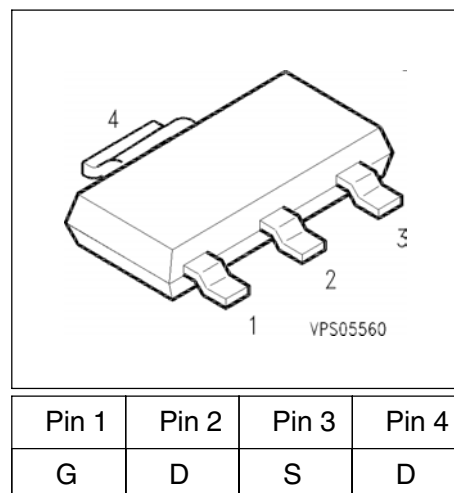
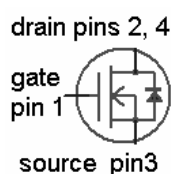


SIPMOS® Small-Signal Transistor

- N channel
- Enhancement mode
- Avalanche rated
- $V_{GS(th)} = 2.1 \dots 4.0 \text{ V}$
- Pb-free lead plating; RoHS compliant
- Qualified according to AEC Q101
- Halogen-free according to IEC61249-2-21



Type	V_{DS}	I_D	$R_{DS(on)}$	Package	Marking
BSP 299	500 V	0.4 A	4 Ω	SOT-223	BSP299

Type	Pb-free	Tape and Reel Information	Packaging
BSP 299	Yes	H6327: 1000 pcs / reel	Dry

Maximum Ratings

Parameter	Symbol	Values	Unit
Continuous drain current $T_A = 25 \text{ }^\circ\text{C}$	I_D	0.4	A
DC drain current, pulsed $T_A = 25 \text{ }^\circ\text{C}$	I_{Dpuls}	1.6	A
Avalanche energy, single pulse $I_D = 1.2 \text{ A}$, $R_{GS} = 25 \text{ } \Omega$ $T_j = 25 \text{ }^\circ\text{C}$	E_{AS}	130	mJ
Gate source voltage	V_{GS}	± 20	V
Power dissipation $T_A = 25 \text{ }^\circ\text{C}$	P_{tot}	1.8	W
ESD Class JESD22-A114-HBM		Class 1b	

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	R_{thJS}	≤ 25	
DIN humidity category, DIN 40 040		E	
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

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 $V_{GS} = 0 \text{ V}$, $I_D = 0.25 \text{ mA}$, $T_j = 0^\circ\text{C}$	$V_{(BR)DSS}$	500	-	-	V
Gate threshold voltage $V_{GS}=V_{DS}$, $I_D = 1 \text{ mA}$	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current $V_{DS} = 500 \text{ V}$, $V_{GS} = 0 \text{ V}$, $T_j = 25^\circ\text{C}$ $V_{DS} = 500 \text{ V}$, $V_{GS} = 0 \text{ V}$, $T_j = 125^\circ\text{C}$	I_{DSS}	- -	0.1 10	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 $V_{GS} = 10 \text{ V}$, $I_D = 0.4 \text{ A}$	$R_{DS(on)}$	-	3.1	4	Ω

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Dynamic Characteristics

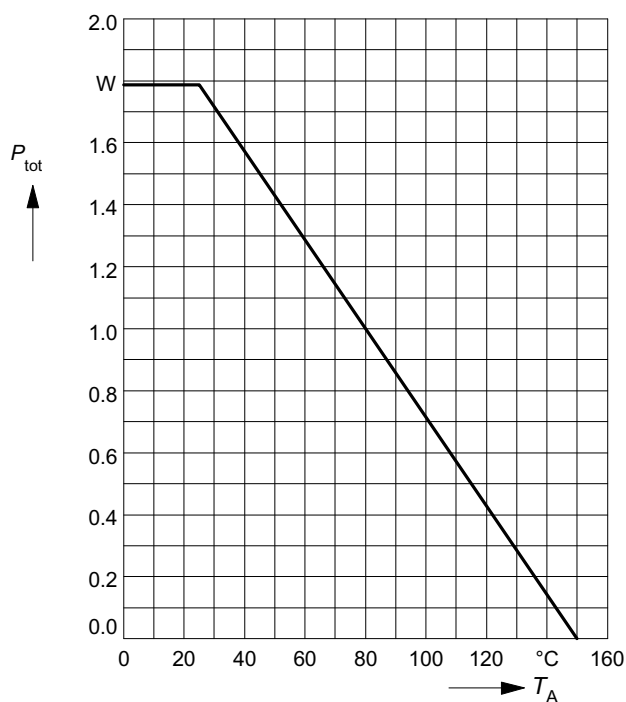
Transconductance $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 0.4 \text{ A}$	g_{fs}	0.3	1.2	-	S
Input capacitance $V_{GS} = 0 \text{ V}$, $V_{DS} = 25 \text{ V}$, $f = 1 \text{ MHz}$	C_{iss}	-	300	400	pF
Output capacitance $V_{GS} = 0 \text{ V}$, $V_{DS} = 25 \text{ V}$, $f = 1 \text{ MHz}$	C_{oss}	-	40	60	
Reverse transfer capacitance $V_{GS} = 0 \text{ V}$, $V_{DS} = 25 \text{ V}$, $f = 1 \text{ MHz}$	C_{rss}	-	15	25	
Turn-on delay time $V_{DD} = 30 \text{ V}$, $V_{GS} = 10 \text{ V}$, $I_D = 0.3 \text{ A}$ $R_{GS} = 50 \Omega$	$t_{d(on)}$	-	8	12	ns
Rise time $V_{DD} = 30 \text{ V}$, $V_{GS} = 10 \text{ V}$, $I_D = 0.3 \text{ A}$ $R_{GS} = 50 \Omega$	t_r	-	15	22	
Turn-off delay time $V_{DD} = 30 \text{ V}$, $V_{GS} = 10 \text{ V}$, $I_D = 0.3 \text{ A}$ $R_{GS} = 50 \Omega$	$t_{d(off)}$	-	55	70	
Fall time $V_{DD} = 30 \text{ V}$, $V_{GS} = 10 \text{ V}$, $I_D = 0.3 \text{ A}$ $R_{GS} = 50 \Omega$	t_f	-	30	40	

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 $T_A = 25\text{ }^{\circ}\text{C}$	I_S	-	-	0.4	A
Inverse diode direct current,pulsed $T_A = 25\text{ }^{\circ}\text{C}$	I_{SM}	-	-	1.6	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$, $I_F = 0.8\text{ A}$, $T_j = 25\text{ }^{\circ}\text{C}$	V_{SD}	-	0.9	1.2	V
Reverse recovery time $V_R = 100\text{ V}$, $I_F=I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	t_{rr}	-	300	-	ns
Reverse recovery charge $V_R = 100\text{ V}$, $I_F=I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	Q_{rr}	-	2.5	-	μC

Power dissipation

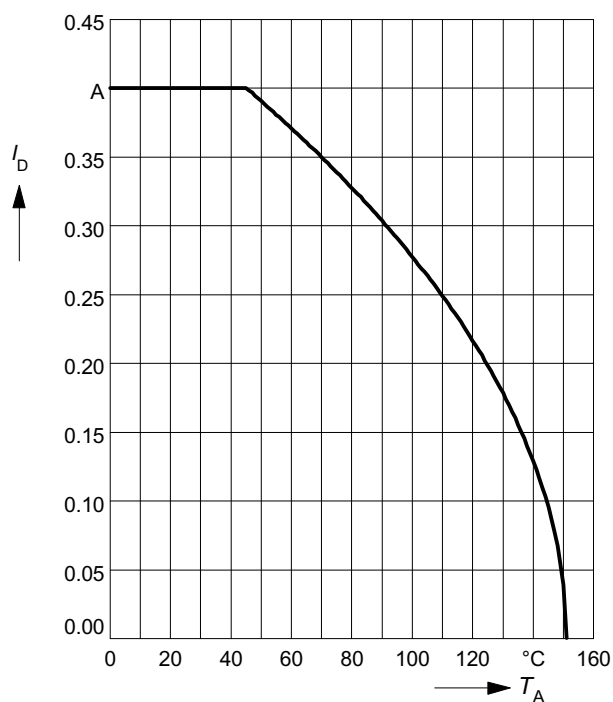
$$P_{\text{tot}} = f(T_A)$$



Drain current

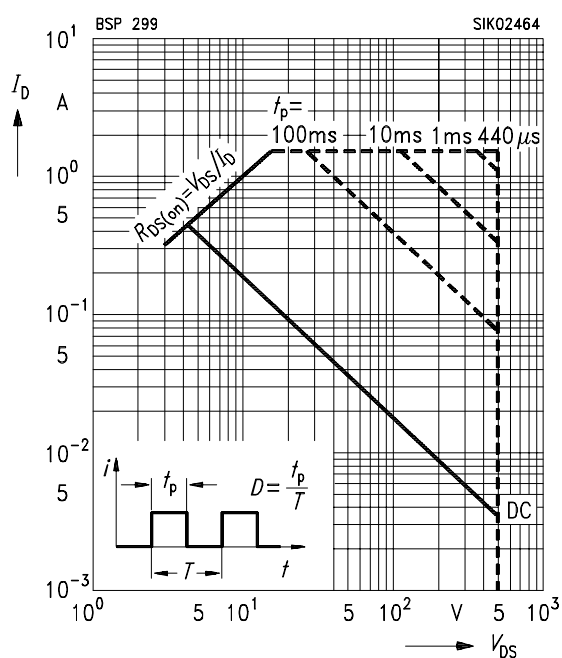
$$I_D = f(T_A)$$

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



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

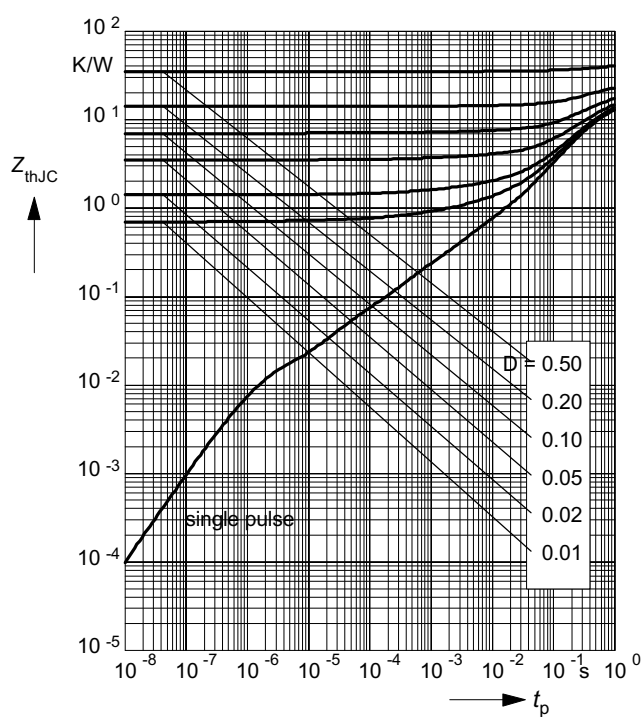
parameter: $D = 0$, $T_C = 25^\circ\text{C}$



Transient thermal impedance

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

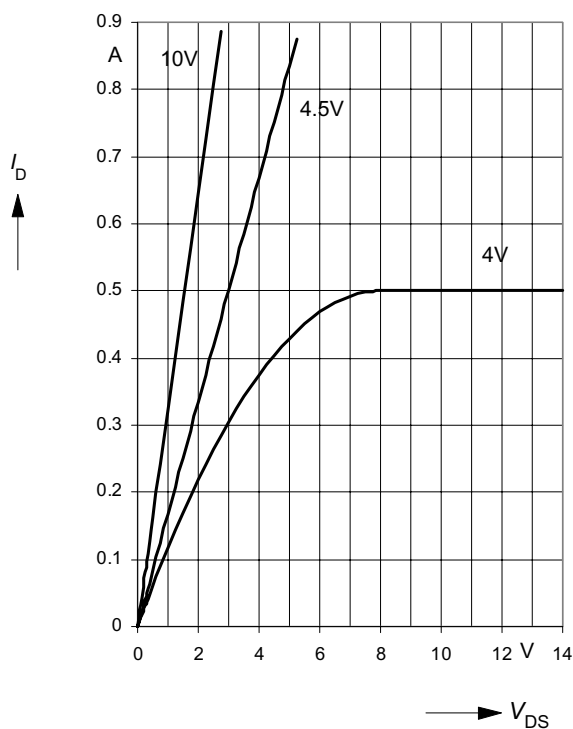
parameter: $D = t_p / T$



Typ. output characteristics

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

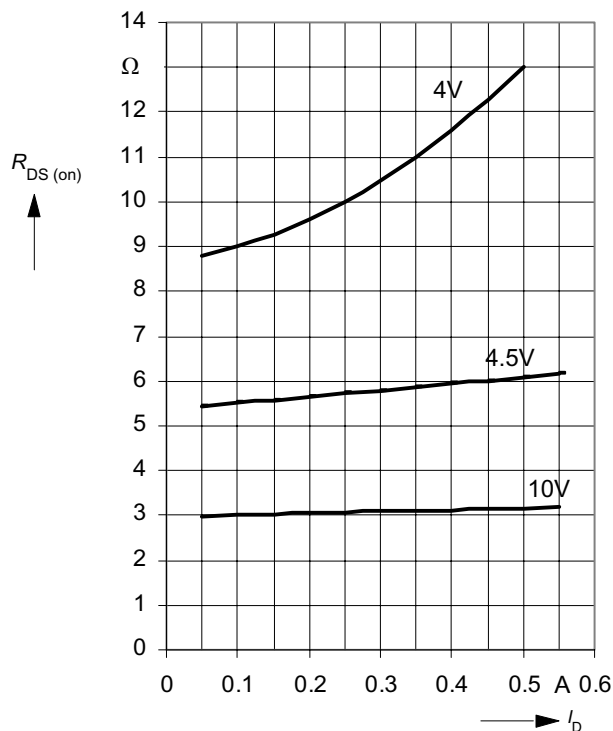
parameter: V_{GS} , $T_j = 25\text{ °C}$



Typ. drain-source on-resistance

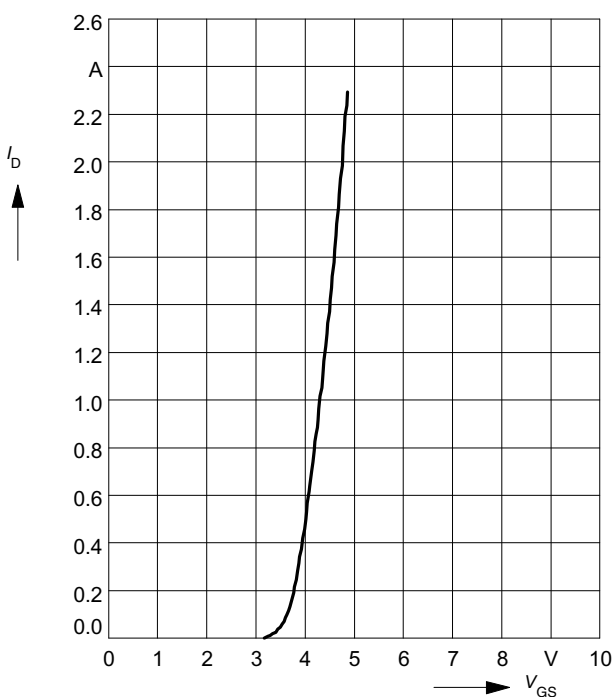
$$R_{DS(on)} = f(I_D)$$

parameter: V_{GS} , $T_j = 25\text{ °C}$



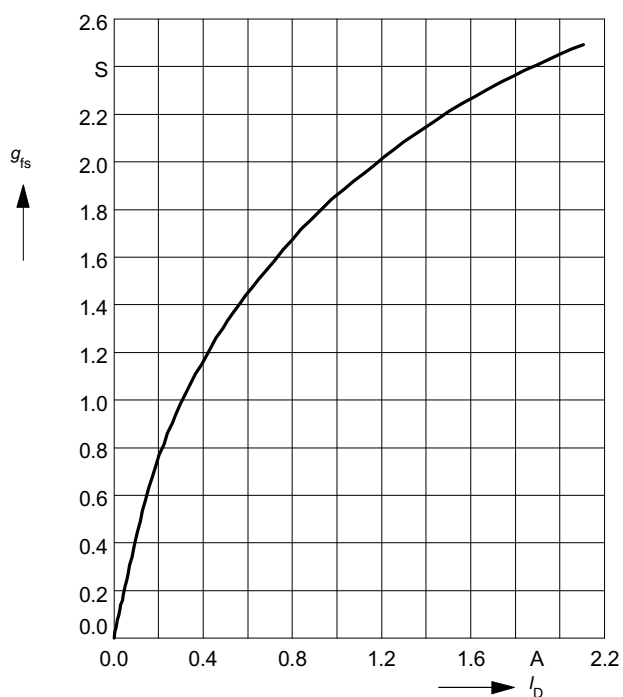
Typ. transfer characteristics $I_D = f(V_{GS})$

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



Typ. forward transconductance $g_{fs} = f(I_D)$

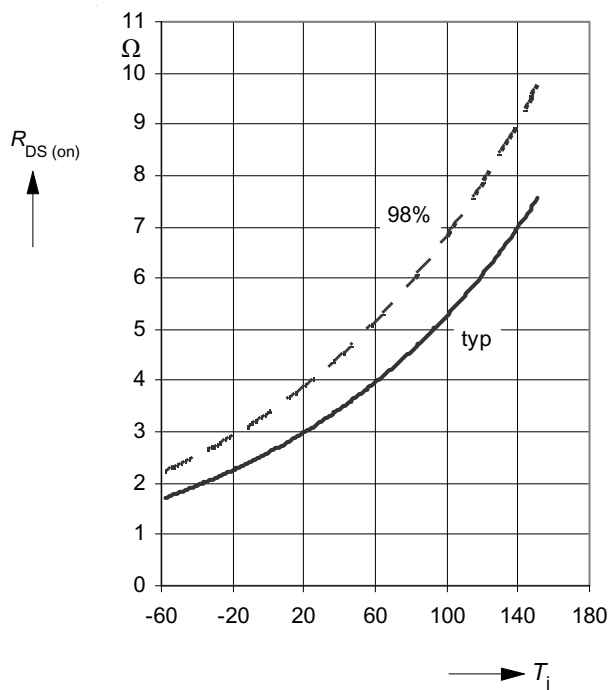
parameter: $t_p = 80\text{ }\mu\text{s}$,



Drain-source on-resistance

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

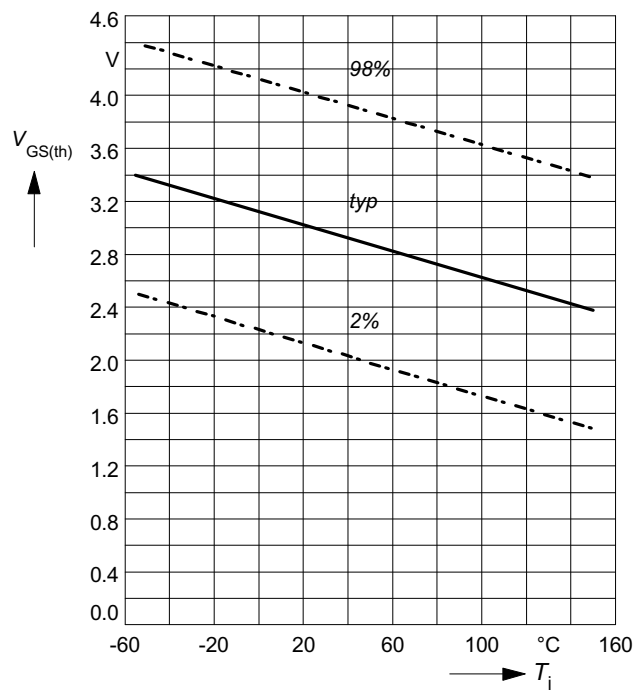
parameter: $I_D = 0.4 \text{ A}$, $V_{GS} = 10 \text{ V}$



Gate threshold voltage

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

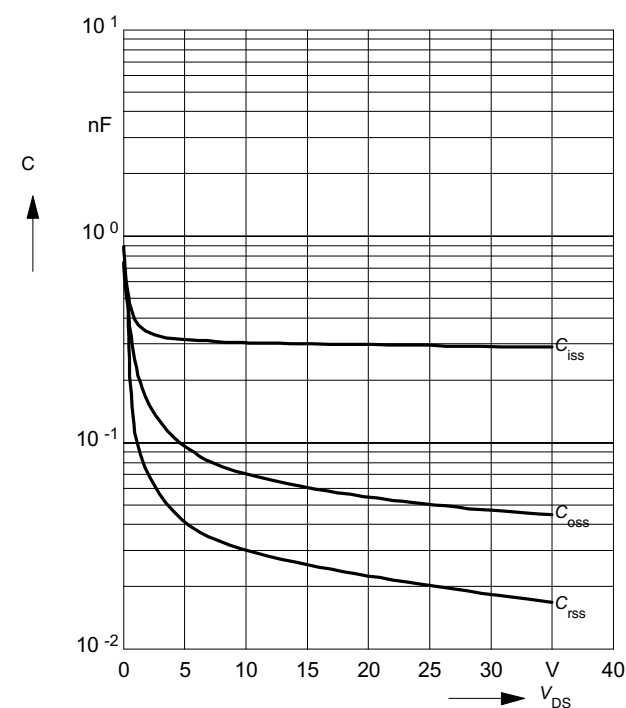
parameter: $V_{GS} = V_{DS}$, $I_D = 1 \text{ mA}$



Typ. capacitances

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

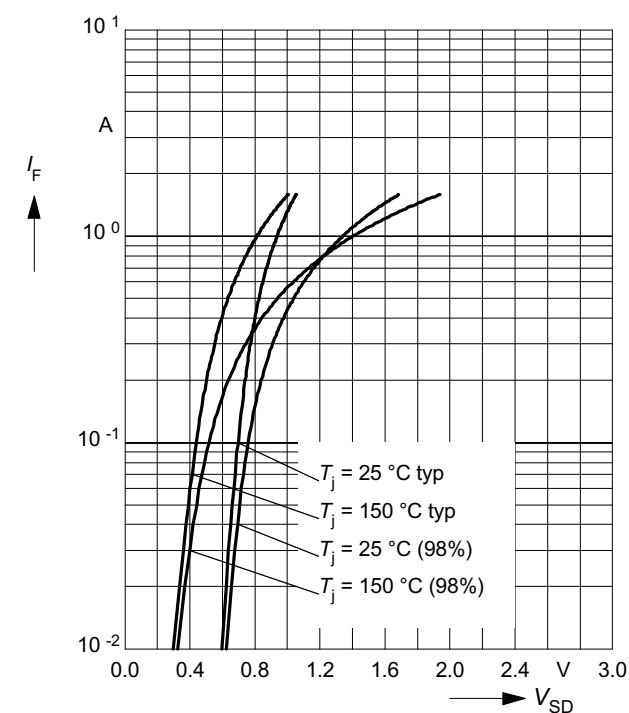
parameter: $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$



Forward characteristics of reverse diode

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

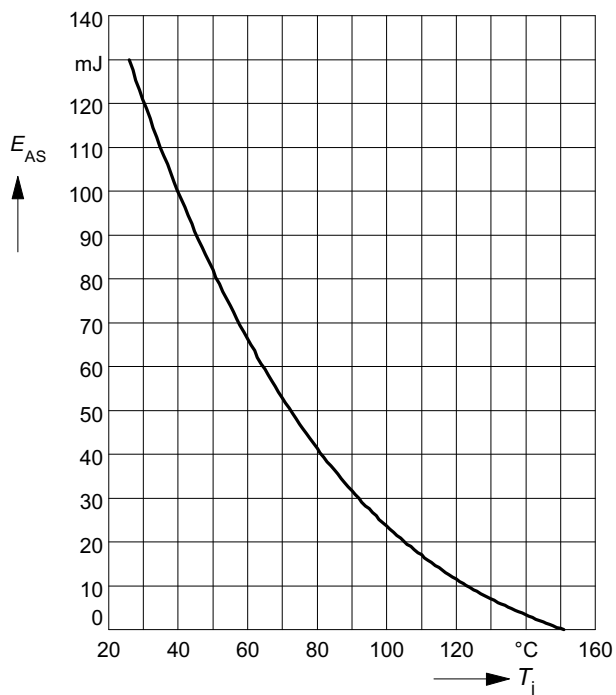
parameter: T_j , $t_p = 80 \mu\text{s}$



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

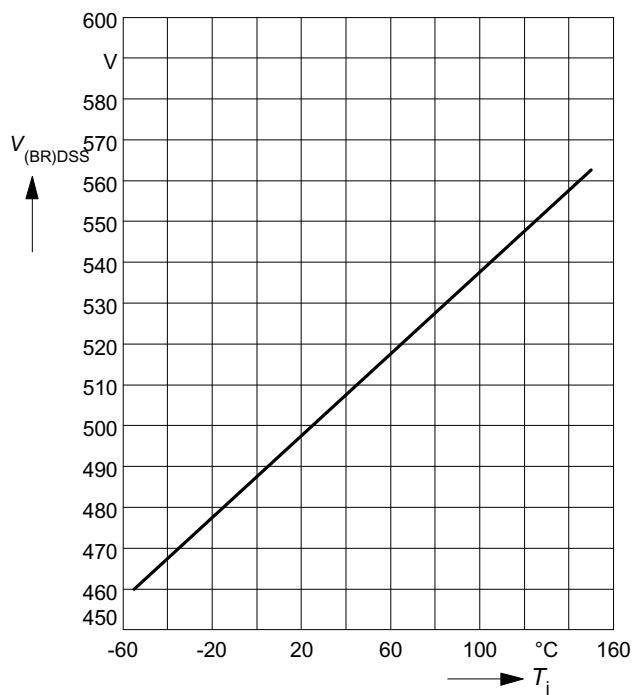
parameter: $I_D = 1.2 \text{ A}$, $V_{DD} = 50 \text{ V}$

$R_{GS} = 25 \Omega$, $L = 163 \text{ mH}$



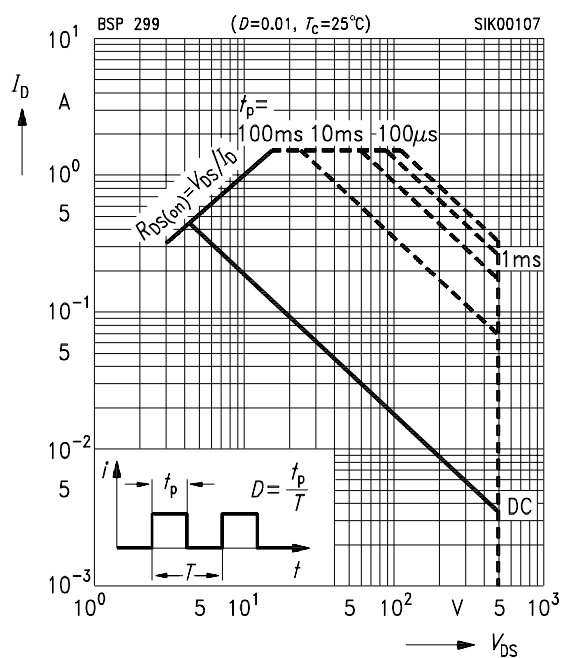
Drain-source breakdown voltage $V_{(BR)DSS} = f(T_j)$

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



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

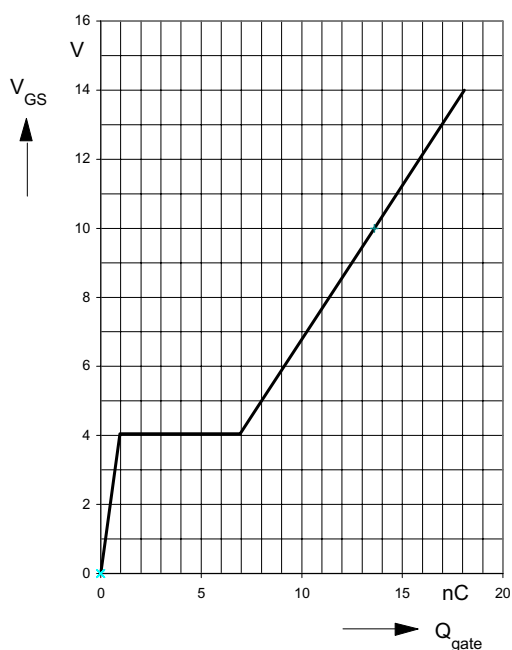
parameter : $D = 0.01$, $T_C = 25^\circ\text{C}$



Typ. gate charge

$V_{GS} = f(Q_{gate})$; $I_D = 0.4 \text{ A}$ pulsed

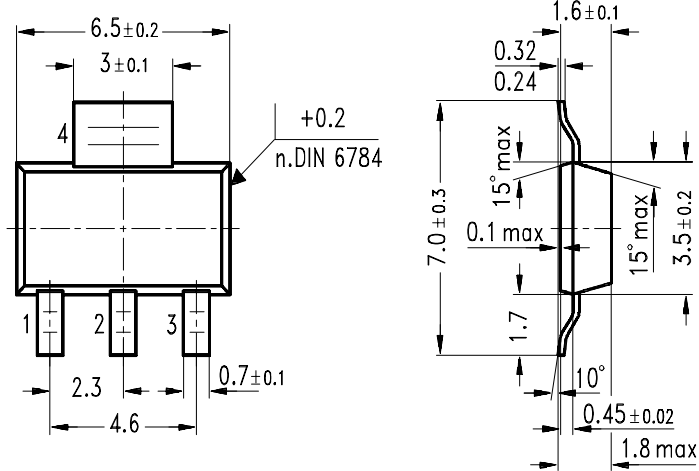
$V_{DD} = 200 \text{ V}$



Package outlines

SOT-223

Dimensions in mm



GPS05560

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