FMC-10GE

V1.1 10/25/16

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FMC Module with Dual 10 Gb Ethernet Ports

FEATURES

- Two independent 10GBASE-T interfaces with SR-IOV support
- 10 GbE/1 GbE/100 Mb/s copper PHYs integrated on-chip
- PCIe 2.1 (2.5GT/s or 5GT/s), Bus width — x1, x2, x4, x8
- Support for jumbo frames of up to 15.5 KB
- Flow control support: send/receive pause frames and receive FIFO thresholds
- TCP segmentation offload: up to 256 KB
- IPv6 support for IP/TCP and IP/UDP receive checksum offload
- Fragmented UDP checksum offload for packet reassembly
- Message Signaled Interrupts (MSI)
- Message Signaled Interrupts (MSI-X)
- Interrupt throttling control to limit maximum interrupt rate and improve CPU usage
- 128 transmit queues
- Receive packet split header
- Receive header replication
- Dynamic interrupt moderation
- DCA support
- TCP timer interrupts
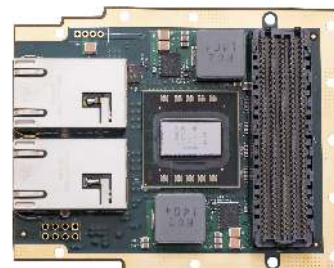- No snoop
- Relaxed ordering

(**Note**: module NIC requires enumeration and control via PCIe root master)

APPLICATIONS

- Remote embedded communications
- Wide area DAQ meshes

SOFTWARE

- Standard Windows/Linux device drivers
- Fast network transfers via supplied C++ libraries and example code

DESCRIPTION

FMC-10GE provides two 10 Gb Ethernet ports on a standard FMC module. Two standard RJ45 connectors support connection to standard CAT6e networks providing high speed connectivity to PCs, servers embedded computers such as Innovative's ePC products or custom, intelligent IO. Aggregated burst rates of up to 20 Gbps are achievable.

The two 10GE ports are fully independent on the module. Monitoring and control signals are mapped to the FMC interface for detection, loss-of-signal, rate and device control.

The FMC-10GE is not VITA 57 compliant. The FMC-10GE is compatible with the Innovative ePC-K7 FMC site 1 only. Use on any other carrier will require mechanical, thermal and electrical customization.

Mechanical: The height of the module exceeds the FMC specification to accomodate the Intel X540 network controller (NIC) and RJ45 ethernet connectors. The FMC connector used on the module is .378" rather than .245" in height.

Thermal: The module dissipates up to 13.5 W necessitating use of a heat spreader capable to conduct heat to the host carrier or chassis.

Electrical: Eight high-speed serial lanes on the FMC connector connect to the X540 NIC, which requires PCIe protocol and signal levels. The X540 must be enumerated and controlled as a slave PCIe device.

The FMC-10GE works with legacy Gigabit Ethernet (GbE) switches and Cat 6A cabling. Install into an ePC-K7 and the auto-negotiation between 1 GbE and 10 GbE provides a smooth transition and easy migration to 10 GbE. When time and budget allows, 10GBASE-T switches can be added to your network to experience the full benefits of 10 GbE.

Software libraries and examples for C++ host development are provided. Application examples demonstrating the module features are provided for Innovative Integration platforms in for Windows and Linux.

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FMC-10GE

ORDERING INFORMATION

| Product	Part No.	Description
FMC-10GE	90101-0-<ER>	FMC-10GE Assembly for ePC-K7: FMC module with two 10GE ports, Intel X540 network interface chip and mounting hardware for ePC-K7. <ER> is environmental rating.
Logic Development Package		
Host Cards		
SBC-K7	90326	FPGA co-processor with dual FMC sites for PCI Express desktop/rackmount applications.
ePC-K7	90502	Conduction-cooled Windows/Linux Embedded Computer with Kintex7 FPGA, dual FMC I/O Sites, Integrated Timing Support
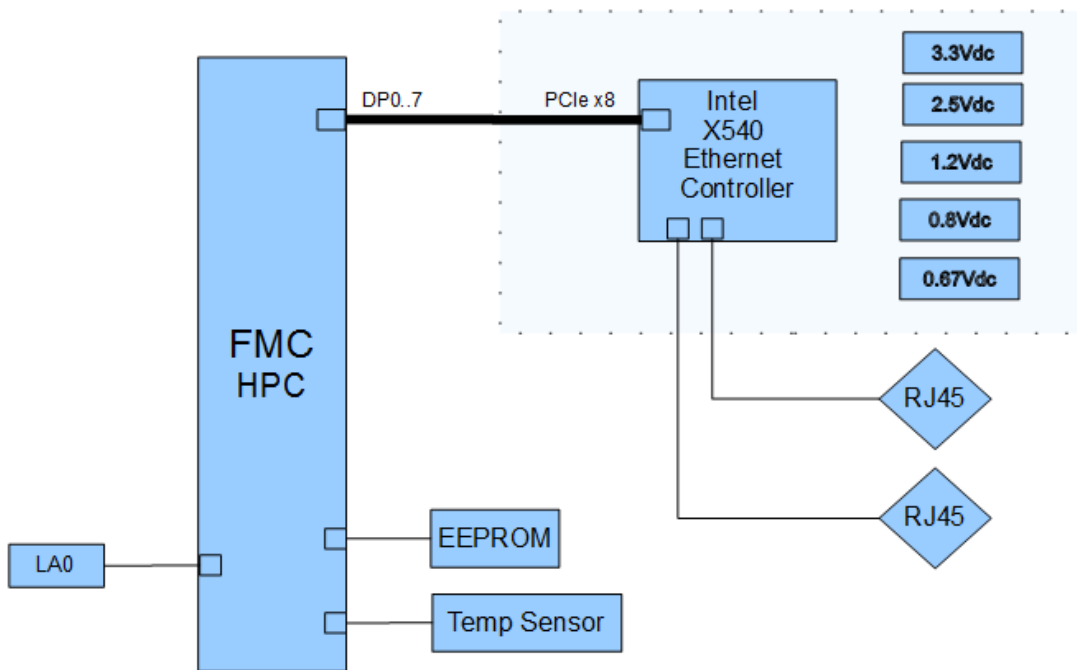
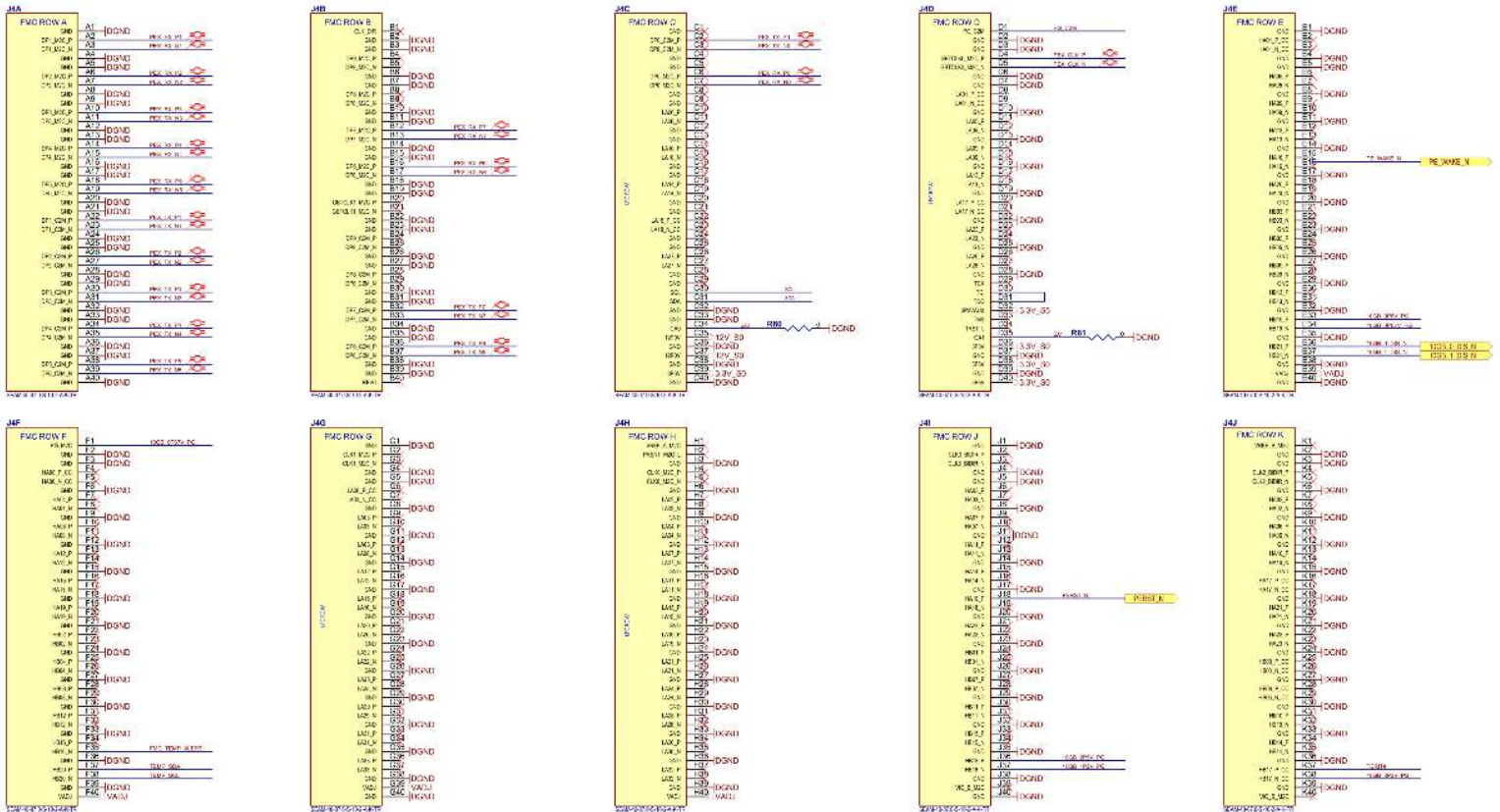**Figure 1. Block Diagram**

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Figure 2. FMC Connections

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Operating Environment Ratings

FMC modules rated for operating environment temperature, shock and vibration are offered. The modules are qualified for wide temperature, vibration and shock to suit a variety of applications in each of the environmental ratings L0 through L4 and 100% tested for compliance.

Environment Rating <ER>		L0	L1	L2	L3	L4
Environment		Office, controlled lab	Outdoor, stationary	Industrial	Vehicles	Military and heavy industry
Applications		Lab instruments, research	Outdoor monitoring and controls	Industrial applications with moderate vibration	Manned vehicles	Unmanned vehicles, missiles, oil and gas exploration
Cooling		Forced Air 2 CFM	Forced Air 2 CFM	Conduction	Conduction	Conduction
Operating Temperature		0 to +50C	-40 to +85C	-20 to +65C	-40 to +70C	-40 to +85C
Storage Temperature		-20 to +90C	-40 to +100C	-40 to +100C	-40 to +100C	-50 to +100C
Vibration	Sine	-	-	2g 20-500 Hz	5g 20-2000 Hz	10g 20-2000 Hz
	Random	-	-	0.04 g^2/Hz 20-2000 Hz	0.1 g^2/Hz 20-2000 Hz	0.1 g^2/Hz 20-2000 Hz
Shock		-	-	20g, 11 ms	30g, 11 ms	40g, 11 ms
Humidity		0 to 95%, non-condensing	0 to 100%	0 to 100%	0 to 100%	0 to 100%
Conformal coating			Conformal coating	Conformal coating, extended temperature range devices	Conformal coating, extended temperature range devices, Thermal conduction assembly	Conformal coating, extended temperature range devices, Thermal conduction assembly, Epoxy bonding for devices
Testing		Functional, Temperature cycling	Functional, Temperature cycling, Wide temperature testing	Functional, Temperature cycling, Wide temperature testing Vibration, Shock	Functional, Temperature cycling, Wide temperature testing Vibration, Shock	Functional, Testing per MIL-STD-810G for vibration, shock, temperature, humidity

Minimum lot sizes and NRE charges may apply. Contact sales support for pricing and availability.

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Standard Features

10GE Ports	
Ports	2 (FMC HPC required)
Type	10Gb Ethernet
Controller-processor	Intel Ethernet Controller X540
Bit Rate	Up to 10 Gbps (dependent on host carrier)
Interface	Per port : I2C bus Status feedback of presence, LOS Control for rate select, enable
Cable Medium	Copper
Cabling Type	RJ-45 Category-6 up to 55 m; Category-6A up to 100 m
PCI-SIG* SR-IOV Capable	Yes
Network Operating Systems (NOS) Software Support	Windows 7 (IA32 and X64) Windows Server 2008 (x64 and IPF) SUSE SLES 10 or later, Professional 9.2 or later Red Hat Enterprise 4 or later FreeBSD 5.x or later support Fedora
Plug and play specification support	Standard

FMC Interface	
Differential Pairs	8 total (8x Tx/Rx pair servicing both 10GE ports) using PCIe 2.1 protocol
Single-ended signals	4 LVCMOS (3.3V)

Power	
Consumption	13.5 W
Power Control	FMC power enable
Heat Sinking	Conduction cooling supported (VITA57 subset)

Physicals	
Form Factor	Non-Standard FMC • Mechanically FMC Compliant • Electrically FMC Non-Compliant • Compatible with ePC-K7 Only Heat spreader required to support 13.5 W dissipation
Size	69 x 87
Weight	80g
Hazardous Materials	Lead-free and RoHS compliant

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Logic Tools

All FMC modules are supplied with example interface code (VHDL) illustrating the module interface and controls. For Innovative cards, the FMC support includes a specific design for each card.

The logic support includes example code, constraints, and a simulation testbench. Application logic uses this code as a starting point for integrating the FMC into target hardware.

Compatible Host Cards

FMC IO modules are supported on a variety of IO platforms, including these Innovative cards.

ePC-K7 (90502)	SBC-K7 (90326)
Combines an industry-standard COM Express CPU module with dual FMC IO modules in a compact, stand alone design	Embedded PC
	Runs Windows/Linux
Programmable Kintex 7 325/410 and Spartan 6 FPGAs	i7 CPU, 4 cores, 2.2 GHz, 16 GB
Small form factor: 5" H x 8" W x 11" D	USB/1000 Ethernet/SATA/IEEE1588
Conduction cooled design: Fins or cold-plate	Touchscreen LCD and DisplayPort support
Stand-alone operation: Able to operate headless, booting from SSD	Removable SDHC boot drive
Windows, Linux OS support	Small and Low Power
Dual VITA 57 FMC IO module sites. Add anything from RF receivers to industrial control modules.	200x160x30mm
IO sites (VITA 42.3) deliver >3000MB/s to CPU memory**	90W (i7) excluding FMC
Integrated timing and triggering support for IO includes GPS, IEEE1588 or IRIG -disciplined clock	Conduction or Air-cooled versions
	FMC I/O sites
Supports Innovative and third-party FMC modules for private data channels, triggering and timing features	Dual VITA 57 module sites with 80 LVDS pairs
USB3.0 x6, Gb Ehernet x2, SATA x4, DisplayPort, Touch Screen	x8 lanes, 6.5 Gbps (x4 shared w/ Ethernet)
Up to 4 SSD or HDD (2.5 in) AC or DC operation	FPGA Computing Core
	Xilinx Kintex7 K160T, K325T, or K410T
	2 memory banks: up to 1GB LPDDR2 DRAM or 8MB QDRII SRAM each
	Communications ports
	10Gb Ethernet with SFP+ fiber optic port
	"Wire Speed" rates support 1GB/s streaming
	Timing Features
	IEEE 1588 and IRIG timing synchronization
	Optional GPS integration
	Clock and trigger I/O for system timing
	Environmental ratings for -40 to 85C and 5g vibe

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Mailing Address: Innovative Integration, Inc.

741 Flynn Rd, Camarillo, California 93012

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