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TPD1E1B04DPYR



TPD1E1B04 具有低 R_{DYN} 和低钳位电压的单通道 ESD 保护二极管

1 特性

- IEC 61000-4-2 4 级静电放电 (ESD) 保护
 - $\pm 30\text{kV}$ 接触放电
 - $\pm 30\text{kV}$ 气隙放电
- IEC 61000-4-4 瞬态放电 (EFT) 保护
 - 80A ($5/50\text{ns}$)
- IEC 61000-4-5 浪涌保护
 - 6.3A ($8/20\mu\text{s}$)
- IO 电容值: 1pF (典型值)
- 直流击穿电压: 6.4V (典型值)
- 低泄漏电流: 100nA (最大值)
- 极低 ESD 钳位电压
 - 8.5V ($\pm 16\text{A}$ TLP 时)
 - R_{DYN} : 0.15Ω
- 工业温度范围: -40°C 至 $+125^\circ\text{C}$
- 行业标准的 0402 封装

2 应用

- 终端设备
 - 可穿戴产品
 - 便携式计算机和台式机
 - 手机和平板电脑
 - 机顶盒
 - 数字视频录像机 (DVR) 和网络视频录像机 (NVR)
 - 电视和监视器
 - EPOS (电子销售终端)
- 接口
 - USB 2.0/1.1
 - 通用输入/输出 (GPIO)
 - 按钮
 - 音频

3 说明

TPD1E1B04 是一款双向 TVS ESD 保护二极管, 特有低 R_{DYN} 和低钳位电压。TPD1E1B04 的额定 ESD 冲击消散值等于 IEC 61000-4-2 (4 级) 国际标准中规定的最高水平。

超低动态电阻 (0.15Ω) 和极低钳位电压 (16A TLP 时为 8.5V) 可针对瞬变事件提供系统级保护。该器件 特有一个 1pF IO 电容, 非常适合用于保护 USB 2.0 等接口。

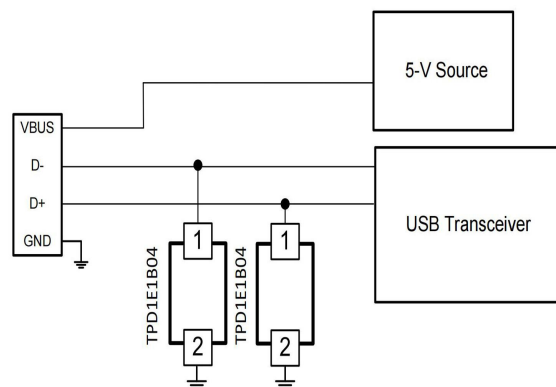
TPD1E1B04 采用符合行业标准的 0402 (DPY) 封装。

器件信息⁽¹⁾

器件型号	封装	封装尺寸 (标称值)
TPD1E1B04	X1SON (2)	$0.60\text{mm} \times 1.00\text{mm}$

(1) 要了解所有可用封装, 请参见数据表末尾的可订购产品附录。

典型的 USB 2.0 应用原理图



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6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

		MIN	MAX	UNIT
Electrical fast transient	IEC 61000-4-4 (5/50 ns)		80	A
Peak pulse	IEC 61000-4-5 Power (t_p - 8/20 μ s)		50	W
	IEC 61000-4-5 Current (t_p - 8/20 μ s)		6.3	A
T_A	Operating free-air temperature	-40	125	°C
T_{stg}	Storage temperature	-65	155	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

6.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±4000	V
	Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±1500	

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
 (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 ESD Ratings—IEC Specification

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	IEC 61000-4-2 contact discharge	±30000	V
	IEC 61000-4-2 air-gap discharge	±30000	

6.4 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_{IO}	Input pin voltage	-3.6	3.6	V
T_A	Operating free-air temperature	-40	125	°C

6.5 Thermal Information

THERMAL METRIC ⁽¹⁾		TPD1E1B04	UNIT
		DPY (X1SON)	
		2 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	420	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	169.3	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	276.1	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	122.1	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	157.3	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	°C/W

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6.6 Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{RWM}	Reverse stand-off voltage	$I_{IO} < 100 \text{ nA}$		3.6	V
V_{BRF}	Breakdown voltage, any IO pin to GND		6.4		V
V_{BRR}	Breakdown voltage, GND to any IO pin		-6.4		V
V_{HOLD}	Holding voltage	$I_{IO} = 1 \text{ mA}$, $T_A = 25^\circ\text{C}$	6	6.6	V
V_{CLAMP}	Clamping voltage	$I_{PP} = 1 \text{ A}$, TLP, from IO to GND	6.3		V
		$I_{PP} = 5 \text{ A}$, TLP, from IO to GND	6.8		
		$I_{PP} = 16 \text{ A}$, TLP, from IO to GND	8.5		
		$I_{PP} = 1 \text{ A}$, TLP, from GND to IO	6.3		
		$I_{PP} = 5 \text{ A}$, TLP, from GND to IO	6.8		
		$I_{PP} = 16 \text{ A}$, TLP, from GND to IO	8.5		
I_{LEAK}	Leakage current, IO to GND	$V_{IO} = \pm 2.5 \text{ V}$	0.2	100	nA
R_{DYN}	Dynamic resistance	IO to GND	0.15		Ω
		GND to IO	0.15		
C_L	Line capacitance	$V_{IO} = 0 \text{ V}$, $f = 1 \text{ MHz}$, IO to GND, $T_A = 25^\circ\text{C}$	1	1.3	pF

6.7 Typical Characteristics

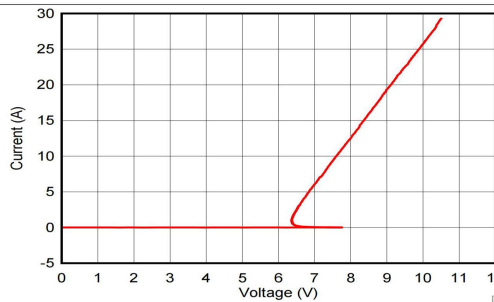


Figure 1. Positive TLP Curve

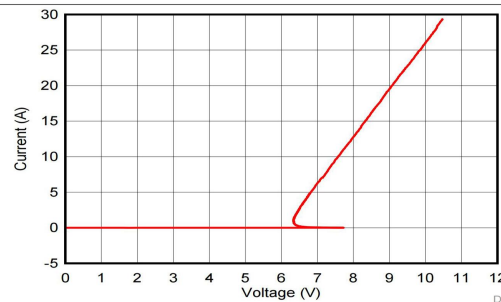


Figure 2. Negative TLP Curve

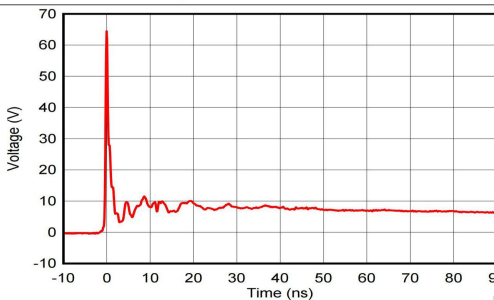


Figure 3. 8-kV IEC Waveform

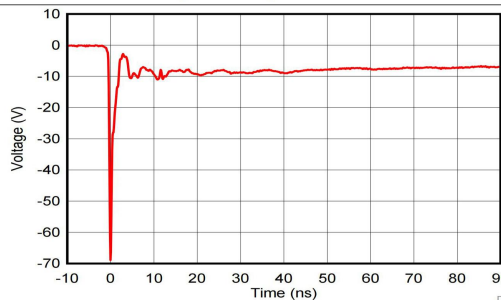


Figure 4. -8-kV IEC Waveform

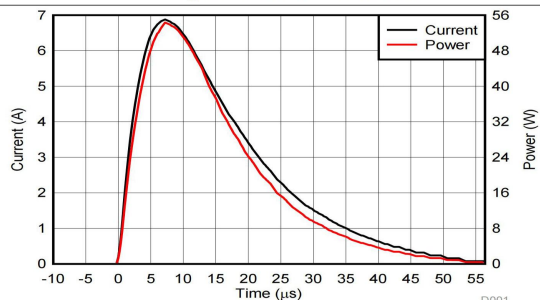


Figure 5. Surge Curve ($t_p = 8/20 \mu\text{s}$), Any IO Pin to GND

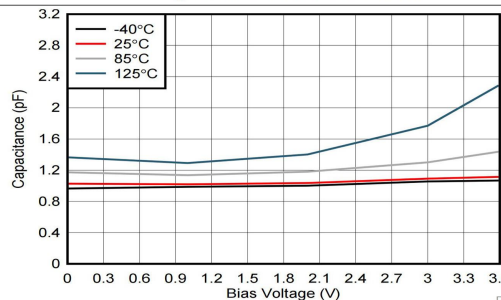


Figure 6. Capacitance vs. Bias Voltage

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Typical Characteristics (continued)

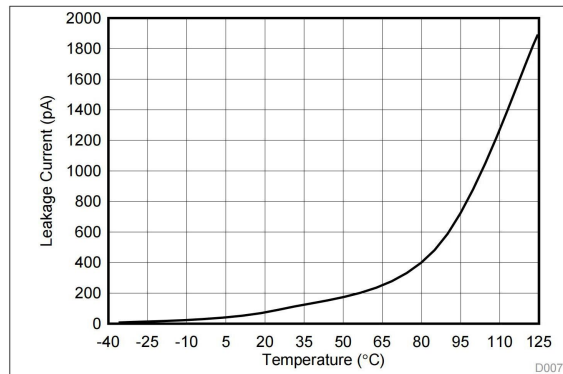


Figure 7. Leakage Current vs. Temperature

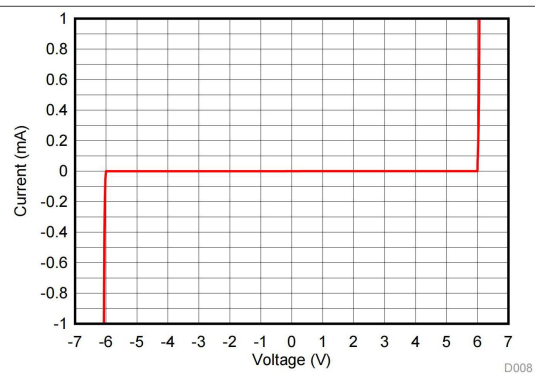


Figure 8. DC Voltage Sweep I-V Curve

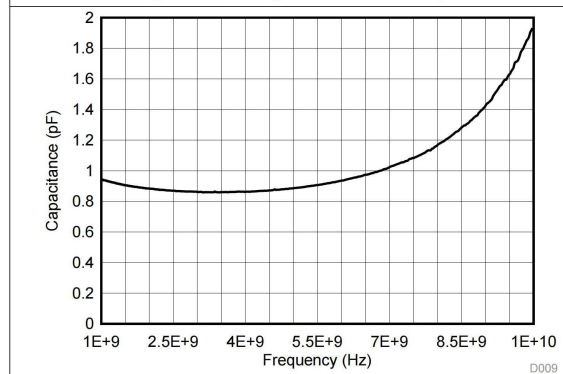


Figure 9. Capacitance vs. Frequency

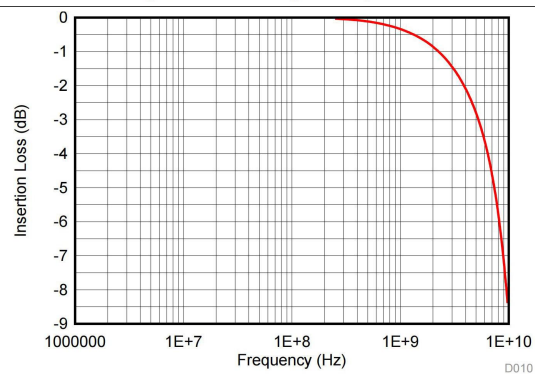


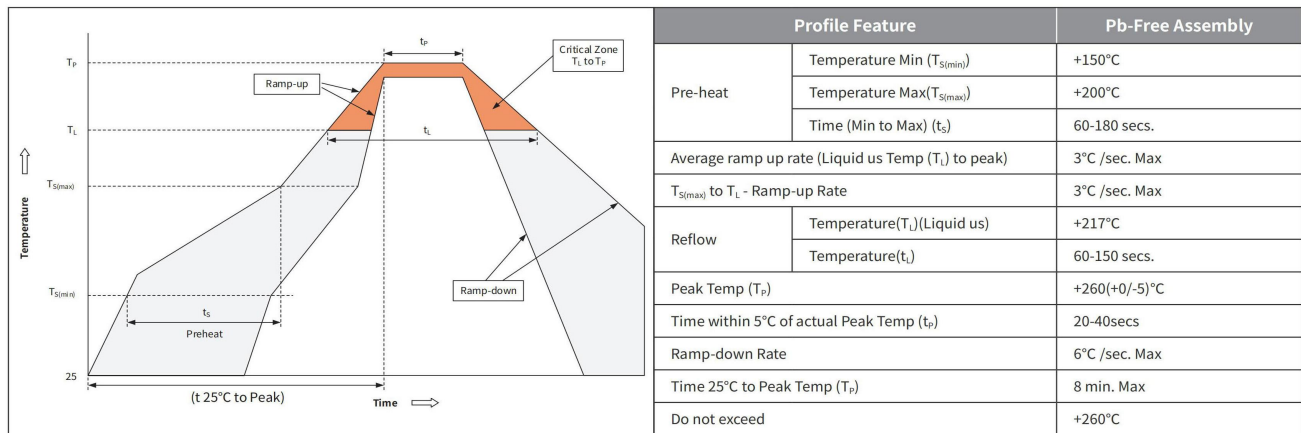
Figure 10. Insertion Loss

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Ordering Information

PREFERRED P/N	PACKAGE	SIZE(mm)	DELIVERY MODE	MPQ(PCS)
	DFN1006-2L	1.00×0.60×0.37	7" REEL	10,000

Recommended Soldering Conditions



Package Outline Dimensions (DFN1006-2L)

Symbol	Dimensions			
	Millimeters		Inches	
	Min	Max	Min	Max
A	0.950	1.050	0.037	0.041
B	0.550	0.650	0.022	0.026
C	0.350	0.450	0.014	0.018
D	0.550	0.650	0.022	0.026
D ₁	0.280	0.380	0.011	0.015
E	0.450	0.550	0.018	0.022
L	0.000	0.100	0.000	0.004

Suggested Pad Layout

Symbol	Dimensions			
	Millimeters		Inches	
	Min	Max	Min	Max
J	0.50	0.60	0.020	0.024
K	0.25	0.35	0.010	0.014
M	0.55	0.65	0.022	0.026