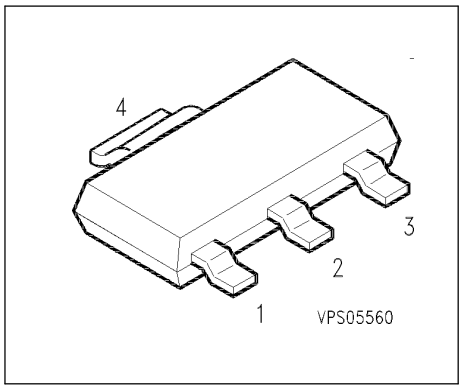
SIPMOS ® Small-Signal Transistor



- N channel
- Enhancement mode
- Avalanche rated
- $V_{GS(th)}$= 2.1 ... 4.0 V

Pin 1	Pin 2	Pin 3	Pin 4
G	D	S	D

Type	V_{DS}	I_D	$R_{DS(on)}$	**Package**	**Marking**
BSP 223	600 V	0.38 A	5 Ω	SOT-223	BSP 223

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

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Continuous drain current T_A = 25 °C	I_D	0.38	A
DC drain current, pulsed T_A = 25 °C	I_{Dpuls}	1.52	
Avalanche energy, single pulse I_D = 1.4 A, V_{DD} = 50 V, R_{GS} = 25 Ω L = 122 mH, T_j = 25 °C	E_{AS}	130	mJ
Gate source voltage	V_{GS}	± 20	V
Power dissipation T_A = 25 °C	P_{tot}	1.8	W

Maximum Ratings

Parameter	Symbol	Values	Unit
Chip or operating temperature	T_j	-55 ... + 150	°C
Storage temperature	T_{stg}	-55 ... + 150	
Thermal resistance, chip to ambient air 1)	R_{thJA}	≤ 70	K/W
Thermal resistance, junction-soldering point 1)	R_{thJS}	≤ 10	
IEC climatic category, DIN IEC 68-1		55 / 150 / 56	

1) Transistor on epoxy pcb 40 mm x 40 mm x 1,5 mm with 6 cm^2 copper area for drain connection

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain- source breakdown voltage V_{GS} = 0 V, I_D = 0.25 mA, T_j = 25 °C	$V_{(BR)DSS}$	600	-	-	V
Gate threshold voltage V_{GS}=V_{DS}, I_D = 1 mA	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current V_{DS} = 600 V, V_{GS} = 0 V, T_j = 25 °C V_{DS} = 600 V, V_{GS} = 0 V, T_j = 125 °C	I_{DSS}	- -	0.1 10	1 100	µA
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0 V	I_{GSS}	-	10	100	nA
Drain-Source on-state resistance V_{GS} = 10 V, I_D = 0.38 A	$R_{DS(on)}$	-	4	5	Ω

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

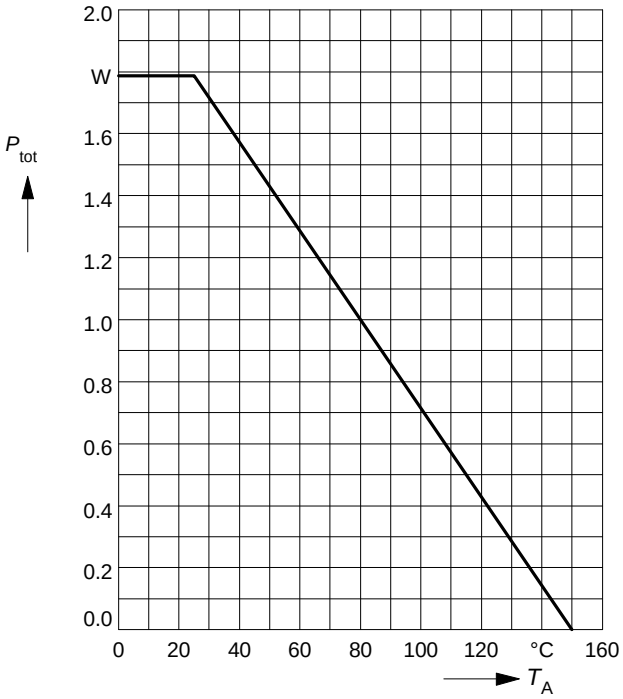
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Transconductance $V_{DS} \geq 2 * I_D * R_{DS(on)max}$, I_D = 0.38 A	g_{fs}	0.2	0.8	-	S
Input capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{iss}	-	300	400	pF
Output capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{oss}	-	40	60	
Reverse transfer capacitance V_{GS} = 0 V, V_{DS} = 25 V, f = 1 MHz	C_{rss}	-	15	25	
Turn-on delay time V_{DD} = 30 V, V_{GS} = 10 V, I_D = 0.3 A R_G = 50 Ω	$t_{d(on)}$	-	8	12	ns
Rise time V_{DD} = 30 V, V_{GS} = 10 V, I_D = 0.3 A R_G = 50 Ω	t_r	-	12	18	
Turn-off delay time V_{DD} = 30 V, V_{GS} = 10 V, I_D = 0.3 A R_G = 50 Ω	$t_{d(off)}$	-	45	65	
Fall time V_{DD} = 30 V, V_{GS} = 10 V, I_D = 0.3 A R_G = 50 Ω	t_f	-	25	40	
Gate charge at threshold V_{DD} = 40 V, $I_D \geq$ 0.1 A, V_{GS} 0 to 1 V	$Q_{g(th)}$	-	0.4	0.6	nC
Gate Charge at 7.0 V V_{DD} = 40 V, I_D = 0.4 A, V_{GS} 0 to 7 V	$Q_{g(7)}$	-	13	20	
Gate Charge total V_{DD} = 40 V, I_D = 0.4 A, V_{GS} 0 to 10 V	$Q_{g(total)}$	-	16	25	
Gate plateau voltage V_{DS} = 15 V, I_D = 0.4 A	$V_{(plateau)}$	-	4.4	-	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_A = 25 °C	I_S	-	-	0.38	A
Inverse diode direct current,pulsed T_A = 25 °C	I_{SM}	-	-	1.52	
Inverse diode forward voltage V_{GS} = 0 V, I_F = 0.76 A	V_{SD}	-	0.85	1.2	V
Reverse recovery time V_R = 100 V, I_F=I_S, di_F/dt = 100 A/µs	t_{rr}	-	200	300	ns
Reverse recovery charge V_R = 100 V, I_F=I_S, di_F/dt = 100 A/µs	Q_{rr}	-	0.65	1	µC

Power dissipation

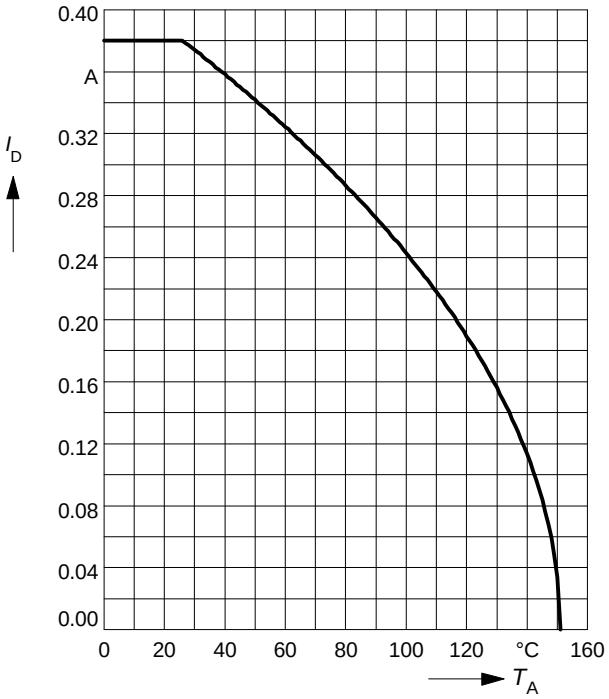
$P_{tot} = f(T_A)$



Drain current

$I_D = f(T_A)$

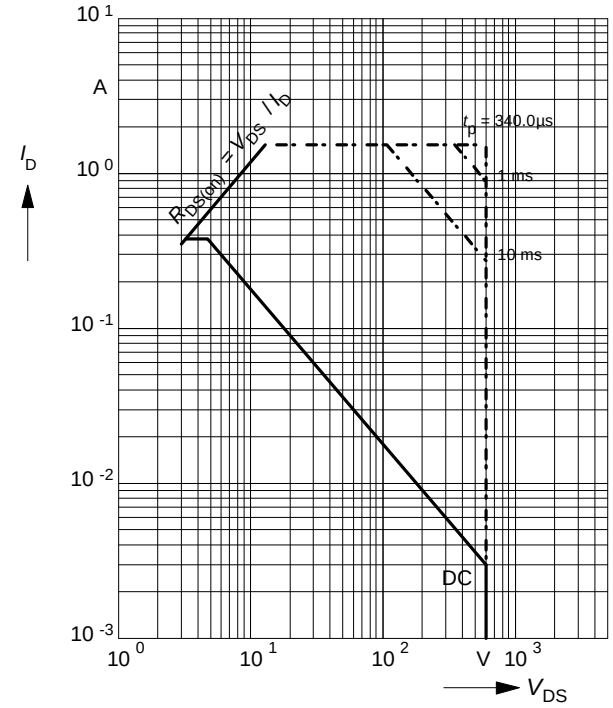
parameter: $V_{GS} \geq 10$ V



Safe operating area

$I_D = f(V_{DS})$

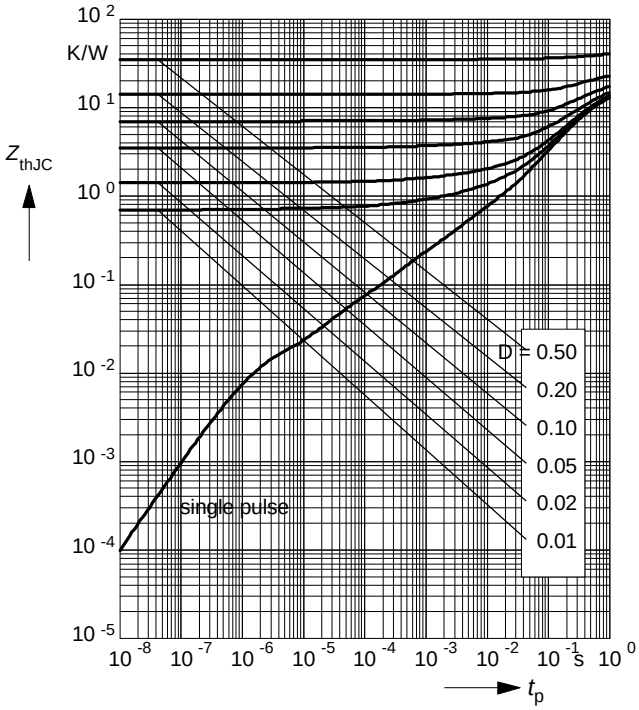
parameter: $D = 0$, $T_C = 25$°C



Transient thermal impedance

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

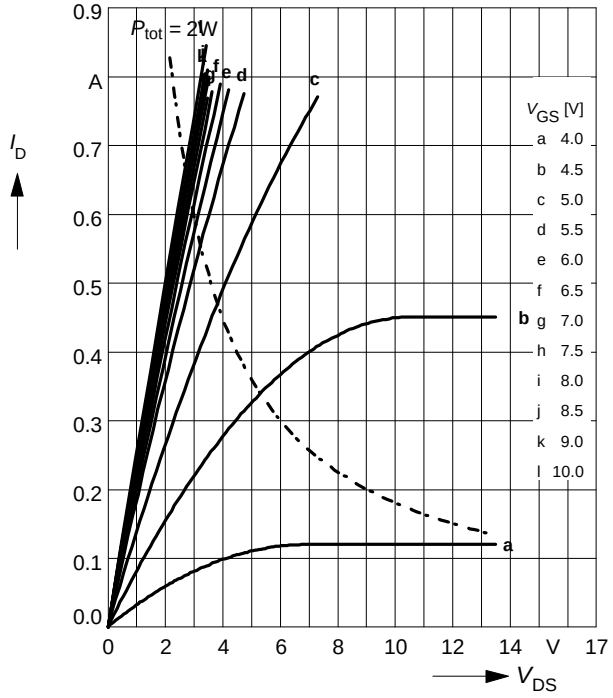
parameter: $D = t_p / T$



Typ. output characteristics

$I_D = f(V_{DS})$

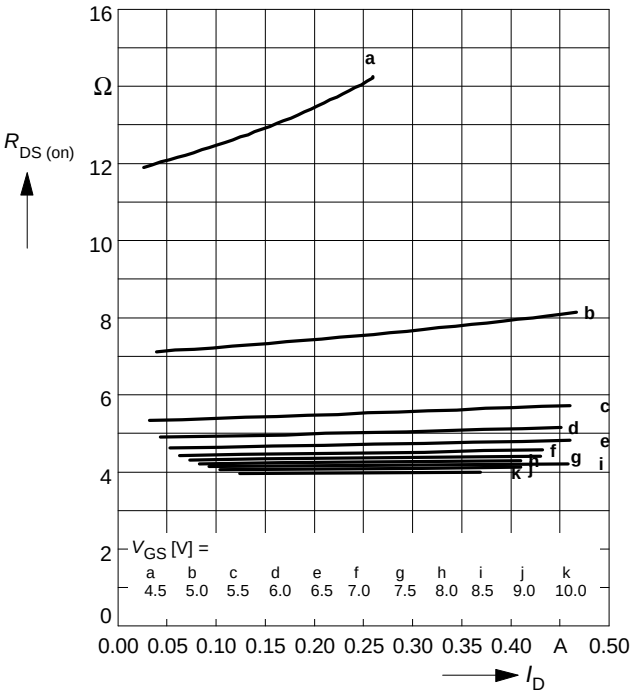
parameter: t_p = 80 µs



Typ. drain-source on-resistance

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

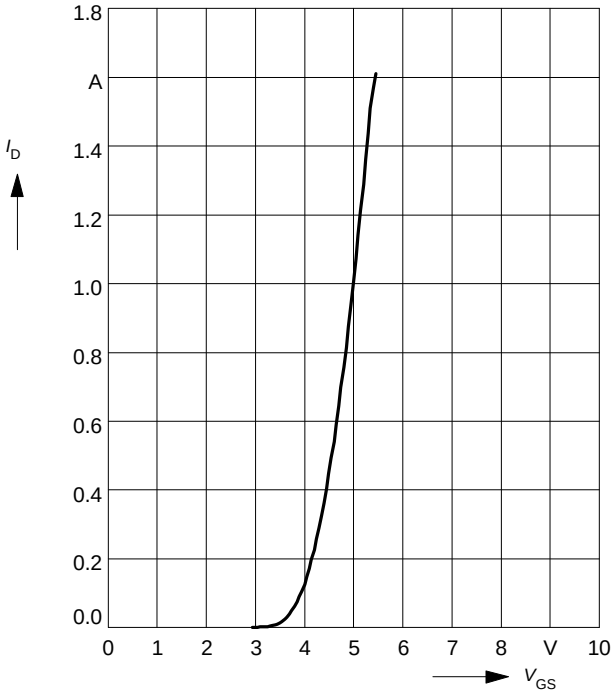
parameter: t_p = 80 µs, T_j = 25 °C



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

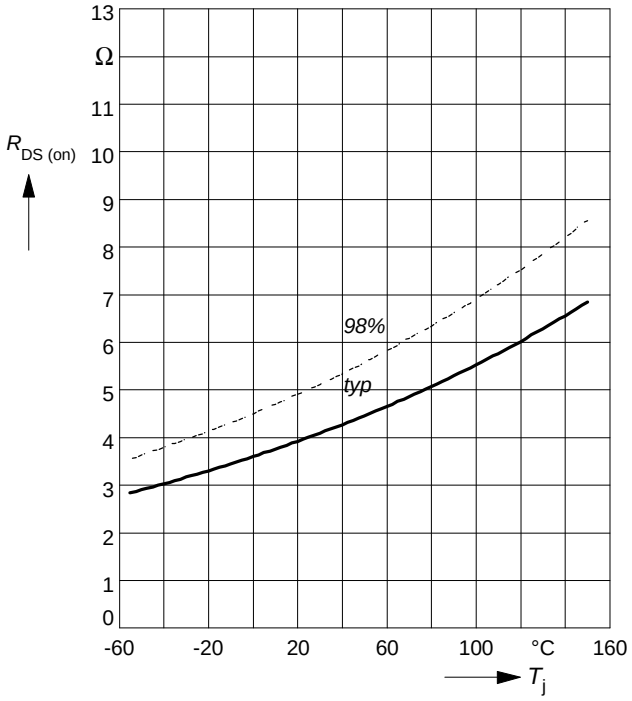
parameter: t_p = 80 µs

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



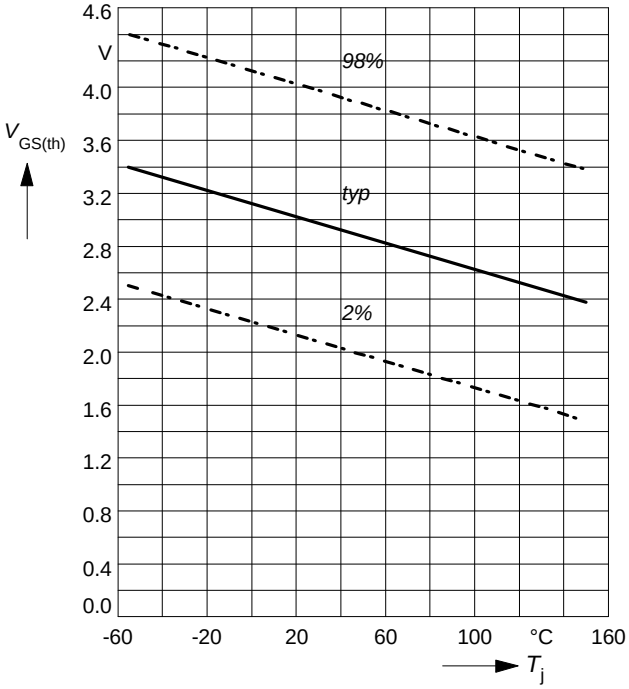
Drain-source on-resistance

$R_{DS\ (on)} = f(T_j)$
parameter: I_D = 0.38 A, V_{GS} = 10 V



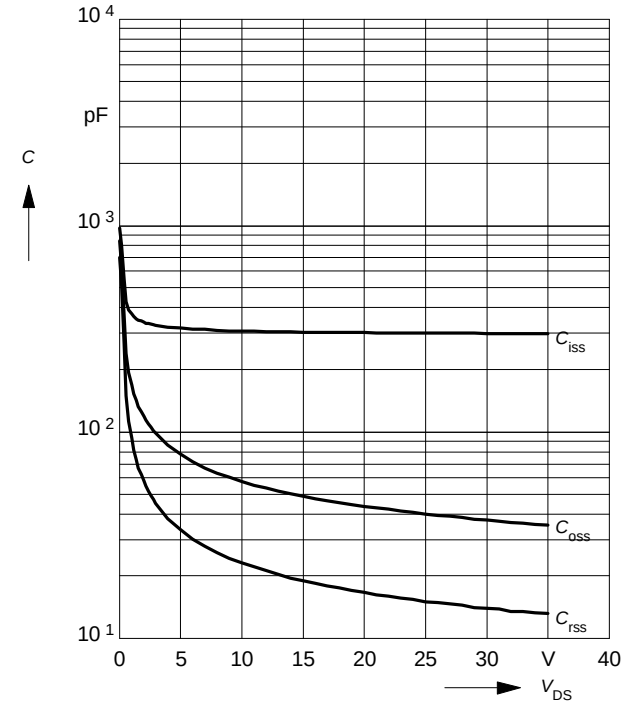
Gate threshold voltage

$V_{GS\ (th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA



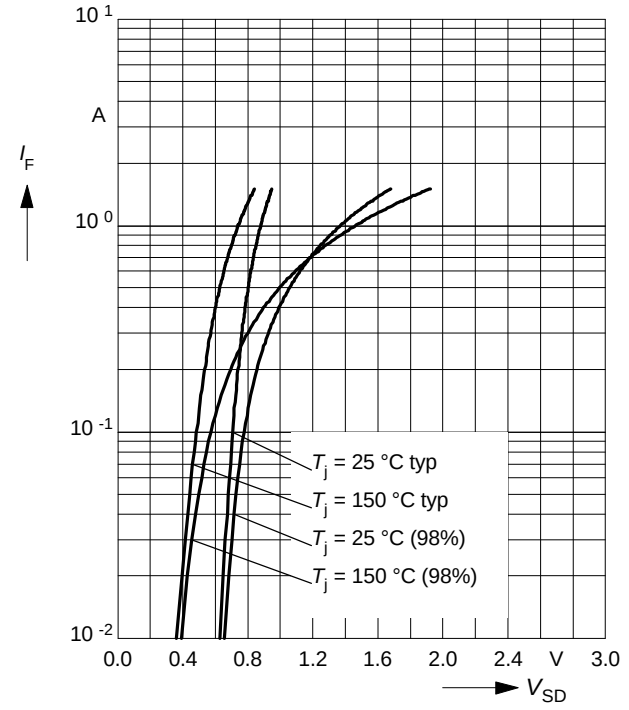
Typ. capacitances

$C = f(V_{DS})$
parameter: V_{GS}=0V, f = 1 MHz

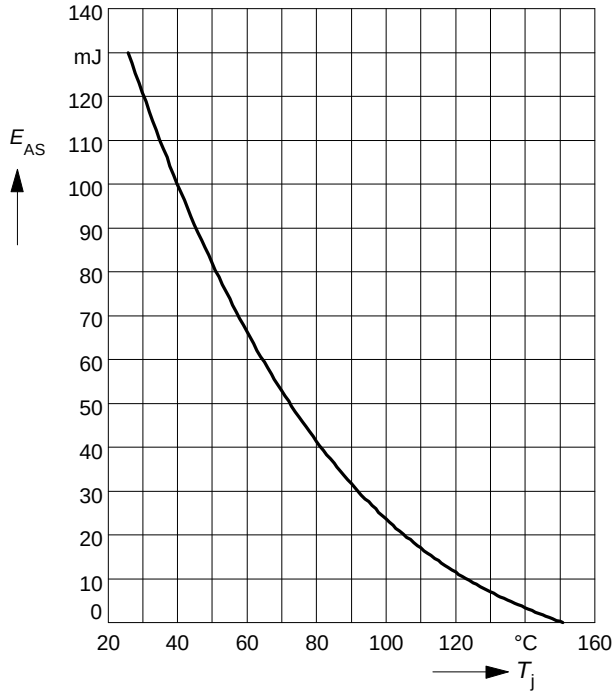


Forward characteristics of reverse diode

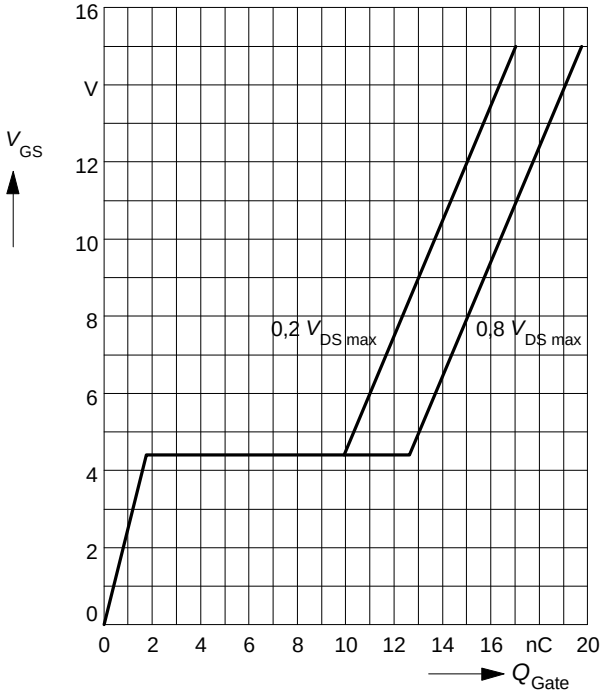
$I_F = f(V_{SD})$
parameter: T_j, t_p = 80 µs



Avalanche energy $E_{AS} = f(T_j)$
parameter: I_D = 1.4 A, V_{DD} = 50 V
R_{GS} = 25 Ω, L = 122 mH



Typ. gate charge
$V_{GS} = f(Q_{Gate})$
parameter: $I_{D\ puls}$ = 0 A



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

