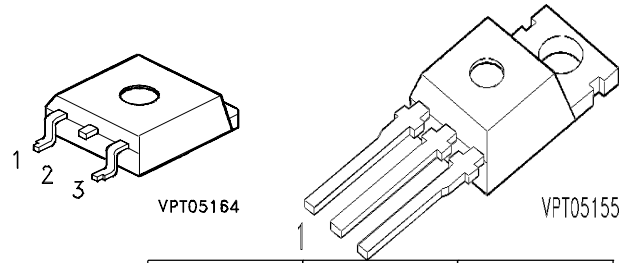


SIPMOS® Power Transistor

- N-Channel
- Enhancement mode
- Avalanche rated
- Logic Level
- dv/dt rated
- 175°C operating temperature



Pin 1	Pin 2	Pin 3
G	D	S

Type	V _{DS}	I _D	R _{DS(on)}	@ V _{GS}	Package	Ordering Code
SPP46N03L	30 V	46 A			P-TO220-3-1	Q67040-S4147-A2
SPB46N03L			0.018 Ω	V _{GS} = 4.5 V	P-TO263-3-2	Q67040-S4743-A3
			0.012 Ω	V _{GS} = 10 V		

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

Parameter	Symbol	Value	Unit
Continuous drain current $T_C = 25\text{ °C}$, limited by bond wire $T_C = 100\text{ °C}$	I_D	46 46	A
Pulsed drain current $T_C = 25\text{ °C}$	$I_{D\text{ puls}}$	184	
Avalanche energy, single pulse $I_D = 46\text{ A}$, $V_{DD} = 25\text{ V}$, $R_{GS} = 25\text{ Ω}$	E_{AS}	250	mJ
Avalanche current, periodic limited by $T_{j\text{max}}$	I_{AR}	46	A
Avalanche energy, periodic limited by $T_{j\text{(max)}}$	E_{AR}	12	mJ
Reverse diode dv/dt $I_S = 46\text{ A}$, $V_{DS} = 24\text{ V}$, $di/dt = 200\text{ A/μs}$, $T_{j\text{max}} = 175\text{ °C}$	dv/dt	6	kV/μs
Gate source voltage	V_{GS}	±14	V
Gate source peak voltage, aperiodic	V_{gs}	±20	
Power dissipation $T_C = 25\text{ °C}$	P_{tot}	120	W
Operating temperature	T_j	-55 ... +175	°C
Storage temperature	T_{stg}	-55 ... +175	
IEC climatic category; DIN IEC 68-1		55/175/56	

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}	-	-	1.25	K/W
Thermal resistance, junction - ambient	R_{thJA}	-	62	-	
SMD version, device on PCB: @ min. footprint @ 6 cm ² cooling area ¹⁾	R_{thJA}	-	tbd	-	

Static Characteristics

Drain- source breakdown voltage $V_{GS} = 0\text{ V}$, $I_D = 0.25\text{ mA}$	$V_{(BR)DSS}$	30	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 80\text{ }\mu\text{A}$, $T_j = 25\text{ °C}$	$V_{GS(th)}$	1.2	1.6	2	
Zero gate voltage drain current $V_{DS} = 30\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 25\text{ °C}$ $V_{DS} = 30\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 150\text{ °C}$	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 $V_{GS} = 4.5\text{ V}$, $I_D = 46\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 46\text{ A}$	$R_{DS(on)}$	-	0.014	0.018	Ω
		-	0.008	0.012	

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 $T_j = 25\text{ °C}$, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Transconductance $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 46\text{ A}$	g_{fs}	20	49	-	S
Input capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{iss}	-	1640	2100	pF
Output capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{oss}	-	650	820	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{rss}	-	280	350	
Turn-on delay time $V_{DD} = 15\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 46\text{ A}$, $R_G = 3.6\text{ }\Omega$	$t_{d(on)}$	-	16	24	ns
Rise time $V_{DD} = 15\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 46\text{ A}$, $R_G = 3.6\text{ }\Omega$	t_r	-	30	45	
Turn-off delay time $V_{DD} = 15\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 46\text{ A}$, $R_G = 3.6\text{ }\Omega$	$t_{d(off)}$	-	20	30	
Fall time $V_{DD} = 15\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 46\text{ A}$, $R_G = 3.6\text{ }\Omega$	t_f	-	25	38	

Electrical Characteristics

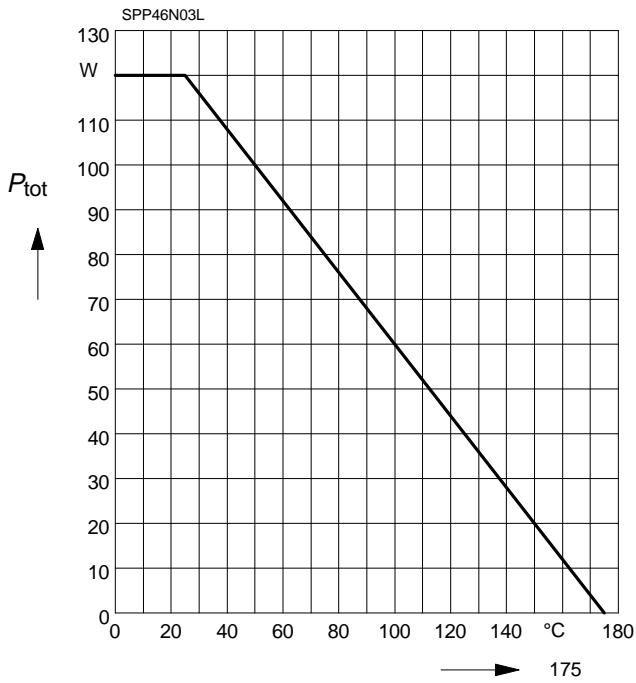
Parameter at $T_j = 25\text{ °C}$, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Gate charge at threshold $V_{DD} = 24\text{ V}$, $I_D \geq 0,1\text{ A}$, $V_{GS} = 0\text{ to }1\text{ V}$	$Q_{G(th)}$	-	1.7	2.6	nC
Gate charge at $V_{GS}=5\text{V}$ $V_{DD} = 24\text{ V}$, $I_D = 46\text{ A}$, $V_{GS} = 0\text{ to }5\text{ V}$	$Q_{g(5)}$	-	32	50	
Gate charge total $V_{DD} = 24\text{ V}$, $I_D = 46\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$	Q_g	-	54	80	nC
Gate plateau voltage $V_{DD} = 24\text{ V}$, $I_D = 46\text{ A}$	$V_{(plateau)}$	-	3.83	-	V

Reverse Diode

Inverse diode continuous forward current $T_C = 25\text{ °C}$	I_S	-	-	46	A
Inverse diode direct current,pulsed $T_C = 25\text{ °C}$	I_{SM}	-	-	184	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$, $I_F = 92\text{ A}$	V_{SD}	-	1.1	1.7	V
Reverse recovery time $V_R = 15\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	t_{rr}	-	50	75	ns
Reverse recovery charge $V_R = 15\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	Q_{rr}	-	0.06	0.09	μC

Power Dissipation

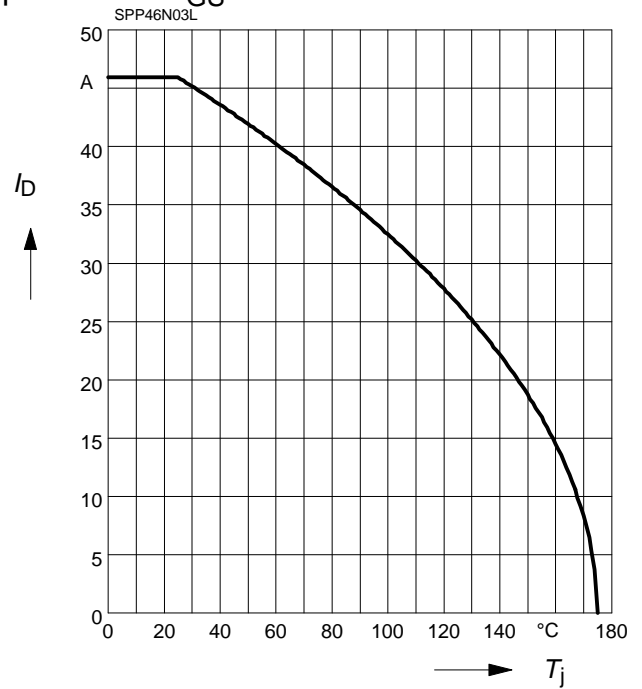
$$P_{\text{tot}} = f(T_C)$$



Drain current

$$I_D = f(T_C)$$

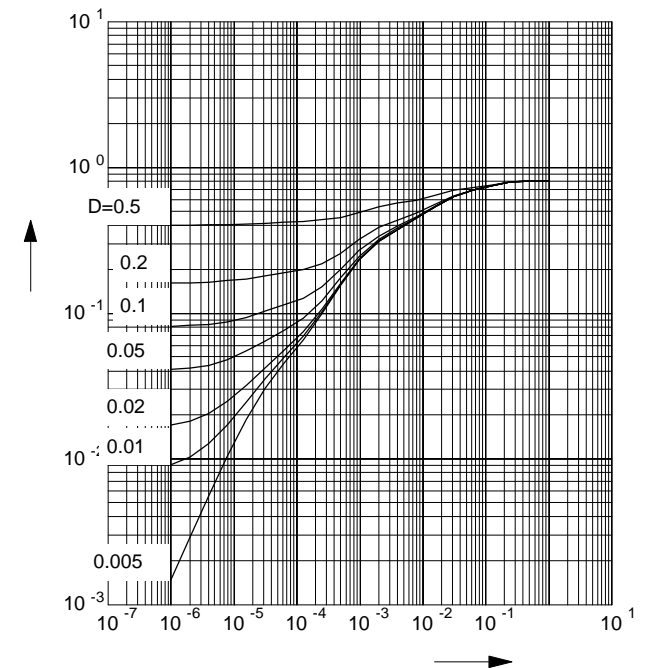
parameter: $V_{GS} \geq 10 \text{ V}$



Transient thermal impedance

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

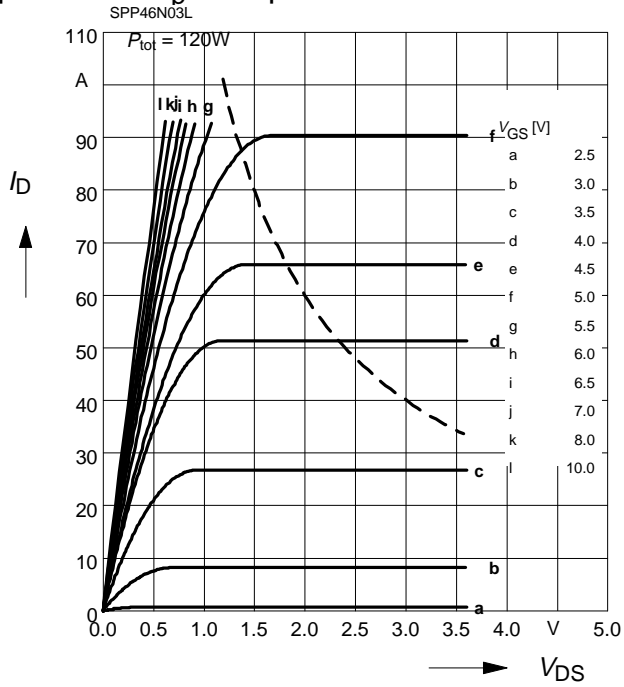
parameter: $D = t_p/T$



Typ. output characteristics

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

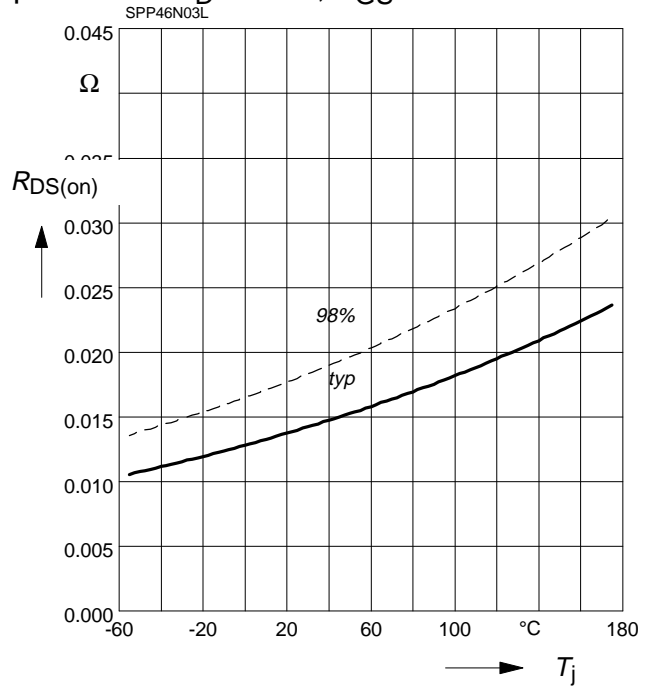
parameter: $t_D = 80 \mu s$



Drain-source on-resistance

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

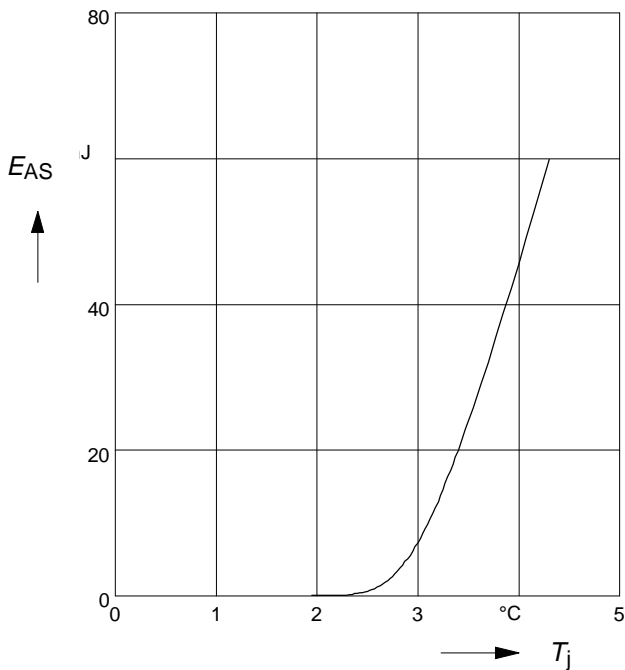
parameter: $I_D = 46 A, V_{GS} = 4.5 V$



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

parameter: $t_p = 80 \mu s$

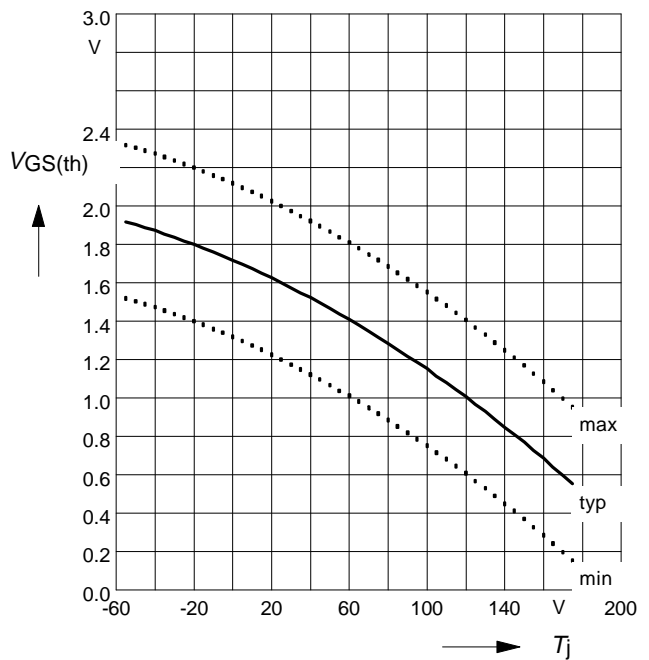
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



Gate threshold voltage

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

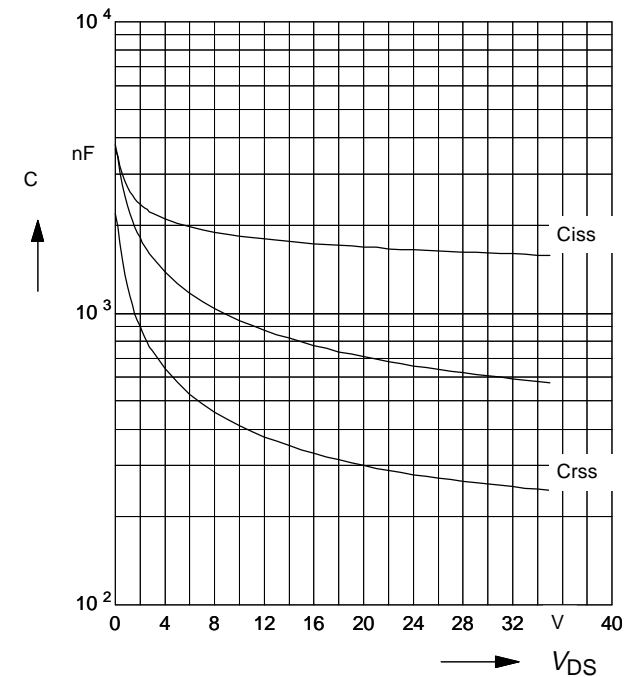
parameter: $V_{GS} = V_{DS}, I_D = 80 \mu A$



Typ. capacitances

$C = f(V_{DS})$

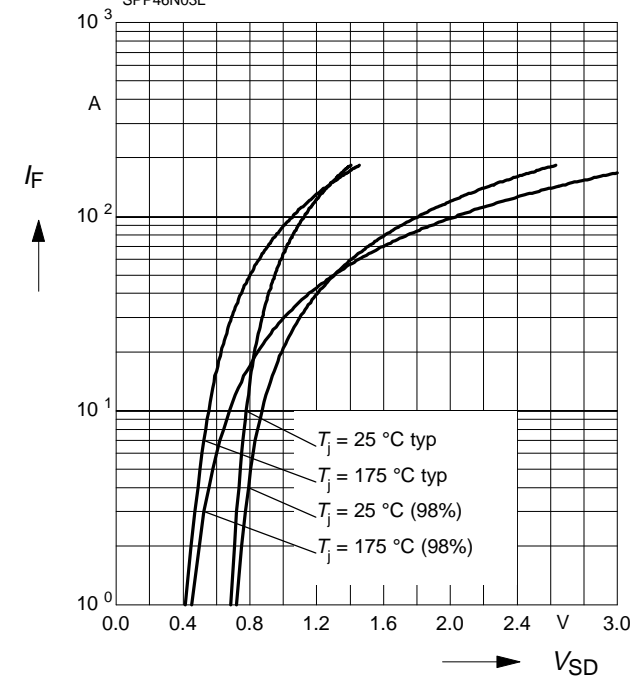
Parameter: $V_{GS} = 0 V, f = 1 MHz$



Forward characteristics of reverse diode

$I_F = f(V_{SD})$

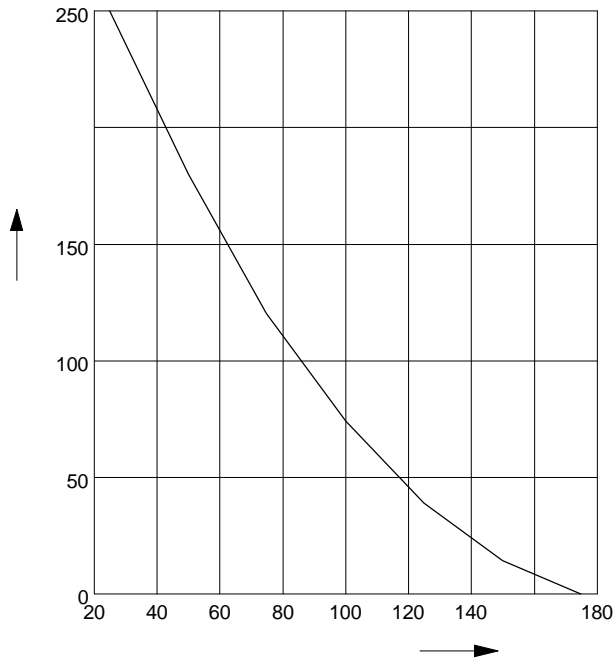
parameter: $T_j, t_p = 80 \mu s$



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

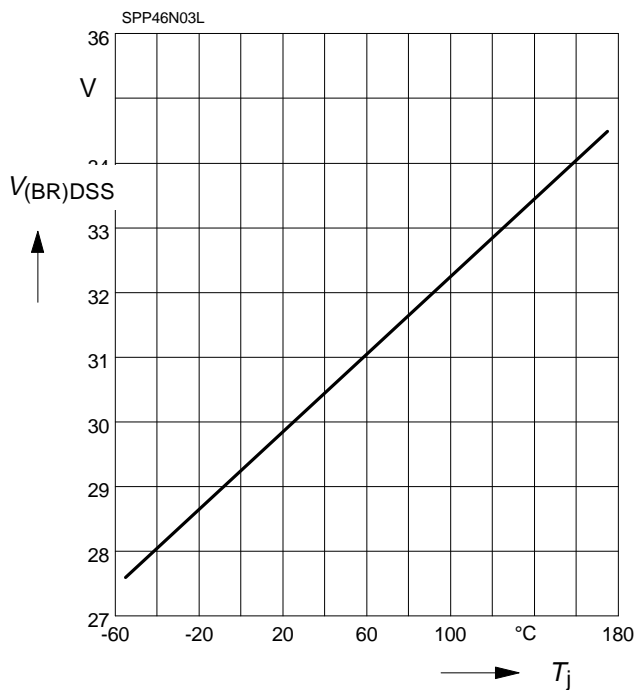
parameter: $I_D = 46 \text{ A}, V_{DD} = 25 \text{ V}$

$R_{GS} = 25 \Omega$



Drain-source breakdown voltage

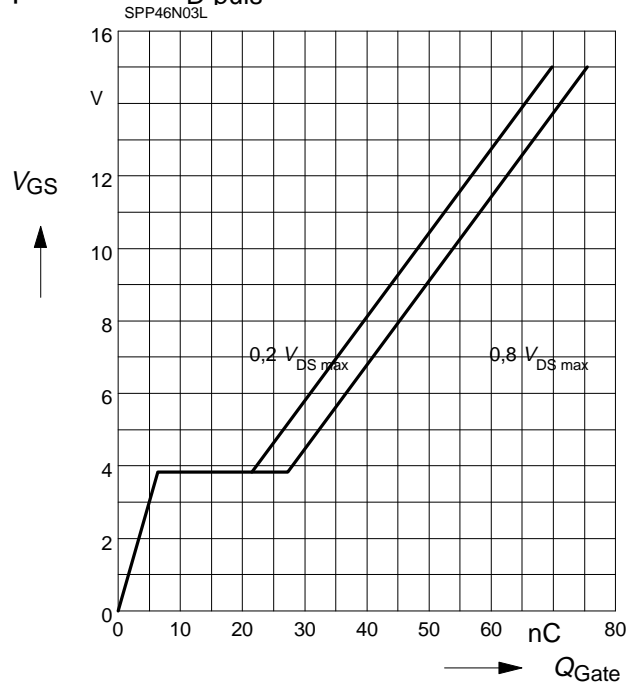
$V_{(BR)DSS} = f(T_j)$



Typ. gate charge

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

parameter: $I_{D \text{ puls}} = 46 \text{ A}$



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