General

1. Is 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.

2. Where can I find suppliers of FMC products?

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

3. Where can I find a list of FMC products?

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

4. 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.

5. Where can I get the FMC specification?

The FMC specification is copyrighted and distributed by VITA. It is available free to VITA members and for $100 to non-members. Order online at: https://vita.com/secure/online-store.html.

6. How do I get started with FMCs?

You can purchase the specification 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.

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

The FMC Marketing Alliance 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.

8. Where can I go to learn more?

A list of articles is maintained at www.vita.com/fmc. Check there for the latest information.

9. How can my company get involved with the FMC technical working group or the FMC Marketing Alliance?

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.

10. 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 requirements request to the industry suppliers as a whole.

Technical

11. What are the key features FMCs?

Key features of the FMC specification 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.

12. What are the differences between V1.0 and V1.1 of the FMC specification?

The main differences are:

- Dedicated clocks have ability for bidirectional capability.
- DP pins now support being unconnected.
- DP decoupling capacitor now reside on mezzanine.
- Clarifications and additional illustrations.

13. What is the pinout for FMCs?

Complete details on the pinout are included in the specification.

14. I have an ASP-xxxxxxx FMC connector; what is the mating connector?

There are 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-Gigbit transceivers.

- Mating a HPC connector to a LPC connector, or vice versa, will function, however, some of the pins will be "no connects."

- Lead/Lead-free: Select based on application, some military and medical applications are exempt from the lead free initiatives.

15. What sources are there for the FMC connectors?

Several sources exist for the FMC connectors, Samtec and Molex have suitable connectors. Each supplier provides PADs files, 3D models, and other drawings necessary for you to complete your design.

16. What environmental configurations are available?

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

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

These are complementary specifications to the ANSI/VITA 57.1 FMC specification. 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 of these specifications are currently in development by the VITA 57 working group. Copies are only available to the working group members.

18. How much signaling I/O is available?

FMC has the capability for up to 80 differential pairs of standard I/O signals with a signalling 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. This delivers an aggregate data bandwidth of over 40 Gbytes/second. The differential pairs can also be used in single ended mode.

19. What signalling speeds can FMC support?

The standard 80 differential pairs can support up to 2 Gbps and the 'DP' signal pairs can support up to 10 Gbps.

20. 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.

21. What are the power limits of FMC?

The FMC specification defines 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.

22. 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 specification for full details.

23. What carrier card form factors are supported?

FMC does not put a restriction on the carrier card that can be used. 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 can also be used on a wide variety of standard motherboard form factors.

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

The specification includes examples of usage on 3U and 6U eurocards.

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

25. What are the dimensions of the 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.

Figure 1
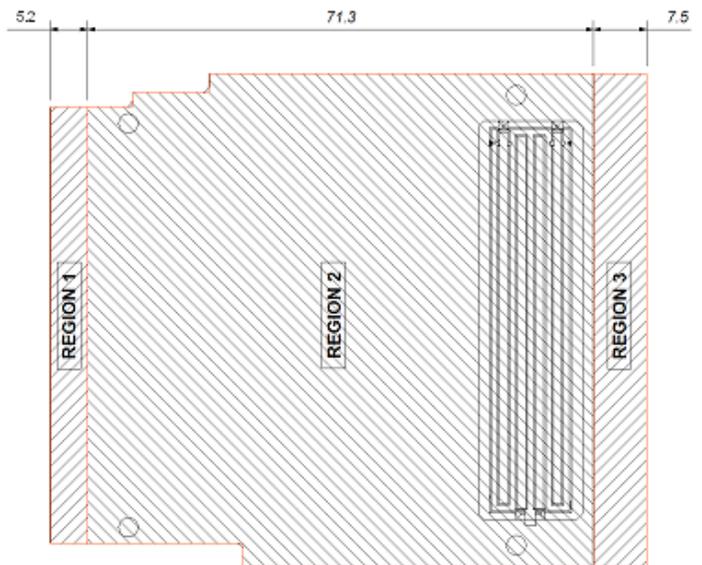
26. How do FMCs compare to other mezzanine form factors like PMC, XMC, or AMC?

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 specification has examples of this configuration.

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

Signal integrity and environmental test reports are available from Samtec.

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

If the system utilizes FPGAs for data handling then FMC would be the preferred choice. PMC, XMC and XMC are more suitable for interfacing to processors. In conduction cooled systems, FMC provides more flexibility for thermal management.

29. Can you put an FPGA on an FMC?

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

30. 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 particular form factor but good for initial evaluation / debug.

31. Are extension cables possible with FMC?

Yes, but they are not defined as part of the FMC specification.

32. Does the FMC specification recommend stand-offs. If so; what vendors, English or metric?

We don't specify the stand-offs, they just need to ensure they do not violate any no go areas. The stand-off will normally be supplied by the mezzanine vendor (or the system integrator themselves) and it would be them that specifies the stand-off type.

33. My application has a different height; does the 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 specification to give particular examples on how the height could be changed, but doesn't specify that they are the only heights.

34. My application has a need for cables to mate with the FMC connectors; does the FMC specification cover this?

Currently this is not within the scope of the FMC specification. But if you have a proposal send an email to VITA at info@vita.com.

35. 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 signalling standards which do not have compatible VIO and/or VREF, then it is recommended that you put one of the signalling standards on Bank A and the other signalling standard on Bank B. This allows it to align with the motivation for VREF_A_M2C and VREF_B_M2C for example.