

CMX7011 Digital Voice Processor

Analogue Communications Enhancements (ACE) for PMR/LMR



Small 48-pin VQFN and LQFP Packages

Introduction

The need for secure voice communication has become an important requirement for wireless systems.

With new communication systems moving more towards the digital domain, which inherently provides voice security, the widely-used legacy analogue systems are being left behind.

There are a number of analogue voice privacy systems based on frequency inversion techniques available today that offer solutions to prevent 'casual eaves dropping'. However, in many applications, a higher level of voice security is being called for.

Digital voice encryption is the answer, providing the highest level of voice security and the added advantage of digital voice.

The CMX7011 provides the complete solution, with embedded low cost, low bit rate RALCWI Vocoder technology combined with an audio band voice data modem.

Applications

- Real-time voice security
- Voice encryption on analogue PMR radios
- Secure wireless door access and gate entry systems
- Providing the digital advantage on analogue radio systems



CMX7011 Brief Description

The CMX7011 is a flexible, half-duplex, digital voice encryption processor that provides the digital advantage to conventional analogue two-way radios, wireless door access and gate entry systems.

Digital voice scrambling is a key feature of the device, transmitting and receiving secure encrypted voice via an embedded robust data modem. The device allows simple implementation and configuration within existing designs and is intended to be added to a radio via an accessory module or "feature socket". The device is simple to control via a small, low-power microcontroller. The CMX7011 offers good quality speech which is better than that of traditional analogue radios at the fringes of reception and, using the internal digital encryption algorithm, significantly higher levels of security are achieved.

Embedded within the CMX7011 is CML's proven and reliable RALCWI (Robust Advanced Low Complexity Waveform Interpolation) vocoder providing near toll quality speech at a low bit rate.

A feature of the CMX7011 is the programmable push-to-talk (PTT) buffer which offers instant voice capture in transmit mode. The CMX7011 header frame contains a user-programmable 8-bit address field that allows up to 256 individual user addresses to be defined. Control of the CMX7011 is via a small external low-power microcontroller, adding to the overall flexibility and used together, a comprehensive set of features can be realised: Digital voice over analogue radio, digital voice encryption, voice storage and retrieval, secure packet data capability and late/re-entry protocol providing a high level of performance in fading conditions.

The CMX7011 uses CML's proprietary FirmASIC® component technology, providing maximum flexibility with upgrade capability. A CMX188 'plug and play' version (no Function Image™ upload required) pin and function compatible with the CMX7011, can be made available for high quantity applications.



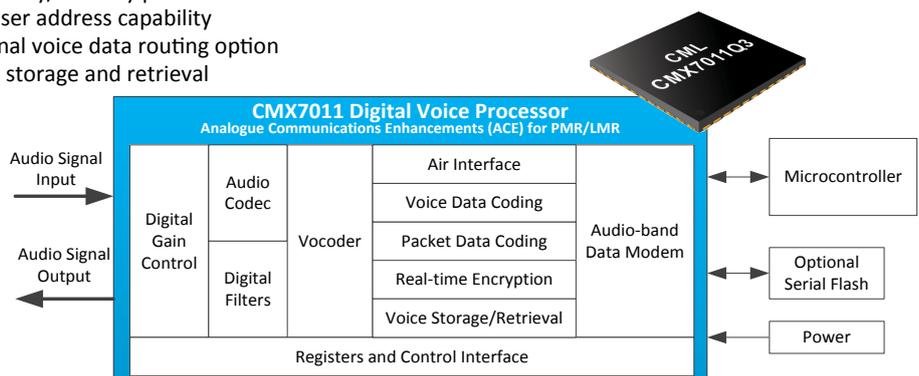
Digital Voice Encryption for Analogue PMR Radio

Features

- Digital voice security on analogue PMR channels (12.5kHz/25kHz)
- Simple interfacing to an existing analogue radio - audio path connections only
- Digitally-controlled input and output gain with fine gain adjustment
- Embedded RALCWI Vocoder (supplied under licence and royalty free)
- Embedded audio-band data modem
- Built-in robust over-air data protocol with good tolerance to bit errors
- Digital voice call late/re-entry protocol
- Real-time digital voice encryption with user-programmable 16-bit encryption keys
- Instant voice capture - eliminating 'PTT' clipping
- Late-entry/re-entry protocol
- 256 user address capability
- External voice data routing option
- Voice storage and retrieval



Secure Digital Voice and Data for Access Control Systems



Digital Voice Encryption for Analogue Two-way Radio Systems

Conventional analogue PMR systems offer zero or very limited voice privacy today. There are analogue scrambler solutions available, but these only offer a basic level of voice security.

Digital voice encryption provides the ultimate voice security. The CMX7011 Digital Voice Processor provides the core functions necessary to build a high-quality digital voice scrambler using digital voice encryption techniques, embedded in a single chip.

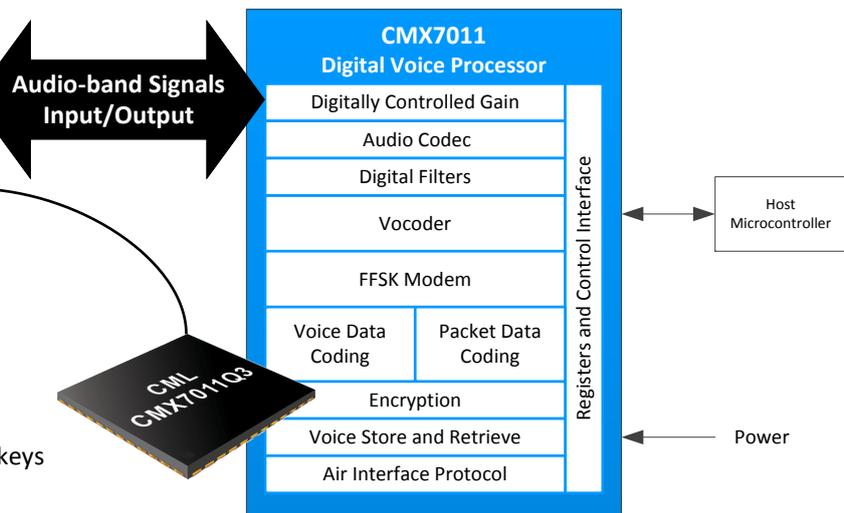
The CMX7011 combines the functionality of a low bit rate vocoder with an audio-band data modem. In addition to these core functions, an over-air data protocol layer is included to allow simple setup and control of the device: analogue voice in, to formatted voice data out and voice data in, to analogue voice out.

Using an audio-band data modem allows the CMX7011 input and output signals to be connected directly into the radio's audio input and output (that are normally available on the radio's accessory/facility socket). No complex connections are required to the radio's discriminator output or modulator input.



Embedded Features

- Low bit rate Vocoder
- Audio-band FFSK modem
- Digitally controlled input and output gain
- Over-air protocol to provide optimum performance in noisy channels
- Late/re-entry protocol
- Internal digital voice encryption algorithm
- External Vocoder voice data routing option
- Voice storage and retrieval
- Packet data



Basic Operations

- Setup operating mode
 - Digital voice or packet data
 - Unit address
 - Input/output gain
 - User-programmable encryption keys
 - Configure programmable I/O
- Transmit
 - Set user address
 - Set encryption key
 - Convert analogue voice to a secure digital bit stream
 - Packet data
 - Voice storage and retrieval
- Receive
 - Receive modem data
 - Check user address and recovered data is correct using local encryption key
 - Convert digital bit stream to analogue voice or retrieve packet data
 - Voice storage and retrieval

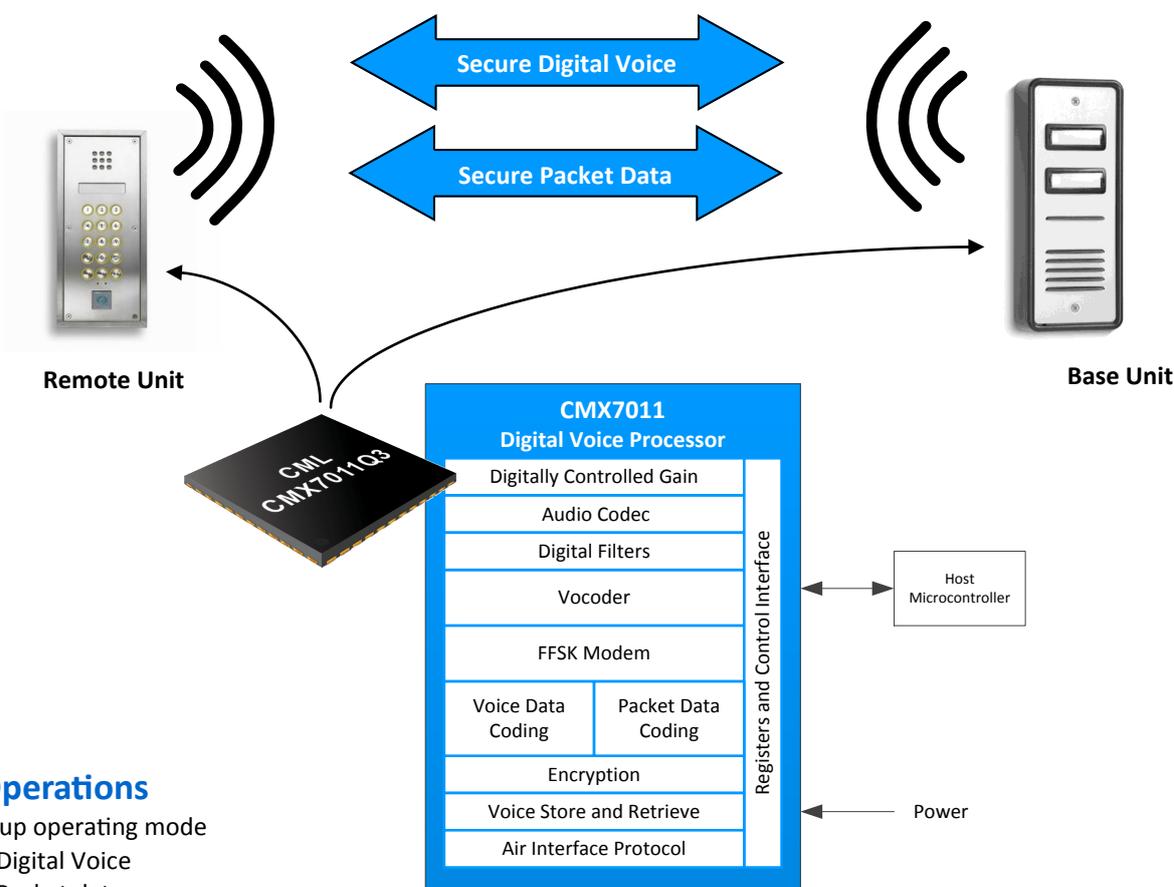
Wireless Door Access and Gate Entry Systems

Wireless door access and gate entry systems that offer analogue voice communication suffer from the basic lack of voice security as analogue PMR systems.

The CMX7011 offers these systems a unique feature set, providing secure digital voice encryption and a flexible packet data system for signalling between the remote and base station.

The CMX7011 is built on CML's proprietary *FirmASIC*® technology, allowing functionality and enhancements to be added via Function Image™ release.

General Description



Basic Operations

- Setup operating mode
 - Digital Voice
 - Packet data
 - Unit address
 - Input/output gain
 - Encryption key
 - Configure programmable I/O
- Transmit
 - Set user address
 - Set encryption keys
 - Convert analogue voice to a secure digital bit stream or setup secure data packet
 - Transmit modem data
- Receive
 - Receive modem data
 - Check user address and recovered data is correct using local encryption keys
 - Check if incoming data is digital voice or packet data
 - Convert digital bit stream to analogue voice or recover data packet

CMX7011 Evaluation Kit

The PE0101-7011 Evaluation Kit is designed to assist in the demonstration, evaluation and application development of the CMX7011 device. The kit is in the form of a populated PCB comprising CMX7011 device and the 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 PE0101-7011 is fitted with a C-BUS connector allowing the board to be operated by connection to either of the two C-BUS ports on a CML PE0002 Interface Card with the use of the associated PC GUI software, or by direct connection between the CMX7011 C-BUS and the user's μ C development application or emulation system.

The CMX7011 Function Image™ (FI) can be uploaded directly into the on-board CMX7011 target device using the PE0002 interface card with associated software or a user's microcontroller development/emulator system.

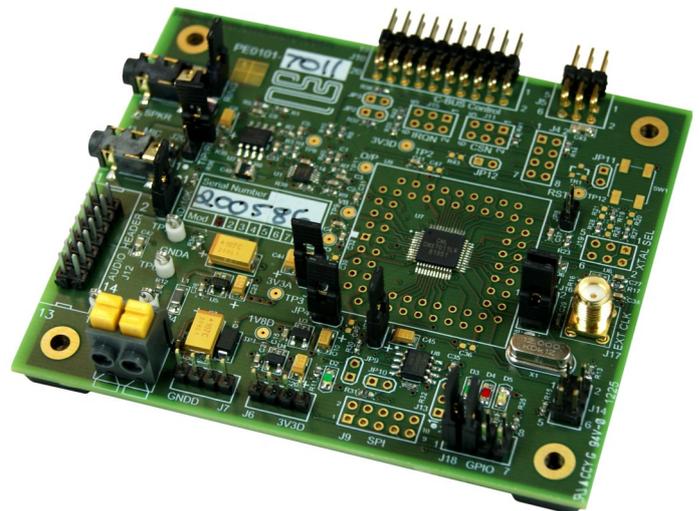
Function images for the CMX7011 target device and scripts for the PE0101-7011 evaluation kit can be downloaded from the CML Website/Technical Portal (registration and access required).

Evaluation/Demonstration Support

Scripts are available for download from the CML Technical Portal to allow fast and easy demonstration of the core functions of the device.

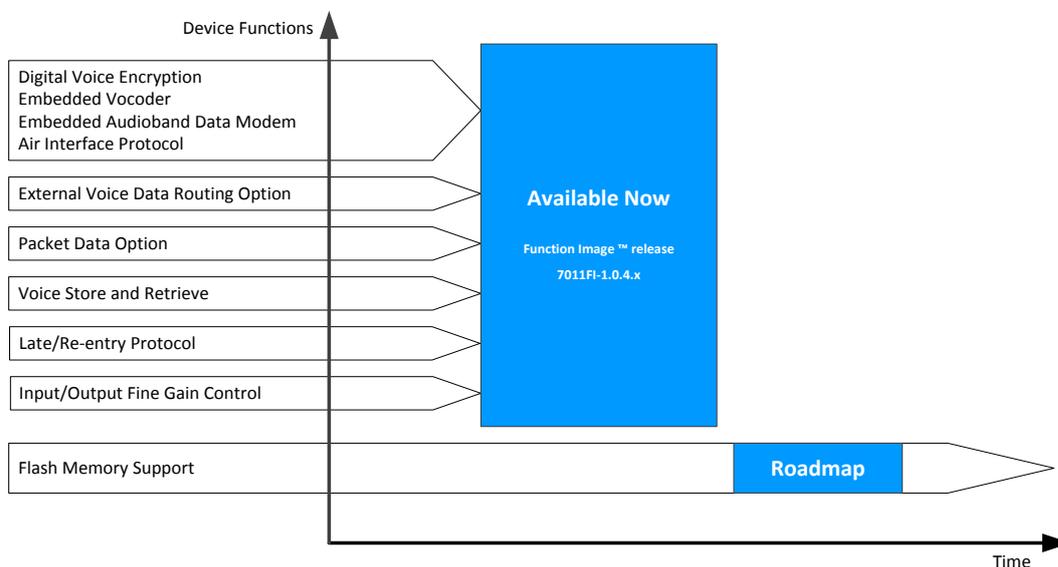
Demonstration of transmitting and receiving real-time digitally encrypted voice with decryption back to analogue voice.

Demonstration of external, vocoder voice data routing.



CMX7011 Roadmap Function Availability (via Function Image™ release)

Please contact CML for updated information concerning new function release dates.

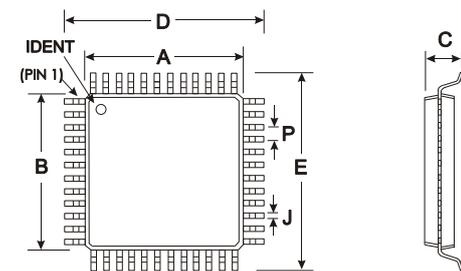


CMX7011 Electrical Specification Summary

Operating Limits	Min	Typ	Max	Unit
Supply Voltage:				
$IOV_{DD} - V_{SS}$	3.0	3.3	3.6	V
$V_{DD} - V_{SS}$	1.7	1.8	1.9	V
$AV_{DD} - AV_{SS}$	3.0	3.3	3.6	V
$V_{DDPA} - V_{SSPA}$	3.0	3.3	3.6	V
Operating Temperature	-40	-	+85	°C
Xtal Frequency	3.0	-	12	MHz
External Clock Frequency	3.0	-	24	MHz

DC Parameter - Supply Current	Min	Typ	Max	Unit
All Powersaved	-	50	-	µA
Encoding				
DI_{DD} ($DV_{DD} = 1.8V$)	-	33	-	mA
AI_{DD} ($AV_{DD} = 3.3V$)	-	6.5	-	mA
Decoding				
DI_{DD} ($DV_{DD} = 1.8V$)	-	28	-	mA
AI_{DD} ($AV_{DD} = 3.3V$)	-	2.8	-	mA

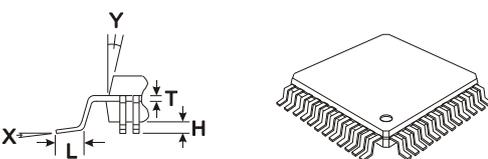
CMX7011 Package Options



DIM.	MIN.	TYP.	MAX.
* A	6.91		7.11
* B	6.91		7.11
C	1.40		1.60
D	8.74		9.25
E	8.74		9.25
H	0.05		0.15
J	0.10		0.28
L	0.35		0.76
P		0.50	
T		0.13	
X	0°		7°
Y	11°		13°

48-pin LQFP Mechanical Outline (L4)

Order as part no. CMX7011L4

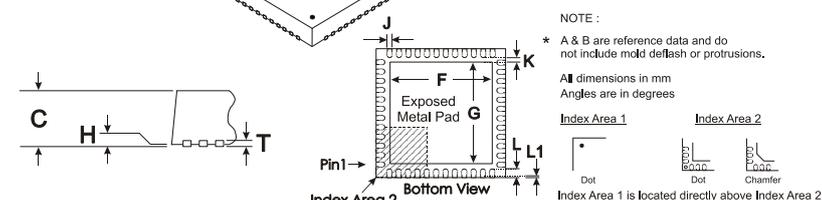


NOTE :
* A & B are reference data and do not include mold deflash or protrusions.
All dimensions in mm
Angles are in degrees
Co-Planarity of leads within 0.1mm

DIM.	MIN.	TYP.	MAX.
* A		7.00 BSC	
* B		7.00 BSC	
C	0.80	0.90	1.00
F	4.60		5.65
G	4.60		5.65
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	

48-pin VQFN Mechanical Outline (Q3)

Order as part no. CMX7011Q3



Depending on the method of lead termination at the edge of the package, pull back (L1) may be present.
L minus L1 to be equal to, or greater than 0.3mm

The underside of the package has an exposed metal pad which should ideally be soldered to the pcb to enhance the thermal conductivity and mechanical strength of the package fixing. Where advised, an electrical connection to this metal pad may also be required

Comprehensive technical datasheet and support material is available from the CML website.

Click here to link to the [CML website](#) or search for: CMX7011

RALCWI™ Vocoder

CML's proprietary RALCWI™ vocoder technology, is supplied under CML's RALCWI user license agreement. A copy of the CML RALCWI™ end user license agreement is available on request from CML Microcircuits.

The CMX7011 Digital Voice Processor product includes embedded RALCWI™ vocoder technology which is provided free of royalties in this device.



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).

FirmASIC , *FirmCODEC* , RALCWI, Function Image and *DuraTALK* are trademarks of CML Microsystems Plc.

	 CML Microcircuits (UK) Ltd <small>COMMUNICATION SEMICONDUCTORS</small>	 CML Microcircuits (USA) Inc. <small>COMMUNICATION SEMICONDUCTORS</small>	 CML Microcircuits (Singapore) Pte Ltd <small>COMMUNICATION SEMICONDUCTORS</small>
Phone:	+44 (0) 1621 875500	+1 336 744 5050 800 638 5577	+65 62 888129
Fax:	+44 (0) 1621 875600	+1 336 638 5577	+65 62 888230
Email Sales:	Sales@cmlmicro.com	us.sales@cmlmicro.com	sg.sales@cmlmicro.com
Email Tech Support:	techsupport@cmlmicro.com	us.techsupport@cmlmicro.com	sg.techsupport@cmlmicro.com
www.cmlmicro.com		Search for: cmlmicro	