Frequently Asked Questions about FMC+

General

1. What is FMC?

FMC is the acronym for FPGA Mezzanine Card. It is a small mezzanine module optimized to provide the physical interface for FPGAs on a carrier card. The physical IO is typically on the faceplate of the FMC mezzanine. FMC requirements are defined by the ANSI/VITA 57.1 standard.

2. What is FMC+?

FMC+ is an enhancement to FMC. It increases multi-gigabit interfaces from 10 to 32 with data rates to 28 Gbps. It also provides a backward compatible path for FMC to reside on newer FMC+ carrier modules. FMC+ requirements are defined by the ANSI/VITA 57.4 standard.

3. Is FMC/FMC+ an industry-wide effort?

Yes, this is an industry-wide effort. FMC+ is intended to be used across a wide spectrum of industries and end applications with products available today. It is not tied to a specific FPGA technology or supplier but is intended to make the use of FPGAs easier for everyone.

4. Where can I find suppliers of FMC/FMC+ products?

The current list of active FMC+ supporters is maintained on the VITA website at www.vita.com/fmc.

5. Where can I find a list of FMC/FMC+ products?

The FMC+ suppliers maintain a list of products in VITA's searchable product directory at www.vita.com/home/Products/productsearch.php.

6. How are FMCs used?

FMCs are most often used as expansion portals for FPGAs on a host or carrier card. They provide flexible I/O solutions for use with VPX, AMC, PCI / PCIe and other form factor carrier cards.

7. Where can I get the FMC/FMC+ Standard?

The FMC and FMC+ Standards are copyrighted and distributed by VITA. They are available free to VITA members and for purchase to non-members. Order online at: https://vita.com/secure/online-store.html.

8. How do I get started with FMCs?

You can purchase the Standard from VITA to get all the technical details. Go to the FMC page at www.vita.com/fmc for information on companies that can help with development or products. Also contact VITA for any specific requirements and contacts within the FMC ecosystem.

9. Where can I go to get answers to additional questions that I might have about FMCs?

The FMC Community has established a LinkedIn user forum. LinkedIn members can search for FMC (FPGA Mezzanine Card) under groups and request to join. You can join existing discussions or start a new one on your specific topic.

10. Where can I go to learn more?

A list of articles is maintained at www.vita.com/fmc. Check there for the latest information. Also check vita.com/tutorials for the latest FMC+ Tutorial.

11. How can my company get involved with the FMC/FMC+ technical working group or the FMC Community?

Contact VITA to become involved with either of these efforts. www.vita.com/home/AboutUs/Contacts.html. You must be a member of VITA to participate in either of these organizations.

12. I have a need to design a new system and would prefer FMC+ COTS subsystems; what are the available FMC+ solutions out there?

The product directory on the VITA web site would be a good start, also the LinkedIn discussion group is a useful avenue to submit a requirement request to the industry suppliers as a whole.

Technical

13. What are the key features FMCs?

Key features of the FMC+ Standard include:

- Up to 20 high speed differential pairs supporting 10 Gbps signaling.
- 4 differential clocks supporting 2 GHz signaling.
- 80 differential I/O or 160 single ended general purpose I/O.
- IPMI programming and card information access.
- Support for user selectable I/O voltage standards.

14. What are the differences between the FMC and FMC+ Standards?

The main differences are:

- Increase in multi-gigabit interfaces from 10 to 32
- Faster data rate at 28Gbps bi-directional.
- FMC+ carriers allow for backwards compatibility with FMC mezzanines.
- Additional I/O and user-defined DPs and SEs.

15. What is the pinout for FMC/FMC+?

Complete details on the pinout are included in the Standard.

16. I have an ASP-xxxxxxx FMC/FMC+ connector; what is the mating connector?

FMC offers a selection of mating solutions to suit different application requirements. All male FMC connectors can mate with any of the female FMC connectors. Here are some common guidelines to illustrate which one is the most appropriate for your target application.

- Board to Board Height: several are available depending on clearance requirements. The male half [module side] will control the stack height. Two options, 8.5 mm and 10 mm, are typical, however other heights are possible provided the mechanical envelope is not violated
- Low Pin Count (LPC) and High Pin Count (HPC): LPC provides 34 differential I/O signals and 1 multi-Gigabit transceiver. HPC provides 80 differential I/O and 10 multi-Gigabit transceivers.
- Mating a HPC connector to a LPC connector, or vice versa, will function, however, some of the pins will be “no connects.”

FMC+ also offers an expanded selection of mating solutions to suit different application requirements. HSPC male FMC+ connectors can mate with HSPC female FMC+ connectors. The same can be said for the optional HSPCe connectors. Here are some common guidelines to illustrate which one is the most appropriate for your target application.

- Board to Board Height: several are available depending on clearance requirements. The male half [module side] will control the stack height. Two options, 8.5 mm and 10 mm, are typical, however other heights are possible provided the mechanical envelope is not violated.
- High Serial Pin Count (HSPC) and High Serial Pin Count extension (HSPCe): HSPC provides 80 differential I/O and 32 multi-Gigabit transceivers. HSPCe provides an additional 16 differential I/O.
- Backwards Compatibility: FMC+ allows for the mating of a female HSPC connector to a male HPC or LPC connector. Due to the large pin-count of the female connector, some of the pins will be “no connects”. Note, the same configuration vice versa, will not function electrically or mechanically. FMC+ can only accept FMC mezzanines.
- Lead/Lead-free: Select based on application, some military and medical applications are exempt from the lead-free initiatives. Both FMC and FMC+ are available in leaded and lead-free configurations.

17. What sources are there for the FMC/FMC+ connectors?

Samtec and Molex have suitable connectors. The supplier provides PADs files, 3D models, and other drawings necessary for you to complete your design.

18. What environmental configurations are available?

FMCs are available that can operate in air-cooled or conduction cooled environments. The Standard allows for both cooling alternatives.

19. I have heard about VITA 57.2 and VITA 57.3, are these related to FMC?

These are complementary Standards to the ANSI/VITA 57.1 FMC Standard. VITA 57.2 defines an ‘electronic datasheet’ meta-data standard to provide automated validation of FMC configurations and performance capability. In short, VITA 57.2 will aid in determining the compatibility of various FMC products.

VITA 57.3 defines the logic interfaces for firmware that resides in the carrier card FPGA that is used to communicate with the FMC mezzanine module.

Both Standards are currently on hold by the VITA 57 Technical Working Group. Copies are only available to the working group members.

20. How much signaling I/O is available?

FMC/FMC+ has the capability for up to 80 differential pairs of standard I/O signals with a signaling speed of 2 Gbps. Up to 20 ‘DP’ differential pair signals are available for connecting to 10 multi-gigabit transceivers, typically available on FPGAs with a capability of 10 Gbps for FMC and 28 Gbps for FMC+. This delivers an aggregate data bandwidth of over 40 Gigabytes/second. The differential pairs can also be used in single ended mode.

21. What signaling speeds can FMC/FMC+ support?

The standard 80 differential pairs can support up to 2 Gbps and the ‘DP’ signal pairs can support up to 10 Gbps. For FMC+, the data rate is supported up to 28 Gbps.

22. What FPGA devices work with FMCs?

FMCs are intended to work with any FPGA - some FPGAs will support the higher speed capabilities of the high-speed serial channels.

23. What are the power limits of FMC/FMC+?

The FMC/FMC+ Standards define the range of current limits on the power supplies provided to the mezzanine modules. Mezzanine modules shall not dissipate more than 10W. If more than 10Ws are generated onboard the mezzanine module then special considerations must be made on the carrier card to assure that the system is capable of dissipating the power generated.

24. Are clocks sourced on the mezzanine or the carrier cards?

It is possible to source clocks from either the mezzanine module or the carrier cards depending on application, consult the FMC/FMC+ Standards for full details.

25. What carrier card form factors are supported?

FMC/FMC+ does not put a restriction on the carrier card that can be used. FMC/FMC+ has been designed to maximize the number of carrier formats that can be supported. Examples of carrier card formats are VME, VPX, VPX REDI, CompactPCI, CompactPCI Express, Advanced TCA, AMC, PCI and PCI Express carriers, PXI and PXI Express carriers. FMC/FMC+ can also be used on a wide variety of standard motherboard form factors.

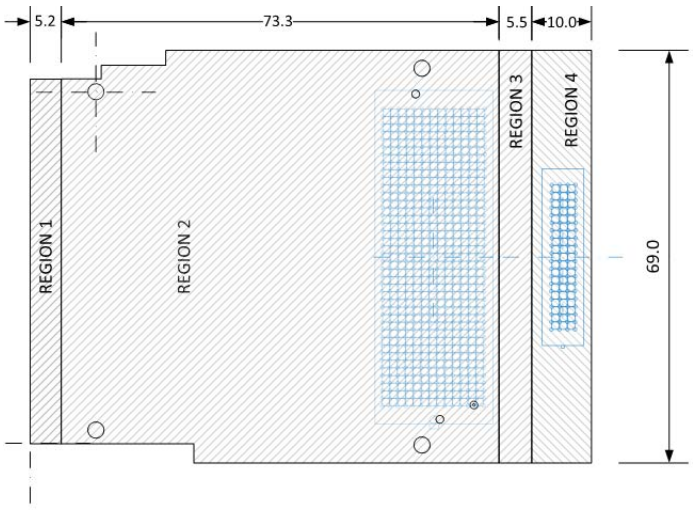
26. Are there any guidelines for using FMCs with a host/carrier card?

The Standard includes examples of usage on 3U and 6U Eurocards.

Appendix A of both Standards has a compatibility check list to help you determine if your particular carrier card will work with FMCs.

27. What are the dimensions of the FMC/FMC+ mezzanine modules?

FMCs are available in single wide (69 mm) and double wide (139 mm) variants. Figure 1 illustrates the three main regions along the length of an FMC+ module. Standard modules include region 1 and 2, and optionally region 3. Conduction-cooled modules include regions 2 and 3. Those using the optional HSPCe in FMC+ will include region 4.



28. How do FMCs compare to other mezzanine form factors like PMC, XMC, or AMC?

FMCs are more compact, have higher module bandwidth than PMC, XMC or AMC, and are intended for interfacing with FPGAs or devices with programmable I/O. The smaller module with its direct connection to the FPGA makes it easier than using a PMC to customize the front-end hardware to the FPGA.

It is also possible to host an FMC+ slot on an AMC card. The FMC+ Standard has examples of this configuration.

29. Are test results available? Where can I find them?

Signal integrity and environmental test reports are available from Samtec.

30. Why or when would you use FMC instead of PMC, XMC, or AMC?

FMC are smaller mezzanine modules and optimized as the physical interface for FPGAs on the carrier card. IO is typically off the faceplate. PMC/XMC/AMC are larger mezzanine modules that typically connect to the PCI/PCIe bus of the main CPU on the carrier card. PMC/XMC typically offer more functionality and have IO on the faceplate or back to the carrier card for connection to the backplane via the PMC/XMC connector.

31. Can you put an FPGA on an FMC/FMC+?

While the Standard does not preclude having an FPGA on the mezzanine module, the Standard has been developed with the assumption that the main FPGA resides on the carrier card.

32. What are some debugging suggestions?

FPGA suppliers like Xilinx have “development” boards specifically for trying out configurations, testing FMC modules, etc. that are not of any form factor but good for initial evaluation / debug.

33. Are extension cables possible with FMC/FMC+?

Yes, but they are not defined as part of the FMC Standard. FMC+ cables are currently in development.

34. Does the FMC+ Standard recommend stand-offs. If so; what vendors, English or metric?

Use cases such as double and triple width mezzanines which feature increased pin counts will benefit from stand-offs. Additionally, to assist in the unmating of high-retention mezzanines, an option is to replace traditional stand-offs with a separation mechanism such as a Jackscrew Stand-off (JSOM), provided by Samtec, or similar mechanism. These applications will benefit from the mechanically-assisted separation provided by the expanding stand-offs. In its compressed condition, a JSOM acts like a traditional standoff, securing PCBs using common M2.5 hardware. Once the nut is removed, the JSOM jackscrew can be unscrewed to separate the mezzanine from its carrier.

35. My application has a different height; does the FMC/FMC+ standard have other mated stack heights planned in the future?

The mating height can be any height, so long as the component envelopes are not violated, which will put upper and lower bounds on the height. 8.5 mm and 10 mm are mentioned in the Standard to give particular examples on how the height could be changed but doesn't specify that they are the only heights.

36. My application has a need for cables to mate with the FMC+ connectors; does the FMC+ Standard cover this?

These are currently in-development and part of the VITA 57.5 "Physical Tools to Aid in FMC+ Development" Technical Work Group. If you have an additional proposal, send an email to VITA at info@vita.com.

Specifics

37. In ANSI/VITA 57.1, Recommendation 6.1: A HPC mezzanine module using signaling standards with differing VIO and VREF requirements can split these requirements between the signaling banks providing two different sets of signals with differing VIO and VREFs. Please elaborate or explain with illustration.

Basically, what the recommendation is saying is that if you have two signaling standards which do not have compatible VIO and/or VREF, then it is recommended that you put one of the signaling standards on Bank A and the other signaling standard on Bank B. This allows it to align with the motivation for VREF_A_ M2C and VREF_B_M2C for example.