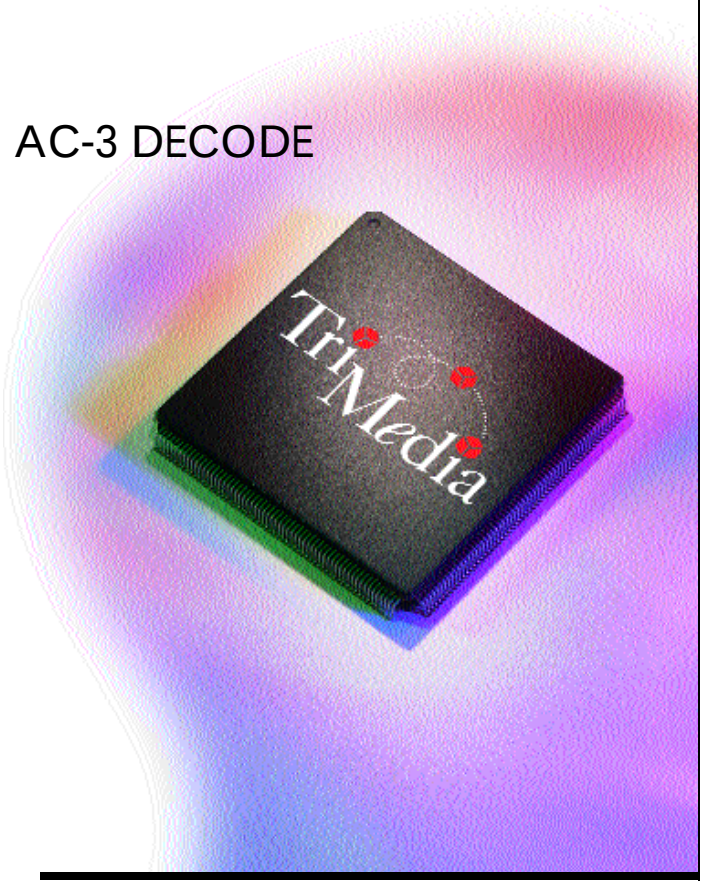
AC-3 DECODE



TriMedia Software Librar y

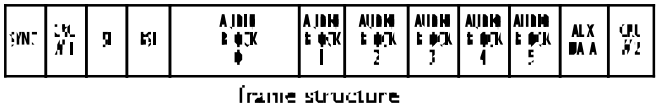
AC-3 is a digital standard developed by Dolby Laboratories for compressed audio signals.The standard covers eight different channel combinations ranging from conventional monophonic or stereophonic sound up to a 6-channel surround-type format. The sample rate of uncompressed audio can be 32 kHz, 44.1 kHz, or 48 kHz; bit rates of coded data range from 32 kbps up to 640 kbps.

Based on the Dolby Laboratories reference implementation, the TriMedia AC-3 Decode library supports the complete feature set of the standard. It enables AC-3 decode functionality to be incorporated into multimedia applications for the TriMedia processor.

BITSTREAM INPUT There are two principal TM-1000 configurations for bitstream input.In one configuration,the Audio In or Video In peripheral block is programmed to receive compressed audio data and store this data into buffers in external synchronous DRAM (SDRAM). Video In can be used to receive PCM audio with resolution higher than 16 bits. In the other configuration, the TM-1000 receives compressed data from a host computer or other external source over its PCI interface and stores the data in SDRAM.

DECODE Bitstream decoding tasks are performed by optimized very-long instruction word (VLIW) code running on the TriMedia processor's CPU.

In an AC-3 bitstream, each data frame is composed of six consecutive blocks of encoded audio; each block specifies 256 PCM samples for every encoded channel. Audio blocks are processed channel by channel,beginning with the unpacking of fixed data such as the block switching flags,exponent strategy, and bit allocation parameters.



frame structure

block structure

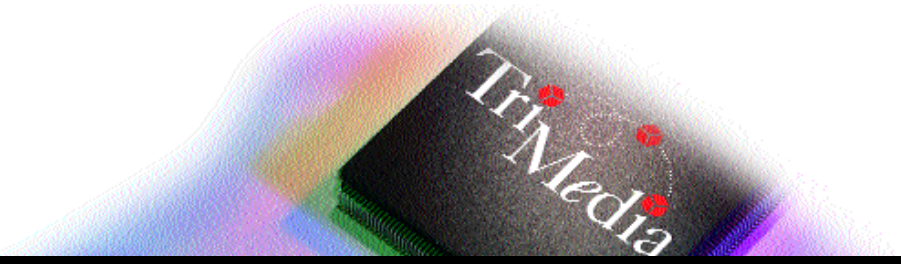
FEATURES

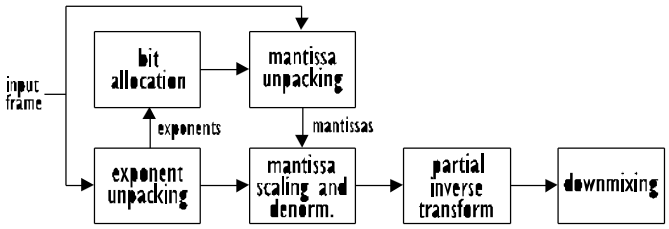
+ Decodes all AC-3 bitstreams
+ Supports sample rates of 32 kHz,44.1 kHz,or 48 kHz
+ Bit rates from 32 kbps to 640 kbps
+ 6-channel surround sound
+ Flexible downmixing options
+ Karaoke compatibility
+ Simple API

Let's make things better.

Philips
Semiconductors

PHILIPS

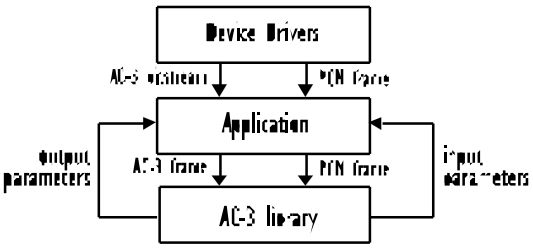




AUDIO CHANNEL DECODE

For each audio channel,band exponents are unpacked and used along with bit allocation parameters to determine the word size of each mantissa. The variable-length mantissas are then unpacked, scaled for dynamic range control, and denormalized by the band exponents. Finally, a partial inverse modified discrete cosine transform (inverse MDCT) is applied in place, using a 128-point FFT along with pre- and post- multiplication stages.DSP operations are performed in 32-bit,fixed point arithmetic. The audio channels are downmixed as needed; different downmixing configurations allow fewer channels to be output than were encoded. After downmixing,the MDCT is completed with a windowing operation.

PCM OUTPUT The TriMedia processor provides two methods to output decompressed audio samples:through the Audio Out or Video Out peripheral block,and through DMA transfers over the PCI bus. Video Out can be used to transmit PCM audio with resolution higher than16 bits. For six-channel AC-3 output, I²S superframe can be used with external demultiplexing to pack three stereo signals into one output frame. For two-channel downmixed output,Audio Out provides a glueless interface to standard DACs.



SOFTWARE API As with other TriMedia library APIs,function calls to the AC-3 Decode API are both hardware- and operating system-independent. Application code makes frame-based calls to the function library, libAC3.a, and uses the device driver library to interface with hardware. Buffer allocation for all input AC-3 data and output PCM data is handled by operating system calls in the application code;pointers to the respective frames are passed to the core library function, ac3_decode_frame.

Library functions are also provided for bitstream management, extracting input bitstream information, setting output configuration parameters, and error handling.In order to obtain a pointer to the next input frame, the library function ac3_find_sync_word is used to search for a sync word in the bitstream,beginning from the pointer to the previous frame. The function ac3_frame_information is used to extract input bitstream parameters such as sampling frequency, input channel configuration,mixing levels, time code, etc. The function ac3_set_parameter is similarly used to set decoder configuration parameters. If ac3_decode_frame returns an error, the function ac3_mute_frame can be used to zero all output PCM samples.

AC-3, 640 kbps	100 MHz	133 MHz
6-channels	25%	20%
2-channels	20%	15%

PROCESSING TIMES OBTAINED USING A CYCLE-ACCURATE SIMULATOR AND TRIMEDIA PROCESSOR WITH 4 MB OF SDRAM,AN SDRAM/CPU CLOCK RATIO OF 1:1,ANDKNOWN SOFTWARETUNING.

PHILIPS SEMICONDUCTORS
TRIMEDIA PRODUCT GROUP
811 EAST ARQUES AVENUE,M/S 71
SUNNYVALE,CA 94088-3409
INTERNET info@trimedia.scs.philips.com
PHONE (408) 991-3838
FAX (408) 991-3300
WEB www.trimedia-philips.com

Printed in USA 468037/6M/FP/497 Pub. No.:9397-750-01914

Let's make things better.

Philips
Semiconductors

PHILIPS