TDM EC C6424

TDM Echo Canceller Chip Application

TARGET APPLICATIONS

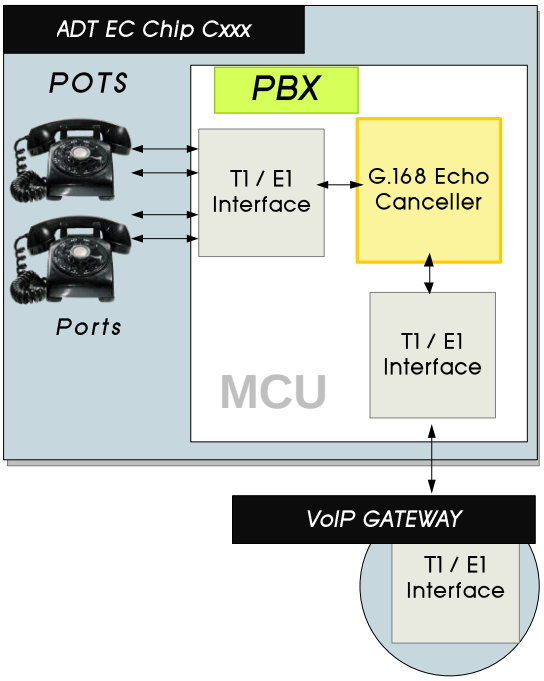
T1/E1 Network Echo Canceller

VoIP Gateway with Digital Trunks

PBX

OVERVIEW

Adaptive Digital's quality enhanced, high-density echo canceller chip TDM EC-C6424 product combines Adaptive Digital's TDM EC DSP software plus host API along with Texas Instruments' TMS320C6424V DSP to form a turnkey soft-chip for use in PBX, Gateway, and telephone network equipment.



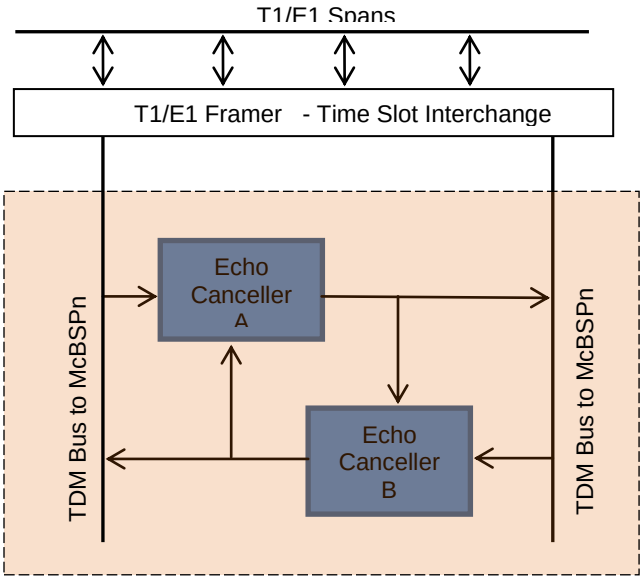
Typical TDM EC-C6424 Application Block Diagram

SOFTWARE FEATURES

- G.168 - Certified by AT&T Voice Quality Lab
- ITU G.168-2002 Compliant
- Compliant using all ITU hybrid models
- Low Throughput Delay (500 microseconds)
- Adaptive Non-linear processor
- Voice Activity Detection / Comfort Noise Generation
- Operates in SS-7 Networks
- No divergence due to double-talk
- G.164/G.165 Tone DisablerNoise Reduction
- Noise Reduction
- Programmable "Aggressiveness"
- Adapts to background noise continuously
- Automatic Level Control
- Programmable maximum gain/loss
- Programmable Output Target Level

Optional Software Features

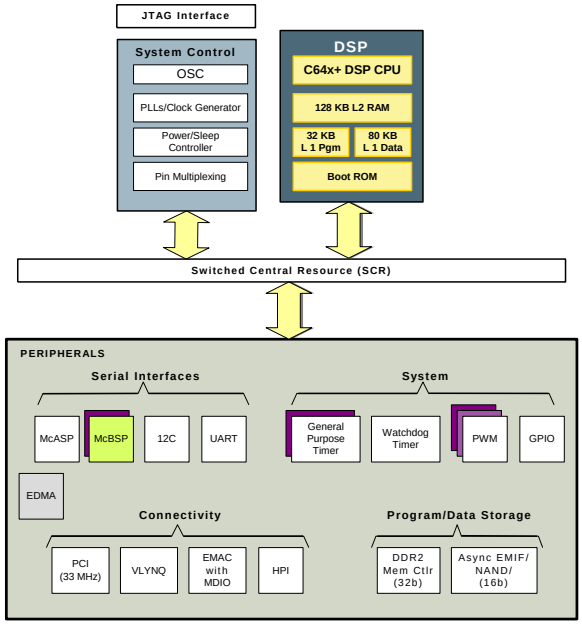
- Tone Detection (DTMF, Call Progress, MF, MFR1 Forward/Back)
- Conference
- Caller ID
- AGC
- Call Progress Tone Generation



TDM EC-C6424 Software Block Diagram

HARDWARE FEATURES

- High-Performance
  - 400-/500-/600-/700-MHz, C64x+™Clock Rate
- Eight 32-Bit C64x+™ Instructions/Cycle
  - 2.5-, 2-, 1.67-, 1.43-ns Instruction Cycle Time
- 16-Bit Host-Port Interface (HPI)
- Enhanced Direct-Memory-Access (EDMA) Controller (64 Independent Channels)
- C64x+ L1/L2 Memory Architecture
- Two Multichannel Buffered Serial Ports
- 10/100 Mb/s Ethernet MAC (EMAC)
- Multichannel Audio Serial Port (McASP0)
- IEEE-1149.1 (JTAG™) Boundary-Scan-Compatible
- On-Chip ROM Bootloader
  - Up to 111 General-Purpose I/O (GPIO) Pins
- Port count: 64
- 3.3-V and 1.8-V I/O, 1.2-V Internal
  - 3.3-V and 1.8-V I/O, 1.05-V Internal
- 2 64-bit timers



This solution is based upon the TI TMS320C6424 DSP. The C6424 device is based on the third-generation high-performance, advanced VelociTI™ very-long-instruction-word (VLIW) architecture developed by Texas Instruments (TI), making these DSPs an excellent choice for digital signal processor applications.

ADDITIONAL HARDWARE FEATURES

- 64-bit Watchdog Timer
- 2 UARTS
- 1 I2C Bus Controller
- 1 McASP
- 32-bit PCI Interface
- 3 PWM outputs
- VLYNQ Interface

PRODUCT OVERVIEW

The high-density echo canceller chip TDM EC-C6424 solution is based upon Adaptive Digital's AT&T certified network echo canceller and supports both T-1 and E-1 configurations.

SPECIFICATIONS

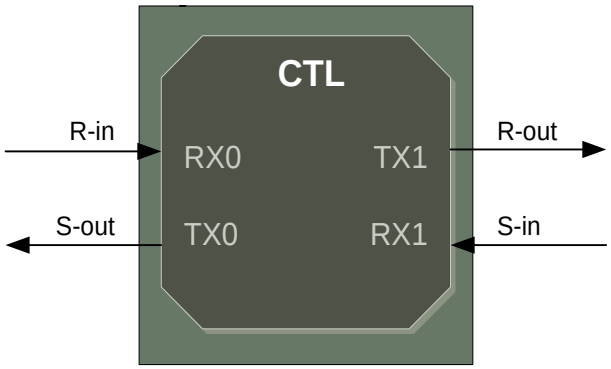
Application	Product Number/Silicon	Channel Count	Description
Network Echo Canceller	TMS320C6424V / 600	128	G.168 EC @ 128 msec, mu-Law and A-Law companding

DETAILED DESCRIPTION

The TDM EC-C6424 is designed to operate in network equipment that does not have an internal echo source; the echo source is located elsewhere in the network. It can deal with long echo delay and can also handle signaling tones often found in the telephone network. The TDM EC-C6424 can cancel reflections caused by more than one hybrid circuit in the network and can deal with echo-free circuits or circuits in which the echo is already cancelled at the source.

CHIP CONFIGURATION

The TDM EC-C6424 needs to be configured at power up. Configuration parameters for the serial ports, echo canceller, automatic level control, and noise reduction are described in the sections that follow.



SERIAL PORT CONFIGURATION

The TDM EC-C6424 can operate using either one or two TDM serial ports. Although time slot mapping can be done, there are default time slot mappings for both the single port and the two port configurations. If two serial ports are used (ports 0 and 1), a single echo canceller channel operates on a given time slot on both serial ports. For example, echo canceller

channel 0 is connected to serial port 0, time slot 0 for its receive side and it is connected to serial port 1, time slot 0 for its send side. If a single serial port is used, the receive and send sides use even and odd time slots. In this case, the receive side would be connected to serial port 0, time slot 0 and the send side would be connected to serial port 0, time slot 1. In order to interface to a wide variety of serial TDM busses, the EC-168 serial port configuration is programmable.

ECHO CANCELLER CONFIGURATION

The echo canceller algorithm has numerous programmable options to allow it to be configured appropriately for a wide variety of applications. When bi-directional cancellation is selected, the canceller is independently programmable in each direction. Table 2 lists the echo canceller configuration parameters. Note that the tail length affects the channel density of the chip.

Echo Canceller Configuration Parameters		
Parameter	Valid Range	Default Value
Global Echo Canceller Enable	Enable / Disable	Enable
Tail Length	32, 64, and 128 milliseconds	128
NLP Type	Off, Mute, Suppress, Random Noise, or Hoth Noise	Hoth Noise
NLP Threshold	12, 18, 24 dB	24
NLP Max Suppress	Maximum NLP suppression (NLP Type=Suppress only) 0..90 dB	12
CNG Threshold	-40..-60 dBm	-43 dBm
Double Talk Threshold	0 to 12 (units of dB)	4
G.165 Detect Enable	Enable or Disable	Enable
Adapt Enable	Enable or Disable	Enable
Number of reflectors	1 to 3	3
Reflector Length	4, 8, 12, 16 milliseconds	8

Table 2: Echo Canceller configuration parameters.

AUTOMATIC LEVEL CONTROL CONFIGURATION

ALC Configuration Parameters		
Parameter	Valid Range	Default Value
Global ALC Enable	Enable/Disable	Enable
Target Power	-30 to 0 (units of dBm)	-18
Loss Limit	-23 to 0 (units of dB)	-10
Gain Limit	0 to 23 (units of dB)	10

Table 3: Lists the configuration parameters that control the operation of the Automatic Level Control (ALC) feature.

Channel Types

Echo canceller channels are turned on and off as needed under control of a host processor. Each time a channel is turned on, it is necessary to provide call setup information. Since an echo canceller is a two port device, we define the two ports as side A and side B. The canceller can be configured to cancel echo in neither, one, or both directions. If echo cancellation is

enabled at the A side, the echo perceived by the speaker at the B side will be cancelled. If echo cancellation is enabled at the B side, the echo perceived by the speaker at the A side will be cancelled.

Channel Setup Parameters		
Parameter	Valid Range	Default Value
A Side Serial Port	0,1	
A Side Time Slot	0..255	
B Side Serial Port	0,1	
B Side Time Slot	0..255	
Enable A Side EC	Enable/Disable	Enable
Enable B Side EC	Enable/Disable	Disable

Table 4: Channel Setup Parameters

If the TDM EC-C6424 is configured for standard serial port mapping, the B side time slot will be derived from the A side time slot.

Online Control and Status Reporting

In order to perform diagnostics and testing, a number of controls are provided to modify the state of an active channel. Table 5 lists the features that be controlled during an active call. Table 7 lists the status parameters that are available during an active call.

Channel Control Parameters		
Parameter	Valid Range	Default Value
EC Enable	Enable/Disable	Global
EC Adapt Enable	Enable / Disable	Enable
EC NLP Enable	Enable / Disable	Enable
EC CNG Enable	Enable / Disable	Enable
ALC Enable	Enable/Disable	Global
Noise Reduction Enable	Enable/Disable	Global

Table 5: Lists the features that be controlled during an active call.

Parameter	Valid Range
Convergence Status	0..32767
G.165 Tone Detector Status	Null, G.164 Active, G.165 Active

Table 6: Lists the status parameters that are available during an active call.

HOST API

Control of the EC-168 is facilitated by using an ANSI “C” set of API functions that are provided to run on the host processor. These functions configure and control the EC-168 as well as return status information to the host application.

```
EC 168Configure( .. )
EC 168SetupChannel( … )
```



```
EC 168TeardownChannel( … )
EC 168ControlChannel( … )
EC 168GetChannelStatus( … )
```

REFERENCES

1. Adaptive Digital Technologies [PRODUCT] Users Guide
2. Texas Instruments [TMS320C6424] Fixed-Point Digital Signal Processor (literature number [SPRS347C])

Deliverables

The deliverable items are platform dependent. In general, there is a single DSP-downloadable binary image along with host API software in C source code format. Also included in the deliverables is product documentation, which includes a users guide and usually includes release notes. Sample/test code may be included as well.

Adaptive Digital is a member of the Texas Instruments Developer Network, and ARM Connected Community.

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