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TPD1E01B04DPYT



TPD1E01B04 适用于 USB Type-C 和 Thunderbolt 3 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
 - $\pm 15\text{kV}$ 接触放电
 - $\pm 17\text{kV}$ 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
 - 2.5A ($8/20\mu\text{s}$)
- IO 电容:
 - 0.18pF (典型值)
 - 0.2pF (最大值)
- 直流击穿电压: 6.4V (典型值)
- 超低泄漏电流: 10nA (最大值)
- 低静电放电 (ESD) 钳位电压: 16A 传输线路脉冲 (TLP) 时为 15V
- 低插入损耗: 26.9GHz (-3dB 带宽)
- 支持速率高达 20Gbps 的高速接口
- 工业温度范围: -40°C 至 $+125^\circ\text{C}$
- 超小型 0201 封装

2 应用

- 终端设备
 - 便携式计算机和台式机
 - 手机和平板电脑
 - 机顶盒
 - 电视和监视器
 - USB 软件狗
 - 扩展坞
- 接口
 - USB Type-C
 - Thunderbolt 3
 - USB 3.1 第 2 代
 - 高清多媒体接口 (HDMI) 2.0/1.4
 - USB 3.0
 - DisplayPort 1.3
 - PCI Express 3

3 说明

TPD1E01B04 是一款适用于 USB Type-C 和 Thunderbolt 3 电路保护的双向 TVS ESD 保护二极管阵列。TPD1E01B04 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。

此器件 特有一个 0.18pF (典型值) IO 电容, 适用于保护速率高达 20Gbps 的高速接口 (例如 USB 3.1 Gen2 和 Thunderbolt 3)。低动态电阻和低钳位电压可针对瞬变事件提供系统级保护。

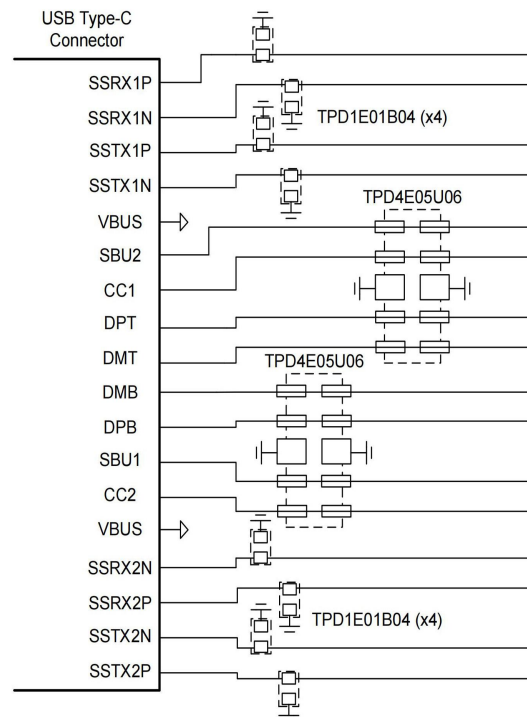
TPD1E01B04 采用符合工业标准的 0201 (DPL) 封装。

器件信息⁽¹⁾

器件型号	封装	封装尺寸 (标称值)
TPD1E01B04	X2SON (2)	$0.60\text{mm} \times 0.30\text{mm}$

(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。

典型应用



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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 61000-4-5 (5/50 ns)		80	A
Peak pulse	IEC 61000-4-5 power (t_p - 8/20 μ s)		27	W
	IEC 61000-4-5 current (t_p - 8/20 μ s)		2.5	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⁾	±2500	V
	Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±1000	

- (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	±15000	V
	IEC 61000-4-2 air-gap discharge	±17000	

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⁾		TPD1E01B04	UNIT
		DPL (X2SON)	
		2 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	582	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	264.5	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	394.4	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	36.4	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	394.4	°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	$I_{IO} < 10 \text{ nA}$		3.6	V
V_{BRF}	Breakdown voltage, IO pin to GND	Measured as the maximum voltage before device snaps back into V_{HOLD}	6.4		V
V_{BRR}	Breakdown voltage, GND to IO pin		-6.4		V
V_{HOLD}	Holding voltage	$I_{IO} = 1 \text{ mA}$, $T_A = 25^\circ\text{C}$	5	6.5	V
V_{CLAMP}	Clamping voltage	$I_{PP} = 1 \text{ A}$, TLP, from IO to GND	7		V
		$I_{PP} = 5 \text{ A}$, TLP, from IO to GND	9.2		
		$I_{PP} = 16 \text{ A}$, TLP, from IO to GND	15		
		$I_{PP} = 1 \text{ A}$, TLP, from GND to IO	7		
		$I_{PP} = 5 \text{ A}$, TLP, from GND to IO	9.2		
		$I_{PP} = 16 \text{ A}$, TLP, from GND to IO	15		
I_{LEAK}	Leakage current, IO to GND	$V_{IO} = \pm 2.5 \text{ V}$		10	nA
R_{DYN}	Dynamic resistance	IO to GND	0.57		Ω
		GND to IO	0.57		
C_L	Line capacitance	$V_{IO} = 0 \text{ V}$, $f = 1 \text{ MHz}$, IO to GND $T_A = 25^\circ\text{C}$	0.18	0.20	pF

6.7 Typical Characteristics

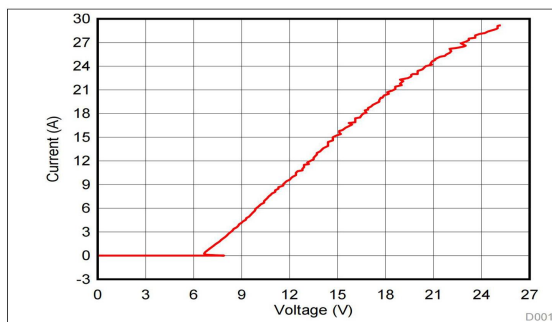


Figure 1. Positive TLP Curve

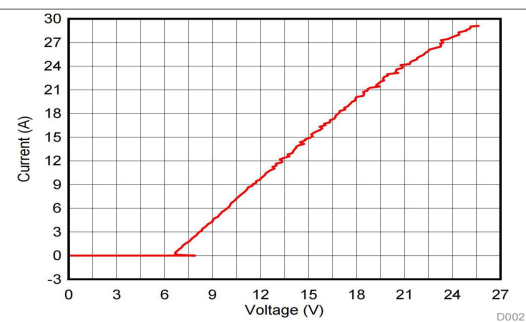


Figure 2. Negative TLP Curve

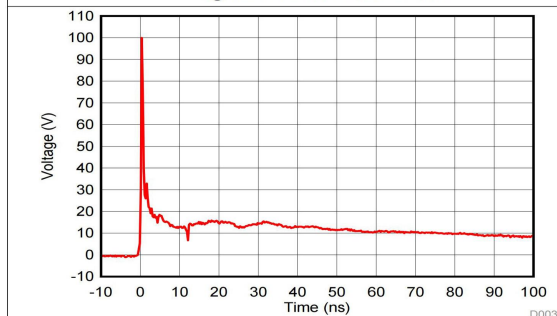


Figure 3. 8-kV IEC Waveform

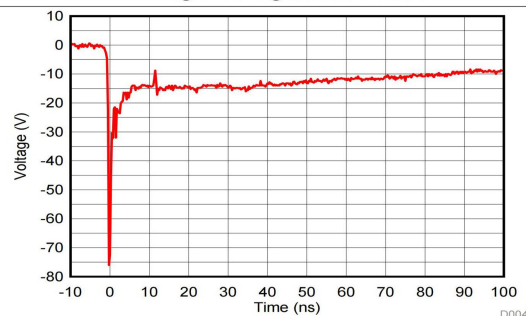


Figure 4. -8-kV IEC Waveform

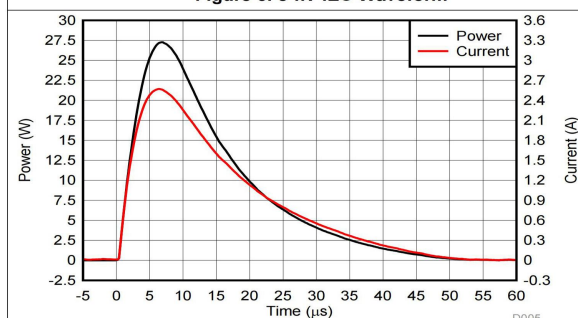


Figure 5. Surge Curve ($t_p = 8/20\mu\text{s}$), IO pin to GND

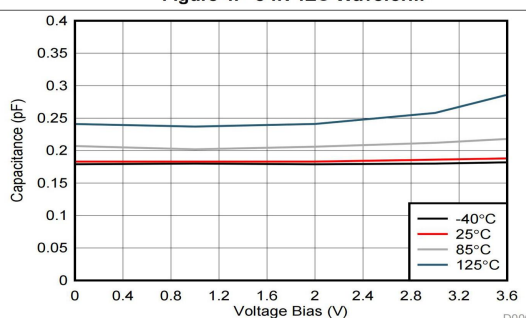
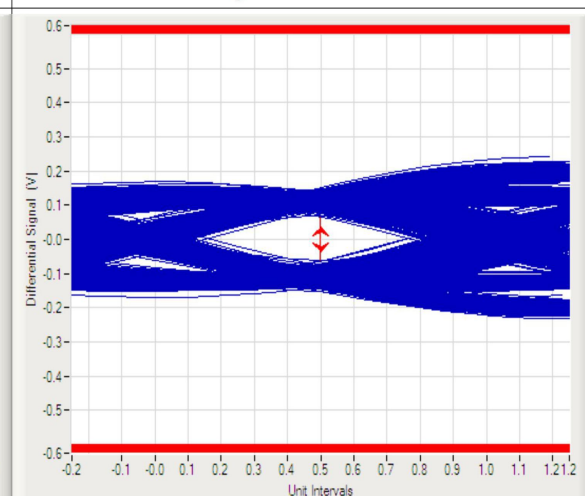
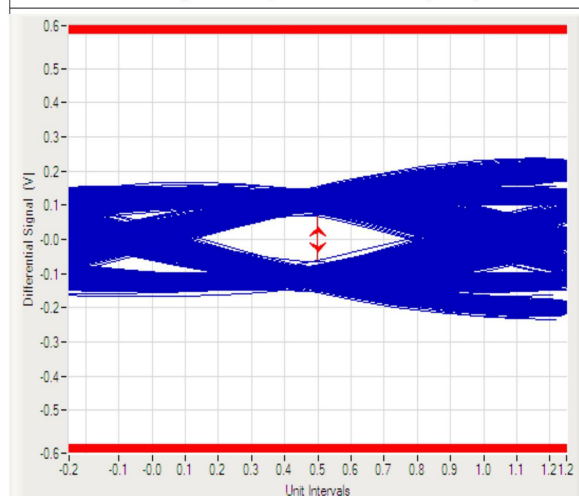
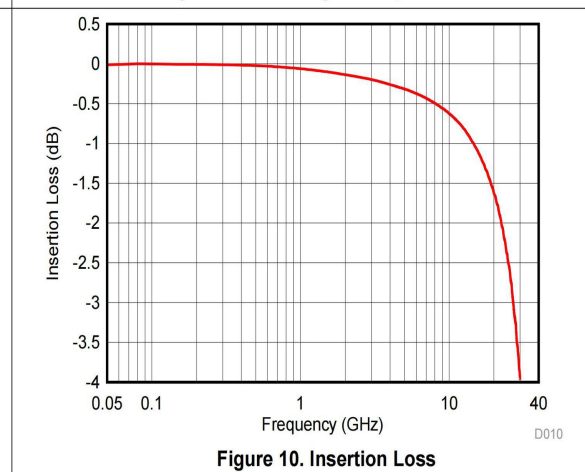
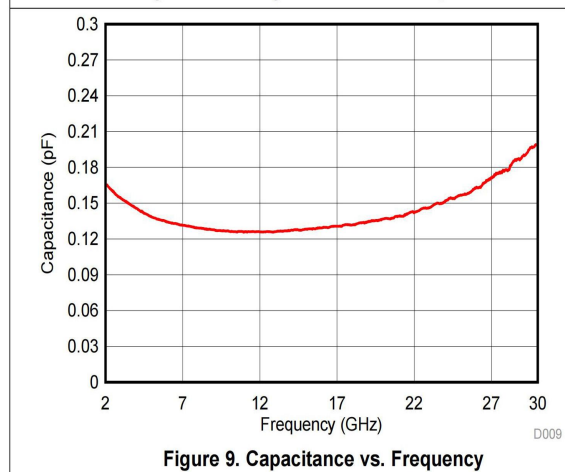
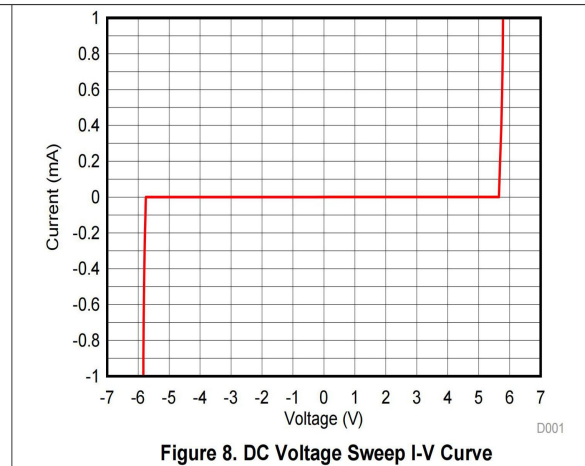
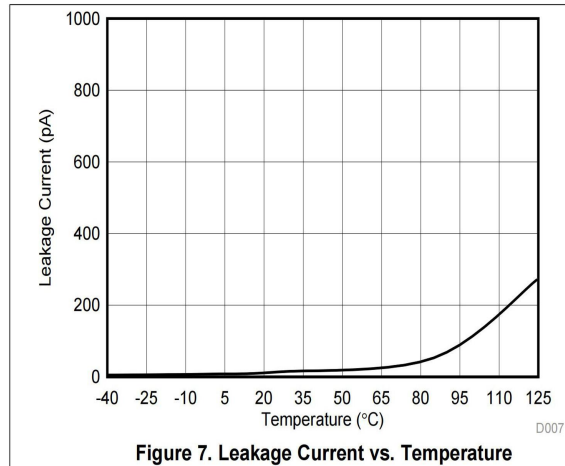


Figure 6. Capacitance vs. Bias Voltage

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Typical Characteristics (continued)

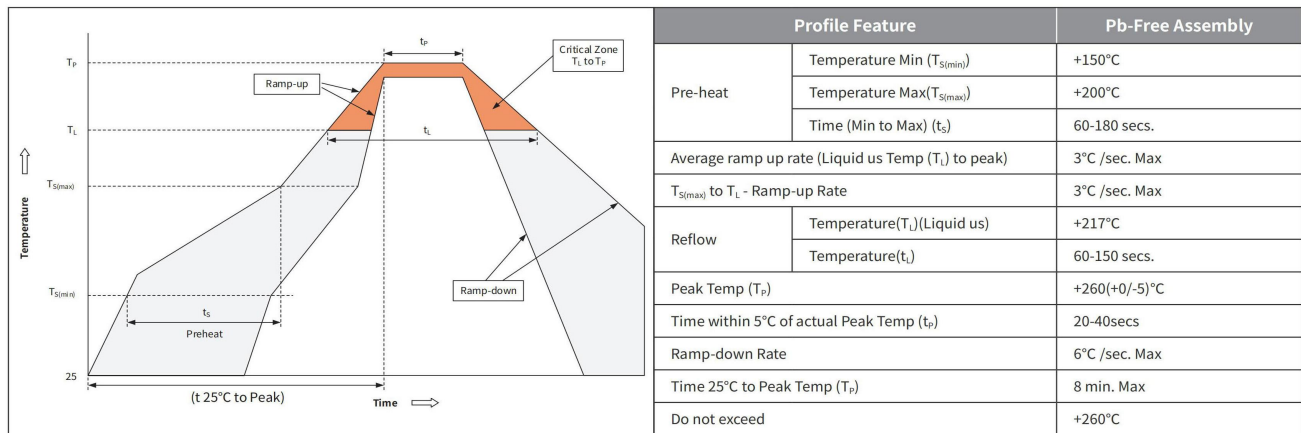


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Ordering Information

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