device on PCB: @ min. footprint @ 6 cm ² cooling area ²⁾	R_{thJA}	-	-	75 50	

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

Drain- source breakdown voltage $V_{GS} = 0\text{ V}$, $I_D = 0.25\text{ mA}$	$V_{(BR)DSS}$	600	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 250\text{ }\mu\text{A}$, $T_j = 25\text{ °C}$	$V_{GS(th)}$	2.3	3	3.7	
Zero gate voltage drain current, $V_{DS}=V_{DSS}$ $V_{GS} = 0\text{ V}$, $T_j = 25\text{ °C}$ $V_{GS} = 0\text{ V}$, $T_j = 150\text{ °C}$	I_{DSS}	-	0.5	1 50	μA
Gate-source leakage current $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	-	-	100	nA
Drain-Source on-state resistance $V_{GS} = 10\text{ V}$, $I_D = 0.5\text{ A}$	$R_{DS(on)}$	-	5.6	6	Ω

¹current limited by T_{jmax}

² Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm thick) copper area for drain connection. PCB is vertical without blown air.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Transconductance $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 0.5\text{ A}$	g_{fs}	-	0.75	-	S
Input capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{iss}	-	100	-	pF
Output capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{oss}	-	70	-	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{rss}	-	7	-	
Turn-on delay time $V_{DD} = 350\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 0.8\text{ A}$, $R_G = 100\ \Omega$	$t_{d(on)}$	-	30	-	ns
Rise time $V_{DD} = 350\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 0.8\text{ A}$, $R_G = 100\ \Omega$	t_r	-	15	-	
Turn-off delay time $V_{DD} = 350\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 0.8\text{ A}$, $R_G = 100\ \Omega$	$t_{d(off)}$	-	60	-	
Fall time $V_{DD} = 350\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 0.8\text{ A}$, $R_G = 100\ \Omega$	t_f	-	20	-	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Gate Charge Characteristics

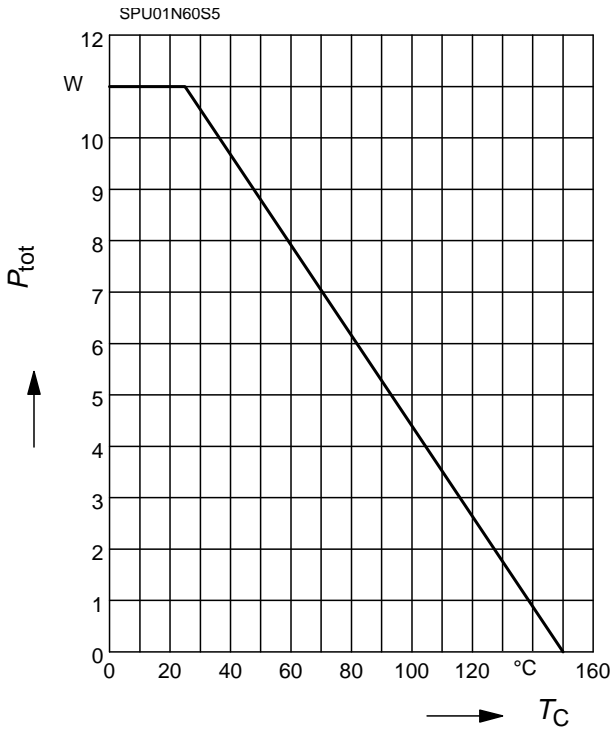
Gate to source charge $V_{DD} = 350\text{ V}$, $I_D = 0.8\text{ A}$	Q_{gs}	-	0.95	-	nC
Gate to drain charge $V_{DD} = 350\text{ V}$, $I_D = 0.8\text{ A}$	Q_{gd}	-	1.5	-	
Total gate charge $V_{DD} = 350\text{ V}$, $I_D = 0.8\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$	Q_g	-	2.9	-	

Reverse Diode

Inverse diode continuous forward current $T_C = 25\text{ °C}$	I_S	-	-	0.8	A
Inverse diode direct current, pulsed $T_C = 25\text{ °C}$	I_{SM}	-	-	1.6	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$, $I_F = 0.8\text{ A}$	V_{SD}	-	1	1.2	V
Reverse recovery time $V_R = 100\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	t_{rr}	-	570	-	ns
Reverse recovery charge $V_R = 100\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	Q_{rr}	-	0.75	-	μC

Power Dissipation

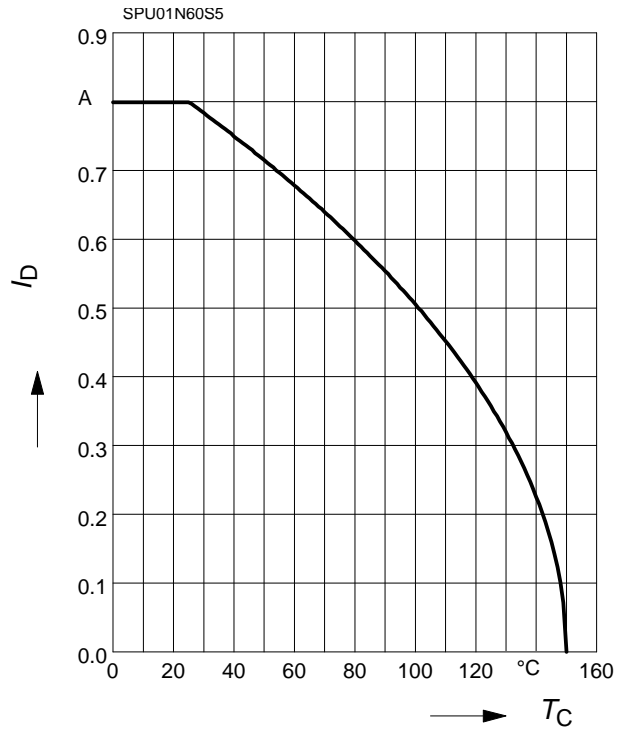
$$P_{\text{tot}} = f(T_C)$$



Drain current

$$I_D = f(T_C)$$

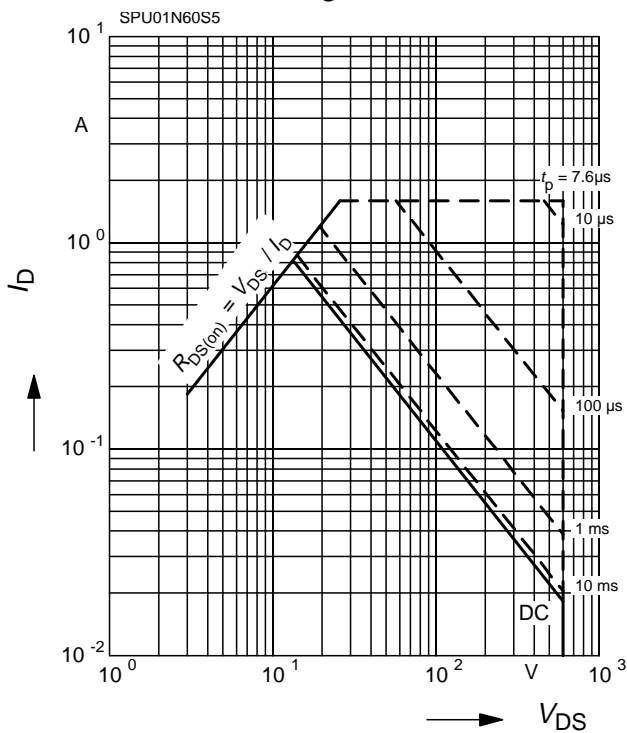
parameter: $V_{GS} \geq 10 \text{ V}$



Safe operating area

$$I_D = f(V_{DS})$$

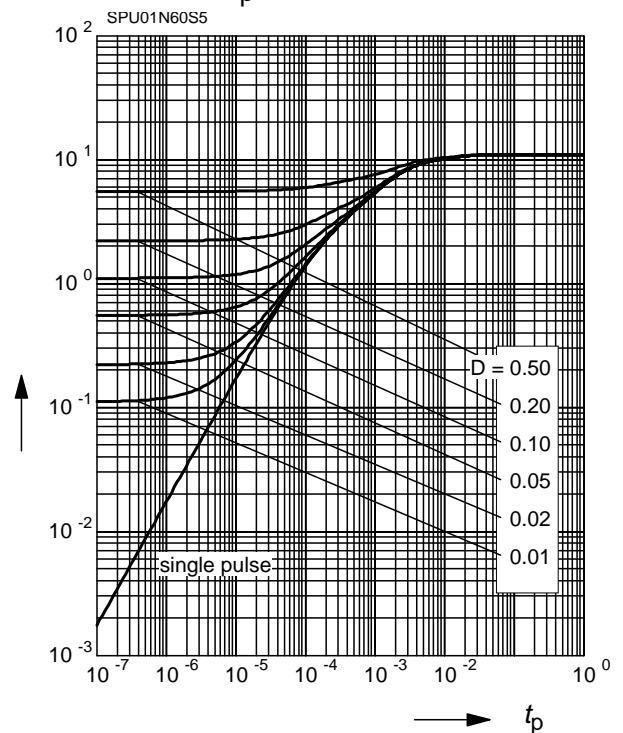
parameter: $D=0.01, T_C=25^\circ\text{C}$



Transient thermal impedance

$$Z_{\text{thJC}} = f(t_p)$$

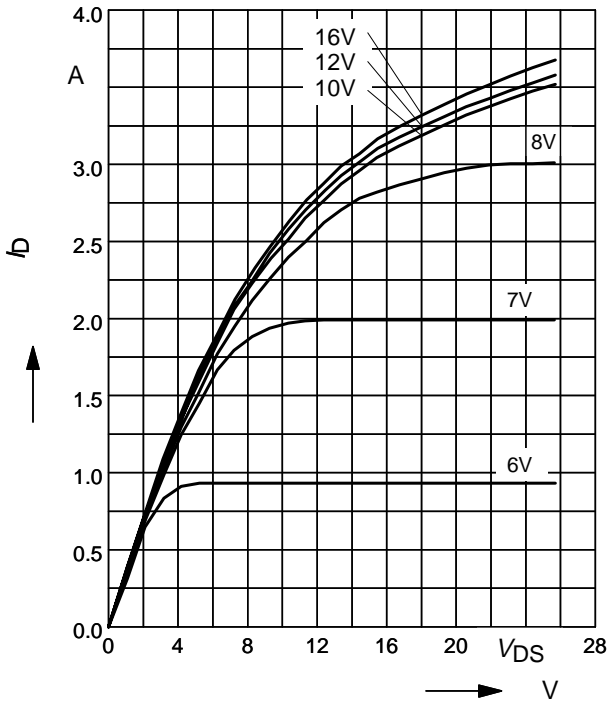
parameter: $D = t_p/T$



Typ. output characteristic

$I_D = f(V_{DS})$

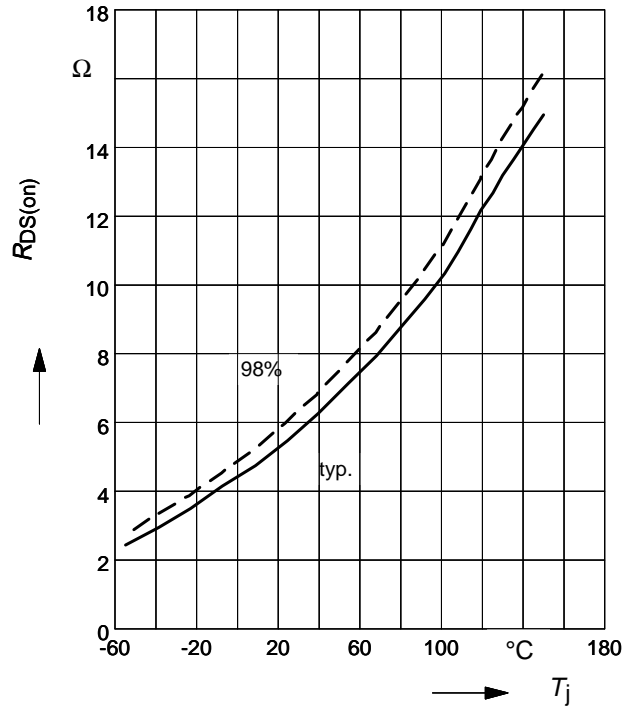
Parameter: $V_{GS}, T_j = 25\text{ }^\circ\text{C}$



Drain-source on-resistance

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

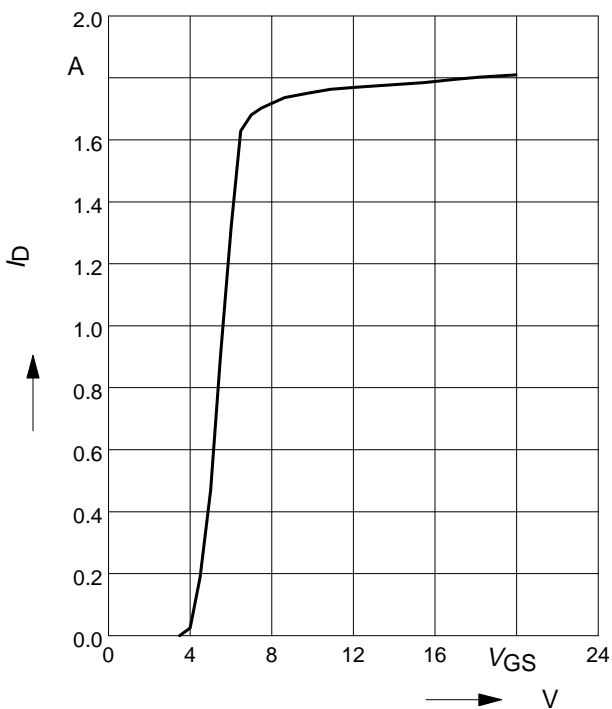
parameter : $I_D = 0.5\text{ A}, V_{GS} = 10\text{ V}$



Typ. transfer characteristics

$I_D = f(V_{GS})$

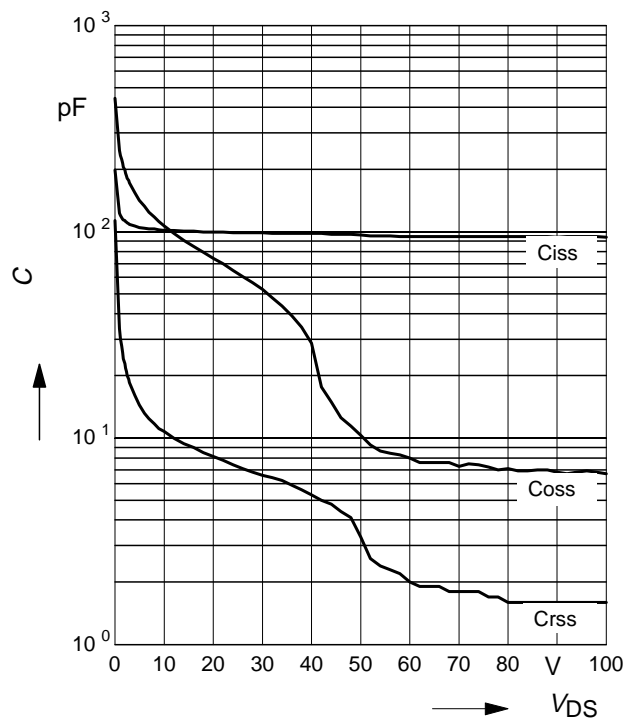
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



Typ. capacitances

$C = f(V_{DS})$

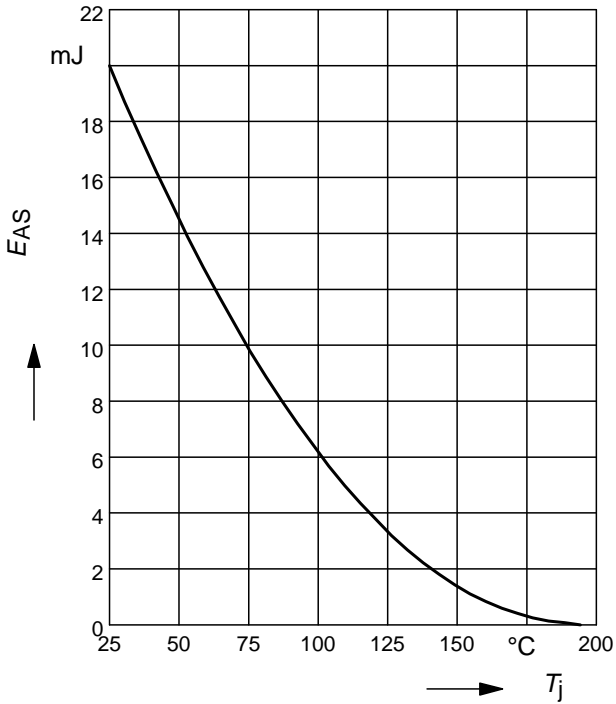
parameter: $V_{GS} = 0\text{ V}, f = 1\text{ MHz}$



Avalanche Energy

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

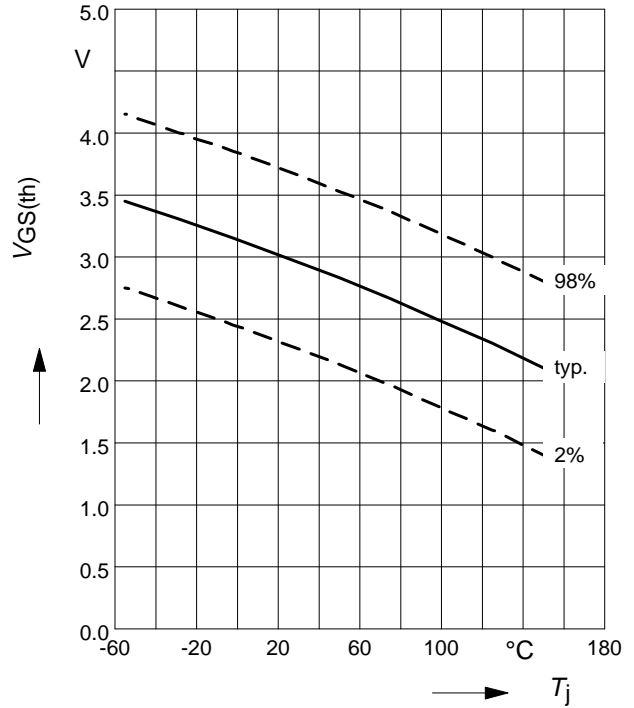
par.: $I_D = 0.8 \text{ A}$, $V_{DD} = 50 \text{ V}$, $R_{GS} = 25 \Omega$



Gate threshold voltage

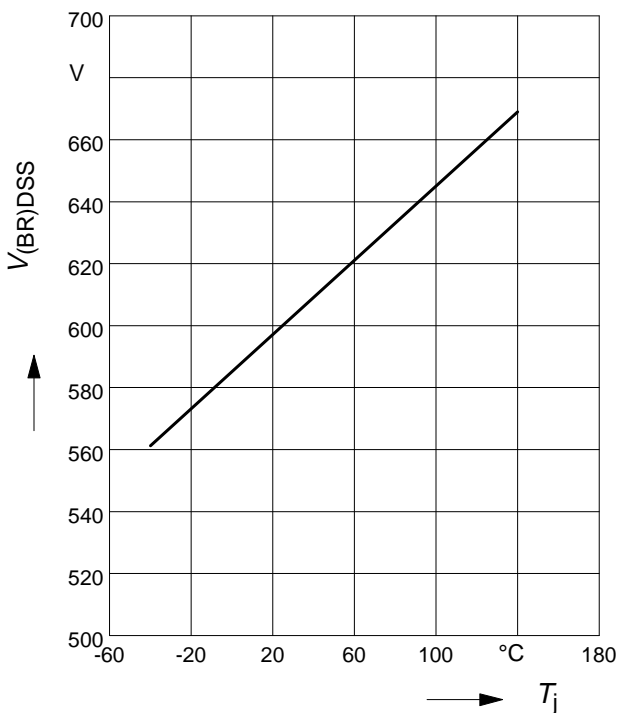
$$V_{GS(th)} = f(T_j)$$

parameter: $V_{GS} = V_{GS}$, $I_D = 250 \mu\text{A}$



Drain-source break down voltage

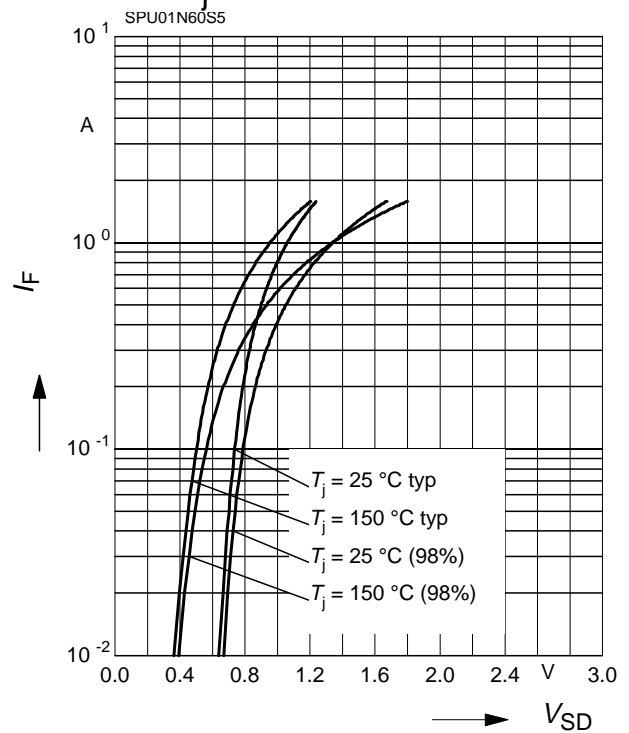
$$V_{(BR)DSS} = f(T_j)$$



Forward characteristics of reverse diode

$$I_F = f(V_{SD})$$

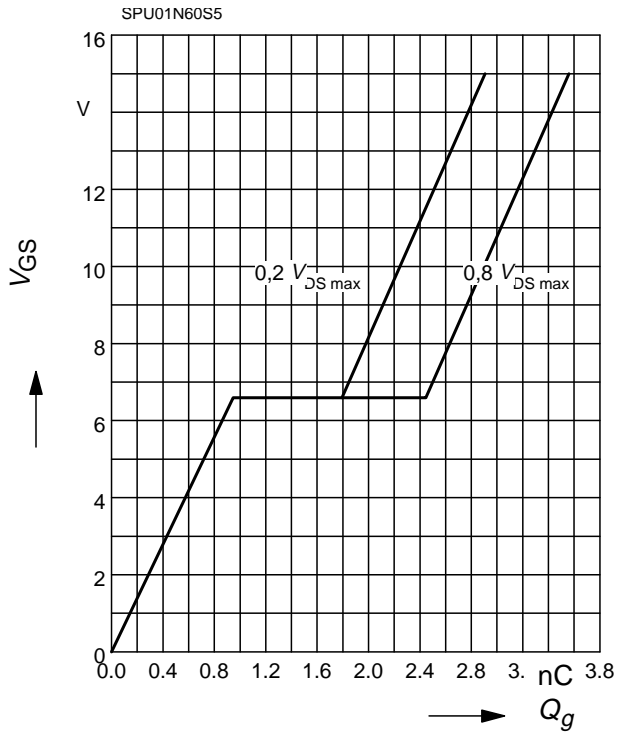
parameter: T_j , $t_p = 80 \mu\text{s}$



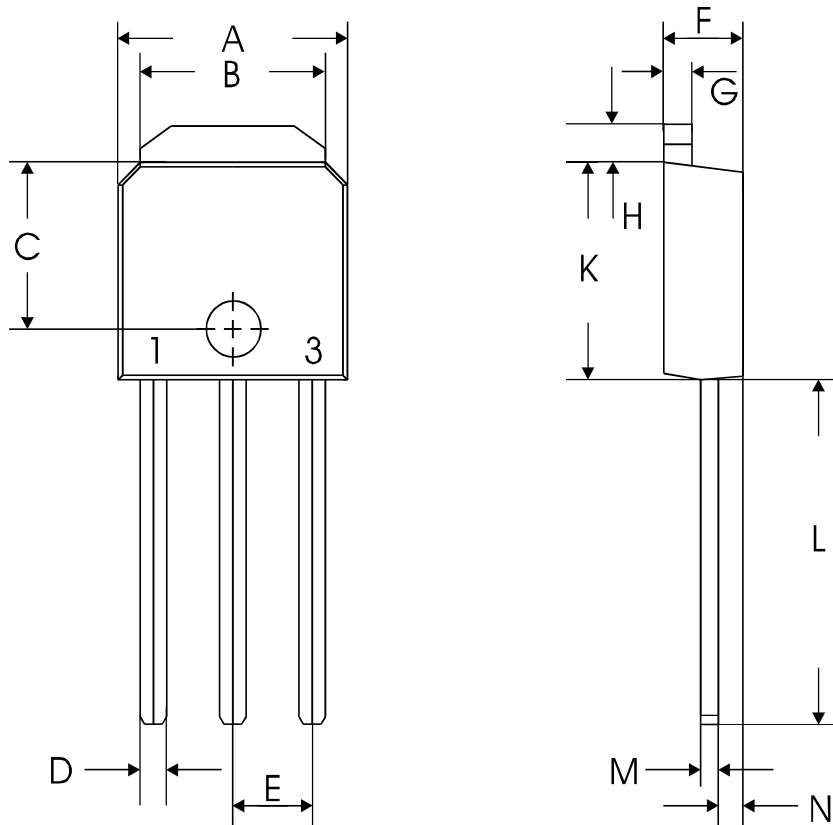
Typ. gate charge

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

parameter: $I_D = 0.8 \text{ A}$ pulsed

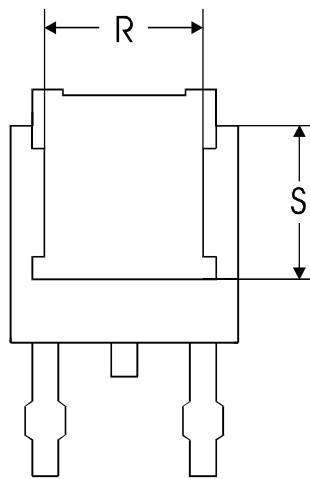
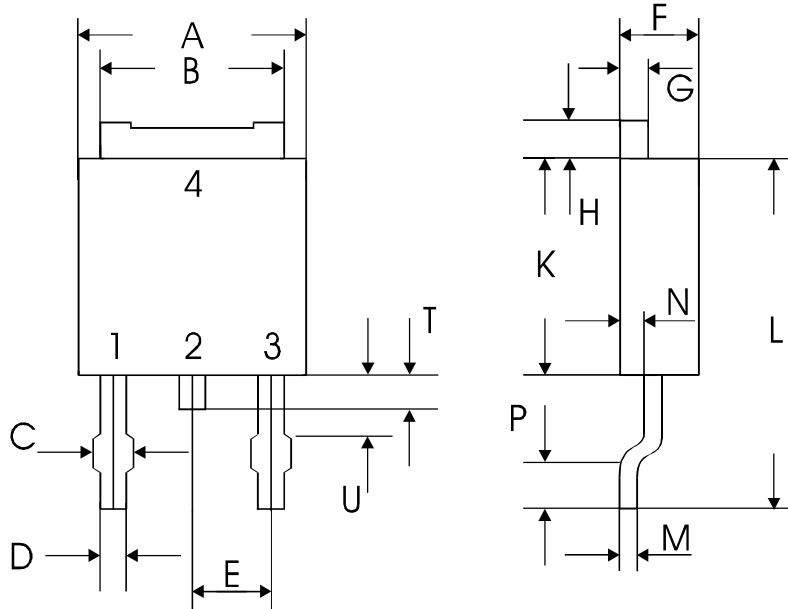


P-TO251-3-1



symbol	dimensions [mm]	
	min	max
A	6.47	6.73
B	5.25	5.41
C	4.19	4.43
D	0.63	0.89
E	2.29 typ.	
F	2.18	2.39
G	0.76	0.86
H	1.01	1.11
K	5.97	6.23
L	9.14	9.65
M	0.46	0.56
N	0.98	1.15

P-TO252



BACK VIEW

symbol	dimensions [mm]	
	min	max
A	6.40	6.73
B	5.25	5.50
C	(0.65)	(1.15)
D	0.63	0.89
E	2.28	
F	2.19	2.39
G	0.76	0.98
H	0.90	1.21
K	5.97	6.23
L	9.40	10.40
M	0.46	0.58
N	0.87	1.15
P	0.51	-
R	5.00	-
S	4.17	-
T	0.26	1.02
U	-	-

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