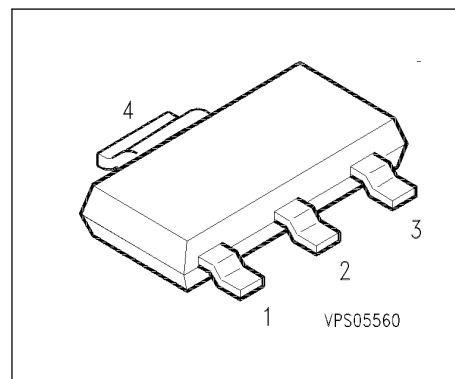


SIPMOS® Small-Signal Transistor

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



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

Type	V_{DS}	I_D	$R_{DS(on)}$	Package	Marking	Ordering Code
BSP 320 S	60 V	2.9 A	0.12Ω	SOT-223		Q67000-S4001

Maximum Ratings

Parameter	Symbol	Values	Unit
Continuous drain current $T_A = 25 \text{ }^\circ\text{C}$ $T_A = 100 \text{ }^\circ\text{C}$	I_D	2.9 1.85	A
DC drain current, pulsed $T_A = 25 \text{ }^\circ\text{C}$	I_{Dpuls}	11.6	
Avalanche energy, single pulse $I_D = 2.9 \text{ A}$, $V_{DD} = 25 \text{ V}$, $R_{GS} = 25 \Omega$ $L = 14.3 \text{ mH}$, $T_j = 25 \text{ }^\circ\text{C}$	E_{AS}	60	mJ
Avalanche energy, periodic limited by $T_{j(max)}$	E_{AR}	0.18	
Avalanche current, repetitive, limited by $T_{j(max)}$	I_{AR}	2.9	A
Reverse diode dv/dt $I_S = 2.9 \text{ A}$, $V_{DS} = 40 \text{ V}$, $di/dt = 200 \text{ A}/\mu\text{s}$ $T_{jmax} = 150 \text{ }^\circ\text{C}$	dv/dt	6	KV/ μs
Gate source voltage	V_{GS}	± 20	V
Power dissipation $T_A = 25 \text{ }^\circ\text{C}$	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}	17	
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 cm² copper area for drain connection

*) MIL STD 883, Method 3015, Class 2

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Static Characteristics

Drain- source breakdown voltage $V_{GS} = 0 \text{ V}$, $I_D = 0.25 \text{ mA}$, $T_j = 25^\circ\text{C}$	$V_{(BR)DSS}$	60	-	-	V
Gate threshold voltage $V_{GS}=V_{DS}$, $I_D = 20 \mu\text{A}$	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current $V_{DS} = 60 \text{ V}$, $V_{GS} = 0 \text{ V}$, $T_j = -40^\circ\text{C}$ $V_{DS} = 60 \text{ V}$, $V_{GS} = 0 \text{ V}$, $T_j = 25^\circ\text{C}$ $V_{DS} = 60 \text{ V}$, $V_{GS} = 0 \text{ V}$, $T_j = 125^\circ\text{C}$	I_{DSS}	- - -	- 0.1 -	0.1 1 100	μA
Gate-source leakage current $V_{GS} = 20 \text{ V}$, $V_{DS} = 0 \text{ V}$	I_{GSS}	-	10	100	
Drain-Source on-state resistance $V_{GS} = 10 \text{ V}$, $I_D = 2.9 \text{ A}$	$R_{DS(on)}$	-	0.09	0.12	Ω

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Transconductance $V_{DS} \geq 2 * I_D * R_{DS(ON)max}$, $I_D = 2.9\text{ A}$	g_{fs}	2.5	-	-	S
Input capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{iss}	-	275	340	pF
Output capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{oss}	-	90	120	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{rss}	-	50	65	
Turn-on delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 2.9\text{ A}$ $R_G = 33\text{ }\Omega$	$t_{d(ON)}$	-	11	17	ns
Rise time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 2.9\text{ A}$ $R_G = 33\text{ }\Omega$	t_r	-	25	40	
Turn-off delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 2.9\text{ A}$ $R_G = 33\text{ }\Omega$	$t_{d(OFF)}$	-	25	40	
Fall time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 2.9\text{ A}$ $R_G = 33\text{ }\Omega$	t_f	-	35	55	
Gate charge at threshold $V_{DD} = 40\text{ V}$, $I_D = 0.1\text{ A}$, V_{GS} 0 to 1 V	$Q_{g(th)}$	-	0.24	0.3	nC
Gate Charge at 7.0 V $V_{DD} = 40\text{ V}$, $I_D = 2.9\text{ A}$, V_{GS} 0 to 7 V	$Q_{g(7)}$	-	7.4	9.3	
Gate Charge total $V_{DD} = 40\text{ V}$, $I_D = 2.9\text{ A}$, V_{GS} 0 to 10 V	$Q_{g(tot)}$	-	9.7	12	
Gate plateau voltage $V_{DS} = 15\text{ V}$, $I_D = 2.9\text{ A}$	$V_{(plateau)}$	-	4.7	-	V

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

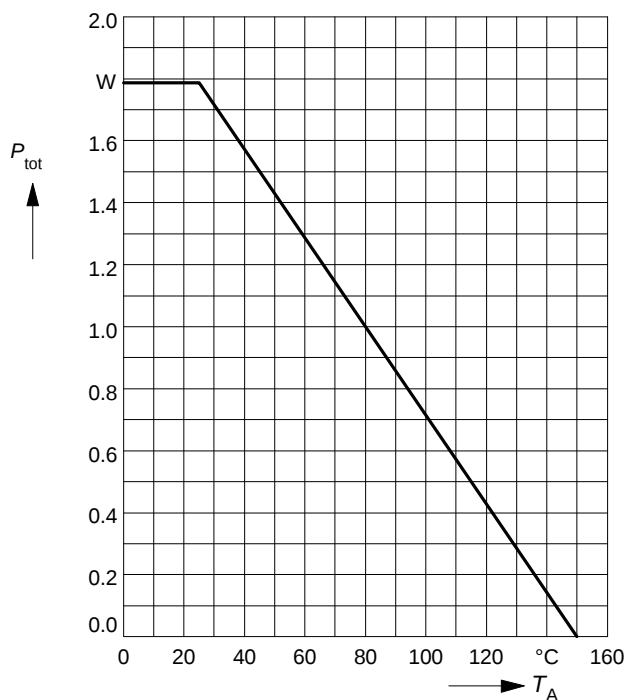
Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Reverse Diode

Inverse diode continuous forward current $T_A = 25^\circ\text{C}$	I_S	-	-	2.9	A
Inverse diode direct current,pulsed $T_A = 25^\circ\text{C}$	I_{SM}	-	-	11.6	
Inverse diode forward voltage $V_{GS} = 0\text{ V}, I_F = 5.8\text{ A}$	V_{SD}	-	0.94	1.2	V
Reverse recovery time $V_R = 30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$	t_{rr}	-	45	56	ns
Reverse recovery charge $V_R = 30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$	Q_{rr}	-	0.08	0.12	μC

Power dissipation

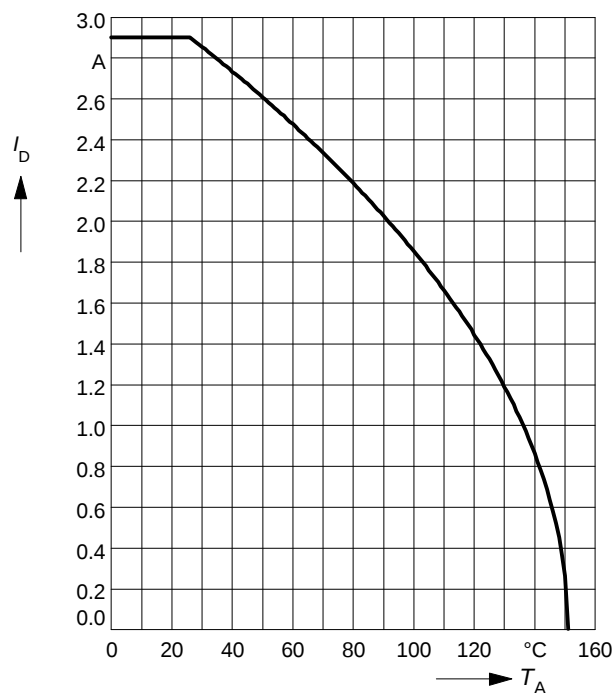
$$P_{\text{tot}} = f(T_A)$$



Drain current

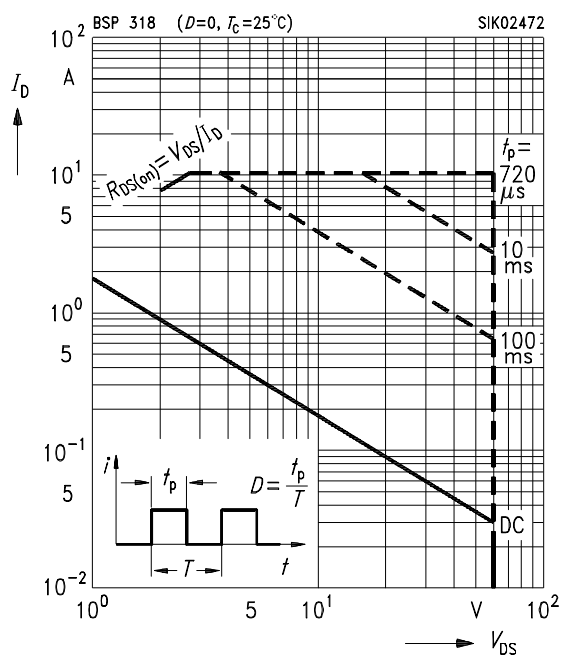
$$I_D = f(T_A)$$

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



Safe operating area $I_D = f(V_{DS})$

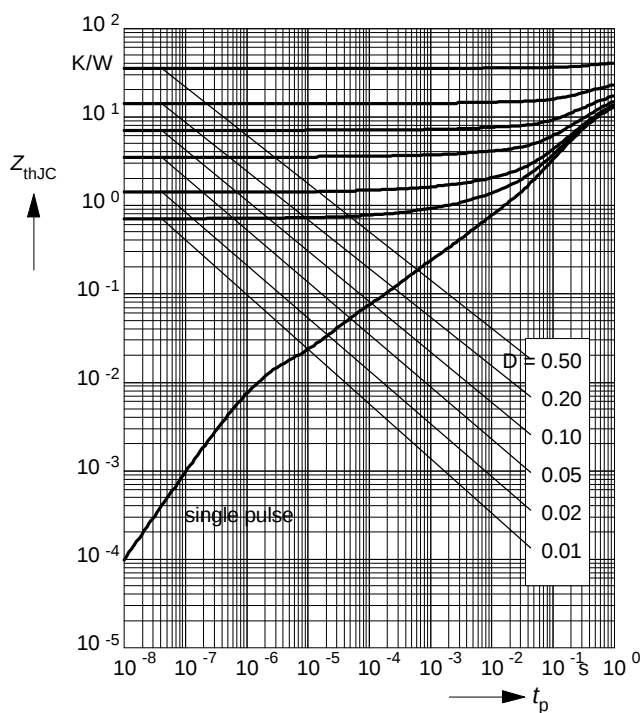
parameter : $D = 0$, $T_C = 25^\circ\text{C}$



Transient thermal impedance

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

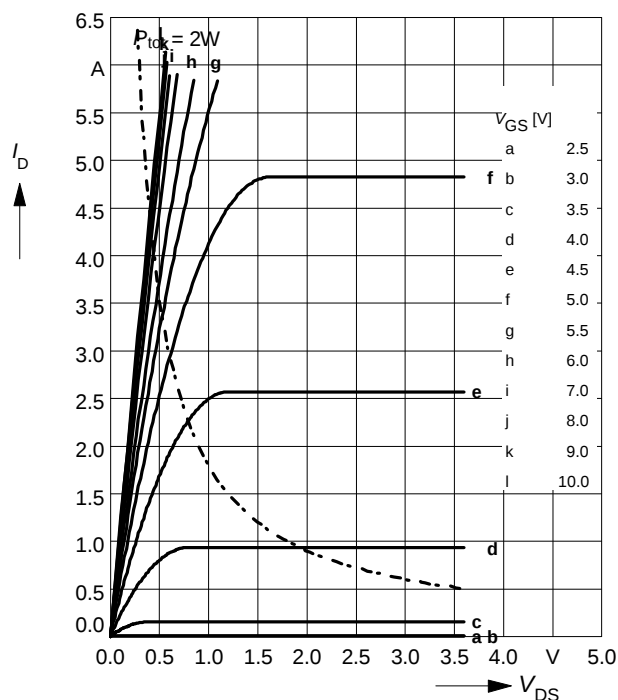
parameter: $D = t_p / T$



Typ. output characteristics

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

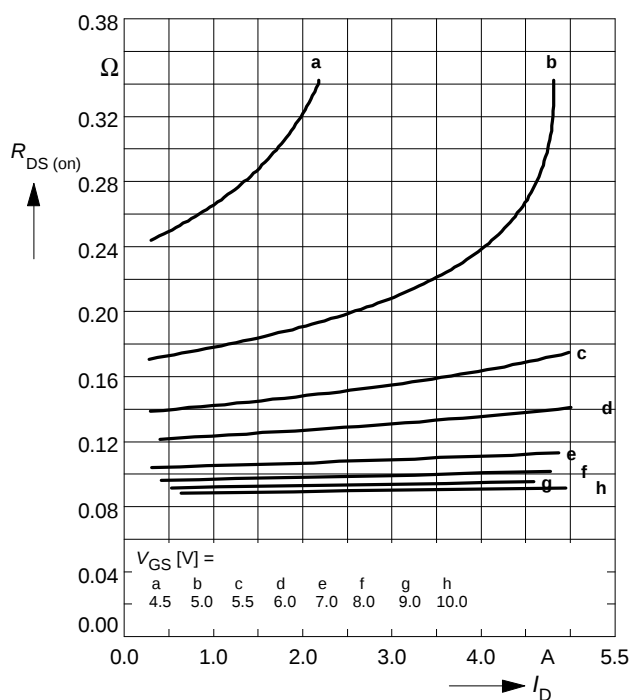
parameter: $t_p = 80 \mu s$, $T_j = 25^\circ C$



Typ. drain-source on-resistance

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

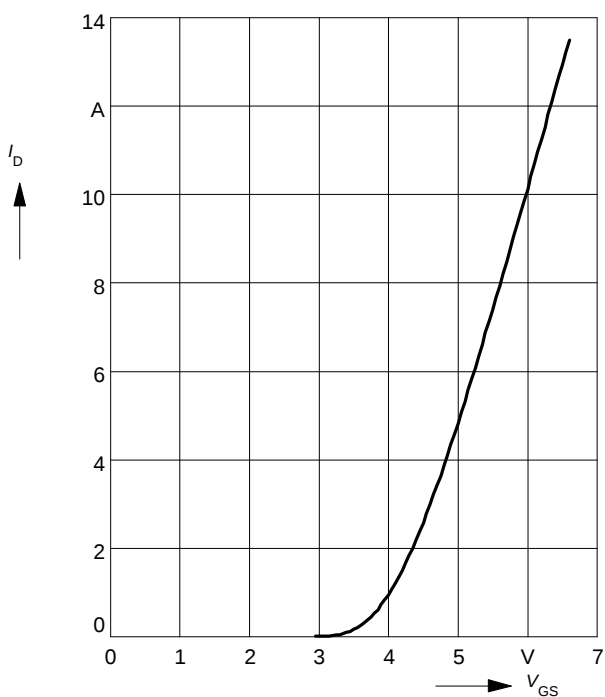
parameter: $t_p = 80 \mu s$, $T_j = 25^\circ C$



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

parameter: $t_p = 80 \mu s$

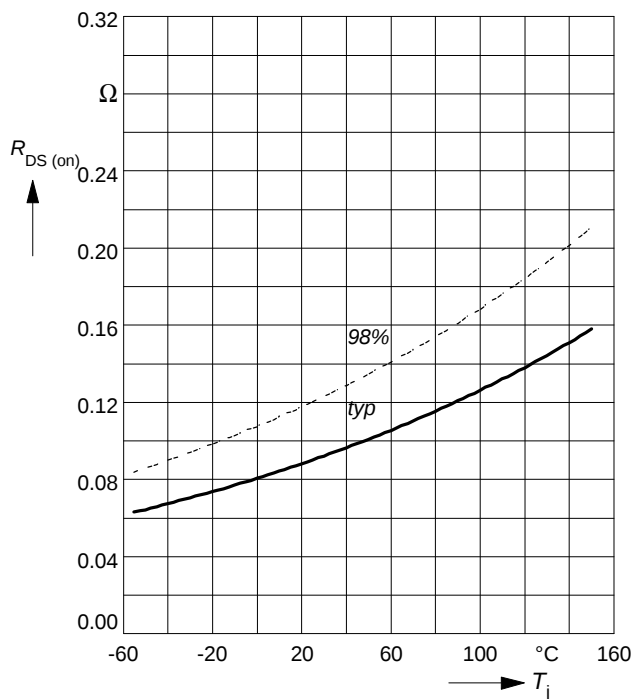
$$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$



Drain-source on-resistance

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

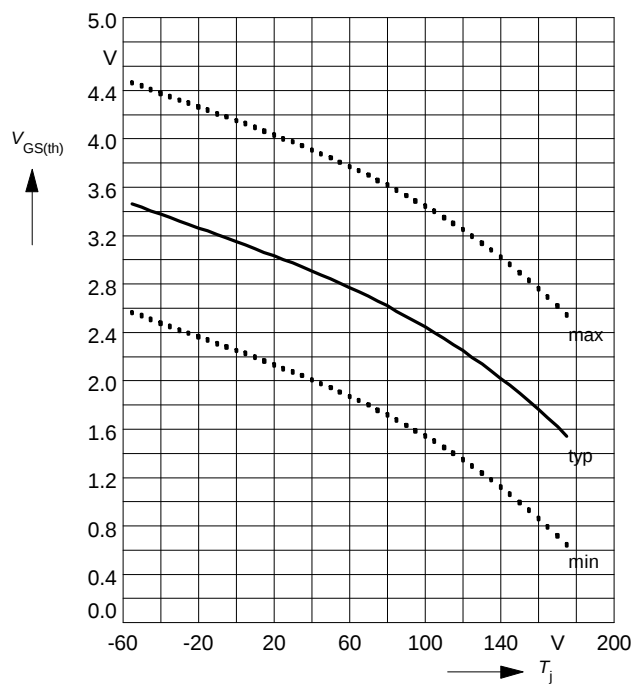
parameter: $I_D = 2.9 \text{ A}$, $V_{GS} = 10 \text{ V}$



Gate threshold voltage

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

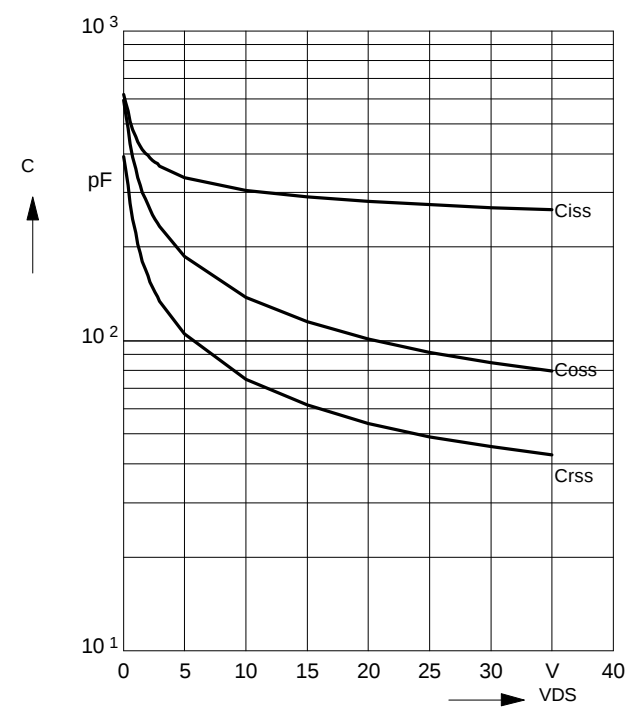
parameter: $V_{GS} = V_{DS}$, $I_D = 20 \mu\text{A}$



Typ. capacitances

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

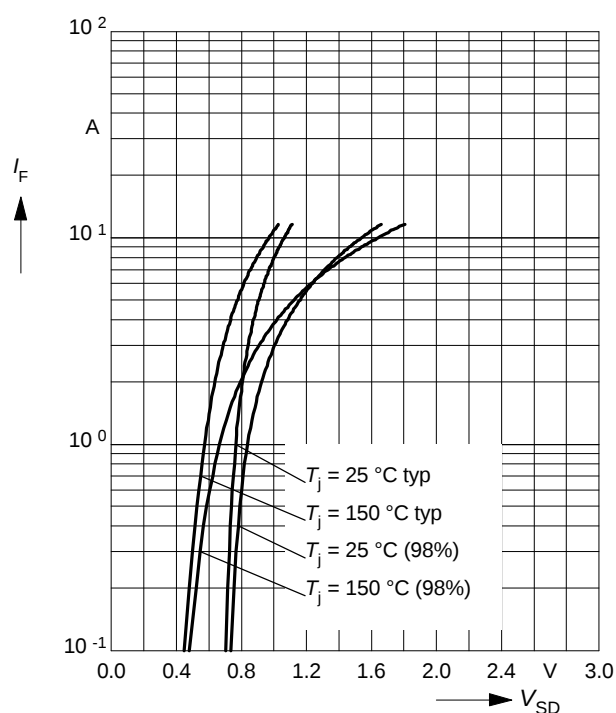
parameter: $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$



Forward characteristics of reverse diode

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

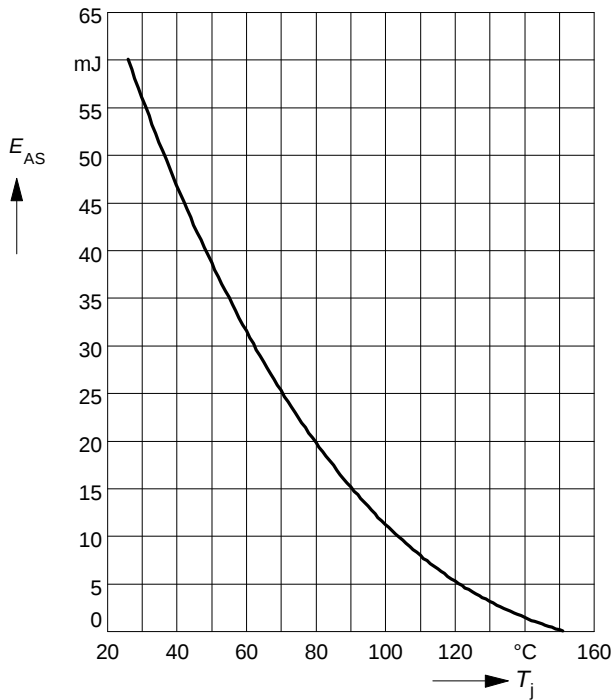
parameter: T_j , $t_p = 80 \mu\text{s}$



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

parameter: $I_D = 2.9 \text{ A}$, $V_{DD} = 25 \text{ V}$

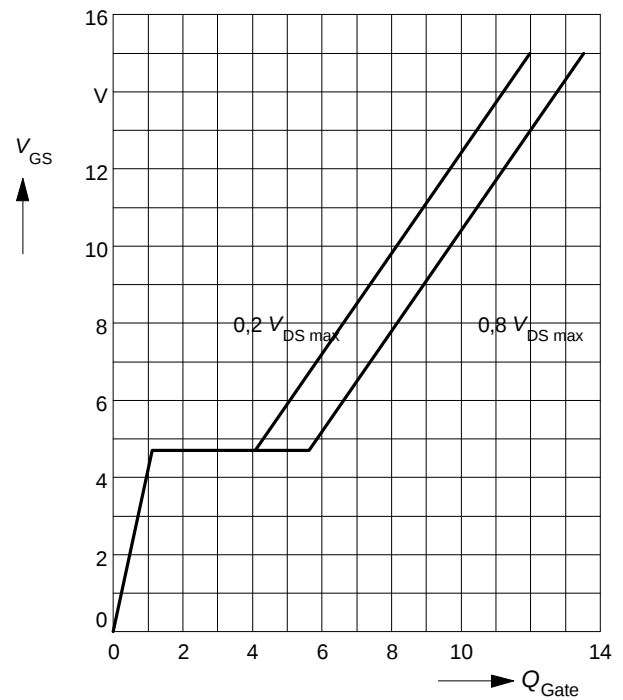
$R_{GS} = 25 \Omega$, $L = 14.3 \text{ mH}$



Typ. gate charge

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

parameter: $I_{D \text{ puls}} = 3 \text{ A}$



Drain-source breakdown voltage

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

