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FMC LPC Breakout

DS#T0003 REV 2026/11/24
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Breakout board for Low-Pin Count FPGA Mezzanine Cards

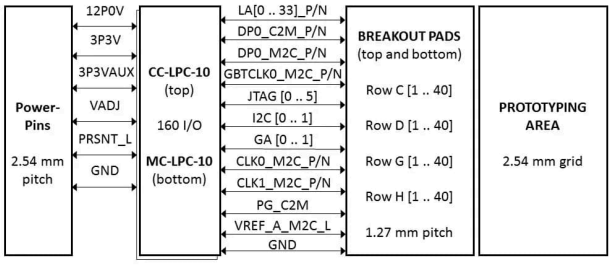
Features

- ANSI/VITA 57.1 compliant
- Commercial grade form factor
- Low-pin count (LPC) connectors
- Breakout of carrier card connector
- Breakout of mezzanine card connector
- Stackable assembly
- Separate breakout of power pins
- Breakout pads with 1.27 mm pitch
- Prototyping area with 2.54 mm grid
- Open-source hardware

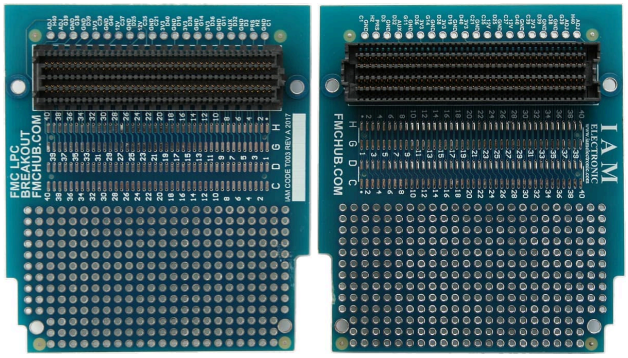
Applications

- Easy prototyping
- Testing and debugging of FMC modules
- Research and education with FPGAs

Block diagram



The photos below show the bottom side with LPC mezzanine card connector (MC-LPC-10) and top side with LPC carrier card connector (CC-LPC-10).



Bottom side Top side

1. Description

The **FMC LPC Breakout board** is a passive adapter for accessing all signals of *ANSI/VITA 57.1 FPGA Mezzanine Card (FMC) Standard* compliant low-pin count (LPC) connectors. All pins of the connector's rows C, D, G, and H are routed to a separate pad array on the top and bottom side. These pads were placed at a 1.27 mm pitch to easily attach additional probes or solder wires. For special measuring tasks or for use as a stand-alone carrier, the power pins of the connector were routed to additional vias in the back of the module. Furthermore, simple electrical circuits can be realized on the prototyping area, which is a field of non connected vias with a pitch of 2.54 mm. The FPGA mezzanine card has commercial grade form factor (single width, 78.80 mm x 69 mm) and is designed for air cooling.

2. Application information

The FMC LPC Breakout module is predestined for four typical applications:

1. Passive FMC module

The board can be used as a passive FMC module or breadboard. Functionality must be realised by external circuitry on the prototyping area.

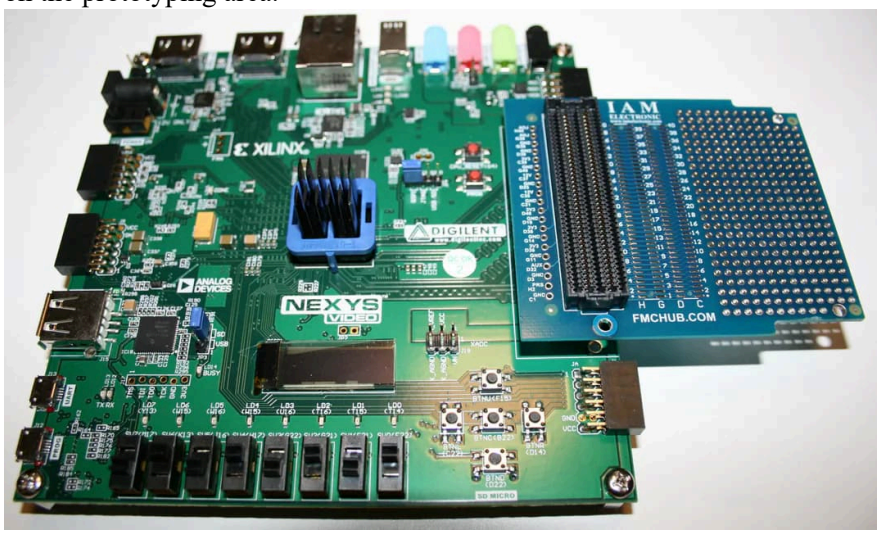


Fig. 1: FMC LPC Breakout module plugged on carrier board (Digilent Nexys Video™ Board, 410-316).

2. Simple FMC carrier

The module can also be used as simple FMC carrier board. This card cannot be used to implement a whole application, but basic functions can be provided. For example, the correct behavior of an attached FMC module can be verified by providing an external power supply through the FMC LPC Breakout board. Or even a simple I2C programmer and reader for a FRU (field replaceable unit) record can be implemented with this carrier board as a basis.

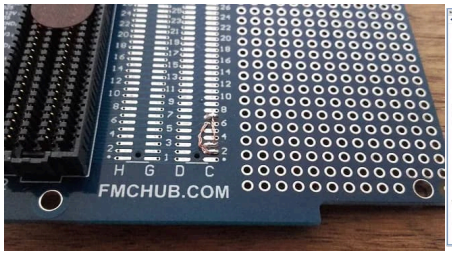
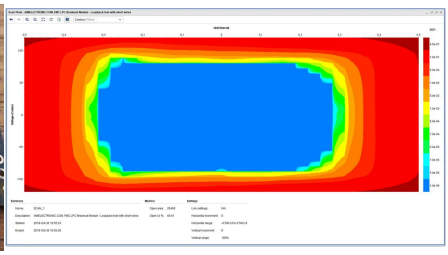
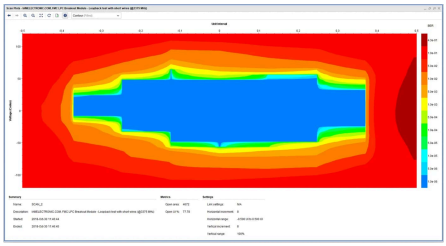
3. Test point insertion (stacked assembly)

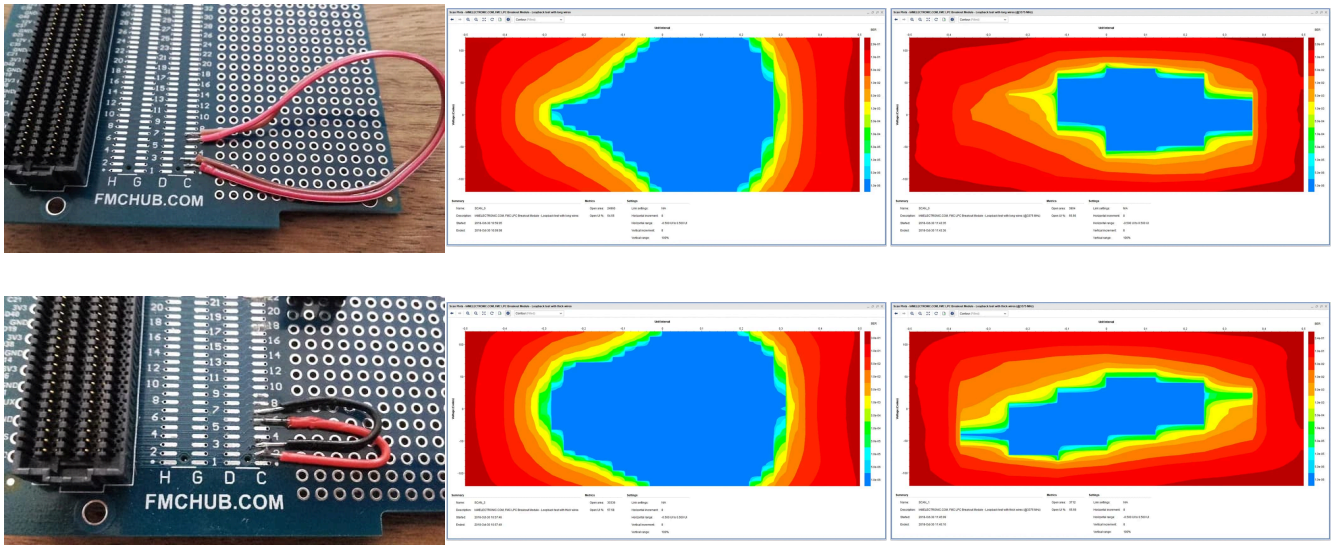
The most reasonable application of the module is probably its use as an external test point array for devices under test. The connectors on the top and bottom allow the stacking of at least two external FMC boards. Thus the FMC LPC Breakout module in the middle of the stack between a carrier and mezzanine card provides test points for all signals passing through the connectors. With such a configuration, a real world FMC setup can be evaluated and debugged.

4. Loopback testing

For the implementation of high-speed data links with FPGAs, loopback testing is a useful method for evaluating performance of the carrier platform and verifying the FPGA design. The FMC LPC Breakout Module can be hooked up as loopback device by shorting the appropriate pins on the board. We have checked different soldered wire connections at two line rates (1.350 Gbit/s and 3.375 Gbit/s) with Xilinx IBERT core on Xilinx Artix-7 FPGA (XC7A200T-1SBG484C). All the loose cable connections from Tab. 1 were capable of transmitting pseudorandom binary sequence patterns (7-bit PRBS pattern) at the tested data rates without any errors.

Tab. 1: FMC LPC Breakout Module with different soldered wire connections for shorting the loopback. The eye scans were recorded with Xilinx IBERT core for GTP transceivers on a Artix-7 FPGA (XC7A200T-1SBG484C).

Soldered wire connection	Eye scan at 1.350 Gbit/s	Eye scan at 3.375 Gbit/s
		



For more demanding loopback applications (higher data rates, multiple lanes, etc.) we recommend the use of our **FMC Loopback Module**.

General information
Depending on the application, it is recommended to solder additional pin headers to the power pin array and to the breakout pad array. Standard pin headers are suitable and fit the PCB layout.

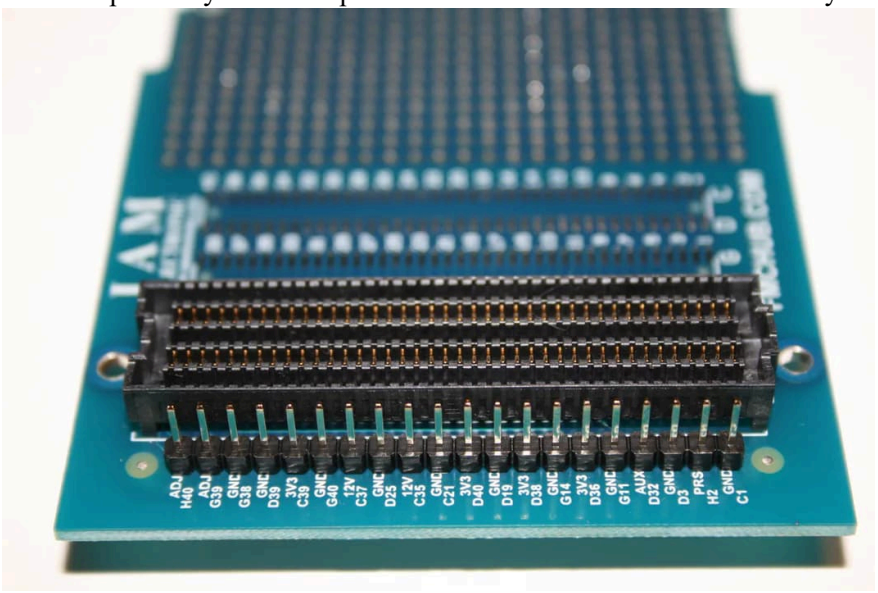


Fig. 2: FMC LPC Breakout module with separate power vias and equipped pin headers (20 pos., 2.54 mm pitch).

3. Electrical data (pin description)

The printed circuit board is open-source hardware! You can download the FMC LPC breakout board schematics and PCB layout files in their latest revision from GitHub. The parts list (see tab. 2) is very simple, because it consists of only two parts.

Tab. 2: Parts list of the FMC LPC Breakout board.

FMC connector	Samtec part no.	Molex part no.	Description
1. CC-LPC-10	ASP-134603-01	45971-4305	female, baseboard side, Low-pin count (LPC), 160 I/O, tin-lead
2. MC-LPC-10	ASP-134604-01	45970-4305	male, mezzanine card side, Low-pin count (LPC), 160 I/O, lead-free, 10 mm mated stack height

A description of the signals from the LPC connector can be found at /knowledge/fmc/pinouts/.

The ANSI/VITA 57.1 FMC standard describes different power supply pins on the LPC connector. The most important are routed to a separate via row next to the FMC connector in the back of the module (see fig. 3).

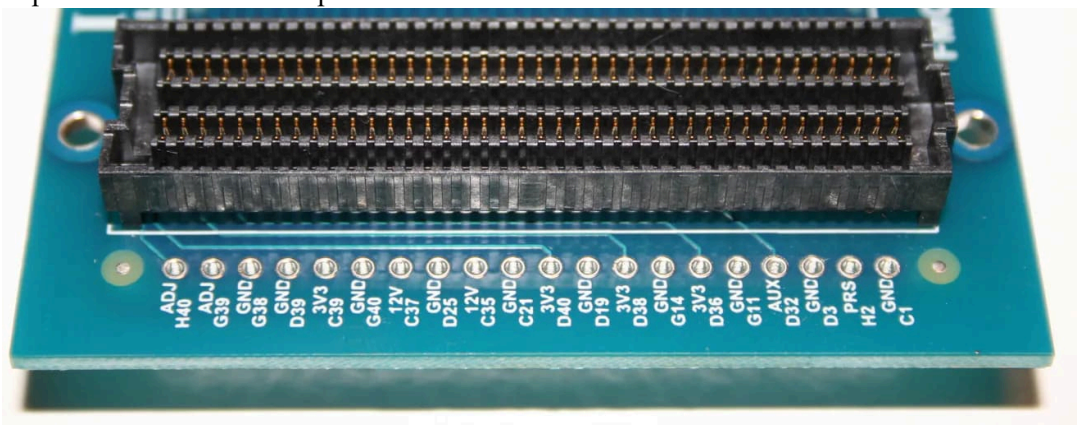


Fig. 3: FMC LPC Breakout board with separate power vias (2.54 mm pitch).

A list of the power supply pins provided by the via row is shown in tab. 3.

Tab. 3: Power pin vias and their signal names, locations, and trace widths on the PCB.

Signal name	Source	Destination	Trace width
VADJ	H40	Power Via #1	0.254 mm (10 mil)
VADJ	G39	Power Via #2	0.254 mm (10 mil)
GND	G38	Power Via #3	0.254 mm (10 mil)
GND	D39	Power Via #4	0.254 mm (10 mil)
3P3V	C39	Power Via #5	0.254 mm (10 mil)
GND	G40	Power Via #6	0.254 mm (10 mil)
12P0V	C37	Power Via #7	0.254 mm (10 mil)
GND	D25	Power Via #8	0.254 mm (10 mil)
12P0V	C35	Power Via #9	0.254 mm (10 mil)
GND	C21	Power Via #10	0.254 mm (10 mil)
3P3V	D40	Power Via #11	0.254 mm (10 mil)
GND	D19	Power Via #12	0.254 mm (10 mil)
3P3V	D38	Power Via #13	0.254 mm (10 mil)
GND	G14	Power Via #14	0.254 mm (10 mil)
3P3V	D36	Power Via #15	0.254 mm (10 mil)
GND	G11	Power Via #16	0.254 mm (10 mil)
3P3VAUX	D32	Power Via #17	0.254 mm (10 mil)
GND	D3	Power Via #18	0.254 mm (10 mil)
PRSNT_M2C_L	H2	Power Via #19	0.254 mm (10 mil)
GND	C1	Power Via #20	0.254 mm (10 mil)

The signals from the LPC connector are routed to an array of pads (fig. 4).

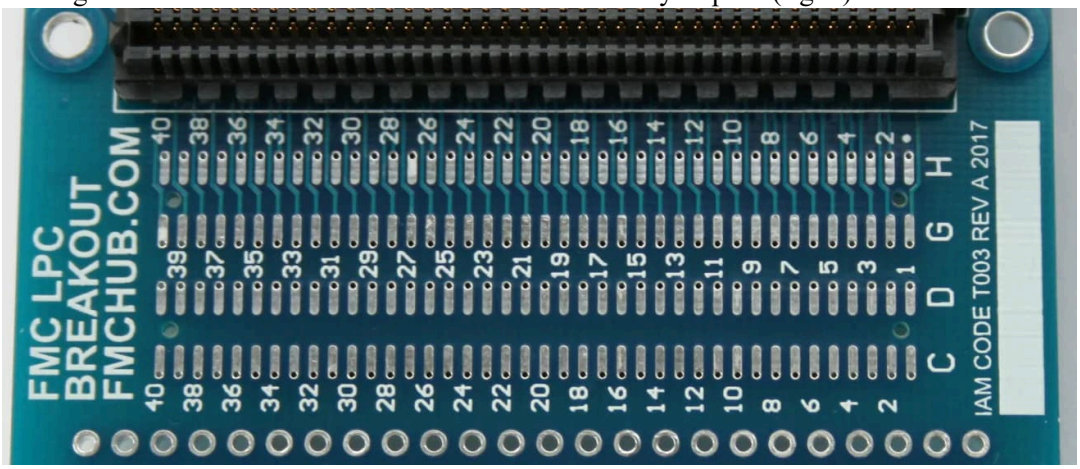


Fig. 4: FMC LPC Breakout board with an array of pads (1.27 mm pitch) for general purpose access to ANSI/VITA 57.1 signals.

Tab. 4: Signals of the ANSI/VITA 57.1 FMC LPC connector and pad array.

Pin #	Row H	Row G	Row D	Row C
1	VREF_A_M2C	GND	PG_C2M	GND
2	PRSNT_M2C_L	CLK1_M2C_P	GND	DP0_C2M_P
3	GND	CLK1_M2C_N	GND	DP0_C2M_N
4	CLK0_M2C_P	GND	GBTCLK0_M2C_P	GND
5	CLK0_M2C_N	GND	GBTCLK0_M2C_N	GND
6	GND	LA00_P_CC	GND	DP0_M2C_P
7	LA02_P	LA00_N_CC	GND	DP0_M2C_N
8	LA02_N	GND	LA01_P_CC	GND
9	GND	LA03_P	LA01_N_CC	GND
10	LA04_P	LA03_N	GND	LA06_P
11	LA04_N	GND	LA05_P	LA06_N
12	GND	LA08_P	LA05_N	GND
13	LA07_P	LA08_N	GND	GND
14	LA07_N	GND	LA09_P	LA10_P
15	GND	LA12_P	LA09_N	LA10_N
16	LA11_P	LA12_N	GND	GND
17	LA11_N	GND	LA13_P	GND
18	GND	LA16_P	LA13_N	LA14_P
19	LA15_P	LA16_N	GND	LA14_N
20	LA15_N	GND	LA17_P_CC	GND
21	GND	LA20_P	LA17_N_CC	GND
22	LA19_P	LA20_N	GND	LA18_P_CC
23	LA19_N	GND	LA23_P	LA18_N_CC
24	GND	LA22_P	LA23_N	GND
25	LA21_P	LA22_N	GND	GND
26	LA21_N	GND	LA26_P	LA27_P
27	GND	LA25_P	LA26_N	LA27_N
28	LA24_P	LA25_N	GND	GND
29	LA24_N	GND	TCK	GND
30	GND	LA29_P	TDI	SCL
31	LA28_P	LA29_N	TDO	SDA
32	LA28_N	GND	3P3VAUX	GND

33	GND	LA31_P	TMS	GND
34	LA30_P	LA31_N	TRST_L	GA0
35	LA30_N	GND	GA1	12P0V
36	GND	LA33_P	3P3V	GND
37	LA32_P	LA33_N	GND	12P0V
38	LA32_N	GND	3P3V	GND
39	GND	VADJ	GND	3P3V
40	VADJ	GND	3P3V	GND

Please note that all Ground pins on the FMC LPC Breakout board are **not** tied together. This also applies to all other pins with identical function on the connector. Traces from the LPC connector to the breakout pads have a minimum width of 0.127 mm (5 mil).

4. Mechanical data

The board outline is defined by ANSI/VITA 57.1 standard for single width FMC modules. The board includes region 2 and region 3 of that standard. Region 1 for additional I/O connectivity with a front panel has been omitted, such that absolute board dimensions are 78.80 mm x 69 mm. Cut outs on board shape have a radius of 1 mm. Exact dimensions are given in figure 5.

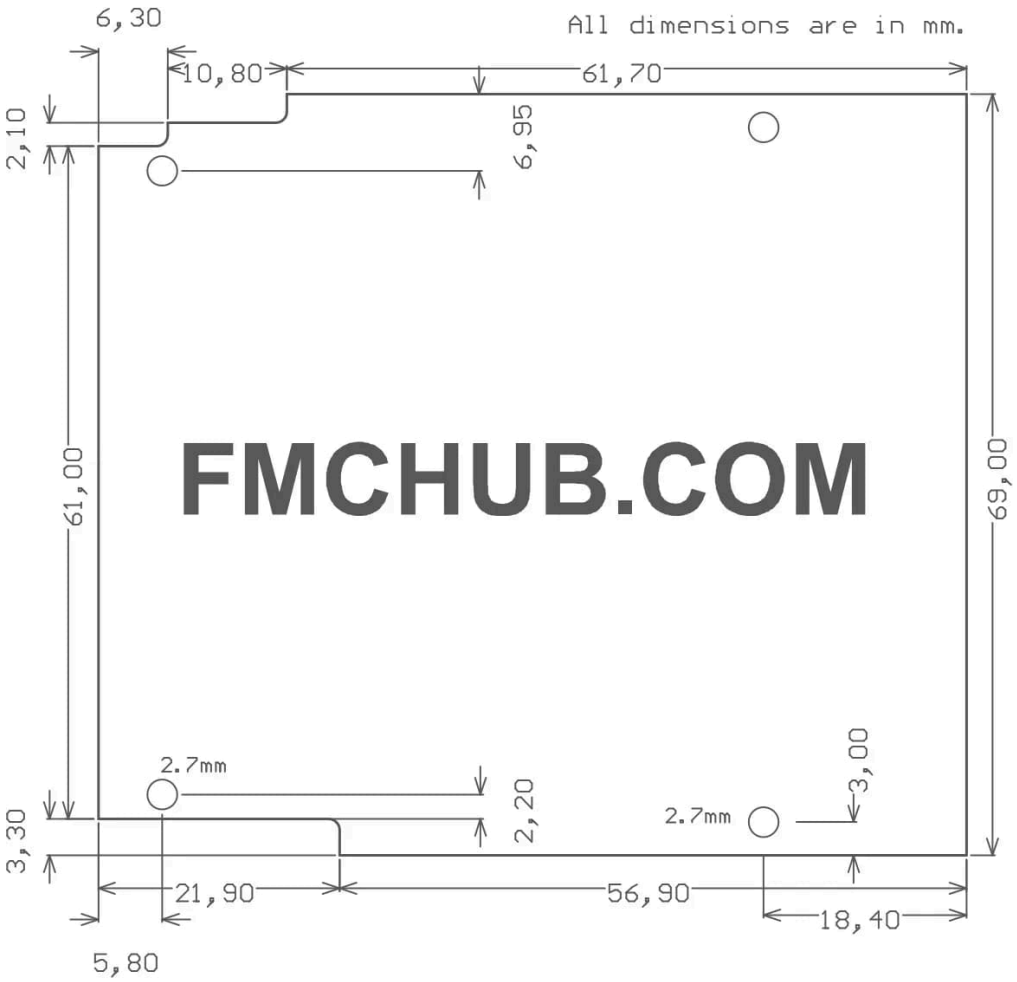


Fig. 5: Mechanical drawing of the FMC LPC breakout board.

The mounting holes are plated but have no electrical connection. Their sizes and positions are in accordance with ANSI/VITA 57.1 single width FMC modules with commercial grade mounting (air cooled).

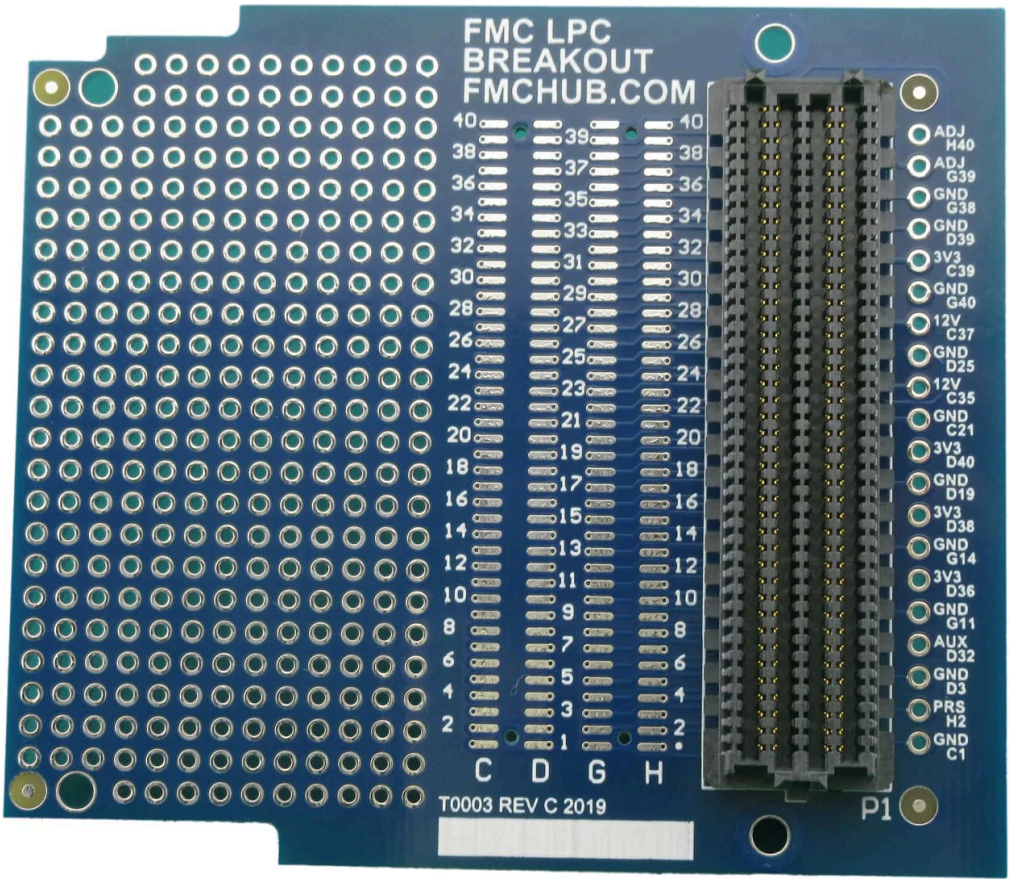


Fig. 6: Product photo of FMC LPC breakout board (bottom view).

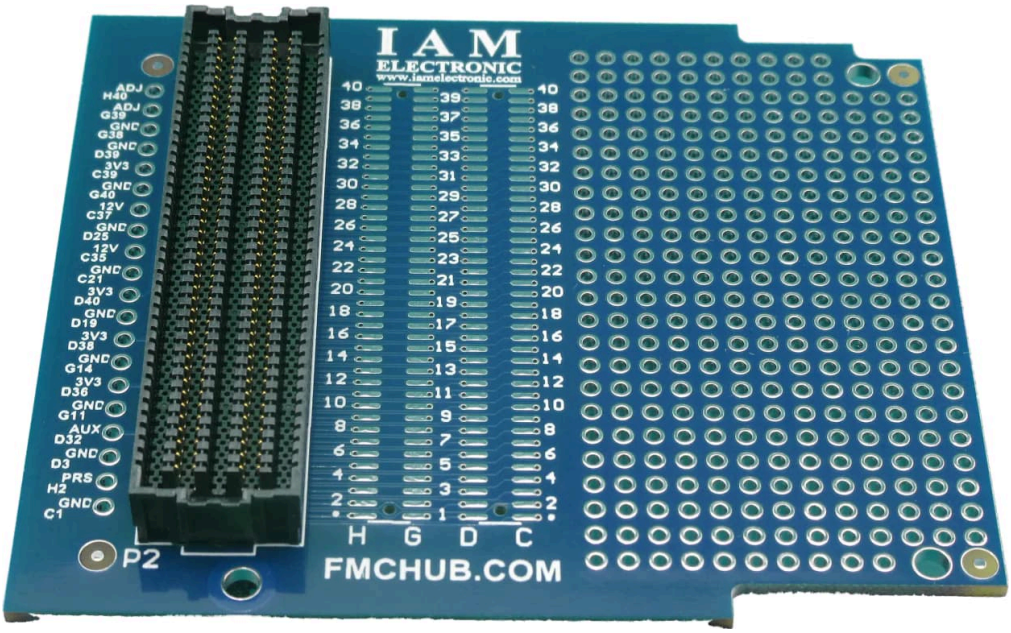


Fig. 7: Product photo of FMC LPC breakout board (top view).

5. Ordering information

The FMC LPC Breakout module can be ordered at various online market places, or you can request a quotation by sending an e-mail to info@iamelectronic.com.

Tab. 5: Assembly variants of FMC LPC Breakout board with product numbers and market places.

Product no.	Description	Market place	Request quote	Standard lead time

T0003	FMC LPC Breakout module with both MC-LPC-10 and CC-LPC-10 connectors on bottom and top side.	IAM Electronic Shop Ebay #183804369803 Tindie #11490 DigiKey 6068-T0003-ND Amazon B0CDHJJCDC	info@iamelectronic.com	Normally in stock, otherwise 3 weeks
T0003MC	FMC LPC Breakout module only with MC-LPC-10 connector on bottom side.	not available (request quote)	info@iamelectronic.com	Normally in stock, otherwise 3 weeks
T0003CC	FMC LPC Breakout module only with CC-LPC-10 connector on top side.	not available (request quote)	info@iamelectronic.com	Normally in stock, otherwise 3 weeks

Related products with similar or improved features

T0017	FMC HPC-U.FL Debug Board with both MC-HPC-10 and CC-HPC-10 connectors on bottom and top side.	IAM Electronic Shop Ebay #187227314198 Tindie #38762 DigiKey 6068-T0017-ND	info@iamelectronic.com	Normally in stock, 6 weeks
T0018	FMC HPC to LPC Breakout module with both MC-HPC-10 and CC-HPC-10 connectors on bottom and top side.	IAM Electronic Shop Ebay #186883255131 Tindie #37080 DigiKey 6068-T0018-ND	info@iamelectronic.com	Normally in stock, 6 weeks

6. Document history

Document number:
DS#T0003

Version history:
2026/11/24: Corrections: table references, units of the loopback line rates (Gbit/s), number of applications, download source of the design files, links

2026/05/05: Added Amazon link to ordering information
2025/08/07: Added related products to ordering information
2025/04/03: Added ordering information DigiKey
2025/01/16: Added ordering information for FMC HPC to LPC Breakout module
2018/10/30: Added loopback testing results to 2. Application information
2018/08/23: Added Designspark Marketplace to 6. Ordering information
2018/03/15: Added Standard lead times to 5. Ordering information
2018/02/22: Added links for schematics and pcb files, update ordering information
2018/02/14: Minor changes (wording, formatting, etc.)
2018/02/13: Initial release