HIGH QUALITY POWER

ElecSuper

湖南静芯微电子技术有限公司

ElecSuper Microelectronics Technology Co.,Ltd.

SEMICONDUCTOR DEVICES

Full-chip integration of high-performance ESD/T-VS design services and discrete device products such as ESD/TVS/MOS

关于我们

湖南静芯微电子技术有限公司是由留学归国人员带领一支年轻且经验丰富的分立器件研发团队创办的企业。是一家专业提供全芯片片上集成高性能ESD/TVS设计服务和ESD/TVS/TSS/-MOS等分立器件产品的集成电路设计公司。公司拥有独立的自主知识产权，是国内第一家成功开发芯片级TVS抗静电保护器件的公司。公司积累了一系列知识产权成果，获得国家知识产权共计51项，其中，获得发明专利4项、实用新型专利18项、集成电路布图登记29项；进入实审发明专利18项。累计测试结构达4000余个，并在多个关键技术取得突破，特别是在国内首次开发成功在人体模型(HBM)下抗静电强度高于30KV关键技术和器件（2014年获得湖南省科技进步奖）。完成过国家“十二五”重大专项、国家自然科学基金、国家863等国家省市级项目片上ESD防护设计；公司2015年入选长沙经济技术开发区“招才引智三年行动计划”项目；2016年入选长沙市3635计划；2018年获得国家高新技术企业认定；2020年获得湖南省科技进步奖，同时完成ISO9001质量体系导入，完成ROHS/CE/REACH/PAHS认证；2022年获得湖南省专精特新“小巨人”企业称号；2022年获得湖南省技术发明奖。

公司主要从事片上集成高性能ESD/TVS设计服务以及ESD/TVS/TSS/MOS等分立器件产品的研发与销售。公司成员是一支经验丰富的ESD/TVS/TSS/MOS研发团队，在片上ESD/TVS设计服务方向，具有丰富的CMOS、BiCMOS、CDMOS、HV MOS、BCD等工艺制程的设计服务经验。在分立器件方向，具有自带完整的ESD/TVS/MOS/二三极管等器件工艺技术能力，且有在多家foundry流片的流片经验。公司成立7年以来，建立了完善的ESD/TVS/MOS/二三极管/肖特基测试实验室，同时与国内外300余家企业达成合作或建立战略合作关系。

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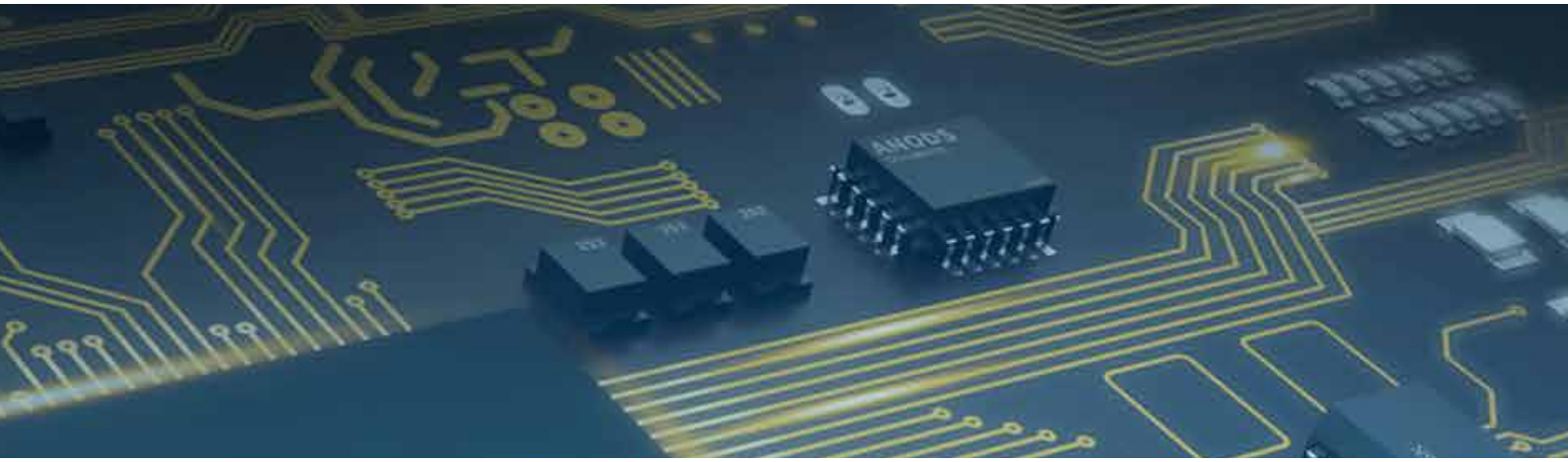

1. 静电保护元件（ESD）

ESD 是由一个或多个 TVS 晶粒采用不同的电路拓扑制成具有特定功能的多路或单路 ESD 保护器件。ESD反向并联于电路中，当电路正常工作时，TVS 处于截止状态（高阻态），不影响电路正常工作。当电路出现异常过电压并达到 ESD 的击穿电压时，ESD迅速由高阻态变为低阻态，泄放由异常过电压导致的瞬时过电流到地，同时把异常过电压钳制在一个安全水平之内，从而保护后级电路免遭异常过电压的损坏。当异常过电压消失后，ESD阻值又恢复为高阻态。ESD 器件主要应用于各类通信接口的 ESD 保护，如 USB、HDMI、RS485、RS422、RS232、CAN、RJ45、RJ11、VGA、BNC、SIM卡、SD卡等。电路设计工程师可以根据电路板布局及接口类型选择不同封装的 ESD 器件。

I_{PP}：峰值脉冲电流

V_C：钳位电压

V_{BR}：击穿电压

I_T：脉冲直流试验电流

V_{RWM}：最高工作电压

I_R：漏电流

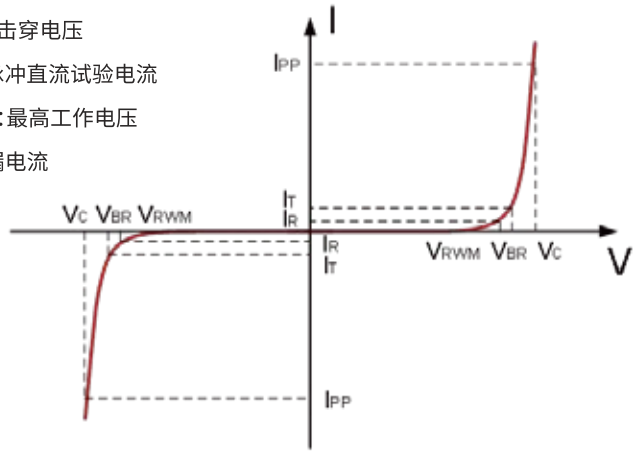

图 1 双向 ESD 伏安特性曲线

ESD 选型注意事项

最高工作电压V_{RWM}：ESD管的截止电压应大于线路上最高工作电压或信号电平电压。如果截止电压选择过低，一方面会影响电路正常工作，另一方面会影响 ESD的使用寿命。

峰值脉冲电流I_{PP}：当ESD单独使用时，要根据线路上可能出现的最大浪涌电流来选择合适的型号。相同电压的 ESD，功率越大 IPP 也越大。功率越大的 ESD 对电路的保护效果也越好。

钳位电压V_C：应小于被保护电路最大可承受的瞬态安全电压，VC 与 ESD的击穿电压及 IPP 都成正比。

漏电流I_R：在通信线路及低功耗电路中，要特别关注 IR 这个参数，IR越小ESD性能越好。

结电容C_j：ESD 一般用于各类通信端口静电防护，在一些高速数据线路，如 USB3.0、HDMI等接口，应选择结电容小的 ESD 器件，以避免影响信号质量。

封装形式：根据电路设计布局及被保护线路数选择合适的封装形式。ESD 器件封装的大小在一定程度上可以反应器件的防护等级大小，一般封装越大的器件可容纳的 ESD 芯片尺寸也越大，防护等级也越高，反之亦然。

极性：ESD 有单向和双向之分，根据工作的信号进行选择，单极性的信号可以选择单向的 ESD 或双向的 ESD 器件，双极性的信号需选择双向的 ESD 器件。

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ESD命名规则
ESD naming convention

SE NC 3D 5V 1 B A

静芯微产品标识

结电容：
UC:极低电容
LC:低电容
NC:常规电容
HC:高电容

封装：
563T:SOT-563
523T:SOT-523
363T:SOT-363
263T:SOT-23-6L
23T:SOT-23
143T:SOT-143
3D:SOD-323
5D:SOD- 523
9D:SOD-923
2F:DFN1006-2L
3F:DFN1006-3L
06F:DFN1610-6L
10F:DFN2510-10L
16F:DFN1610-2L
23F:DFN2*2-3L
2X:DFN0603-2L

版本标识

方向：
B:双向
U:单向

通道数：
1:1通道
2:2通道
4:4通道

工作电压(V_{RWM})
3V:3.3V
5V:5V
…

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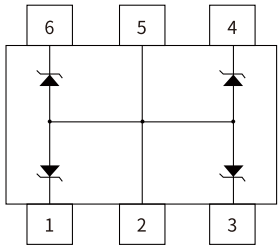
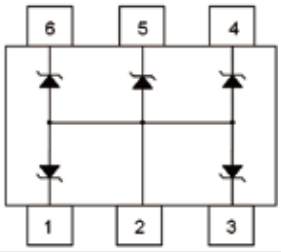
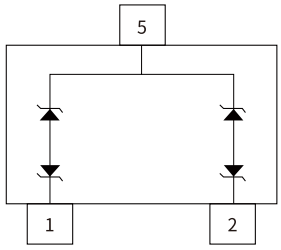
SuperESD-Low Capacitance ESD(continued)

Part Number	Directional	VRWM (V)(Max)	IPP@8/20us (A)(Max)	VCL@IPP (V)(Max)	CJ@0V/1MHz (pF)(Type)	Package	Device Schematic
SENC236T5V4UA	Uni.	5	22	15	200	SOT-23-6L	
SENC236T7V4UA	Uni.	7	20	20	150	SOT-23-6L	
SENC236T12V4UA	Uni.	12	15	30	90	SOT-23-6L	
SENC236T15V4UA	Uni.	15	12	35	70	SOT-23-6L	
SENC236T5V4UB	Uni.	5	12	15	130	SOT-23-6L	
SENC236T5V5UA	Uni.	5	19	15	180	SOT-23-6L	
SENC236T7V5UA	Uni.	7	20	18	130	SOT-23-6L	
SENC236T12V5UA	Uni.	12	12	28	75	SOT-23-6L	
SENC236T15V5UA	Uni.	15	11	33	65	SOT-23-6L	
SENC23T3V2B	Bi.	3.3	24	22	120	SOT-23	
SENC23T5V2B	Bi.	5	20	22	120	SOT-23	
SENC23T8V2B	Bi.	8	15	28	110	SOT-23	
SENC23T12V2B	Bi.	12	12	37	70	SOT-23	
SENC23T15V2B	Bi.	15	9	44	40	SOT-23	
SENC23T18V2B	Bi.	18	7	55	35	SOT-23	
SENC23T24V2B	Bi.	24	6	63	30	SOT-23	
SENC23T36V2B	Bi.	36	4	72	25	SOT-23	
SENC23T3V2BA	Bi.	3.3	16	18	100	SOT-23	
SENC23T5V2BA	Bi.	5	15	20	90	SOT-23	
SENC23T8V2BA	Bi.	8	12	22	70	SOT-23	
SENC23T12V2BA	Bi.	12	8	35	50	SOT-23	
SENC23T15V2BA	Bi.	15	6	45	30	SOT-23	
SENC23T24V2BA	Bi.	24	4	55	20	SOT-23	
SENC23T3V2BB	Bi.	3.3	24	21	135	SOT-23	
SENC23T5V2BB	Bi.	5	8	9	12	SOT-23	
SENC712	Bi.	7/12	28/16	15/23	80	SOT-23	
SENC712A	Bi.	7/12	17/17	25/35	55	SOT-23	

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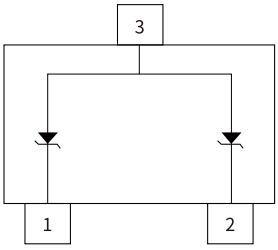
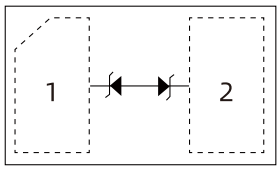
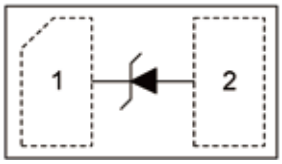
SuperESD-Low Capacitance ESD(continued)

Part Number	Directional	VRWM (V)(Max)	IPP@8/20us (A)(Max)	VCL@IPP (V)(Max)	CJ@0V/1MHz (pF)(Type)	Package	Device Schematic
SENC23T3V2U	Uni.	3.3	32	18	300	SOT-23	
SENC23T5V2U	Uni.	5	30	18	220	SOT-23	
SENC23T7V2U	Uni.	7	25	20	180	SOT-23	
SENC23T12V2U	Uni.	12	11	32	120	SOT-23	
SENC23T15V2U	Uni.	15	10	38	100	SOT-23	
SENC23T24V2U	Uni.	24	7	52	60	SOT-23	
SENC23T36V2U	Uni.	36	4	75	50	SOT-23	
SENC23T12V2UA	Uni.	12	10	25	120	SOT-23	
SENC23T15V2UA	Uni.	15	7	30	100	SOT-23	
SENC23T24V2UA	Uni.	24	4	40	100	SOT-23	
SENC23T3V2UA	Uni.	3.3	20	15	195	SOT-23	
SENC23T5V2UA	Uni.	5	15	21	150	SOT-23	
SENC23T5V2UB	Uni.	5	10	15	120	SOT-23	
SENC23T5V2UC	Uni.	5	16	20	120	SOT-23	
SENC23T5V2UD	Uni.	5	16	19	150	SOT-23	
SENC2F5V1B	Bi.	5	4	15	7	DFN1006-2L	
SENC2F3V1BA	Bi.	3.3	6	10	15	DFN1006-2L	
SENC2F5V1BA	Bi.	5	6	10	12	DFN1006-2L	
SENC2F8V1BA	Bi.	8	6	16	10	DFN1006-2L	
SENC2F12V1BA	Bi.	12	6	25	11	DFN1006-2L	
SENC2F24V1BA	Bi.	24	4	48	20	DFN1006-2L	
SENC2F3V1BB	Bi.	3.3	8	10	15	DFN1006-2L	
SENC2F5V1BB	Bi.	5	15	15	40	DFN1006-2L	
SENC2F3V1BC	Bi.	3.3	20	10	50	DFN1006-2L	
SENC2F3V1UA	Uni.	3.3	16	18	200	DFN1006-2L	
SENC2F5V1UA	Uni.	5	15	21	150	DFN1006-2L	
SENC2F7V1UA	Uni.	7	10	14	130	DFN1006-2L	
SENC2F12V1UA	Uni.	12	7	30	100	DFN1006-2L	
SENC2F15V1UA	Uni.	15	5	35	60	DFN1006-2L	
SENC2F24V1UA	Uni.	24	4	48	40	DFN1006-2L	
SENC2F5V1UB	Uni.	5	15	16	150	DFN1006-2L	

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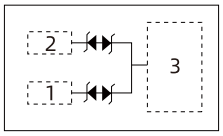
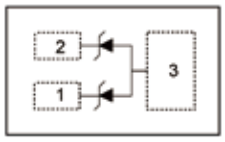
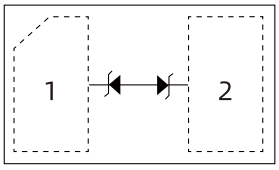
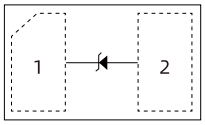
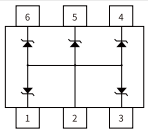
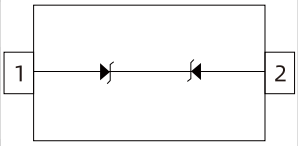
SuperESD-Low Capacitance ESD(continued)

Part Number	Directional	VRWM (V)(Max)	IPP@8/20us (A)(Max)	VCL@IPP (V)(Max)	CJ@0V/1MHz (pF)(Type)	Package	Device Schematic
SENC3F3V2BB	Bi.	3.3	8	9	15	DFN1006-3L	
SENC3F5V2B	Bi.	5	5	14	5	DFN1006-3L	
SENC3F5V2BA	Bi.	5	10	11	15	DFN1006-3L	
SENC3F5V2U	Uni.	5	15	12	150	DFN1006-3L	
SENC2X3V1BB	Bi.	3.3	6	10	15	DFN0603-2L	
SENC2X5V1BA	Bi.	5	6	11	15	DFN0603-2L	
SENC2X8V1BA	Bi.	8	6	17	10	DFN0603-2L	
SENC2X12V1BA	Bi.	12	6	25	10	DFN0603-2L	
SENC2X5V1B	Bi.	5	4	15	7	DFN0603-2L	
SENC2X3V1U	Uni.	3.3	8	9	15	DFN0603-2L	
SENC363T5V5UB	Uni.	5	12	15	130	SOT-363	
SENC3D3V1B	Bi.	3.3	24	22	120	SOD-323	
SENC3D5V1B	Bi.	5	24	18	120	SOD-323	
SENC3D8V1B	Bi.	8	18	24	110	SOD-323	
SENC3D12V1B	Bi.	12	13	32	70	SOD-323	
SENC3D15V1B	Bi.	15	10	38	40	SOD-323	
SENC3D18V1B	Bi.	18	8	45	35	SOD-323	
SENC3D24V1B	Bi.	24	7	52	30	SOD-323	
SENC3D36V1B	Bi.	36	3	75	25	SOD-323	
SENC3D3V1BA	Bi.	3.3	16	18	100	SOD-323	
SENC3D5V1BA	Bi.	5	15	20	90	SOD-323	
SENC3D8V1BA	Bi.	8	12	22	70	SOD-323	
SENC3D12V1BA	Bi.	12	8	35	50	SOD-323	
SENC3D15V1BA	Bi.	15	6	45	30	SOD-323	
SENC3D24V1BA	Bi.	24	4	55	20	SOD-323	
SENC3D3V1BB	Bi.	3.3	20	20	60	SOD-323	
SENC3D5V1BB	Bi.	5	16	18	30	SOD-323	
SENC3D12V1BB	Bi.	12	3	23	20	SOD-323	
SENC3D3V1BC	Bi.	3.3	25	16	150	SOD-323	
SENC3D5V1BC	Bi.	5	8	11	15	SOD-323	
SENC3D12V1BC	Bi.	12	6	20	10	SOD-323	
SENC3D5V1BD	Bi.	5	15	10	36	SOD-323	
SENC1524	Bi.	15/24	11/7	19/45	30	SOD323	

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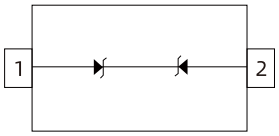
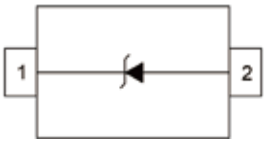
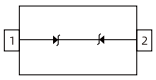
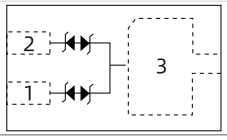
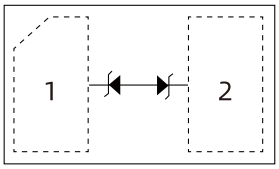
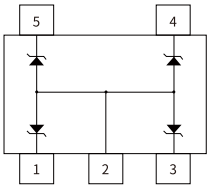
SuperESD-Normal Capacitance ESD(continued)

Part Number	Directional	VRWM (V)(Max)	IPP@8/20us (A)(Max)	VCL@IPP (V)(Max)	CJ@0V/1MHz (pF)(Type)	Package	Device Schematic
SENC3D3V1U	Uni.	3.3	32	12	300	SOD-323	
SENC3D5V1U	Uni.	5	28	20	200	SOD-323	
SENC3D7V1U	Uni.	7	28	15	200	SOD-323	
SENC3D12V1U	Uni.	12	15	35	100	SOD-323	
SENC3D15V1U	Uni.	15	10	45	70	SOD-323	
SENC3D24V1U	Uni.	24	6	55	20	SOD-323	
SENC3D36V1U	Uni.	36	4	56	120	SOD-323	
SENC3D3V1UA	Uni.	3.3	30	18	300	SOD-323	
SENC3D36V1UA	Uni.	36	2	75	15	SOD-323	
SENC3D5V1UC	Uni.	5	5	12	150	SOD-323	
SENC5D3V1BA	Bi.	3.3	8	10	15	SOD-523	
SENC5D5V1BA	Bi.	5	8	10	15	SOD-523	
SENC5D8V1BA	Bi.	8	9	17	10	SOD-523	
SENC5D12V1BA	Bi.	12	6	20	10	SOD-523	
SENC5D5V1B	Bi.	5	4	15	7	SOD-523	
SENC5D3V1UA	Uni.	3.3	16	18	200	SOD-523	
SENC5D5V1UA	Uni.	5	15	16	150	SOD-523	
SENC5D7V1UA	Uni.	7	10	14	130	SOD-523	
SENC5D12V1UA	Uni.	12	7	30	100	SOD-523	
SENC5D15V1UA	Uni.	15	5	35	60	SOD-523	
SENC5D24V1UA	Uni.	24	4	48	40	SOD-523	
SENC5D36V1UA	Uni.	36	2	75	20	SOD-523	
SENC9D3V1BA	Bi.	3.3	6	10	15	SOD-923	
SENC9D5V1BA	Bi.	5	6	10	10	SOD-923	
SENC9D12V1UA	Uni.	12	12	28	75	SOD-923	
SENC23F3V2BB	Bi.	3.3	8	10	15	DFN2x2-3L	
SENC23F5V2B	Bi.	5	4	15	7	DFN2x2-3L	
SENC23F5V2BA	Bi.	5	6	10	15	DFN2x2-3L	
SENC16F5V1BA	Bi.	5	100	13.5	300	DFN1610-2L	
SENC353T5V4U	Uni.	5	12	15	130	SOT-353	

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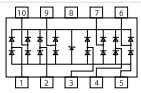
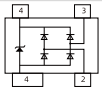
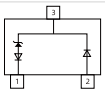
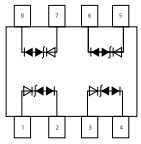
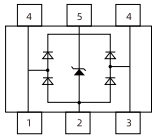
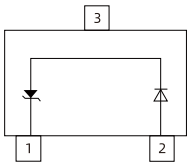
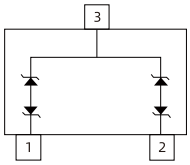
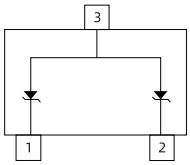
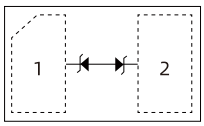
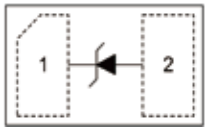
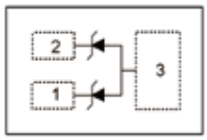
SuperESD-ow Capacitance ESD(continued)

Part Number	Directional	VRWM (V)(Max)	IPP@8/20us (A)(Max)	VCL@IPP (V)(Max)	CJ@0V/1MHz (pF)(Type)	Package	Device Schematic
SELC10P5V8L	Uni.	5	4	20	0.8	MSOP-10	
SELC143T5V2UA	Uni.	5	6	15	1.2	SOT-143	
SELC143T5V2UB	Uni.	5	6	15	0.8	SOT-143	
SELC2.8	Bi.	2.8	20	24	10	SOT-23	
SELC2.8L	Bi.	2.8	10	8	5	SOT-23	
SELC2.8-4	Bi.	2.8	20	20	2	SOP-8	
SELC236T5V2UA	Uni.	5	4.5	15	0.8	SOT-23-6L	
SELC23T5V1U	Uni.	5	17	23	1.5	SOT-23	
SELC23T12V1U	Uni.	12	12	28	1.5	SOT-23	
SELC23T15V1U	Uni.	15	10	24	1.5	SOT-23	
SELC23T24V1U	Uni.	24	8	43	1.5	SOT-23	
SELC23T36V1U	Uni.	24	4	55	1.5	SOT-23	
SELC23T3V2BA	Bi.	3.3	20	20	0.8	SOT-23	
SELC23T5V2BA	Bi.	5	15	21	0.8	SOT-23	
SELC23T8V2BA	Bi.	8	10	25	0.8	SOT-23	
SELC23T12V2BA	Bi.	12	7	35	0.8	SOT-23	
SELC23T15V2BA	Bi.	15	5	45	0.8	SOT-23	
SELC23T24V2BA	Bi.	24	4	55	0.8	SOT-23	
SELC23T36V2BA	Bi.	36	2	65	0.8	SOT-23	
SELC23T5V2U	Uni.	5	4	15	0.6	SOT-23	
SELC2F5V1B	Bi.	5	4	18	0.35	DFN1006-2L	
SELC2F5V1BE	Bi.	5	5	8	0.8	DFN1006-2L	
SELC2F5V1U	Uni.	5	4	18	0.8	DFN1006-2L	
SELC3F5V2U	Uni.	5	4	5	0.8	DFN1006-3L	

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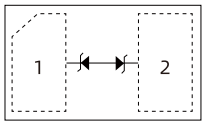
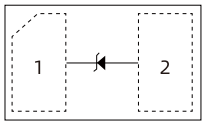
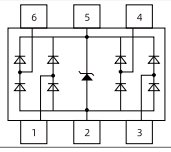
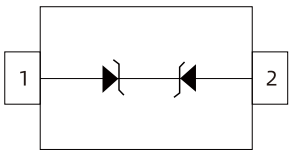
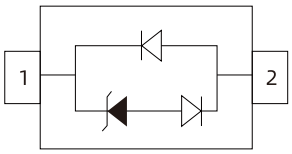
SuperESD-Low Capacitance ESD(continued)

Part Number	Directional	VRWM (V)(Max)	IPP@8/20us (A)(Max)	VCL@IPP (V)(Max)	CJ@0V/1MHz (pF)(Type)	Package	Device Schematic
SELC2X5V1B	Bi.	5	4	20	0.35	DFN0603-2L	
SELC2X5V1U	Uni.	5	4	15	0.6	DFN0603-2L	
SELC363T5V4U	Uni.	5	4	20	0.8	SOT-363	
SELC3D3V1B	Bi.	3.3	19	20	1.5	SOD-323	
SELC3D5V1B	Bi.	5	18	21	1.5	SOD-323	
SELC3D8V1B	Bi.	8	14	25	1.5	SOD-323	
SELC3D12V1B	Bi.	12	9	35	1.5	SOD-323	
SELC3D15V1B	Bi.	15	7	45	1.5	SOD-323	
SELC3D18V1B	Bi.	18	11	44	1.2	SOD-323	
SELC3D24V1B	Bi.	24	5	55	1.5	SOD-323	
SELC3D36V1B	Bi.	36	3	70	1.5	SOD-323	
SELC3D3V1BA	Bi.	3.3	14	20	0.8	SOD-323	
SELC3D5V1BA	Bi.	5	12	21	0.8	SOD-323	
SELC3D8V1BA	Bi.	8	10	25	0.8	SOD-323	
SELC3D12V1BA	Bi.	12	8	35	0.8	SOD-323	
SELC3D15V1BA	Bi.	15	6	45	0.8	SOD-323	
SELC3D24V1BA	Bi.	24	3	55	0.8	SOD-323	
SELC3D3V1BB	Bi.	3.3	14	20	1	SOD-323	
SELC3D3V1BL	Bi.	3.3	23	20	0.8	SOD-323	
SELC3D3V1UA	Uni.	3.3	17	20	0.8	SOD-323	
SELC3D5V1UA	Uni.	5	15	21	0.8	SOD-323	
SELC3D8V1UA	Uni.	8	10	25	0.8	SOD-323	
SELC3D12V1UA	Uni.	12	7	35	0.8	SOD-323	
SELC3D15V1UA	Uni.	15	5	45	0.8	SOD-323	
SELC3D24V1UA	Uni.	24	4	55	0.8	SOD-323	
SELC3D36V1UA	Uni.	36	2	65	0.8	SOD-323	

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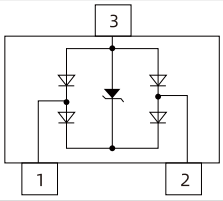
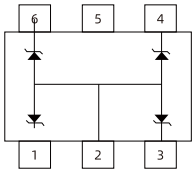
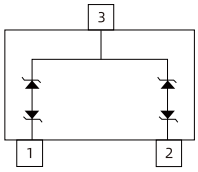
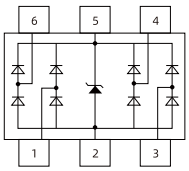
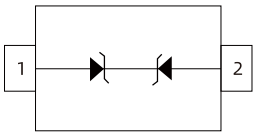
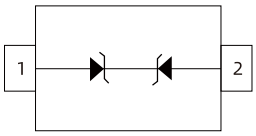
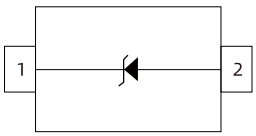
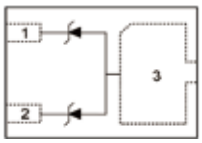
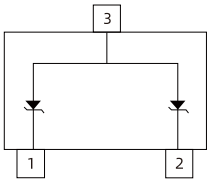
SuperESD-Low Capacitance ESD(continued)

Part Number	Directional	VRWM (V)(Max)	IPP@8/20us (A)(Max)	VCL@IPP (V)(Max)	CJ@0V/1MHz (pF)(Type)	Package	Device Schematic
SELC523T5V2U	Uni.	5	4	15	1	SOT-523	
SELC563T5V4U	Uni.	5	4	20	0.8	SOT-563	
SENC1236	Bi.	12/36	3/15	32/60	60	SOT-23	
SELC363T5V4UA	Uni.	5	4.5	20	0.8	SOT-363	
SELC3D5V1BC	Bi.	5	9	15	1.2	SOD-323	
SELC5D5V1B	Bi.	5	4	25	0.5	SOD-523	
SELC5D5V1U	Uni.	5	4	25	0.8	SOD-523	
SELC23F5V2U	Uni.	5	4	15	0.6	DFN2*2-3L	
SELC23T5V2UB	Uni.	5	4	25	1.2	SOT-23	

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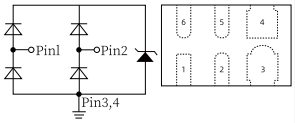
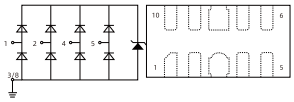
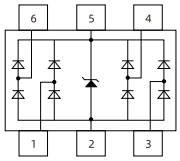
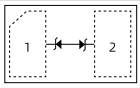
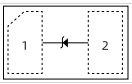
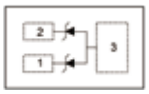
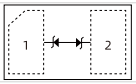
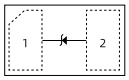
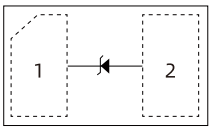
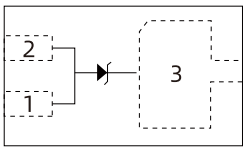
SuperESD-Ulta Low Capacitance ESD(continued)

Part Number	Directional	VRWM (V)(Max)	IPP@8/20us (A)(Max)	VCL@IPP (V)(Max)	CJ@0V/1MHz (pF)(Type)	Package	
SEUC06F5V2U	Uni.	5	4	12	0. 6	DFN1610-6L	
SEUC10F3V4U	Uni.	3.3	4.5	12	0. 6	DFN2510-10L	
SEUC10F5V4U	Uni.	5	4.5	12	0. 6	DFN2510-10L	
SEUC236T5V4U	Uni.	5	4.5	12	0. 8	SOT-23-6L	
SEUC236T5V4UB	Uni.	5	5.5	16	0. 8	SOT-23-6L	
SEUC2F5V1B	Bi.	5	3	25	0. 2	DFN1006-2L	
SEUC2F5V1U	Uni.	5	3	15	0. 4	DFN1006-2L	
SEUC3F5V2U	Uni.	5	3	15	0. 4	DFN1006-3L	
SEUC2X5V1B	Bi.	5	3	25	0. 25	DFN0603-2L	
SEUC2X5V1U	Uni.	5	3	24	0. 5	DFN0603-2L	

SuperESD-High Capacitance ESD(continued)

Part Number	Directional	VRWM (V)(Max)	IPP@8/20us (A)(Max)	VCL@IPP (V)(Max)	CJ@0V/1MHz (pF)(Type)	Package	
SEHC16F4V1U	Uni.	4.5	100	10	1000	DFN1610-2L	
SEHC16F5V1U	Uni.	5	100	10	1000	DFN1610-2L	
SEHC16F7V1U	Uni.	7	90	18	800	DFN1610-2L	
SEHC16F10V1U	Uni.	10	80	25	600	DFN1610-2L	
SEHC16F12V1U	Uni.	12	70	35	500	DFN1610-2L	
SEHC3D4V1U	Uni.	4.5	100	10	1000	SOD-323	
SEHC3D5V1U	Uni.	5	100	10	1000	SOD-323	
SEHC3D7V1U	Uni.	7	90	18	800	SOD-323	
SEHC3D10V1U	Uni.	10	80	25	600	SOD-323	
SEHC3D12V1U	Uni.	12	70	35	500	SOD-323	
SEHC3D15V1U	Uni.	15	100	50	400	SOD-323	
SEHC23F4V1U	Uni.	4.5	300	20	3200	DFN2*2-3L	
SEHC23F5V1U	Uni.	5	300	20	3200	DFN2*2-3L	
SEHC23F7V1U	Uni.	7	200	18	1800	DFN2*2-3L	
SEHC23F10V1U	Uni.	10	200	26	1500	DFN2*2-3L	
SEHC23F12V1U	Uni.	12	180	30	1400	DFN2*2-3L	
SEHC23F15V1U	Uni.	15	130	35	1000	DFN2*2-3L	
SEHC23F24V1U	Uni.	24	100	54	800	DFN2*2-3L	

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2. 瞬态电压抑制二极管(TVS)

TVS(Transient Voltage Suppressors),即瞬态电压抑制二极管,又称瞬态电压抑制器。它是采用半导体工艺制成的具有单个 PN 结或多个 PN 结集成的器件。TVS 有单向与双向之分,单向 TVS 一般应用于直流供电电路,双向 TVS应用于电压交变的电路。直流应用时单向 TVS 反向并联于电路中,当电路正常工作时,TVS 处于截止状态(高阻态),不影响电路正常工作。当电路出现异常过电压并达到 TVS 的击穿电压时,TVS 迅速由高阻态变为低阻态,泄放由异常过电压导致的瞬时过电流到地,同时把异常过电压钳制在一个安全水平之内,从而保护后级电路免遭异常过电压的损坏。当异常过电压消失后,TVS 阻值又恢复为高阻态。

I_{PP}:峰值脉冲电流

V_C:钳位电压

V_{BR}:击穿电压

I_T:脉冲直流试验电流

V_{RWM}:最高工作电压

I_R:漏电流

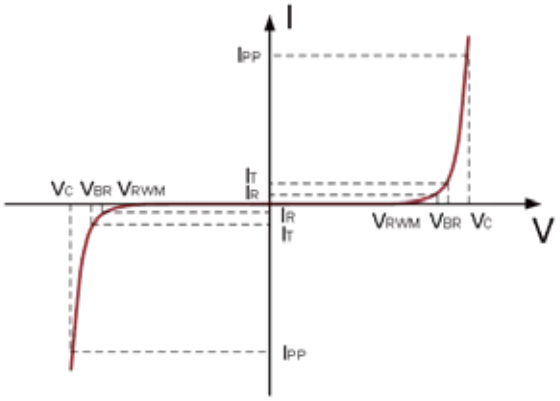

图 2 双向 TVS 伏安特性曲线

TVS 选型注意事项

最高工作电压V_{RWM}:TVS管的截止电压应大于线路上最高工作电压或信号电平电压。如果截止电压选择过低,一方面会影响电路正常工作,另一方面会影响 TVS的使用寿命;

峰值脉冲电流I_{PP}: 当TVS单独使用时,要根据线路上可能出现的最大浪涌电流来选择合适的型号。相同电压的ESD,功率越大 IPP 也越大。功率越大的TVS 对电路的保护效果也越好;

钳位电压V_C:应小于被保护电路最大可承受的瞬态安全电压,VC 与TVS的击穿电压及 IPP 都成正比;

漏电流I_R:在通信线路及低功耗电路中,要特别关注 IR 这个参数;

封装形式:根据电路设计布局及被保护线路数选择合适的封装形式。TVS器件封装的大小从一定程度上可以反应器件的防护等级大小,一般封装越大的器件可容纳的TVS芯片尺寸也越大,防护等级也越高;

极性:TVS有单向和双向之分,根据工作的信号进行选择,单极性的信号可以选择单向的TVS或双向的TVS器件,双极性的信号需选择双向的TVS器件。

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SuperTVS – Normal TVS Series (Continued)

Series Name	Directional	Reverse Standoff Voltage VR (V)	Maximum Clamping Voltage VC (V)	Peak Pulse Power Range PPPM (W)	Package	Product Image
SMAJ	Uni./ Bi.	5.0~440.0	9.2~713.0	400	SMA/DO-214AC	
SMBJ	Uni./ Bi.	5.0~440.0	9.2~713.0	600	SMB/DO-214AA	
SMCJ	Uni./ Bi.	5.0~440.0	9.2~713.0	1500	SMC/DO-214AB	
SMDJ	Uni./ Bi.	5.0~220.0	9.2~356.0	3000	SMC/DO-214AB	
1.5KE	Uni./ Bi.	5.8~512.0	10.5~828.0	1500	DO-201	
P4SMA	Uni./ Bi.	5.8~468.0	10.5~760.0	400	SMA/DO-214AC	
P6SMB	Uni./ Bi.	5.8~468.0	10.5~760.0	600	SMB/DO-214AA	
P6KE	Uni./ Bi.	5.8~512.0	10.5~828.0	600	DO-204AC/DO-15	
AMF	Uni./ Bi.	5.0~170.0	9.2~275.0	200	SOD-123F	
TKx	Bi.	15~440	85~625	-	-	

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SuperTVS – Auto TVS Series (Continued)

Series Name	Directional	Reverse Standoff Voltage VR (V)	Maximum Clamping Voltage VC (V)	Peak Pulse Power Range PPPM (W)	Package	Product Image
3KP	Uni./ Bi.	5.0~220.0	9.2~371.1	3000	P600	
5KP	Uni./ Bi.	5.0~250.0	9.2~425.0	5000	P600	
15KPA	Uni./ Bi.	17.0~280.0	29.3~454.5	15000	P600	
20KPA	Uni./ Bi.	20.0~300.0	36.8~483.0	20000	P600	
6.0SMDJ	Uni./ Bi.	18.0~43.0	29.2~69.4	6600	SMC/DO-214AB	
ATE	Uni./ Bi.	16.0~43.0	26.0~69.4	5000	SMC/DO-214AB	
ATF	Uni./ Bi.	18.0~43.0	29.2~69.4	8000	P600	
ATG	Uni./ Bi.	18.0~43.0	29.2~69.4	12000	P600	
ATH	Uni./ Bi.	24.0~48.0	40.7~77.7	15000	P600	
SM8S	Uni./ Bi.	18.0~43.0	29.2~69.4	6600	-	
SM8T	Uni./ Bi.	18.0~43.0	29.2~69.4	8000	-	

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3. 半导体放电管(TSS)

TSS(Thyristor Surge Suppressors),浪涌抑制晶闸管,也称半导体放电管,是采用半导体工艺制成的PNPN 结四层结构器件,其伏安特性类似于晶闸管(如图 1.3),具有典型的开关特性。TSS 一般并联在电路中应用,正常工作状态下 TSS处于截止状态,当电路中由于感应雷、操作过电压等出现异常过电压时,TSS 快速导通泄放异常过电流,保护后端设备免遭异常过电压的损坏,异常过电压消失后,TSS 又恢复至截止状态。TSS 的伏安特性及参数如图 3 所示。

V_{DRM}:反向截止电压

V_T:通态电压

V_S:转折电压

I_H:保持电流

I_S:转折电流

I_{DRM}:反向最大漏电流

I_T:通态电流

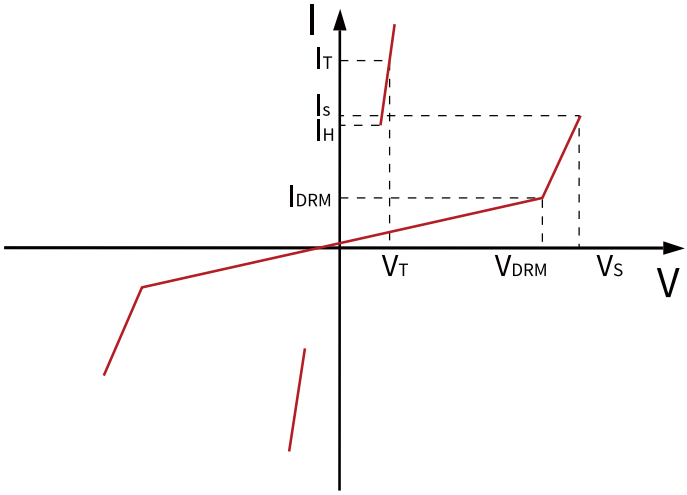

图 2 双向 TVS 伏安特性曲线

TSS 选型注意事项

反向截止电压(V_{DRM}):反向截止电压应等于或大于被保护电路的最大工作电压,否则会影响被保护电路的正常工作;

结电容(C_J): 通信线路要注意器件结电容不能对通信造成影响;

续流问题:TSS为开关元器件,导通后电压较低,不能直接应用于电源线的防护。

SuperTSS – TSS Series (Continued)

Series Name	VDRM (V)(Min.)	Vs (V)(Max.)	CJ (pF)(Typ.)	10/700uS (kV)(Max.)	Package	Product Image
PXXXXTA	6.0~440.0	25.0~600.0	15.0~40.0	2	SOD123FL	
PXXXXRA	6.0~440.0	25.0~600.0	15.0~40.0	2	SMA	
PXXXXRB	6.0~320.0	25.0~400.0	50.0~120.0	4	SMA	
PXXXXSB	6.0~320.0	25.0~400.0	50.0~120.0	4	SMB	
PXXXXSC	6.0~440.0	25.0~600.0	50.0~120.0	6	SMB	

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4. 金属氧化物压敏电阻(MOV)

MOV(Metal Oxide Varistors),即金属氧化物压敏电阻。目前市场上多以氧化锌为主体,掺杂多种金属氧化物,采用典型的电子陶瓷工艺制成的多晶半导体陶瓷元器件。压敏电阻具有对称的伏安特性曲线(如图 4),流过 MOV 的电流随 MOV 两端电压的增大呈指数规律增大。应用时,MOV一般并联在电路中,当电路正常工作时,MOV 处于高阻状态,不影响电路正常工作。当电路出现异常瞬时过电压并达到其导通电压(压敏电压)时,MOV 迅速由高阻态变为低阻状态,泄放由异常瞬时过电压导致的瞬时过电流到地,同时把异常瞬态过压钳制在一个较低的水平,从而保护后级电路免遭异常瞬时过电压的损坏。MOV 具有较好的瞬时脉冲吸收能力,电容较大,一般应用于 AC 交流输入端防雷保护。由于压敏电阻的浪涌吸收能力取决于它的物理尺寸,可通过制造不同直径的 MOV 获得不同的瞬态浪涌电流。

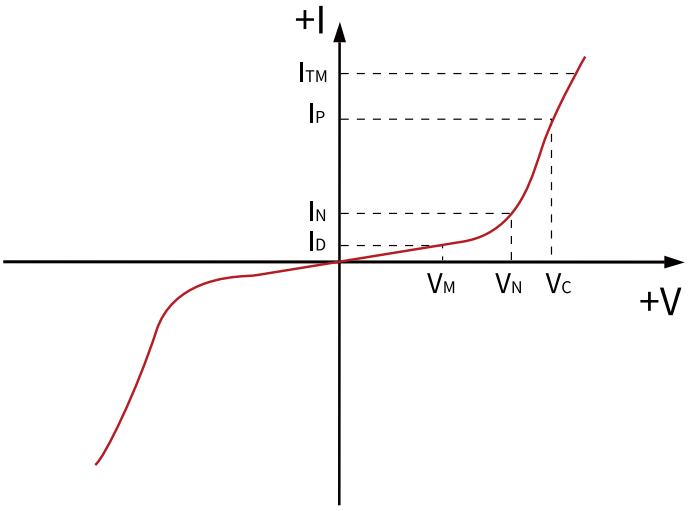

图 4 MOV伏安特性曲线

I_P:规定波形及峰值的脉冲电流(通常为8/20μs)

V_C:在规定脉冲峰值电流(IP)下测得MOV两端电压的峰值。

I_N:规定时间的脉冲峰值电流

V_N:在规定持续时间和脉冲峰值电流(IN)下测得的MOV两端的电压峰值,IN通常为1mA

I_D:待机电流

V_M:规定温度下可连续施加的电压

I_{TM}:不引起MOV失效,可单次施加规定波形脉冲的额定最大值

MOV 特点

具有较强的浪涌吸收能力,具有双向对称的击穿电压特性,常用于交变电源线或低频信号线的保护;MOV 是一种老化型元器件,用于大功率电源保护时常与陶瓷气体放电管(GDT)或玻璃气体放电管(SPG)串联使用,以减缓 MOV 的老化,延长 MOV 使用寿命。

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SuperMOV Series (Continued)								
Series Name	Varistor Voltage(V)	Maximum Allowable Voltage(V)		Maximum Peak Current (8/20μs)(A)		Maximum Energy (10/1000μs)(J)		Typical Capacitance (Reference)(pF)
		AC(RMS)	DC	Standard	High Surge	Standard	High Surge	@ 1KHz
ES05D	05D	11~420	14~560	100~400	250~800	0.4~19.4	0.6~29.1	38~1400
ES07D	07D	11~510	14~670	250~1250	500~1750	0.9~52.0	2.0~73.0	60~2800
ES10D	10D	11~680	14~895	500~2500	1000~3500	2.1~115.0	3.0~155.0	90~5600
ES14D	14D	11~1100	14~1465	1000~4500	2000~6000	4.0~250.0	7.0~335.0	130~11100
ES20D	20D	11~1100	14~1465	2000~6500	3000~1000	11.0~625.0	13.0~990.0	320~28500

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5. 陶瓷气体放电管(GDT)/玻璃气体放电管(SPG)

GDT(Gas Discharge Tubes),即陶瓷气体放电管。GDT 是由封装在充满惰性气体的陶瓷管中具有一个或一个以上的放电间隙组成的器件。GDT 电气性能取决于气体种类、气体压力、内部电极结构、制作工艺等因素。GDT 可以承受高达数十甚至数百千安培的浪涌电流冲击,具有极低的电容,应用于保护电子设备和人身免遭瞬态高电压的危害。

SPG(Spark Gap Protectors),玻璃气体放电管,也称强效气体放电管。SPG 是靠电极之间的距离获得放电微隙,管内充有隋性气体,用玻璃管和杜镁丝线玻封而成。当 SPG 两端电压增高时,附近气体被电离,微隙处开始出现放电现象。随着两极压降逐渐增大,放电电流也随之增大,其电离区随之扩大,此时放电电流经气体电离区流向另一极,当电流继续增加到一定程度时,管内出现从辉光放电向弧光放电转换,产品由高阻状态进入低阻状态,SPG 两端的电压也随之减小,从而对后面的电路起到保护作用,在异常电压消失后,产品又恢复到高阻状态。GDT 的伏安特性及参数如图 5所示,SPG 的伏安特性曲线与 GDT 相似。

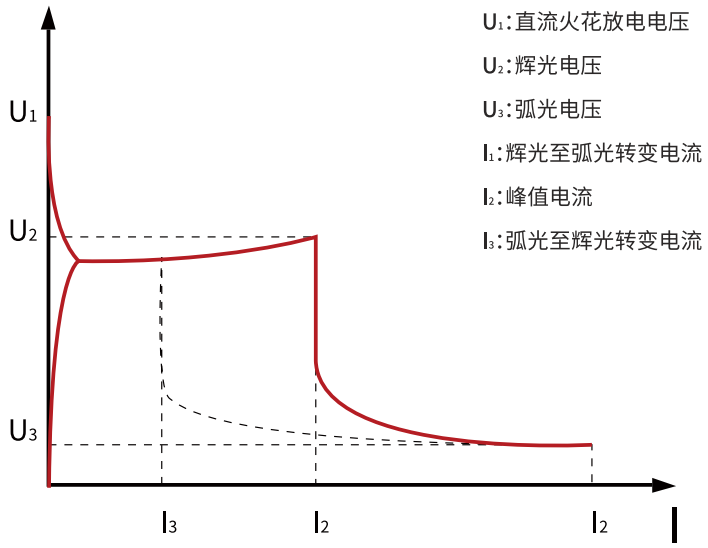

图 5 GDT 伏安特性曲线

GDT 主要参数:

DC spark-over Voltage:直流击穿电压,测量电压应以不大于 100V/s 的上升速率施加;

Maximum Impulse Spark-over Voltage:脉冲击穿电压,测量时以 1000V/μs 的电压上升速率施加电压;

Nominal Impulse Discharge current:标称放电电流,施加 8/20μs 脉冲电流,10 次,间隔 1min;

Minimum Insulation Resistance:最小绝缘阻抗,施加一定的直流电压测量;

Maximum Capacitance:最大电容。

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SuperGDT Series (Continued)						
Series Name	DC Spark Over Voltage (100v/s)(V)	Impulse Spark Over Voltage (1kv/us)(V)	Electrode Capacitance (1MHz@0.5v)(PF)	Impulse Discharge Current (8/20us 10times)	AC Discharge Current (50Hz 1s 10times)	Product Image
ES3DS	90~500	900~1300	≤1	0.5KA	1A	
ES4DS	75~600	700~1400	≤1	2KA	2A	
ES5DS	75~800	600~1600	≤1	5KA	5A	
ES5DL	75~3600	600~5000	≤1	5KA	5A	
ES8DL	75~3600	600~5000	≤1.5	5KA	10A	
ES5TS	75~800	600~1600	≤1.5	5KA	5A	
ES8TL	75~600	600~1400	≤1.5	10KA	10A	
ESG3S	140~500	600~1400	≤1	1KA		

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6. 场效应晶体管(MOSFET)

SuperMOS – MOS Series (Continued)						
Part Number	Polarity	VDS (V)(Max.)	VGS (V)(Max.)	RDSON VGS:4.5V(mR,Typ.)	ID@TA=25°C (A)(Max.)	Package
ESN32106	N	20	±10	3.1	20	PDFN5*6-8L
ES8205	N	20	±12	22	4.9	SOT-23-6L
ES2300	N	20	±10	22	4	SOT23-3L
ES2300A	N	20	±10	22	4	SOT23-3L
ES2302	N	20	±10	36	3.5	SOT23
ES2302A	N	20	±10	36	3.5	SOT23-3L
ES2301	N	-20	±12	80	-2.8	SOT23
ES2301A	N	-20	±12	80	-3	SOT23-3L
ESN7407	P	-20	±12	7	-40	PDFN3X3-8L
ES3400	N	30	±12	25	5.8	SOT23
ES3400A	N	30	±12	25	5.8	SOT-23-3L
ES6400	N	30	±12	25	6.5	SOT-23-6L
ES6800	N	30	±12	25	3.4	SOT-23-6L
ES7400	N	30	±12	25	1.7	SOT-323
ES3401	P	-30	±12	53	-4.2	SOT23
ES3401A	P	-30	±12	53	-4.2	SOT-23-3L
ES6401A	P	-30	±12	53	-5	SOT23-6L
ES6405	P	-30	±20	55	-5	SOT23-6L
ES3407	P	-30	±20	55	-4.5	SOT23
ES3407A	P	-30	±20	55	-4.5	SOT23-3L
ES6403	P	-30	±20	26	-6	SOT23-6L
ES4419	P	-30	±20	26	-9.7	SOP8
ES4803A	P	-30	±20	55	-5	SOP8
ES4813	P	-30	±20	26	-7.1	SOP8
ES4805	P	-30	±25	15	-9	SOP8
ES4435	P	-30	±25	15	-40	SOP8
ES4407	P	-30	±25	14	-12	SOP8
ESD403	P	-30	±20	11.5	-70	TO-252
ES4405	P	-30	±20	55	-6.5	SOP8
ES9435	P	-30	±20	55	-5	SOP8
ES4953	P	-30	±20	55	-5	SOP8
ES3345	P	-30	±20	15	-30	PDFN3X3-8L
ESN7401	P	-30	±20	15	-30	PDFN3X3-8L
ESN7403	P	-30	±20	15	-30	PDFN3X3-8L
ESN6435	P	-30	±20	15	-34	PDFN5*6-8L
ES3347	P	-30	±20	11.5	-39	PDFN3X3-8L
ESN7409	P	-30	±20	11.5	-39	PDFN3X3-8L
ESN21307	P	-30	±20	11.5	-24	PDFN5*6-8L
ES3404	N	30	±12	30	5.8	SOT23
ES3404A	N	30	±12	30	5.8	SOT-23-3L

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SuperMOS – MOS Series (Continued)						
Part Number	Polarity	VDS (V)(Max.)	VGS (V)(Max.)	RDSON VGS:4.5V(mR,Typ.)	ID@TA=25°C (A)(Max.)	Package
ESN7410	N	30	±12	28	24	PDFN3X3-8L
ES4430	N	30	±20	12	13	SOP8
ESN7466	N	30	±20	12	30	PDFN3X3-8L
ESN6830	N	30	±20	12	24	PDFN5*6-8L
ES4800	N	30	±12	25	5.8	SOP8
ES4842	N	30	±12	30	5.8	SOP8
ESD480	N	30	±12	30	25	TO-252
ES4406A	N	30	±20	15	13	SOP8
ES4832	N	30	±20	15	10	SOP8
ESN7414	N	30	±20	15	20	PDFN3X3-8L
ESN6204	N	30	±20	15	24	PDFN5*6-8L
ES3342	N	30	±20	10	40	PDFN3X3-8L
ESN2420	N	30	±20	10	8	DFN 2x2B
ESN6586	N	30	±20	10	30	PDFN5*6-8L
ESD536	N	30	±20	10	46	TO-252
ESD6428	N	30	±20	13	43	PDFN5*6-8L
ESN6512	N	30	±20	2.1	150	PDFN5*6-8L
ESB6512L	N	30	±20	2.1	150	TO-263
ESD508	N	30	±20	5	70	TO-252
ESN7508	N	30	±20	5	32	PDFN3X3-8L
ESN6354	N	30	±20	5	83	PDFN5*6-8L
ES4354	N	30	±20	4.8	23	SOP8
ES4576	N	30	±20	7	18	SOP8
ES3343	N	30	±20	6.5	45	PDFN3X3-8L
ESN7534	N	30	±20	6.5	45	PDFN3X3-8L
ESN6426	N	30	±20	6.5	65	PDFN5*6-8L
ESD516	N	30	±20	6.5	46	TO-252
ES4404	N	30	±20	30	8.5	SOP8
ES4606	N+P	30	±12	30	5.8	SOP8
ESD2144	N	40	±20	1.75	120	TO-252
EST2144L	N	40	±20	1.75	120	TO-220
ESTF2144L	N	40	±20	1.75	120	TO-220F
ESB2144L	N	40	±20	1.75	120	TO-263
ESN6144	N	40	±20	3.3	100	PDFN5*6-8L
ES4882	N	40	±20	30	8	SOP8
ES4884	N	40	±20	19	8	SOP8
ESN4186	N	40	±20	19	35	PDFN3*3
ESD4186	N	40	±20	19	35	TO-252
ES4840	N	40	±20	32	6	SOP8
ESD4814	N	40	±20	10.5	50	TO-252

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SuperMOS – MOS Series (Continued)						
Part Number	Polarity	VDS (V)(Max.)	VGS (V)(Max.)	RDSON VGS:4.5V(mR,Typ.)	ID@TA=25°C (A)(Max.)	Package
ESN6884	N	40	±20	10.5	34	PDFN5*6-8L
ESN7420	N	40	±20	6	40	PDFN3X3-8L
ESN66406	N	40	±20	6	30	PDFN5*6-8L
ES66406	N	40	±20	6	17	SOP8
ESD66406	N	40	±20	6	54	TO-252
ESD2146	N	40	±20	4	70	TO-252
EST2146L	N	40	±20	4	100	TO-220F
ESB2146L	N	40	±20	4	105	TO-263
ESN7242	N	40	±20	4	50	PDFN3X3-8L
ESN4413	P	-40	±20	45	-6.5	PDFN3X2-8L
ES4443	P	-40	±20	45	-6	SOP8
ESD413A	P	-40	±20	45	-12	TO-252
ES4485	P	-40	±20	15	-10	SOP8
ESN4485	P	-40	±20	15	-15	PDFN3X3-8L
ESD4185	P	-40	±20	15	-40	TO-252
ESTF4185	P	-40	±20	15	-34	TO-220F
ESD609	N	40	±20	25	12	TO-252-4L
ES4614	N	40	±20	25	6	SOP8
ES138KA	N	50	±20	1250	0.41	SOT23-3L
ES138K	N	50	±20	1250	0.41	SOT-23
ES138KQ	N	50	±20	1250	0.41	SOT-323
ES138KW	N	50	±20	1250	0.41	SOT-523
ES138KR	N	50	±20	1250	0.41	SOT-723
ESD138KZ	N	50	±20	1250	0.41	SOT363
ES2310	N	60	±20	70	3A	SOT-23
ES7002KA	N	60	±20	2400	0.38	SOT23-3L
ES7002K	N	60	±20	2400	0.38	SOT-23
ES7002KQ	N	60	±20	2400	0.38	SOT-323
ES7002KW	N	60	±20	2400	0.38	SOT-523
ES7002KR	N	60	±20	2400	0.38	SOT-723
ESD7002KZ	N	60	±20	2400	0.38	SOT363
ESN67614	N	60	±20	3.2	85	PDFN5*6-8L
ESD6614	N	60	±20	27	30	TO-252
ES4264	N	60	±20	13	12	SOP8
ES4266	N	60	±20	14.5	11	SOP8
EST2610L	N	60	±20	13	55	TO-220
ESN66620	N	60	±20	8.5	40	PDFN3X3-8L
ESN6262	N	60	±20	8.5	40	PDFN5*6-8L
ESB66620L	N	60	±20	8.5	50	TO-263
ESD66620	N	60	±20	8.5	50	TO-252

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SuperMOS – MOS Series (Continued)						
Part Number	Polarity	VDS (V)(Max.)	VGS (V)(Max.)	RDSON VGS:4.5V(mR,Typ.)	ID@TA=25°C (A)(Max.)	Package
EST460	N	60	±20	8.5	50	TO-220
ESD442G	N	60	±20	22	40	TO-252
EST2618L	N	60	±20	22	40	TO-220
ESNS62814T	N	80	±20	2.58	100	PDFN5*6-8L
ESB66811L	N	80	±20	2.58	140	TO-263
ESTL66811L	N	80	±20	2.58	200	TOLL
EST66811L	N	80	±20	2.58	120	TO-220
ESTF66811L	N	80	±20	2.58	100	TO-220F
ESN6278	N	80	±25	4	105	PDFN5*6-8L
ESB282L	N	80	±25	4	105	TO-263
EST282L	N	80	±25	4	105	TO-220
ESB284L	N	85	±20	5.4	105	TO-263
EST284L	N	85	±20	5.4	105	TO-220
ESN6282	N	85	±20	5.4	85	PDFN5*6-8L
ESN62818	N	80	±25	8.5	50	PDFN3X3-8L
ESB286L	N	80	±25	8.5	70	TO-263
EST286L	N	80	±25	8.5	70	TO-220
ESTF286L	N	80	±25	8.5	56	TO-220F
ESN6284A	N	80	±25	8.5	48	PDFN5*6-8L
ESN66820	N	80	±25	9	50	PDFN3X3-8L
ESN6284	N	80	±25	9	78	PDFN5*6-8L
ESD2810	N	80	±25	9	46	TO-252
EST482L	N	80	±25	9	105	TO-220
ESB288L	N	80	±20	9.6	56	TO-263
ESN7280	N	80	±20	9.6	50	PDFN3X3-8L
ESN6448	N	80	±20	9.6	65	PDFN5*6-8L
EST288L	N	80	±20	9.6	46	TO-220
ESTF288L	N	80	±20	9.6	46	TO-220F
ES5N10	N	100	±20	120	5	SOT-23
ES5N10A	N	100	±20	120	5	SOT23-3L
ESP10N10	N	100	±20	120	10	SOP8
ES15N10G	N	100	±20	92	12	TO-252
ES4486	N	100	±20	92	4.2	SOP8
ESN4486	N	100	±20	92	10	PDFN3X3-8L
ESN6484	N	100	±20	92	12	PDFN5*6-8L
ESTL66912	N	100	±20	2.19	380	TOLL
ESN66917	N	100	±20	3.1	100	PDFN5*6-8L
ESB66917L	N	100	±20	3.1	100	TO-263
EST66916L	N	100	±20	4	120	TO-220
ESB66916L	N	100	±20	4	120	TO-263

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SuperMOS – MOS Series (Continued)

Part Number	Polarity	VDS (V)(Max.)	VGS (V)(Max.)	RDSON VGS:4.5V(mR,Typ.)	ID@TA=25°C (A)(Max.)	Package
ESN6290	N	100	±20	4	120	PDFN5*6-8L
ES4290A	N	100	±20	7.6	15.5	SOP8
ESN62922	N	100	±20	7.6	50A	PDFN3X3-8L
ESN62920	N	100	±20	7.6	85A	PDFN5*6-8L
ESB66919L	N	100	±20	7.6	105	TO-263
ESD66919	N	100	±20	7.6	70	TO-252
EST66919L	N	100	±20	7.6	80	TO-220
ESTF66919L	N	100	±20	7.6	50	TO-220F
ESD4454	N	150	±20	100	20	TO-252
ESH3254	N	150	±20	100	5	SOT-223
ESD256	N	150	±20	100	19	TO-252
ESTF256L	N	150	±20	100	12	TO-220F
ESB256L	N	150	±20	100	19	TO-263
ESN66524	N	150	±25	16	56	PDFN5*6-8L
EST2502L	N	150	±25	16	56	TO-220
ESN6521	N	150	±20	11	100	PDFN5*6-8L
ESN4842	N	30	±12	30	5.8	PDFN3X3-8L

SuperMOS – MOS Series (Continued)

Part Number	Polarity	VDS (V)(Max.)	VGS (V)(Max.)	RDSON VGS:4.5V(mR,Typ.)	ID@TA=25°C (A)(Max.)	Package
SE02N60G	N	650	±30	3.8	2	TO-252
SE02N65G	N	700	±30	3.8	2	TO-252
SE02N65H	N	700	±30	4.3	2	TO-251
SE04N60G	N	650	±30	2.9	4	TO-252
SE04N65C	N	690	±30	2	5	TO-220
SE04N65D	N	690	±30	2	5	TO-220F
SE04N65G	N	690	±30	2	5	TO-252
SE04N65H	N	690	±30	2	5	TO-251
SE07N65C	N	690	±30	1.17	7	TO-220
SE07N65D	N	690	±30	1.17	7	TO-220F
SE07N65G	N	690	±30	1.17	7	TO-252

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7. 二极管 (Diodes)

SuperDiodes – Diodes Series (Continued)						
Part Number	Ptot (W)	IO (mA)	VR (V)(Min.)	VF@IF (V)	IF@VF (mA)	Package
1N4148W	0.5	150	100	1	10	SOD-123
1N4448W	0.5	250	100	0.72	5	SOD-123
1N914W	0.5	200	100	0.72	5	SOD-123
MMSD914	0.5	200	100	1	10	SOD-123
BAS16H	0.5	150	100	0.855	10	SOD-123
BAV16W	0.5	150	100	0.855	10	SOD-123
BAV19W	0.5	200	120	1	100	SOD-123
BAV20W	0.5	200	200	1	100	SOD-123
BAV21W	0.5	200	250	1	100	SOD-123
1N4148WS	0.2	150	100	1	10	SOD-323
1N4448WS	0.2	250	100	0.72	5	SOD-323
1N914WS	0.2	200	100	0.72	5	SOD-323
MMDL914	0.2	200	100	1	10	SOD-323
1SS352	0.2	200	80	0.98	100	SOD-323
1SS355	0.2	200	80	1.2	100	SOD-323
BAS16WS	0.25	100	75	0.855	10	SOD-323
BAS316	0.25	250	100	0.855	10	SOD-323
BAS20H	0.2	200	250	1	100	SOD-323
BAS21H	0.2	200	250	1	100	SOD-323
BAV19WS	0.2	200	120	1	100	SOD-323
BAV20WS	0.2	200	200	1	100	SOD-323
BAV21WS	0.2	200	250	1	100	SOD-323
1N4148WT	0.15	125	100	0.855	10	SOD-523
BAS16X	0.15	200	100	0.855	10	SOD-523
BAS516	0.15	250	100	0.855	10	SOD-523
1SS400	0.15	100	80	1.2	100	SOD-523
BAV21WT	0.15	200	250	1	100	SOD-523
1SS181	0.15	100	80	1.2	100	SOT-23
1SS187	0.15	100	80	1.2	100	SOT-23
1SS226	0.15	100	85	1	100	SOT-23

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SuperDiodes – Diodes Series (Continued)						
Part Number	Ptot (W)	IO (mA)	VR (V)(Min.)	VF@IF (V)	IF@VF (mA)	Package
BAW56	0.225	200	70	0.715	1	SOT-23
BAV70	0.225	200	70	0.715	1	SOT-23
BAV99	0.225	200	70	0.715	1	SOT-23
BAV199	0.25	215	85	0.9	1	SOT-23
BAS16	0.225	150	75	0.715	1	SOT-23
BAS19	0.25	200	120	0.855	10	SOT-23
BAS20	0.25	200	200	1	100	SOT-23
BAS21	0.225	200	250	1	100	SOT-23
BAS21A	0.225	200	250	1	100	SOT-23
BAS21C	0.225	200	250	1	100	SOT-23
BAS21S	0.225	200	250	1	100	SOT-23
BAS23	0.35	225	250	1	100	SOT-23
BAS23A	0.35	225	250	1	100	SOT-23
BAS23C	0.35	225	250	1	100	SOT-23
BAS23S	0.35	225	250	1	100	SOT-23
MMBD7000	0.225	200	100	0.82	10	SOT-23
MMBD914	0.35	300	100	0.855	10	SOT-23
MMBD4148	0.35	150	100	0.855	10	SOT-23
MMBD4148A	0.35	200	100	1	10	SOT-23
MMBD4148CA	0.35	200	100	1	10	SOT-23
MMBD4148CC	0.35	200	100	1	10	SOT-23
MMBD4148SE	0.35	200	100	1	10	SOT-23
BAW56W	0.2	150	75	0.855	10	SOT-323
BAV70W	0.2	150	75	0.855	10	SOT-323
BAV99W	0.2	150	75	0.855	10	SOT-323
MMBD4148W	0.2	150	75	0.855	10	SOT-323
BAS16W	0.2	150	75	0.855	10	SOT-323
1SS370	0.2	100	250	1	10	SOT-323
BAS19W	0.2	200	100	1	100	SOT-323
BAS20W	0.2	200	150	1	100	SOT-323
BAS21W	0.2	200	250	1	100	SOT-323

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8. 肖特基二极管(Schottky Barrier Diodes)

SuperDiodes – Schottky Barrier Diodes Series (Continued)						
Part Number	Ptot (W)	VRRM (V)	IFM (A)	VF@IF (V)	IF@VF (mA)	Package
B5819W	0.5	40	1	0.6	1000	SOD-123
B5818W	0.5	30	1	0.55	1000	SOD-123
B5817W	0.5	20	1	0.45	1000	SOD-123
SD103AW	0.5	40	0.35	0.37	20	SOD-123
SD103BW	0.5	30	0.35	0.37	20	SOD-123
SD103CW	0.5	20	0.35	0.37	20	SOD-123
B0520W	0.5	20	0.5	0.33	100	SOD-123
B0530W	0.5	30	0.5	0.38	100	SOD-123
B0540W	0.5	40	0.5	0.51	500	SOD-123
BAT42W	0.5	30	0.2	0.65	50	SOD-123
BAT43W	0.5	30	0.2	0.45	15	SOD-123
BAT46W	0.5	100	0.35	1	250	SOD-123
BAT54W	0.5	30	0.3	0.5	30	SOD-123
B16W	0.5	60	0.3	0.7	1000	SOD-123
MBR140	0.5	40	1	0.56	1000	SOD-123
MBR130	0.5	30	1	0.45	700	SOD-123
MBR120	0.5	20	1	0.46	1000	SOD-123
B5819WS	0.2	40	1	0.6	1000	SOD-323
B5818WS	0.2	30	1	0.55	1000	SOD-323
B5817WS	0.2	20	1	0.45	1000	SOD-323
B0520WS	0.2	20	0.5	0.39	5000	SOD-323
B0530WS	0.2	30	0.5	0.45	5000	SOD-323
B0540WS	0.2	40	0.5	0.51	5000	SOD-323
SD103AWS	0.2	40	0.35	0.37	20	SOD-323
SD103BWS	0.2	30	0.35	0.37	20	SOD-323
SD103CWS	0.2	20	0.35	0.37	20	SOD-323
RB551V-30	0.25	30	0.5	0.36	100	SOD-323
RB501V-40	0.2	45	0.1	0.55	100	SOD-323
RB751V-40	0.2	40	0.03	0.37	1	SOD-323
BAT42WS	0.2	30	0.2	0.4	10	SOD-323

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SuperDiodes – Schottky Barrier Diodes Series (Continued)						
Part Number	Ptot (W)	VRRM (V)	IFM (A)	VF@IF (V)	IF@VF (mA)	Package
BAT43WS	0.2	30	0.2	0.33	2	SOD-323
BAT46WS	0.2	100	0.35	0.45	10	SOD-323
B16WS	0.25	60	0.3	0.7	1000	SOD-323
BAT60B	0.35	10	3	0.6	1000	SOD-323
1SS357	0.2	40	0.1	0.6	100	SOD-323
BAT54	0.2	30	0.2	0.24	0.1	SOT-23
BAT54A	0.2	30	0.2	0.24	0.1	SOT-23
BAT54C	0.2	30	0.2	0.24	0.1	SOT-23
BAT54S	0.2	30	0.2	0.24	0.1	SOT-23
BAS40	0.2	40	0.2	0.38	1	SOT-23
BAS40-04	0.2	40	0.2	0.38	1	SOT-23
BAS40-05	0.2	40	0.2	0.38	1	SOT-23
BAS40-06	0.2	40	0.2	0.38	1	SOT-23
BAS70	0.2	70	0.07	0.41	1	SOT-23
BAS70-04	0.2	70	0.07	0.41	1	SOT-23
BAS70-05	0.2	70	0.07	0.41	1	SOT-23
BAS70-06	0.2	70	0.07	0.41	1	SOT-23
BAR43	0.2	30	0.2	0.33	2	SOT-23
BAR43A	0.2	30	0.2	0.33	2	SOT-23
BAR43C	0.2	30	0.2	0.33	2	SOT-23
BAR43S	0.2	30	0.2	0.33	2	SOT-23
RB495D	0.25	40	0.4	0.3	10	SOT-23
BAS40W	0.15	40	0.2	0.38	1	SOT-323
BAS40W-04	0.15	40	0.2	0.38	1	SOT-323
BAS40W-05	0.15	40	0.2	0.38	1	SOT-323
BAS40W-06	0.15	40	0.2	0.38	1	SOT-323

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9. 三极管极管(BJT)

SuperBJT – BJT Series (Continued)						
Part Number	Polarity	IC (mA)	VCEO (V)	VCE-SAT (V)	IC/IB (mA)	Package
S8050	NPN	500	25	0.6	500/50	SOT-23
S8550	PNP	500	25	0.6	500/50	SOT-23
M8050	NPN	800	25	0.5	800/80	SOT-23
M8550	PNP	800	25	0.5	800/80	SOT-23
SS8050	NPN	1500	25	0.5	800/80	SOT-23
SS8550	PNP	1500	25	0.5	800/80	SOT-23
S9012	PNP	500	25	0.6	500/50	SOT-23
S9013	NPN	500	25	0.6	500/50	SOT-23
S9014	NPN	100	45	0.3	100/5	SOT-23
S9015	PNP	100	45	0.3	100/10	SOT-23
S9018	NPN	50	15	0.5	10/1	SOT-23
MMBT2222	NPN	600	30	0.3	150/15	SOT-23
MMBT2222A	NPN	600	40	0.3	150/15	SOT-23
MMBT2907	PNP	600	40	0.4	150/15	SOT-23
MMBT2907A	PNP	600	60	0.4	150/15	SOT-23
MMBT3904	NPN	200	40	0.3	5/1	SOT-23
MMBT3906	PNP	200	40	0.3	5/1	SOT-23
MMBT4401	NPN	600	40	0.4	150/15	SOT-23
MMBT4403	PNP	600	40	0.4	150/15	SOT-23
MMBT5551	NPN	600	160	0.15	10/1	SOT-23
MMBT5401	PNP	600	150	0.2	10/1	SOT-23
MMBTA06	NPN	500	80	0.25	100/10	SOT-23
MMBTA56	PNP	500	80	0.2	100/10	SOT-23
MMBTA42	NPN	300	300	0.2	2/20	SOT-23
MMBTA92	PNP	200	300	0.2	2/20	SOT-23
MMBTA43	NPN	500	200	0.5	2/20	SOT-23
MMBTA93	PNP	500	200	0.5	2/20	SOT-23
MMBTA44	NPN	200	400	0.4	1/0.1	SOT-23
MMBTA94	PNP	200	400	0.2	1/0.1	SOT-23
C945	NPN	150	50	0.3	100/10	SOT-23

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SuperBJT – BJT Series (Continued)						
Part Number	Polarity	IC (mA)	VCEO (V)	VCE-SAT (V)	IC/IB (mA)	Package
A733	PNP	150	50	0.3	100/10	SOT-23
C1815	NPN	150	50	0.25	100/10	SOT-23
A1015	PNP	150	50	0.3	100/10	SOT-23
BC846A	NPN	100	65	0.5	100/5	SOT-23
BC846B	NPN	100	65	0.5	100/5	SOT-23
BC847A	NPN	100	45	0.5	100/5	SOT-23
BC847B	NPN	100	45	0.5	100/5	SOT-23
BC847C	NPN	100	45	0.5	100/5	SOT-23
BC848A	NPN	100	30	0.5	100/5	SOT-23
BC848B	NPN	100	30	0.5	100/5	SOT-23
BC848C	NPN	100	30	0.5	100/5	SOT-23
BC856A	PNP	100	65	0.5	100/5	SOT-23
BC856B	PNP	100	65	0.5	100/5	SOT-23
BC857A	PNP	100	45	0.5	100/5	SOT-23
BC857B	PNP	100	45	0.5	100/5	SOT-23
BC857C	PNP	100	45	0.5	100/5	SOT-23
BC858A	PNP	100	30	0.5	100/5	SOT-23
BC858B	PNP	100	30	0.5	100/5	SOT-23
BC858C	PNP	100	30	0.5	100/5	SOT-23
BC81716	NPN	500	45	0.7	500/50	SOT-23
BC81725	NPN	500	45	0.7	500/51	SOT-23
BC81740	NPN	500	45	0.7	500/52	SOT-23
BC80716	PNP	500	45	0.7	500/53	SOT-23
BC80725	PNP	500	45	0.7	500/54	SOT-23
BC80740	PNP	500	45	0.7	500/55	SOT-23
2SC1623	NPN	100	50	0.3	100/10	SOT-23
BC81716W	NPN	500	45	0.7	500/50	SOT-323
BC81725W	NPN	500	45	0.7	500/50	SOT-323
BC81740W	NPN	500	45	0.7	500/50	SOT-323
BC80716W	PNP	500	45	0.7	500/50	SOT-323

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SuperBJT – BJT Series (Continued)						
Part Number	Polarity	IC (mA)	VCEO (V)	VCE-SAT (V)	IC/IB (mA)	Package
BC80725W	PNP	500	45	0.7	500/50	SOT-323
BC80740W	PNP	500	45	0.7	500/50	SOT-323
MMST2222A	NPN	600	40	1	500/50	SOT-323
MMST2907A	PNP	600	60	1.6	500/50	SOT-323
MMST3904	NPN	200	40	0.3	5/1	SOT-323
MMST3906	PNP	200	40	0.3	5/1	SOT-323
MMST5551	NPN	600	160	0.2	5/1	SOT-323
MMST5401	PNP	600	150	0.5	5/1	SOT-323
S9013W	NPN	500	25	0.6	500/50	SOT-323
S9012W	PNP	500	25	0.6	500/50	SOT-323
S9014W	NPN	100	45	0.3	100/5	SOT-323
S9015W	PNP	100	45	0.3	100/10	SOT-323
BC846S	NPN+NPN	100	65	0.3	100/5	SOT-363
BC856S	PNP+PNP	100	65	0.3	100/5	SOT-363
BC847S	NPN+NPN	100	45	0.65	100/5	SOT-363
BC857S	PNP+PNP	200	45	0.65	100/5	SOT-363
MMDT2222A	NPN+NPN	600	40	0.3	150/15	SOT-363
MMDT2907A	PNP+PNP	600	60	0.4	150/15	SOT-363
MMDT4401	NPN+NPN	600	40	0.4	150/15	SOT-363
MMDT4403	PNP+PNP	600	40	0.4	150/15	SOT-363
MMDT3904	NPN+NPN	200	40	0.3	5/1	SOT-363
MMDT3906	PNP+PNP	200	40	0.4	5/1	SOT-363
MMDT5551	NPN+NPN	200	160	0.2	5/1	SOT-363
MMDT5401	PNP+PNP	200	150	0.5	5/1	SOT-363
MMDT9014	NPN+NPN	100	45	0.3	100/5	SOT-363
MMDT9015	PNP+PNP	100	45	0.3	100/5	SOT-363
MMBT3904T	NPN	200	40	0.3	5/1	SOT-523
MMBT3906T	PNP	200	40	0.4	5/1	SOT-523
MMBT2222AT	NPN	600	40	0.3	150/15	SOT-523
MMBT2907AT	PNP	600	60	0.4	150/15	SOT-523

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SuperBJT – BJT Series (Continued)						
Part Number	Polarity	IC (mA)	VCEO (V)	VCE-SAT (V)	IC/IB (mA)	Package
PXT3904	NPN	200	40	0.3	5/1	SOT-89
PXT3906	PNP	200	40	0.4	5/1	SOT-89
PXT2222A	NPN	600	40	1	500/50	SOT-89
PXT2907A	PNP	600	60	1.6	500/5	SOT-89
PXT8050	NPN	1500	25	0.5	800/80	SOT-89
PXT8550	PNP	1500	25	0.5	800/80	SOT-89
CXT5551	NPN	600	160	0.2	5/1	SOT-89
CXT5401	PNP	500	150	0.5	5/1	SOT-89
BCX54	NPN	1000	45	0.5	5/1	SOT-89
BCX5410	NPN	1000	45	0.5	500/50	SOT-89
BCX5416	NPN	1000	45	0.5	500/50	SOT-89
BCX55	NPN	1000	60	0.5	500/50	SOT-89
BCX5510	NPN	1000	60	0.5	500/50	SOT-89
BCX5516	NPN	1000	60	0.5	500/50	SOT-89
BCX56	NPN	1000	80	0.5	500/50	SOT-89
BCX5610	NPN	1000	80	0.5	500/50	SOT-89
BCX5616	NPN	1000	80	0.5	500/50	SOT-89
BCX51	PNP	1000	45	0.5	500/50	SOT-89
BCX5110	PNP	1000	45	0.5	500/50	SOT-89
BCX5116	PNP	1000	45	0.5	500/50	SOT-89
BCX52	PNP	1000	60	0.5	500/50	SOT-89
BCX5210	PNP	1000	60	0.5	500/50	SOT-89
BCX5216	PNP	1000	60	0.5	500/50	SOT-89
BCX53	PNP	1000	80	0.5	500/50	SOT-89
BCX5310	PNP	1000	80	0.5	500/50	SOT-89
BCX5316	PNP	1000	80	0.5	500/50	SOT-89
D882	NPN	3000	30	0.5	2000/200	SOT-89
B772	PNP	3000	30	0.5	2000/200	SOT-89

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10. CAN芯片

CAN Series (Continued)						
Part Number	Power Supply (V)	Signaling Rate (Mbps)	Wake up & Sleep	Low power Current (uA)	Bus fault voltage (V)	Low power mode
SIT82C250T	4.5~5.5	1	N	5	-36~36	Silent
SIT82C251T	4.5~5.5	0.04~1	Y	5	-40~40	Standby
SIT2551T	4.5~5.5	0.04~1	N	600	-27~40	Silent
SIT1050T	4.5~5.5	1	N	5	-8~18	Silent
SIT1040T	4.5~5.5	0.04~1	Y	5	-27~40	Standby
SIT1051T/E	4.5~5.5	5	N	0.5	-70~70	Silent
SIT1051T/3	VDD:4.5~5.5 VIO:3.0~5.5	5	N	1000	-70~70	Silent
SIT1042T	4.5~5.5	5	Y	15	-70~70	Standby
SIT1042T/3	VDD:4.5~5.5 VIO:3.0~5.5	5	Y	10	-70~70	Standby
SIT65HVD230DR	3.0~3.6	1	N	370	-4~16	Silent
SIT65HVD231DR	3.0~3.6	1	Y	1		sleep
SIT65HVD232DR	3.0~3.6	1	N	370	-4~16	N
SIT65HVD233DR	3.0~3.6	1	N	370	-36~36	Silent
SIT65HVD234DR	3.0~3.6	1	N	370/0.5	-36~36	Standby mode & Sleep mode
SIT65HVD235DR	3.0~3.6	1	N	370/0.6	-36~36	Silent
SIT3051ESA	3.0~3.6	1	Y	360/ 1	-36~36	silent mode &sleep mode

11. 485芯片

485 Series (Continued)						
Part Number	Power Supply (V)	Signaling Rate (Mbps)	Dupex	RECEIVER/DRIVER ENABLE	Number of Nodes	ICC (uA)
SIT65HVD75DR	3.3/5	20	Half	Y	32	400
SIT3485ESA	3.3	12	Half	Y	256	540
SIT3485EESA	3.3	12	Half	Y	256	540
SIT3088EESA	3.3/5	14	Half	Y	256	280
SIT485EESA	5	0.5	Half	Y	256	180
SIT3085EESA	5	0.5	Half	Y	256	165
SIT13085EESA	5	2.5	Half	Y	256	400
SIT65176BDR	3.3/5	10	Half	Y	32	360
SIT65HVD08DR	3.3/5	10	Half	Y	256	580

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12. 422芯片

422 Series (Continued)						
Part Number	Power Supply (V)	Signaling Rate (Mbps)	Dupex	RECEIVER/DRIVER ENABLE	Number of Nodes	ICC (uA)
SIT3490ESA	3.3/5	12	Full	N	256	890
SIT3491EESD	3.3/5	12	Full	Y	256	250
SIT488EESA	5	1	Full	N	256	300
SIT490EESA	5	12	Full	N	256	220
SIT491EESD	5	12	Full	Y	256	280
SIT75179BDR	5	1.5	Full	N	256	350

13. 232芯片

232 Series (Continued)						
Part Number	Power Supply (V)	Signaling Rate (Mbps)	ESD Ability (KV)	NO. OF EXTERNAL CAPACITORS (μF)	No. of TX	No. of RX
SIT232ESE	5	0.12	2	4(1)	2	2
SIT202EESE	5	0.12	15	4(0.1)	2	2
SIT3232EESE	3.3~5	0.12	15	4(0.1)	2	2
SIT3232EEAE	3.3~5	0.12	15	4(0.1)	2	2
SIT3232EEUE	3.3~5	0.12	15	4(0.1)	2	2

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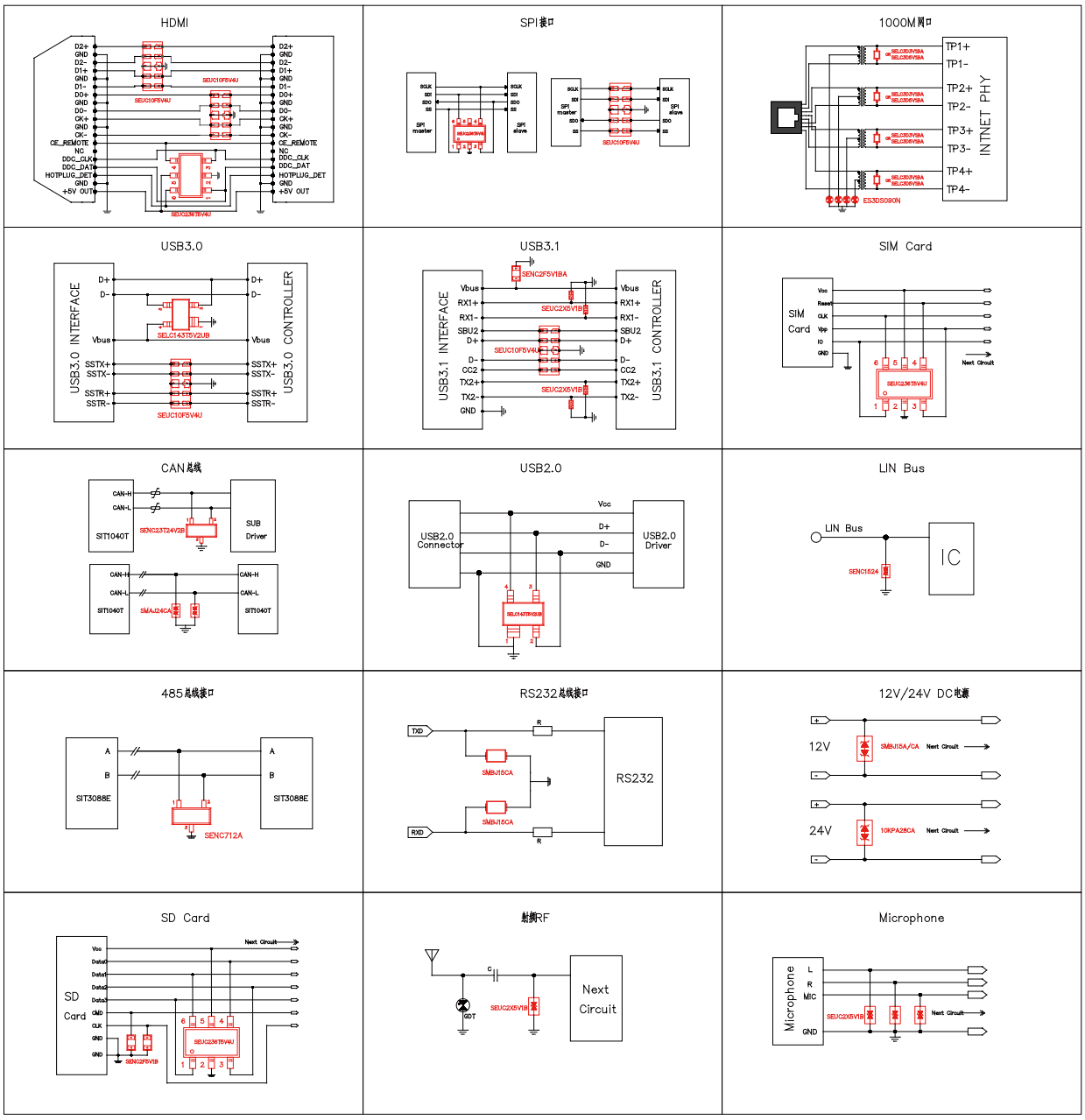
典型应用


HDMI
SPI接口
1000M网口
INTNET PHY
USB3.0
USB3.0 INTERFACE
USB3.0 CONTROLLER
USB3.1
USB3.1 INTERFACE
USB3.1 CONTROLLER
SIM Card
CAN总线
SUB Driver
USB2.0
USB2.0 Connector
USB2.0 Driver
LIN Bus
IC
485总线接口
SIT3088E
RS232总线接口
RS232
12V/24V DC电源
12V
24V
SD Card
射频RF
Next Circuit
Microphone

14. 专利

发明专利证书
发明专利证书
实用新型专利证书
实用新型专利证书
实用新型专利证书
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15. 集成电路布图设计专有权

16.资质荣誉

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证书

湖南省专精特新“小巨人”企业
（2022-2025）
湖南省工业和信息化厅
二〇二二年五月

17.部分测试设备

ESD61002TB 静电枪

TVS 8/20 雷击浪涌发生器

DPO2024B 四通道示波器

B1505A 功率器件分析仪

QT-4100 分立器件测试系统

探针台

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