

**Product Name: ZX180HAPS-ST – FPGA 8x20 BGA Mezzanine card breakout adapter**

**Product Description:** ZX180HAPS-ST is 8x20 BGA SEAM / SEAF breakout adapter, offering full access to SEARAY 8x20 BGA connector via onboard 0402 shunt SMD landing pads. It enables user to implement design changes ( cut signal path ), or simply access any signals for test and measurement purpose. ZX180HAPS-ST is designed for any design utilizing SEAM / SEAF 8x20 BGA Samtec or Molex SEARAY connectors as well as Synopsys HAPS HapsTrak 3 HT3 ASIC emulation system. ZX180HAPS-ST is SEAM / SEAF passive FPGA Mezzanine Card, FMC,

**Full access to all connector signals** via onboard 0402 shunt SMD footprint. **Page 2** lists accessible signals. Module reference ground, GND , access point is offered by 2 onboard GND test points interfacing with test equipment, host and target. The GND test points are connected to top/bottom as well as all inner layers ground planes.

- 1- All signals are accessible via onboard standard 0402 shunt SMD footprint.
- 2- All signals are pass through, enabling user to implement design changes ( cut signal path ), if design changes are required.
- 3- Mates with Samtec or Molex HI-SPEED HI-DENSITY SEARRAY 8x20 BGA connectors.
- 4- Fully compatible with 8 rows x 20 pins per row single ended or differential pairs design configuration
- 5- Compatible with Synopsys HAPS ASIC emulation system, interfacing with HapsTrak3 HT3 or any 8x20 BGA design.
- 6- Designed in **12** layers PCB stackup
- 7- Improved signal integrity and crosstalk
- 8- Multiple GND test points connecting directly to inner layers GND planes.
- 9- Onboard both SEAM and SEAF connectors
- 10- Matching connector's **50Ω** trace impedance on all signals.

See Pages 2 & 3 for more details

**Electrical:** Insertion loss > -1dB @3GHz  
 Trace impedance: 50 Ω  
 PCB Material : FR4, 12 layers  
 Plating: Gold = 30 μ" (0.76 μm) over 50 μ" (1.27 μm) Ni, all signal layers  
 Operating Temperature: -55°C to +125°C  
 Connector:  
 Onboard Connector type: SEAM 8x20 BGA – ( Male / Plug )  
 SEAF 8x20 BGA – ( Female / Socket )  
 Connector contact : Copper Alloy  
 Connector housing: LCP UL 94 V0, COLOR: BLACK  
 Connector contacts: COPPER ALLOY / LEAD FREE SOLDER  
 Connector plating: = 30 μ" (0.76 μm) Au over 50 μ" (1.27 μm) Ni  
 Mates with: Any height SEAM and SEAF 8x20 BGA connectors  
 Pitch: 0.05" ( 1.27mm ) pin to pin pitch  
 Shunt:  
 Package: 0402 SMD standard footprint  
 Plating: Gold = 30 μ" (0.76 μm) over 50 μ" (1.27 μm) Ni

**Application:** SEAM / SEAF 8x20 Board to Board design validation, characterization test debug and measurement. Synopsys HAPS HapsTrak 3 , HT3 , Debug of HAPS HapsTrak3 FMC Mezzanine card. ASIC, emulation prototyping , modular design interface evaluations.

**Access:** All SEARAY connector signals are accessible via onboard 0402 shunt SMD footprint.

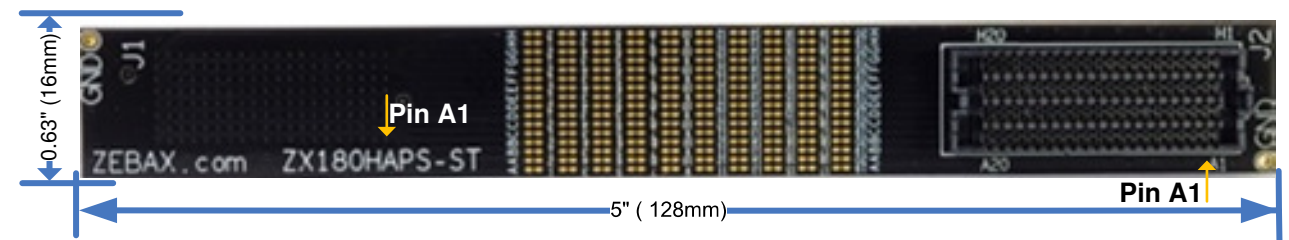
**Pitch:** 1.27mm (0.05") High Speed connector

**Mates with :** SEAM SEAF SEAM-RA SEAF-RA SEAMP SEAFP SEAFP-RA connector series  
 Molex SEARAY and SEARAY Slim Mezzanine family, including 0459702385 and 0459712385  
 All listed Samtec Molex FMC connectors listed, please see table on **Page 3**  
 Synopsys HAPS ASIC emulation system.  
 Any and all Synopsys HAPS Trak3 HT3 compliant design.

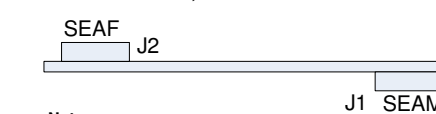
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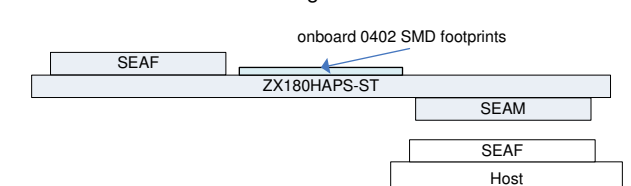


ZX180HAPS-ST , Passive Mezzanine card



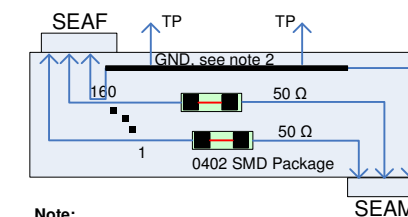
**Note:**  
 1- SEAM connector type interfaces with HOST.  
 2- SEAF connector type interfaces with Target.  
 3- Pin A1 of J1 is connected to Pin A1 of J2

ZX180HAPS-ST interface diagram

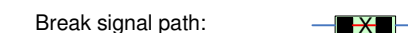
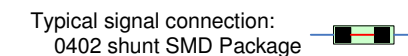


**Note:**  
 1- HOST would be any design using 8 x 20 SEARAY connector or Synopsys HAPS system  
 2- ZX180HAPS-ST interfaces with HOST offering access to all SEARAY signals via onboard 0402 shunt SMD footprints.

Simplified Block diagram

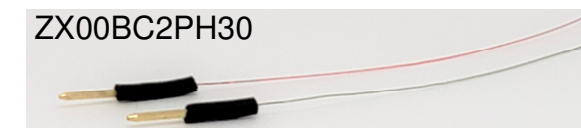


**Note:**  
 1- All connector signals are accessible via onboard 0402 SMD footprint  
 2- SEAM mates with Host  
 3- SEAF mates with Target ( Mezzanine card )



**ZX180HAPS-ST package includes:**

Part number	Quantity	Description
ZX180HAPS-ST	1	FPGA 8x20 / HAPS breakout adapter
ZX00BC2PH30	0	30AWG Bare Copper wire to pin header wire assembly
ZX0002SRF4	0	High Frequency semi-rigid SMA to bare wire coax cable assembly



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SPECIFIED DIMENSIONS ARE INCHES (MM). ROHS COMPLIANT	<b>ASSEMBLY DRAWING</b>  <b>ITEM: ZX180HAPS-ST</b>	
<b>DESCRIPTION: SEARAY 8x20 FMC Mezzanine breakout adapter - Synopsys HAPS HapsTrak3 HT3</b>		
<b>CHECKED:</b> M. MARINA	<b>DRAWN:</b> SLAVIK	<b>REVISION: 1.0</b> <b>SHEET: 1 OF 3</b>

**Product Name: Cont's ZX180HAPS-ST – FPGA 8x20 BGA Mezzanine card breakout adapter**

**Ground:** The ZX180HAPS-ST module offers two GND test points which are connected to the module inner GND planes and top & bottom GND fills. It is recommended to connect the GND reference test points to system & test equipment GND reference points, Host & target.

**Access:** ZX180HAPS-ST provides access to all SEARAY , SEAM, SEAF connector contacts via onboard standard 0402 shunts SMD footprint. Table 2.1 & 2.2 lists the accessible connector's ( SEARAY ) contact as listed the ZX180HAPS-ST.

Table 2.1 – Lists the SEARAY signal number based on the Row/Column matrix configuration.

Table 2.2 – Lists the SEARAY signal number based on the ZX180HAPS-ST design.

The followings are few recommendations for interfacing ZX180HAPS-ST with test & measurement equipment , scope, function generator, Network Analyzer, power supply, electronics load and more.

- 1- Using 32AWG solid copper wire with pin header, ZX00BC2PH30 or similar to interface to any scope probe / test equipment
- 2- Using high frequency semi-rigid coax cable assembly , ZX0002SRF4 , to solder on any signal on ZX180HAPS-ST. The SMA connector part of the cable assembly may be interfaced with any test equipment for purpose of signal injection or interface.

**Loopback test:** ZX180HAPS-ST may be configured for manufacturing , development , or qualification loopback test configuration. Using any 32AWG solid copper wire to inner connect any connection combination. The ZX180HAPS-ST enables any design loopback test requirement, ensuring solid test & measurement method for pre-bringup, bringup, qualification and manufacturing phase of any design.

**Typical Application:** ZX180HAPS-ST is designed for purpose of test and debugging at full connector's bandwidth. It provides new approach in usage of breakout adapters by :

- 1- Utilizing single or differential scope probe for purpose of test & measurements
- 2- Enabling design changes, by re-assignment of any signal by means of cut and solder, where any signal may be cut and assigned to new location by jumper wires.
- 3- Loopback test & measurement , enabling software development & testing.

**Scope Probe wire Installation:**

- 1- It is recommended to keep the probe wire length at 0.5" ( 1.2cm ) long.
- 2- In order to avoid ground loop problems, please use the shortest Ground probe wire interfacing to the nearest GND reference. The ZX180HAPS-ST provides two GND test points for reference.
- 3- Both Keysight as well as Tektronix offer variety of single ended as well as differential probes along with their accessories, below are few probes from each vendor:

- a) Keysight differential probe or similar N2795A, N2796A, 1168V, 1134B along with E2677B differential Solder-in probe, N5426A ZIF Tip, N2884A Fine Wire ZIF Tip and more – See the figure “probe head accessories”.
- b) Tektronix offers several single-ended as well as differential probes such as : P6245, P6248, P6247, P6246 or any of TDP7000 series and more

- 4- Please follow your vendor's guideline in installation of probe wires & accessories.

**Signal Access & re-route:**

Re-routing any signal on ZX180HAPS-ST may be implemented by cutting the designated 0402 SMD shunt and re-routing to new location.

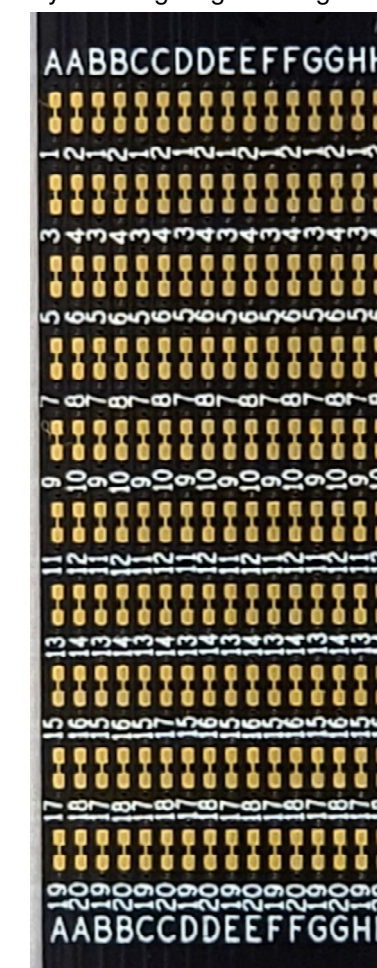
Row	A	A	B	B	C	C	D	D	E	E	F	F	G	G	H	H
1 / 2	1	9	2	10	3	11	4	12	5	13	6	14	7	15	8	16
3 / 4	17	25	18	26	19	27	20	28	21	29	22	30	23	31	24	32
5 / 6	33	41	34	42	35	43	36	44	37	45	38	46	39	47	40	48
7 / 8	49	57	50	58	51	59	52	60	53	61	54	62	55	63	56	64
9 / 10	65	73	66	74	67	75	68	76	69	77	70	78	71	79	72	80
11 / 12	81	89	82	90	83	91	84	92	85	93	86	94	87	95	88	96
13 / 14	97	105	98	106	106.5	115	108	116	109	117	110	118	111	119	112	120
15 / 16	113	121	114	122	115	123	116	124	117	125	118	126	119	127	120	128
17 / 18	129	137	130	138	131	139	132	140	133	141	134	142	135	143	136	144
19 / 20	145	153	146	154	147	155	148	156	149	157	150	158	151	159	152	160
Column	A	A	B	B	C	C	D	D	E	E	F	F	G	G	H	H

Table 2 – SEARAY pin number based on the module silkscreen

Table 1 – SEARAY pin number based on the Row/Column matrix  
Pin# column lists the first Pin# of each row.  
Row column lists the row number.

Column	A	B	C	D	E	F	G	H
Pin# 1	1	2	3	4	5	6	7	8
9	9	10	11	12	13	14	15	16
17	17	18	19	20	21	22	23	24
25	25	26	27	28	29	30	31	32
33	33	34	35	36	37	38	39	40
41	41	42	43	44	45	46	47	48
49	49	50	51	52	53	54	55	56
57	57	58	59	60	61	62	63	64
65	65	66	67	68	69	70	71	72
73	73	74	75	76	77	78	79	80
81	81	82	83	84	85	86	87	88
89	89	90	91	92	93	94	95	96
97	97	98	99	100	101	102	103	104
105	105	106	107	108	109	110	111	112
113	113	114	115	116	117	118	119	120
121	121	122	123	124	125	126	127	128
129	129	130	131	132	133	134	135	136
137	137	138	139	140	141	142	143	144
145	145	146	147	148	149	150	151	152
153	153	154	155	156	157	158	159	160
Column	A	B	C	D	E	F	G	H

Figure 2.1 – ZX180HAPS-ST layout design signal assignments



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	<b>ITEM: ZX180HAPS-ST</b>	
<b>DESCRIPTION: SEARAY 8x20 FMC Mezzanine breakout adapter - Synopsys HAPS HapsTrak3 HT3</b>		
<b>CHECKED:</b> M. MARINA	<b>DRAWN:</b> SLAVIK	<b>REVISION: 1.0</b> <b>SHEET: 2 OF 3</b>

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**Accessories:** The following accessories compliment ZX180HAPS-ST for testing purpose.

**ZX00BC2PH30** 30AWG Bare Copper wire to pin header wire assembly – It can be easily soldered to any pads on the ZX180HAPS-ST for scope probe interface.

**ZX0002SRF4** High Frequency SMA to bare wire semi-rigid coax cable assembly – It is **semi-rigid** coax cable assembly where case of the cable assembly is exposed copper. It can easily soldered to any pads on ZX180HAPS-ST. With Insertion loss of >-0.5dB, ZX0002SRF4 is excellent for characterization and performance test qualification.

**Compatibility Matrix :** ZX180HAPS-ST is compatible with all listed connectors in the following tables. ZX180HAPSxx is referred to any ZX180HAPS design module, including ZX180HAPS-ST.

ZX180HAPSxx FMC breakout adapter mates with the following Samtec SEARAY™ connectors

Type	Samtec PN	Description
SEAM	SEAM-20-02.0-S-08-1-A-K-TR	male
	SEAM-20-02.0-S-08-2-A-K-TR	
	SEAM-20-02.0-L-08-1-A-K-TR	
	SEAM-20-02.0-L-08-2-A-K-TR	
	SEAM-RA	
	SEAM-20-01-S-08-1-RA	
	SEAM-20-01-S-08-2-RA	
	SEAM-20-01-L-08-2-RA	
	SEAM-20-01-L-08-2-RA	
	SEAMP	
SEAMP-20-02.0-L-08		
SEAMP-20-02.0-S-08		
SEAMP-20-02.0-S-08-GP		
SEAF	SEAF	female
	SEAF-20-05.0-S-08-2-A-K-TR	
	SEAF-20-05.0-L-08-2-A-K-TR	
	SEAFP-RA	
	SEAFP-20-01-L-08-RA-WT-GP	
	SEAFP-20-01-L-08-RA-WT	
	SEAFP	
	SEAFP-20-05.0-L	
	SEAFP-20-05.0-S	
	SEAF-RA	
SEAF-20-S-08-2-RA-GP		
SEAF-20-S-08-2-RA-LP		
SEAF-20-08-2-RA-K		

ZX180HAPSxx FMC breakout adapter mates with the following Molex SEARAY Slim Mezzanine connectors

Molex	
SEAM ( Male )	SEAF ( Socket )
045970-2185	045971-2185
45970-2185	45971-2185
0459702185	0459712185
045970-2285	045971-2285
45970-2285	45971-2285
0459702285	0459712285
045970-2385	045971-2385
45970-2385	45971-2385
0459702385	0459712385
045970-2485	045971-2485
45970-2485	45971-2485
0459702485	0459712485
045970-2585	045971-2585
45970-2585	45971-2585
0459702585	0459712585
045970-2685	
45970-2685	
0459702685	
045970-2715	
45970-2715	
0459702715	

SEARAY 45970 and 45971 are offered at various mated stacking heights, ZX180HAPSxx mates with all versions of 8 columns 20 rows version of the Slim Mezzanine connector series.

SEAM / SEAF connectors are offered with various options as listed below, ZX180HAPSxx mates with all versions of the SEAM / SEAM family for the 8 columns 20 row configuration.

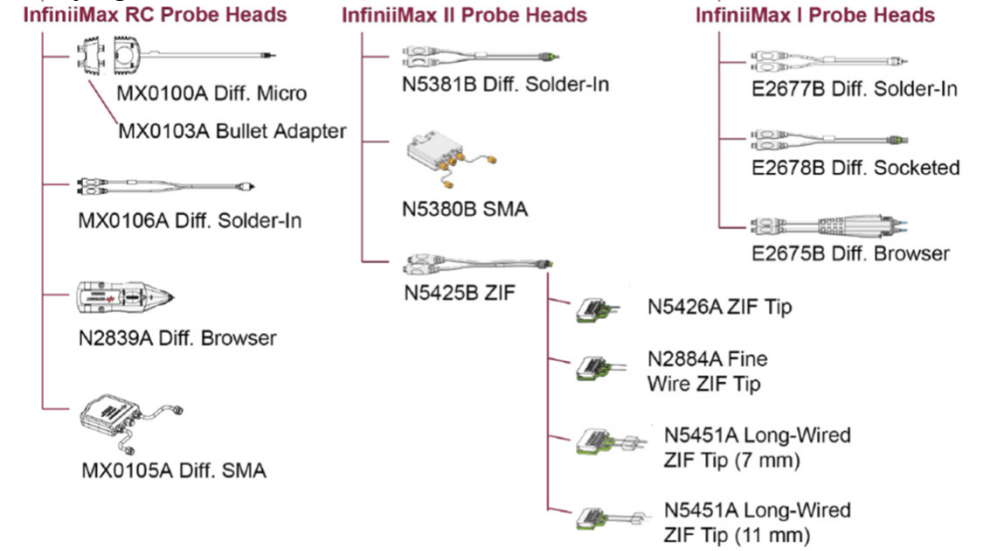
Option	Description
"-L"	10u" ( 0.25um ) Gold on contact area
"-S"	30u" ( 0.76um ) Gold on contact area
"-1"	Tin/Lead Alloy Solder Charge
"-2"	Lead-Free Solder Charge

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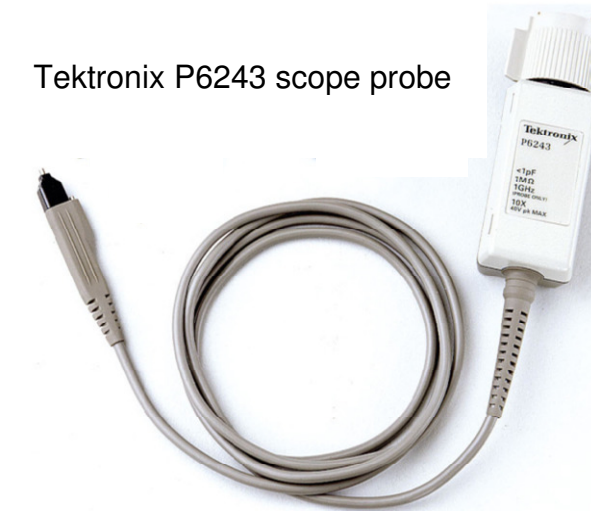
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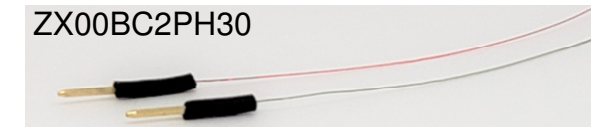
**Keysight Probe Head accessories**



Tektronix P6243 scope probe



ZX00BC2PH30



ZX0002SRF4



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**ASSEMBLY DRAWING**  
**ITEM: ZX180HAPS-ST**

**DESCRIPTION: SEARAY 8x20 FMC Mezzanine breakout adapter - Synopsys HAPS HapsTrak3 HT3**

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 SHEET: 3 OF 3