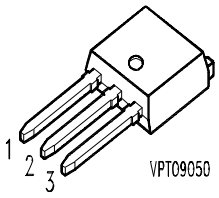
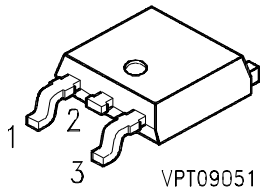
SIPMOS ® Power Transistor

- N channel
- Enhancement mode
- Logic Level
- Avalanche-rated
- d*v*/d*t* rated
- 175°C operating temperature





Pin 1	Pin 2	Pin 3
G	D	S

Type	V_{DS}	I_D	$R_{DS(on)}$	Package	Ordering Code
SPD13N05L	55 V	12.5 A	0.12 Ω	P-TO252	Q67040 - S4124 - A2
SPU13N05L	55 V	12.5 A	0.12 Ω	P-TO251	Q67040 - S4116 - A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Continuous drain current	I_D		A
T_C = 25 °C		12.5	
T_C = 100 °C		8.8	
Pulsed drain current	I_{Dpuls}		
T_C = 25 °C		50	
Avalanche energy, single pulse	E_{AS}		mJ
I_D = 12.5 A, V_{DD} = 25 V, R_{GS} = 25 Ω			
L = 666 µH, T_j = 25 °C		52	
Avalanche current,limited by T_{jmax}	I_{AR}	12.5	A
Avalanche energy,periodic limited by T_{jmax}	E_{AR}	3.5	mJ
Reverse diode d*v*/d*t*	d*v*/d*t*		kV/µs
I_S = 12.5 A, V_{DS} = 40 V, di_F/d*t* = 200 A/µs			
T_{jmax} = 175 °C		6	
Gate source voltage	V_{GS}	± 14	V
Power dissipation	P_{tot}		W
T_C = 25 °C		35	

Maximum Ratings

Parameter	Symbol	Values	Unit
Operating temperature	T_j	-55 ... + 175	°C
Storage temperature	T_{stg}	-55 ... + 175	
Thermal resistance, junction - case	R_{thJC}	≤ 4.3	K/W
Thermal resistance, junction - ambient (PCB mount)**	R_{thJA}	≤ 50	
Thermal resistance, junction - ambient	R_{thJA}	≤ 100	
IEC climatic category, DIN IEC 68-1		55 / 175 / 56	

** when mounted on 1 " square PCB (FR4);for recommended footprint

Electrical Characteristics, at T_j = 25°C, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain- source breakdown voltage	$V_{(BR)DSS}$				V
V_{GS} = 0 V, I_D = 0.25 mA, T_j = 25 °C		55	-	-	
Gate threshold voltage	$V_{GS(th)}$				
V_{GS}=V_{DS}, I_D = 20 µA		1.2	1.6	2	
Zero gate voltage drain current	I_{DSS}				µA
V_{DS} = 50 V, V_{GS} = 0 V, T_j = -40 °C		-	-	0.1	
V_{DS} = 50 V, V_{GS} = 0 V, T_j = 25 °C		-	0.1	1	
V_{DS} = 50 V, V_{GS} = 0 V, T_j = 150 °C		-	-	100	
Gate-source leakage current	I_{GSS}				nA
V_{GS} = 20 V, V_{DS} = 0 V		-	10	100	
Drain-Source on-resistance	$R_{DS(on)}$				Ω
V_{GS} = 4.5 V, I_D = 8.8 A		-	0.105	0.12	
V_{GS} = 10 V, I_D = 8.8 A		-	0.062	0.07	

Electrical Characteristics, at T_j = 25°C, unless otherwise specified

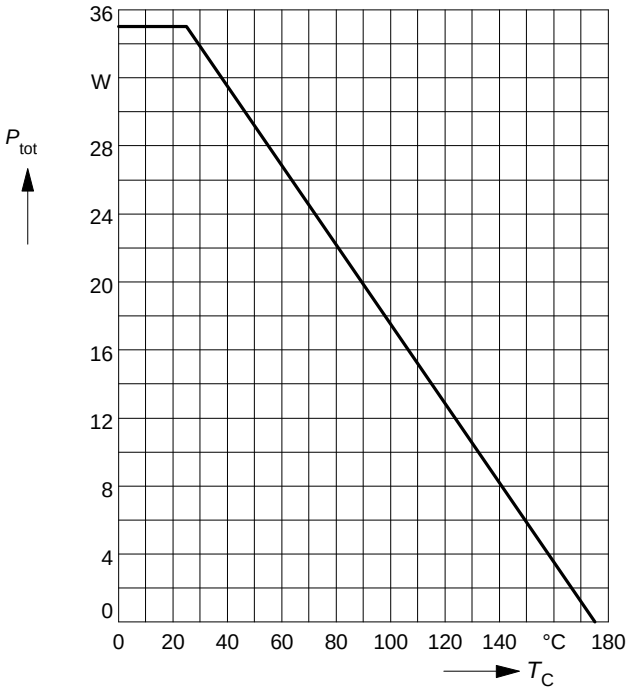
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Transconductance $V_{DS} \geq 2 * I_D * R_{DS(on)max}$, I_D = 8.8 A	g_{fs}	5	8	-	S
Input capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{iss}	-	317	400	pF
Output capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{oss}	-	97	120	
Reverse transfer capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{rss}	-	54	70	
Turn-on delay time V_{DD} = 30 V, V_{GS} = 4.5 V, I_D = 12.5 A R_G = 16 Ω	$t_{d(on)}$	-	15	22	ns
Rise time V_{DD} = 30 V, V_{GS} = 4.5 V, I_D = 12.5 A R_G = 16 Ω	t_r	-	106	160	
Turn-off delay time V_{DD} = 30 V, V_{GS} = 4.5 V, I_D = 12.5 A R_G = 16 Ω	$t_{d(off)}$	-	11	17	
Fall time V_{DD} = 30 V, V_{GS} = 4.5 V, I_D = 12.5 A R_G = 16 Ω	t_f	-	14	20	
Gate charge at threshold V_{DD} = 40 V, $I_D \geq$ 0.1 A, V_{GS} =0 to 1 V	$Q_{g(th)}$	-	0.37	0.56	nC
Gate charge at 5.0 V V_{DD} = 40 V, I_D = 12.5 A, V_{GS} =0 to 5 V	$Q_{g(5)}$	-	7.85	12	
Gate charge total V_{DD} = 40 V, I_D = 12.5 A, V_{GS} =0 to 10 V	$Q_{g(total)}$	-	13.5	20	
Gate plateau voltage V_{DD} = 40 V, I_D = 12.5 A	$V_{(plateau)}$	-	4	-	V

Electrical Characteristics, at T_j = 25°C, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Inverse diode continuous forward current T_C = 25 °C	I_S	-	-	12.5	A
Inverse diode direct current,pulsed T_C = 25 °C	I_{SM}	-	-	50	
Inverse diode forward voltage V_{GS} = 0 V, I_F = 25 A	V_{SD}	-	1.15	1.8	V
Reverse recovery time V_R = 30 V, I_F=I_S, di_F/dt = 100 A/µs	t_{rr}	-	50	75	ns
Reverse recovery charge V_R = 30 V, I_F=I_S, di_F/dt = 100 A/µs	Q_{rr}	-	0.1	0.15	µC

Power dissipation

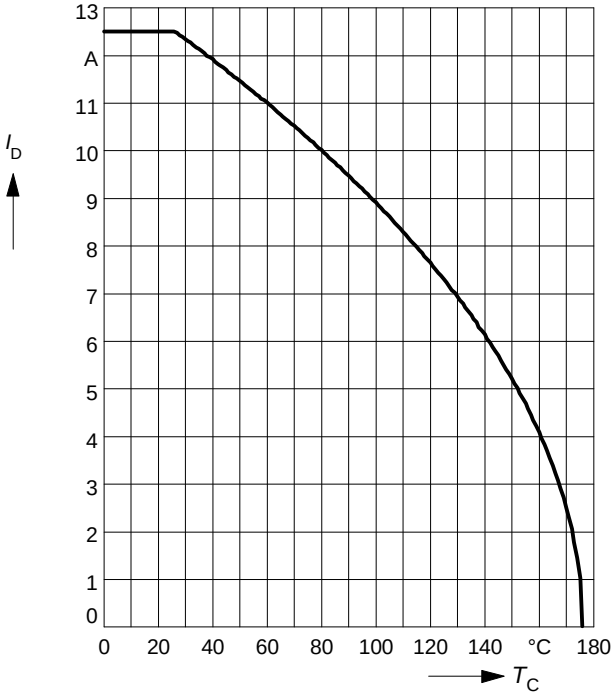
$P_{tot} = f(T_C)$



Drain current

$I_D = f(T_C)$

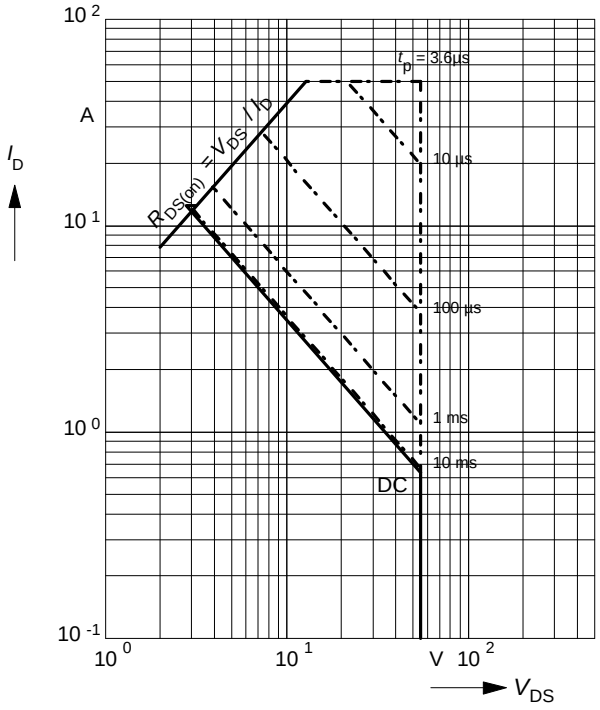
parameter: $V_{GS} \geq 4$ V



Safe operating area

$I_D = f(V_{DS})$

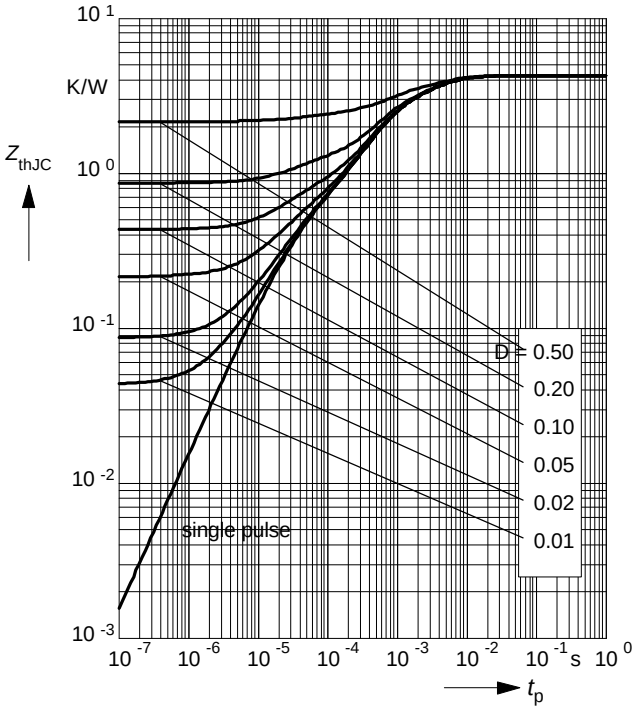
parameter: $D = 0.01$, $T_C = 25$°C



Transient thermal impedance

$Z_{th\,JC} = f(t_p)$

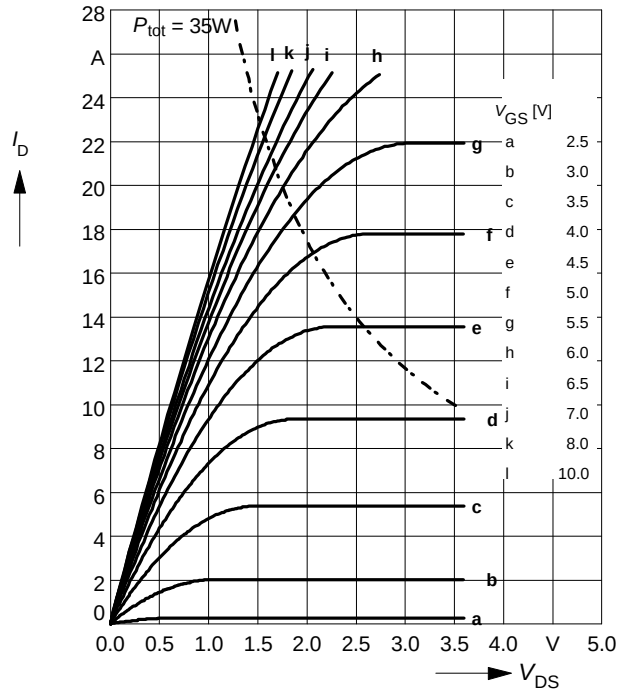
parameter: $D = t_p / T$



Typ. output characteristics

$I_D = f(V_{DS})$

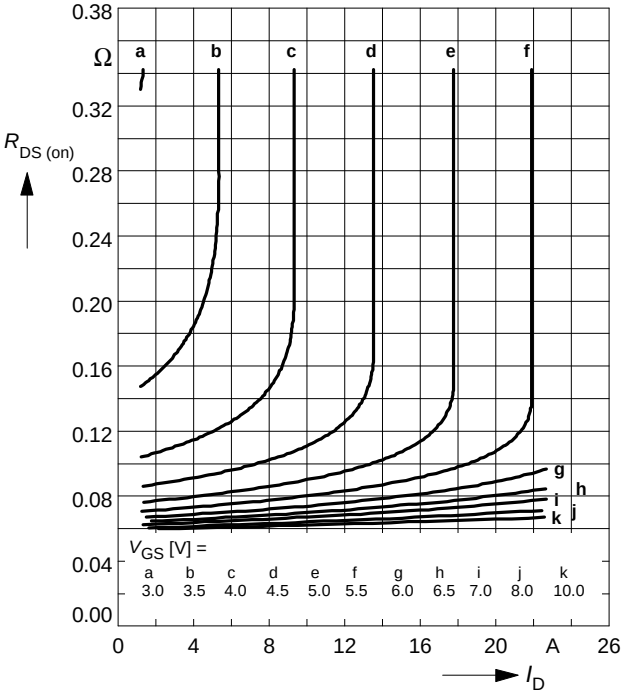
parameter: t_p = 80 µs



Typ. drain-source on-resistance

$R_{DS\ (on)} = f(I_D)$

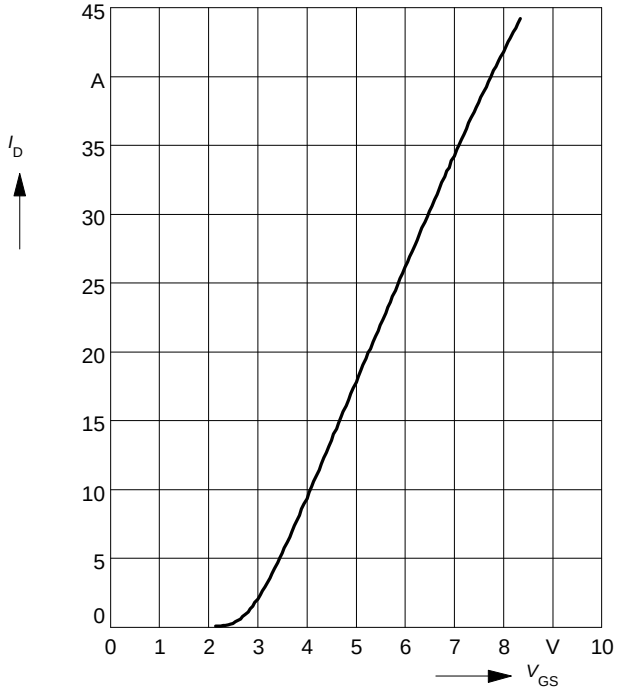
parameter: t_p = 80 µs, T_j = 25 °C



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

parameter: t_p = 80 µs

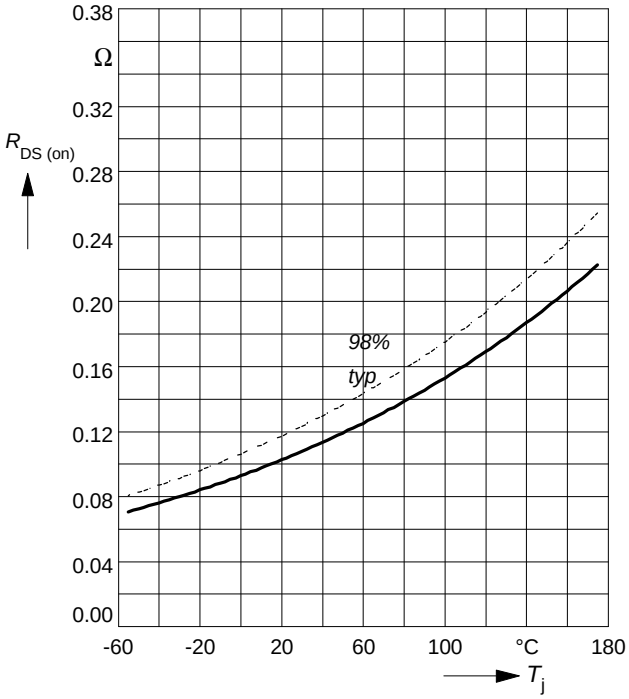
$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$



Drain-source on-resistance

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

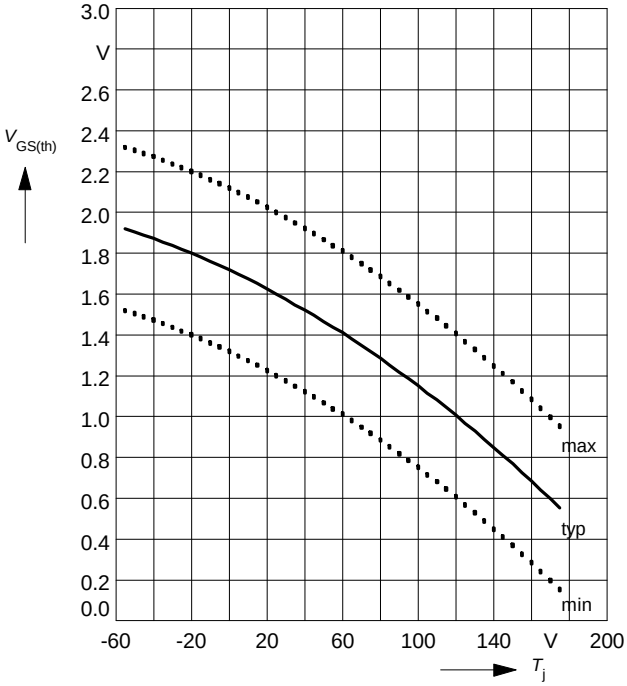
parameter: I_D = 8.8 A, V_{GS} = 4.5 V



Gate threshold voltage

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

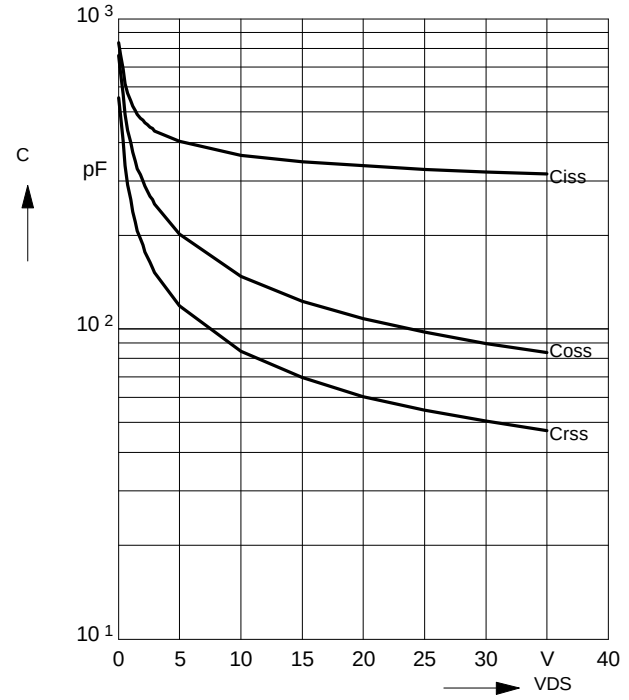
parameter: V_{GS}=V_{DS}, I_D = 20µA



Typ. capacitances

$C = f(V_{DS})$

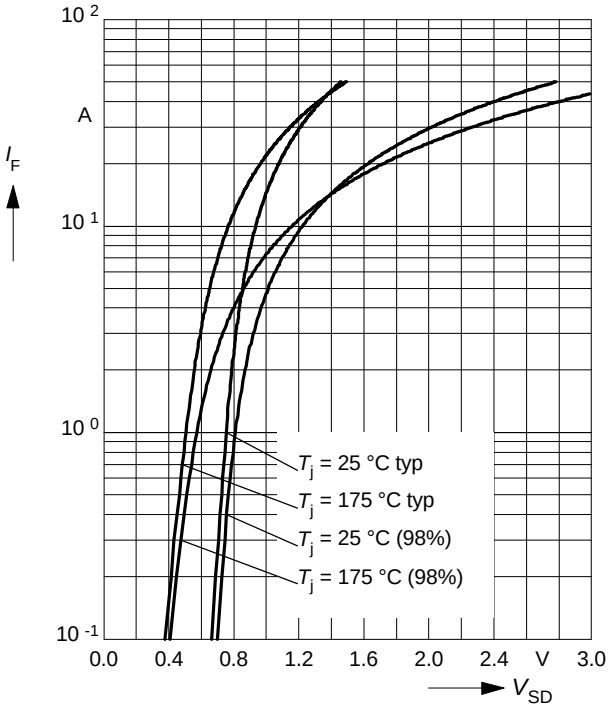
parameter: V_{GS} = 0V, f = 1MHz



Forward characteristics of reverse diode

$I_F = f(V_{SD})$

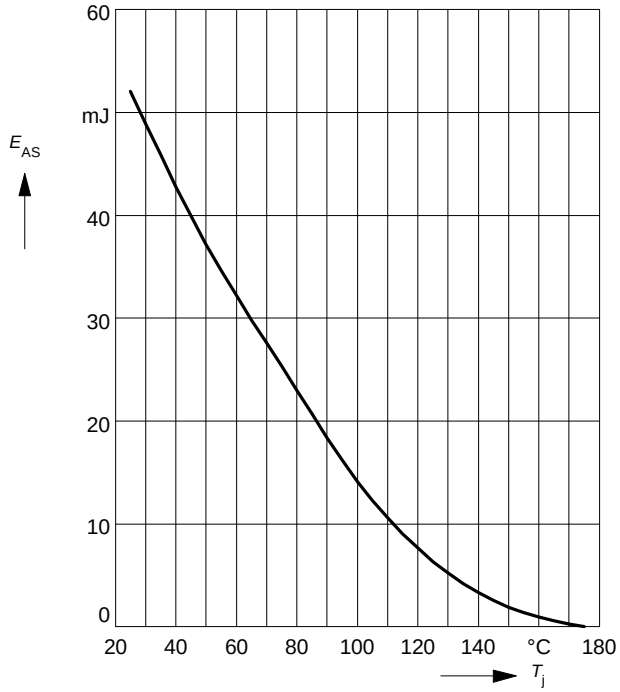
parameter: T_j, t_p = 80 µs



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

parameter: I_D=12.5 A, V_{DD} =25 V

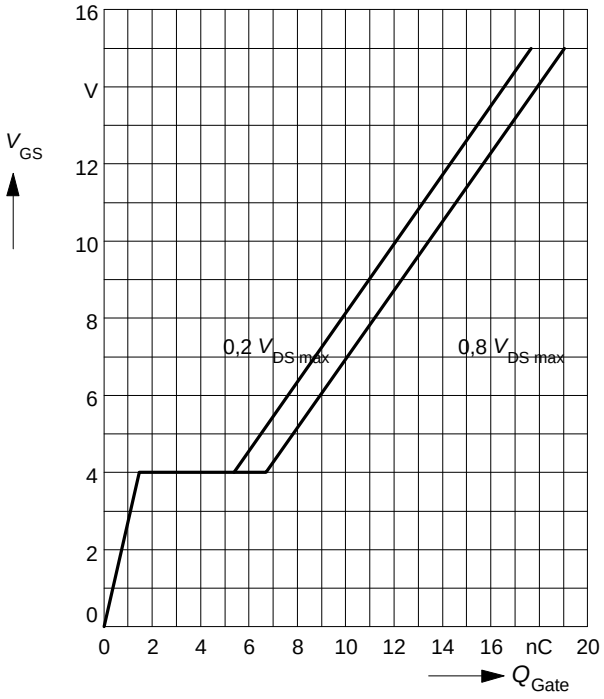
R_{GS} =25 Ω , L = 666 µH



Typ. gate charge

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

parameter: $I_{D\ puls}$ = 13 A



Drain-source breakdown voltage

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