

## CMX7131/CMX7141 - Digital PMR/LMR Platform Processors

### Multi-mode analogue/digital PMR/LMR

The traditional analogue PMR industry is finally going digital. The word 'Digital' is seen in the market place as meaning advanced and better than analogue, which is questionable, however digital does present a number of advantages for the user, operator and in the area of spectrum management.

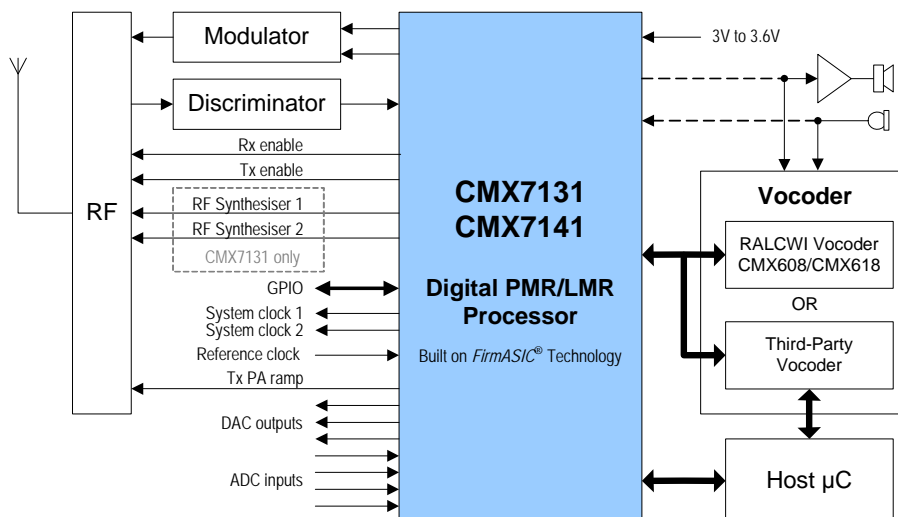
Data capability is a major benefit to the end user, opening up completely new application areas more synonymous with the mobile phone market, such as texting and gaming. Operators benefit by potentially doubling their end user capability and therefore revenue chain, with their same channel allocation. Spectrally, digital PMR is at least twice as efficient as analogue, offering 6.25kHz channel bandwidth per communication, as opposed to 12.5kHz or even 25kHz in the legacy analogue systems.

In forthcoming years, we will see digital PMR systems being installed worldwide, gradually displacing existing analogue systems. In the short to medium term there is a clear requirement for multi-mode (analogue/digital) radios to be developed. This will simplify the introduction of digital radios in the market place by providing users with such key benefits as data capability; on digital systems and for legacy analogue systems: full backward compatibility. The multi-mode (analogue/digital) radio approach has benefits for the radio manufacturer: a single radio platform design capable of supplying both analogue and digital PMR market needs.

Two distinct methodologies exist to enable the narrowband PMR market to go digital: Time Division Multiple Access (TDMA) and Frequency Division Multiple Access (FDMA). Here we focus on the FDMA route as it is generally considered to have a number of benefits over the more complex and more costly TDMA route.

### Radio platforms are the answer

The CMX7131/CMX7141 digital PMR processors are ideally placed to meet the specific requirements of both new and emerging digital PMR radio systems and the provision of dual-mode digital/analogue two-way radio platforms.



The CMX7131/CMX7141 are enablers for the radio platform concept. Incorporating functionality to support the RF transceiver side they only require minimal control from the host microcontroller. Built on CML's proprietary *FirmASIC*<sup>®</sup> technology the CMX7131/CMX7141 encompasses the elements required for the implementation of a digital radio's air interface physical and data link layers. The vocoder is also completely managed and controlled by the CMX7131/CMX7141 enabling a small, low power host microcontroller to be utilised for overall radio operation.

## Vocoder management and control

The CMX7131/CMX7141 can completely manage and control the external vocoder function therefore, providing the most efficient data routing through the digital PMR/LMR Air Interfaced Layers, keeping the overall system power consumption to an absolute minimum. The vocoder connectivity by default is designed to work with CML's low bit rate RALCWI vocoder ICs CMX608/CMX618.

The CMX7131/CMX7141 can also be configured to work with third-party vocoders such as the AMBE2020 and AMBE3000 ICs from DVSI. (AMBE2020 and AMBE3000 are trademarks of Digital Voice Systems, Inc).

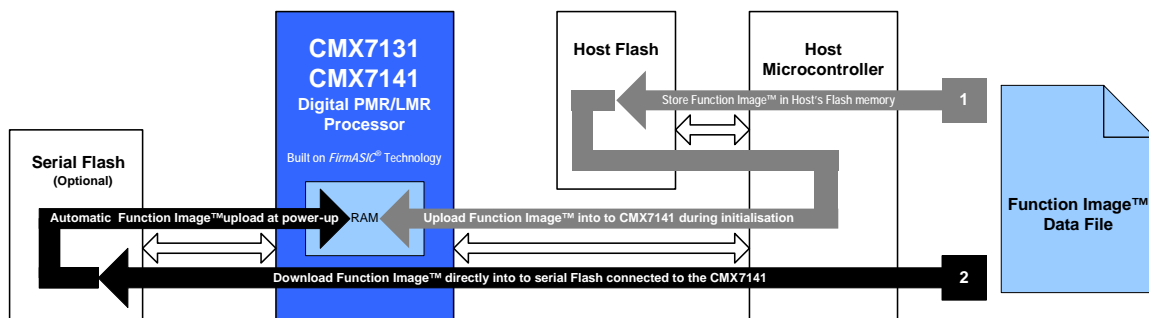
## Function Image™ is the key to flexibility

The Function Image™ concept is the key to a multi-mode radio platform. A Function Image™ is a small data file that is uploaded to the CMX7141 during power-up. The Function Image™ configures on-chip subsystems to provide the operation and functionality for a specific application.

Two methods of uploading the Function Image™ into the CMX7141 are available, as depicted below.

Method 1 - The Function Image™ is loaded into and retained within the host's Flash memory. During CMX7131/CMX7141 initialisation, the Function Image™ is uploaded into the device via the host and C-BUS.

Method 2 - The Function Image™ is loaded directly into the optional serial Flash attached to the CMX7131/CMX7141. The Function Image™ is then automatically uploaded into the CMX7131/CMX7141 during power-up, without host intervention.



## Software Defined Radio (SDR)

The CMX7131/CMX7141 multi-mode digital PMR processors are perfectly positioned to fulfil the needs of an SDR platform. A single radio hardware design can be reconfigured to meet the needs of a conventional analogue two-way radio, currently defined digital PMR/LMR systems and adapt to meet the requirements of the emerging digital specifications.

This is all achievable due to the flexibility of the Function Image™ concept. Uploading a different CMX7131/CMX7141 Function Image™ completely changes the device's operation and function. Function images are available to support both analogue and digital PMR/LMR systems with an evolving roadmap to support new emerging digital PRM/LMR systems. Please visit the CMX7131/CMX7141 'Technical Portal' page on the CML website for the latest information. If you are interested in more information concerning support for a digital PMR/LMR system mentioned, please contact your local CML representative.

## Digital PMR/LMR Function Image™ Library

Common to all function images and operating modes for the CMX7141:

- Low power 3V – 3.6V operation
- Small footprint LQFP and VQFN packaging
- Auxiliary ADCs (4 mux inputs)
- Auxiliary DACs (4 outputs)
- Two auxiliary system clock outputs
- Optional serial Flash memory
- Progressive powersave operating modes

Three function images are currently released and available for download:

A. Analogue two-way radio – this is an emulation of the CMX7031/CMX7041 providing:

- Concurrent audio, signalling and data operations
- Complete audio processing including scrambler option
- Sub-audio signalling – CTCSS, DSC and XTCSS
- Audio-band signalling – Selcall, DTMF
- FFSK/MSK data modem with packet and free-format modes
- Marine VHF operations – DSC, NOAA WAT and SAME
- Three analogue signal inputs
- Single and two-point modulation drivers

B. dPMR conforming to ETSI TS 102 490 specification:

- Air Interface Physical Layer (layer 1)
- Air Interface Data Link Layer (layer 2)
- 4FSK Modem
  - Soft decision decoding
  - Automatic Frame Sync Detection (AFSD)
- Vocoder connectivity
  - Management and control
  - Data transport

C. DCR – ARIB STD-98 compliant:

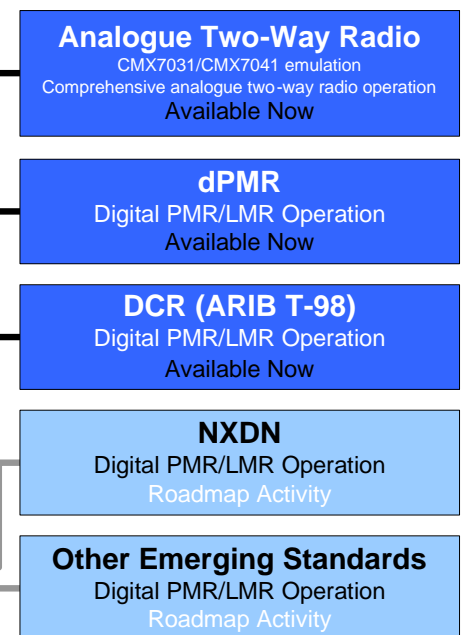
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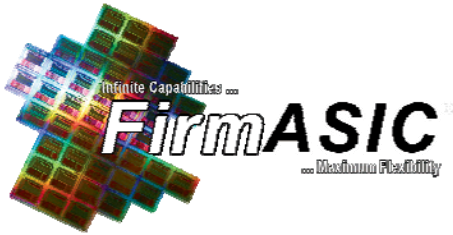
Multi-Mode Analogue/Digital PMR/LMR Platforms

Built on FirmASIC® Technology



**CML is keen to work with radio manufacturers to support new/emerging digital PMR/LMR systems with the development of a specific Function Image™. Standard, semi-custom and full custom Function Image™ possibilities exist.**

Further details concerning the availability of function images for the CMX7131/CMX7141 can be found at the 'Technical Portal' on CML's website [www.cmlmicro.com](http://www.cmlmicro.com). If you would like to discuss your specific digital PMR/LMR requirements in more detail, please contact your local CML representative.



CML's proprietary *FirmASIC*<sup>®</sup> component technology reduces cost, time to market and development risk, with increased flexibility for the designer and end application. *FirmASIC*<sup>®</sup> 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*<sup>®</sup> device are determined by uploading its Function Image<sup>™</sup> during device initialization. New Function Images<sup>™</sup> 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*<sup>®</sup> 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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