

Altera High Speed Mezzanine Card HSMC breakout adapter ZX106, ZX107 Breakout boards in Cyclone III development systems

Altera's Cyclone III development systems incorporates Q series® Samtec High Speed Connectors, QTH/QSH. Zebax offers high quality breakout adaptors tailored for testing, bringup, software development and emulation applications. This document lists the HSMC requirements and outlines benefits of ZX106 and ZX107 in FPGA applications.

This document identifies:

1. Samtec Q series® connector
2. Altera HSMC requirements- ASP-122952-01 – ASP-122953-01
3. Application of ZX106, ZX107 w/ Cyclone III development system

Revision History

Version	Date	Description
v01	Aug, 8, 2011	Initial release –

1 Samtec Q Series

Samtec Q-Strip® hi-speed connectors are 0.5mm pitch high speed connectors with performance exceeding 8GHz/9.5GHz bandwidth due to their contacts, surface mount, ground shielding that exists between two rows of signals for improved electrical performance.

QTH, and QSH connectors are one of the Q-Strip connector types offered by Samtec with wide industry acceptance due to their high performance and ground shielding. QTH is considered the HEADER (Male) whereas the QSH is defined as Socket (Female). The Header / Socket terminology is due to the ground plating that is located at mid section of the connector, rather the legacy contact pins terminology.

QSH/QTH is offered in single ended and differential configuration. The single ended, SE, connectors are commonly used and it is offered in 60 (30 pins per row) , 120(60) , 180(90) , 240(120) pins whereas the differential pair signaling is by pair, maintaining the 50 Ω impedance at each 2 pins where the 3rd signal is left empty. Differential pair , DP, connectors are offered in 40(20 pins per row) , 40(80), 60(120), 80(160). **Zebax products do not offer dedicated differential pair breakout adapter, however one can enforce improved signal integrity by applying external GND to the un-used pin at the spare differential pair using Zebax Samtec breakout adapter signal at their discretion.**

QSH/QTH is offered in multiple **Bank segments** where each bank contains 60 (30 pins per row) , and 40(20 pins per row) pins for single ended and differential pairs types respectively. Rule of thumb is that All lower banks QTH connectors mate with higher bank segment Sockets. Example: One can use **Zebax ZX101 Samtec Breakout** adapter offers 60 (30 pins per row) header and socket that can be used for 40(20 pins per row) differential pair as well as single ended 120(60 pins per row) QSH060, 180(90) QSH090, or 240(120) pins as well as QSH020, QSH040, QSH060, QSH080 differential pairs sockets.

Figure 1 – Samtec QTH Header

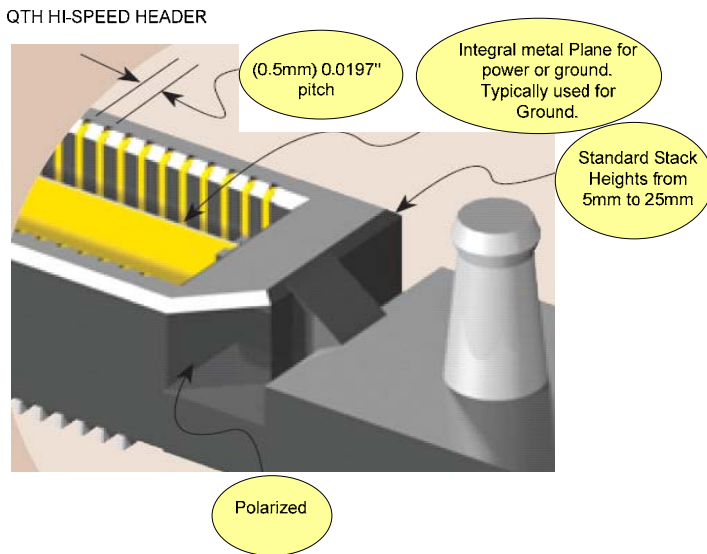
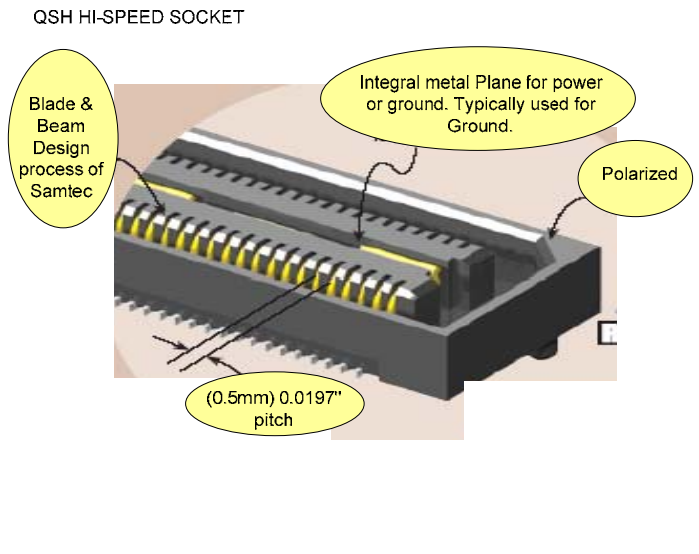


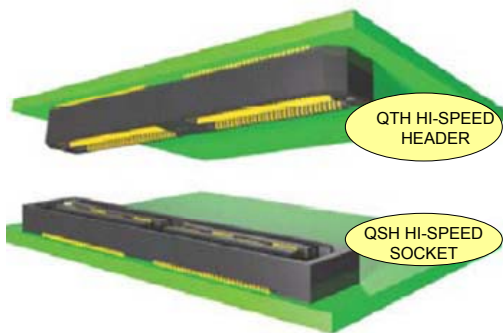
Figure 2 – Samtec QSH Socket



Q-Series Height QSH QTH

Traditionally Socket connectors are placed on PCBoard or the main board whereas the Header connector is adapted on the Device Under Test, DUT, board.

Figure 3 – Header Socket board configuration



Standard QSH connector height is 0.125" (3.05mm) and it is NOT offered in any other height. QTH, Header is offered in various height enabling designs with height restrictions. QTH LEAD STYLE provides QTH height ordering options as listed in Table 1. ALL QTH lead style connectors mate with the QSH connector.

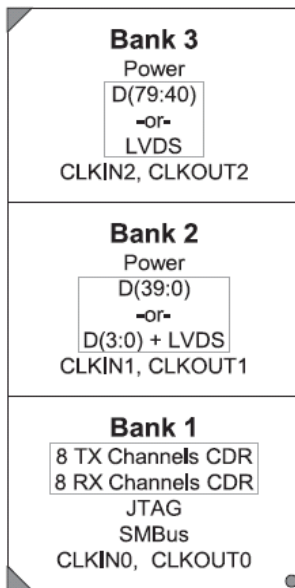
Table 1 – QTH Samtec Header

QTH LEAD STYLE	A	HEIGHT WITH QSH
-01	(4,27) .168	(5,00) .198
-02	(7,26) .286	(8,00) .316
-03	(10,27) .404	(11,00) .433
-04	(15,25) .600	(16,00) .630
-05	(18,24) .718	(19,00) .748
-07	(24,24) .954	(25,00) .984

2 Altera HSMC requirements

The Altera High Speed Mezzanine Card (HSMC) specification defines the electrical and mechanical properties of high speed mezzanine card adapter interface for FPGA-based motherboards utilizing Samtec QSH series adopting ASP-122952-01 ASP-122953-01 and where **Zebax Zx106 ZX107 breakout adapters** may facilitate DUT interface solutions. The HSMC specification allows for the design of interoperable motherboards and add-on cards by different manufacturers that can interoperate and utilize high-performance I/O features found in today's FPGA devices. Figure 4 outlines simplified block diagram of the HSMC connector using Samtec QSH/QTH connector bank segment allocation.

Figure 4- HSMC QSH/QTH connector Bank segment allocation using **Zebax ZX106, ZX107 breakout adapter**



The HSMC interface provides a mechanism to extend the peripheral-set of an FPGA host by means of a mezzanine card. **Zebax Samtec breakout adapters** provide full interface enabling DUT to the FPGA method both in single ended as well as differential pair configuration.

Host Boards are defined as any board with an FPGA connected to one or more HSMC interfaces utilizing ASP-122953-01 (gender: female or socket). Since FPGA are configurable devices, the interconnect I/Os available on the HSMC connector can have all possible I/O standard and logic features the can be supported by the host FPGA. **Zebax ZX106, Zx107 Samtec breakout adapters are designed in 4 layers PCB with no via and 50 Ω impedance traces meeting both analog as well as digital worlds requirements with both internal layers as GND plane with precision GND stitching design enabling full Samtec connector signal bandwidth performance.**

Mezzanine Cards are daughter cards which feature electrical components and interfaces using ASP-12295-01 (gender: male or header) on both. One can easily interface their evaluation / prototype board to the Host board using **Zebax ZX106, ZX107 breakout adapters facilitating ease of use.**

HSMC Connectors provide the interface between a host board and a mezzanine card.

The HSMC connector has total of 172 pins (ASP-122952-01 ASP-122953-01) where **Zebax ZX106 ZX107 Samtec Breakout Adapter** offers hardware interface.

The connector is based on the 0.5mm-ptich QWSH/QTH series from Samtec offering 3 banks where Bank 1 has every third pin removed (similar to the differential pair) as one in QSH-DP/QTP-DP connector series. Bank 2 and Bank3 have all of the pins populated similar to the single ended connectors.

Figure 5 – HSMC connector configuration – Zebax ZX106 ZX107 Samtec breakout adapter

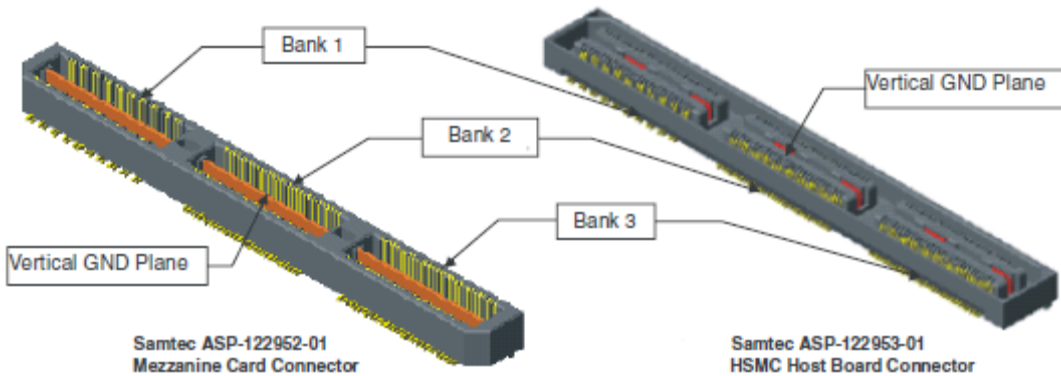


Figure 6 – HSMC board interface

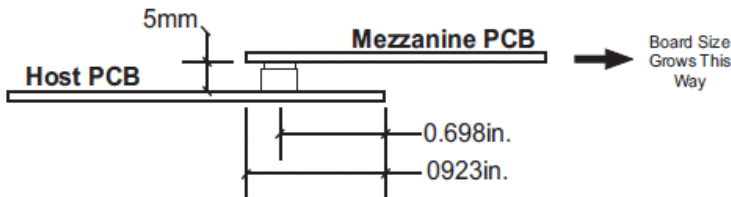


Figure 7 – Zebax ZX107 application as HSMC breakout adapter

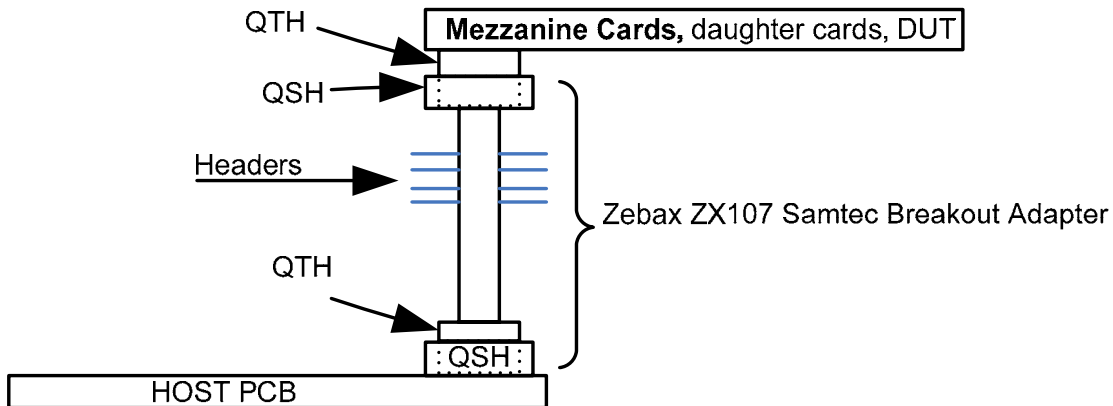
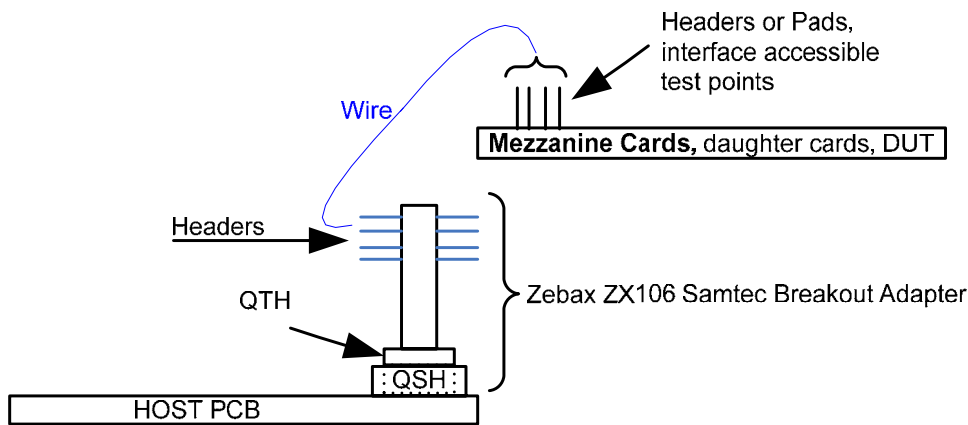


Figure 8 – Zebax ZX106 application as HSMC breakout adapter



3 Application of ZX106, ZX107 w/ Cyclone III development system

Zebax ZX106, Zx107 Samtec breakout adapters are designed in 4 layers PCB with no via and 50 Ω impedance traces meeting both analog as well as digital worlds requirements with both internal layers as GND plane with precision GND stitching design enabling full Samtec connector signal bandwidth performance.

ZX106-QTH Samtec breakout adapter facilitates interface of any prototype or evaluation board to HSMC configured host (Host using : ASP-122952-01 Socket / Female) by providing accessible headers for debugging via scope or logic Analyzer, Agilent or Tektronix.

Zx107 Samtec breakout adapter facilitates interface of any prototype, evaluation board, or **Mezzanine Cards** (daughter cards) to HSMC configured host (Host using : ASP-122952-01 Socket / Female Mezzanine card using: ASP-122953-01) by providing accessible headers for debugging via scope or logic Analyzer, Agilent or Tektronix.

Both ZX106 and ZX107 Samtec breakout adapters may be used for single ended as well as differential pair configuration covering QSH060 QTH060 QSH040 QTH040 as well as 3 banks of the QSH120 QTH120 QSH080 QSH080 type Samtec Q-Series HI-Speed Socket and Headers.

In addition, ZX106, ZX107 Samtec breakout adapters are designed using 4 layer PCBoard where the internal layers are ground layers attributing to reduced noise, cress-talk, distortion, and attenuation at optimum Samtec's connector signal bandwidth.

All Zebax breakout adapters provide Ground test point for external ground shielding of the HSMC interface solution. TP1 , TP2 ground test points may be connected to external ground for improved signal integrity along

with shielding requirements. Traditionally the Tp1 or Tp2 ground test points are used for proper Scope or logic analyzer ground interface.

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