

## ADT VQE G-168 EC CHIP

Adaptive Digital Technologies, Inc.

### PRODUCT DESCRIPTION

The Adaptive Digital Technologies high-density echo canceller chip (VQE-168) is a carrier-class ITU G.168-2002 compliant PCM network echo canceller chip. This solution is based upon Adaptive Digital's AT&T certified soft echo canceller running on the Texas Instruments TMS320C641X digital signal processor. The VQE-168 supports both T-1 and E-1 configurations.

The VQE-168 uses two TDM serial ports, one for the receive side of the canceller and the other for the send side of the canceller. The TDM serial ports are fully programmable to allow connection to nearly any type of serial bus.

The VQE-168 includes Adaptive Digital's proprietary voice quality enhancement algorithms including noise reduction and automatic level control. These features, in conjunction with the echo canceller, ensure maximum voice quality.

### EC FEATURES

- Certified by AT&T Voice Quality Lab
- ITU G.168-2002 Compliant
- Compliant using all ITU hybrid models
- Low Throughput Delay (500 microseconds)
- Supports up to 240 channels
- Adaptive Non-linear processor
- Comfort Noise Generator
- Operates in SS-7 Networks
- No divergence due to double-talk
- G.164/G.165 Tone Disabler

### ADDITIONAL VQE FEATURES

- Noise Reduction
- Programmable "Aggressiveness"
- Adapts to background noise continuously
- Automatic Level Control
- Programmable maximum gain/loss
- Programmable Output Target Level

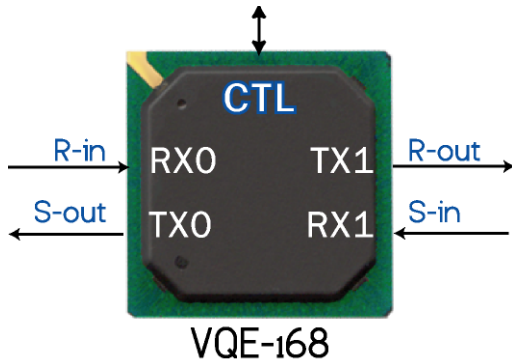
Channel Density				
	Echo Cancellor		Echo Cancellor with Noise Reduction and Automatic Level Control	
	T-1 Spans	E-1 Spans	T-1 Spans	E-1 Spans
32 msec. tail	9	7	4	3
64 msec. tail	7	6	3	2
128 msec. tail	5	4	2	2
EC Off	N/A	N/A	6	4

**Table 1:** Channel density.

Control of the VQE-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 VQE-168 as well as return status information to the host application.

**Chip Configuration**

The VQE-168 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 VQE-168 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 VQE-168 serial port configuration is programmable. Table 1 below describes the serial port configuration parameters.

Serial Port Characteristics		
Parameter	Valid Range	Default Value
Serial Port 0	Enabled/Disabled	Enabled
Serial Port 1	Enabled/Disabled	Enabled
Number of Time Slots	0..255	128
Use Standard Mapping	True / False	True
Data Format	u-Law, A-Law, 8 bit Linear, or 16 bit Linear	u-Law
Transmit Sync Polarity	Active High or Active Low	Active High
Receive Sync Polarity	Active High or Active Low	Active High
Transmit Clock Polarity	Rising Edge or Falling Edge	Rising Edge
Receive Clock Polarity	Rising Edge or Falling Edge	Falling Edge
Transmit Data Delay	0 to 2	1
Receive Data Delay	0 to 2	1
DX Pin Delay	Enable or Disable	Disable

**Table 2:** Serial port characteristics.

### 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.

### Echo Canceller Configuration – cont'd

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 3:** Echo Canceller configuration parameters.

Note that the tail length affects the channel density of the chip.

Table 3: 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 4:** Lists the configuration parameters that control the operation of the Automatic Level Control (ALC) feature.

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 5:** Channel Setup Parameters

If the VQE-168 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 6 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

**Table6:** 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 7:** Lists the status parameters that are available during an active call.

**VQE-168 ANSI "C" API**

Control of the VQE-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 VQE-168 as well as return status information to the host application.

FUNCTION

VQE168Configure( .. )

VQE168SetupChannel( ... )

VQE168TeardownChannel( ... )

VQE168ControlChannel( ... )

VQE168GetChannelStatus( ... )

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