

# FMC-500M

V 0.1 8/13/11



FMC Module with 2x 500 MSPS 14-bit A/D, 2x 500 MSPS 16-bit or 1x 1GSPS DAC with PLL and Timing Controls

## FEATURES

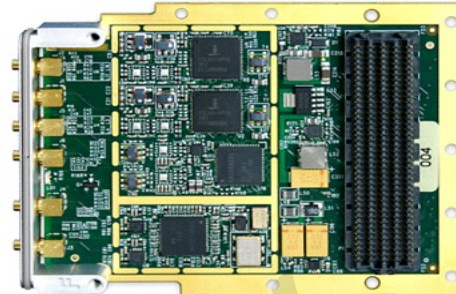
- Two A/D Inputs
- 500 MSPS, 14-bit
  - 250 MSPS, 16-bit option
  - AC or DC coupled
- Two D/A Outputs
  - 500 MSPS, 16-bit D/A
  - 1 GSPS single channel mode
- Sample clocks and timing and controls
  - External clock/reference input
  - Programmable PLL
  - 10 MHz, 0.5 ppm reference
  - Integrated with FMC triggers
- FMC module, VITA 57.1
  - High Pin Count no SERDES required
  - Compatible with 1.2 to 3.3V VADJ
  - Power monitor and controls
- 6W typical (AC-coupled inputs)
- Conduction Cooling per VITA 20 subset
- Environmental ratings for -40 to 85C  
9g RMS sine, 0.1g2/Hz random vibration

## APPLICATIONS

- Wireless Receiver and Transmitter
- LTE, WiMAX Physical Layer
- RADAR
- Medical Imaging
- High Speed Data Recording and Playback

## SOFTWARE

- MATLAB/VHDL FrameWork Logic



## DESCRIPTION

The FMC-500M is a high speed digitizing and signal generation FMC IO module featuring two 500MSPS A/D channels and two 500 MSPS D/A channels supported by sample clock and triggering features.

The FMC-500M features two 14-bit 500MSPS or 16-bit 250 MSPS A/Ds, either AC or DC-coupled, plus two 500MSPS update rate DACs. The DAC can be used a single 1 GHz output channel. Analog IO is either AC or DC coupled. Receiver IF frequencies of up to 250 MHz are supported. The sample clock is from either a low-jitter PLL or external input. Multiple cards can be synchronized for sampling.

The FMC-500M power consumption is 6W for typical operation. The module may be conduction cooled using VITA20 standard and a heat spreading plate. Ruggedization levels for wide-temperature operation from -40 to +85C operation and 0.1 g<sup>2</sup>/Hz vibration. Conformal coating is available.

Support logic in VHDL is provided for integration with FPGA carrier cards. Specific support for Innovative carrier cards includes integration with Framework Logic tools that support VHDL/Verilog and Matlab developers. The Matlab BSP supports real-time hardware-in-the-loop development using the graphical block diagram Simulink environment with Xilinx System Generator for the FMC integrated with the FPGA carrier card.

Software tools for Innovative carrier cards include host development include C++ libraries and drivers for Windows, Linux and VxWorks. Application examples demonstrating the module features are provided.

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Innovative Integration standard warranty. Production processing does not necessarily include testing of all parameters.

08/22/12

## FMC-500M



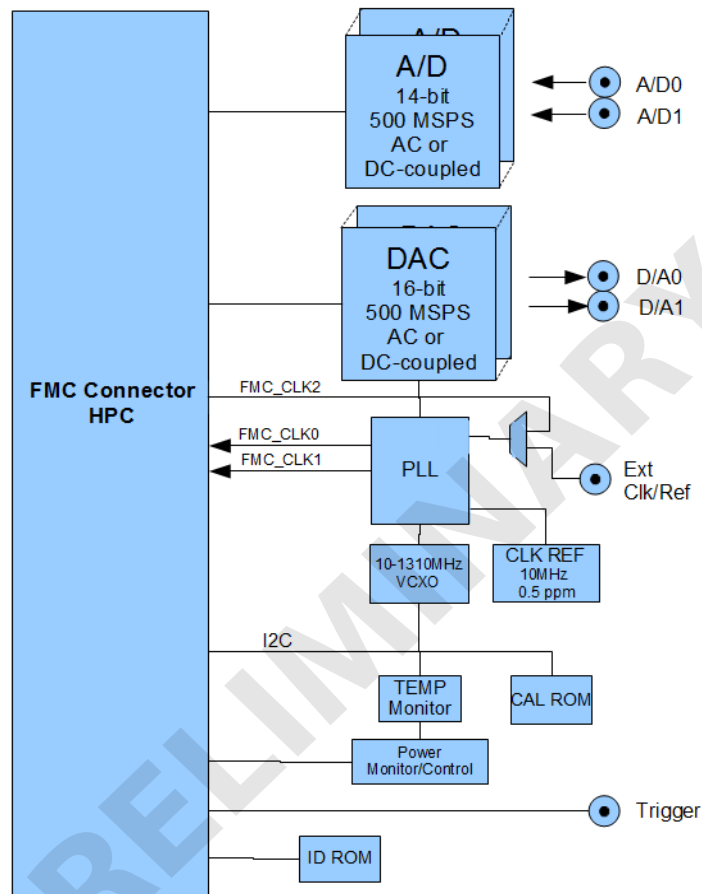
This electronics assembly can be damaged by ESD. Innovative Integration recommends that all electronic assemblies and components circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### ORDERING INFORMATION

Product	Part No.	Description
FMC-500M	80281-0- <ER>	FMC module with two 500 MSPS 14-bit A/Ds, two 500 MSPS DACs, PLL and timing controls, AC-coupled A/D and DACs
FMC-500M	80270-1- <ER>	FMC module with two 500 MSPS 14-bit A/Ds, two 500 MSPS DACs, PLL and timing controls, DC-coupled A/D and DACs
FMC-500M	80270-2- <ER>	FMC module with two 250 MSPS 16-bit A/Ds, two 500 MSPS DACs, PLL and timing controls, AC-coupled A/D and DACs
FMC-500M	80270-3- <ER>	FMC module with two 250 MSPS 16-bit A/Ds, two 500 MSPS DACs, PLL and timing controls, DC-coupled A/D and DACs
<b>Cables</b>		
SSMC to BNC cable	67156	IO cable with SSMC (male) to BNC (male), 1 meter
<b>Carrier Cards</b>		
VPX6-COP	80262	3U VPX FPGA co-processor card with FMC site
PEX6-COP	80284	Desktop/server PCI Express FPGA co-processor card with FMC site
<b>Embedded Computer Hosts</b>		
ePC-K7	80295	Embedded PC with support for one FMC module; COM Express Type 10 CPU; Windows, Linux or VxWorks

# FMC-500M

FMC-500M Block Diagram



# FMC-500M

## Operating Environment Ratings

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 <sup>2</sup> /Hz 20-2000 Hz	0.1 g <sup>2</sup> /Hz 20-2000 Hz	0.1 g <sup>2</sup> /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.

## FMC-500M

### Standard Features

Analog Input	
Inputs	2
Input Range	+/-1V
Input Type	Single ended, AC or DC coupled
Input Impedance	50 ohm
A/D Device	Intersil ISL214P50 (500MSPS, 14-bit) Intersil ISL216P25 (250MSPS, 16-bit)
A/D Resolution	14-bit or 16-bit
A/D Sample Rate	80 MHz to 500 MHz (500MSPS version) 40 MHz to 250 MHz (250MSPS version) lower rates are supported using decimation
Input Bandwidth	400 MHz (-3dB) (AC-Coupled) 250 MHz (-3dB) (DC-Coupled)

Analog Output	
Outputs	2
Output Range	+/-0.5V (DC-coupled) +/-450mV (AC-Coupled)
Output Type	Single ended, AC or DC coupled
Output Impedance	50 ohm
DAC Device	Texas Instruments DAC5682Z
DAC Resolution	16-bit
DAC Update Rate	1000 MHz max, single channel mode 500 MHz max, dual channel mode
Interpolation	None, 2x, 4x
Output Bandwidth	450 MHz (-3dB) (AC-Coupled) 220 MHz (-3dB) (DC-Coupled)

Clocks and Triggering	
Clock Sources	PLL or External
	0.3125 to 1000 MHz
PLL Reference	External or 10MHz on-card 10MH ref is +/-250ppb -40to +85C
PLL Resolution	100 kHz Tuning Resolution
Phase Noise	-130 dBc @ 100 kHz
Triggering	External, software, acquire N frame
Decimation	1:1 to 1:4095 in FPGA
Channel Clocking	All channels are synchronous
Multi-card Synchronization	External triggering input is used to synchronize sample clocks or an external clock and trigger may be used.

FMC Interface	
IO	LA[33:0] pairs, HA[22:0] pairs, HB[12:0] pairs
IO Standards	LA: LVDS HA: LVDS HB : LVCMOS 1.2V to 3.3V
Required voltages	3.3V, 3.3V AUX VADJ = 1.2V to 3.3V

## FMC-500M

Power	
Consumption	6W total 3.3V @ 1.7A 3.3V AUX @ 0.05A VADJ @ 0.1A
Heat Sinking	Conduction cooling supported (VITA20 subset)
Physicals	
Form Factor	FMC VITA 57.1 single-width
Size	76.5 x 69 mm 10 mm mounting height
Weight	100g
Hazardous Materials	Lead-free and RoHS compliant

PRELIMINARY

# FMC-500M

## ELECTRICAL CHARACTERISTICS

Over recommended operating free-air temperature range at 0°C to +60°C, unless otherwise noted.

Parameter	Typ	Units	Notes
<b>A/D Channels</b>			
Analog Input Bandwidth	250	MHz	-3dB, DC coupled inputs
	400	MHz	-3dB, AC coupled inputs
Analog Input Passband Flatness	0.5	dB	0 to 200 MHz, DC Coupled
	0.3	dB	0 to 200 MHz, AC Coupled
Broadband SFDR	69	dB	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, DC Coupled
	80.2	dB	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, DC Coupled
SFDR, 70 MHz carrier +/-5 MHz band	90	dB	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, DC Coupled
	95	dB	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, DC Coupled
Harmonic Distortion	-58	dB	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, DC Coupled
	-90.7	dB	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, DC Coupled
ENOB	10.1	bits	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, DC Coupled
	11.1	bits	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, DC Coupled
SNR	62.7	dB	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, DC Coupled
	68.4	dB	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, DC Coupled
Crosstalk	< -95	dB	Measured channel grounded with a 70.5 MHz, 95% FS sine input on other channel
Noise Floor	-100	dB	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, AC Coupled
	-105	dB	Fin = 70 MHz, 95% FS, sine sampled at 400 MSPS; Broadband DC to 200 MHz, AC Coupled
Offset Error	700	µV	Factory calibration, average of 64K samples after warmup.
Gain Error	<0.5	%	Factory calibration after warmup.

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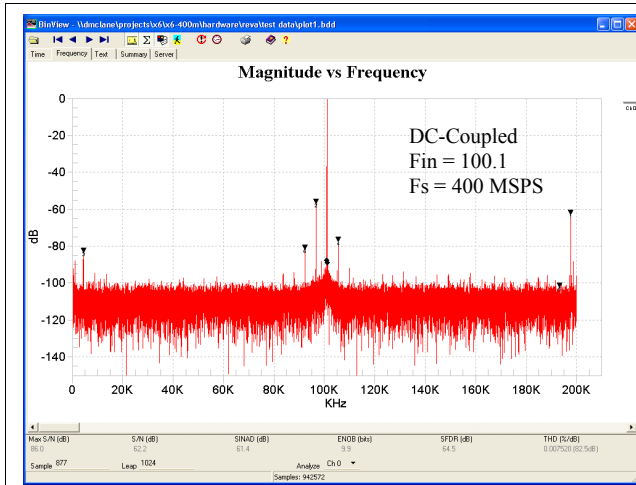
## ELECTRICAL CHARACTERISTICS

Over recommended operating free-air temperature range at 0°C to +60°C, unless otherwise noted.

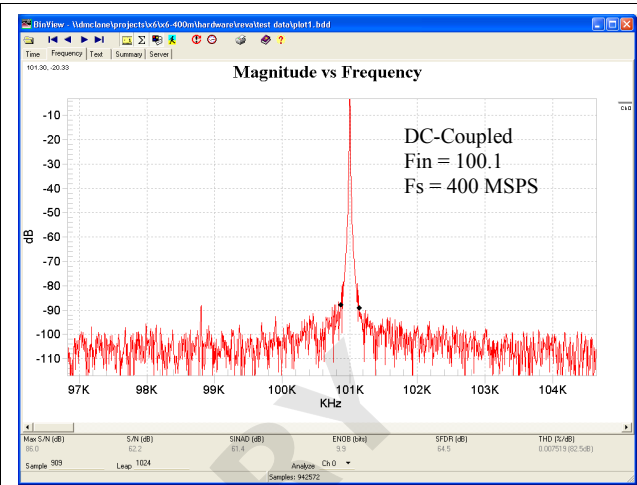
Parameter	Typ	Units	Notes
<b>DAC Channels</b>			
Analog Output Range	+/-450	mV	Typical, AC Coupled
	+/-500	mV	Typical, DC Coupled
Analog Output Bandwidth	220	MHz	DC Coupled, no sinc compensation
	200	MHz	AC Coupled, no sinc compensation
Output Amplitude Variation	0.7	dB	0-100 MHz, DC Coupled, no sinc compensation
	0.8	dB	1-100 MHz, AC Coupled, no sinc compensation
SFDR	66	dB	70.1 MHz sine output, -6 dBfs, AC coupled
	50	dB	70.1 MHz sine output, -6 dBfs, DC coupled
S/N	59.7	dB	70.1 MHz sine output, -6 dBfs, AC coupled
	58	dB	70.1 MHz sine output, -6 dBfs, DC coupled
THD	-62	dB	70.1 MHz sine output, -6 dBfs, AC coupled
	-49	dB	70.1 MHz sine output, -6 dBfs, DC coupled
Intermodulation Distortion	<-75	dB	70+/-0.1 MHz, -6dBfs, AC Coupled
Channel Crosstalk	<-85	dB	Aggressor = 125.1 MHz, -3 dBfs adjacent channel
Noise floor	-100	dB	AC or DC output
Gain Error	<0.02	% of FS	Calibrated
Offset Error	<10	mV	Calibrated



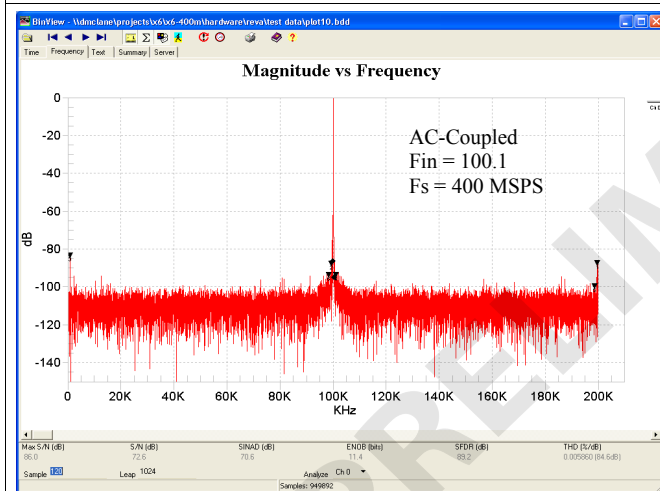
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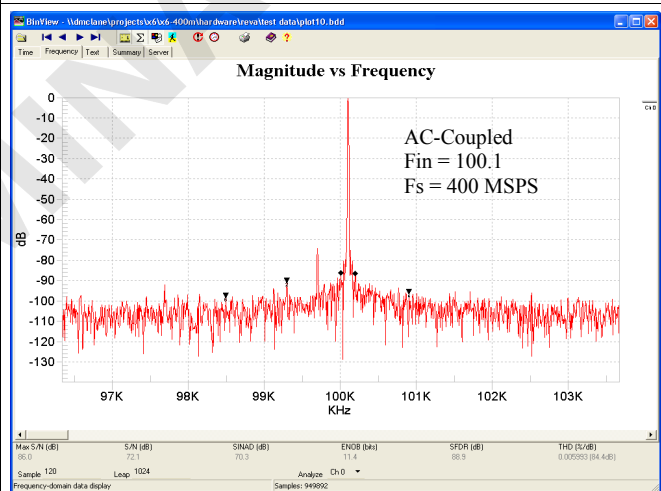
DC-Coupled A/D wideband signal quality, Fin = 101MHz, Fs = 400 MHz onboard PLL. Channel 0, 15 pF parallel cap at A/D device inputs



DC-Coupled A/D narrowband signal quality, Fin = 101 MHz, Fs = 400 MHz onboard PLL. Channel 0, 15 pF parallel cap at A/D device inputs

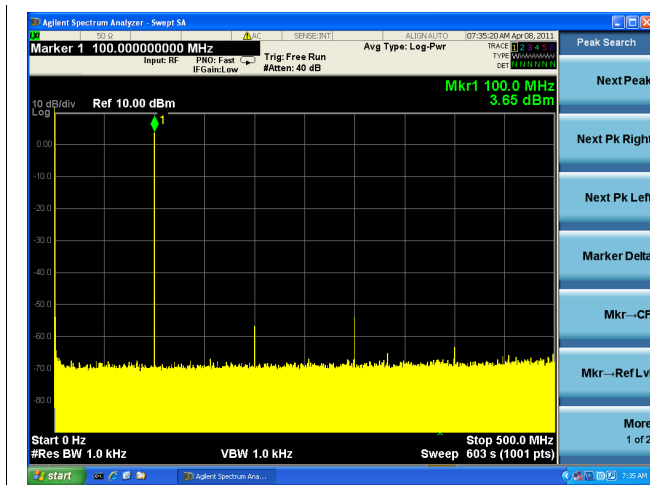


AC-Coupled A/D wideband signal quality, Fin = 101MHz, Fs = 400 MHz onboard PLL. Channel 0, 15 pF parallel cap at A/D device inputs

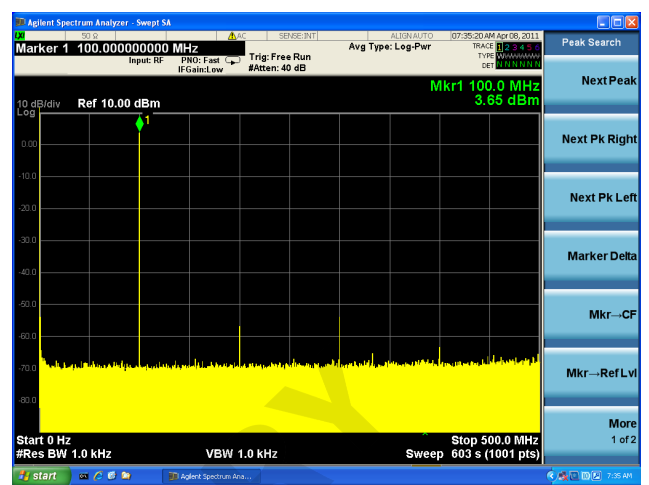


AC-Coupled A/D narrowband signal quality, Fin = 101 MHz, Fs = 400 MHz onboard PLL. Channel 0, 15 pF parallel cap at A/D device inputs

# FMC-500M



**DC-Coupled Output Signal Quality for  $F_{out} = 100.1\text{MHz}$ ,  $F_s = 1\text{GSPS}$ .**



**AC-Coupled Output Signal Quality for  $F_{out} = 100.1\text{MHz}$ ,  $F_s = 1\text{GSPS}$ .**

PRELIMINARY

## FMC-500M

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