

Quad Channel High Speed ESD Protection Device

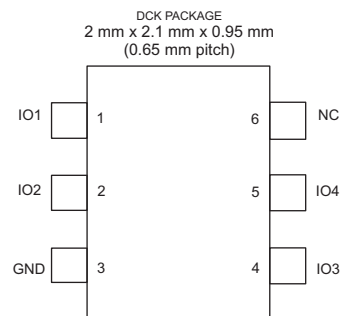
Check for Samples: [TPD4E1B06](#)

FEATURES

- Provides System Level ESD Protection for Low-Voltage IO Interfaces
- IEC 61000-4-2 Level 4
 - $\pm 12\text{kV}$ (Contact discharge)
 - $\pm 15\text{kV}$ (Air-gap discharge)
- IO Capacitance 1.0pF (Typ)
- DC Breakdown Voltage 7V (Min)
- Ultra low Leakage Current 10nA (Max)
- Low ESD Clamping Voltage
- Industrial Temperature Range: -40°C to 125°C
- Small, Easy-to-Route DCK package

APPLICATIONS

- USB2.0
- HDMI control lines
- MIPI Bus
- LVDS
- SATA



DESCRIPTION

The TPD4E1B06 is a quad channel ultra low cap ESD protection device. It offers $\pm 12\text{KV}$ IEC air-gap and $\pm 15\text{KV}$ contact ESD protection. Its 1.0pF line capacitance makes it suitable for a wide range of applications. Typical application areas are HDMI, USB2.0, Ethernet, and 1394 interfaces.

ORDERING INFORMATION

T_A	PACKAGE ⁽¹⁾⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 125°C	3000	Tape and reel	TPD4E1B06DCKR	BYI

(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.



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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.

FUNCTIONAL BLOCK DIAGRAM

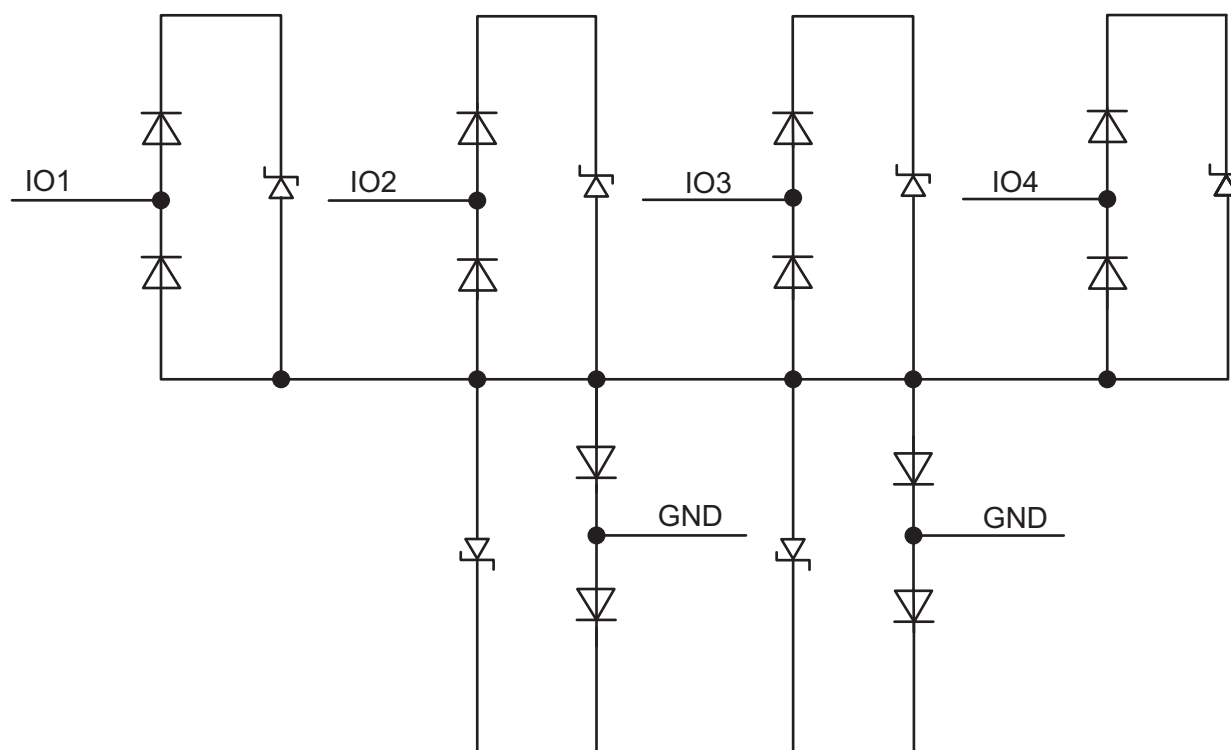


Figure 1. Circuit Schematic Diagram

TERMINAL FUNCTIONS

PIN			DESCRIPTION	USAGE
NAME	NUMBER	TYPE		
IO1	1	I/O	ESD protected channel	Connect to data line as close to the connector as possible
IO2	2	I/O		
IO3	4	I/O		
IO4	5	I/O		
NC	6	NC	No connect	Can be left floating, grounded, or connected to Vcc
GND	3	GND	Ground	Connect to ground

ABSOLUTE MAXIMUM RATINGS

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

	MIN	MAX	UNIT
Operating temperature range	–40	125	°C
Storage temperature	–65	155	°C
IEC 61000-4-2 contact ESD		±12	kV
IEC 61000-4-2 air-gap ESD		±15	kV
I _{PP} , peak pulse current (tp = 8/20 µs), IO pin to GND		3.5	A
P _{PP} , peak pulse power (tp = 8/20 µs)		45	W

ELECTRICAL CHARACTERISTICS

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

PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
V _{RWM}	Reverse stand-off voltage			5.5	V
V _{CLAMP}	Clamp voltage with ESD strike, IO to GND	I _{PP} = 1 A, tp = 8/20 µSec, from I/O to GND or GND to I/O	10.5		V
		I _{PP} = 3A, tp = 8/20 µSec, from I/O to GND or GND to I/O	14.5		V
R _{DYN}	Dynamic resistance	I _{TLP} = 10A to 20 A, I/O to GND	1		Ω
		I _{TLP} = 10A to 20 A, GND to I/O	0.8		
C _L	Line capacitance	f = 1 MHz, V _{BIAS} = 2.5 V	1		pF
V _{BR}	Break-down voltage	I _{IO} = 1 mA, from I/O to GND or GND to I/O	7	9.5	V
I _{LEAK}	Leakage current	V _{IO} = 5.0 V	1	10	nA

TYPICAL CHARACTERISTICS

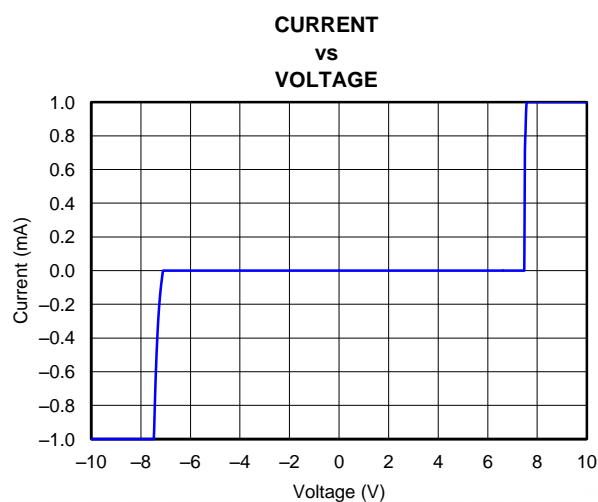


Figure 2. DC Voltage Sweep I-V Curve

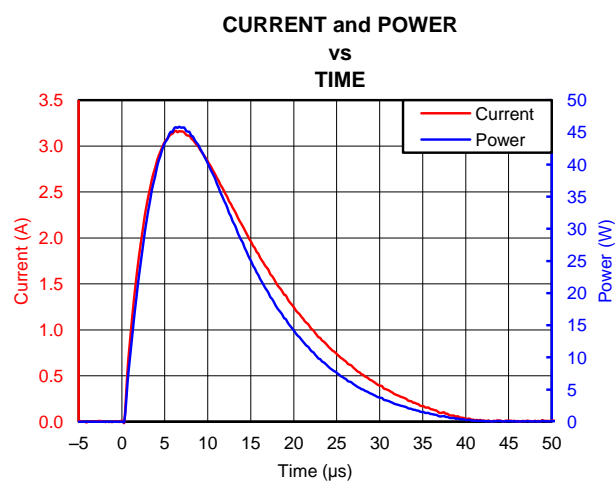
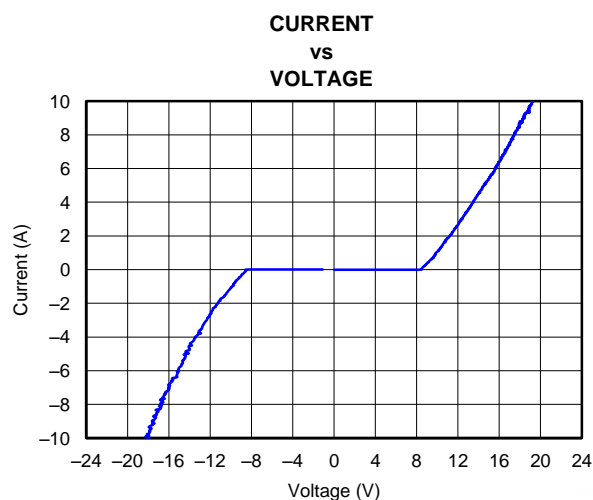
Figure 3. Surge Curve ($t_p = 8/20\mu s$), Pin IO to GND

Figure 4. TLP Plot IO to GND

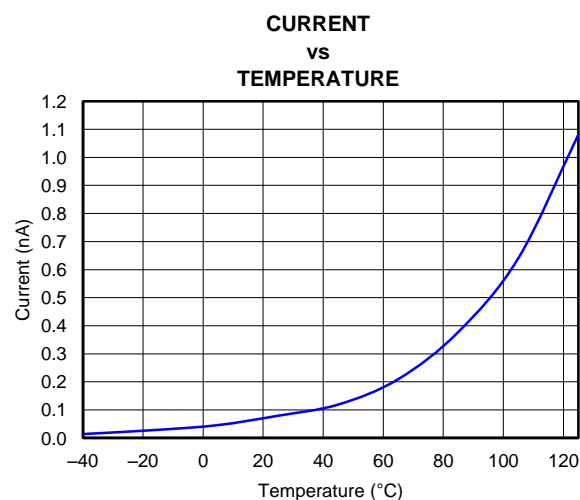


Figure 5. Leakage vs Temperature

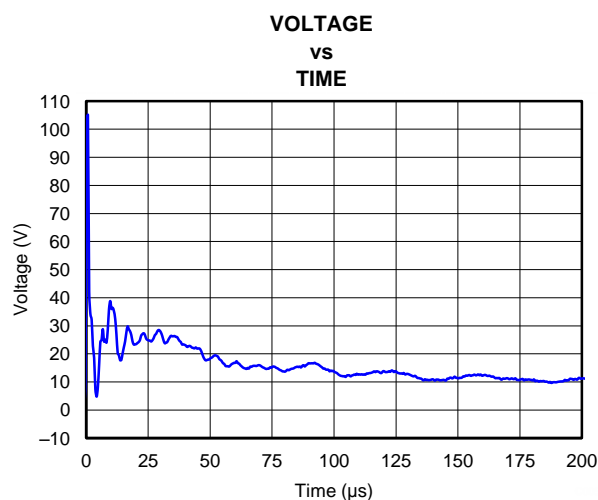


Figure 6. +8kV IEC Waveform

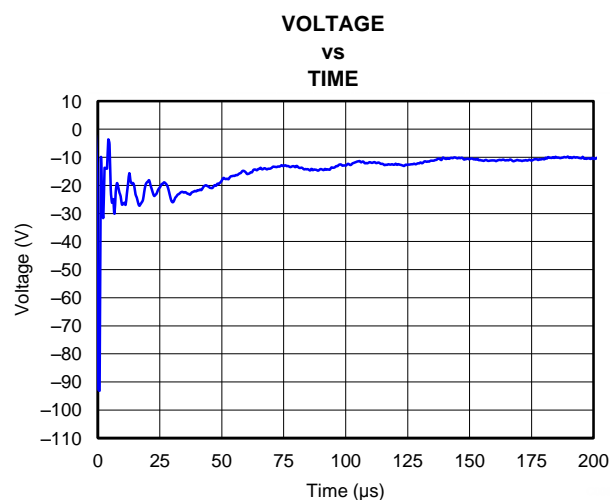


Figure 7. -8kV IEC Waveform

APPLICATION INFORMATION

The TPD4E1B06DCK offers a unique pinout that allows straight through routing with no stubs. [Figure 8](#) shows an example layout. Pins 1 & 2 and pins 4 & 5 are routed differentially. Pin 3 is routed to the ground plane. Pin 6 is not bonded internally in the device and does not need to be routed anywhere on the board. It is also okay if pin 6 is connected to power plane or a capacitor.

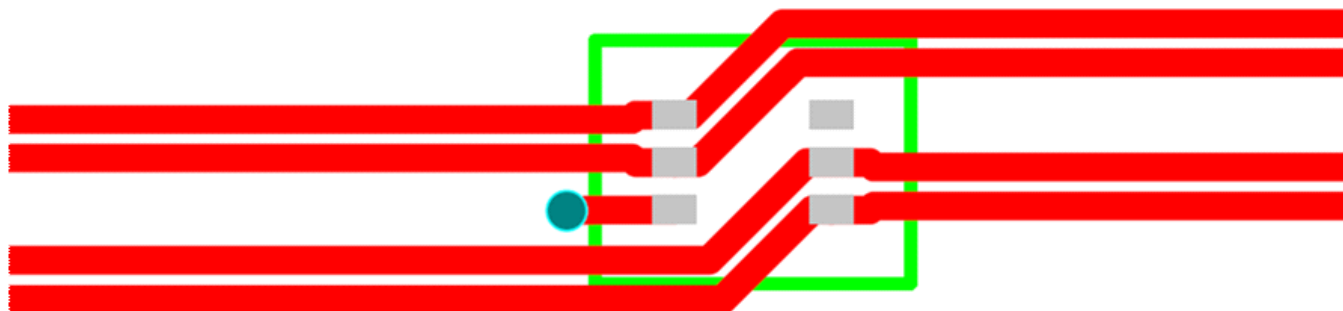


Figure 8. TPD4E1B06 Layout Example

REVISION HISTORY

Changes from Original (December 2012) to Revision A	Page
<ul style="list-style-type: none"> Fixed "f" units typo from GHz to MHz for C_L parameter in ELECTRICAL CHARACTERISTICS table. 	3

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
TPD4E1B06DCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	BY1	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.

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TAPE AND REEL INFORMATION


*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
TPD4E1B06DCKR	SC70	DCK	6	3000	178.0	9.0	2.4	2.5	1.2	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS

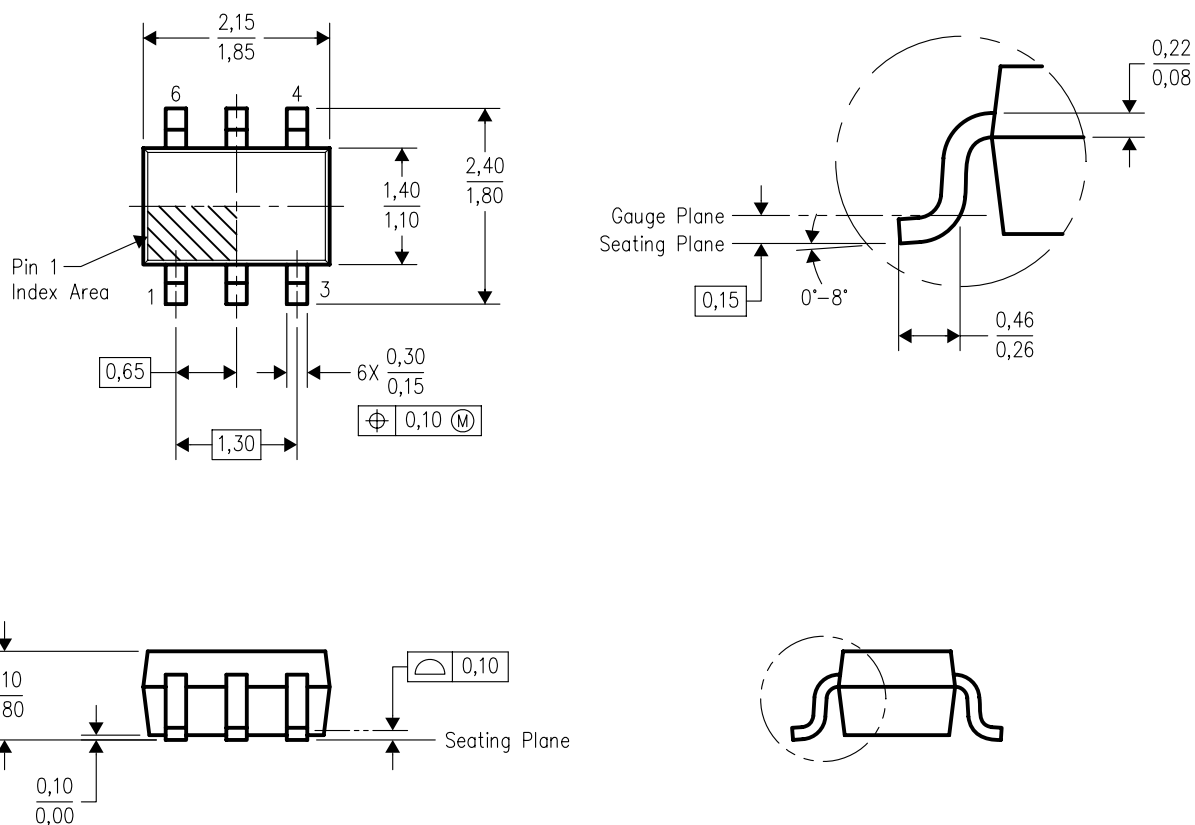


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPD4E1B06DCKR	SC70	DCK	6	3000	180.0	180.0	18.0

DCK (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



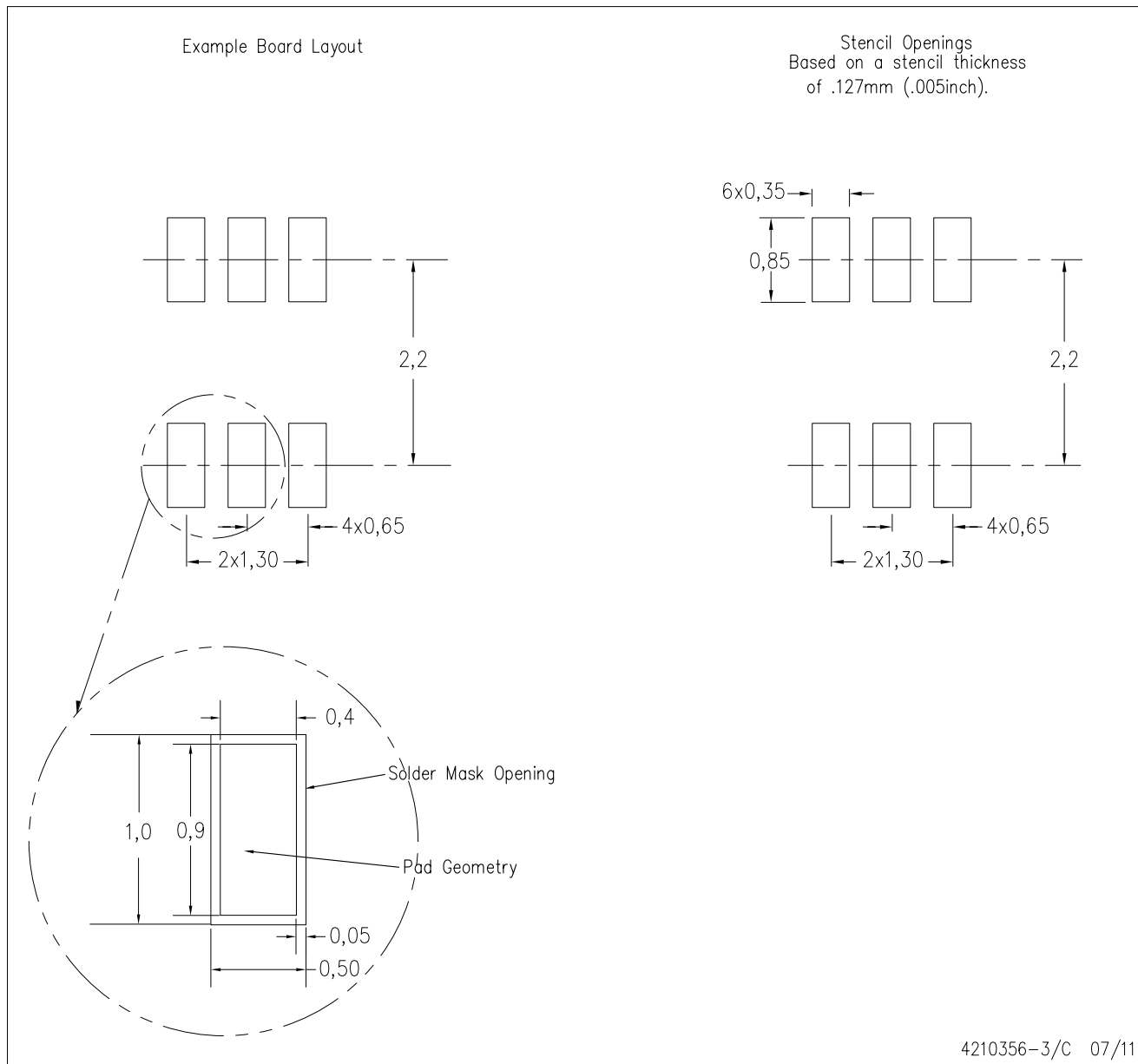
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NOTES:

- A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO-203 variation AB.

DCK (R-PDSO-G6)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - D. Publication IPC-7351 is recommended for alternate designs.
 - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

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