G.PAK™ C54x

Adaptive Digital Technologies, Inc.

Product Description

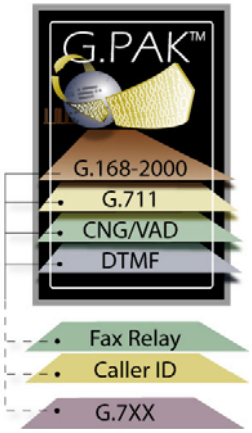
G.PAK is a scalable and configurable voice-over-packet DSP software solution that turns a digital signal processor chip into an easily controlled voice-over-packet engine. G.PAK integrates the building blocks that are required in voice-over-packet systems into a turnkey solution. System designers can therefore leverage a proven solution, allowing them to focus their efforts on rapid product development.

Build Time Configurability

In order to maximize channel density, G.PAK is configured specifically for the user's application. No extra resources (MIPS and Memory) are wasted on algorithms or port configurations that are not required in the users application. Similarly, this approach allows the designer to select a more cost effective DSP solution.

Runtime Configurability

Each channel is configured at runtime to interface between the appropriate port types. Port types include PCM, Packet, and Circuit Data. The most common channel configuration is PCM on one side of the channel and packet data on the other side of the channel (a PCM to Packet channel.) Other configurations include PCM to PCM, Packet to Packet, and Circuit Data. The result is true universal port operation



Voice Processing Functions

G.PAK always supports G.711 and can be configured at build time to optionally support G.726 (16, 24, 32, and 40 kbps), G.168, Automatic Gain Control (AGC), Voice Activity Detection (VAD), Comfort Noise Generation (CNG), and Tone Relay (DTMF, MFR1, MFR2 Forward, and/or MFR2 Reverse). G.168 can be configured to operate on PCM and/or Packet data.

Parameter values associated with AGC, VAD, and G.168 (e.g. tail length) are initialized at build time and can be modified at run time. Each channel can be configured at run time to use any of the functions selected at build time.

Frame Sizes

G.PAK can be configured at build time to support processing frame sizes of 8, 20, 40, 80, 160, and 240 samples. Each channel can be configured at run time to use any of the frame sizes selected at build time.

Packet Types

G.PAK can be configured at build time to format Voice, Silence, and Tone packets for either RTP or AAL2 type payloads.

Input/Output

The DSP's multi channel serial ports are used to read and write 8 KHz sampled speech data. From 1 to 3 serial streams can be supported depending on the DSP type and from 1 to 128 time slots per stream can be used. The format of the data can be configured as u-Law, A-Law, or linear.

Port characteristics such as transmit and receive sync and clockpolarities are configured at build time.

Channel (slot)selections are configured at run time for flexibility in assigning resources in multiple DSP applications.

Dynamic transmit enabling is used to allow multiple DSPs to share the same stream

Typical G.PAK Application

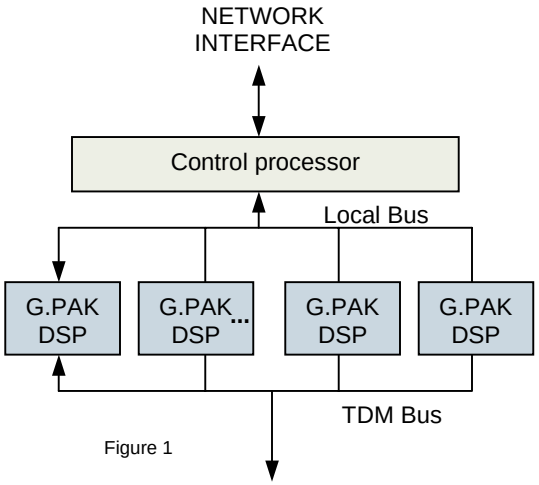


Figure 1

Figure 1 shows an example of a PCM to Packet system with multiple G.PAK DSPs. The control processor controls the G.PAK DSPs via a local bus and the DSPs' host port interfaces (HPI). The control processor also exchanges packet information with the DSPs via the same interface. The control processor uses the G.PAK ANSI "C" API software, which runs on the control processor, to control the G.PAK DSPs and also to exchange packet information. By providing this level of abstraction, the designer does not need to be bothered with the details of inter-processor messaging.

Adaptive Digital is a strategic member of the TI's TMS320™ Third Party Program

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Channel Type

G.PAK provides four types of channels; PCM to Packet, PCM to PCM, Packet to Packet, and Circuit Data. Each channel can be setup for either type.

PCM to Packet type channels have 2 threads of processing. The first thread inputs 8 KHz samples from a serial port slot, processes, encodes, and writes packet payload data to the control processor. The second thread reads packet payload data from the control processor, decodes, processes, and outputs 8 KHz samples to a serial port slot. Each thread can use any configured frame size, codec type, and serial port slot. AGC, VAD, and Tone processing can optionally be performed on the PCM data. G.168 can optionally be used for the PCM and/or packet data. This type of channel is typically used in a voice over packet application.

PCM to PCM type channels have 2 functions within a single thread of processing. The thread can use any configured frame size. The first function inputs 8 KHz samples from serial port slot A and outputs to serial port slot B. The second function inputs 8 KHz samples from serial port slot C and outputs to serial port slot D. G.168 can optionally be used for serial port A's data and/or serial port C's data This type of channel is typically used to provide echo cancellation and can also be used as a time slot interchanger.

Packet to Packet type channels provide conversion of packet payload data from one type or frame size to another for a full duplex communication path. Packet payload data is read from the control processor and decoded to 8 KHz samples. The samples are then processed, encoded, and the modified packet is written to the control processor. This same process occurs for two packet paths (A to A' and B to B'). Each packet can use any configured frame size and codec type. VAD and Tone processing can optionally be performed on the decoded data. G.168 can optionally be used for the A to A' path and/or B to B' path. This type of channel is typically used in a gateway application to perform rate conversion, codec type conversion, or echo cancellation.

Circuit Data type channels have 2 threads of processing. The first thread inputs a number of contiguous slots (8 KHz samples) from a serial port, multiplexes the samples into a single packet payload, and writes the packet payload to the control processor. The second thread reads a packet payload from the control processor, demultiplexes the samples from the payload, and outputs the samples to a number of contiguous slots on a serial port. Both threads multiplex or demultiplex the same number of samples (Mux Factor). The frame size used by both channels is dependent upon the Mux Factor. This type of channel is typically used for AAL2 Circuit Data packets.

G.PAK APIs

Read a DSP's System Configuration
gpakGetSystemConfig(Dsp, pSysCfg)
Read a DSP's System Parameters
gpakReadSystemParms(Dsp, pSysParms)
Write a DSP's System Parameters
gpakWriteSystemParms(Dsp, pSysParms, Flags, pStatus)
Configure a DSP's serial ports
gpakConfigurePorts(Dsp, pPortCfg, pStatus)
Configure a DSP's Channel
gpakConfigureChannel(Dsp, Chan, Type, pChanCfg, pStatus)
Tear Down a DSP's Channel
gpakTearDownChannel(Dsp, Chan, pStatus)
Read a DSP's Channel Status
gpakGetChannelStatus(Dsp, Chan, pChanStat, pStatus)
Send a Payload to a DSP's Channel
gpakSendPayloadToDsp(Dsp, Chan, Class, Type, pData, Size)
Read a Payload from a DSP's Channel
gpakGetPayloadFromDsp(Dsp, Chan, pClass, pType, pData, pSize)
Read an Event Report from a DSP
gpakGetEventReport(Dsp, pId, pData, pSize)

Control Processor Dependent Support Functions

Read DSP memory
gpakReadDspMemory(Dsp, Address, pValue)
Write DSP memory
gpakWriteDspMemory(Dsp, Address, Value)
Delay for a fixed time interval
gpakHostDelay()
Lock access to the specified DSP
gpakLockAccess(Dsp)
Unlock access to the specified DSP
gpakUnlockAccess(Dsp)

Channel Densit

The maximum number of channels available with G.PAK is a function of the target DSP type and the features selected at build time. Each G.PAK DSP is configured at build time to ensure that sufficient DSP memory and MIPS exist to support all channels concurrently regardless of the features selected at channel setup.

Control/DSP Interface

G.PAK API functions are provided to allow applications executing on the control processor to control and monitor the G.PAK DSPs. There are APIs to read the system configuration, read and write system parameters, configure the serial ports, setup and tear down channels, read channel status, and read and write packet payloads. All APIs are provided as operating system independent ANSI "C" source code for easy integration into the control processor's software environment. The physical interface between a G.PAK DSP and a control processor is through the DSP's Host Port Interface. The G.PAK APIs use the HPI to access DSP memory. Several control processor dependent support functions must be completed by the user. Template functions are provided with the G.PAK APIs. The support functions are used to read and write DSP memory via the HPI, time delay, and optionally provide DSP access mutual exclusion.

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Sample Channel Densities

- Typical Access Device Configuration
- G.711
- G.726
- DTMF Detection
- Tone Generation
- VAD/CNG
- G.168-2002 Echo Cancellation (8 msec tail)
- RTP Packetization

Processor	Channels per DSP Chip
C5410	6
C5416-120	7
C5416-160	10
C5420	12
C5421	12
C5441	32

Typical Gateway Configuration

- G.711
- G.726
- DTMF Detection
- Tone Generation
- VAD/CNG
- PCM port G.168-2002 Echo Cancellation (8 msec tail)
- Packet port G.168-2002 Echo Cancellation (64 msec tail)
- RTP Packetization

Processor	Channels per DSP Chip
C5410	4
C5416-120	5
C5416-160	7
C5420	8
C5421	8
C5441	24

FEATURES

True Toll Quality Voice-Over-Packet

- Quality of Service
- Minimizes processing delay
- Carrier Class Echo Cancellation

Short Time to Market

- With G.PAK, there is no need to reinvent the wheel. In fact, with G.PAK, there is no need to write a single line of DSP code. The G.PAK software image as delivered loads directly on the DSP.
- Provides tone generation

Building Blocks

- G.711 PCM
- G.726 ADPCM
- G.168-2002 Echo Cancellation
- Tone Detection and Generation
- Tone Relay
- Voice Activity Detection / Comfort Noise Generation
- Silence Suppression
- G.729AB 8 kbps speech coder
- G.723.1 6.3/5.3 kbps speech coder
- G.728 16, 12.8, or 9.6 kbps vocoder
- Fax Relay

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