

英飞凌 OptiMOS™ 小信号晶体管

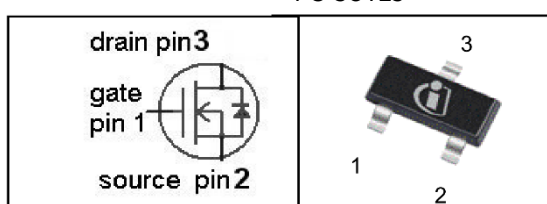
特性

- N沟道
- 增强模式
- 逻辑电平
- 雪崩额定
- 快速开关
- 无铅镀层；符合 RoHS 标准
- 符合 IEC61249-2-21 标准的无卤素

产品概述

V_{DS}	60	V
$R_{DS(on),max}$	$V_{GS}=10\text{ V}$	3 Ω
	$V_{GS}=4.5\text{ V}$	4
I_D	0.3	A

PG-SOT23



Type	Package	Tape and Reel Information	Marking	HalogenFree	Packing
2N7002	PG-SOT-23	H6327: 3000 pcs/reel	72s	Yes	Non Dry

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_A=25\text{ }^\circ\text{C}$	0.30	A
		$T_A=70\text{ }^\circ\text{C}$	0.24	
Pulsed drain current	$I_{D,pulse}$	$T_A=25\text{ }^\circ\text{C}$	1.2	
Avalanche energy, single pulse	E_{AS}	$I_D=0.3\text{ A}$, $R_{GS}=25\text{ }\Omega$	1.3	mJ
Reverse diode dv/dt	dv/dt	$I_D=0.3\text{ A}$, $V_{DS}=48\text{ V}$, $di/dt=200\text{ A}/\mu\text{s}$, $T_{j,max}=150\text{ }^\circ\text{C}$	6	kV/ μs
Gate source voltage	V_{GS}		± 20	V
ESD class		JESD22-A114 (HBM)	class 0 (<250V)	
Power dissipation	$P_{tot}^{(2)}$	$T_A=25\text{ }^\circ\text{C}$	0.5	W
Operating and storage temperature	T_j , T_{stg}		-55 ... 150	$^\circ\text{C}$
IEC climatic category; DIN IEC 68-1			55/150/56	

⁽¹⁾ J-STD20 和 JESD22

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - minimal footprint ⁽²⁾	R_{thJA}		-	-	250	K/W
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电气特性，除非另有规定，否则均为 $T_j=25\text{ }^{\circ}\text{C}$

Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=250\text{ }\mu\text{A}$	60	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\text{ }\mu\text{A}$	1.5	2.1	2.5	
Drain-source leakage current	$I_{D(off)}$	$V_{DS}=60\text{ V},$ $V_{GS}=0\text{ V}, T_j=25\text{ }^{\circ}\text{C}$	-	-	0.1	μA
		$V_{DS}=60\text{ V},$ $V_{GS}=0\text{ V}, T_j=150\text{ }^{\circ}\text{C}$	-	-	5	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	1	10	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=4.5\text{ V}, I_D=0.25\text{ A}$	-	2.0	4	Ω
		$V_{GS}=10\text{ V}, I_D=0.5\text{ A}$	-	1.6	3	
Transconductance	g_{fs}	$ V_{DS} >2 I_D R_{DS(on)max},$ $I_D=0.24\text{ A}$	0.2	0.36	-	S

⁽²⁾ 在 $40\times40\text{ mm}^2$ FR4 PCB 上执行，双面铜质力感应走线，每条走线宽 1mm，厚 $70\mu\text{m}$ ，长 20mm。

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$	-	13	20	pF
Output capacitance	C_{oss}		-	4.1	6	
Reverse transfer capacitance	C_{rss}		-	2.0	3	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=30\text{ V}, V_{GS}=10\text{ V},$ $I_D=0.5\text{ A}, R_G=6\ \Omega$	-	3.0	4.5	ns
Rise time	t_r		-	3.3	5	
Turn-off delay time	$t_{d(off)}$		-	5.5	9	
Fall time	t_f		-	3.1	5	

Gate Charge Characteristics

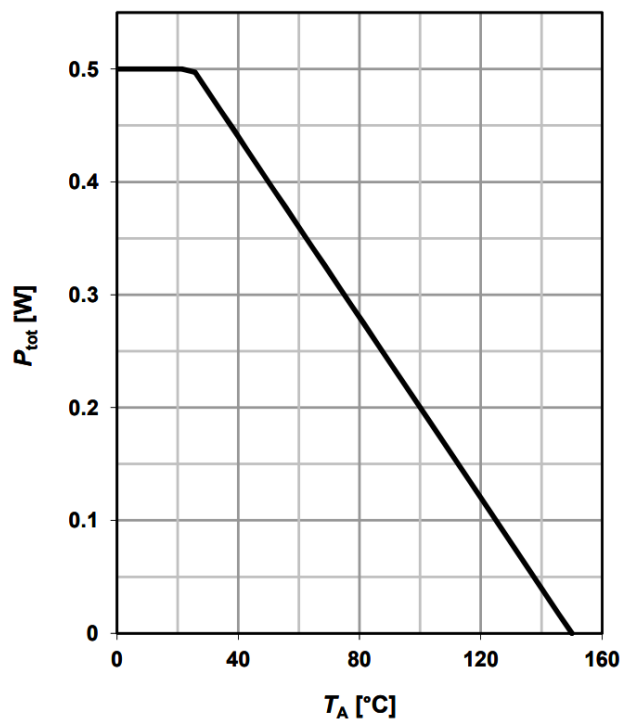
Gate to source charge	Q_{gs}	$V_{DD}=48\text{ V}, I_D=0.5\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	0.05	0.1	nC
Gate to drain charge	Q_{gd}		-	0.2	0.4	
Gate charge total	Q_g		-	0.4	0.6	
Gate plateau voltage	$V_{plateau}$		-	4.0	-	V

Reverse Diode

Diode continuous forward current	I_S	$T_A=25\text{ °C}$	-	-	0.3	A
Diode pulse current	$I_{S,pulse}$		-	-	1.2	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=0.5\text{ A},$ $T_j=25\text{ °C}$	-	0.96	1.2	V
Reverse recovery time	t_{rr}	$V_R=30\text{ V}, I_F=0.5\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	8.5	13	ns
Reverse recovery charge	Q_{rr}		-	2.4	4	

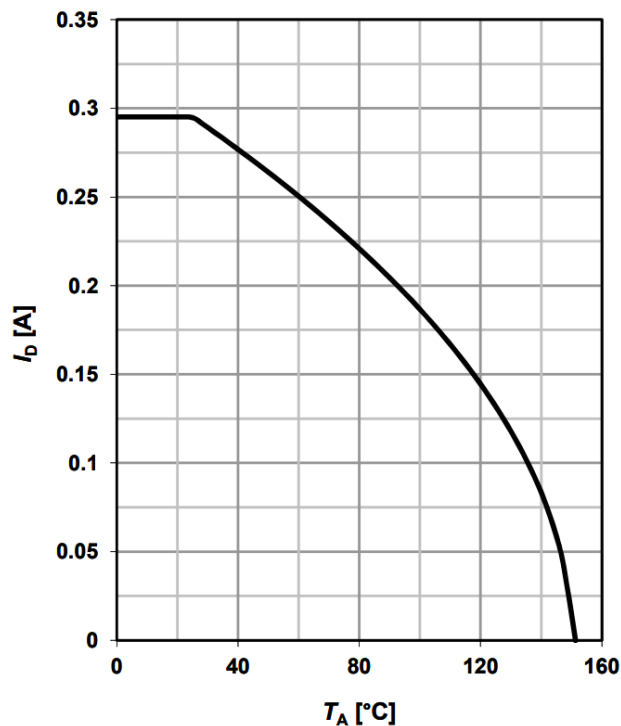
1 功率耗散

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



2 漏极电流

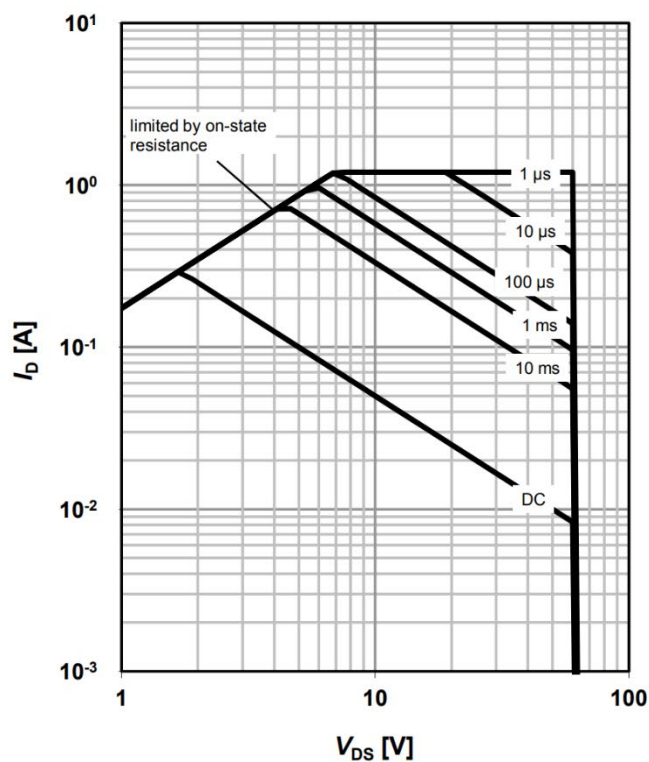
$$I_D = f(T_A); V_{GS} \geq 10 \text{ V}$$



3 安全工作区

$$I_D = f(V_{DS}); T_A = 25 \text{ °C}; D = 0$$

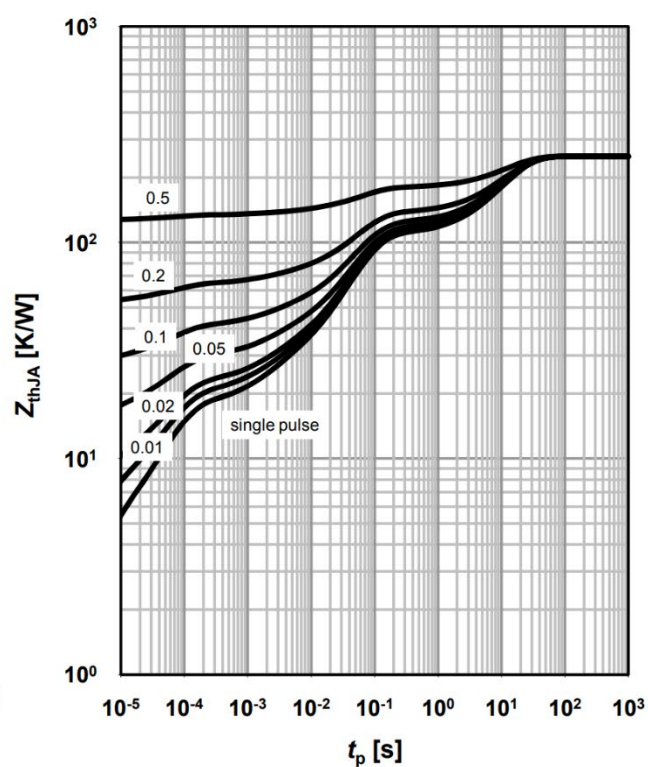
parameter: t_p



4 最大瞬态热阻抗

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

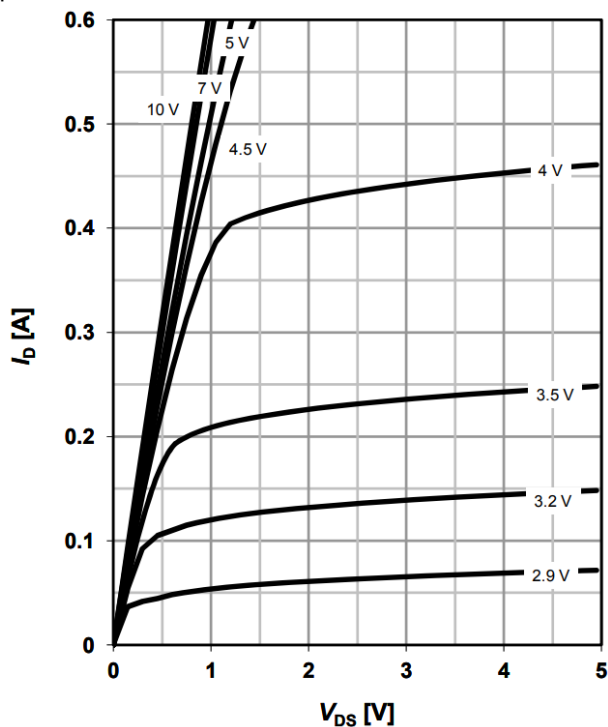
parameter: $D = t_p / T$



5 典型输出特性

$$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$$

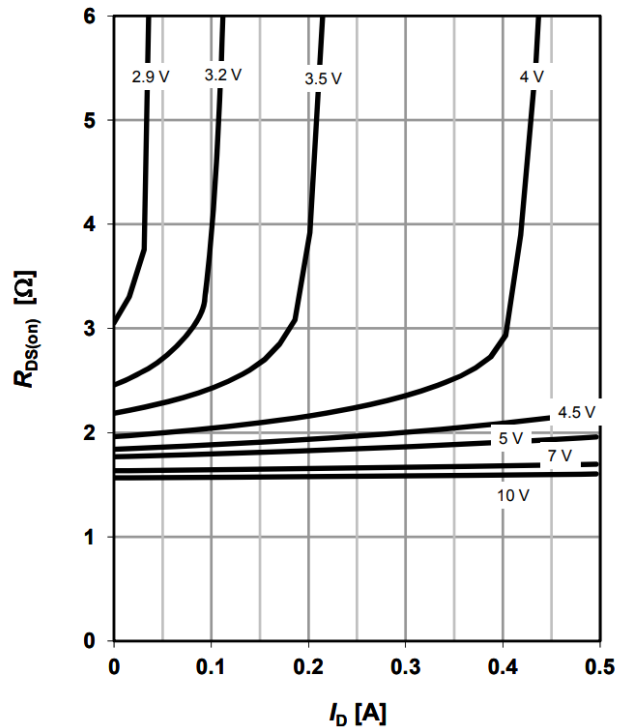
parameter: V_{GS}



6 典型漏源导通电阻

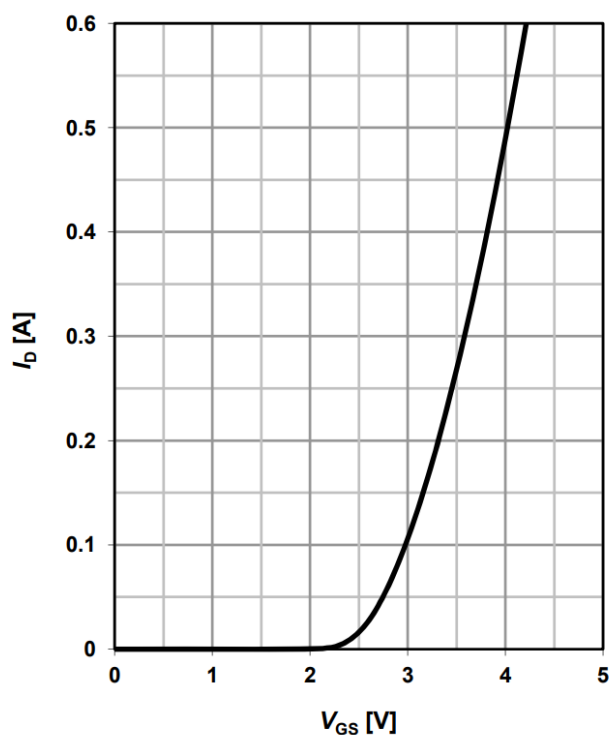
$$R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}$$

parameter: V_{GS}



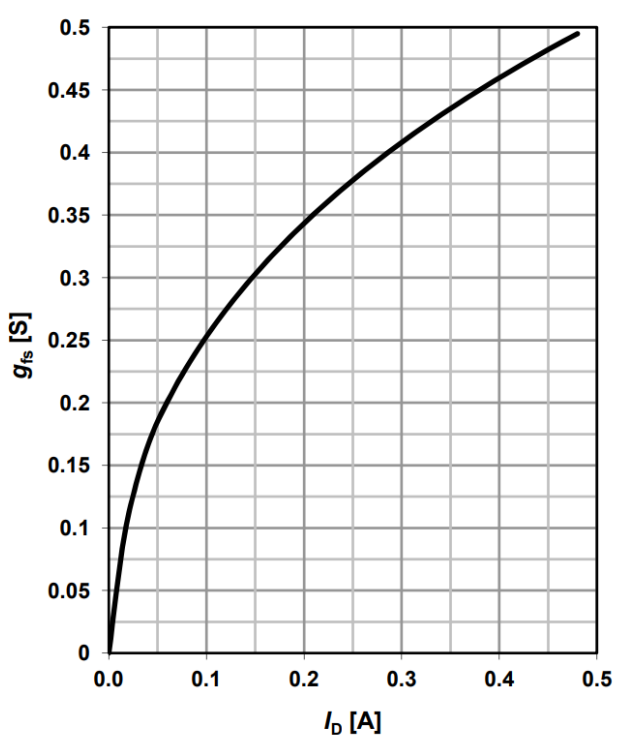
7 典型转移特性

$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$$



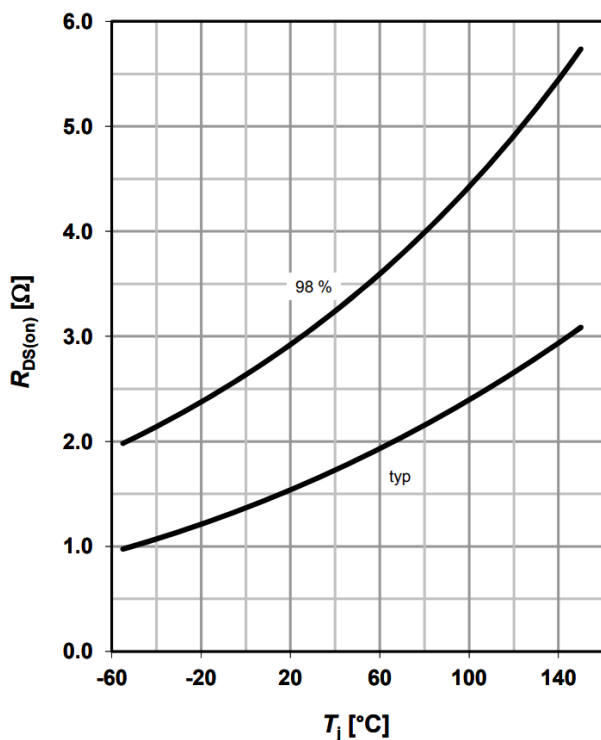
8 典型正向跨导

$$g_{fs} = f(I_D); T_j = 25^\circ\text{C}$$



9 漏源导通电阻

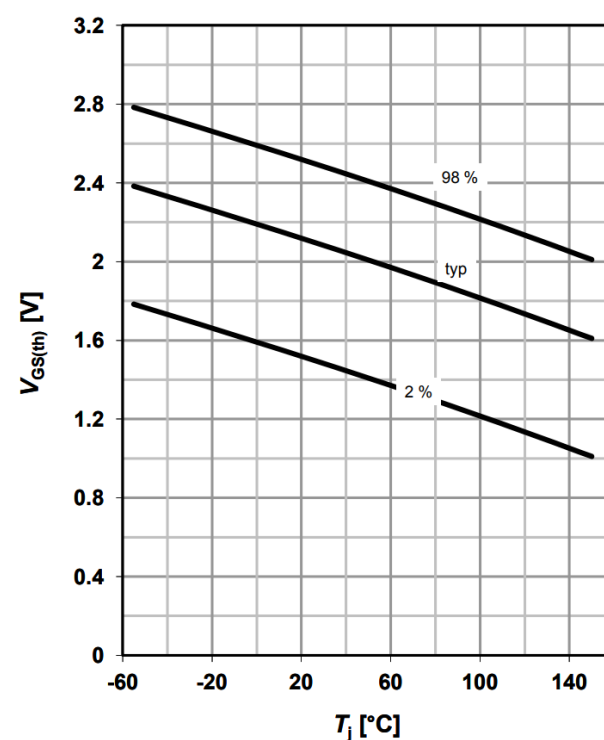
$$R_{DS(on)} = f(T_j); I_D = 0.3 \text{ A}; V_{GS} = 10 \text{ V}$$



10 典型栅极阈值电压

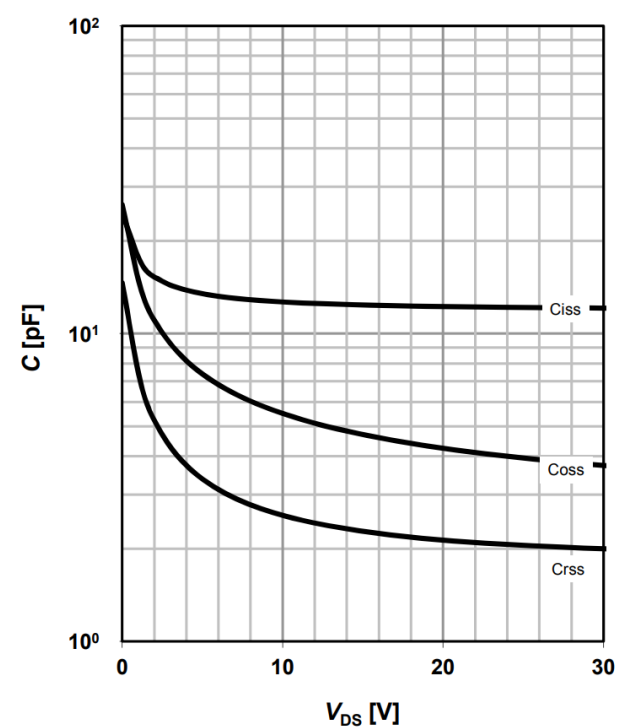
$$V_{GS(th)} = f(T_j); V_{DS} = V_{GS}; I_D = 250 \mu\text{A}$$

parameter: I_D



11 典型电容值

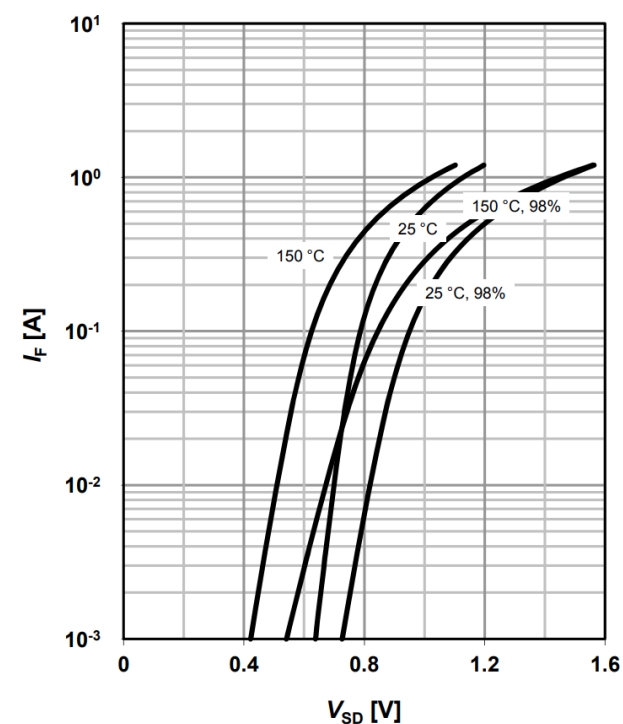
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25^{\circ}\text{C}$$



12 反向二极管的正向特性

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

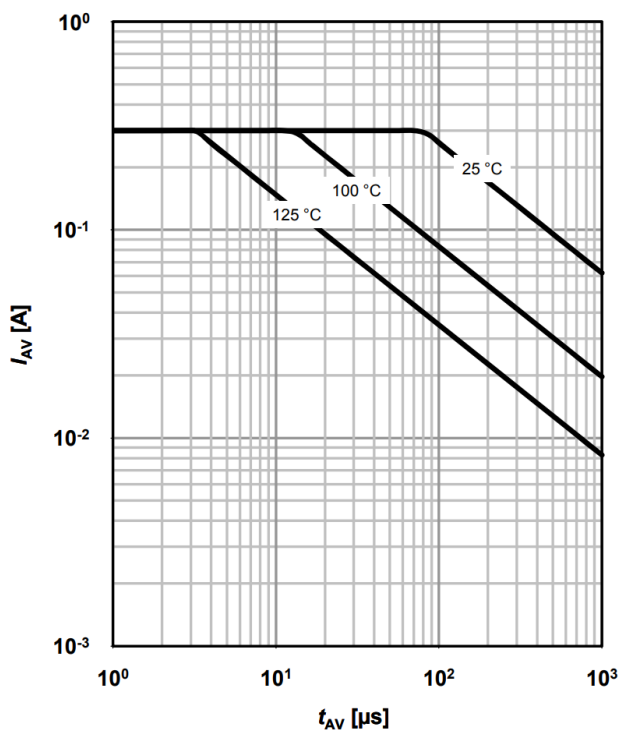
parameter: T_j



13 雪崩特性

$$I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega$$

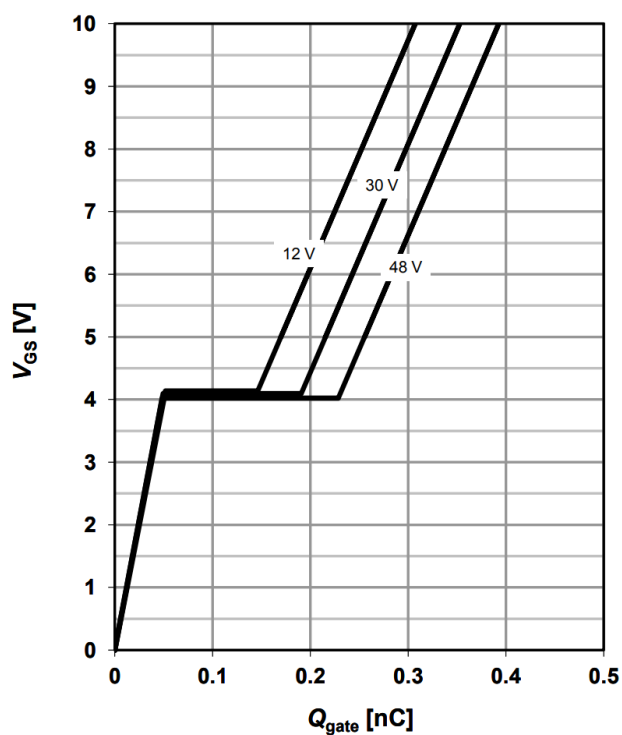
parameter: $T_{j(\text{start})}$



14 典型栅极电荷

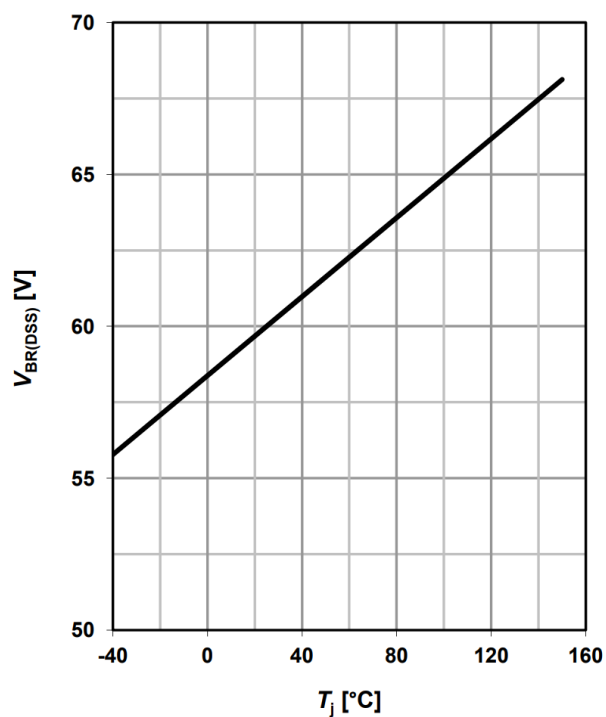
$$V_{GS}=f(Q_{gate}); I_D=0.5\ \text{A pulsed}$$

parameter: V_{DD}



15 漏源击穿电压

$$V_{BR(DSS)}=f(T_j); I_D=250\ \mu\text{A}$$



Technical drawing of a DIN 6784 plug, showing two views: a front view (left) and a side view (right).

Front View (Left):

- Overall width: 2.9 ± 0.1
- Feature A: Top surface.
- Feature B: Right side.
- Feature C: Bottom surface.
- Feature 1: Left side.
- Feature 2: Bottom center.
- Feature 3: Top center.
- Dimension $0.4^{+0.1}_{-0.05}$ indicates the height of the top flange.
- Dimension 0.95 indicates the width of the bottom flange.
- Dimension 1.9 indicates the width of the central hole.
- Surface finish: $+0.2$ acc. to DIN 6784.
- Feature Control Frame: $\oplus 0.25 \text{ (M) B C}$

Side View (Right):

- Overall height: 2.6 MAX.
- Top flange width: 1.1 MAX.
- Top flange thickness: 0.1 MAX.
- Top flange angle: 10° MAX.
- Bottom flange width: 1.3 ± 0.1
- Bottom flange thickness: $0.08 \dots 0.15$
- Bottom flange angle: $2^\circ \dots 30^\circ$
- Feature Control Frame: $\equiv 0.20 \text{ (M) A}$

Technical drawing of a 3-hole punch. The drawing includes a top view and a side view. The top view shows a rectangular punch with three circular holes. Dimensions are: 4 (width of the punch), 2.65 (height of the punch), 3.15 (width of the punch body), and 8 (height of the punch body). The side view shows the profile of the punch with dimensions: 0.2 (thickness of the punch) and 1.15 (height of the punch body).

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