

**SIPMOS® Power Transistor**

- N channel
- Enhancement mode
- Avalanche-rated
- dv/dt rated
- 175°C operating temperature
- also in SMD available



Pin 1	Pin 2	Pin 3
G	D	S

Type	V <sub>DS</sub>	I <sub>D</sub>	R <sub>DS(on)</sub>	Package	Ordering Code
BUZ 104 S	55 V	13.5 A	0.1 Ω	TO-220 AB	Q67040-S4007-A2

**Maximum Ratings**

Parameter	Symbol	Values	Unit
Continuous drain current <i>T<sub>C</sub></i> = 25 °C <i>T<sub>C</sub></i> = 100 °C	<i>I<sub>D</sub></i>	13.5 9.6	A
Pulsed drain current <i>T<sub>C</sub></i> = 25 °C	<i>I<sub>Dpuls</sub></i>	54	
Avalanche energy, single pulse <i>I<sub>D</sub></i> = 13.5 A, <i>V<sub>DD</sub></i> = 25 V, <i>R<sub>GS</sub></i> = 25 Ω <i>L</i> = 571 μH, <i>T<sub>j</sub></i> = 25 °C	<i>E<sub>AS</sub></i>	52	mJ
Avalanche current, limited by <i>T<sub>jmax</sub></i>	<i>I<sub>AR</sub></i>	13.5	A
Avalanche energy, periodic limited by <i>T<sub>jmax</sub></i>	<i>E<sub>AR</sub></i>	3.5	mJ
Reverse diode dv/dt <i>I<sub>S</sub></i> = 13.5 A, <i>V<sub>DS</sub></i> = 40 V, <i>di<sub>F</sub>/dt</i> = 200 A/μs <i>T<sub>jmax</sub></i> = 175 °C	dv/dt	6	kV/μs
Gate source voltage	<i>V<sub>GS</sub></i>	± 20	V
Power dissipation <i>T<sub>C</sub></i> = 25 °C	<i>P<sub>tot</sub></i>	35	W

**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	$R_{thJA}$	≤ 62	
IEC climatic category, DIN IEC 68-1		55 / 175 / 56	

**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 $V_{GS} = 0\text{ V}$ , $I_D = 0.25\text{ mA}$ , $T_j = 25\text{ }^\circ\text{C}$	$V_{(BR)DSS}$	55	-	-	V
Gate threshold voltage $V_{GS} = V_{DS}$ , $I_D = 20\text{ }\mu\text{A}$	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current $V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = -40\text{ }^\circ\text{C}$ $V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$ $V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$	$I_{DSS}$	-	-	0.1 1 100	$\mu\text{A}$
Gate-source leakage current $V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$	$I_{GSS}$	-	10	100	
Drain-Source on-resistance $V_{GS} = 10\text{ V}$ , $I_D = 9.6\text{ A}$	$R_{DS(on)}$	-	0.076	0.1	

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

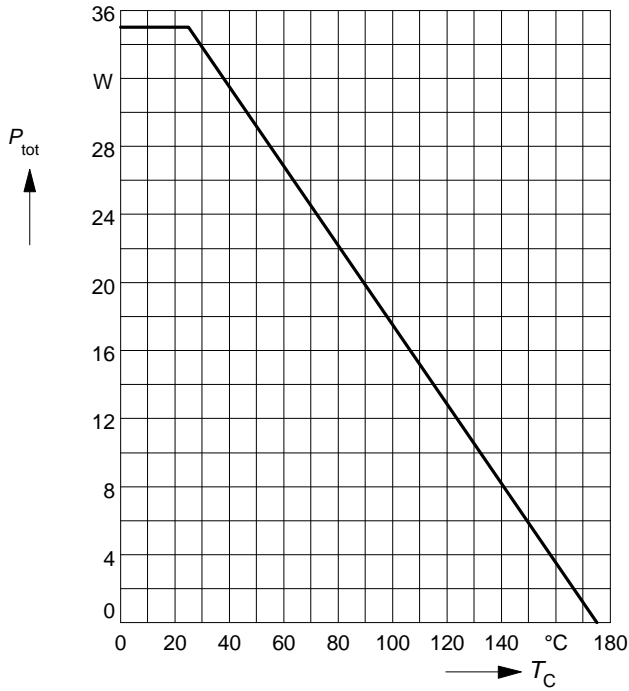
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Dynamic Characteristics</b>					
Transconductance $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 9.6 \text{ A}$	$g_{fs}$	4	-	-	S
Input capacitance $V_{GS} = 0 \text{ V}$ , $V_{DS} = 25 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{iss}$	-	270	340	pF
Output capacitance $V_{GS} = 0 \text{ V}$ , $V_{DS} = 25 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{oss}$	-	95	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 $V_{DD} = 30 \text{ V}$ , $V_{GS} = 10 \text{ V}$ , $I_D = 13.5 \text{ A}$ $R_G = 33 \Omega$	$t_{d(on)}$	-	9	15	ns
Rise time $V_{DD} = 30 \text{ V}$ , $V_{GS} = 10 \text{ V}$ , $I_D = 13.5 \text{ A}$ $R_G = 33 \Omega$	$t_r$	-	22	35	
Turn-off delay time $V_{DD} = 30 \text{ V}$ , $V_{GS} = 10 \text{ V}$ , $I_D = 13.5 \text{ A}$ $R_G = 33 \Omega$	$t_{d(off)}$	-	18	30	
Fall time $V_{DD} = 30 \text{ V}$ , $V_{GS} = 10 \text{ V}$ , $I_D = 13.5 \text{ A}$ $R_G = 33 \Omega$	$t_f$	-	16.5	25	
Gate charge at threshold $V_{DD} = 40 \text{ V}$ , $I_D = 0.1 \text{ A}$ , $V_{GS} = 0 \text{ to } 1 \text{ V}$	$Q_{g(th)}$	-	0.33	0.5	nC
Gate charge at 7.0 V $V_{DD} = 40 \text{ V}$ , $I_D = 13.5 \text{ A}$ , $V_{GS} = 0 \text{ to } 7 \text{ V}$	$Q_{g(7)}$	-	7.11	11	
Gate charge total $V_{DD} = 40 \text{ V}$ , $I_D = 13.5 \text{ A}$ , $V_{GS} = 0 \text{ to } 10 \text{ V}$	$Q_{g(total)}$	-	9.5	14	
Gate plateau voltage $V_{DD} = 40 \text{ V}$ , $I_D = 13.5 \text{ A}$	$V_{(plateau)}$	-	5.9	-	V

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Reverse Diode</b>					
Inverse diode continuous forward current $T_C = 25^\circ\text{C}$	$I_S$	-	-	13.5	A
Inverse diode direct current, pulsed $T_C = 25^\circ\text{C}$	$I_{SM}$	-	-	54	
Inverse diode forward voltage $V_{GS} = 0\text{ V}, I_F = 27\text{ A}$	$V_{SD}$	-	1.17	1.8	V
Reverse recovery time $V_R = 30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$	$t_{rr}$	-	50	75	ns
Reverse recovery charge $V_R = 30\text{ V}, I_F = I_S, di_F/dt = 100\text{ A}/\mu\text{s}$	$Q_{rr}$	-	0.1	0.15	$\mu\text{C}$

### Power dissipation

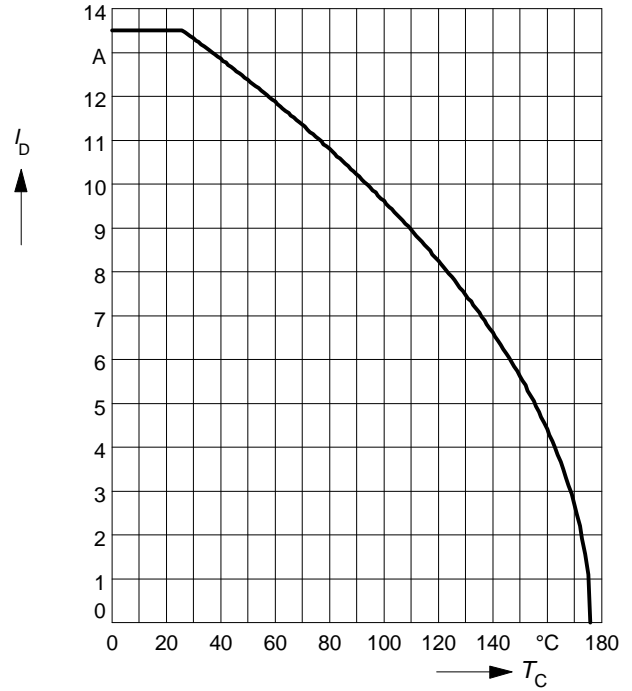
$$P_{\text{tot}} = f(T_C)$$



### Drain current

$$I_D = f(T_C)$$

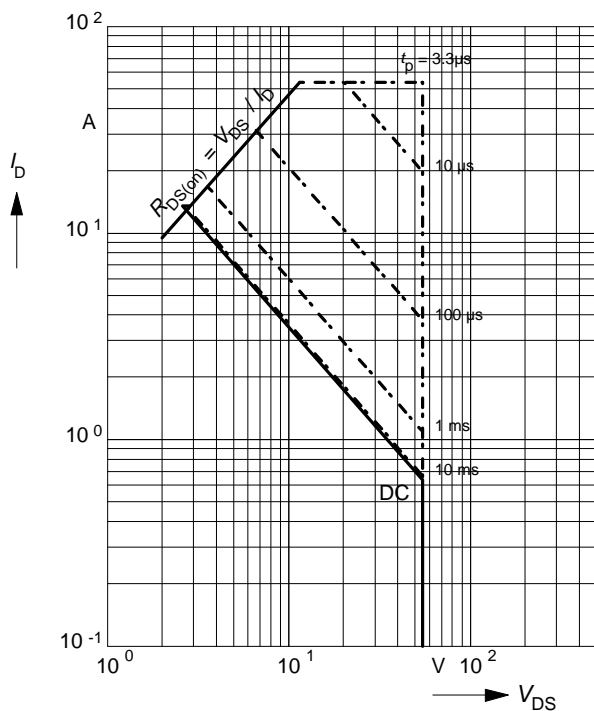
parameter:  $V_{GS} \geq 10 \text{ V}$



### Safe operating area

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

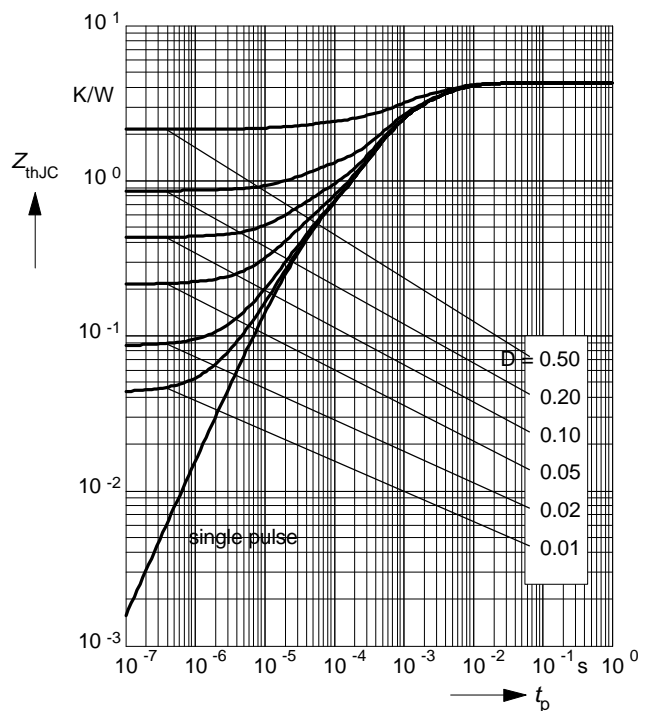
parameter:  $D = 0, T_C = 25^\circ\text{C}$



### Transient thermal impedance

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

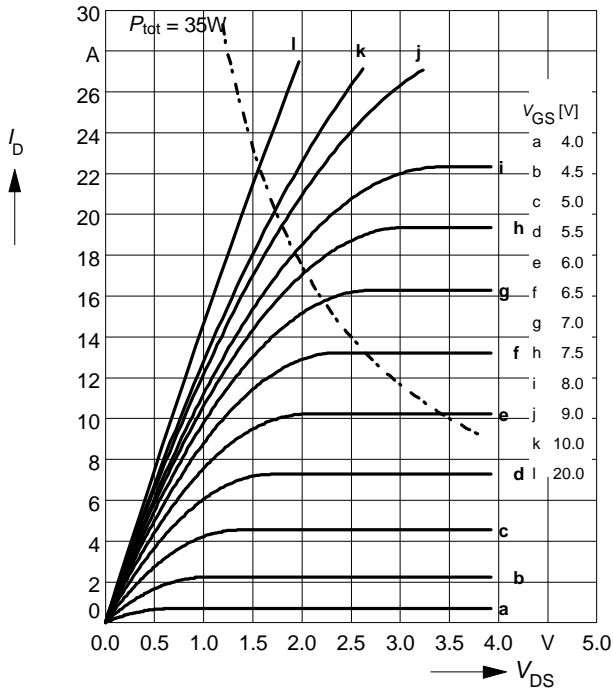
parameter:  $D = t_p / T$



**Typ. output characteristics**

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

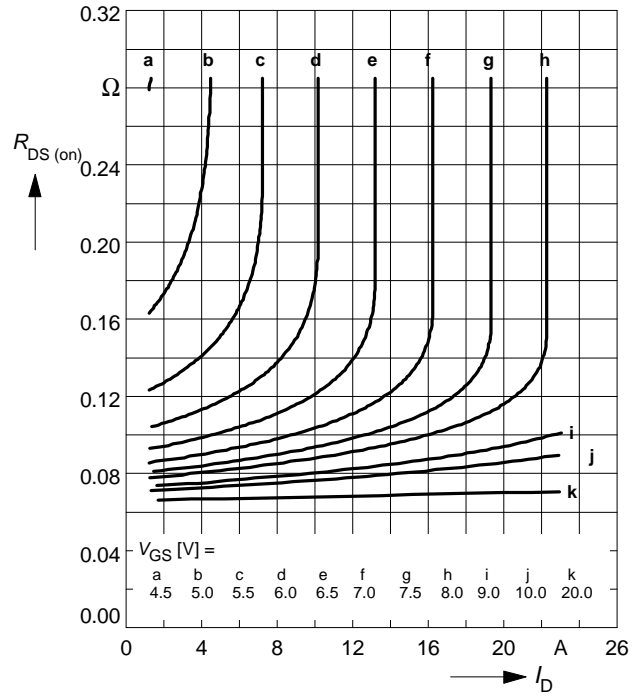
parameter:  $t_p = 80 \mu s$ ,  $T_j = 25^\circ C$



**Typ. drain-source on-resistance**

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

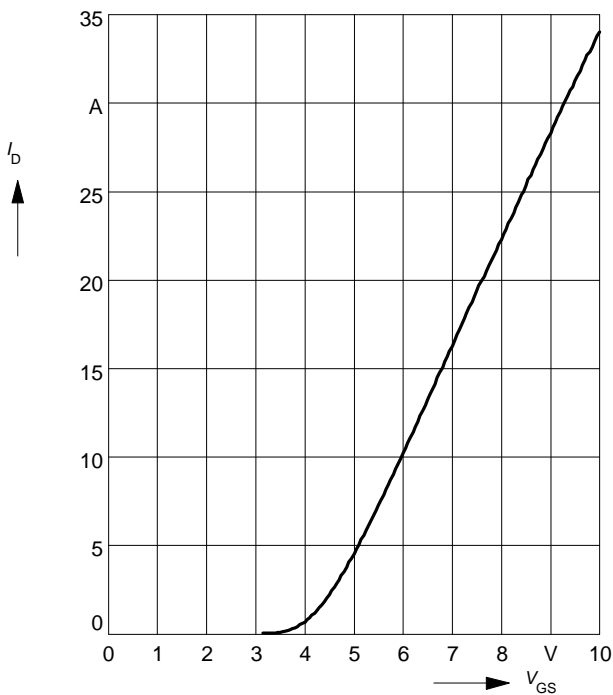
parameter:  $t_p = 80 \mu s$ ,  $T_j = 25^\circ C$



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

parameter:  $t_p = 80 \mu s$

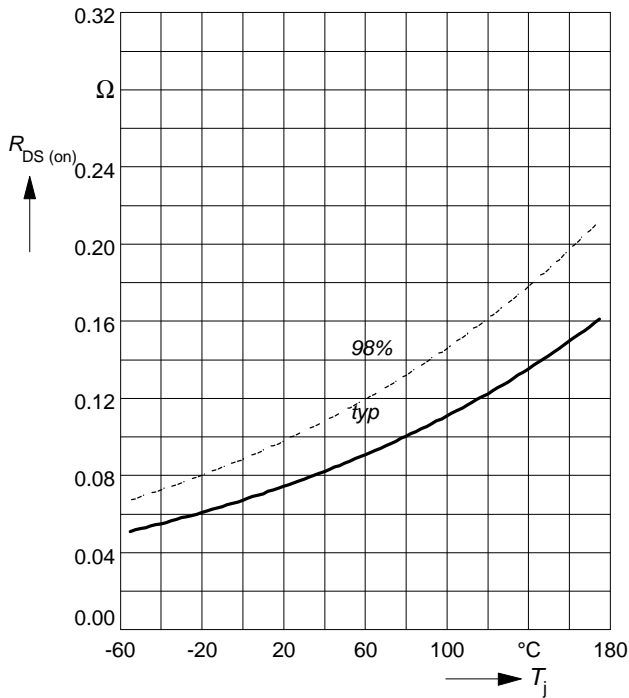
$$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$$



### Drain-source on-resistance

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

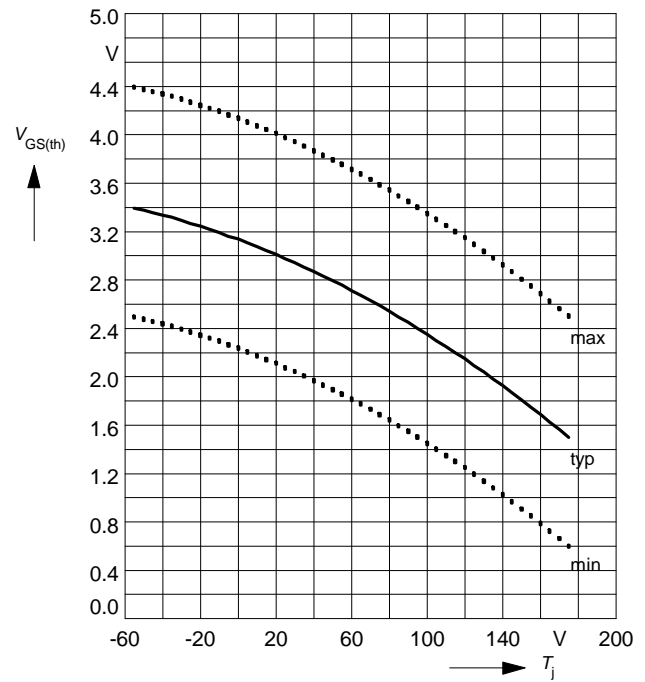
parameter:  $I_D = 9.6 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



### Gate threshold voltage

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

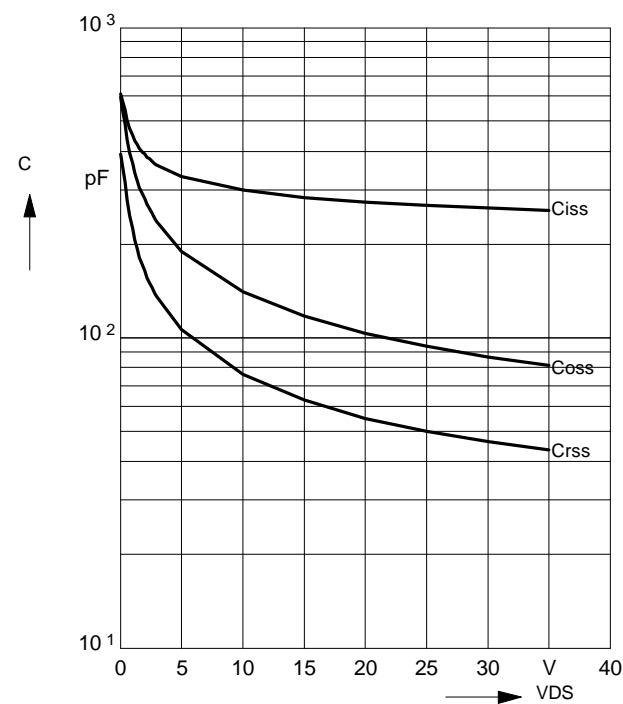
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 20 \mu\text{A}$



### Typ. capacitances

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

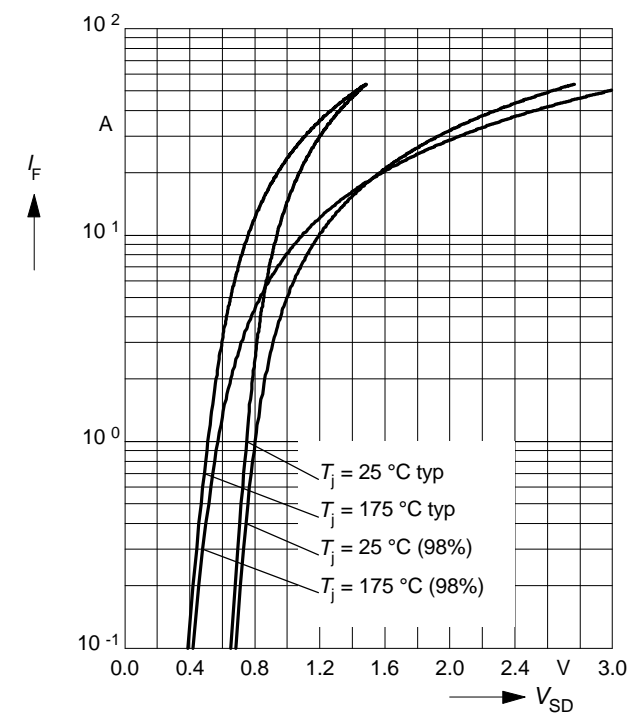
parameter:  $V_{GS} = 0 \text{ V}$ ,  $f = 1 \text{ MHz}$



### Forward characteristics of reverse diode

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

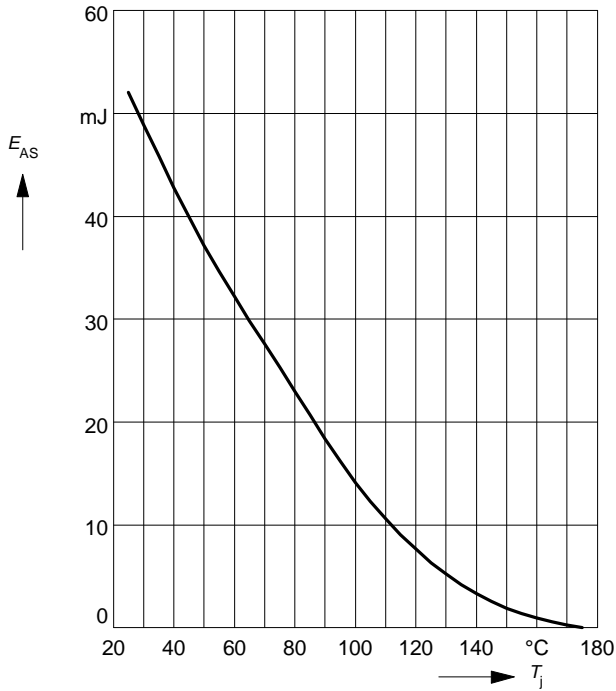
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



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

parameter:  $I_D = 13.5 \text{ A}$ ,  $V_{DD} = 25 \text{ V}$

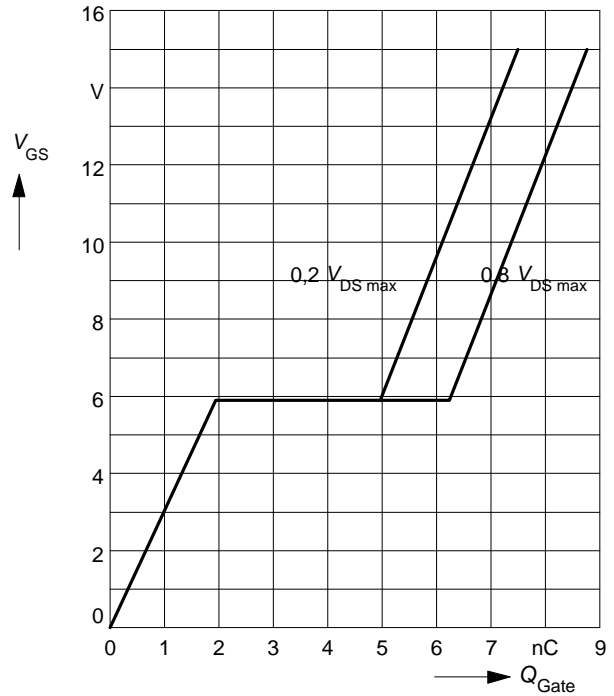
$R_{GS} = 25 \Omega$ ,  $L = 571 \mu\text{H}$



**Typ. gate charge  $V_{GS} = f(Q_{Gate})$**

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

parameter:  $I_{D \text{ puls}} = 14 \text{ A}$



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

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

