

UM/0101/3 October 2012

Features

- CMX7x1x *FirmASIC*[®] Product Range Evaluation
- CMX188 Product Evaluation
- On-board Supply Regulators: Operation from a Single +5V Supply

PE0101 Evaluation Kit User Manual

Advance Information

- Command and Control by PC via:
 - PE0002 Universal Interface Card or
 - User's µC Development Application or
 - User's µC Emulator



1 Brief Description

The PE0101 Platform Evaluation Kit is designed to assist in the demonstration, evaluation and application development of the CMX188¹ and CMX7x1x range of *FirmASIC*[®] products. The kit is in the form of a populated PCB comprising a CMX7x1x IC and appropriate supporting components and circuitry.

The board also incorporates all of the necessary power supply regulation facilities for operation from a single 5 volt supply.

The board is fitted with a C-BUS connector allowing the PE0101 to be operated by connection to either of the two C-BUS ports on a CML PE0002 Interface Card, and used with the associated PC GUI software, or by direct connection between the CMX7x1x C-BUS and the user's μ C development application or emulation system.

The CMX7x1x Function ImageTM (FI) can be loaded, on power-up, directly into the on-board target IC (CMX7x1x) using the PE0002 interface or the user's system.

¹ Hereinafter, references to the CMX7x1x range of products should also include reference to the CMX188.

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Function images suitable for the CMX7x1x range of products can be downloaded from the CML Technical Portal. A separate overlay is available for each product which can be evaluated with the PE0101, since the pin-names and jumper settings are dependent on the evaluation device which is fitted to this board. These overlays can be obtained from the CML Technical Portal [http://www.cmlmicro.com/].

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It is always recommended that you check for the latest product datasheet version from the Datasheets page of the CML website: [www.cmlmicro.com].

Note that text shown in pale grey indicates features that will be supported in future versions of this Evaluation Kit.

1.1 **History**

Version	Changes	Date
3	Expanded product range to include CMX188	23 rd Oct '12
	Mentioned the existence of product overlays for the PE0101 kit	
	Details of TP8 (ext bias) added	
	Added a reminder about jumper settings and the different device pin names	
2	New photograph and PCB layout diagrams (top and bottom)	2 nd July '12
	Table 3 (Jumpers) – Jumper added to J14, pins 5 and 6 (to connect TEST	-
	(SYNC) pin to ground).	
1	Original document.	11 th April '12



Figure 1 Block Diagram

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2 Preliminary Information

The PE0101 is designed to support the CMX7x1x range of $FirmASIC^{\otimes}$ devices using their respective Function ImageTM.

The CMX7x1x IC fitted to the PE0101 is a special evaluation IC with the architecture of all CMX7x1x series ICs. The functionality of this evaluation IC is obtained from the relevant Function ImageTM (FI); evaluation FIs are downloaded from the CML Technical Portal. Each Function ImageTM can represent a different set of features.

2.1 Laboratory Equipment

The following laboratory equipment is needed to use this evaluation kit:

A 5V dc regulated power supply.

If the PE0101 is being used with the PE0002 Interface Card, the following items will also be required:

- 1. An IBM compatible PC with the following requirements:
 - One of the following Windows operating systems installed: Win7sp1, XPsp2 or 2000sp4.
 - USB port.
 - Minimum screen resolution of 800 x 600. Recommended resolution of 1024 x 768.
- 2. A USB type A male-to-mini B male cable.
- 3. Software application ES000243.exe, or later version, installed on the PC.

2.2 Handling Precautions

Like most evaluation kits, this product is designed for use in office and laboratory environments. The following practices will help ensure its proper operation.

2.2.1 Static Protection

This product uses low-power CMOS circuits that can be damaged by electrostatic discharge. Partially damaged circuits can function erroneously, leading to misleading results. Observe ESD precautions at all times when handling this product.

2.2.2 Contents - Unpacking

Please ensure that all the items on the separate information sheet (EK0101) have been received and notify CML within seven working days if the delivery is incomplete.

2.3 Approvals

This product is not approved to any EMC or other regulatory standard. Users are advised to observe local statutory requirements, which may apply to this product.

3 Quick Start

This section is divided into two sub-sections. The first is for those users who are using the PE0101 with a PE0002 controller card and associated Windows PC GUI software. The second is for users who are using the PE0101 by itself, without a PE0002.

3.1 With PE0002

Note that the C-BUS connector J10 and the power connector J5 are both right-angle headers and are designed to plug directly into sockets J5 (C-BUS 1 port) and J9 respectively, or sockets J3 (C-BUS 2 port) and J7 respectively, of a PE0002. Power is supplied to the pair of boards either via connector J8 on the PE0101 or via connector J8 on the PE0002.

3.1.1 Setting-Up

Refer to the PE0002 user manual, and follow the instructions given in the quick start section. The basic arrangement, when used with the PE0002 is shown below:



Figure 2 PE0101 used with PE0002

3.1.2 Jumper Settings

Check the jumper settings are correct by reference to Table 3, section 6.1 and Figure 5 before operating the board.

3.1.3 Operation

The Function ImageTM (FI) must now be loaded into the CMX7x1x device. A FI is provided as a .ped type file and must be obtained from the CML Technical Portal after registration. A PE0002 script is provided to load the FI directly to the CMX7x1x, using the PE0002 script handler tab.

The PE0101 should now be ready for evaluation of the CMX7x1x.

3.2 Without PE0002

As an alternative to using the PE0002 controller kit, users may control the CMX7x1x target device with a user-supplied host controller card. C-BUS connections are made via connector J10 and the PE0101 should be powered via connector J8.

A FI for the CMX7x1x device must be either included in the customer's host system and loaded into the CMX7x1x device on power-up or programmed into the PE0101 on-board serial memory (U8) following the guidelines in the relevant datasheets and application notes.

Check the jumper settings are correct by reference to Table 3, section 6.1 and Figure 5 before operating the board.

4 Pin and Signal Lists

cc	ONNECTOR P	INOUT		
Connector Ref.	Connector Pin No.	Signal Name	Signal Type	Description
J2	-	SPKR	O/P	3.5mm Jack socket, speaker output
J3	-	MIC	I/P	3.5mm Jack socket, microphone input
J5	1, 2	GNDD	PWR	Digital supply ground
	3 to 6	+V	PWR	External supply voltage – Daisy chained from PE0002
J6	1 to 4	3V3D	PWR	Digital supply 3.3V
J7	1 to 4	GNDD	PWR	Digital supply ground
J8	1	0V	PWR	External supply ground
	2	+V	PWR	External supply voltage (5.0V)
J9	1	SSOUT	O/P	EPROM Chip select
NOT	2	3V3D	PWR	Digital supply 3.3V
POPULATED	3	SSIN	I/P	SSIN
	4	MOSI	O/P	Master Out Slave in
	5	GNDD	PWR	Digital supply ground
	6	SCLK	O/P	Serial Clock
	7	OUT1	O/P	Output 1
	8	MISO	I/P	Master in serial Out
	9	OUT2	O/P	Output 2
	10	CSEL	I/P	Chip select
J10	2	CSN	I/P	Chip select. Connects to host μ C, via R41
	4	CDATA	I/P	Serial Data input. Connects to host µC
	5	ENABLEXTAL	I/P	Enable / disable XTAL
	6	CLK	I/P	Serial clock input. Connects to host µC
	8	RDATA	O/P	Serial data output. Connects to host µC
	10	IRQN	O/P	Interrupt request. Connects to host μ C, via R42
	11, 12	GNDD	PWR	Digital supply ground
	16	SOFT_RESET	I/P	PE0002 software reset
	17	PEOUT1	I/P	Input to analogue switch for MIC/ RXDISC
	18	PEOUT2	I/P	Input to analogue switch for SPKR/ TXMOD
	1, 3, 7, 9, 13, 14, 15, 19, 20		N/C)) No connection)

CC	DNNECTOR P	INOUT		
Connector Ref.	Connector Pin No.	Signal Name	Signal Type	Description
J12	1	SPKR	O/P	Speaker output
	2	GNDA	PWR	Analogue supply ground
	3	TXMOD	O/P	TX Modulator output
	4	GNDA	PWR	Analogue supply ground
	5	MIC	I/P	Microphone input
	6	GNDA	PWR	Analogue supply ground
	7	RXDISC	I/P	RX discriminator input
	8	GNDA	PWR	Analogue supply ground
	9	OUT1	O/P	Output 1
	10	OUT2	O/P	Output 2
	11	OUT3	O/P	Output 3
	12, 13, 14		N/C	No connection
J17		EXT Clock	I/P	External Clk input (SMA connector)

Table 1 Signal List

-	TEST POINTS	
Test Point Ref.	Default Measuremen t	Description
TP1	1V8D	Pad – Power supply 1.8V digital
TP2	3V3D	Pad – Power supply 3.3V digital
TP3	3V3A	Pad – Power supply 3.3V analogue
TP4	GNDD	Pad – GNDD, digital ground
TP5	GNDD	Pad – GNDD, digital ground
TP6	GNDA	Pad – GNDA, analogue ground
TP7	GNDA	Pad – GNDA, analogue ground
TP8	EXT Bias	Pad – Externally generated V _{BIAS} output for audio circuits
TP9	VB	Pad – CMX7x1x VBIAS
TP10	I/P	Pad – CMX7x1x AUDIO INPUT
TP11	O/P	Pad – CMX7x1x AUDIO OUTPUT
TP12	RST	Pad – CMX7x1x RESET INPUT

Table 2 Test Points

	JUMPERS		
Link Ref.	Positions	Default Position	Description
JP1	1, 2	SHORT	Jumper to connect TIP to RING of 3.5mm jack J2
JP4	1, 2	SHORT	Jumper to enable 1.8V supply to CMX7x1x
JP5	1, 2	SHORT	Jumper to enable 3.3V digital supply to CMX7x1x
JP6	1, 2	SHORT	Jumper to enable 3.3V analogue supply to CMX7x1x
JP8	1, 2	OPEN	Jumper to disable crystal and clock input (open = enabled)
J1	1, 2	OPEN	Jumper to connect MIC via 10k resistor to ground
	2, 3	SHORT	Jumper to connect MIC directly to ground
	1.0		(Connect the jumper to either 1, 2 or 2, 3).
J14	1, 2 3, 4	OPEN)) Populated, but unused. Do not connect to these pins
)
	5, 6	SHORT	Jumper to connect TEST pin to ground via 100k resistor
116	1.2		lumper to elect External Clk operation
510	3.4	SHORT	Jumper to select 12MHz crystal operation
	5, 6	SHORT	Jumper to select 12MHz crystal operation
	-, -		(Connect a jumper to 1, 2 only or connect jumpers to 3, 4 and 5, 6 respectively, leaving 1, 2 unconnected).
J18	1, 2	SHORT	Jumper to connect LED D3 to OUT1
	3, 4	SHORT	Jumper to connect LED D4 to OUT2
	5, 6	SHORT	Jumper to connect LED D5 to OUT3
	7, 8	OPEN	Internal test input, which is pulled high via a 100k ohm resistor if no jumper is fitted, or pulled low if a jumper is fitted. The jumper setting is unimportant on CMX7011 and CMX188, as there is no internal connection to this pin.
J19	1, 2	OPEN)
	3, 4	OPEN) Not populated. Do not connect to these XTALSEL pins.
	5, 6	OPEN)
J20	1, 2	OPEN	Jumper to connect powered mic supply to J3 Tip
	2, 3	OPEN	Jumper to connect powered mic supply to J3 Ring
			(Leave both jumpers unconnected for no mic power).

Table 3 Jumpers

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	LEDs
LED Ref.	Description
D2	Indicates that the digital supply voltage is present (Green)
D3	Via Jumper J18 connection to OUT1 (Green)
D4	Via Jumper J18 connection to OUT2 (Red)
D5	Via Jumper J18 connection to OUT3 (Yellow)

Table 4 LEDs

Notes:

I/P	=	Input
O/P	=	Output
PWR	=	Power supply connection

5 Circuit Schematics and Board Layouts

For clarity, circuit schematics are available as separate high-resolution files. These can be obtained via the CML website.



Figure 3 PCB Layout: Top





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6 Detailed Description

6.1 Hardware Description

The PE0101 as shipped may not have the optimum configuration or component values for all Function Images™. Check the PE0101 schematic against recommendations in the specific CMX7x1x datasheet. Pin names differ between the board and the various CMX7x1x devices. Figure 5 shows the PE0101 board and CMX7011/CMX188 device pinouts.

6.1.1 Power Supplies

The board is fitted with three voltage regulators. U3, U4 and U6 provide the digital core, digital I/O and analogue supply rails respectively. The input to these three regulators should be provided by an external 5V dc regulated power supply, which can be daisy chained from the PE0002 or connected to the board via connector J8, a push type connector.

The digital and analogue supply voltage levels can be monitored on test points TP1 (1V8D), TP2 (3V3D) and TP3 (3V3A) respectively.

LED illumination confirms the on-board presence of the +3.3V dc digital voltage supply.

6.1.2 Clock Options

The PCB is designed to provide two CMX7x1x device clock options. The board is supplied with a 12MHz crystal fitted. The other option is an external clock source at J17.

Jumper block (Header) J16 is used to choose either 12MHz crystal or external clock. Jumper block (Header) (Not Fitted) J19 can be used to change the clock or crystal frequency input to the CMX7x1x. The default setting, dictated by R27, R19, R28, is 12MHz. Other frequencies can be set by using the correct pull-up/pull-down combination of R20/R27, R19/R26 and R21/R28.

6.1.3 Control Interface

The C-BUS signals are brought out on connector J10. This is a right-angle male header designed to plug directly into the PE0002 interface card, that has a matching female header.

6.1.4 Serial Memory

The PE0101 is shipped with a blank serial memory (U8), type Atmel AT45DB041D.

6.1.5 Baseband Interfacing

Audio signals are routed for both input and output via an analogue switch block. The input is switchable between a Rx discriminator and a microphone input, the output is switchable between a Tx modulator and a speaker output. The analogue switches are controlled by outputs on the CMX7x1x (OUT1 and OUT2).

The CMX7x1x audio input is connected from the analogue switch via a single-pole low-pass filter with a 3dB cutoff of nominally 15kHz.

The CMX7x1x audio output is connected to the analogue switch via a single-pole low-pass filter. This filter will remove spurious high frequency signals. The 14-pin header J12 contains the analogue input and output interfaces and the OUT1 – OUT3 control outputs.

6.1.6 Digital Interfacing

Connector J12 also provides access to the three I/O lines (OUT1 – OUT3); two of these are used as control lines for the analogue switches discussed in section 6.1.5.

6.2 Configuration

PE0101 board pin-name			VDD	IOVDD	IRQN	CSN	RDATA	CDATA	CLK	VSS	тх	RX	RTS	RI			
	CMX7011 device pin-name		DVDD	IOVDD	IRQN	CSN	RDATA	CDATA	CLK	SSV	~ ~ ~ (n/c)						
		•	48	47	46	45	44	43	42	41	40	39	38	37			
AVDD	AVDD	1													36	~ ~ ~ (n/c)	DCD
AVSS	AVSS	2													35	IOVDD	IOVDD
BIAS	VBIAS	3													34	ENABXTAL	ENABXTAL
VSSREF	VSSREF	4													33	XTALSEL3	XTALSEL3
INPUTP	INPUTP	5													32	XTALSEL2	XTALSEL2
INPUTN	INPUTN	6													31	XTALSEL1	XTALSEL1
AVDD	AVDD	7													30	RESETN	RESETN
AVSS	AVSS	8													29	IOVDD	IOVDDPLL
VSSPA	VSSPA	9													28	XTALN	XTALOUT
OUTP	OUTP	10													27	XTAL/CLK	XTALIN
OUTN	OUTN	11													26	DVSS	VSSPLL
VDDPA	VDDPA	12		-	-	-									25	TEST	SYNC
			13	14	15	16	17	18	19	20	21	22	23	24			
			DVDD	~ ~ ~ ()/u)	SDI	SDO	SCLK	~ ~ ~ (ɔ/u)	GPIO1	GPIO2	SSOUT	DVSS	~ ~ ~ (ɔ/u)	IOVDD			
			VDD	OUT3	NOSI	MISO	SCLK	SSIN	OUT1	OUT2	SSOUT	VSS	CSEL	IOVDD			

Figure 5 Alternative Board/Device Pin Names for CMX7011/CMX188

An overlay diagram for the PE0101, for use when fitted with CMX7011 (loaded with FI-1.x) or CMX188, can be obtained from the CML Technical Portal [http://www.cmlmicro.com/]. The PE0101-7011 FI-1.x jumper settings are the default settings described in this document. Different CMX7x1x evaluation devices or Function ImageTM may require the jumper settings to be changed. Details will be supplied with the Function ImageTM or with an amendment to this document for alternative CMX7x1x evaluation devices.

6.3 Adjustments and Controls

None.

6.4 Download Protocol for Function Images™

Function Images[™] can be downloaded into the CMX7x1x device by means of the script handler tab on the PE0002 GUI. Example scripts are provided for this purpose in the **ES0101xx.zip** software bundle.

New features and enhancements to existing functions are available as Function Images[™]. These are downloaded into the device over the C-BUS via the DECFRAME register (\$10). The data is sent in packets of 128 bytes. The Function Image[™] will always be a whole multiple of 128 bytes. The following steps should be taken to download a Function Image[™]. Please check the documentation supplied with any Function Image[™] which may detail a deviation from the following instructions.

- 1. Reset the device. This can be achieved by using either the RESETN pin (30), or by writing to the C-BUS RESET register (\$01).
- 2. Wait until the device indicates that it is ready. This can be done by either polling the STATUS register (\$40) and waiting for bit 15 (RDY) to be set to '1', or waiting until IRQN goes low, and then reading the STATUS register to reset it (bit 15 will have been set to '1').
- 3. If the process is to be interrupt driven (i.e. using IRQN to indicate a change in the STATUS register), then write the value of \$C000 to the IRQENAB register (\$1F). This will enable interrupts for the SVC bit (bit 14), which is used in the download protocol.
- Write the value of \$01 to the SVCREQ register (\$0E). This indicates to the device that a Function Image[™] is waiting to be downloaded.
- 5. Wait for bit 14 to be set to '1' in the STATUS register (either by polling or waiting for IRQN to go low).
- Read the SVCACK register (\$2E) and check that bit 0 is set to '1'. This indicates that the device is able to accept a Function Image[™].
- 7. Write 128 bytes of Function Image[™] data to the DECFRAME register (\$10). This may be done as a single 128-byte streaming write, 128 single byte writes or 64 x 2-byte writes.
- 8. Wait for bit 14 to be set to '1' in the STATUS register (either by polling or waiting for IRQN to go low).
- 9. Read the SVCACK register (\$2E) and check that bit 0 is set to '1'. This indicates that the device has accepted the data packet.
- 10. If there is more data to send, go back to step 7.
- 11.Write the value of \$01 to the SVCREQ register (\$0E). This indicates to the device that all of the Function Image[™] has now been sent.
- 12.Wait for bit 15 to be set to '1' in the STATUS register (either by polling or waiting for IRQN to go low).
- 13.Read the SVCACK register (\$2E) and check that bit 0 is set to '1'. This indicates that the device has accepted the Function Image[™] and is now ready to be used.

The device should be reset, if at any time through the above sequence, when read, the SVCACK does not have bit 0 set to '1'.

Formats of the function image that can be used are:

.h header format file .bfi binary file .ped one hexademical value per line .pes PE0002 file format.

Information on what features the Function Image[™] provides, and instructions on how to use them, will be included with the Function Image[™].

6.5 Troubleshooting

The CMX7x1x is a complex audio processor. If incorrectly programmed or modified, results will be at variance from datasheet performance. Please study the CMX7x1x datasheet, this manual and the associated schematics and layout drawings carefully when troubleshooting.

This section provides suggestions to help users resolve application issues they might encounter.

6.5.1 General

Error Observed	Possible Cause	Remedy		
ES000243.exe software fails	Faulty USB port or cable.	Check USB cable to your PC.		
to run correctly and reports an error during start up.	PE0002 or PE0101 is not powered up during start up.	Power up PE0002 (5.0V) and PE0101 (5.0V).		
	Incorrect software for PE0002.	Contact: techsupport@cmlmicro.com		
Programming data to PE0101 does not appear to work.	The data is being programmed to the wrong C-BUS port on PE0002.	Check whether the PE0101 is connected to PE0002 Port 1 (J5) or Port 2 (J3) and ensure that the correct window is used for programming data. (See PE0002 user manual for further information).		

Table 5 Possible General Errors

6.5.2 Modification State

The modification state (mod state) of the PE0101 can be determined from the 'Board Mod' box printed on the PCB silkscreen. The highest number in the box that is blacked out gives the mod state. The following examples indicate a mod state of 3.

4 8

E	Board	d Mo	b
٠	٠	•	4
5	6	7	8

Figure 6 Examples of Mod State Identification

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Performance Specification 7

7.1 **Electrical Performance**

7.1.1 **Absolute Maximum Ratings**

Exceeding these maximum ratings can result in damage to the Evaluation Kit.

	Min.	Max.	Units
Supply $(+V - 0V)$	-0.3	9.0	V
Voltage on any connector pin to V _{SS}	-0.3	3.6	V
Current into or out of +V and V _{SS} pins	0	+0.45	А
Current into or out of any other connector pin	-20	+20	mA

7.1.2 Operating Limits

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Correct operation of the Evaluation Kit outside these limits is not implied.

	Notes	Min.	Max.	Units	
Supply (+V – 0V)		4.5	5.5	V	
External Clock Frequency		3.0	24.576	MHz	

7.1.3 Operating Characteristics

For the following conditions unless otherwise specified:

Evaluation Device Clock Frequency = 12MHz, +V = 5.0V, $T_{AMB} = +25$ °C.

For CMX7x1x parameters, see relevant CMX7x1x data sheet.

	Notes	Min.	Тур.	Max.	Units
DC Parameters					
I _{DD}	1, 2	_	15	_	mA
+3V3A on-board supply voltage		3.0	3.3	3.6	V
+3V3D on-board supply voltage		3.0	3.3	3.6	V
+1V8D on-board supply voltage		1.7	1.8	1.9	V
Analogue Parameters					
Impedances					
MIC or Disc Input Impedance	3	_	5	_	kΩ
Modulator Output Impedance	3	_	1	_	kΩ
SPKR Output Impedance	3	_	100	_	Ω
Signal Levels					
MIC or Disc Input Level		_	_	2.0	Vp-p
SPKR or Modulator Output Level		-	2.6	_	Vp-p
External Clock Input					
'High' pulse width		21	_	_	ns
'Low' pulse width		21	_	_	ns
Input İmpedance (J17) – Resistance		_	150	_	kΩ
Input Impedance (J17) – Capacitance		_	20	-	pF

1. PCB current consumption, not current consumption of the CMX7x1x.

2. Not including any current drawn from pins by external circuitry.

3. Small signal impedance.

7.1.4 Operating Characteristics – Timing Diagrams and Other Parameters

Please refer to relevant CMX7x1x Datasheet for details.

Notes:



About FirmASIC®

CML's proprietary *FirmASIC*® component technology reduces cost, time to market and development risk, with increased flexibility for the designer and end application. *FirmASIC*® combines Analogue, Digital, Firmware and Memory technologies in a single silicon platform that can be focused to deliver the right feature mix, performance and price for a target application family. Specific functions of a *FirmASIC*® device are determined by uploading its Function Image™ during device initialization. New function images may be later provided to supplement and enhance device functions, expanding or modifying end-product features without the need for expensive and time-consuming design changes. *FirmASIC*® devices provide significant time to market and commercial benefits over Custom ASIC, Structured ASIC, FPGA and DSP solutions. They may also be exclusively customised where security or intellectual property issues prevent the use of Application Specific Standard Products (ASSP's).

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