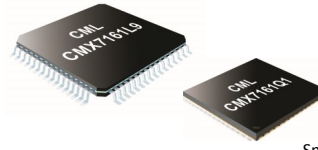


CMX7161

TDMA Digital Radio Processor

Digital Mobile Radio (DMR) based systems



Small 64-pin VQFN/LQFP

Introduction

2-slot TDMA is the digital radio technology chosen by many business critical PMR/LMR users in the market today. DMR has become a force within the digital radio market, with its strong foundation based on the ETSI DMR standard.

A number of 2-slot TDMA systems are currently being implemented around the world, these include DMR, PDT and APCO P25 phase 2.

All these systems have the essential market drivers: small size, high performance, low cost and fast time to market. In many cases the software defined radio (SDR)/radio platform approach is the chosen route to market in order to achieve the core requirements.

The CMX7161 Digital Radio Processor, combined with the CMX994 Direct Conversion Receiver, provides the ultimate solution to achieve the 2-slot TDMA market objectives.

The CMX7161 and CMX994 are supported by the DE9943 SDR demonstrator board that provides a fast route to product evaluation and system development.

Applications

- 2-slot TDMA Digital Mobile Radio
- ETSI TS 102 361 Digital Mobile Radio (DMR)
- Police Digital Trunking (PDT) Radio

CMX7161 Brief Description

The CMX7161 is a digital radio processor intended for use in two-slot TDMA systems. Function Image 7161FI-1.x implements a high performance radio modem specifically targeted at the ETSI TS 102 361 standard for Digital Mobile Radio (DMR).

7161FI-1.x implements a half-duplex digital radio modem using root-raised-cosine ($\alpha=0.2$) 4-FSK modulation in a 12.5kHz channel. Slot timing and synchronisation are handled automatically by the device.

An integrated analogue interface (with no requirement for external codecs) supports direct connection to the RF receive chip CMX994 Direct Conversion Receiver and in Tx, a two-point modulation transmitter with a few external components can be implemented.

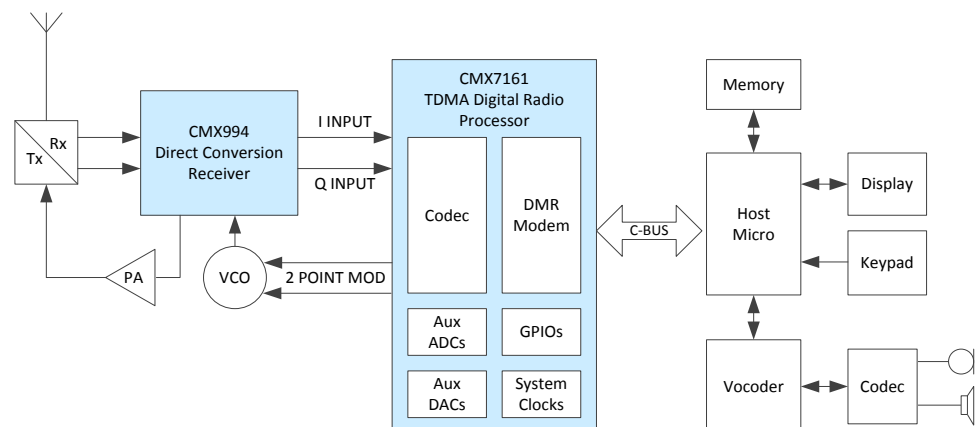
Intelligent auxiliary ADC, DAC and GPIO sub-systems are provided to minimise required host interaction and host I/O resources. Two synthesised system clock generators develop clock signals for off-chip use. The C-BUS/SPI master interface expands host C-BUS/SPI ports to control external devices.

The CMX7161 operates from a 3.0V - 3.6V supply and is available in small 64-pin VQFN and LQFP packages.

The device uses CML's proprietary *FirmASIC*[®] component technology. On-chip sub-systems are configured by a Function Image™ data file that is uploaded during device initialisation to define the device's function and feature set.

Features

- 9600bps 4FSK modem
 - Hard/soft decision data bits
 - Root-raised-cosine pulse shaping
 - Automatic Frame sync detection
 - Automatic tracking of symbol timing and input I/Q dc offsets
- Embedded codecs (Analogue to digital conversion)
- RAMDAC capability for PA ramping control
- Two-point modulation analogue outputs
- Direct connection to CMX994 Direct Conversion Receiver IC
- Auxiliary Functions:
 - Two programmable system clock outputs
 - Four ADCs with six selectable input paths
 - SPI Thru-port for interfacing to synthesisers and other serially controllable devices
 - Four DACs
- FIFO based C-BUS interface for efficient data transfer
- Small 64-pin VQFN/LQFP packages



Key Product Features Descriptions

Tx Functions:

- Two-point modulation analogue outputs
- Root-raised-cosine ($\alpha=0.2$) pulse shaping
- RAMDAC capability for PA ramping control
- Tx trigger feature allowing precise control of burst start time
- Tx burst sequence for automatic RAMDAC ramping and hardware switching

Rx Functions:

- I/Q analogue inputs
- Rx channel filtering and root-raised-cosine ($\alpha=0.2$) pulse shaping
- Data returned as hard-decision bits or 4-bit soft-decision LLR metrics
- Automatic frame sync detection
- Automatic tracking of symbol timing and input I/Q DC offsets
- RSSI indication

Slot timing functions:

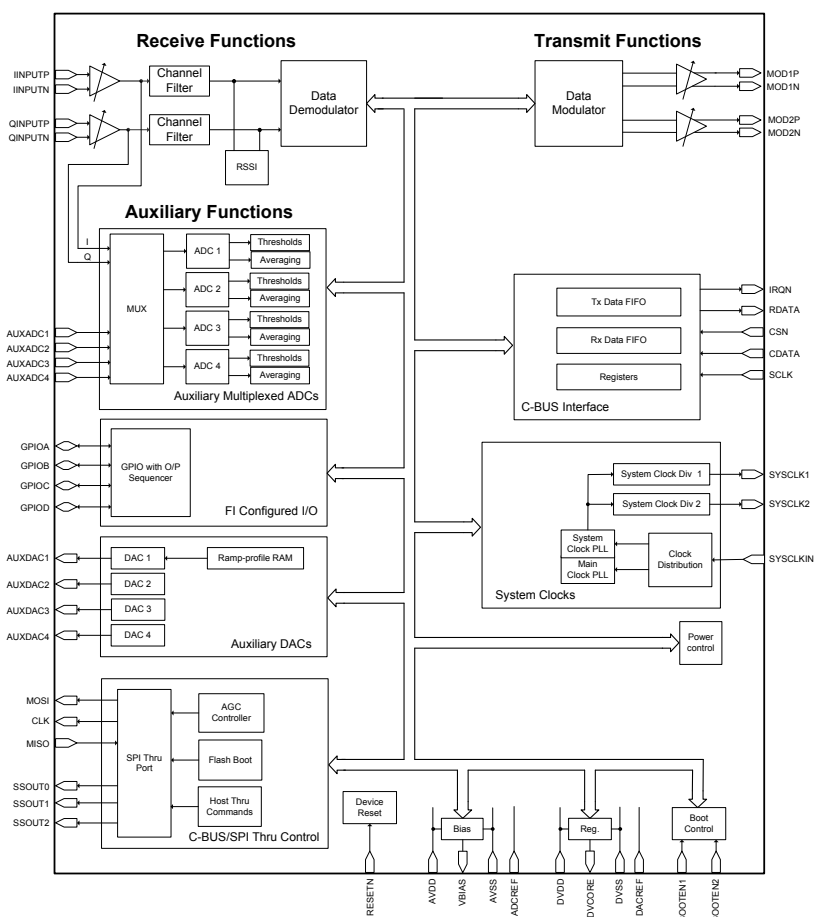
- 30ms slot format (264-bit bursts)
- Internal slot clock and timing maintenance
- Automatic synchronisation to received channel
- Automatic sequencing of hardware control

Auxiliary Functions:

- Two programmable system clock outputs
- Four auxiliary ADCs with six selectable input paths
- SPI Thru-Port for interfacing to synthesisers and other serially controllable devices
- Four auxiliary DACs, one with built-in programmable RAMDAC

Host Interface:

- Optimised C-BUS (4-wire, high speed synchronous serial command/data bus) interface to host for control and data transfer, including streaming C-BUS for efficient data transfer
- Open drain IRQ to host
- Four GPIO pins
- Serial memory or C-BUS (host) boot mode.

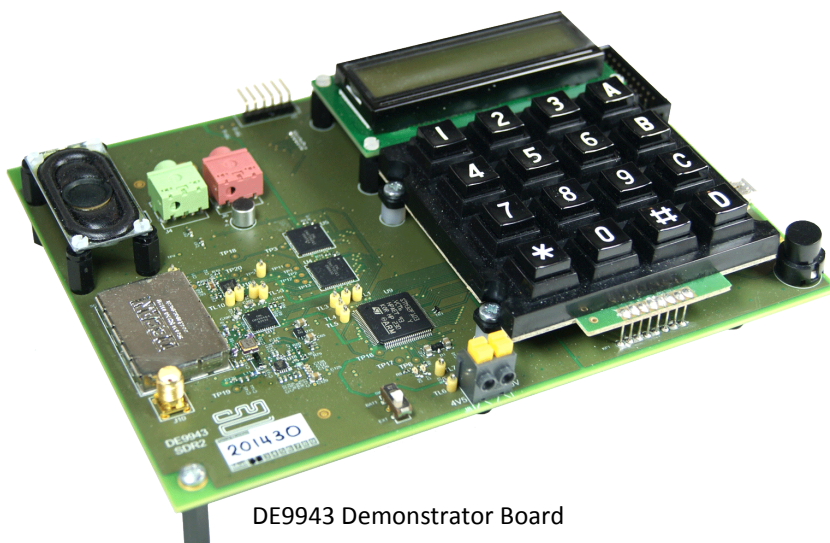
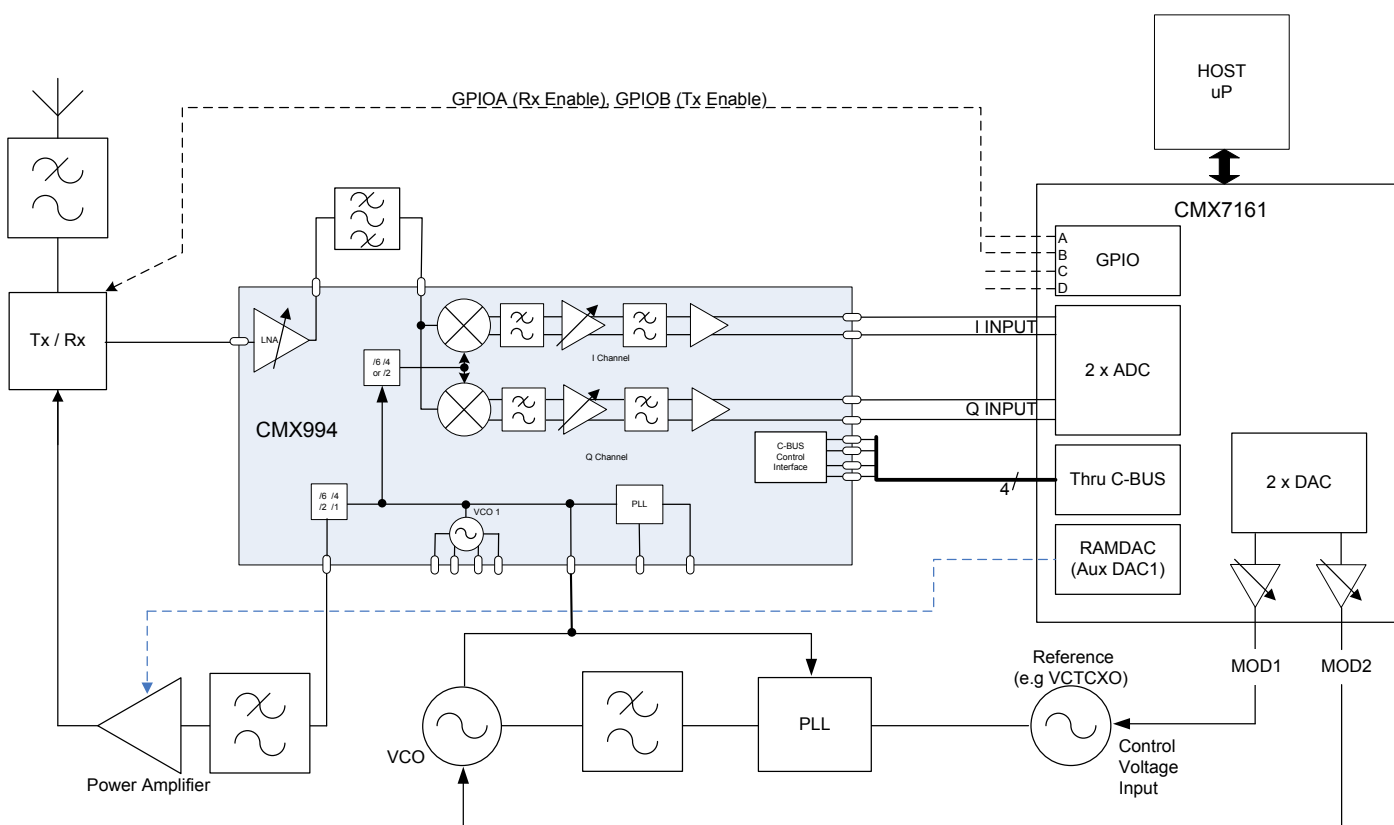


Evaluation Support

The DE9943 is a compact demonstration/evaluation platform for 2-slot TDMA Digital Radio designs incorporating the CMX7161 TDMA Digital Radio Processor, the CMX994 Direct Conversion Receiver and the CMX7262 TWELP Professional Radio Vocoder. The board can be used to demonstrate a complete RF transceiver and baseband function supporting a direct conversion receiver and VCO 2-point modulation transmitter.

The DE9943 features a built in keyboard, display, microphone and speaker and so can be used to demonstrate DMR peer-to-peer operation in a standalone configuration. The board has an ARM processor which handles initial board power up and loading of the Function Image™ data files to the CMX7161 and CMX7262.

Once the system is powered up, the processor will handle basic radio functionality (channel selection etc) and baseband control, allowing demonstration of a simple voice call and data transfer



DE9943 Demonstrator Board

Electrical Specification Summary

| Operating Limits | Min | Typ | Max | Unit |
|--------------------------|-----|-----|------|------|
| Supply Voltage: | | | | |
| $DV_{DD} - DV_{SS}$ | 3.0 | 3.3 | 3.6 | V |
| $DV_{CORE} - AV_{CORE}$ | 1.7 | 1.8 | 1.9 | V |
| Operating Temperature | -40 | - | +85 | °C |
| External Clock Frequency | 3.0 | - | 19.2 | MHz |

Packaging

| DIM. | MIN. | TYP. | MAX. |
|------|------|----------|------|
| * A | | 9.00 BSC | |
| * B | | 9.00 BSC | |
| C | 0.80 | 0.90 | 1.00 |
| F | 7.00 | | 7.80 |
| G | 7.00 | | 7.80 |
| H | 0.00 | | 0.05 |
| J | 0.18 | 0.25 | 0.30 |
| K | 0.20 | | |
| L | 0.30 | 0.40 | 0.50 |
| L1 | 0 | | 0.15 |
| P | | 0.50 | |
| T | | 0.20 | |

| DIM. | MIN. | TYP. | MAX. |
|------|-------|------|-------|
| * A | 9.80 | | 10.20 |
| * B | 9.80 | | 10.20 |
| C | 1.40 | | 1.60 |
| D | 11.80 | | 12.20 |
| E | 11.80 | | 12.20 |
| H | 0.05 | | 0.15 |
| J | 0.17 | | 0.27 |
| L | 0.45 | | 0.75 |
| P | | 0.50 | |
| T | 0.09 | | 0.20 |
| X | 0° | | 7° |
| Y | 11° | | 13° |

NOTE:
* A & B are reference data and do not include mold flash or protrusions.
All dimensions in mm
Angles are in degrees

Index Area 1 is located directly above Index Area 2

NOTE:
* A & B are reference data and do not include mold flash or protrusions.
All dimensions in mm
Angles are in degrees
Co-Planarity of leads within 0,1mm

64-pin VQFN Mechanical Outline (Q1)
Order as part no. CMX7161Q1

64-pin LQFP Mechanical Outline (L9)
Order as part no. CMX7161L9

Further information links

- >> [CML Product Selector](#)
- >> [CMX7161 Digital Radio processor](#)
- >> [CMX994 Direct Conversion Receiver](#)
- >> [CMX7262 Profession Radio Vocoder](#)
- >> [DE9943 SDR Demonstrator](#)

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