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TPD1E05U06DPYT



静电放电 (ESD) 保护器件

1 特性

- IEC 61000-4-2 4 级 ESD 保护
 - $\pm 12\text{kV}$ 接触放电
 - $\pm 15\text{kV}$ 空气间隙放电
- IEC 61000-4-4 EFT 保护
 - 80A (5/50ns)
- IEC 61000-4-5 浪涌保护
 - 2.5A (8/20 μs)
- IO 电容 0.42pF 至 0.5pF (典型值)
- 直流击穿电压为 6.5V (最小值)
- 超低漏电流为 10nA (最大值)
- 低 ESD 钳位电压
- 工业级温度范围: -40°C 至 $+125^{\circ}\text{C}$
- 简易直通布线封装
- 业界通用的 SOD-523 封装
(1.60mm $\times$ 0.80mm $\times$ 0.65mm)

2 应用

- [HDMI 1.4b](#)
- HDMI 2.0
- [USB 3.0](#)
- MHL
- [LVDS 接口](#)
- [DisplayPort](#)
- [PCI-express®](#)
- [eSata 接口](#)
- [V-by-One® HS](#)

3 说明

TPDxE05U06 是基于单向瞬态电压抑制器 (TVS) 的静电放电 (ESD) 保护二极管产品系列, 具有超低电容。每个器件的 ESD 冲击消散值高于 IEC 61000-4-2 国际标准规定的最高水平。TPDxE05U06 超低负载电容特性使得该器件非常适合保护任何高速信号引脚。

TPDxE05U06 的典型应用包括 HDMI 1.4b、HDMI 2.0、USB 3.0、MHL、LVDS、DisplayPort、PCI-Express®、eSata 和 V-by-One® HS 中的高速信号线。

器件信息

器件型号	通道数	封装 ⁽¹⁾
TPD1E05U06	单通道	DPY (X1SON, 2)
		DYA (SOD-523, 2)

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5 Specifications

Absolute Maximum Ratings

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

		MIN	MAX	UNIT
Electrical Fast Transient (2) (3)	IEC 61000-4-4 (5/50ns)		80	A
Peak Pulse (2) (3)	IEC 61000-4-5 Current (8/20us)		2.5	A
	IEC 61000-4-5 Power (8/20us)		40	W
T _A	Ambient Operating 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.
- (2) Voltages are with respect to GND unless otherwise noted.
- (3) Measured at 25°C

5.1 ESD Ratings—JEDEC Specification

			VALUE	UNIT
V _(ESD)	Electrostatic discharge - DPY, DQA, and RVZ	Human body model (HBM), per ANSI/ESDA/ JEDEC JS-001 ⁽¹⁾	±4000	V
		Charged device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±1500	V
V _(ESD)	Electrostatic discharge - DYA	Human body model (HBM), per ANSI/ESDA/ JEDEC JS-001	±2500	V
		Charged device model (CDM), per JEDEC specification JS-002	±1000	V

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500-V HBM is possible with the necessary precautions. Pins listed as ±4000 V may actually have higher performance.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250-V CDM is possible with the necessary precautions. Pins listed as ±1500 V may actually have higher performance.

5.2 ESD Ratings—IEC Specification

			VALUE	UNIT
V _(ESD)	Electrostatic discharge	IEC 61000-4-2 contact discharge	±12000	V
		IEC 61000-4-2 air-gap discharge	±15000	

Recommended Operating Conditions

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

		MIN	NOM	MAX	UNIT
V _{IO}	Input pin voltage	0		5.5	V
T _A	Operating free-air temperature	-40		125	°C

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5.3 Thermal Information

THERMAL METRIC ⁽¹⁾		TPD1E05U06		TPD4E05U06	TPD6E05U06	UNIT
		DPY (X1SON)	DYA (SOD523)	DQA (USON)	RVZ (USON)	
		2 PINS	2 PINS	10 PINS	14 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	697.3	772.1	327	197.9	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	471	444.6	189.5	119.1	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	575.9	540.4	257.7	92.6	°C/W
ψ_{JT}	Junction-to-top characterization parameter	175.7	159.9	60.9	22	°C/W
ψ_{JB}	Junction-to-board characterization parameter	575.1	533.9	257	91.6	°C/W

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

5.4 Electrical Characteristics

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

PARAMETER			TEST CONDITION	MIN	TYP	MAX	UNIT
INPUT - OUTPUT RESISTANCE							
V _{RWM}	Reverse stand-off voltage		I _{IO} < 10 μA			5.5	V
V _{BR}	Break-down voltage		I _{IO} = 1 mA	6.5		8.5	V
V _{Clamp}	Clamp voltage		I _{PP} = 1 A, TLP, from I/O to GND ⁽¹⁾		10		V
			I _{PP} = 5 A, TLP, from I/O to GND ⁽¹⁾		14		
			I _{PP} = 1 A, TLP, from GND to I/O ⁽¹⁾		3		
			I _{PP} = 5 A, TLP, from GND to I/O ⁽¹⁾		7		
I _{LEAK}	Leakage current		V _{IO} = 2.5 V		0.01	10	nA
R _{DYN}	Dynamic resistance	DPY package	I/O to GND ⁽²⁾		0.8		Ω
			GND to I/O ⁽²⁾		0.8		
		DYA package	I/O to GND ⁽²⁾		0.8		
			GND to I/O ⁽²⁾		0.7		
		DQA package	I/O to GND ⁽²⁾		0.8		
			GND to I/O ⁽²⁾		0.8		
		RVZ package	I/O to GND ⁽²⁾		0.8		
			GND to I/O ⁽²⁾		0.8		
CAPACITANCE							
C _L	Line capacitance ⁽³⁾		V _{IO} = 2.5 V; f = 1 MHz , I/O to GND	TPD1E05U06 DPY package	0.42		pF
				TPD1E05U06 DYA package	0.42		
				TPD4E05U06 DQA package	0.5		
				TPD6E05U06 RVZ package	0.47		
Δ C _{IO-TO-GND}	Variation of input capacitance		GND Pin = 0 V, f = 1 MHz, VBIAS = 2.5 V, Channel x pin to GND - channel y pin to GND		0.05	0.07	pF
C _{CROSS}	Channel to channel input capacitance		GND Pin = 0 V, f = 1 MHz, VBIAS = 2.5 V, between channel pins		0.01	0.06	pF

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5.5 Typical Characteristics

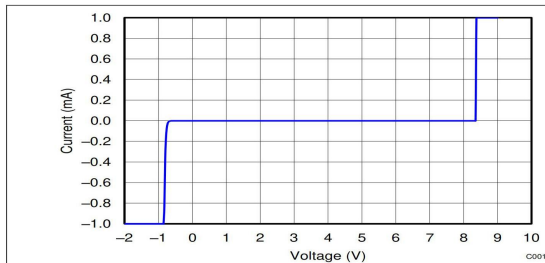


图 5-1. DC Voltage Sweep I-V Curve

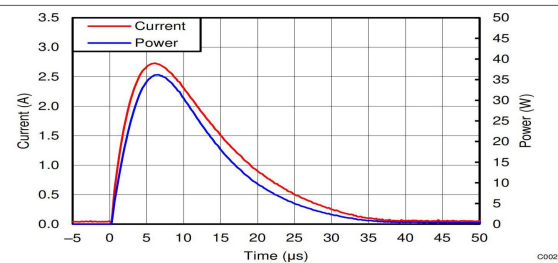


图 5-2. Surge Curve ($t_p = 8/20 \mu s$, Pin IO to GND)

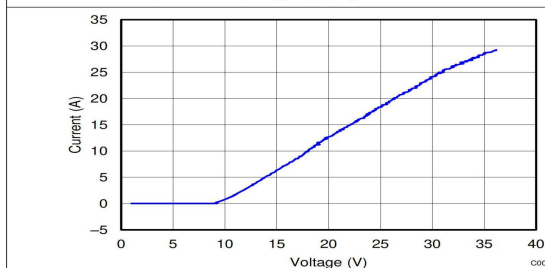


图 5-3. Positive TLP Plot IO to GND

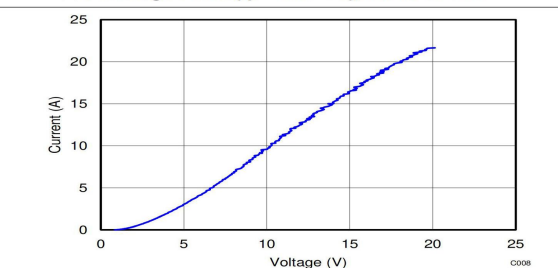


图 5-4. Negative TLP Plot IO to GND

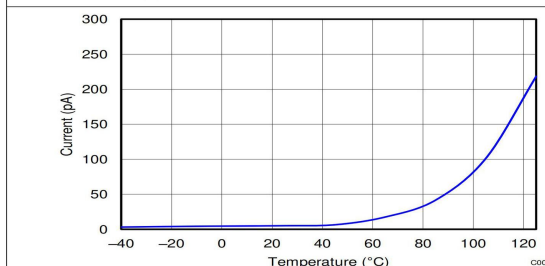


图 5-5. Leakage vs Temperature

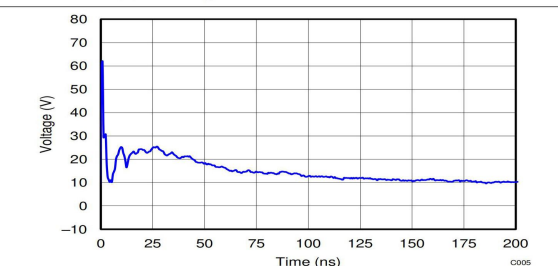


图 5-6. 8-kV IEC Waveform

5.5 Typical Characteristics (continued)

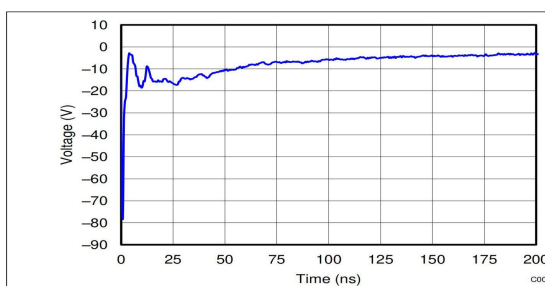


图 5-7. -8-kV IEC Waveform

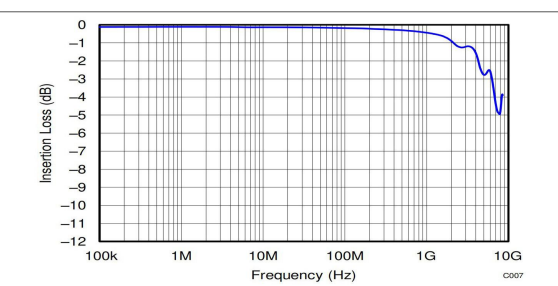


图 5-8. TPD1E05U06 Insertion Loss

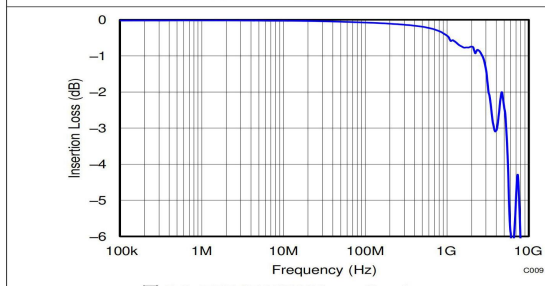


图 5-9. TPD4E05U06 Insertion Loss

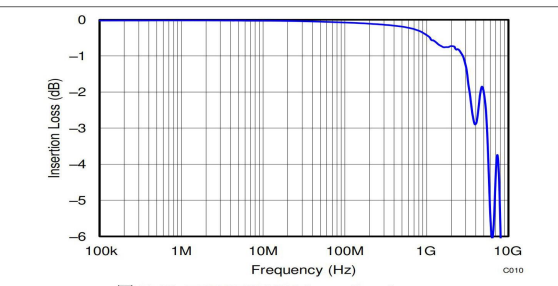


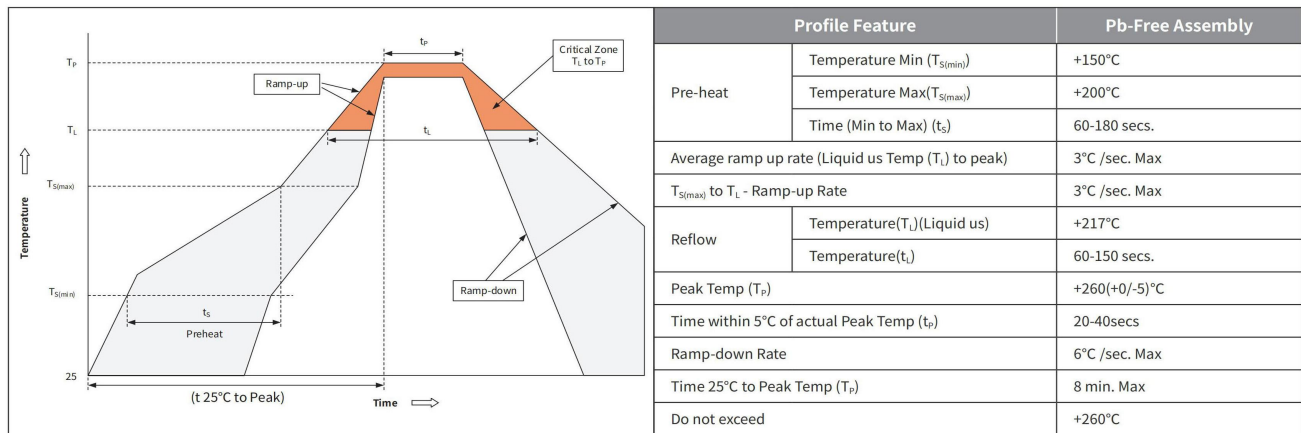
图 5-10. TPD6E05U06 Insertion Loss

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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