

Subscriber Pulse Metering (SPM) Detection

INNOVATIONS
INV/Telecom/SPM/1 September 2001

Versatile telephone call-charge and security functions for PBX, Payphone and Pair-Gain applications - employing CML's family of 12kHz and 16kHz SPM ICs

CML's current family of SPM ICs offers a versatile and varied menu of features for call-charge metering applications. In addition, the battle against payphone fraud is waged using the CMX641A's selectable 12/16 kHz ASK Generator, in combination with an SPM Detector, to provide dynamic on-line security. With simple control and signal interfacing, compact packaging and low power requirements, each of these products, individually, presents the design engineer with the ideal solution to all call-charge or recording application problems.

Products

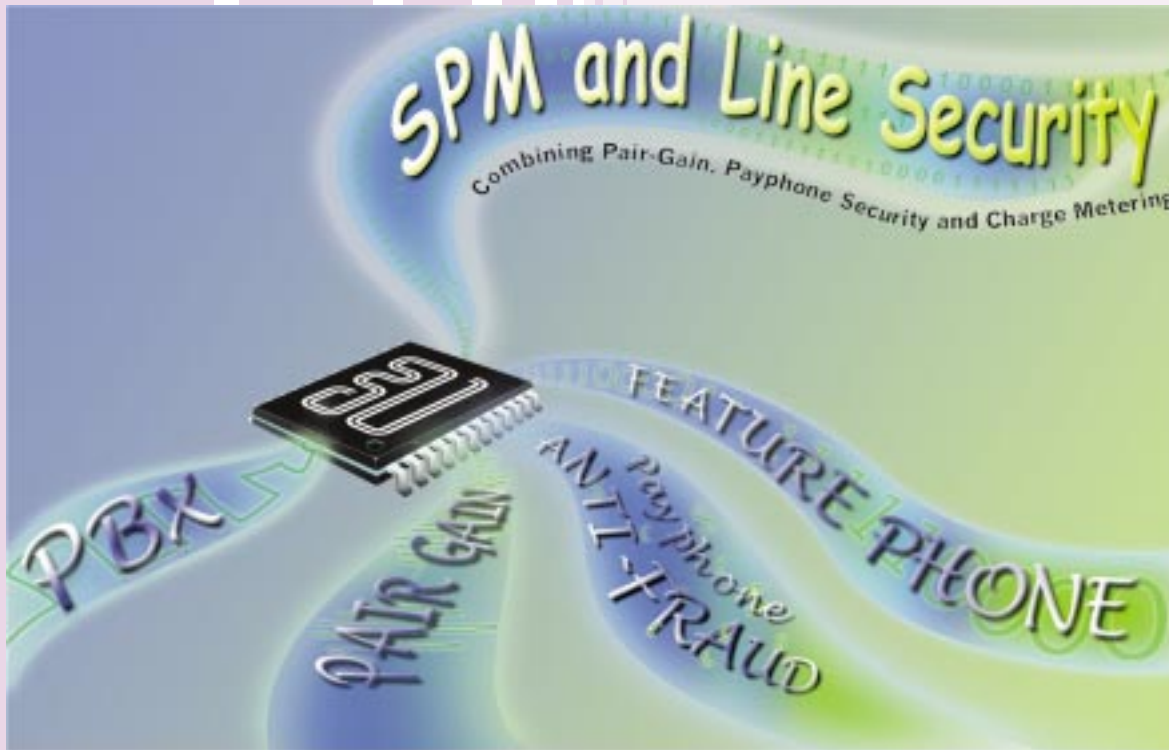
- **CMX631A** Low Voltage SPM Detector
- **CMX641A** Dual SPM/Security Detector/Generator
- **CMX661** Pair Gain Dual SPM Detector

Subscriber Pulse Metering (SPM) functions are employed by an analogue telephone system primarily to enable call-charge recording and billing. In order to achieve this, the relevant telephone equipment must be able to accurately determine several factors, amongst which is the ability to measure the duration of the call. CML's SPM IC products have the ability to accurately detect 12kHz or 16kHz call-charge tones to most countries' national telephone level and frequency specifications.

(SPM) Pair-Gain - To allow the transmission of analogue 'SPM' timings to be passed over a digital system, the CML SPM devices will provide outputs in a digital format in the *Tone Follow* mode. The CMX661 offers an adjustable 'decode bandwidth' for global system implementation.

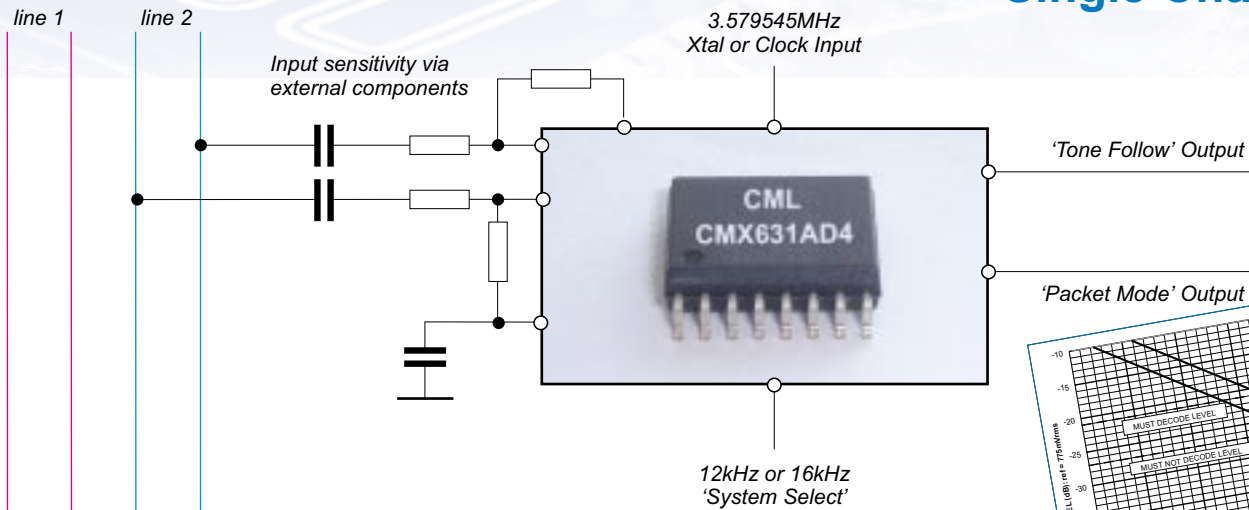
Payphone Antifraud - Interference with the payphone or its telephone line can be detected by interrogation of the remote unit. The CMX641A offers a tone generator/detector facility to form the core of such an interrogation system.

This document describes the functions and applications of three of CML's SPM, Pair-Gain and Payphone Antifraud ICs.



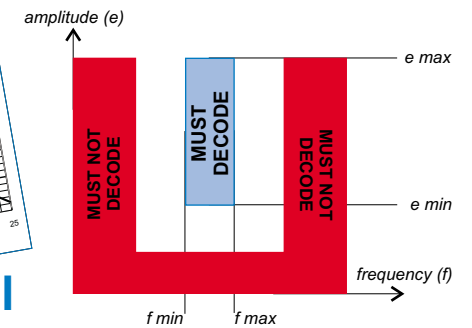
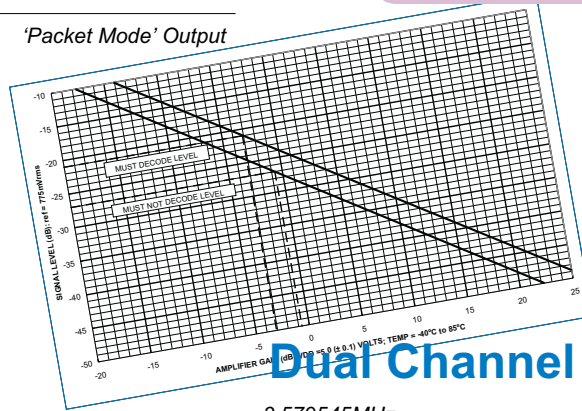
Single and Dual Channel SPM

Single Channel



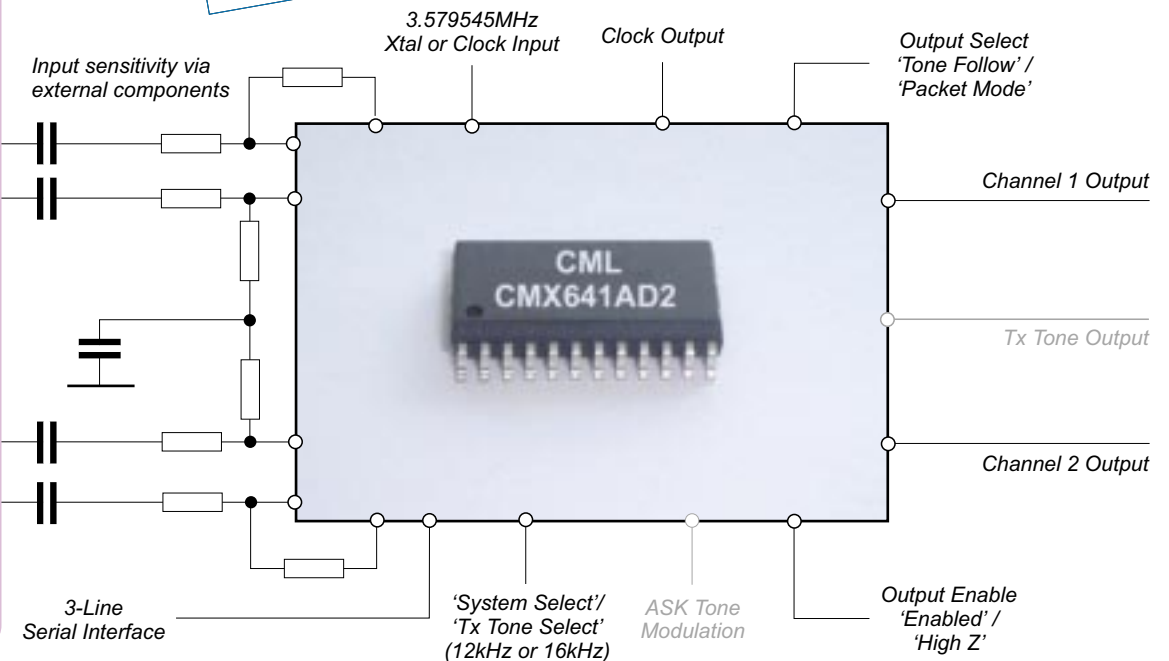
CMX631A

- Single input
- 'Tone Follow' and 'Packet Mode' outputs
- Pin selectable to 12kHz and 16kHz systems
- D4, D5 and P3 packages
- 800µA at 3.0V requirement (2.2mA at 5.0V)

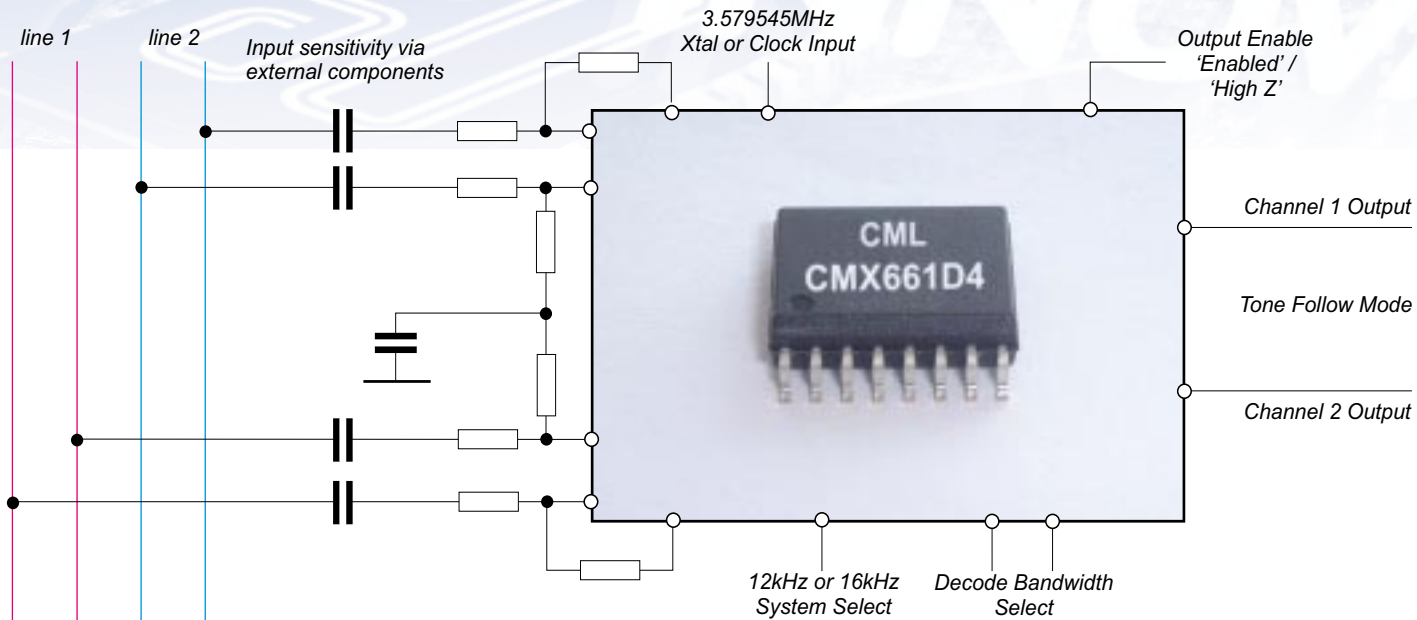


CMX641A - SPM Applications

- Dual input/Dual output
- Selectable output modes (both channels):
Tone Follow
Packet Mode
High Impedance
- Dual operating states:
Fixed Bandwidth:
Controlled: (both channels) Level sensitivity and system frequency via serial interface
Fixed: (both channels) level sensitivity via external components, system frequency via pin selection
Enhanced Operation:
Independent (per channel) control of: Decode bandwidth, Level sensitivity and System frequency via serial interface
- D2 and P4 packages
- 1.2mA at 3.0V (2.0mA at 5.0V)



SPM in Pair-Gain



CMX661

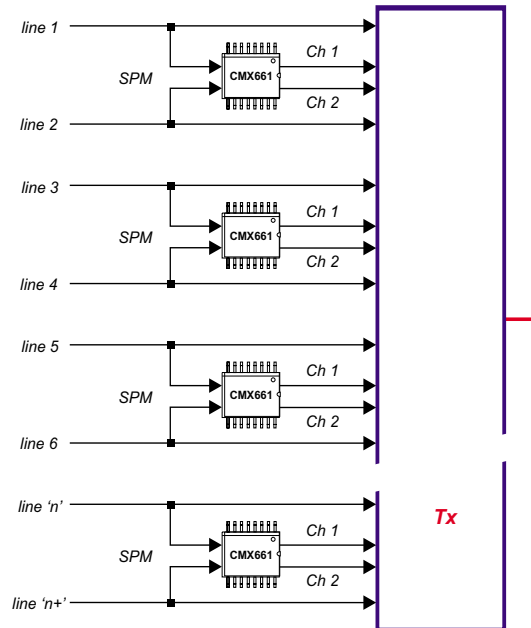
- Dual inputs
- Dual outputs in 'Tone Follow' mode
- Pin selectable to 12kHz and 16kHz systems
- Pin selectable decode bandwidth range
- Output Enable function for multiplexing
- D4 and P3 packages
- 750µA at 3.0V requirement (1.25mA at 5.0V)

Decode Bandwidth Settings

- ±1.5%
- ±3.0% % of nominal tone frequency
- ±5.0%
- ±7.5%

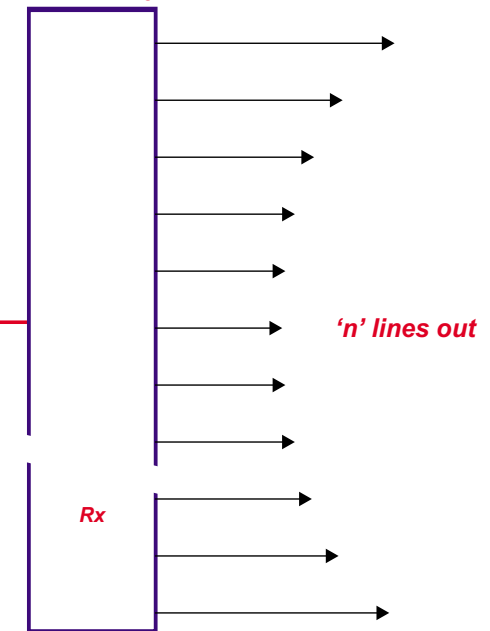
Pair-Gain - to distribute multiple voice telephone channels over a single digital route. CML's SPM function in this scheme is to facilitate the detection and digitisation of each channel's call charge metering pulses for inclusion in the final 'multi-channel' pair-gain signal.

Analogue Line Inputs



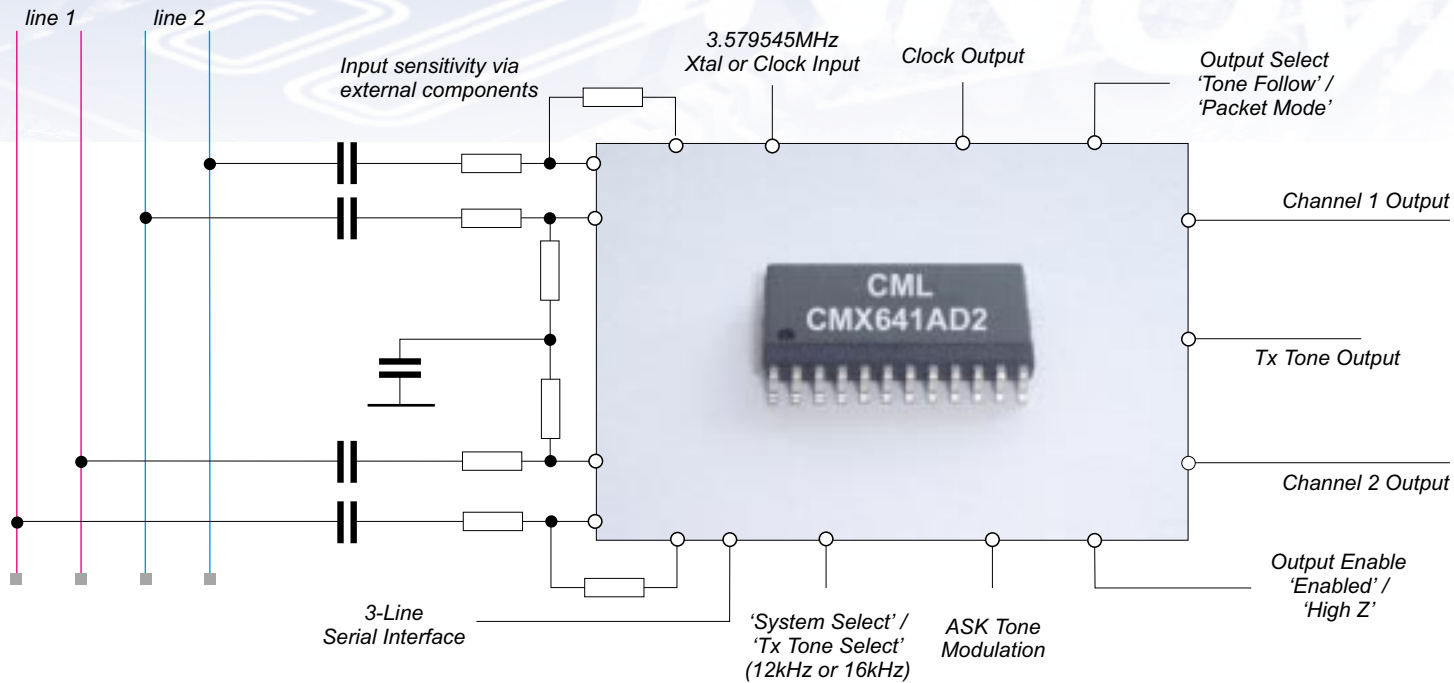
Single Digital Route

Remote Exchange



SPM in Pair Gain - an Overview

Payphone Security

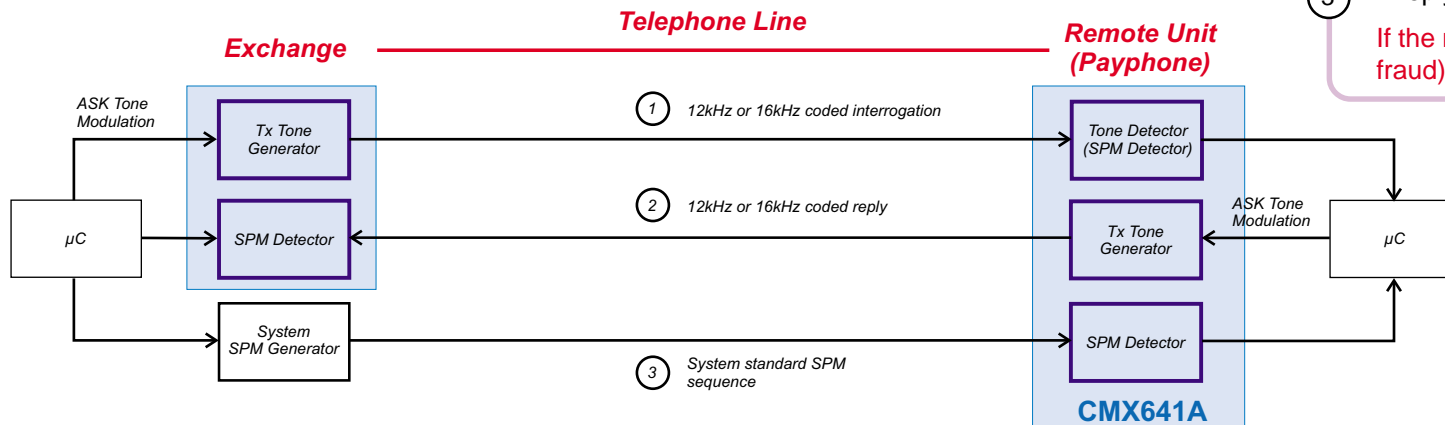


CMX641A - Security Applications

- Dual SPM inputs/Dual SPM outputs
- Pin selectable output modes (both channels):
Tone Follow
Packet Mode
High Impedance
- Input sensitivity by external components or via serial interface
- Independent control of both 'detector' channels via serial interface:
Decode bandwidths
Level sensitivity
Channel system (12kHz/16kHz) frequencies
- ASK modulated transmit tone
- Output Enable function for multiplexing
- D2 and P4 packages
- 1.2mA at 3.0V (2.0mA at 5.0V)

Payphone Fraud is responsible for enormous financial losses to telecom operating companies worldwide. The CMX641A, with its tone generator and SPM detector combination, offers a unique reliable method of safeguarding payphone security.

Theoretical Payphone Security Implementation



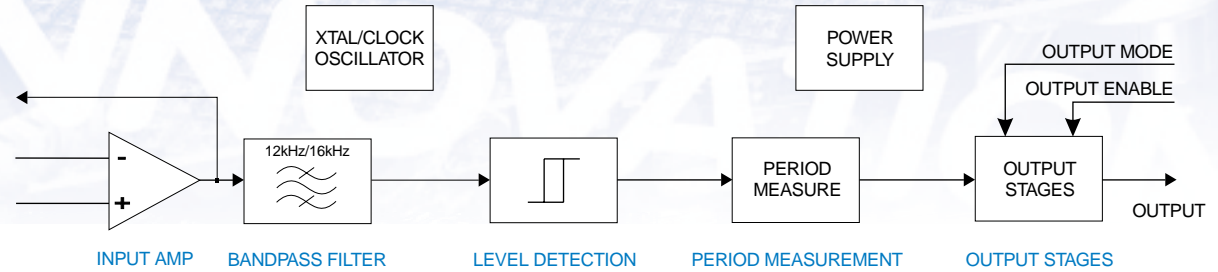
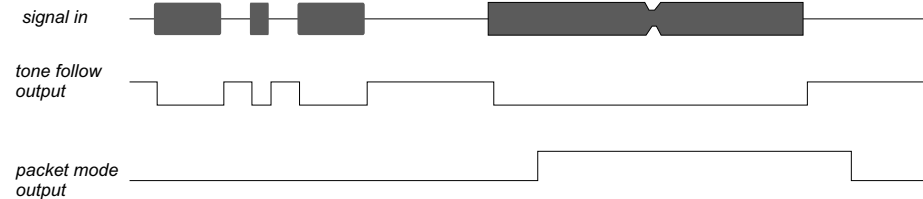
- ① Coded interrogation sent to line via Tx Tone Generator
- ② Remote unit replies to interrogation
- ③ If reply is correct, exchange µC allows call to continue

If the reply is missing or incorrect (due to broken line or fraud), the µC will terminate the call

General CML SPM Functions

Input Amplifier

... with relevant external gain components, is used to set the overall level sensitivity of the product to conform to the national level specification ('Must' and 'Must-Not' Decode signal levels). Additionally, level parameters on the CMX641A can be set over the serial data interface.



This diagram illustrates a typical CML SPM detector channel. Each product described in this document has additional function-specific features

Output Stages

Two outputs are available: 'Tone Follow' and 'Packet Mode'. To allow multiplexing in a line card environment, the CMX641A and CMX661 outputs are additionally controllable to a high impedance (off) level.

Tone Follow Mode, having a short (15ms) response/deresponse time, forms an 'envelope' of the input tone. Host systems will need to qualify the received tone; this format can be employed in Pair Gain and Security applications.

The Packet Mode only responds after 40ms of continuous tone (with a similar deresponse time), ignoring erroneous (shorter bursts) tones. This output supplies the host with a pseudo-qualified indication of an SPM detection.

Bandpass Filter

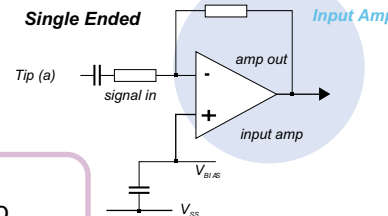
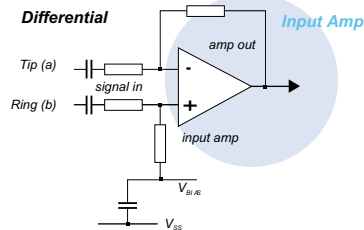
A constant-gain tone bandpass/audio-reject filter which is automatically centred on the selected system frequency: 12kHz or 16kHz.

Level Detector

The signal level discrimination function. Input signals which fulfil the system-level requirements activate the period measurement circuitry.

Period Measurement

A valid SPM tone is recognised when a correct sequence of timing pulses is received from the level-detector circuitry.



Input Configurations

To cater for all types of installation, all CML's SPM products can be configured to either: **Differential** or **Single-Ended** inputs.

Frequency Accuracy and Stability

'Must' and 'Must-Not' Decode frequency accuracy is obtained and maintained by the use of a stable 3.579545MHz Xtal or clock input. The CMX641A can be employed as a Master Oscillator for up to 3 additional SPM microcircuits.

Power Requirements

All three products described here are specified to operate accurately over the voltage range of 3.0 to 5.5 volts.

Product Applications

PBX and PABX Line-Cards - Pair-Gain Systems - Payphone Security - Featurephones - Out-of-Band Signalling

The CML Advantage

- 12kHz and 16kHz operation
- High accuracy and stability
- Low Power 2.7 to 5.5 volt requirement accommodates line power operation
- CMX641A includes a 12kHz and 16kHz tone generator to offer low speed data facility
- Integrated solution; compares favourably with discrete component arrangements
- Simple or serial control
- CMX641A and CMX661 both offer 'dual-channel' outputs
- Flexible configuration suits multiple applications

Product	Function	SPM Channels	Sensitivity	Selectivity	Control	Output	Voltage Range	Packages
CMX631A	SPM Detector	One	ext comps	preset	pin select	tone follow packet mode	2.7 to 5.5 V	D4, D5, P3
CMX641A	SPM Detector/ Security Gen/Detect	Two	ext comps serial select	preset/ serial select	pin select/ serial select	tone follow packet mode	2.7 to 5.5 V	D2, P4
CMX661	SPM Detector	Two	ext comps	logic inputs (adjustable decode bandwidths)	pin select	tone follow	2.7 to 5.5 V	D4, P3

YOUR LOCAL CML DISTRIBUTOR

More Information

www.cmlmicro.co.uk/products/telecom/cm631A.htm

www.cmlmicro.co.uk/products/telecom/cm641A.htm

www.cmlmicro.co.uk/products/telecom/cm661.htm

Packages	-40° to +85°C
CMX631AD4	16-pin plastic SOIC
CMX631AD5	24-pin plastic SSOP
CMX631AP3	16-pin plastic DIL
CMX641AD2	24-pin plastic SOIC
CMX641AP4	24-pin plastic DIL
CMX661D4	16-pin plastic SOIC
CMX661P3	16-pin plastic DIL



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