ASM2464PD/PDX PCB Guideline(Mid loss)

ECN

Date	Revision	Item	Description	Explanation
2023/7/3	1.0		Release	

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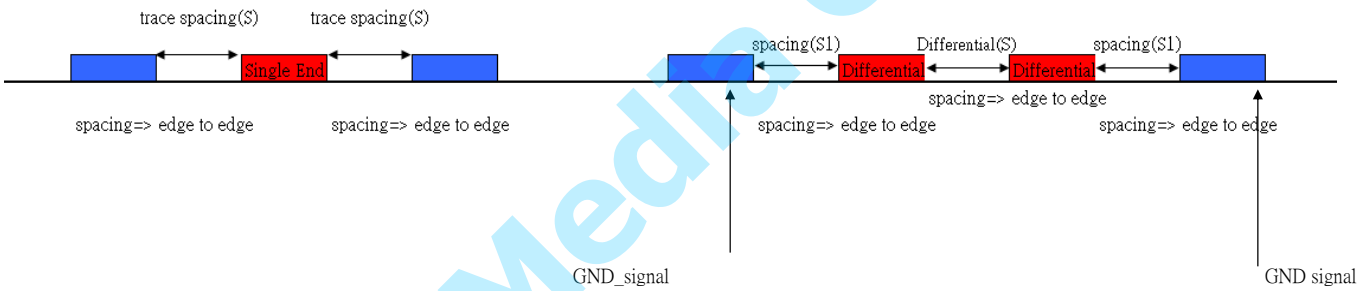
PCB Stack-up

			Single end +/-15%		Differential +/-10%		
Thickness	1.2mm+/-10%		Trace Width / impedance		Trace Width_spacing / impedance		
Layer	lyr type	Thickness		50ohm	90 ohm	95 ohm	85 ohm
S/M	S/M	0.7					
L1-COMP	0.5oz+plating	1.4		4 / 50.18	4_5 / 89.71	4_7 / 91.59	4_4 / 83.48
	PP 1067(Dk/Df:3.41/0.0059)	2.42					
L2-GND	copper	1.4					
	CORE (TU768:Dk/Df:3.9/0.026)	3					
L3-Signal/Power	copper	1.4					
	CORE(TU-768)	27.76					
L4-Signal/Power	copper	1.4					
	CORE (TU768:Dk/Df:3.9/0.026)	3					
L5-GND	copper	1.4					
	PP 1067(Dk/Df:3.41/0.0059)	2.42					
L6-SOLD	0.5oz+plating	1.4		4 / 50.18	4_5 / 89.71	4_7 / 91.59	4_4 / 83.48
S/M	S/M	0.7		\			
	Thickness(mil)	48.4					
	mm	1.22936					



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USB4 20Gbps

UTXP/N/0/1,URXP/N/0/1 Differential Pair Guidelines

Parameter	Guidelines	Notes
Topology	Point to Point	
Signal Reference	Ground	
Layer	Microstrip	
Characteristic Trace Impedance	Difference Pair Impedance = 85 ohm +/- 10 ohm	Shielding is needed for USB 4 differential pairs for signal integrity and EMC performance as below. A radial bend is preferred for 20Gbps.
Differential(S1:W:S:W:S1)	30 : 4 : 4 : 4 : 30(S1 > 8 h)	Each distance 40mil with ground via hole for guard trace as below.
Serpentine Spacing		No Serpentines
VIA hole Max.	<=2	
Total Length	< 1.5" for type C SMT connector, ASAP (prefer 0.5"~1.2") or Maximum insertion loss < 4dB@10GHz.	maintain loss, crosstalk and fiber weave effect. Shielding is needed for USB 4 differential pairs for signal integrity and EMC performance. TX0/TX1 length match < 1000 mil; RX0/RX1 length match < 1000mil for lane to lane skew.
Series Capacity	C_TX=0.22uF (Size 0201 / X7R) ; C_RX=0.33uF (Size 0201/ X7R)/R_DN= 220K ohm(Size 0201)	The Cap close to Connector for UTXP/N; RX AC coupling Cap and resistor pull down for short protection.(Component size should be 0201 on USB4 .)
Differential Pair P/N Length Matching	< 5 mil	Every segment intra pair skew: < 1 mil

USB2.0 UDP/N Differential Pair Guidelines

Parameter	Guidelines	Notes
Topology	Point to Point	
Signal Reference	Ground	
Characteristic Trace Impedance	Difference Pair Impedance = 85 ohm +/- 10%	
Differential (S1:W:S:W:S1)	15 : 4 : 4 : 4 : 15	
Serpentine Spacing	15 mil	
VIA hole Max.	<=4	
Total Length	< 4"	
Differential Pair Length Matching	< 20 mil	

Other

Parameter	Guidelines	Guidelines	Guidelines
Signal Name	UREXT	VBUS	VCC33U,VDD,VCCH
Topology	Point to Point	Point to Point	Point to Point
Single End (W:S)	10 : 7	5 : 8	15 : 8
Total Length	ASAP	10"	ASAP

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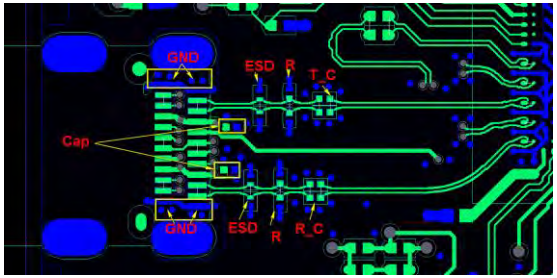
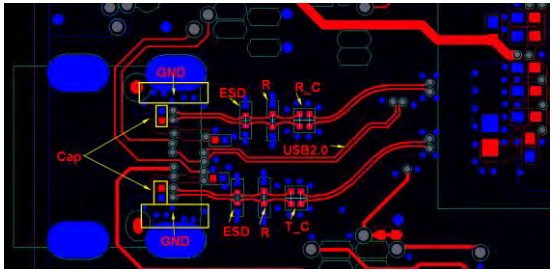
Refer to USB4 system design guidelines

https://www.usb.org/sites/default/files/D2T2-2%20-%20USB4%20Cable%20and%20System.pdf
TYPE C (only SMT type)





Layout Design Considerations/Examples - 5/7

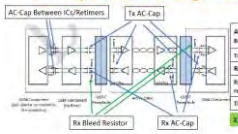
- Void under SMT pads for better SI. The larger the pad size, the more important this is

- **Single-ended voids** are recommended for most cases/components

- **Differential voids** for larger pads and/or thin dielectric height (~ 60um)
  - These voids can over-compensate (increase impedance too much). So analysis/3D modeling may be needed

- Ensure that layer under the void (surface-2) is not a source of noise, e.g. power plane. It's best to have ground on surface-2 under the void

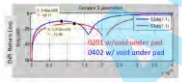
AC-Caps and Discharge Resistors



	Value	Voltage Rating	Tx	Rx
AC-Cap Between IC/Retimer	135-265nF	5V	X	X
Tx AC-Cap		25V	X	NA
Rx AC-Cap	300-363nF	25V	NA	X
Rx bleed/Discharge resistor	200-242 kΩ	25V	NA	X
Tx bleed resistor		25V	O	NA

X: Mandatory O: Optional NA: Not Applicable

- Smaller size components (e.g. 0201) will have smaller parasitic and therefore better return loss than larger ones (0402). Consider using 0201 components



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PCIe Gen4 16Gbps

PTXPx/Nx,PRXPx/Nx, Differential Pair Rounting Guidelines

Parameter	Guidelines	Notes
Topology	Point to Point	
Signal Reference	Ground	
Layer	Microstrip	
Characteristic Trace Impedance	TX&RX Impedance Difference Pair = 85 ohm +/- 10%	
Differential (S1:W:S:W:S1)	30 : 4 : 4 : 4 : 30(S1 > 8 h)	
Serpentine Spacing		
Series Capacity	Cs=0.22uF (Size 0402 / X7R or Size 0201(max. length) ;)	The AC-couple capacitor close to connector for PETXP/N
VIA hole Max.	<= 2 for connector ; <= 4 for down device or chip	
Total Length	< 5" for connector, ASAP. 1.5" < Down device(on board device or chip to chip) < 6"	
Differential Pair P/N Length Matching	< 5 mil	

XO/XI

Parameter	Guidelines
Signal Name	XO /XI
Characteristic Trace Impedance	Impedance Difference Pair = 85 ohm +/- 15%
Differential (S1:W:S:W:S1)	30 : 4 : 4 : 4 : 30
Total Length	< 0.5" ,ASAP

Other

Parameter	Guidelines
Signal Name	VDD/VCCLP/VCCLU/VCCH/VCCx
Topology	Point to Point
Single End (W:S)	15 : 8
Total Length	ASAP

PECLK

PE_CLKP/N

Parameter	Guidelines	Notes
Signal Reference	Ground	
Signal Name	PECLKP/N	
Layer	Microstrip	
Characteristic Trace Impedance	Impedance Difference Pair = 85 ohm +/- 15%	
Differential (S1:W:S:W:S1)	30 : 4 : 4 : 4 : 30(S1 > 8 h)	
Total Length	< 7" for connector ,< 8" for chip pad, ASAP.	
Differential Pair P/N Length Matching	< 5 mil	

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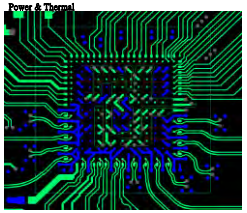
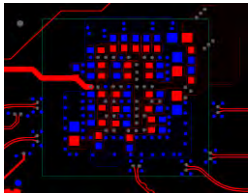
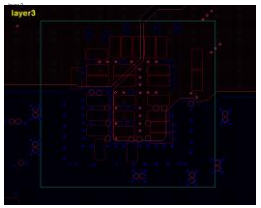
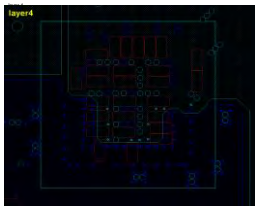
Power & Thermal









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SPIDI/SPICK/SPIDO/SPICS/I2C_DATA/I2C_CLK

Parameter	Guidelines	Notes
Topology	Point to Point	
Signal Reference	Ground	
Characteristic Trace Impedance (Single-Ended)	50 ohm +/- 15%	
Trace Width	5 mils	
Trace Spacing	10 mils	
Total Length	< 10"	

CC1/CC2

Parameter	Guidelines	Notes
Topology	Point to Point	
Signal Reference	Ground	
Trace Width	8 mils	
Trace Spacing	15 mils	
Total Length	< 10"	

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GPIO/Strapping/UART_TX/UART_RX

Parameter	Guidelines	Notes
Topology	Point to Point	
Signal Reference	Ground	
Characteristic Trace Impedance (Single-Ended)	50 ohm +/- 15%	
Trace Width	5 mils	
Trace Spacing	8 mils	
Total Length	< 10"	

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