Five Channel Space Saving ESD Protection Device

Check for Samples: TPD5E003

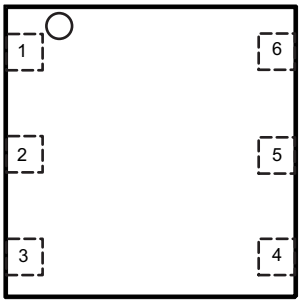
FEATURES

- **Provides System Level ESD Protection for Low-Voltage IO Interface**
- **IEC 61000-4-2 Level 4**
  - **±15kV (Contact discharge)**
  - **±15kV (Air-gap discharge)**
- **Typical IO Capacitance 7pF (V_{IO} = 2.5V)**
- **DC Breakdown Voltage 6V (Min)**
- **Low Leakage Current 100nA (Max)**
- **Low ESD Clamping Voltage**
- **Industrial Temperature Range: –40°C to 125°C**
- **IEC 61000-4-5 (Surge): 40 W (8/20 µs Pulse)**
- **Small, Easy-to-Route DPF Package**

APPLICATIONS

- **SIM Card**
- **Side Keys**
- **Audio Interface**
- **Memory Card**

DPF



1 mm x 1 mm x 0.4mm
(0.35-mm pitch)

DESCRIPTION

The TPD5E003 is a five channel ESD protection device. It offers ±15KV IEC contact and ±15KV air-gap ESD protection. It features five identical ESD clamping diodes that could be used for either five unidirectional (0V to 5V) I/O lines or four bidirectional (-5V to 5V) I/O lines. The lower IO capacitance is suitable for a wide range of applications. Typical application areas include audio lines (mic, earphone, and speakerphone), SD interface, and keypad, or other buttons.

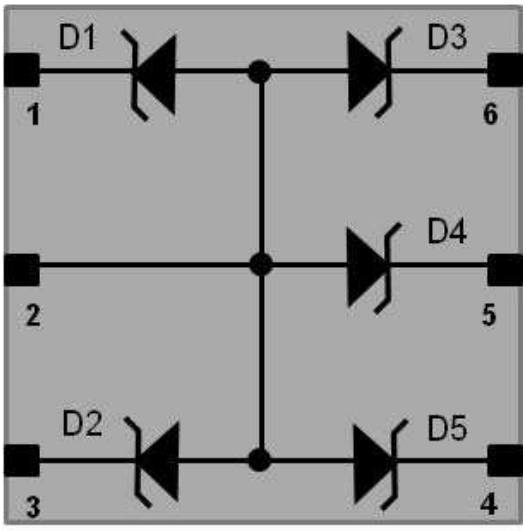
ORDERING INFORMATION

T_A	PACKAGE(1)(2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 125°C	5000	Tape and reel	TPD5E003DPFR	9Q

(1) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
(2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI Web site at www.ti.com.

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

APPLICATION/FUNCTIONAL BLOCK DIAGRAM



PIN FUNCTIONS

PIN NAME	DPF	PIN TYPE	DESCRIPTION
I/O	1, 3, 4, 5, 6	I/O	ESD Protected channel
GND	2	GND	Ground

ABSOLUTE MAXIMUM RATINGS

	MIN	MAX	UNIT
IO voltage tolerance		5.5	V
Operating temperature range	-40	125	°C
Storage temperature	-55	150	°C
IEC 61000-4-2 contact ESD		±15	kV
IEC 61000-4-2 air-gap ESD		±15	kV
I_{PP}, peak pulse current (tp = 8/20μs)		3	A
P_{PP}, peak pulse power (tp = 8/20μs)		40	W

ELECTRICAL CHARACTERISTICS

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
V_{RWM}	Reverse stand-off voltage	I_I = 0.1 μA			5.0	V
I_{LEAK}	Leakage Current	Pin 1, 3, 4, 5, or 6 = 5V, Pin 2 = 0V		10	100	nA
VClamp	Clamp voltage with ESD strike	I_{PP} = 6A, TLP, Dx pin to GND, T_A = 25 °C		13	15.6	V
		I_{PP} = 10 A, TLP, Dx pin to GND, T_A = 25 °C		16.3	19.5	V
R_{DYN}	Dynamic resistance	I_{TLP} = 6A to 10 A, Dx pin to GND, T_A = 25 °C		0.8	1	Ω
		I_{TLP} = 6A to 10 A, GND to Dx pin, T_A = 25 °C		0.3	0.4	Ω
C_{IO}	IO capacitance	V_{IO} = 2.5V, 1 MHz, T_A = 25 °C	5.6	7	8.4	pF
		V_{IO} = 0V, 1 MHz, T_A = 25 °C	8	10	12	pF
V_{BR}	Break-down voltage	I_{IO} = 1 mA	6.0	7	8.5	V

APPLICATION INFORMATION

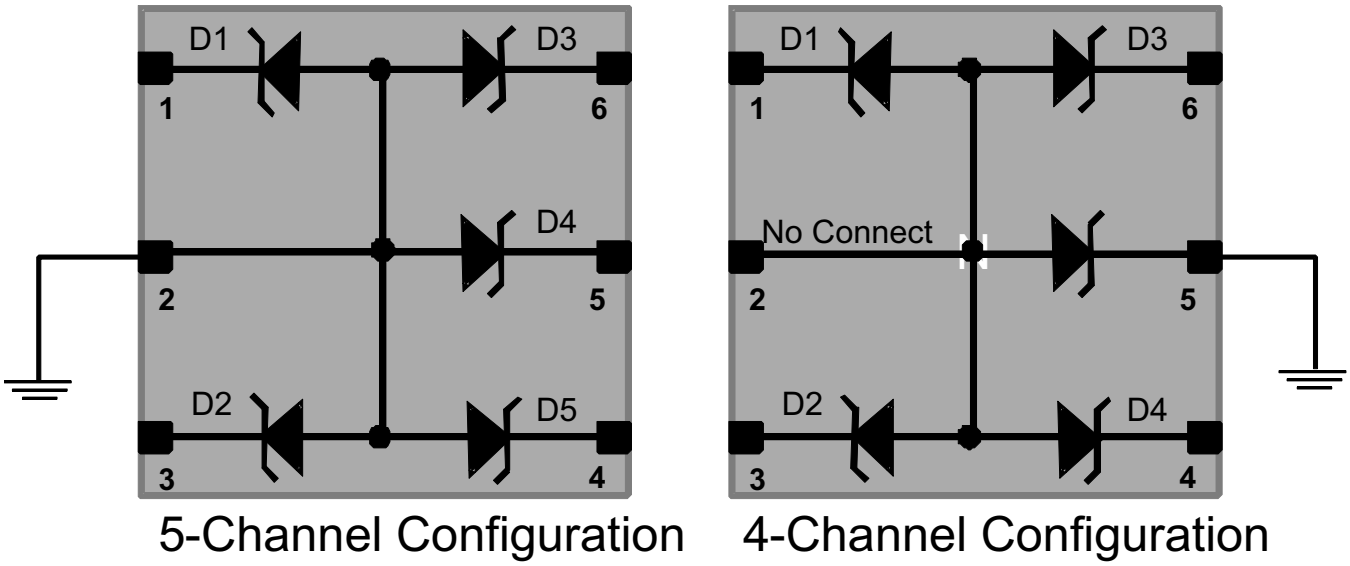


Figure 1. Application Diagram

The TPD5E003 offers 5 identical unidirectional ESD protection channels. To use all 5 channels, the recommended configuration is shown in Figure 1. The TPD5E003 can also be used as 4 identical bidirectional ESD protection channels. To do so, pin 5 would be connected to ground, with pin 1, 3, 4, and 6 connected to the I/O to be protected. In the bidirectional configuration, IO capacitance is reduced by half and the breakdown voltage is doubled.

TYPICAL CHARACTERISTICS

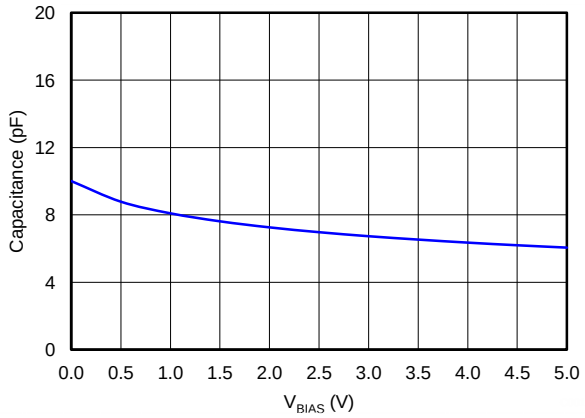


Figure 2. Capacitance vs DC Bias Voltage

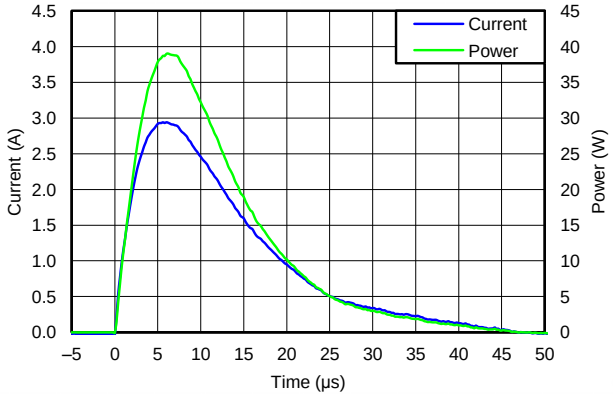


Figure 3. Surge Plot (tp = 8/20µs), Pin Dx to GND

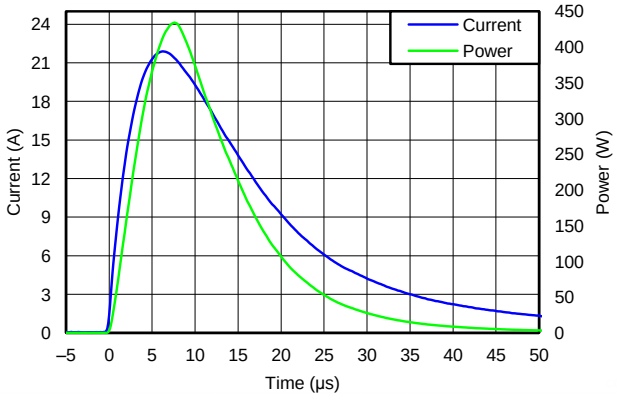


Figure 4. Surge Plot (tp = 8/20µs), Pin GND to Dx

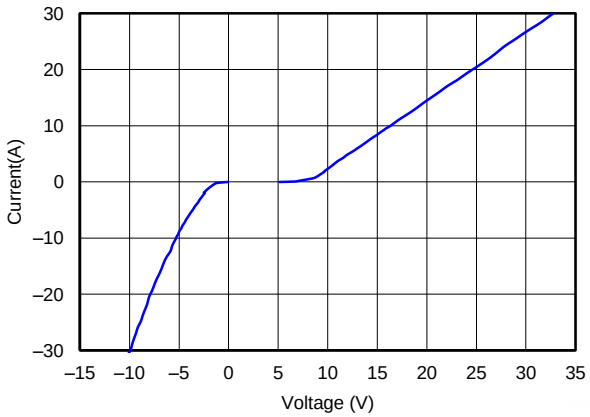


Figure 5. 30 Amps TLP Plot

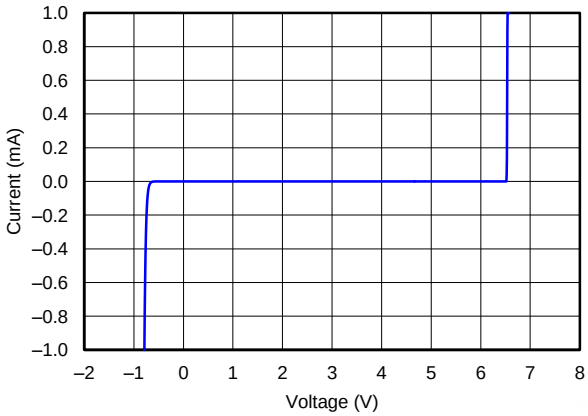


Figure 6. DC SWEEP V-I Curve

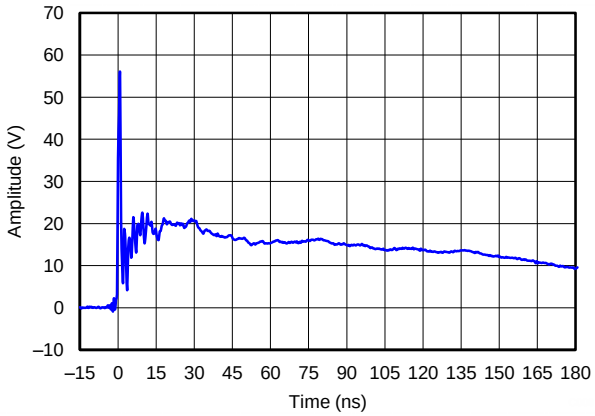


Figure 7. IEC 61000-4-2 Clamping Voltage, +8kV Contact

TYPICAL CHARACTERISTICS (continued)

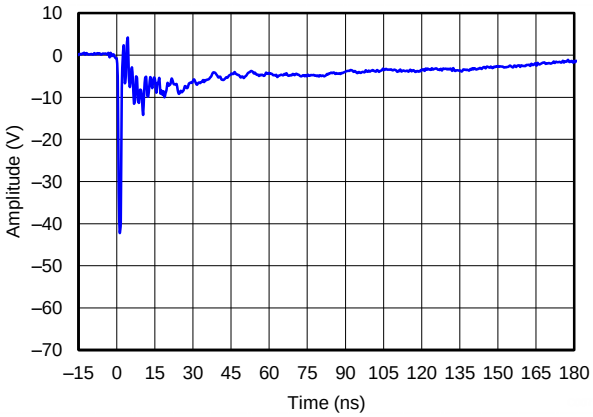


Figure 8. IEC 61000-4-2 Clamping Voltage, –8kV Contact

REVISION HISTORY

Changes from Original (December 2012) to Revision A **Page**

- Added IO voltage tolerance to the ABSOLUTE MAXIMUM RATINGS table. 2
- Added MAX values to parameters in the ELECTRICAL CHARACTERISTICS table. 2

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
TPD5E003DPFR	ACTIVE	X2SON	DPF	6	5000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	9Q	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

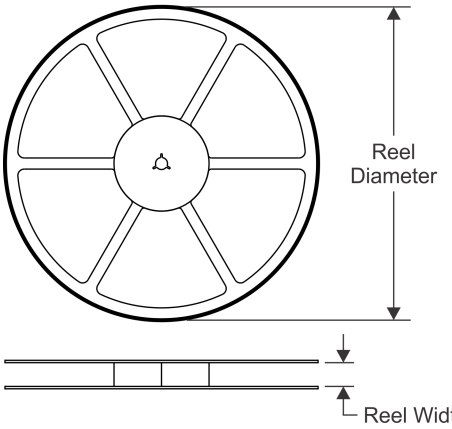
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

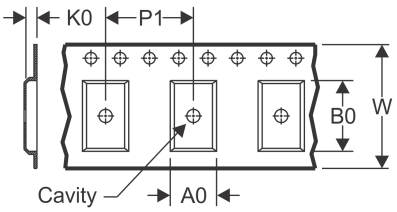
(4) Only one of markings shown within the brackets will appear on the physical device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

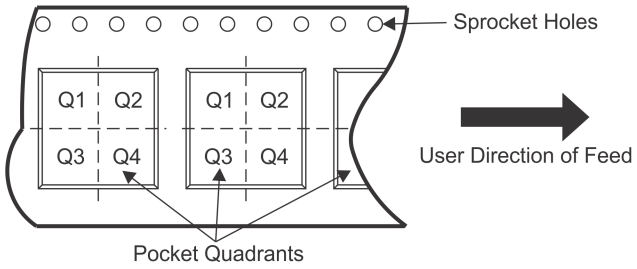


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

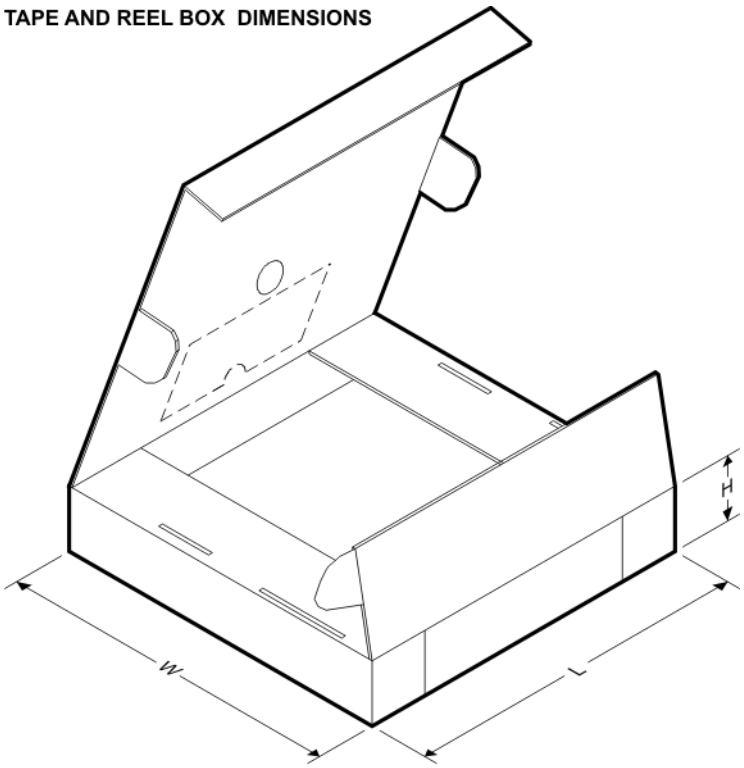
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TPD5E003DPFR	X2SON	DPF	6	5000	180.0	9.5	1.16	1.16	0.63	4.0	8.0	Q2

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPD5E003DPFR	X2SON	DPF	6	5000	180.0	180.0	30.0

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