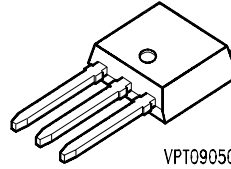
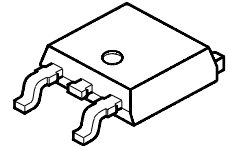


SIPMOS® Power Transistor

- N-Channel
- Enhancement mode
- Avalanche rated



VPT09050



VPT09051

Pin 1	Pin 2	Pin 3
G	D	S

Type	V_{DS}	I_D	$R_{DS(on)}$ @ V_{GS}	Package	Ordering Code
SPD02N60	600 V	2 A	5.5Ω $V_{GS} = 10 V$	P-TO252	Q67040-S4133
SPU02N60				P-TO251	Q67040-S4127-A2

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

Parameter	Symbol	Value	Unit
Continuous drain current $T_C = 25^\circ C$ $T_C = 100^\circ C$	I_D	2 1.3	A
Pulsed drain current $T_C = 25^\circ C$	I_{Dpulse}	8	
Avalanche energy, single pulse $I_D = 2 A$, $V_{DD} = 50 V$, $R_{GS} = 25 \Omega$, $T_j = 25^\circ C$	E_{AS}	135	mJ
Gate source voltage	V_{GS}	± 20	V
Power dissipation $T_C = 25^\circ C$	P_{tot}	55	W
Operating temperature	T_j	-55 ... +150	$^\circ C$
Storage temperature	T_{stg}	-55 ... +150	
IEC climatic category; DIN IEC 68-1		55/150/56	

Electrical Characteristics

Parameter at $T_j = 25\text{ °C}$, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	

Thermal Characteristics

Thermal resistance, junction - case	R_{thJC}	-		2.25	K/W
Thermal resistance, junction - ambient	R_{thJA}	-	100	-	
SMD version, device on PCB: @ min. footprint	R_{thJA}	-	50	-	
@ 6 cm ² cooling area ¹⁾		-	tbid	-	

Static Characteristics

Drain- source breakdown voltage $V_{GS} = 0\text{ V}$, $I_D = 0.25\text{ mA}$	$V_{(BR)DSS}$	600	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 1\text{ mA}$	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current $V_{DS} = 600\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 25\text{ °C}$ $V_{DS} = 600\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 150\text{ °C}$	I_{DSS}	-	0.1	1	μA
		-	-	100	
Gate-source leakage current $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	-	10	100	nA
Drain-Source on-state resistance $V_{GS} = 10\text{ V}$, $I_D = 1.3\text{ A}$	$R_{DS(on)}$	-	4.2	5.5	Ω

¹⁾ Device on 50mm*50mm*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

Parameter at $T_j = 25\text{ }^{\circ}\text{C}$, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Transconductance $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 1.3\text{ A}$	g_{fs}	1	1.8	-	S
Input capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{iss}	-	350	460	pF
Output capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{oss}	-	40	60	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{rss}	-	15	22	
Turn-on delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 1.5\text{ A}$, $R_G = 50\text{ }\Omega$	$t_{d(on)}$	-	10	15	ns
Rise time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 1.5\text{ A}$, $R_G = 50\text{ }\Omega$	t_r	-	25	40	
Turn-off delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 1.5\text{ A}$, $R_G = 50\text{ }\Omega$	$t_{d(off)}$	-	35	50	
Fall time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 1.5\text{ A}$, $R_G = 50\text{ }\Omega$	t_f	-	25	35	

Electrical Characteristics

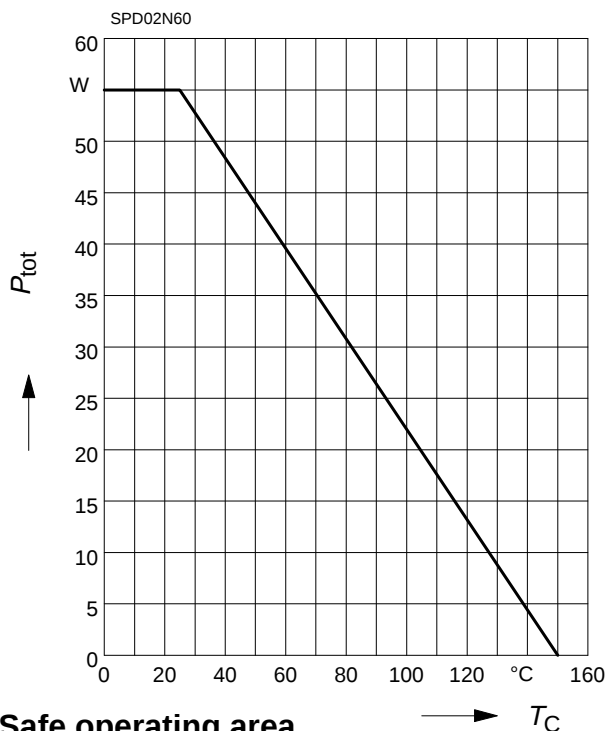
Parameter at $T_j = 25\text{ °C}$, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	

Reverse Diode

Inverse diode continuous forward current $T_C = 25\text{ °C}$	I_S	-	-	2	A
Inverse diode direct current, pulsed $T_C = 25\text{ °C}$	I_{SM}	-	-	8	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$, $I_F = 4\text{ A}$	V_{SD}	-	0.85	1.4	V
Reverse recovery time $V_R = 100\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A/}\mu\text{s}$	t_{rr}	-	300	450	ns
Reverse recovery charge $V_R = 100\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A/}\mu\text{s}$	Q_{rr}	-	2.3	3.45	μC

Power Dissipation

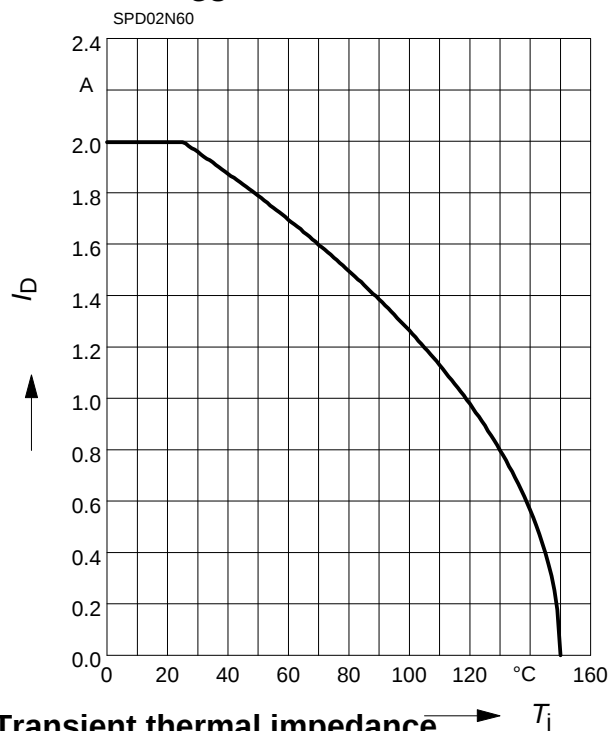
$$P_{\text{tot}} = f(T_C)$$



Drain current

$$I_D = f(T_C)$$

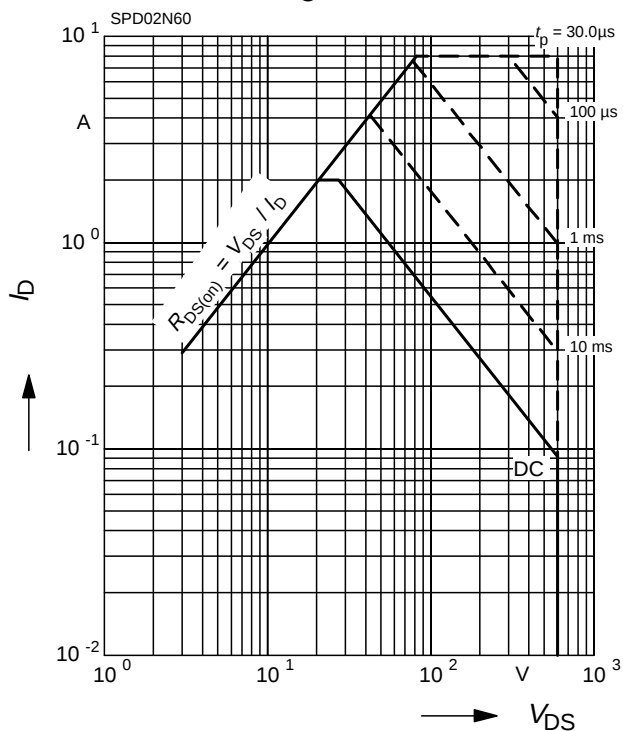
parameter: $V_{GS} \geq 10$ V



Safe operating area

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

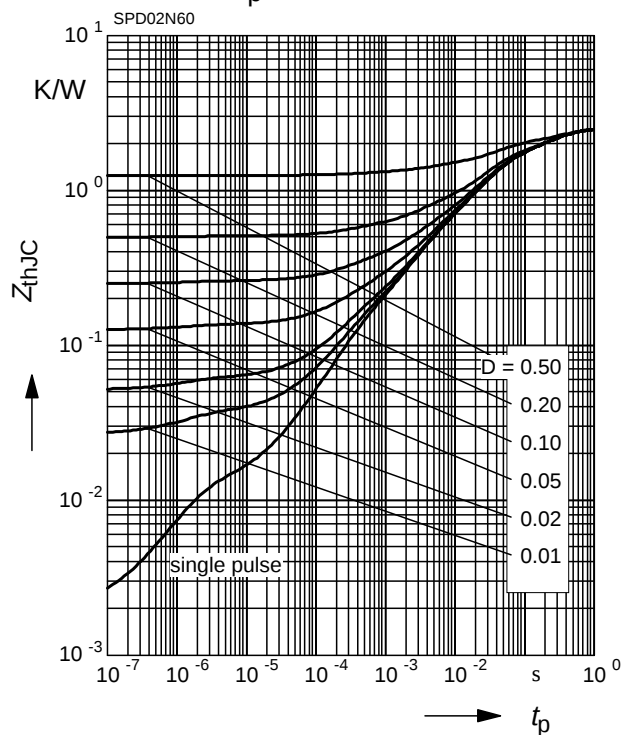
parameter: $D = 0$, $T_C = 25$ °C



Transient thermal impedance

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

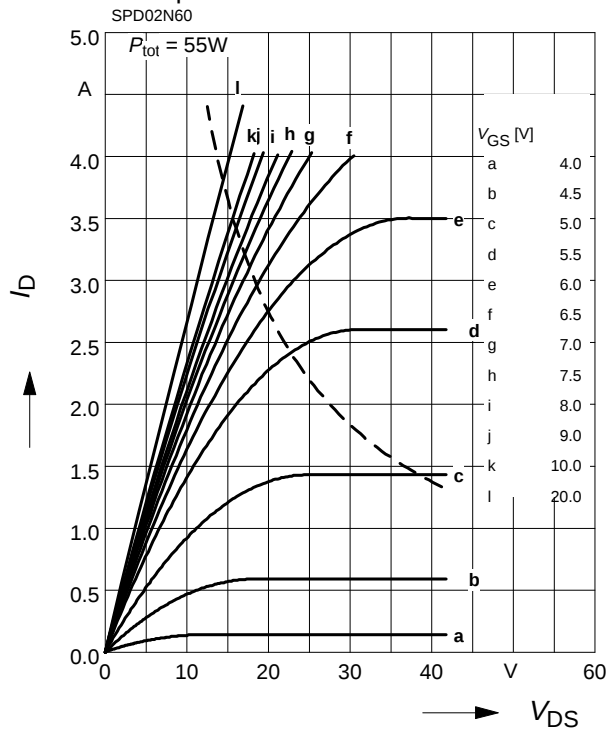
parameter: $D = t_p / T$



Typ. output characteristics

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

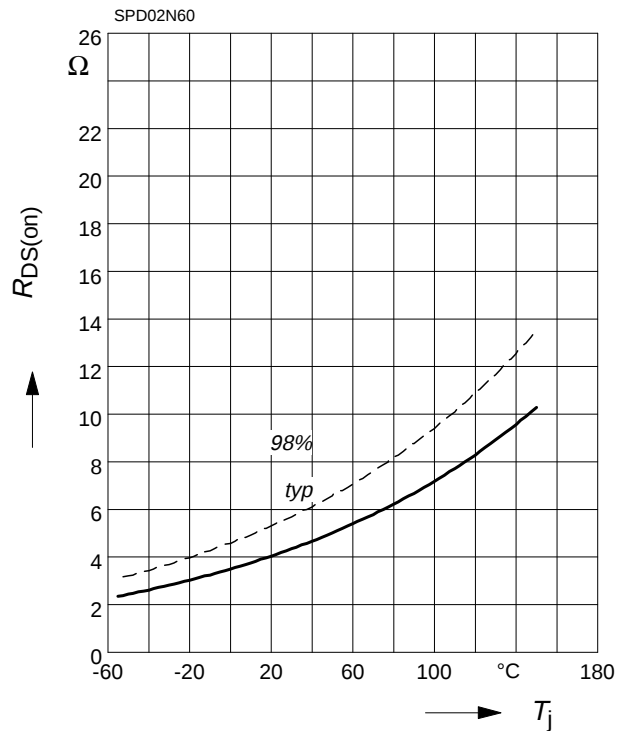
parameter: $t_p = 80 \mu s$



Drain-source on-resistance

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

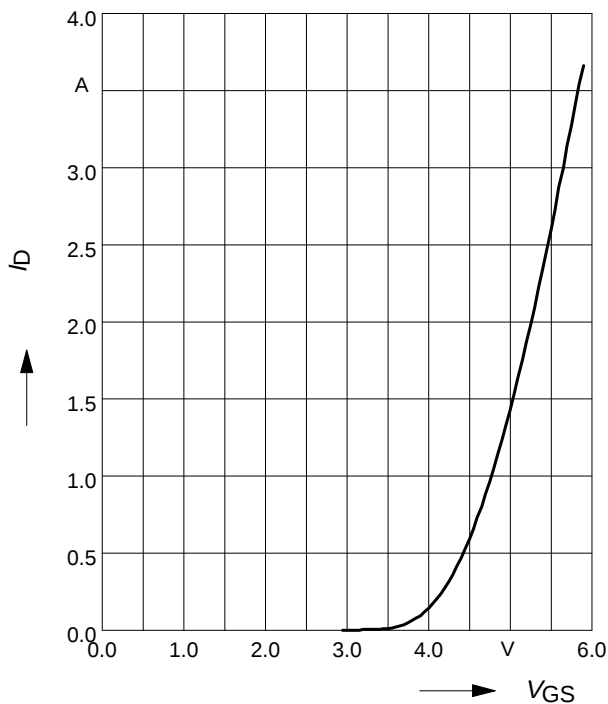
parameter: $I_D = 1.3 A$, $V_{GS} = 10 V$



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

parameter: $t_p = 80 \mu s$

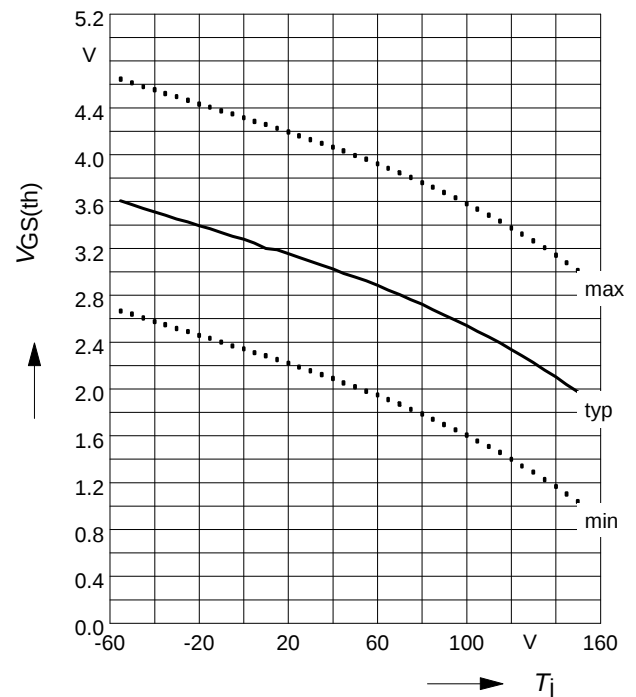
$$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$



Gate threshold voltage

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

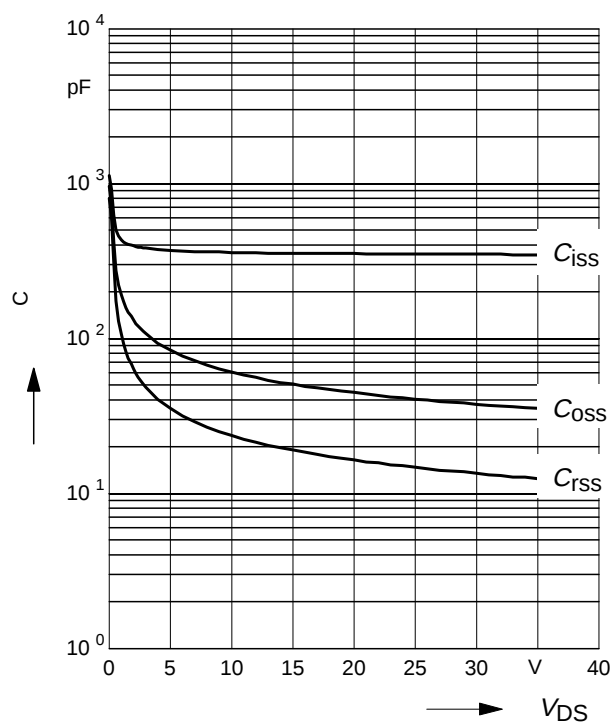
parameter: $V_{GS} = V_{DS}, I_D = 1 \text{ mA}$



Typ. capacitances

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

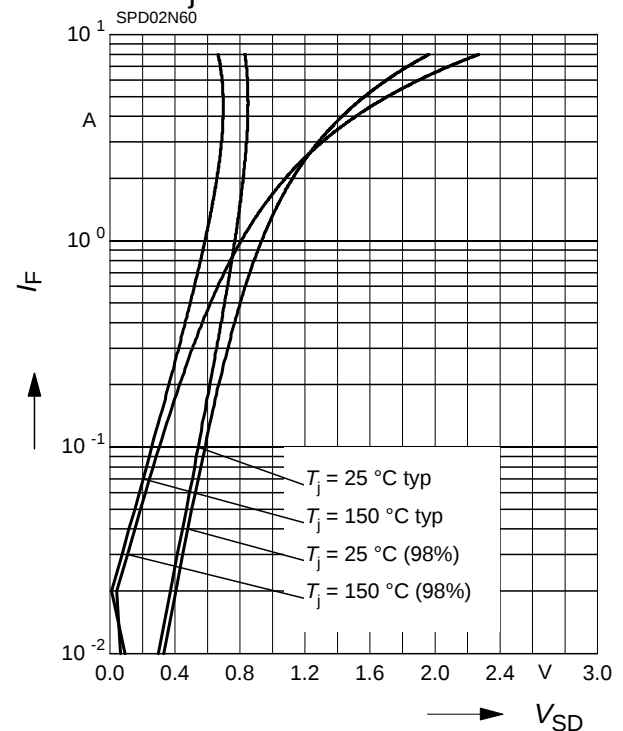
Parameter: $V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$



Forward characteristics of reverse diode

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

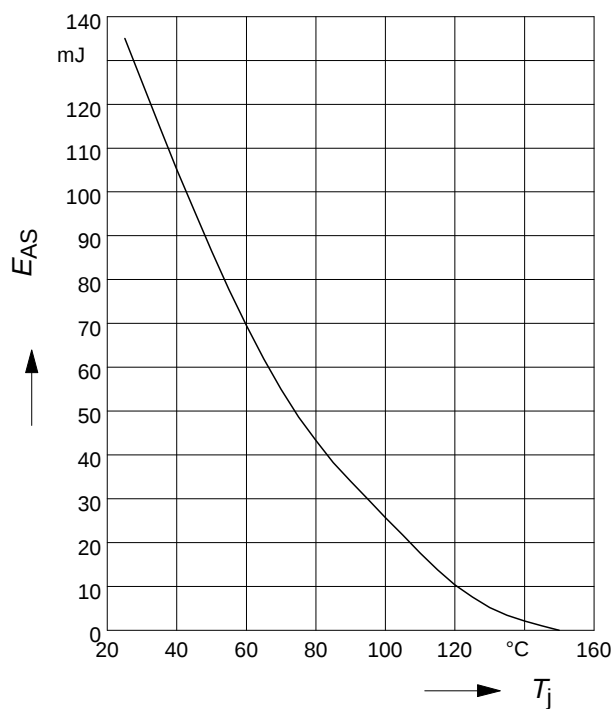
parameter: $T_j, t_p = 80 \mu s$



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

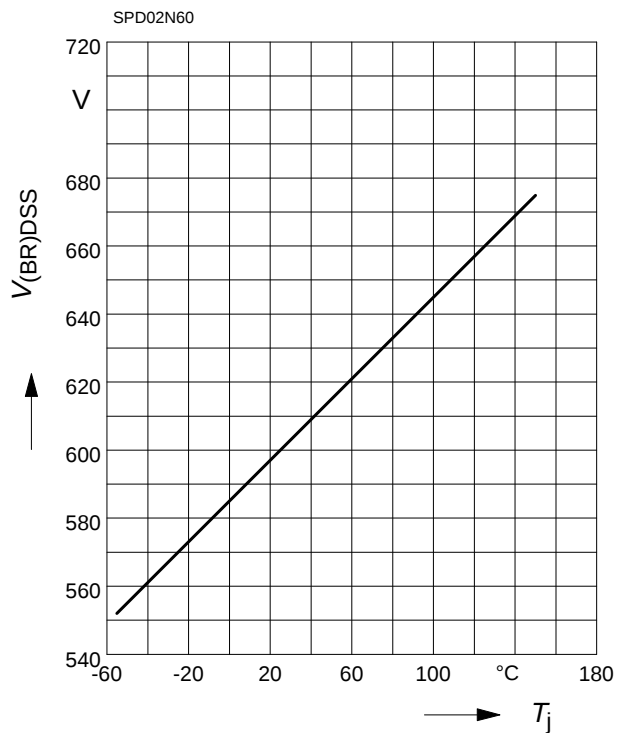
parameter: $I_D = 2 \text{ A}$, $V_{DD} = 50 \text{ V}$

$R_{GS} = 25 \Omega$



Drain-source breakdown voltage $V_{(BR)DSS} = f(T_j)$

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



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