

CMX850 Communications Controller IC

INNOVATIONS
INV/Telecom/850/2 November 2003

- Single-Chip Embedded 80C51 μ C with Integral V.22bis Modem -

www.cmlmicro.com

Further enhancement of this product has resulted in a group of additional functions which enable the use of the product in a much larger range of wireline telecom end-products. This updated Innovations document details the functions and features of the CMX850 and the product enhancements.

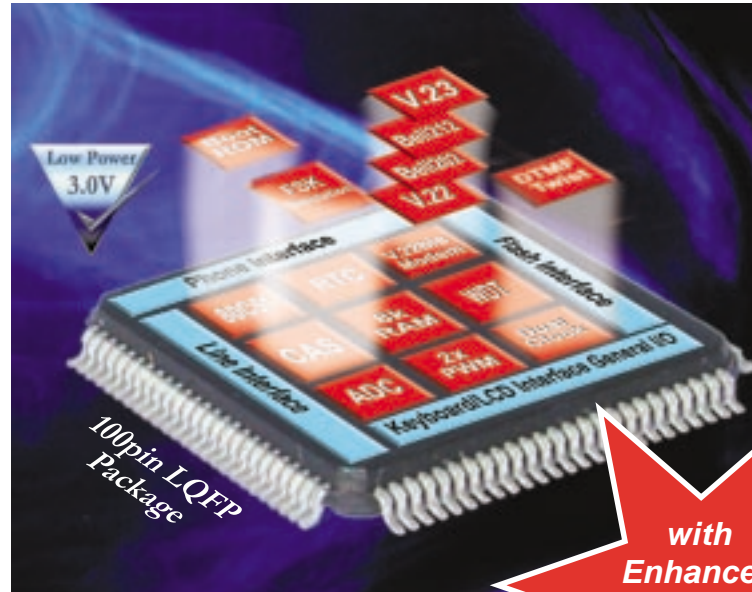
- this highly integrated product removes the need, in a communications end-product, for multiple ICs and their attendant components -

Enhanced 80C51 μ C with Internal Memory

- Extended Memory Addressing
- Versatile Memory and Peripheral Interfacing
- 8kB Internal XRAM
- 'Real-Time' Clocks and Timing Facilities
- Dynamic In-Circuit Programming and Software Upgrading in the Field via Boot ROM Facility
- Low Power 'Sleep' Modes with Programmable Wakeup

Integral Low-Power Modem plus ...

- Integral V.22bis, V.22, V.23 and V.21 (and Bell) Modems
- Stand-Alone FSK (CLI) Demodulator and High-Sensitivity CAS Tone Detector
- Full-Feature Programmable Telephone Signalling Facilities



Applications - Low power and battery-operated communications terminals which need to access the PSTN to upload or download data

- SMS and ADSI Terminals
- Telemetry and Remote Meter Reading
- Vending and Gaming Machines
- Feature Phones, Smart Phones and Pay Phones
- Telephone Routers
- SIA Security Alarms
- EPOS and ATM Terminals
- E-mail and Internet Appliances

with
Enhanced
Facilities

Stand-Alone FSK (CLI) Demod

CMX850
Communications
Controller

On-Chip Boot ROM

CTR21 and FCC68
Line Interface (DAA)
Designs

Configurable Tx DTMF Twist

EV8500
Evaluation
Kit

- V.22bis Modem - Wireline Signalling - Embedded 80C51 μ Controller - CLI Demodulator - On-Chip RAM -
- Versatile General Purpose I/O Ports - Boot ROM Reprogramming Feature - 100-pin LQFP Package -
- 3V Low-Power Operation with Advanced Dynamic Power Management and Powersave Modes -

- A single-chip product that provides ALL the functions required (data, memory, signalling, switching and control) for stand-alone wireline telecoms terminals -

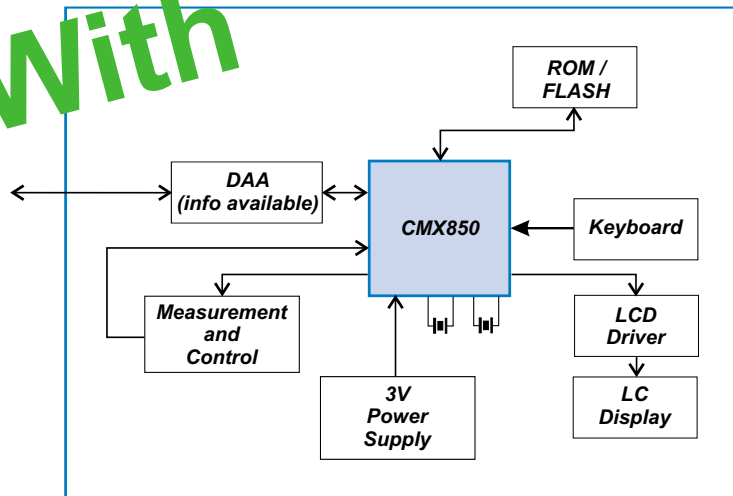
The CML Advantage

- Save Time - Save Space - Save Money - Save Power -

An extremely compact and low-power microcircuit that will satisfy all of the communications, control, data and signalling requirements of any wireline product using on-line communication

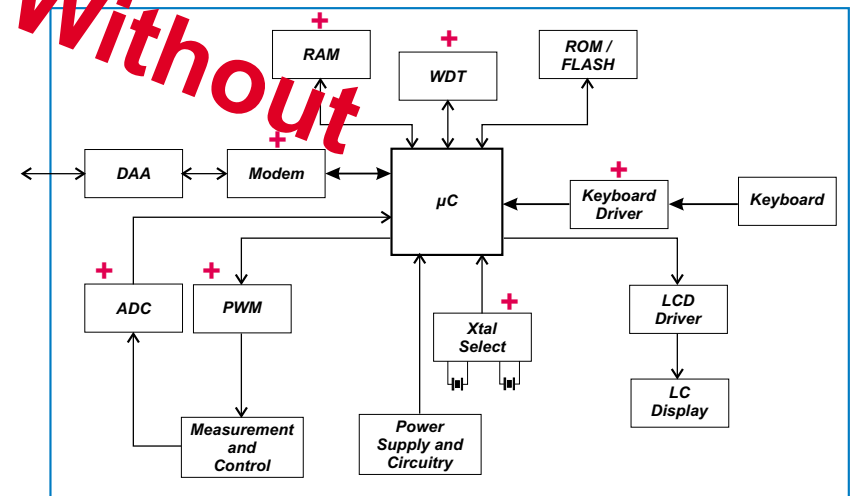
- Highly integrated single product replaces multiple ICs and components
- Enhanced 80C51 μ Controller with WDT, ADC, 8kB XRAM, keyboard encoder, extended addressing of multiple blocks (64kB) of external memory, PWM outputs and dual clocks with separate Xtals
- On-Chip Boot ROM facility available for in-circuit programming and software upgrading in the field
- Integral modem: V.22bis, V.22, V.23, V.21 and Bell equivalents
- Easy integration with peripherals (Flash, ROM, RAM, LCD circuits and keyboard)
- 13 interrupt sources
- Rx/Tx audio-tone telephone signalling including DTMF function
- Programmable Tx DTMF Twist to facilitate operation to many telephone systems and for use in lower-cost DAA circuits
- Line reversal, ring-tone and off-hook detection
- Improved sensitivity CAS tone detection and stand-alone FSK demodulator for CLI Types I and II will allow on-hook CLI operations whilst all other functions are in powersave
- Low voltage (3.0 to 3.6 V) operation with comprehensive on-chip power management
- CMX850L8 100-pin low profile, small footprint quad flat pack (LQFP) package saves PCB space
- Compact multi-function product saves design and production time and costs
- CML support is available globally for design and implementation assistance
- EV8500 EvKit aids experimentation and product evaluation; accelerates hardware and software design times
- CTR21 and FCC68 DAA interface designs available from CML website

With



- OR -
CMX850

Without



Typical Control and Monitoring System employing the CMX850

[reduced chip and component count, integrated software and much lower power and PCB requirement]

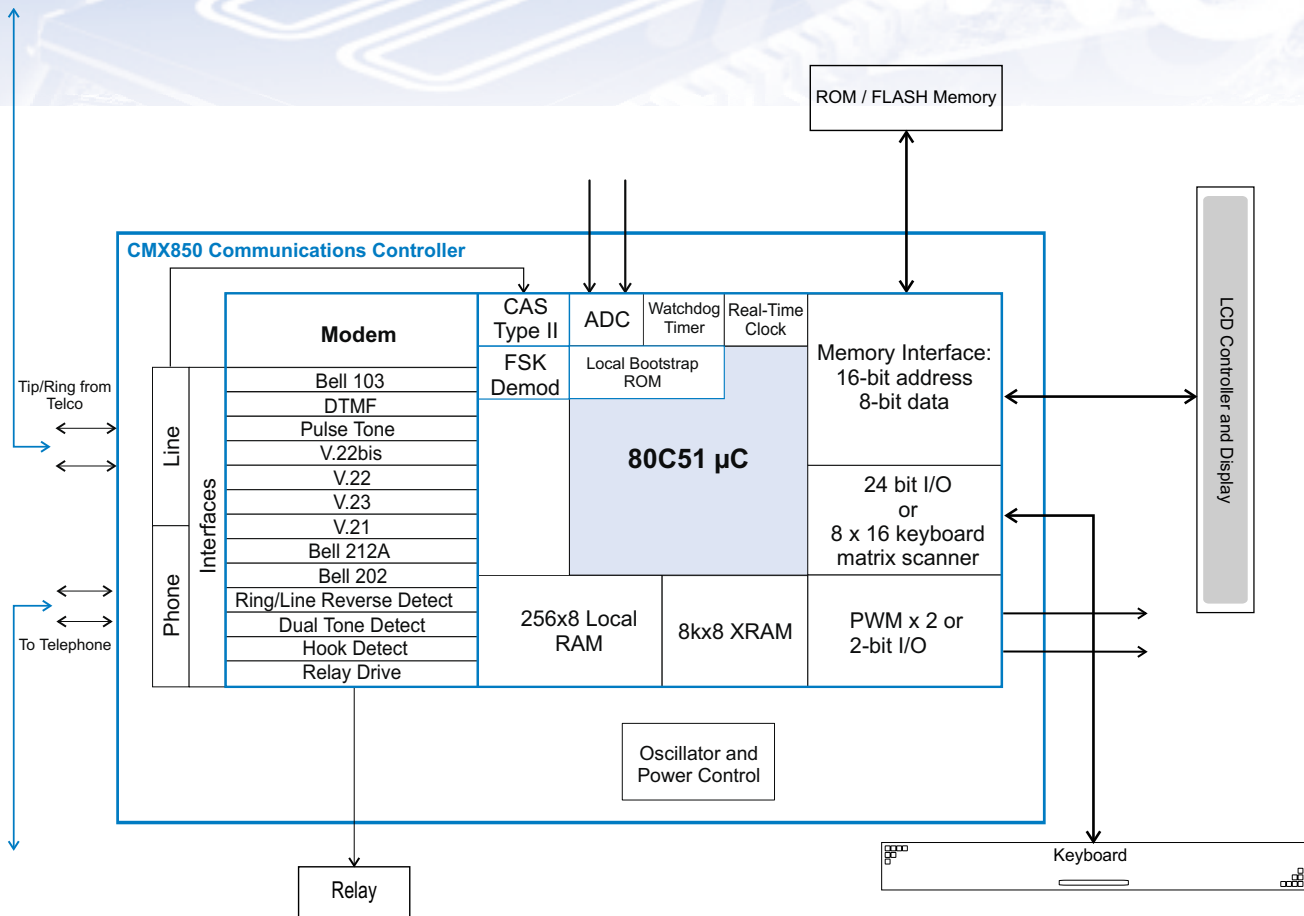
Typical Control and Monitoring System

[high chip and component count, high power and PCB requirement, diverse software load]

Contents

The CML Advantage 2 [Functional Block Diagram](#) 3 [Embedded Microcontroller](#) 4 [Integral Low Power Modem](#) 5 [CMX850 in Action](#) 6 [Demonstration, Design, Evaluation, Investigation and Implementation](#) 7 [Wireline Telecoms Products](#) 8

Functional Block Diagram



Low-Power Operation

- 3.0 to 3.6 volt operating range
- Full operation at 3.3V = 6.6mA typ.
- Powersave at 3.3V = 6.0µA typ.
- Separate analogue and digital supply sections

Advance Power Management

- The power efficiency of the CMX850 is infinitely variable in-line with dynamic operational demands
- Low power RC oscillator and powerdown speed-control for 80C51 clock
- Standard 80C51 idle and powerdown modes; with automatic exit without reset
- External interrupts (ie. keyboard input) can bring the CMX850 µC up from powerdown without system reset
- Real-time clock and alarm interrupts available for µC 'wake-up'
- ADC monitoring can wake the µC on an input signal or level

Peripheral Powersave

- The following µC peripheral functions can be powersaved:
Modem - CAS Detector - A-to-D Converter - Pulse Width Modulator - Real Time Clock - Watch-Dog Timer - Keyboard Encoder
- **Modem powersave** - disables all modem-section circuitry except 'C-BUS' and 'Ring' and 'Hook' detectors

Control

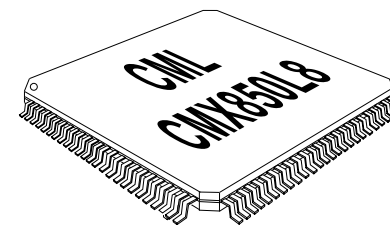
- Controlling firmware is held in external FLASH memory accessed via the Memory Interface
- Dynamic in-circuit programming and software upgrading in the field via Boot-ROM facility
- Communication between the embedded V.22bis modem and the µC is over an internal serial bus via the 'C-BUS' Controller

'C-BUS' Emulation for Modem Comms

- Communication between internal modem and µC uses standard CML 'C-BUS' protocol
- 'C-BUS' controller registers are mapped via Special Function Registers (SFRs) in core

Dual Clocks and On-Chip RC Oscillator

- Selectable 11.0592 or 12.288 MHz Xtal system clock
- 5.5MHz on-chip RC oscillator option for non-time critical operations
- Ultra-low power 32.768kHz Xtal clock for real-time clock operation in powersave



100-pin low profile, small footprint quad flat package

Embedded Enhanced 80C51 Microcontroller and Peripherals

All the features of a standard 80C51 μ C augmented by many new and flexible functions

Hardware

- 8kbytes of internal RAM
- Addressing for 64kbytes of external program memory, 64kbytes of external SRAM and an external LCD controller
- On-Chip Boot ROM ('thin-stub'/'thick-stub' loader)
- Dual clock system with sub-divided main clock and multiple powersaving options
- Two input 10-bit A-to-D converter
- 'C-BUS' controller to on-chip modem
- Watchdog timer
- Real time clock and alarm
- Multiplexed address / data mode giving extra I/O and debug help
- Keyboard encoder (16 x 8 matrix)
- Two low-power PWM outputs

External XRAM Addressing

- Simple addressing of up to 64kB of SRAM
- Increased memory addressing using port-pins for 'page mode' and 'program memory' operation

Real and Virtual Timing

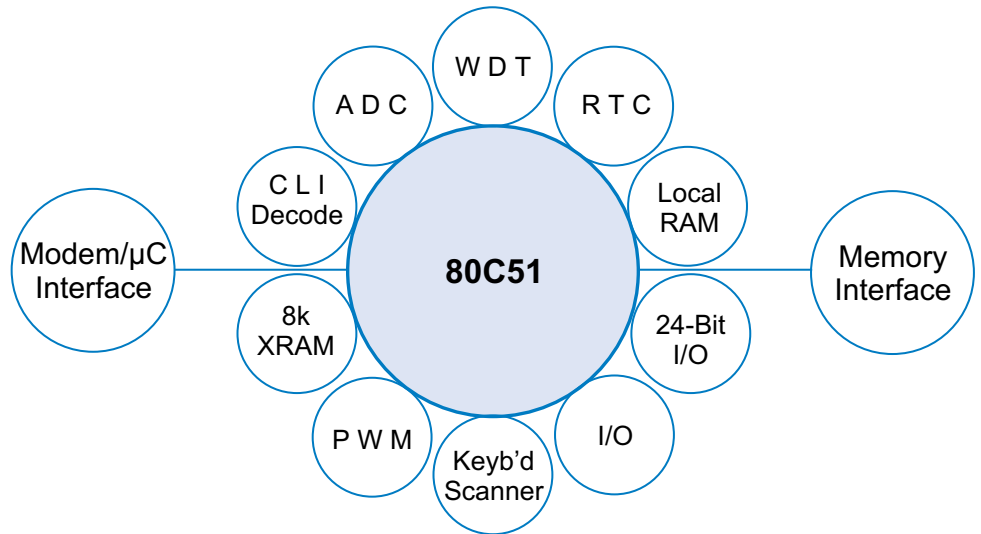
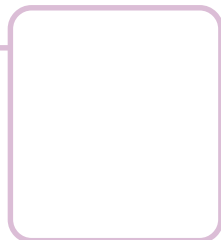
- Selectable Real Time (long period) Clock timer with alarm facilities
- WatchDog Timer for CMX850 system monitoring
- Wide range of timeout values
- Timeout 'reset' or 'interrupt' options

Software

- Additional interrupts serve new controller functions
- MOVX read and write to internal XRAM, external ROM/FLASH, external SRAM or external LCD controller
- Dual data pointers for easy data-block moves
- Special Function Register (SFR) extensions to interface with new 80C51 features

PROM Emulator Interfacing

- Interrupt *Int 9* provides control priority for program review and problem solving
- MOVX read/write stretch for slower peripherals



LCD Interface

- Compatible with any size LCD
- Direct interface with 4- or 8-bit data bus

Keyboard Encoder

- Full 'n-key' rollover with key debounce and separate 'press' and 'release' indications
- 8-character FIFO data buffer
- Automatic 'sleep'/'wake-up' option for low-power operation and reduced EMI
- 8 row input pins with integral pull-up resistors
- 1 to 13 column drive pins - increased to 16 by multiplexed memory interface

ADC Inputs

- For signal and level monitoring
- Multiplexed to 10-bit ADC
- 'One-shot' or 'continuous convert' mode with sample and hold facility
- Selectable sample rate; up to 20kHz
- Interrupt generation available

Low-Power PWM Outputs

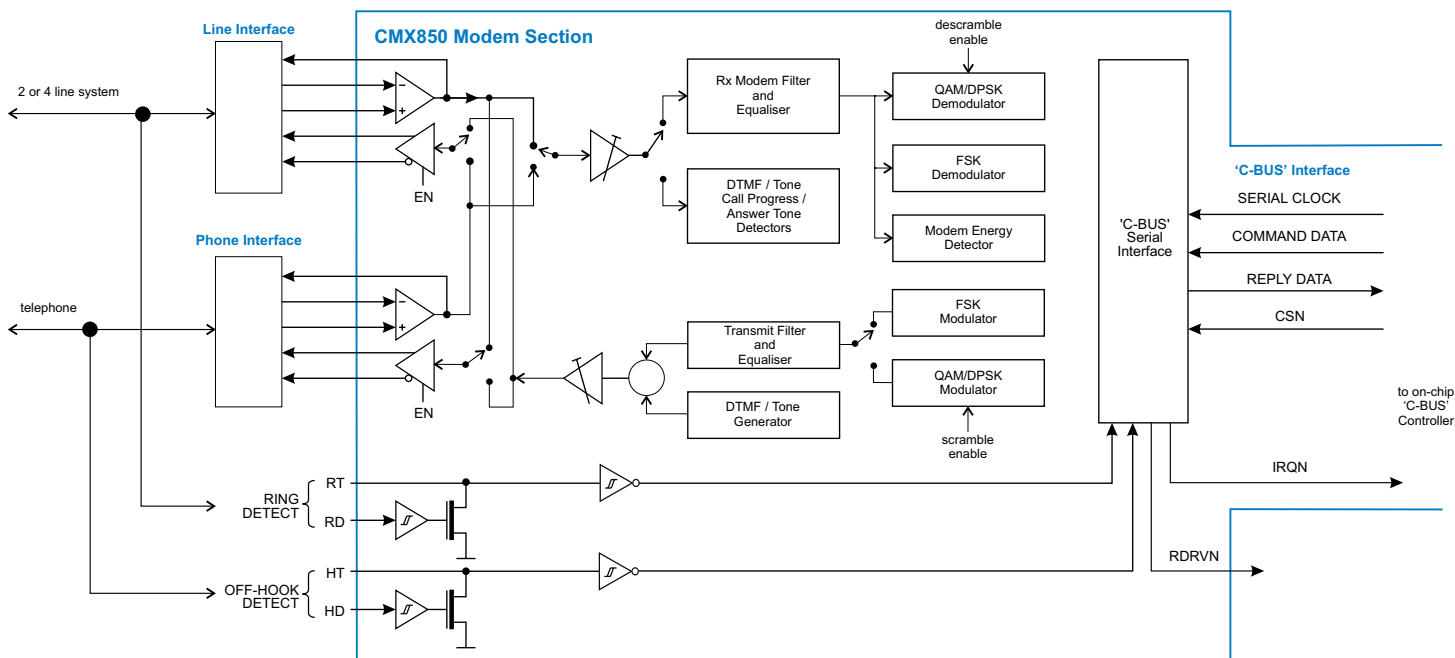
- Two independent, 8-bit Pulse Width Modulation outputs
- Fixed frequency square-wave output with programmable duty cycle

Integral Low-Power Modem



Modem Data Options

- V.22bis 2400b/s QAM
- V.22 1200 or 600 b/s DPSK
- V.23 1200 or 75 b/s FSK
- V.21 300b/s FSK
- Bell 212A 1200 or 600 b/s DPSK
- Bell 202 1200 or 150 b/s FSK
- Bell 103 300b/s FSK



Modulation Schemes

- QAM Quadrature Amplitude Modulation
- DPSK - Differential Phase Shift Keying
- FSK - Frequency Shift Keying

Modem Features

V.14 Compatible USART

- Individual Rx and Tx facilities

Data Scrambling (DPSK and QAM)

- Twin selectable data scramble and descramble formats

Modem Powersave

- Disables all modem-section circuitry except for 'C-BUS' and the 'Ring' and 'Hook' detectors

Rx and Tx Line Equalisation

- 'Fixed compromise' line equaliser for 600, 1200 and 2400 bps

Analogue Input / Output Control and Paths

- Selectable 'line' and 'phone' line drives via differential amplifiers

Level Setting

- Independent Rx and Tx (phone and line) setting; Range: 0 to -10.5 dB

Rx Pattern Detection

- 10101010 ... bit reversals (FSK)
- Continuous 1s (DPSK and QAM)
- Continuous 0s (DPSK and QAM)

Inband Audio

DTMF and Single Tones

- Generates and detects single or dual frequency inband tones
- Programmable tones, tone pairs and bandwidths
- Programmable Tx DTMF twist

Custom Tones/Pairs

- 2 Rx and 4 Tx Tone Pairs can be programmed (max $f = 3.4\text{kHz}$)
- Tx/Rx CAS Tone features available (2130 + 2750 Hz)
- Frequency and level setting facility

Call Progress Frequency Detection

- Detects and indicates inband tones in range: 275 to 665 Hz

Answer Tone Detection

- Indicates when a valid 2225Hz or 2100Hz signal is detected

Relay Drive Output

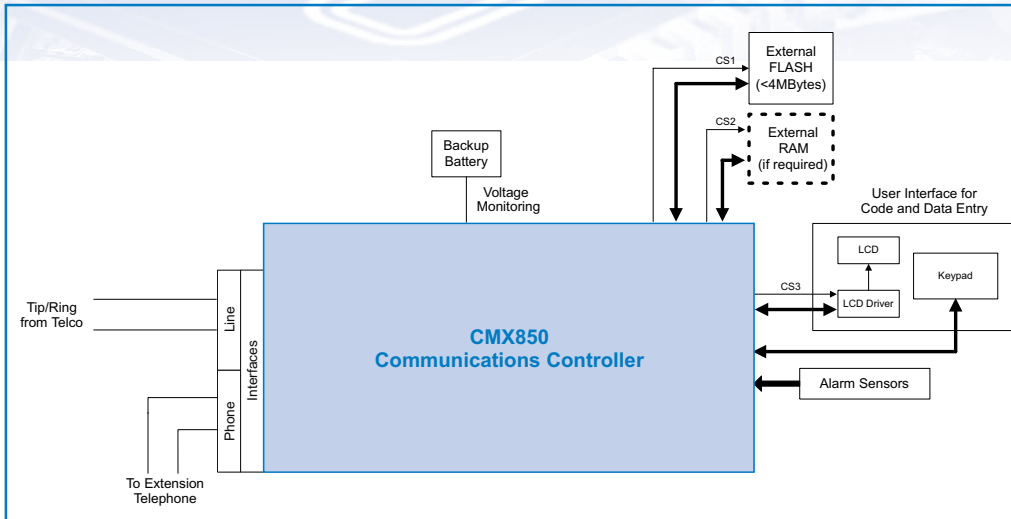
- Available for 'hook-switch' type operations

'Off Hook' and 'Ring' Detection

- Detects large amplitude AC 'ringing' signals
- Stand-alone FSK (CLI) demodulator with high sensitivity CAS tone detector
- Detects CAS tone in the presence of near-end (phone) signals
- Detects 'off hook' voltage-change across phone 'tip' and 'ring' lines
- Provides 'ring' and 'hook' interrupts and status indication
- Modem operation can be stopped on 'hook detect'
- Selectable 'tone detect' timing window

The CMX850 in Action

..... two simple stand-alone application suggestions for the CMX850 and its DAA

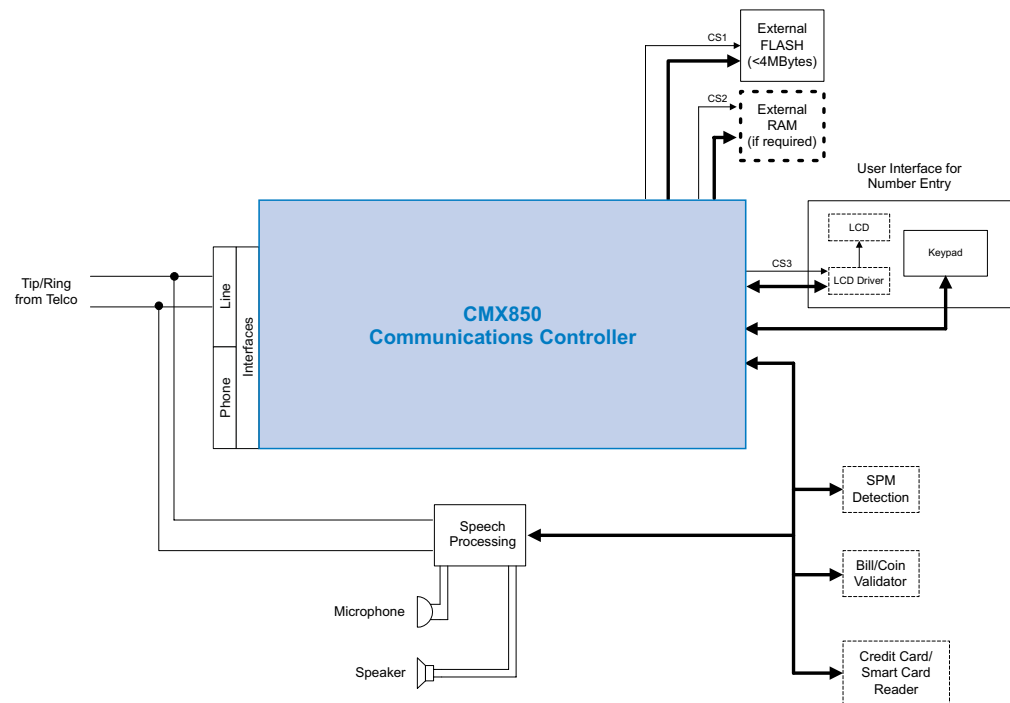


Security Alarm Controller with SIA Protocol

- Compatible with all Security Industry Association (SIA) formats (Pulse, DTMF, FSK)
- Extensive powersave capabilities improve backup battery life
- ADC can monitor backup battery voltage
- Generous I/O can monitor multiple alarm sensors
- Additional interrupt sources assist programming efforts
- Flexible oscillator control minimizes power consumption
- Reference design available for telephone line interface
- Keyboard encoder plus debounce function handles keypad data entry
- LCD controller interface accommodates a wide range of LCDs

Smart PayPhone

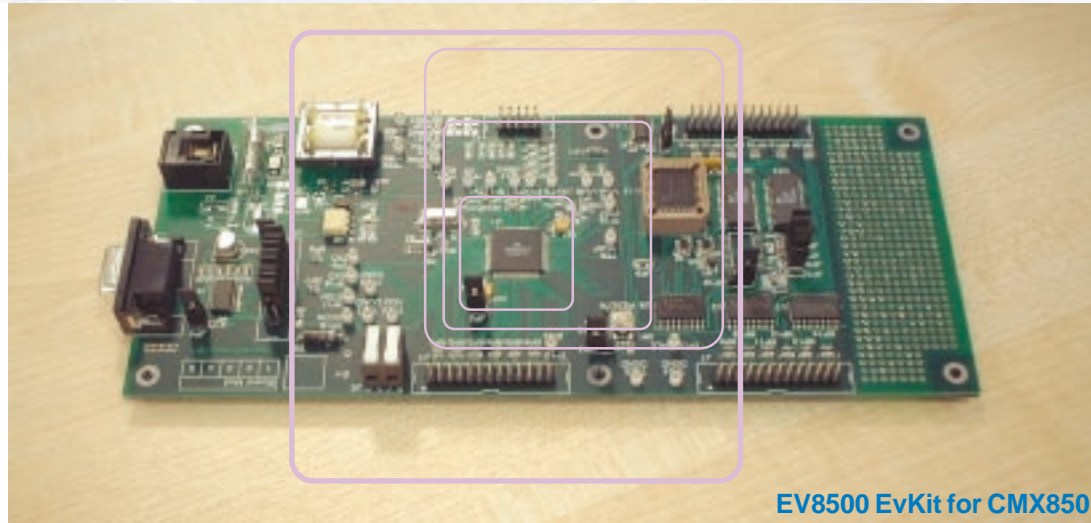
- Generous I/O allows for easy integration of differentiating features
- Reference design available for telephone line interface
- LCD controller interface accommodates wide range of LCDs
- Keyboard encoder plus debounce facility handles keypad data entry
- Built-in modem allows for diagnostic and rate-table updates
- DTMF encoder and call progress detector on-chip increases product integration
- Compatible with Type I and II Caller ID
- Additional interrupts allow for easy control of speech processing



Demonstration, Design, Evaluation, Investigation and Implementation

..... the EV8500 EvKit and DAA interface designs

a single board product comprising a CMX850 Communications Controller, line interface components, firmware and a serial communications port



EV8500 Evaluation Kit

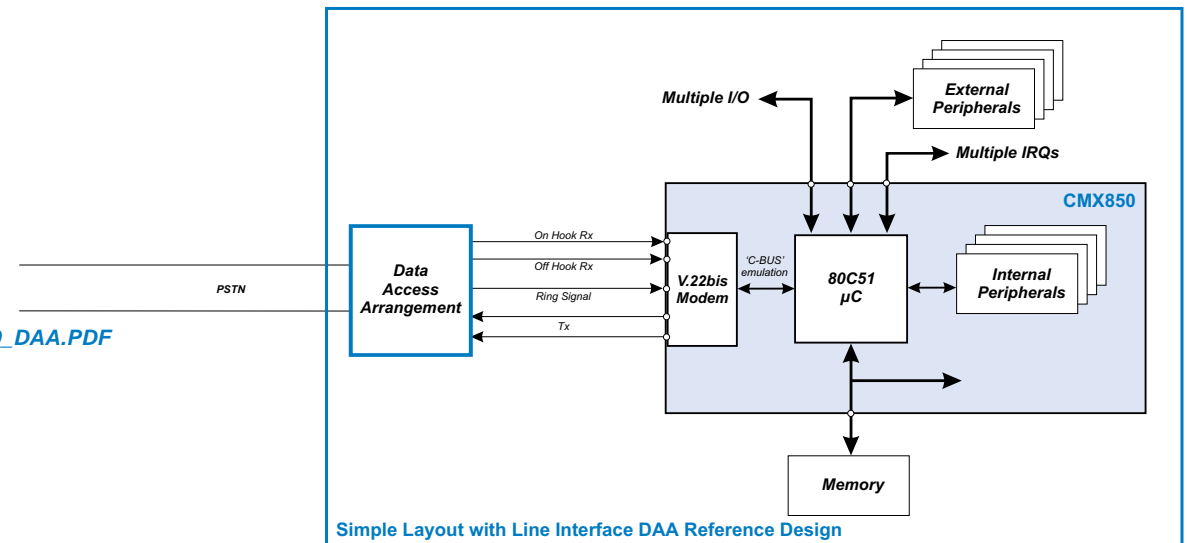
- Includes CMX850 IC for Product Evaluation
- Fully Isolated 2-Wire Line-Interface for FCC68 or CTR21 (DAA)
- Modem Calling/Answering and CLI Firmware
- Full Access to Unused CMX850 (80C51) Ports
- 'AT' Command Compatible Firmware
- Control via PC Terminal Emulator
- Opto-Isolated 'Ring Detect' Circuitry and 'Hook' Relay
- Keyboard Encoder (16 x 8 matrix)
- 8kB Internal RAM with 4M-bit (512kB) External Flash and 64kB External RAM
- Pre-Loaded Operating Software; Future Upgrades will be Available from the CML Website
- On-Board Flash Reprogramming
- Dual Analogue-to-Digital (ADC) Inputs
- Dual Low-Power PWM Outputs
- User's On-Board Design and Prototyping Area
- Space for Optional Telco-Specific Components

Telecom Interfacing with a DAA

As a stand-alone product, the CMX850 is intended to communicate via a telephone line. The connection to the line is via a special interface circuit that is often referred to as a Data Access Arrangement (DAA). CML has available, on its web site, two DAA designs catering for the CMX850 within CTR21 and FCC Part 68 installations.

DAA Interface Designs for the CMX850

- Line Interface Circuits (DAA) for CTR21 and FCC Part 68
- Ring Detect
- Hook Switch
- Line-in-Use Detect
- Parallel Phone Detect
- CLI Capability
- Example (Pre-Loaded Operating Software) μ C source code to be run in the CMX850 external Flash/RAM is available from the EV8500 EvKits page
- Design Information Available from: www.cmlmicro.com/products/applications/Ap850_DAA.PDF



Recent Wireline Telecom Products From CML

- CMX683** Call Progress and 'Voice-Audio' Detector
- CMX860** Telephone Signalling Transceiver
- CMX866** V.22bis Modem with 'AT' Command Set
- CMX867** Low Power V.22 Modem
- CMX868** Low Power V.22bis Modem
- CMX869** V.32bis Modem
- CMX878** V.22bis Modem plus DAA
- DE8661** Demonstration Kit for CMX866
- DE8681** Demonstration Kit for CMX868

www.cmlmicro.com/products/wtelecom/

Member Companies



**CML Microcircuits
(UK) Ltd**

COMMUNICATION SEMICONDUCTORS
Oval Park, Langford, Maldon, Essex CM9 6WG, England
Tel: +44 (0)1621 875500 Fax: +44 (0)1621 875600
sales@cmlmicro.com www.cmlmicro.com



**CML Microcircuits
(USA) Inc.**

COMMUNICATION SEMICONDUCTORS
4800 Bethania Station Road, Winston-Salem, NC 27105, USA
Tel: +1 336 744 5050, 800 638 5577 Fax: +1 336 744 5054
us.sales@cmlmicro.com www.cmlmicro.com



**CML Microcircuits
(Singapore) Pte Ltd**

Singapore

COMMUNICATION SEMICONDUCTORS
No. 2 Kallang Pudding Road,
#09 - 05/06 Mactech Industrial Building, Singapore 349307
Tel: +65 67450426 Fax: +65 67452917
sg.sales@cmlmicro.com www.cmlmicro.com

Shanghai

No. 218, Tian Mu Road West, Tower 1, Unit 1008,
Shanghai Kerry Everbright City, Zhabei, Shanghai 200070, China
Tel: +86 21 63174107 and +86 21 63178916 Fax: +86 21 63170243
cn.sales@cmlmicro.com.cn www.cmlmicro.com

Package	-40° to +85°C
CMX850L8	100-pin LQFP



Your Local CML Distributor

Information

www.cmlmicro.com/products/wtelecom/CMX850.htm

Technical Support

techsupport@cmlmicro.com