ESD122 USB Type-CおよびHDMI 2.0用の2チャネルESD保護ダイオード

1 特長

- IEC 61000-4-2 レベル4 ESD保護
  - 接触放電 ±17kV
  - 空気ギャップ放電 ±17kV
- IEC 61000-4-2 Level 4 (接触放電)に準拠し、10,000回以上のESD衝撃に対して性能低下なしに耐えられる
- IEC 61000-4-4 EFT保護
  - 80A (5/50ns)
- IEC 61000-4-5 サージ保護
  - 2.5A (8/20µs)
- 低いIO容量
  - IO間で0.1pF (標準値)
  - IO-GND間で0.2pF (標準値)
- DCブレークダウン電圧: 5.1V (最小値)
- 非常に低いリーク電流: 10nA (最大値)
- 低いESDクランピング電圧: 5A TLPにおいて8.4V
- 10Gbpsを超える高速インターフェイスをサポート
- 工業用温度範囲: -40℃～+125℃
- Type-Cに使いやすい2チャネルのフロースルー配線パッケージ
- 対称型の差動高速信号ルーティングに適したピン配置
- 2つの異なるパッケージ・オプション
  - 0402パッケージ、0.6mm×1mm、0.34mmピッチ
  - 0502パッケージ、0.6mm×1.32mm、0.5mmピッチ

2 アプリケーション

- 最終製品
  - モバイルおよびタブレット
  - ラップトップおよびデスクトップPC
  - セットトップ・ボックス
  - TVおよびモニタ
  - サーバー
- インターフェイス
  - USB Type-C
  - HDMI 2.0/1.4
  - USB 3.1 Gen 2/Gen1、USB 3.0、USB 2.0
  - Thunderbolt-1およびThunderbolt-2
  - DisplayPort 1.3
  - PCI Express 3.0
  - SATA

3 概要

ESD122は、USB Type-CおよびHDMI 2.0の回路保護用の双方向TVS ESD保護ダイオード・アレイです。ESD122は、IEC 61000-4-2国際規格に規定されている最大レベルの接触ESD衝撃(接触17kV、エアギャップ17kV)を放散できるよう定格が規定されています。

このデバイスはチャネルごとのIO容量が低く、対称型の差動高速信号ルーティングに適したピン配置であるため、USB 3.1 Gen2やHDMI 2.0など、10Gbpsまでの高速インターフェイスの保護に理想的です。動的抵抗とクランピング電圧が低いため、過渡事象に対してシステム・レベルの保護が保証されます。

さらに、ESD122はUSB Type-CのTx/Rxライン用の理想的なESDソリューションです。USB Type-Cコネクタには2つのレイヤがあるため、4チャネルのESDデバイスを使用するとビアが必要になり、シグナル・インテグリティ(信号品質)が低下します。4つのESD122 (2チャネル)デバイスを使用することで、ビアの数を最小限にし、基板のレイアウトを簡素化できます。

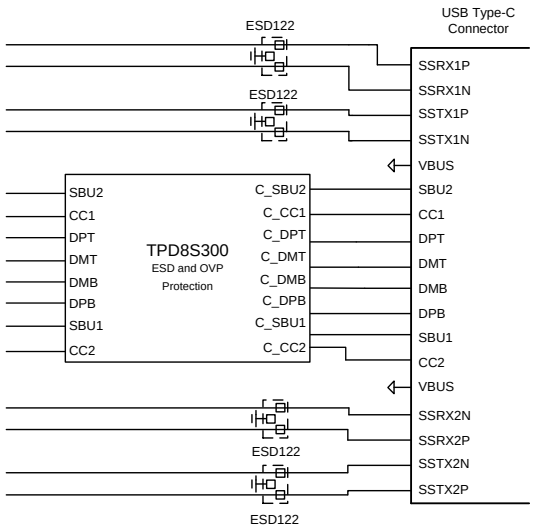
ESD122は、配線が簡単な2種類のフロースルー・パッケージで供給されます。

製品情報(1)

型番	パッケージ		本体サイズ(公称)
ESD122	X2SON (3)	(DMX)	0.60mm×1.00mm
		(DMY)	0.60mm×1.32mm

(1) 利用可能なすべてのパッケージについては、このデータシートの末尾にある注文情報を参照してください。

USB Type-Cアプリケーションの例



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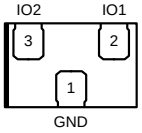
4 改訂履歴

2017年6月発行のものから更新 **Page**

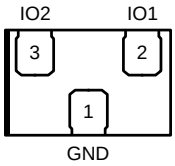
- Changed V_{BRF} From: MIN = 5.1, MAX = 7 To: MIN = 5 and MAX = 7.9 ... 5
- Changed V_{BRR} From: MIN = –7, MAX = –5.1 To: MIN = –7.9 and MAX = –5 ... 5

5 Pin Configuration and Functions

DMX Package
3-Pin X2SON
Top View



DMY Package
3-Pin X2SON
Top View



Pin Functions

PIN			I/O	DESCRIPTION
NAME	DMX NO.	DMY NO.		
GND	1	1	—	Ground
IO1	2	2	I	ESD protected channel
IO2	3	3	I	ESD protected channel

6 Specifications

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) at 25°C		80	A
Peak pulse	IEC 61000-4-5 Power (t_p - 8/20 µs) at 25°C		20	W
	IEC 61000-4-5 Current (t_p - 8/20 µs) at 25°C		2.5	A
T_A	Operating free-air temperature	–40	125	°C
T_{stg}	DMD 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—JEDEC Specification

			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	±17000	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)		ESD122		UNIT
		DMX (X2SON)	DMY (X2SON)	
		3 PINS	3 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	617.8	717.4	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	286.2	300.2	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	455.1	526	°C/W
ψ_{JT}	Junction-to-top characterization parameter	99.3	113.9	°C/W
ψ_{JB}	Junction-to-board characterization parameter	453.4	523.8	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	N/A	°C/W

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

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 nA	–3.6		3.6	V
V_{BRF}	Breakdown voltage, any IO pin to GND(1)	I_{IO} = 1 mA, T_A = 25°C	5		7.9	V
V_{BRR}	Breakdown voltage, GND to any IO pin(1)	I_{IO} = 1 mA, T_A = 25°C	–7.9		–5	V
V_{HOLD}	Holding voltage(2)	I_{IO} = 1 mA		5.9		V
V_{CLAMP}	Clamping voltage	I_{PP} = 1 A, TLP, from IO to GND, T_A = 25°C		6.4		V
		I_{PP} = 5 A, TLP, from IO to GND, T_A = 25°C		8.4		
		I_{PP} = 1 A, TLP, from GND to IO, T_A = 25°C		6.4		
		I_{PP} = 5 A, TLP, from GND to IO, T_A = 25°C		8.4		
I_{LEAK}	Leakage current, any IO to GND	V_{IO} = ±2.5 V			10	nA
R_{DYN}	Dynamic resistance	IO to GND, Measured between TLP I_{PP} of 10 A and 20 A, T_A = 25°C		0.5		Ω
		GND to IO, Measured between TLP I_{PP} of 10 A and 20 A, T_A = 25°C		0.5		
C_L	Line capacitance	V_{IO} = 0 V, f = 1 MHz, IO to GND, T_A = 25°C		0.2	0.27	pF
ΔC_L	Variation of line capacitance	Difference between the capacitance of the two IO pins measured with respect to ground, V_{IO} = 0 V, f = 1 MHz, T_A = 25°C, GND = 0 V			0.01	pF
C_{CROSS}	Channel to channel capacitance	Capacitance from one IO to another IO, V_{IO} = 0 V, f = 1 MHz, T_A = 25°C, GND = 0 V		0.1	0.14	pF

(1) V_{BRF} and V_{BRR} are defined as the voltage obtained at 1 mA when sweeping the voltage up, before the device latches into the snapback state.
(2) V_{HOLD} is defined as the voltage when 1 mA is applied, after the device has successfully latched into the snapback state.

6.7 Typical Characteristics

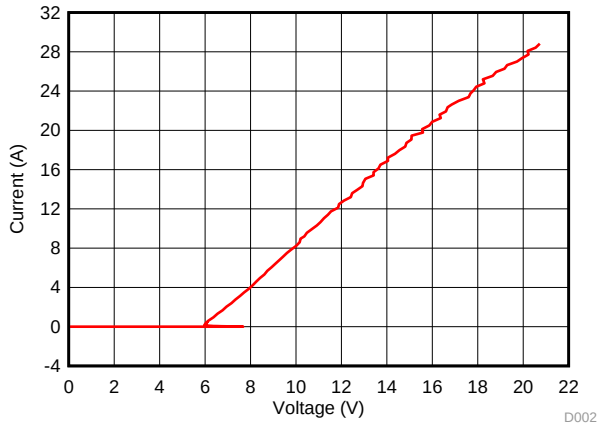


Figure 1. Positive TLP Curve, IO Pin to GND

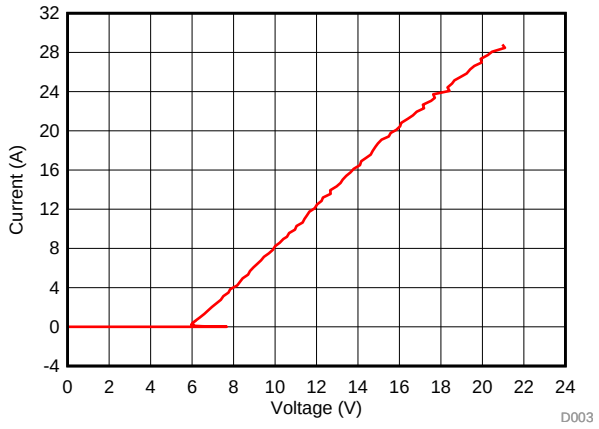


Figure 2. Negative TLP Curve, IO Pin to GND (Plotted as Positive TLP Curve GND to IO)

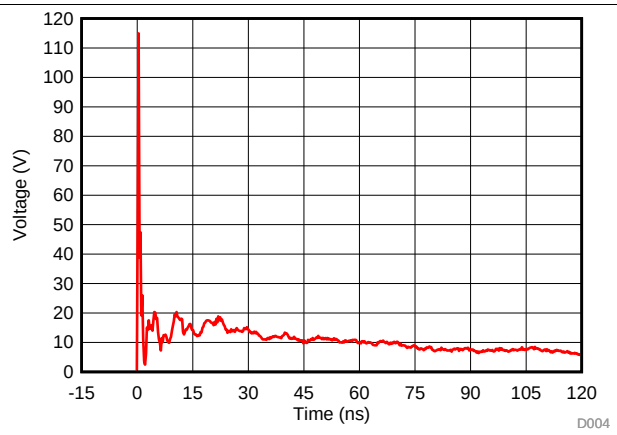


Figure 3. 8-kV IEC 61000-4-2 Waveform, IO Pin to GND

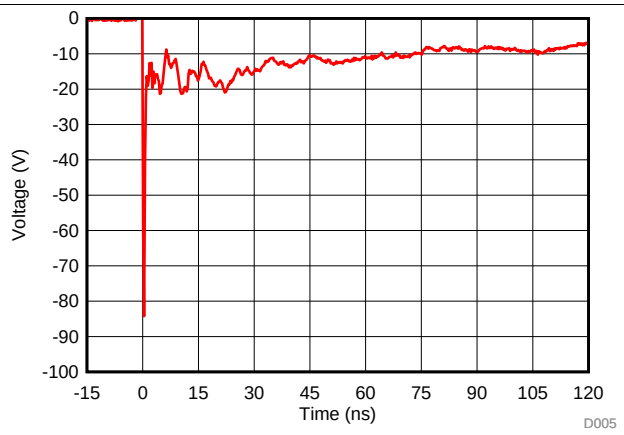


Figure 4. –8-kV IEC 61000-4-2 Waveform, IO Pin to GND

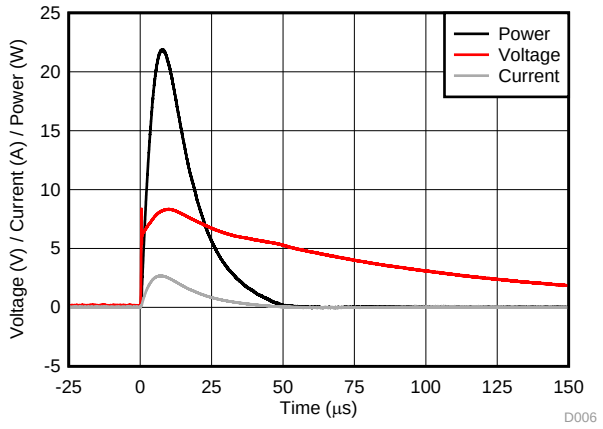


Figure 5. IEC 61000-4-5 Surge Curve (tp = 8/20µs), IO Pin to GND

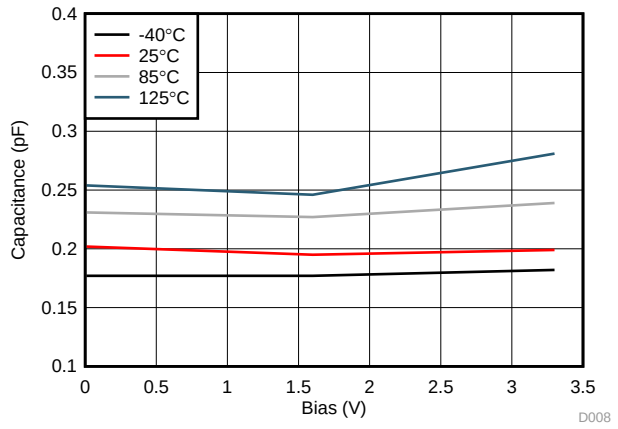


Figure 6. Capacitance vs Bias Voltage at Multiple Temperatures, IO Pin to GND

Typical Characteristics (continued)

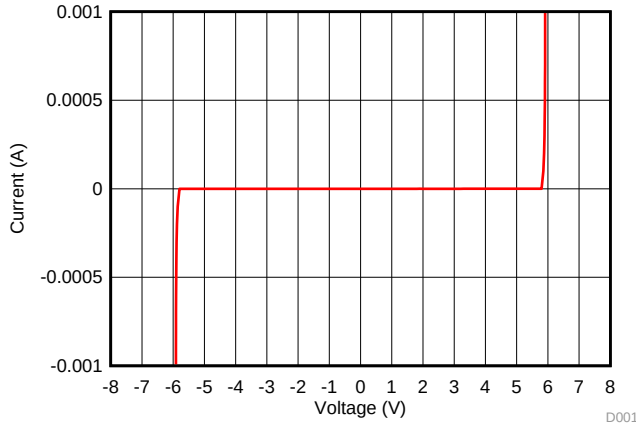


Figure 7. DC Voltage Sweep I-V Curve, IO Pin to GND

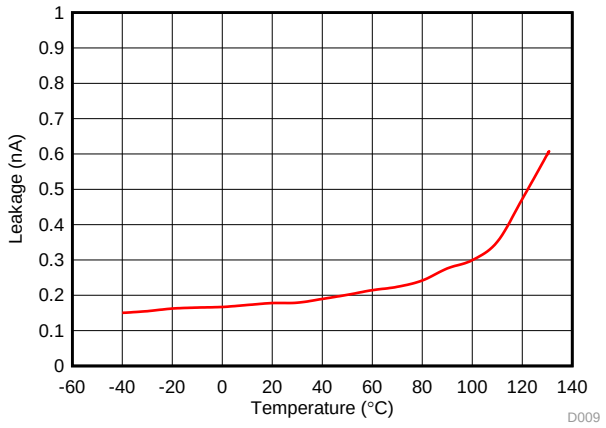


Figure 8. Leakage Current vs Temperature, IO Pin to GND, at 2.5 V Bias

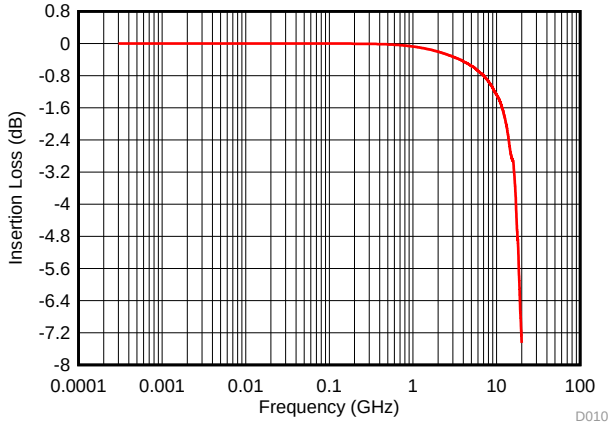


Figure 9. Insertion Loss

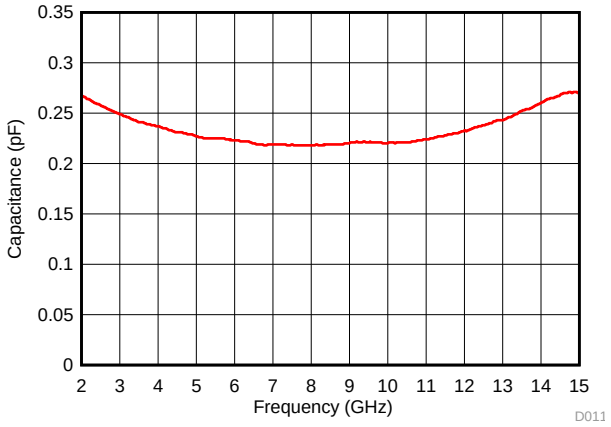


Figure 10. Capacitance vs Frequency

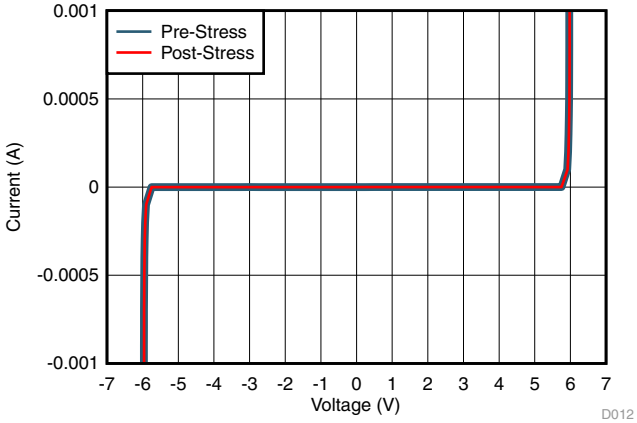


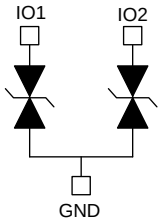
Figure 11. DC Voltage Sweep I-V Curve, IO Pin to GND, Pre and Post 10,000 Repetitive ESD Strikes per IEC 61000-4-2 Level 4 (Contact)

7 Detailed Description

7.1 Overview

The ESD122 is a bidirectional ESD Protection Diode with ultra-low capacitance. This device can dissipate ESD strikes above the maximum level specified by the IEC 61000-4-2 International Standard. The ultra-low capacitance makes this device ideal for protecting any super high-speed signal pins. Additionally, the ESD122 has two identical protection channels with a symmetrical pin-out that is suited for the differential high-speed signal lines.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 IEC 61000-4-2 ESD Protection

The I/O pins can withstand ESD events up to ±17-kV contact and air gap. An ESD-surge clamp diverts the current to ground.

7.3.2 IEC 61000-4-4 EFT Protection

The I/O pins can withstand an electrical fast transient burst of up to 80 A (5/50-ns waveform, 4 kV with 50-Ω impedance). An ESD-surge clamp diverts the current to ground.

7.3.3 IEC 61000-4-5 Surge Protection

The I/O pins can withstand surge events up to 2.5 A and 20 W (8/20-µs waveform). An ESD-surge clamp diverts this current to ground.

7.3.4 IO Capacitance

The capacitance between each I/O pin to ground is very small and supports data rates up to 10 Gbps.

7.3.5 DC Breakdown Voltage

The DC breakdown voltage of each I/O pin is a minimum of ±5.1 V. This ensures that sensitive equipment is protected from surges above the reverse standoff voltage of ±3.6 V.

7.3.6 Ultra Low Leakage Current

The I/O pins feature an ultra-low leakage current of 10 nA (maximum) with a bias of ±2.5 V.

7.3.7 Low ESD Clamping Voltage

The I/O pins feature an ESD clamp that is capable of clamping the voltage to 8.4 V (I_{PP-TLP} = 5 A).

7.3.8 Supports High Speed Interfaces

This device is capable of supporting high speed interfaces up to 10 Gbps such as USB 3.1 Gen2 and Gen1, USB 3.0, USB 2.0, Thunderbolt-1, Thunderbolt-2, PCI express 3.0, Display Port 1.3, HDMI 2.0, and HDMI 1.4, because of the extremely low IO capacitance.

7.3.9 Industrial Temperature Range

This device features an industrial operating range of –40°C to +125°C.

Feature Description (continued)

7.3.10 Easy Flow-Through Routing Package

The layout of this device makes it simple and easy to add protection to an existing layout. 2-channel setup provides easy, flexible routing and good matching between the channels.

7.4 Device Functional Modes

The ESD122 is a passive circuit that triggers when voltages are above V_{BRF} or below V_{BRR}. During ESD events, voltages as high as ±17 kV (contact) can be directed to ground via the internal diode network. When the voltages on the protected line fall below the trigger levels of ESD122 (usually within 10s of nano-seconds) the device reverts to passive.

Figure 12 shows typical TLP behavior of bi-directional ESD device.

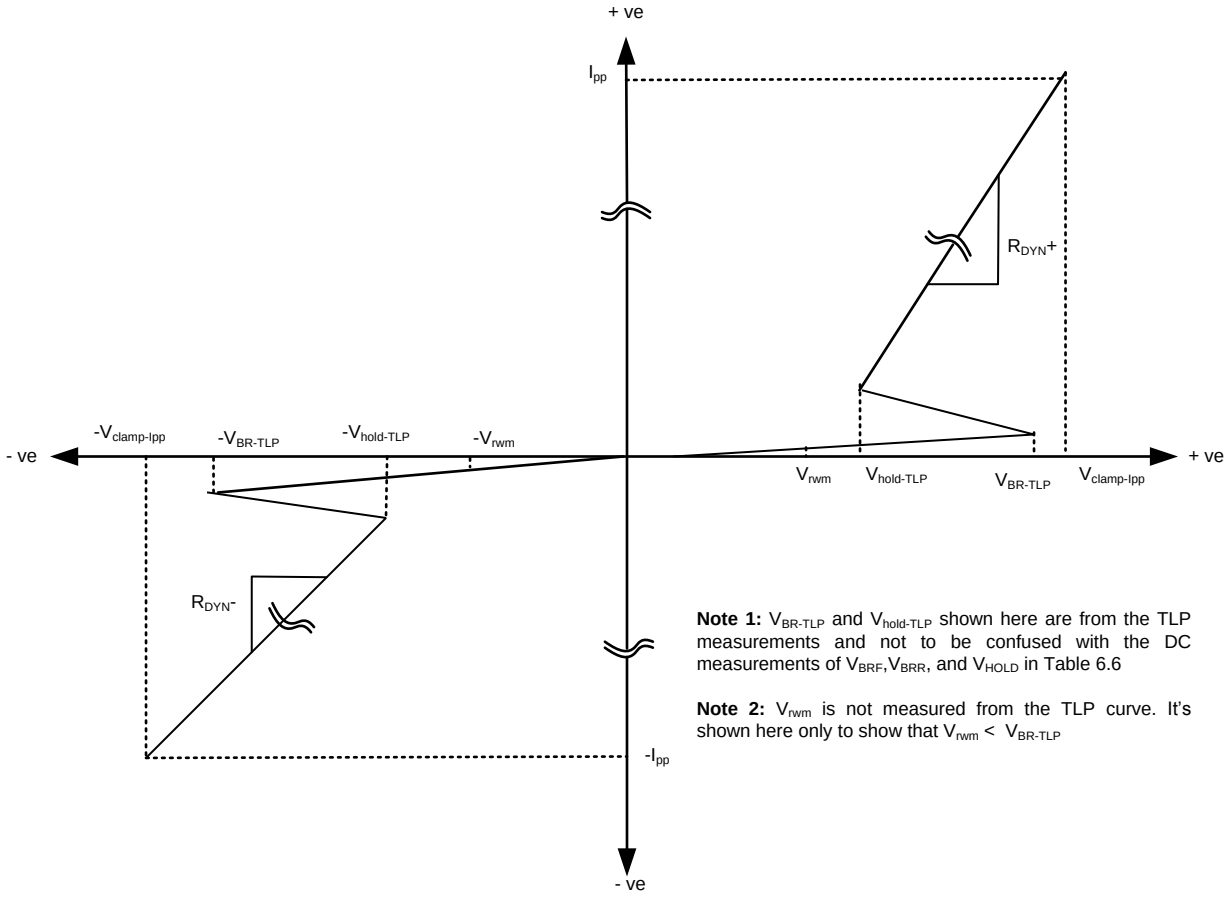


Figure 12. Generic TLP I-V Curve for a Bi-Directional ESD Device for the Illustration of V_{rwm}, V_{BR}, V_{hold} and V_{clamp}

8 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

8.1 Application Information

The ESD122 is a diode type TVS which is used to provide a path to ground for dissipating ESD events on high-speed signal lines between a human interface connector and a system. As the current from ESD passes through the TVS, only a small voltage drop is present across the diode. This is the voltage presented to the protected IC. The low R_{DYN} of the triggered TVS holds this voltage, V_{CLAMP}, to a safe level for the protected IC.

8.2 Typical Applications

8.2.1 USB 3.1 Gen 2 Application

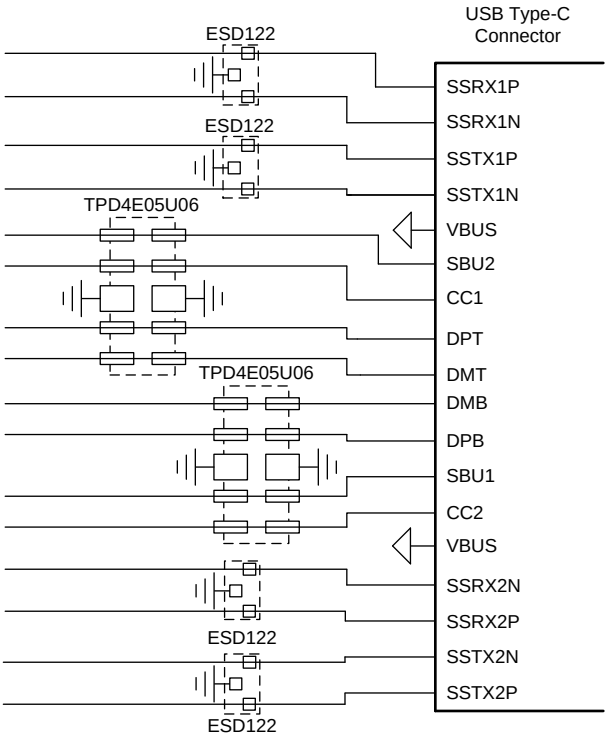


Figure 13. Typical Application

8.2.1.1 Design Requirements

For this design example, four ESD122 devices and two TPD4E05U06 devices are being used in a USB 3.1 Gen 2 Type-C application. This provides a complete ESD protection scheme.

Given the application, the parameters listed in Table 1 are known.

Typical Applications (continued)

Table 1. Design Parameters

DESIGN PARAMETER	VALUE
Signal range on Type C SuperSpeed+ lines	0 V to 3.6 V
Operating frequency on Type C USB 3.1 Gen 2 SuperSpeed+ lines	5 GHz
Signal range on CC, SBU, and DP/DM lines	0 V to 5 V
Operating frequency on CC, SBU, and DP/DM lines	up to 480 MHz

8.2.1.2 Detailed Design Procedure

8.2.1.2.1 Signal Range

The ESD122 supports signal ranges between –3.6 V and 3.6 V, which supports the SuperSpeed+ pairs on the USB Type-C application. The TPD4E05U06 supports signal ranges between 0 V and 5.5 V, which supports the CC, SBU, and DP/DM lines.

8.2.1.2.2 Operating Frequency

The ESD122 has a 0.27 pF (maximum) capacitance, which supports the USB 3.1 Gen 2 Type-C rate of 10 Gbps with sufficient capacitance margin. The TPD4E05U06 has a 0.5 pF (typical) capacitance, which easily supports the CC, SBU, and DP/DM data rates. The ESD122 has 2 identical protection channels for the differential HDMI high-speed signal lines. The symmetrical pin out of the device with a ground pin between the two differential signal pins makes it suitable for this application.

8.2.1.3 Application Curves

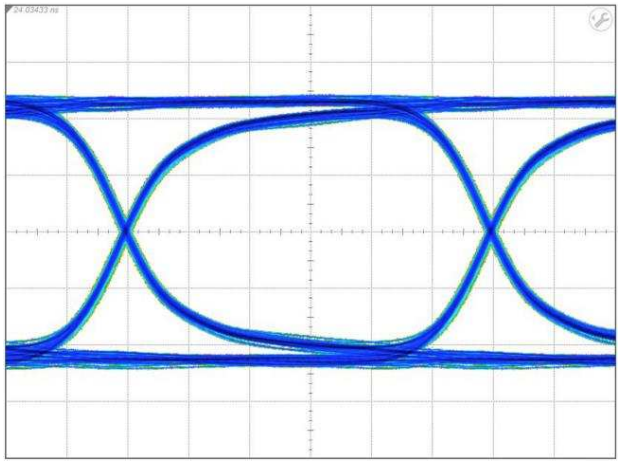


Figure 14. USB3.1 Gen2 10-Gbps Eye Diagram Without ESD122

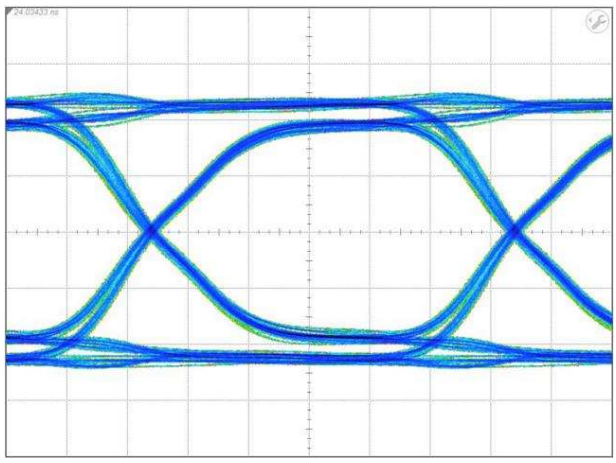


Figure 15. : USB3.1 Gen2 10-Gbps Eye Diagram With ESD122

8.2.2 HDMI 2.0 Application

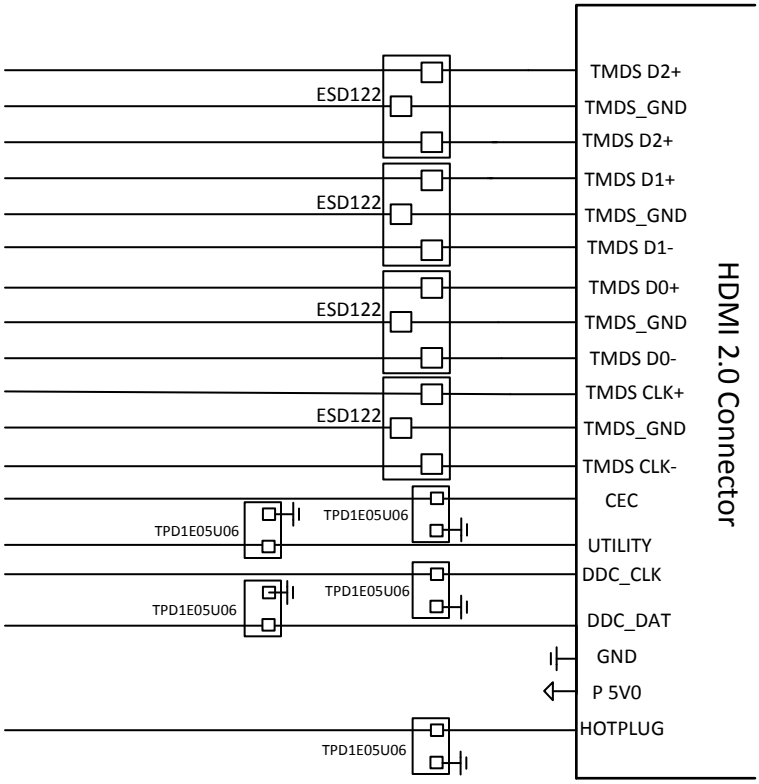


Figure 16. HDMI 2.0 Schematic

8.2.2.1 Design Requirements

For this design example, the four ESD122 devices for the HDMI 2.0 high-speed lines, and four TPD1E05U06 devices on the control lines HDMI 2.0 control lines. This provides a complete port protection scheme.

Given the HDMI 2.0 application, the parameters listed in Table 2 are known.

Table 2. Design Parameters

DESIGN PARAMETER	VALUE
Signal voltage range on the high-speed pins	0 V to 3.3 V
Signal voltage range on the control pins	0 V to 5 V
Max operating frequency of high-speed lines	3 GHz

8.2.2.2 Detailed Design Procedure

8.2.2.2.1 Signal Range

The ESD122 supports signal ranges between –3.6 V and 3.6 V, which supports the high-speed lines on the HDMI 2.0 application. The TPD1E05U06 supports signal ranges between 0 V and 5.5 V, which supports the HDMI control lines.

8.2.2.2.2 Operating Frequency

The ESD122 has a 0.27 pF (maximum) capacitance, which supports the HDMI 2.0 rate of 6 Gbps with sufficient capacitance margin. The TPD1E05U06 has a 0.42 pF (typical) capacitance, which easily supports the control lines. The ESD122 has 2 identical protection channels for the differential HDMI high-speed signal lines. The symmetrical pin out of the device with a ground pin between the two differential signal pins makes it suitable for this application.

8.2.2.3 Application Curves

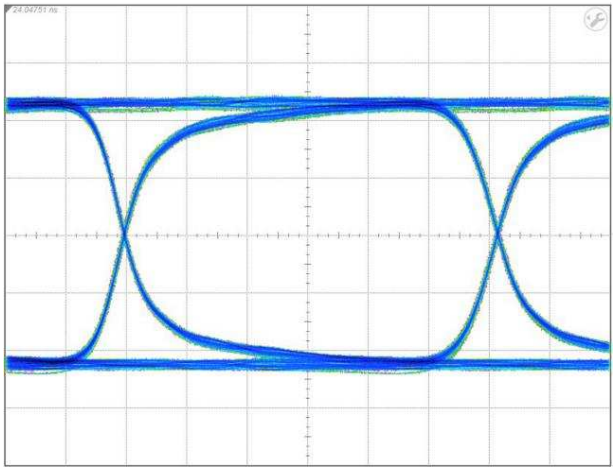


Figure 17. HDMI 2.0 6-Gbps Eye Diagram Without ESD122

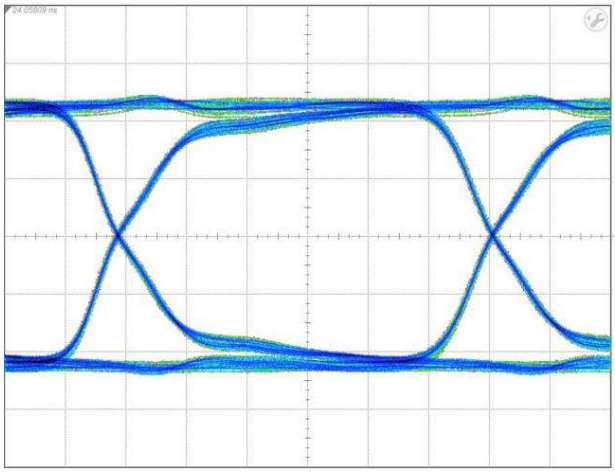


Figure 18. HDMI 2.0 6-Gbps Eye Diagram With ESD122

9 Power Supply Recommendations

This device is a passive ESD device so there is no need to power it. Take care not to violate the recommended I/O specification (–3.6 V to 3.6 V) to ensure the device functions properly.

10 Layout

10.1 Layout Guidelines

- The optimum placement is as close to the connector as possible.
  - EMI during an ESD event can couple from the trace being struck to other nearby unprotected traces, resulting in early system failures.
  - The PCB designer must minimize the possibility of EMI coupling by keeping any unprotected traces away from the protected traces which are between the TVS and the connector.
- Route the protected traces as straight as possible. Use as few vias as possible for 10-Gbps application.
- Eliminate any sharp corners on the protected traces between the TVS and the connector by using rounded corners with the largest radii possible.
  - Electric fields tend to build up on corners, increasing EMI coupling.

10.2 Layout Examples

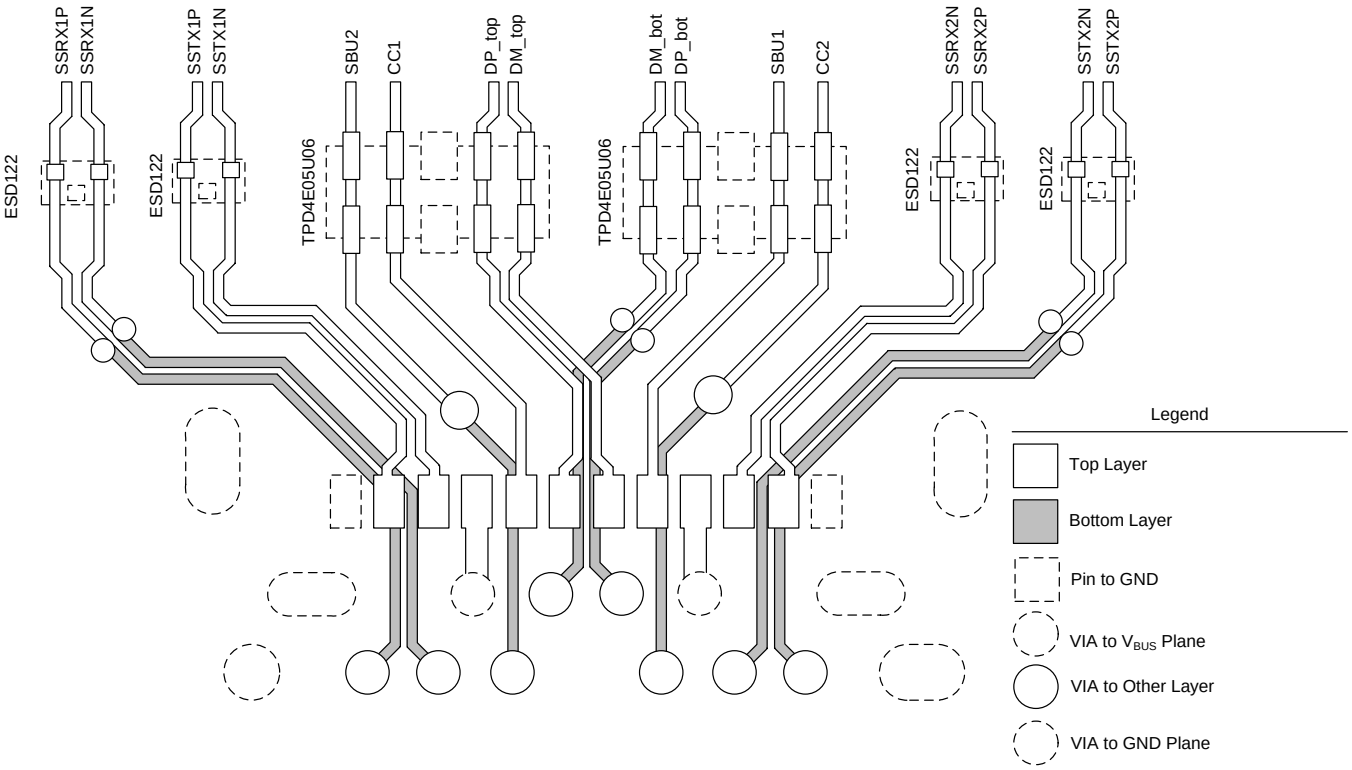


Figure 19. USB 3.1 Gen 2 SuperSpeed Lines Protected by ESD122

Layout Examples (continued)

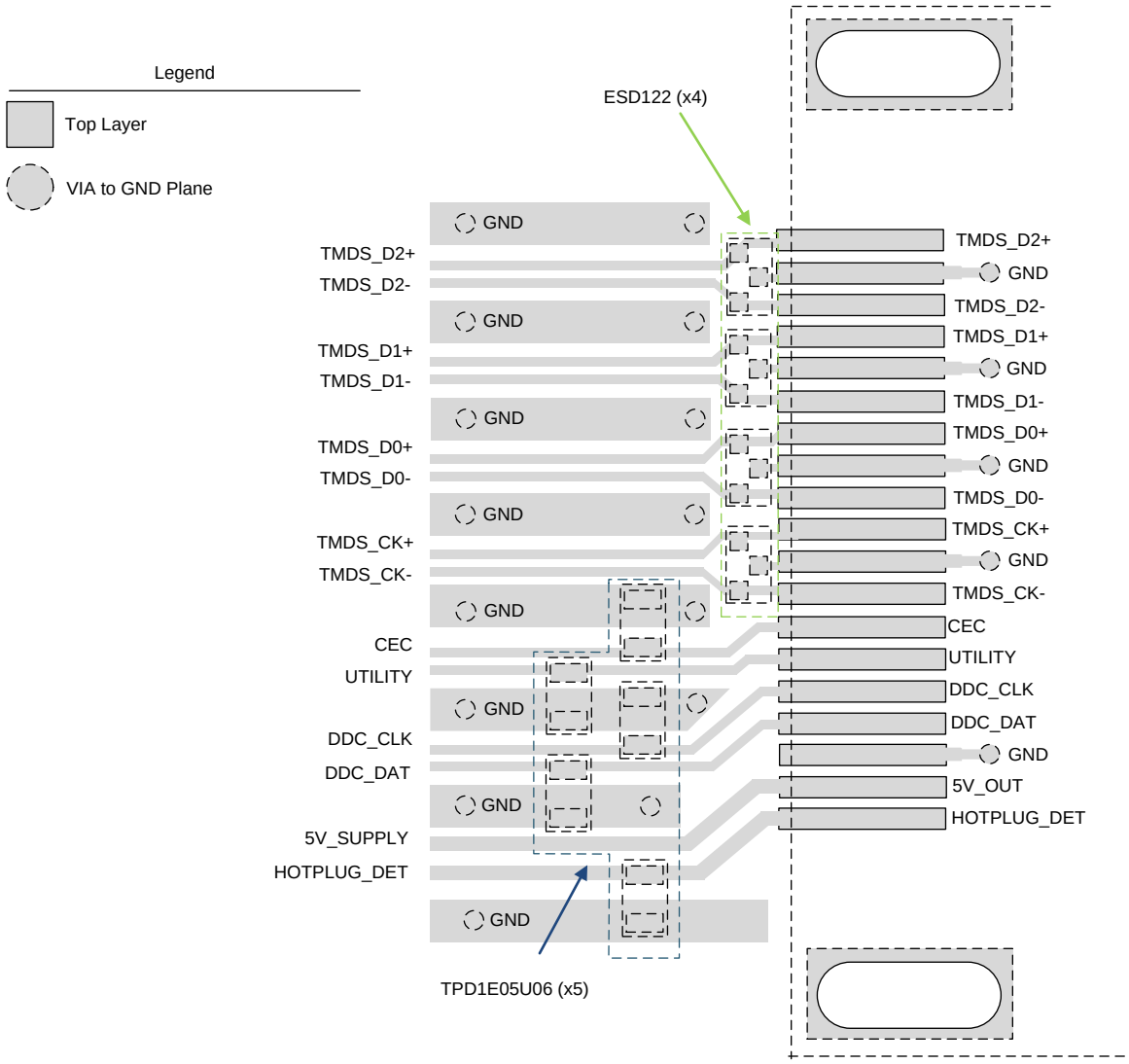


Figure 20. HDMI2_Layout

11 デバイスおよびドキュメントのサポート

11.1 ドキュメントのサポート

11.1.1 関連資料

関連資料については、以下を参照してください。

『ESD122評価モジュール』

11.2 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、ti.comのデバイス製品フォルダを開いてください。右上の隅にある「*通知を受け取る*」をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取れます。変更の詳細については、修正されたドキュメントに含まれている改訂履歴をご覧ください。

11.3 コミュニティ・リソース

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

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設計サポート ***TIの設計サポート*** **役に立つE2Eフォーラムや、設計サポート・ツールをすばやく見つけることができます。技術サポート用の連絡先情報も参照できます。**

11.4 商標

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SATA is a trademark of others.
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11.5 静電気放電に関する注意事項

すべての集積回路は、適切なESD保護方法を用いて、取扱いと保存を行うようにして下さい。

静電気放電はわずかな性能の低下から完全なデバイスの故障に至るまで、様々な損傷を与えます。高精度の集積回路は、損傷に対して敏感であり、極めてわずかなパラメータの変化により、デバイスに規定された仕様に適合しなくなる場合があります。

11.6 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

12 メカニカル、パッケージ、および注文情報

以降のページには、メカニカル、パッケージ、および注文に関する情報が記載されています。この情報は、そのデバイスについて利用可能な最新のデータです。このデータは予告なく変更されることがあり、ドキュメントが改訂される場合もあります。本データシートのブラウザ版を使用されている場合は、画面左側の説明をご覧ください。

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
ESD122DMXR	ACTIVE	X2SON	DMX	3	10000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	6U	Samples
ESD122DMYR	ACTIVE	X2SON	DMY	3	10000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	6V	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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

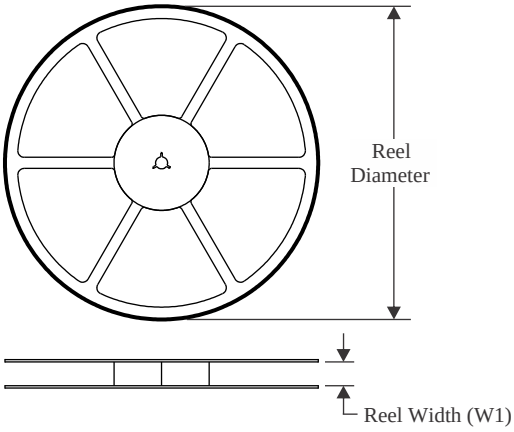
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

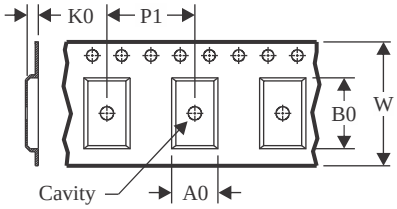
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

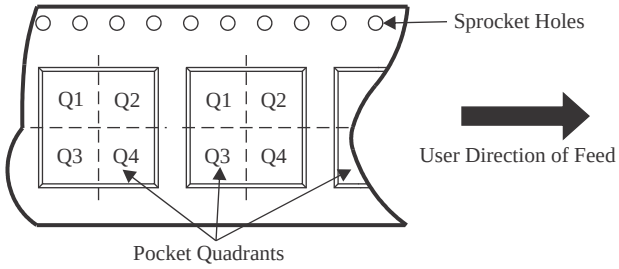


TAPE DIMENSIONS



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

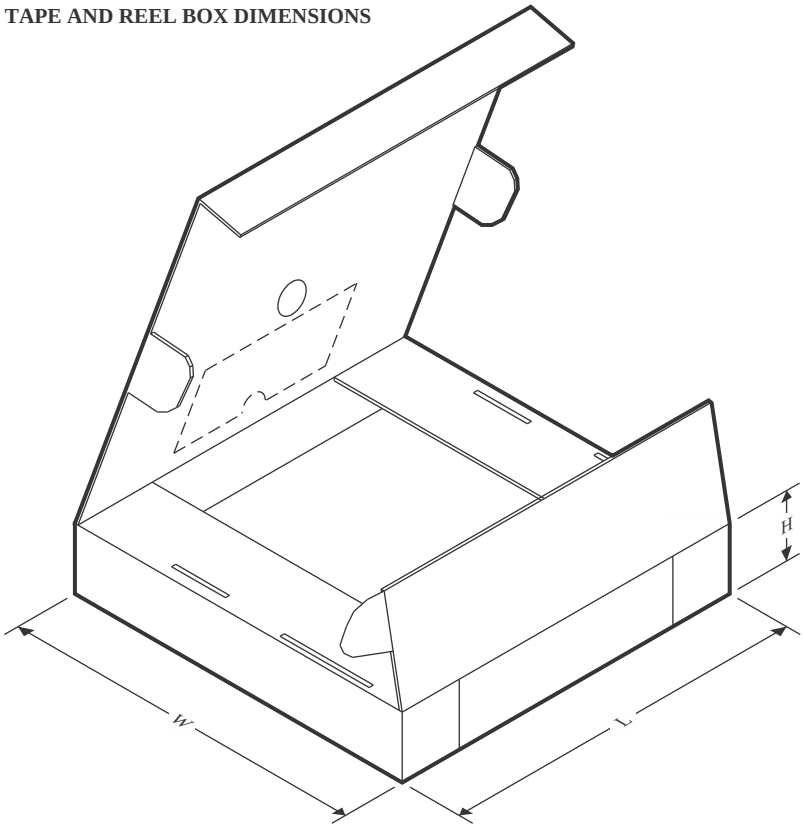
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
ESD122DMXR	X2SON	DMX	3	10000	180.0	9.5	0.72	1.12	0.43	2.0	8.0	Q1
ESD122DMYR	X2SON	DMY	3	10000	180.0	9.5	0.72	1.42	0.43	2.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

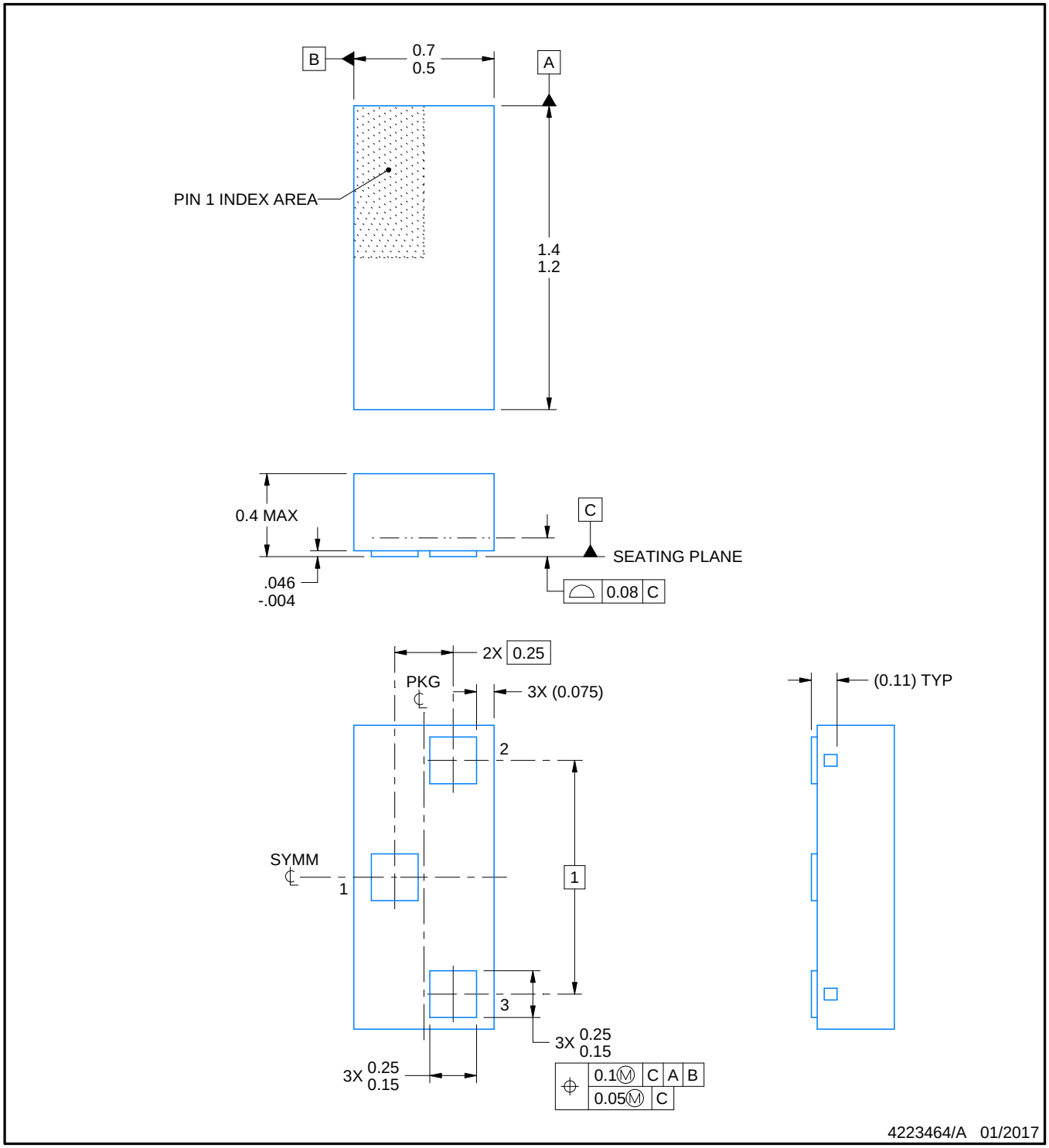
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
ESD122DMXR	X2SON	DMX	3	10000	189.0	185.0	36.0
ESD122DMYR	X2SON	DMY	3	10000	189.0	185.0	36.0

PACKAGE OUTLINE

DMY0003A

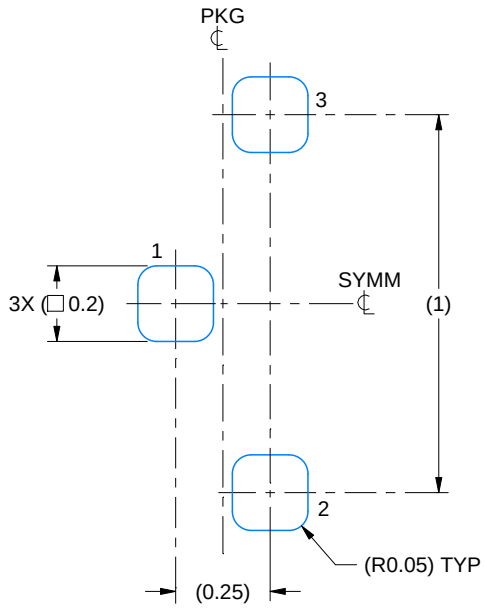
X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD

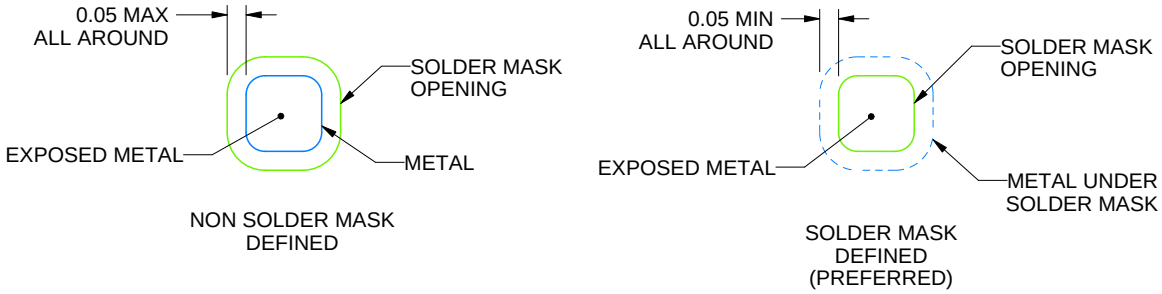


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 50X

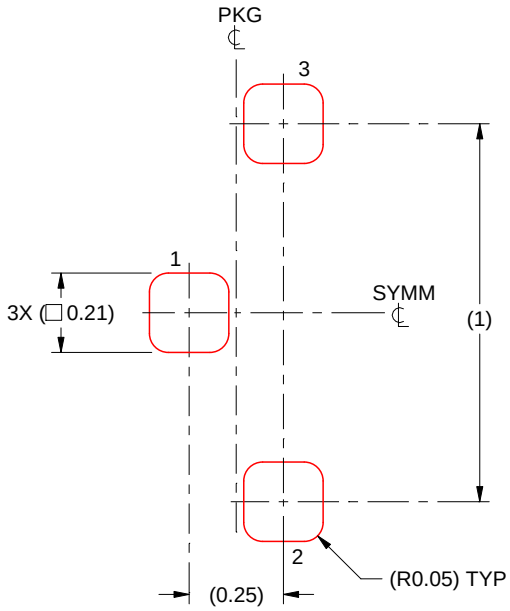


SOLDER MASK DETAILS

4223464/A 01/2017

NOTES: (continued)

3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271)



SOLDER PASTE EXAMPLE
BASED ON 0.075 - 0.1 mm THICK STENCIL
SCALE: 50X

4223464/A 01/2017

NOTES: (continued)

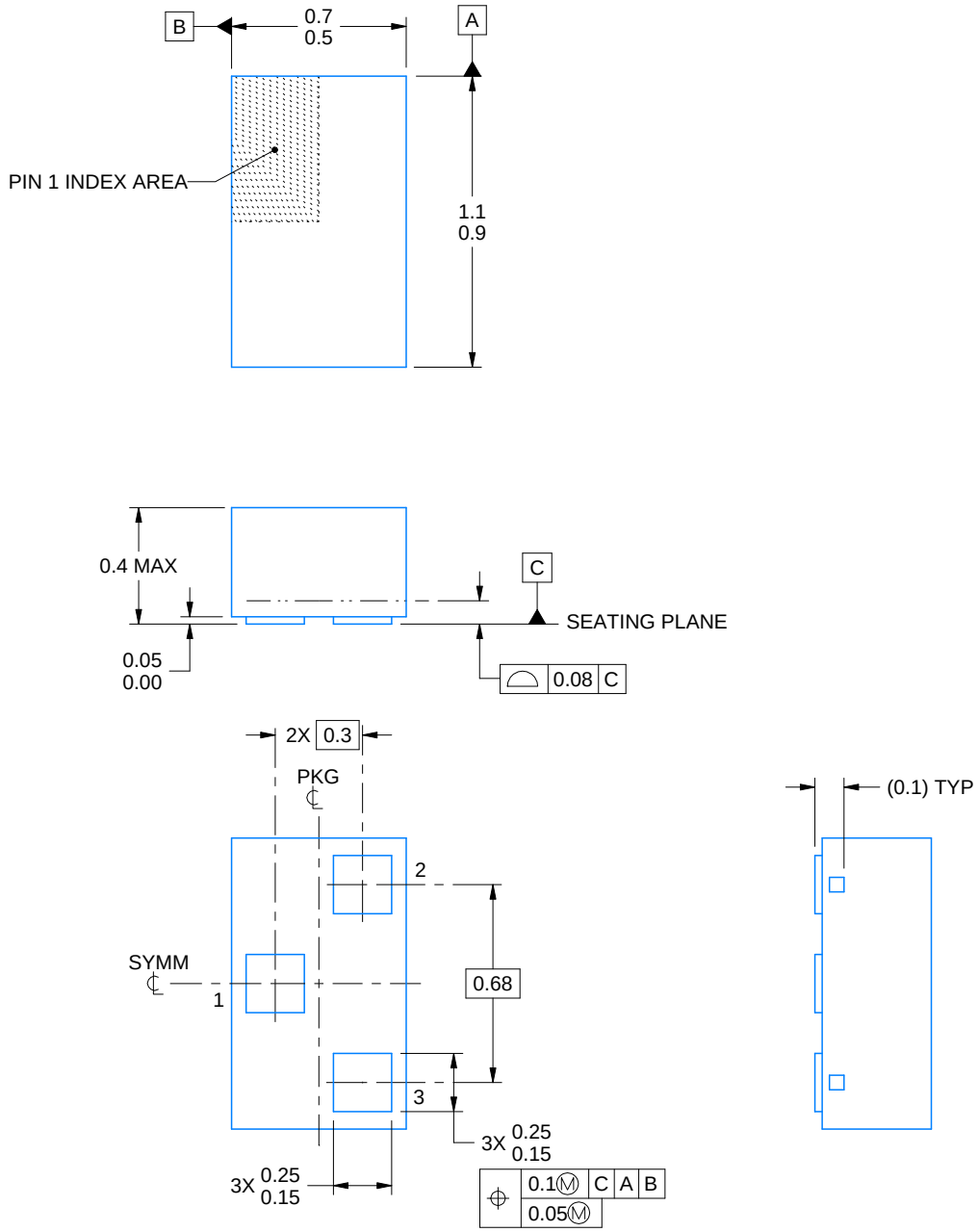
4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

PACKAGE OUTLINE

DMX0003A

X2SON - 0.4 mm max height

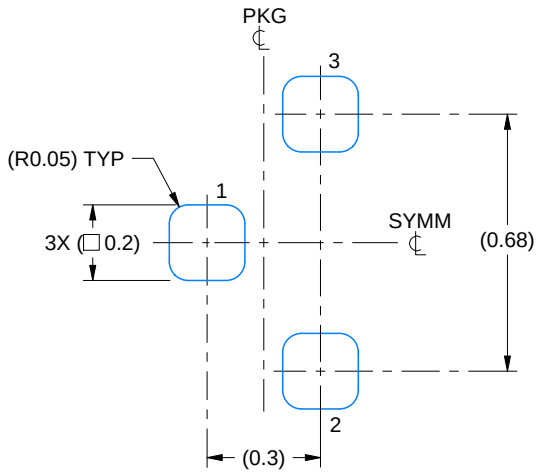
PLASTIC QUAD FLATPACK - NO LEAD



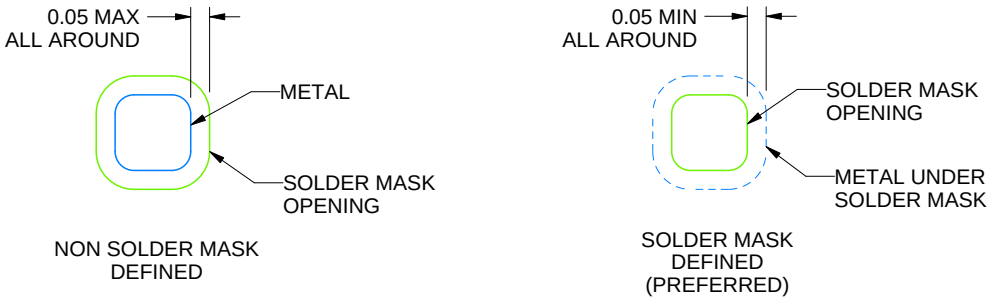
4223380/A 10/2016

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.



LAND PATTERN EXAMPLE
SCALE:50X

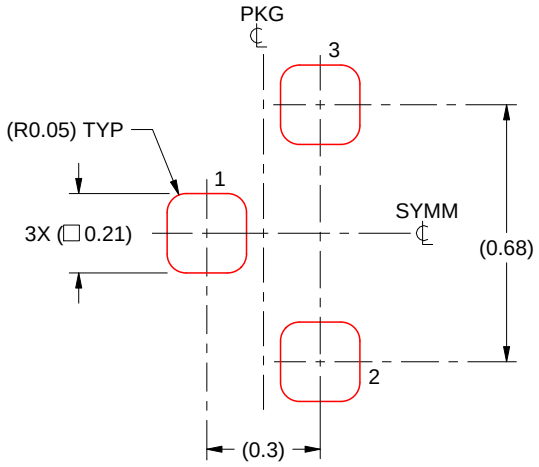


SOLDER MASK DETAILS

4223380/A 10/2016

NOTES: (continued)

3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).



SOLDER PASTE EXAMPLE
BASED ON 0.075 - 0.1 mm THICK STENCIL
SCALE:50X

4223380/A 10/2016

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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