

MPEG2 Main Profile Decoder on C64x+

User Guide



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Read This First

About This Manual

This document describes how to install and work with Texas Instruments' (TI) MPEG2 Main Profile Decoder implementation on the C64x+ platform. It also provides a detailed Application Programming Interface (API) reference and information on the sample application that accompanies this component.

TI's codec implementations are based on the eXpressDSP Digital Media (XDM) standard. XDM is an extension of the eXpressDSP Algorithm Interface Standard (XDAIS).

Intended Audience

This document is intended for system engineers who want to integrate TI's codecs with other software to build a multimedia system based on the C64x+ platform.

This document assumes that you are fluent in the C language, have a good working knowledge of Digital Signal Processing (DSP), digital signal processors, and DSP applications. Good knowledge of eXpressDSP Algorithm Interface Standard (XDAIS) and eXpressDSP Digital Media (XDM) standard will be helpful.

How to Use This Manual

This document includes the following chapters:

- ❑ **Chapter 1 - Introduction**, provides a brief introduction to the XDAIS and XDM standards. It also provides an overview of the codec and lists its supported features.
- ❑ **Chapter 2 - Installation Overview**, describes how to install, build, and run the codec.
- ❑ **Chapter 3 - Sample Usage**, describes the sample usage of the codec.
- ❑ **Chapter 4 - API Reference**, describes the data structures and interface functions used in the codec.

Related Documentation From Texas Instruments

The following documents describe TI's DSP algorithm standards such as, XDAIS and XDM. To obtain a copy of any of these TI documents, visit the Texas Instruments website at www.ti.com.

- ❑ *TMS320 DSP Algorithm Standard Rules and Guidelines* (literature number SPRU352) defines a set of requirements for DSP algorithms that, if followed, allow system integrators to quickly assemble production-quality systems from one or more such algorithms.
- ❑ *TMS320 DSP Algorithm Standard API Reference* (literature number SPRU360) describes all the APIs that are defined by the TMS320 DSP Algorithm Interface Standard (also known as XDAIS) specification.
- ❑ *Technical Overview of eXpressDSP - Compliant Algorithms for DSP Software Producers* (literature number SPRA579) describes how to make algorithms compliant with the TMS320 DSP Algorithm Standard which is part of TI's eXpressDSP technology initiative.
- ❑ *Using the TMS320 DSP Algorithm Standard in a Static DSP System* (literature number SPRA577) describes how an eXpressDSP-compliant algorithm may be used effectively in a static system with limited memory.
- ❑ *DMA Guide for eXpressDSP-Compliant Algorithm Producers and Consumers* (literature number SPRA445) describes the DMA architecture specified by the TMS320 DSP Algorithm Standard (XDAIS). It also describes two sets of APIs used for accessing DMA resources: the IDMA2 abstract interface and the ACPY2 library.
- ❑ *eXpressDSP Digital Media (XDM) Standard API Reference* (literature number SPRUEC8)

The following documents describe TMS320 devices and related support tools:

- ❑ *Design and Implementation of an eXpressDSP-Compliant DMA Manager for C6X1X* (literature number SPRA789) describes a C6x1x-optimized (C6211, C6711) ACPY2 library implementation and DMA Resource Manager.
- ❑ *TMS320c64x+ Megamodule* (literature number SPRAA68) describes the enhancements made to the internal memory and describes the new features which have been added to support the internal memory architecture's performance and protection.
- ❑ *TMS320C64x+ DSP Megamodule Reference Guide* (literature number SPRU871) describes the C64x+ megamodule peripherals.
- ❑ *TMS320C64x to TMS320C64x+ CPU Migration Guide* (literature number SPRAA84) describes migration from the Texas Instruments TMS320C64x™ digital signal processor (DSP) to the TMS320C64x+™ DSP.
- ❑ *TMS320C6000 Optimizing Compiler v 6.0 Beta User's Guide* (literature number SPRU187N) explains how to use compiler tools

such as compiler, assembly optimizer, standalone simulator, library-build utility, and C++ name demangler.

- ❑ *TMS320C64x/C64x+ DSP CPU and Instruction Set Reference Guide* (literature number SPRU732) describes the CPU architecture, pipeline, instruction set, and interrupts of the C64x and C64x+ DSPs.
- ❑ *TMS320DM6446 Digital Media System-on-Chip* (literature number SPRS283)
- ❑ *TMS320DM6446 Digital Media System-on-Chip Errata (Silicon Revision 1.0)* (literature number SPRZ241) describes the known exceptions to the functional specifications for the TMS320DM6446 Digital Media System-on-Chip (DMSoC).
- ❑ *TMS320DM6443 Digital Media System-on-Chip* (literature number SPRS282)
- ❑ *TMS320DM6443 Digital Media System-on-Chip Errata (Silicon Revision 1.0)* (literature number SPRZ240) describes the known exceptions to the functional specifications for the TMS320DM6443 Digital Media System-on-Chip (DMSoC).
- ❑ *TMS320DM644x DMSoC DSP Subsystem Reference Guide* (literature number SPRUE15) describes the digital signal processor (DSP) subsystem in the TMS320DM644x Digital Media System-on-Chip (DMSoC).
- ❑ *TMS320DM644x DMSoC ARM Subsystem Reference Guide* (literature number SPRUE14) describes the ARM subsystem in the TMS320DM644x Digital Media System on a Chip (DMSoC).
- ❑ *DaVinci Technology - Digital Video Innovation Product Bulletin (Rev. A)* (sprt378a.pdf)
- ❑ *The DaVinci Effect: Achieving Digital Video Without Complexity White Paper* (spr079.pdf)
- ❑ *DaVinci Benchmarks Product Bulletin* (sprt379.pdf)
- ❑ *DaVinci Technology for Digital Video White Paper* (spr067.pdf)
- ❑ *The Future of Digital Video White Paper* (spr066.pdf)
- ❑ *MPEG-2 Video Decoder: TMS320C62x DSP Implementation* (literature number SPRA649) describes the implementation of the MPEG-2 video decoder on the TMS320C62x DSP.

Related Documentation

You can use the following documents to supplement this user guide:

- ❑ *ISO/IEC 11172-2 Information technology -- Coding of moving pictures and associated audio for digital storage media at up to about 1.5Mbits/s -- Part 2: Video* (MPEG-1 video standard).
- ❑ *ISO/IEC 13818-2 Information technology -- Generic coding of moving pictures and associated audio information: Video* (MPEG-2 video standard).

Abbreviations

The following abbreviations are used in this document.

Table 1-1. List of Abbreviations

Abbreviation	Description
API	Application Programming Interface
CBR	Constant Bit Rate
CPB	Constrained Parameters Bit-streams
DCT	Discrete Cosine Transform
DMA	Direct Memory Access
DMAN3	DMA Manager
DSS	Direct Satellite System
DTV	Digital Television
DVB	Digital Video Broadcast
DVD	Digital Versatile Disc
EVM	Evaluation Module
fps	Frames per second
IDCT	Inverse Discrete Cosine Transform
Kbps	Kilo bits per second
MPEG	Motion Picture Expert Group
XDAIS	eXpressDSP Algorithm Interface Standard
XDM	eXpressDSP Digital Media

Text Conventions

The following conventions are used in this document:

- Text inside back-quotes (“”) represents pseudo-code.
- Program source code, function and macro names, parameters, and command line commands are shown in a `mono-spaced` font.

Product Support

When contacting TI for support on this codec, please quote the product name (MPEG2 Main Profile Decoder on C64x+) and version number. The version number of the codec is included in the title of the release notes that accompanies this codec.

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Introduction

This chapter provides a brief introduction to XDAIS and XDM. It also provides an overview of TI's implementation of the MPEG2 Main Profile Decoder on the C64x+ platform and its supported features.

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1.1 Overview of XDAIS and XDM

TI's multimedia codec implementations are based on the eXpressDSP Digital Media (XDM) standard. XDM is an extension of the eXpressDSP Algorithm Interface Standard (XDAIS).

1.1.1 XDAIS Overview

An eXpressDSP-compliant algorithm is a module that implements the abstract interface IALG. The IALG API takes the memory management function away from the algorithm and places it in the hosting framework. Thus, an interaction occurs between the algorithm and the framework. This interaction allows the client application to allocate memory for the algorithm and also share memory between algorithms. It also allows the memory to be moved around while an algorithm is operating in the system. In order to facilitate these functionalities, the IALG interface defines the following APIs:

- ❑ `algAlloc()`
- ❑ `algInit()`
- ❑ `algActivate()`
- ❑ `algDeactivate()`
- ❑ `algFree()`

The `algAlloc()` API allows the algorithm to communicate its memory requirements to the client application. The `algInit()` API allows the algorithm to initialize the memory allocated by the client application. The `algFree()` API allows the algorithm to communicate the memory to be freed when an instance is no longer required.

Once an algorithm instance object is created, it can be used to process data in real-time. The `algActivate()` API provides a notification to the algorithm instance that one or more algorithm processing methods is about to be run zero or more times in succession. After the processing methods have been run, the client application calls the `algDeactivate()` API prior to reusing any of the instance's scratch memory.

The IALG interface also defines three more optional APIs `algControl()`, `algNumAlloc()`, and `algMoved()`. For more details on these APIs, see *TMS320 DSP Algorithm Standard API Reference* (literature number SPRU360).

1.1.2 XDM Overview

In the multimedia application space, you have the choice of integrating any codec into your multimedia system. For example, if you are building a video decoder system, you can use any of the available video decoders (such as MPEG4, H.263, or H.264) in your system. To enable easy integration with the client application, it is important that all codecs with similar functionality use similar APIs. XDM was primarily defined as an extension to XDAIS to ensure uniformity across different classes of codecs

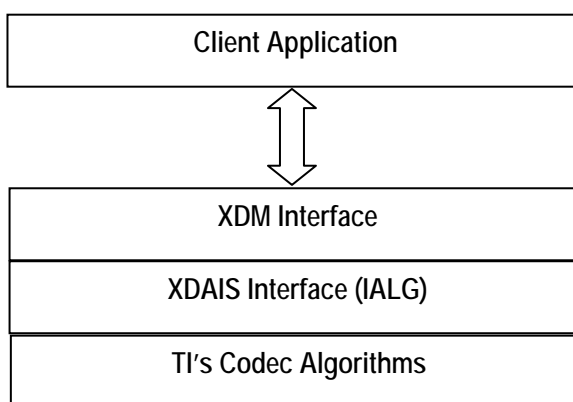
(for example audio, video, image, and speech). The XDM standard defines the following two APIs:

- ❑ `control()`
- ❑ `process()`

The `control()` API provides a standard way to control an algorithm instance and receive status information from the algorithm in real-time. The `control()` API replaces the `algControl()` API defined as part of the IALG interface. The `process()` API does the basic processing (encode/decode) of data.

Apart from defining standardized APIs for multimedia codecs, XDM also standardizes the generic parameters that the client application must pass to these APIs. The client application can define additional implementation specific parameters using extended data structures.

The following figure depicts the XDM interface to the client application.



As depicted in the figure, XDM is an extension to XDAIS and forms an interface between the client application and the codec component. XDM insulates the client application from component-level changes. Since TI's multimedia algorithms are XDM-compliant, it provides you with the flexibility to use any TI algorithm without changing the client application code. For example, if you have developed a client application using an XDM-compliant MPEG4 video decoder, then you can easily replace MPEG4 with another XDM-compliant video decoder, say H.263, with minimal changes to the client application.

For more details, see *eXpressDSP Digital Media (XDM) Standard API Reference* (literature number SPRUEC8).

1.2 Overview of MPEG2 Main Profile Decoder

The MPEG2 video standard specifies the decompression and coded representation for entertainment-quality digital video. It is widely used in different digital video systems, including DTV (Digital Television), DVB (Digital Video Broadcast), DSS (Direct Satellite System), and DVD (Digital Versatile Disc). The MPEG2 video decoder plays an important role in consumer electronics like DVD players, set-top boxes, and DSS units.

The decoder software implements all the MPEG2 main-profile-at-high-level functionality. For more information on the MPEG2 video decoding algorithm, see *MPEG2 Video Decoder: TMS320C62x (TM) DSP Implementation* application report (literature number SPRA649).

From this point onwards, all references to MPEG2 Decoder means MPEG2 Main Profile Decoder only.

1.3 Supported Services and Features

This user guide accompanies TI's implementation of MPEG2 Decoder on the C64x+ platform. This version of the codec has the following supported features:

- Supports MPEG2 main-profile-at-high-level feature of the ISO/IEC 13818-2 standard
- Compliant as per ISO/IEC 13818-4 conformance standard, based on Inverse Discrete Cosine Transform (IDCT)
- Supports YUV 420 planar and YUV 422 interleaved output formats
- Supports interlace and progressive decoding
- Supports only elementary video stream input formats
- Supports MPEG-1 Constrained Parameters Bit-streams (CPB)
- Supports bottom field reordering in case of non-progressive sequences where bottom field is sent ahead of top field for frame pictures
- Does not support non-multiple of 16 streams
- eXpressDSP compliant
- eXpressDSP Digital Media (XDM) compliant

Note:

This version of MPEG2 Decoder:

- Ignores metadata information included in the input bit stream
- Does not support sequences with escape bit set in the sequence extension header

Installation Overview

This chapter provides a brief description on the system requirements and instructions for installing the codec component. It also provides information on building and running the sample test application.

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2.1 System Requirements

This section describes the hardware and software requirements for the normal functioning of the codec component.

2.1.1 Hardware

This codec has been built and tested on DM6437 EVM with XDS560 JTAG emulator.

2.1.2 Software

The following are the software requirements for the normal functioning of the codec:

- ❑ **Development Environment:** This project is developed using Code Composer Studio version 3.3.24.
- ❑ **Code Generation Tools:** This project is compiled, assembled, archived, and linked using the code generation tools version 6.0.7.

2.2 Installing the Component

The codec component is released as a compressed archive. To install the codec, extract the contents of the zip file onto your local hard disk. The zip file extraction creates a directory called 100_V_MPEG2_D_MP_c64x+_1_01.

Figure 2-1 shows the sub-directories created in this directory.

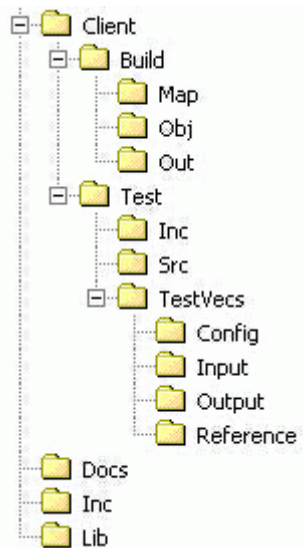


Figure 2-1. Component Directory Structure

Note:

If you are installing an evaluation version of this codec, the directory name will be 100E_V_MPEG2_D_MP_c64x+_1_01.

Table 2-1 provides a description of the sub-directories created in the 100_V_MPEG2_D_MP_c64x+_1_01 directory.

Table 2-1. Component Directories

Sub-Directory	Description
\Inc	Contains XDM related header files which allow interface to the codec library
\Lib	Contains the codec library file
\Docs	Contains user manual, datasheet, and release notes
\Client\Build	Contains the sample test application project (.pj) file
\Client\Build\Map	Contains the memory map generated on compilation of the code
\Client\Build\Obj	Contains the intermediate .asm and/or .obj file generated on compilation of the code
\Client\Build\Out	Contains the final application executable (.out) file generated by the sample test application
\Client\Test\Src	Contains application C files
\Client\Test\Inc	Contains header files needed for the application code
\Client\Test\TestVecs\Input	Contains input test vectors
\Client\Test\TestVecs\Output	Contains output generated by the codec
\Client\Test\TestVecs\Reference	Contains read-only reference output to be used for cross-checking against codec output
\Client\Test\TestVecs\Config	Contains configuration parameter files

2.3 Before Building the Sample Test Application

This codec is accompanied by a sample test application. To run the sample test application, you need DSP/BIOS and TI Framework Components (FC).

This version of the codec has been validated with DSP/BIOS version 5.31 and Framework Component (FC) version 1.04.

2.3.1 Installing DSP/BIOS

You can download DSP/BIOS from the TI external website:

https://www-a.ti.com/downloads/sds_support/targetcontent/bios/index.html

Install DSP/BIOS at the same location where you have installed Code Composer Studio. For example:

<install directory>\CCStudio_v3.2

The sample test application uses the following DSP/BIOS files:

- ❑ Header file, bcache.h available in the <install directory>\CCStudio_v3.2<bios_directory>\packages\ti\bios\include directory.
- ❑ Library file, biosDM420.a64P available in the <install directory>\CCStudio_v3.2<bios_directory>\packages\ti\bios\lib directory.

2.3.2 Installing Framework Component (FC)

You can download FC from the TI external website:

https://www-a.ti.com/downloads/sds_support/targetcontent/FC/index.html

Extract the FC zip file to the same location where you have installed Code Composer Studio. For example:

<install directory>\CCStudio_v3.2

The test application uses the following DMAN3 files:

- ❑ Library file, dman3.a64P available in the <install directory>\CCStudio_v3.2<fc_directory>\packages\ti\sdo\fc\dman3 directory.
- ❑ Header file, dman3.h available in the <install directory>\CCStudio_v3.2<fc_directory>\packages\ti\sdo\fc\dman3 directory.
- ❑ Header file, idma3.h available in the <install directory>\CCStudio_v3.2<fc_directory>\fctools\packages\ti\xdais .

2.4 Building and Running the Sample Test application

This codec is accompanied by a sample test application. This application will run in TI's Code Composer Studio development environment. To build and run the sample application in Code Composer Studio, follow these steps:

- 1) Verify that you have an installation of TI's Code Composer Studio version 3.3.24 and code generation tools version 6.0.7.
- 2) Verify that the codec object library, `mpeg2vdec_ti.l64P` exists in the `\Lib` sub-directory.
- 3) Open the test application project file, `TestAppDecoder.pjt` in Code Composer Studio. This file is available in the `\Client\Build` sub-directory.
- 4) Select **Project > Build** to build the sample test application. This creates an executable file, `TestAppDecoder.out` in the `\Client\Build\Out` sub-directory.
- 5) Select **File > Load**, browse to the `\Client\Build\Out` sub-directory, select the codec executable created in step 4, and load it into Code Composer Studio in preparation for execution.

- 6) Select **Debug > Run** to execute the sample test application.

The sample test application takes the input files stored in the `\Client\Test\TestVecs\Input` sub-directory, runs the codec, and uses the reference files stored in the `\Client\Test\TestVecs\Reference` sub-directory to verify that the codec is functioning as expected.

- 7) On successful completion, the application displays one of the following messages for each frame:
 - "PASS/FAIL: Pass criteria that more than 99 percent decoded samples should have at the most one-bit difference with reference output is satisfied/NOT satisfied" (for compliance check mode)
 - "Decoder output dump completed" (for output dump mode)

2.5 Configuration Files

This codec is shipped along with:

- A generic configuration file (`Testvecs.cfg`) – specifies input and reference files for the sample test application.
- A Decoder configuration file (`Testparams.cfg`) – specifies the configuration parameters used by the test application to configure the Decoder.

2.5.1 Generic Configuration File

The sample test application shipped along with the codec uses the configuration file, `Testvecs.cfg` for determining the input and reference files for running the codec and checking for compliance. The `Testvecs.cfg` file is available in the `\Client\Test\TestVecs\Config` sub-directory.

The format of the Testvecs.cfg file is:

```
X
Config
Input
Output/Reference
```

where:

- ❑ x may be set as:
 - 1 - for compliance checking, no output file is created
 - 0 - for writing the output to the output file
- ❑ Config is the Decoder configuration file. For details, see Section 2.5.2.
- ❑ Input is the input file name (use complete path).
- ❑ Output/Reference is the output file name (if x is 0) or reference file name (if x is 1).

A sample Testvecs.cfg file is as shown:

```
1
..\..\Test\TestVecs\Config\Testparams.cfg
..\..\Test\TestVecs\Input\akiyo_frame.m2v
..\..\Test\TestVecs\Reference\akiyo_frame_420Ref.yuv
0
..\..\Test\TestVecs\Config\Testparams.cfg
..\..\Test\TestVecs\Input\akiyo_frame.m2v
..\..\Test\TestVecs\Output\akiyo_frame.yuv
```

2.5.2 Decoder Configuration File

The decoder configuration file, Testparams.cfg contains the configuration parameters required for the decoder. The Testparams.cfg file is available in the \Client\Test\TestVecs\Config sub-directory.

A sample Testparams.cfg file is as shown:

```
# Input File Format is as follows
# <ParameterName> = <ParameterValue> # Comment
#
#####
Parameters
#####

ImageWidth = 1920 # Image width in Pels, must be
                  multiples of 16
ImageHeight = 1088 # Image height in Pels, must be
                   multiples of 16
ChromaFormat = 1 # 1 => XDM_YUV_420P,
                  3 => XDM_YUV_422IBE,
                  4 => XDM_YUV_422ILE
FramesToDecode = 10 # Number of frames to be coded
```

Any field in the IVIDDEC_Params structure (see section 4.2.1.5) can be set in the Testparams.cfg file using the syntax shown above. If you specify additional fields in the Testparams.cfg file, ensure to modify the test application appropriately to handle these fields.

2.6 Standards Conformance and User-Defined Inputs

To check the conformance of the codec for the default input file shipped along with the codec, follow the steps as described in Section 2.4.

To check the conformance of the codec for other input files of your choice, follow these steps:

- ❑ Copy the input files to the \Client\Test\TestVecs\Inputs sub-directory.
- ❑ Copy the reference files to the \Client\Test\TestVecs\Reference sub-directory.
- ❑ Edit the configuration file, Testvecs.cfg available in the \Client\Test\TestVecs\Config sub-directory. For details on the format of the Testvecs.cfg file, see section 2.5.1.
- ❑ Execute the sample test application. On successful completion, the application displays one of the following message for each frame:
 - “PASS/FAIL: Pass criteria that more than 99 percent decoded samples should have at the most one-bit difference with reference output is satisfied/NOT satisfied” (if x is 1)
 - “Decoder output dump completed” (if x is 0)

If you have chosen the option to write to an output file (x is 0), you can use any standard file comparison utility to compare the codec output with the reference output and check for conformance.

2.7 Uninstalling the Component

To uninstall the component, delete the codec directory from your hard disk.

2.8 Evaluation Version

If you are using an evaluation version of this codec a Texas Instruments logo will be visible in the output.

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Sample Usage

This chapter provides a detailed description of the sample test application that accompanies this codec component.

3.1 Overview of the Test Application

The test application exercises the `IVIDDEC` base class of the MPEG2 Decoder library. The main test application files are `TestAppDecoder.c` and `TestAppDecoder.h`. These files are available in the `\Client\Test\Src` and `\Client\Test\Inc` sub-directories respectively.

Figure 3-1 depicts the sequence of APIs exercised in the sample test application.

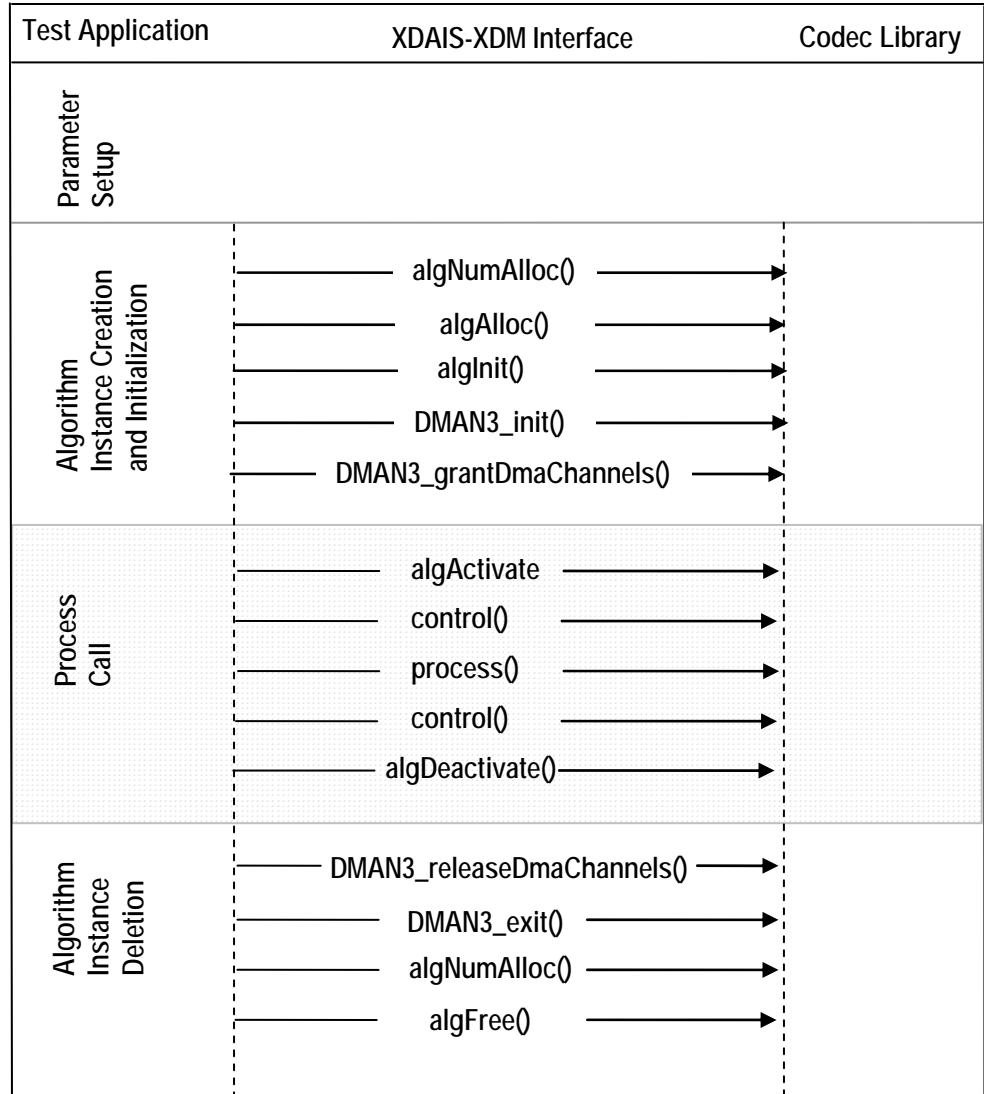


Figure 3-1. Test Application Sample Implementation

The test application is divided into four logical blocks:

- ❑ Parameter setup
- ❑ Algorithm instance creation and initialization
- ❑ Process call
- ❑ Algorithm instance deletion

3.1.1 Parameter Setup

Each codec component requires various codec configuration parameters to be set at initialization. For example, a video codec requires parameters such as video height, video width, etc. The test application obtains the required parameters from the Decoder configuration files.

In this logical block, the test application does the following:

- 1) Opens the generic configuration file, `Testvecs.cfg` and reads the compliance checking parameter, Decoder configuration file name (`Testparams.cfg`), input file name, and output/reference file name.
- 2) Opens the Decoder configuration file, (`Testparams.cfg`) and reads the various configuration parameters required for the algorithm.
For more details on the configuration files, see Section 2.5.
- 3) Sets the `IVIDDEC_Params` structure based on the values it reads from the `Testparams.cfg` file.
- 4) Initializes the various DMAN3 parameters.
- 5) Reads the input bit stream into the application input buffer.

After successful completion of the above steps, the test application does the algorithm instance creation and initialization.

3.1.2 Algorithm Instance Creation and Initialization

In this logical block, the test application accepts the various initialization parameters and returns an algorithm instance pointer. The following APIs are called in sequence:

- 1) `algNumAlloc()` - To query the algorithm about the number of memory records it requires.
- 2) `algAlloc()` - To query the algorithm about the memory requirement to be filled in the memory records.
- 3) `algInit()` - To initialize the algorithm with the memory structures provided by the application.

A sample implementation of the create function that calls `algNumAlloc()`, `algAlloc()`, and `algInit()` in sequence is provided in the `ALG_create()` function implemented in the `alg_create.c` file.

After successful creation of the algorithm instance, the test application does DMA resource allocation for the algorithm. This requires initialization of DMA Manager Module and grant of DMA resources. This is implemented by calling DMAN3 interface functions in the following sequence:

- 1) `DMAN3_init()` - To initialize the DMAN module.
- 2) `DMAN3_grantDmaChannels()` - To grant the DMA resources to the algorithm instance.

Note:

DMAN3 function implementations are provided in `dman3.a64P` library.

3.1.3 Process Call

After algorithm instance creation and initialization, the test application does the following:

- 1) Sets the dynamic parameters (if they change during run time) by calling the `control()` function with the `XDM_SETPARAMS` command.
- 2) Sets the input and output buffer descriptors required for the `process()` function call. The input and output buffer descriptors are obtained by calling the `control()` function with the `XDM_GETBUFINFO` command.
- 3) Calls the `process()` function to encode/decode a single frame of data. The behavior of the algorithm can be controlled using various dynamic parameters (see section 4.2.1.6). The inputs to the process function are input and output buffer descriptors, pointer to the `IVIDDEC_InArgs` and `IVIDDEC_OutArgs` structures.

The `control()` and `process()` functions should be called only within the scope of the `algActivate()` and `algDeactivate()` XDAIS functions which activate and deactivate the algorithm instance respectively. Once an algorithm is activated, there could be any ordering of `control()` and `process()` functions. The following APIs are called in sequence:

- 1) `algActivate()` - To activate the algorithm instance.
- 2) `control()` (optional) - To query the algorithm on status or setting of dynamic parameters etc., using the six available control commands.
- 3) `process()` - To call the Decoder with appropriate input/output buffer and arguments information.
- 4) `control()` (optional) - To query the algorithm on status or setting of dynamic parameters etc., using the six available control commands.
- 5) `algDeactivate()` - To deactivate the algorithm instance.

The do-while loop encapsulates frame level `process()` call and updates the input buffer pointer every time before the next call. The do-while loop breaks off either when an error condition occurs or when the input buffer exhausts. It also protects the `process()` call from file operations by placing appropriate calls for cache operations as well. The test application does a cache invalidate for the valid input buffers before `process()` and a cache write back invalidate for output buffers after `process()`.

In the sample test application, after calling `algDeactivate()`, the output data is either dumped to a file or compared with a reference file.

3.1.4 Algorithm Instance Deletion

Once encoding/decoding is complete, the test application must release the DMA channels granted by the DMA Manager interface and delete the current algorithm instance. The following APIs are called in sequence:

- 1) `DMAN3_releaseDmaChannels()` - To remove logical channel resources from an algorithm instance.
- 2) `DMAN3_exit()` - To free DMAN3 memory resources.
- 3) `algNumAlloc()` - To query the algorithm about the number of memory records it used.
- 4) `algFree()` - To query the algorithm to get the memory record information.

A sample implementation of the delete function that calls `algNumAlloc()` and `algFree()` in sequence is provided in the `ALG_delete()` function implemented in the `alg_create.c` file.

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API Reference

This chapter provides a detailed description of the data structures and interfaces functions used in the codec component.

Topic	Page
4.1 Symbolic Constants and Enumerated Data Types	4-2
4.2 Data Structures	4-5
4.3 Interface Functions	4-19

4.1 Symbolic Constants and Enumerated Data Types

This section summarizes all the symbolic constants specified as either #define macros and/or enumerated C data types. Described alongside the macro or enumeration is the semantics or interpretation of the same in terms of what value it stands for and what it means.

Table 4-1. List of Enumerated Data Types

Group or Enumeration Class	Symbolic Constant Name	Description or Evaluation
IVIDEO_FrameType	IVIDEO_I_FRAME	Intra coded frame
	IVIDEO_P_FRAME	Forward inter coded frame
	IVIDEO_B_FRAME	Bi-directional inter coded frame
	IVIDEO_IDR_FRAME	Intra coded frame that can be used for refreshing video content
IVIDEO_ContentType	IVIDEO_PROGRESSIVE	Progressive video content
	IVIDEO_INTERLACED	Interlaced video content
IVIDEO_FrameSkip	IVIDEO_NO_SKIP	Do not skip the current frame
	IVIDEO_SKIP_P	Skip forward inter coded frame. Not supported in this version of MPEG2 Decoder.
	IVIDEO_SKIP_B	Skip bi-directional inter coded frame. Not supported in this version of MPEG2 Decoder.
	IVIDEO_SKIP_I	Skip intra coded frame. Not supported in this version of MPEG2 Decoder.
ePicStrFormat	TOP_FIELD	Indicates top field in field picture
	BOTTOM_FIELD	Indicates bottom field in field picture
	FRAME_PICTURE	Indicates frame picture
XDM_DataFormat	XDM_BYTE	Big endian stream
	XDM_LE_16	16-bit little endian stream. Not supported in this version of MPEG2 Decoder.
	XDM_LE_32	32-bit little endian stream
XDM_ChromaFormat	XDM_YUV_420P	YUV 4:2:0 planar
	XDM_YUV_422P	YUV 4:2:2 planar. Not supported in this version of MPEG2 Decoder.

Group or Enumeration Class	Symbolic Constant Name	Description or Evaluation
	XDM_YUV_422IBE	YUV 4:2:2 interleaved (big endian). Not supported in this version of MPEG2 Decoder.
	XDM_YUV_422ILE	YUV 4:2:2 interleaved (little endian)
	XDM_YUV_444P	YUV 4:4:4 planar. Not supported in this version of MPEG2 Decoder.
	XDM_YUV_411P	YUV 4:1:1 planar. Not supported in this version of MPEG2 Decoder.
	XDM_GRAY	Gray format. Not supported in this version of MPEG2 Decoder.
	XDM_RGB	RGB color format. Not supported in this version of MPEG2 Decoder.
XDM_CmdId	XDM_GETSTATUS	Query algorithm instance to fill Status structure
	XDM_SETPARAMS	Set run-time dynamic parameters via the DynamicParams structure
	XDM_RESET	Reset the algorithm
	XDM_SETDEFAULT	Initialize all fields in Params structure to default values specified in the library
	XDM_FLUSH	Handle end of stream conditions. This command forces algorithm instance to output data without additional input.
	XDM_GETBUFINFO	Query algorithm instance regarding the properties of input and output buffers
XDM_DecMode	XDM_DECODE_AU	Decode entire access unit
	XDM_PARSE_HEADER	Decode only header. Not supported in this version of MPEG2 Decoder.
XDM_ErrorBit	XDM_APPLIEDCONCEALMENT	Bit 9 <input type="checkbox"/> 1 - Applied concealment <input type="checkbox"/> 0 - Ignore
	XDM_INSUFFICIENTDATA	Bit 10 <input type="checkbox"/> 1 - Insufficient data <input type="checkbox"/> 0 - Ignore

Group or Enumeration Class	Symbolic Constant Name	Description or Evaluation
	XDM_CORRUPTEDDATA	Bit 11 <input type="checkbox"/> 1 - Data problem/corruption <input type="checkbox"/> 0 - Ignore
	XDM_CORRUPTEDHEADER	Bit 12 <input type="checkbox"/> 1 - Header problem/corruption <input type="checkbox"/> 0 - Ignore
	XDM_UNSUPPORTEDINPUT	Bit 13 <input type="checkbox"/> 1 - Unsupported feature/parameter in input <input type="checkbox"/> 0 - Ignore
	XDM_UNSUPPORTEDPARAM	Bit 14 <input type="checkbox"/> 1 - Unsupported input parameter or configuration <input type="checkbox"/> 0 - Ignore
	XDM_FATALERROR	Bit 15 <input type="checkbox"/> 1 - Fatal error (stop encoding) <input type="checkbox"/> 0 - Recoverable error

Note:

The remaining bits that are not mentioned in `XDM_ErrorBit` are interpreted as:

- Bit 16-32: Reserved
- Bit 8: Reserved
- Bit 0-7: Codec and implementation specific (see Table 4-2)

The algorithm can set multiple bits to 1 depending on the error condition.

The MPEG2 Decoder specific error status messages are listed in Table 4-2. The Value column indicates the decimal value of the last 8-bits reserved for codec specific error statuses.

Table 4-2. MPEG2 Decoder Error Status

Group or Enumeration Class	Symbolic Constant Name	Value	Description or Evaluation
MPEG2VDEC_ERROR	MPEG2VDEC_ERROR_Success	0	Successful decoding
	MPEG2VDEC_ERROR_Failure	1	Decoding failed
	MPEG2VDEC_ERROR_bitstream_Overrun	2	Decoder has exhausted the given bit stream and run past available number of bits. This indicates either erroneous bit stream or insufficient data to decoder.

Group or Enumeration Class	Symbolic Constant Name	Value	Description or Evaluation
	MPEG2VDEC_ERROR_unsupportedpictureSpatialScalableExtension	3	Unsupported picture spatial scalable extension
	MPEG2VDEC_ERROR_unsupportedpictureTemporalScalableExtension	4	Unsupported picture temporal scalable extension
	MPEG2VDEC_ERROR_erroneousBitstream	5	Erroneous bit stream
	MPEG2VDEC_ERROR_sliceVerticalPosition	6	Slice position is outside the permissible range, and hence error in decoding
	MPEG2VDEC_ERROR_corruptedHeader	7	Corrupted frame header
	MPEG2VDEC_ERROR_unsupportedInput	8	Unsupported input stream
	MPEG2VDEC_ERROR_incorrectWidthHeight	9	Width and height of the input sequence is not in accordance with the maximum width and height.
	MPEG2VDEC_ERROR_nullOutputBufPtrs	10	Output buffer pointers passed by the application are NULL
	MPEG2VDEC_ERROR_noRefBufferToFlush	11	Reference buffer is not available to flush on calling control API with FLUSH command
	MPEG2VDEC_ERROR_nullInputBufPtr	12	Input buffer pointer passed by the application is NULL

Note:

For the non-fatal bit stream error MPEG2VDEC_ERROR_sliceVerticalPosition, extended error is set but the decoder returns SUCCESS.

4.2 Data Structures

This section describes the XDM defined data structures that are common across codec classes. These XDM data structures can be extended to define any implementation specific parameters for a codec component.

4.2.1 Common XDM Data Structures

This section includes the following common XDM data structures:

- ❑ XDM_BufDesc
- ❑ XDM_AlgBufInfo
- ❑ IVIDEO_BufDesc
- ❑ IVIDDEC_Fxns
- ❑ IVIDDEC_Params
- ❑ IVIDDEC_DynamicParams
- ❑ IVIDDEC_InArgs
- ❑ IVIDDEC_Status
- ❑ IVIDDEC_OutArgs

4.2.1.1 XDM_BufDesc

|| Description

This structure defines the buffer descriptor for input and output buffers.

|| Fields

Field	Datatype	Input/ Output	Description
<code>**bufs</code>	<code>XDAS_Int8</code>	Input	Pointer to the vector containing buffer addresses
<code>numBufs</code>	<code>XDAS_Int32</code>	Input	Number of buffers
<code>*bufSizes</code>	<code>XDAS_Int32</code>	Input	Size of each buffer in bytes

4.2.1.2 XDM_AlgBufInfo

|| Description

This structure defines the buffer information descriptor for input and output buffers. This structure is filled when you invoke the `control()` function with the `XDM_GETBUFINFO` command.

|| Fields

Field	Datatype	Input/ Output	Description
<code>minNumInBufs</code>	<code>XDAS_Int32</code>	Output	Number of input buffers
<code>minNumOutBufs</code>	<code>XDAS_Int32</code>	Output	Number of output buffers
<code>minInBufSize[XDM_MAX_IO_BUFFERS]</code>	<code>XDAS_Int32</code>	Output	Size in bytes required for each input buffer
<code>minOutBufSize[XDM_MAX_IO_BUFFERS]</code>	<code>XDAS_Int32</code>	Output	Size in bytes required for each output buffer

Note:

For MPEG2 Decoder, the buffer details are:

- Number of input buffer required is 1
- Number of output buffer required is 1 for YUV 422ILE and 3 for YUV420P
- There is no restriction on input buffer size except that it should contain at least one frame of encoded data.

- ❑ The output buffer sizes (in bytes) for worst case HDTV_1080I format are:

For YUV 420P:

Y buffer = 1920 * 1080

U buffer = 960 * 544

V buffer = 960 * 544

For YUV 422ILE:

Buffer = 1920 * 1080 * 2

These are the maximum buffer sizes but you can reconfigure depending on the format of the bit stream.

4.2.1.3 IVIDEO_BufDesc

|| Description

This structure defines the buffer descriptor for input and output buffers.

|| Fields

Field	Datatype	Input/ Output	Description
numBufs	XDAS_Int32	Input	Number of buffers
width	XDAS_Int32	Input	Padded width of the video data
*bufs[XDM_MAX_IO_BUFFERS]	XDAS_Int8	Input	Pointer to the vector containing buffer addresses
bufSizes[XDM_MAX_IO_BUFFERS]	XDAS_Int32	Input	Size of each buffer in bytes

4.2.1.4 IVIDDEC_Fxns

|| Description

This structure contains pointers to all the XDAIS and XDM interface functions.

|| Fields

Field	Datatype	Input/ Output	Description
ialg	IALG_Fxns	Input	Structure containing pointers to all the XDAIS interface functions. For more details, see <i>TMS320 DSP Algorithm Standard API Reference</i> (literature number SPRU360).
*process	XDAS_Int32	Input	Pointer to the <code>process()</code> function
*control	XDAS_Int32	Input	Pointer to the <code>control()</code> function

4.2.1.5 IVIDDEC_Params

|| Description

This structure defines the creation parameters for an algorithm instance object. Set this data structure to `NULL`, if you are unsure of the values to be specified for these parameters.

|| Fields

Field	Datatype	Input/ Output	Description
size	XDAS_Int32	Input	Size of the basic or extended (if being used) data structure in bytes.
maxHeight	XDAS_Int32	Input	Maximum video height to be supported in pixels
maxWidth	XDAS_Int32	Input	Maximum video width to be supported in pixels
maxFrameRate	XDAS_Int32	Input	Maximum frame rate in fps * 1000 to be supported.
maxBitRate	XDAS_Int32	Input	Maximum bit rate to be supported in bits per second. For example, if bit rate is 10 Mbps, set this field to 10485760.
dataEndianness	XDAS_Int32	Input	Endianness of input data. See <code>XDM_DataFormat</code> enumeration for details.

Field	Datatype	Input/ Output	Description
<code>forceChromaFormat</code>	<code>XDAS_Int32</code>	Input	Sets the output to the specified format. For example, if the output should be in YUV 4:2:2 interleaved (little endian) format, set this field to <code>XDM_YUV_422ILE</code> . See <code>XDM_ChromaFormat</code> enumeration for details.

Note:

- ❑ MPEG2 Decoder does not use the `maxFrameRate` and `maxBitRate` fields for creating the algorithm instance.
- ❑ Maximum video height and width supported are 1088 pixels and 1920 pixels respectively (for HDTV_1080I format).

4.2.1.6 IVIDDEC_DynamicParams

|| Description

This structure defines the run time parameters for an algorithm instance object. Set this data structure to `NULL`, if you are unsure of the values to be specified for these parameters.

|| Fields

Field	Datatype	Input/ Output	Description
size	XDAS_Int32	Input	Size of the basic or extended (if being used) data structure in bytes.
decodeHeader	XDAS_Int32	Input	Number of access units to decode: <ul style="list-style-type: none"> <input type="checkbox"/> 0 (<code>XDM_DECODE_AU</code>) - Decode entire frame including all the headers <input type="checkbox"/> 1 (<code>XDM_PARSE_HEADER</code>) - Decode only one NAL unit
displayWidth	XDAS_Int32	Input	If the field is set to: <ul style="list-style-type: none"> <input type="checkbox"/> 0 - Uses decoded image width as pitch <input type="checkbox"/> If any other value greater than the decoded image width is given, then this value in pixels is used as pitch.
frameSkipMode	XDAS_Int32	Input	Frame skip mode. See <code>IVIDEO_FrameSkip</code> enumeration for details.

Note:

- `decodeHeader` is not supported. Set the `decodeHeader` field to `XDM_DECODE_AU`.
- MPEG2 Decoder does not use `displayWidth` field and is set to the default value of zero.
- Frame skip is not supported. Set the `frameSkipMode` field to `IVIDEO_NO_SKIP`.

4.2.1.7 *IVIDDEC_InArgs*

|| Description

This structure defines the run time input arguments for an algorithm instance object.

|| Fields

Field	Datatype	Input/ Output	Description
size	XDAS_Int32	Input	Size of the basic or extended (if being used) data structure in bytes.
numBytes	XDAS_Int32	Input	Size of input data (in bytes) provided to the algorithm for decoding
inputID	XDAS_Int32	Input	Application passes this ID to algorithm and decoder will attach this ID to the corresponding output frames. This is useful in case of re-ordering (for example, B frames). If there is no re-ordering, <code>outputID</code> field in the <code>IVIDDEC_OutArgs</code> data structure will be same as <code>inputID</code> field.

Note:

For B-frames, MPEG2 Decoder copies the current `inputID` value to the `outputID` value of `IVIDDEC_OutArgs` structure. However, for I and P frames, `inputID` value of the previous reference frame is copied to the `outputID` value of `IVIDDEC_OutArgs` structure.

4.2.1.8 *IVIDDEC_Status*

|| Description

This structure defines parameters that describe the status of an algorithm instance object.

|| Fields

Field	Datatype	Input/ Output	Description
size	XDAS_Int32	Input	Size of the basic or extended (if being used) data structure in bytes.
extendedError	XDAS_Int32	Output	Extended error code. See <code>XDM_ErrorBit</code> enumeration for details.
outputHeight	XDAS_Int32	Output	Output height in pixels

Field	Datatype	Input/ Output	Description
outputWidth	XDAS_Int32	Output	Output width in pixels
frameRate	XDAS_Int32	Output	Average frame rate in fps * 1000. The average frame rate for all video decoders is 30 fps.
bitRate	XDAS_Int32	Output	Average bit rate in bits per second
contentType	XDAS_Int32	Output	Video content. See IVIDEO_ContentType enumeration for details.
outputChromaFormat	XDAS_Int32	Output	Output chroma format. See XDM_ChromaFormat enumeration for details.
bufInfo	XDM_AlgbufInfo	Output	Input and output buffer information. See XDM_AlgbufInfo data structure for details.

Note:

The output chroma format for YUV 4:2:2 interleaved is as shown:

```

u00  y00  v00  y01  u02  y02  v02  y03  .  .
u00  y10  v00  y11  u02  y12  v02  y13  .  .
u20  y20  v20  y21  u22  y22  v22  y23  .  .
u20  y30  v20  y31  u22  y32  v22  y33  .  .
u40  y40  v40  y41  u42  y42  v42  y43  .  .
u40  y50  v40  y51  u42  y52  v42  y53  .  .
u60  y60  v60  y61  u62  y62  v62  y63  .  .
u60  y70  v60  y71  u62  y72  v62  y73  .  .
.    .    .    .    .    .    .    .    .    .

```

4.2.1.9 *IVIDDEC_OutArgs*

|| Description

This structure defines the run time output arguments for an algorithm instance object.

|| Fields

Field	Datatype	Input/ Output	Description
size	XDAS_Int32	Input	Size of the basic or extended (if being used) data structure in bytes.
extendedError	XDAS_Int32	Output	Extended error code. See <code>XDM_ErrorBit</code> enumeration for details.
byteConsumed	XDAS_Int32	Output	Bytes consumed per decode call
decodedFrameType	XDAS_Int32	Output	Decoded frame type. See <code>IVIDEO_FrameType</code> enumeration for more details.
outputID	XDAS_Int32	Output	Output ID. See <code>inputID</code> field description in <code>IVIDDEC_InArgs</code> data structure for details.
displayBufs	IVIDEO_Buf Desc	Output	Decoder fills this structure to denote the buffer pointers for current frames. In case of sequences having I and P frames only, these values are identical to the output buffers (<code>outBufs</code>) passed using the process call.

Note:

For B-frames, MPEG2 Decoder copies the current `inputID` value to the `outputID` value of `IVIDDEC_OutArgs` structure. However, for I and P frames, `inputID` value of the previous reference frame is copied to the `outputID` value of `IVIDDEC_OutArgs` structure.

4.2.2 MPEG2 Decoder Data Structures

This section includes the following MPEG2 Decoder specific extended data structures:

- ❑ IMPEG2VDEC_Params
- ❑ IMPEG2VDEC_DynamicParams
- ❑ IMPEG2VDEC_InArgs
- ❑ IMPEG2VDEC_Status
- ❑ IMPEG2VDEC_OutArgs

4.2.2.1 *IMPEG2VDEC_Params*

|| Description

This structure defines the creation parameters and any other implementation specific parameters for the MPEG2 Decoder instance object. The creation parameters are defined in the XDM data structure, `IVIDDEC_Params`.

|| Fields

Field	Datatype	Input/ Output	Description
<code>viddecParams</code>	<code>IVIDDEC_Params</code>	Input	See <code>IVIDDEC_Params</code> data structure for details.

4.2.2.2 *IMPEG2VDEC_DynamicParams*

|| Description

This structure defines the run time parameters and any other implementation specific parameters for the MPEG2 Decoder instance object. The run time parameters are defined in the XDM data structure, `IVIDDEC_DynamicParams`.

|| Fields

Field	Datatype	Input/ Output	Description
<code>viddecDynamicParams</code>	<code>IVIDDEC_DynamicParams</code>	Input	See <code>IVIDDEC_DynamicParams</code> data structure for details.
<code>ppNone</code>	<code>XDAS_Int32</code>	Input	Indicates no post processing will be done on decoded output and the output will be in 4:2:0 planar format. The decoder reference buffers will be exposed as output buffers. Note that if this field is set to 1, instead of output buffers being passed to algorithm, it will return reference buffers.

4.2.2.3 IMPEG2VDEC_InArgs

|| Description

This structure defines the run time input arguments for the MPEG2 Decoder instance object.

|| Fields

Field	Datatype	Input/Output	Description
viddecInArgs	IVIDDEC_InArgs	Input	See IVIDDEC_InArgs data structure for details.
resetReferencesFlag	XDAS_UInt32	Input	Reset the reference frame. Not supported in this version of MPEG2 Decoder.
displayFieldReorder	XDAS_UInt32	Input	Reorder the bottom field in case of non-progressive sequences where bottom field is sent ahead of top field for frame pictures.
frameLevelByteSwap	XDAS_UInt32	Input	To enable byte swap inside the decoder only for the current frame number of bytes. This flag restricts the byte swap at the frame level for optimization.

4.2.2.4 IMPEG2VDEC_Status

|| Description

This structure defines parameters that describe the status of the MPEG2 Decoder and any other implementation specific parameters. The status parameters are defined in the XDM data structure, IVIDDEC_Status.

|| Fields

Field	Datatype	Input/Output	Description
viddecStatus	IVIDDEC_Status	Output	See IVIDDEC_Status data structure for details
displayBufinfo	IVIDEO_BufDesc	Output	Buffer information for current displayable frame. See IVIDEO_BufDesc data structure for details. If the control API FLUSH is called, decoder returns the buffer information for the valid reference frame stored inside the decoder.
outputID	XDAS_Int32	Output	See IVIDDEC_OutArgs data structure for details. In case, the control API FLUSH is called, this ID indicates the valid reference frame stored inside the decoder.

Note:

In case the control API with command FLUSH is called, decoder updates only the fields `extendedError` of the structure `viddecStatus`, `displayBufinfo` and `OutputID` of the structure `IMPEG2VDEC Status`.

4.2.2.5 IMPEG2VDEC_OutArgs**|| Description**

This structure defines the run time output arguments for the MPEG2 Decoder instance object.

|| Fields

Field	Datatype	Input/ Output	Description
<code>viddecOutArgs</code>	<code>IVIDDEC_OutArgs</code>	Output	See <code>IVIDDEC_OutArgs</code> data structure for details.
<code>*frameIdentifier</code> [2]	<code>XDAS_UInt32</code>	Output	Timestamp of the frame returned by the decoder
<code>is_mpeg2</code>	<code>XDAS_Int8</code>	Output	Indicates MPEG2 streams. This field is set to zero for MPEG1 streams.
<code>topfirst</code>	<code>XDAS_Int8</code>	Output	Set to one if top field comes before bottom field
<code>end_of_seq</code>	<code>XDAS_Int8</code>	Output	End of sequence flag, may be used for displaying the last frame stored in buffer.
<code>repeatfield</code>	<code>XDAS_Int8</code>	Output	Repeat first field. This field is applicable only for frame pictures. For a field picture, this field is set to zero. Not supported in this version of MPEG2 Decoder.
<code>stepSize</code>	<code>XDAS_Int8</code>	Output	Quantization step size used in the frame
<code>pitch</code>	<code>XDAS_UInt32</code>	Output	Image width rounded to next 16 pixels boundary
<code>pict_struct</code>	<code>ePicStrFormat</code>	Output	Indicates decoded picture type. In case of field picture, the TOP or BOTTOM field can be identified by looking at this. See Table 4-1 (<code>ePicStrFormat</code>) for details.
<code>progressive_frame</code>	<code>XDAS_Int8</code>	Output	Frame type <input type="checkbox"/> 1 - Progressive <input type="checkbox"/> 0 - Interlaced
<code>progressive_seque nce</code>	<code>XDAS_Int8</code>	Output	Sequence type <input type="checkbox"/> 1 - Progressive <input type="checkbox"/> 0 - Non-progressive

4.3 Interface Functions

This section describes the Application Programming Interfaces (APIs) used in the MPEG2 Decoder. The APIs are logically grouped into the following categories:

- ❑ **Creation** – `algNumAlloc()`, `algAlloc()`
- ❑ **Initialization** – `algInit()`
- ❑ **Control** – `control()`
- ❑ **Data processing** – `algActivate()`, `process()`, `algDeactivate()`
- ❑ **Termination** – `algFree()`

You must call these APIs in the following sequence:

- 1) `algNumAlloc()`
- 2) `algAlloc()`
- 3) `algInit()`
- 4) `algActivate()`
- 5) `process()`
- 6) `algDeactivate()`
- 7) `algFree()`

`control()` can be called any time after calling the `algInit()` API.

`algNumAlloc()`, `algAlloc()`, `algInit()`, `algActivate()`, `algDeactivate()`, and `algFree()` are standard XDAIS APIs. This document includes only a brief description for the standard XDAIS APIs. For more details, see *TMS320 DSP Algorithm Standard API Reference* (literature number SPRU360).

4.3.1 Creation APIs

Creation APIs are used to create an instance of the component. The term creation could mean allocating system resources, typically memory.

|| Name

`algNumAlloc()` – determine the number of buffers that an algorithm requires

|| Synopsis

```
XDAS_Int32 algNumAlloc(Void);
```

|| Arguments

Void

|| Return Value

```
XDAS_Int32; /* number of buffers required */
```

|| Description

`algNumAlloc()` returns the number of buffers that the `algAlloc()` method requires. This operation allows you to allocate sufficient space to call the `algAlloc()` method.

`algNumAlloc()` may be called at any time and can be called repeatedly without any side effects. It always returns the same result. The `algNumAlloc()` API is optional.

For more details, see *TMS320 DSP Algorithm Standard API Reference* (literature number SPRU360).

|| See Also

`algAlloc()`

|| Name

`algAlloc()` – determine the attributes of all buffers that an algorithm requires

|| Synopsis

```
XDAS_Int32 algAlloc(const IALG_Params *params, IALG_Fxns
**parentFxns, IALG_MemRec memTab[]);
```

|| Arguments

```
IALG_Params *params; /* algorithm specific attributes */
```

```
IALG_Fxns **parentFxns; /* output parent algorithm
functions */
```

```
IALG_MemRec memTab[]; /* output array of memory records */
```

|| Return Value

```
XDAS_Int32 /* number of buffers required */
```

|| Description

`algAlloc()` returns a table of memory records that describe the size, alignment, type, and memory space of all buffers required by an algorithm. If successful, this function returns a positive non-zero value indicating the number of records initialized.

The first argument to `algAlloc()` is a pointer to a structure that defines the creation parameters. This pointer may be `NULL`; however, in this case, `algAlloc()` must assume default creation parameters and must not fail.

The second argument to `algAlloc()` is an output parameter. `algAlloc()` may return a pointer to its parent's IALG functions. If an algorithm does not require a parent object to be created, this pointer must be set to `NULL`.

The third argument is a pointer to a memory space of size `nbufs * sizeof(IALG_MemRec)` where, `nbufs` is the number of buffers returned by `algNumAlloc()` and `IALG_MemRec` is the buffer-descriptor structure defined in `ialg.h`.

After calling this function, `memTab[]` is filled up with the memory requirements of an algorithm.

For more details, see *TMS320 DSP Algorithm Standard API Reference* (literature number SPRU360).

|| See Also

```
algNumAlloc(), algFree()
```

4.3.2 Initialization API

Initialization API is used to initialize an instance of the algorithm. The initialization parameters are defined in the `Params` structure (see *Data Structures* section for details).

|| Name

`algInit()` – initialize an algorithm instance

|| Synopsis

```
XDAS_Int32 algInit(IALG_Handle handle, IALG_MemRec  
memTab[], IALG_Handle parent, IALG_Params *params);
```

|| Arguments

```
IALG_Handle handle; /* algorithm instance handle*/  
IALG_memRec memTab[]; /* array of allocated buffers */  
IALG_Handle parent; /* handle to the parent instance */  
IALG_Params *params; /* algorithm initialization  
parameters */
```

|| Return Value

```
IALG_EOK; /* status indicating success */  
IALG_EFAIL; /* status indicating failure */
```

|| Description

`algInit()` performs all initialization necessary to complete the run time creation of an algorithm instance object. After a successful return from `algInit()`, the instance object is ready to be used to process data.

The first argument to `algInit()` is a handle to an algorithm instance. This value is initialized to the base field of `memTab[0]`.

The second argument is a table of memory records that describe the base address, size, alignment, type, and memory space of all buffers allocated for an algorithm instance. The number of initialized records is identical to the number returned by a prior call to `algAlloc()`.

The third argument is a handle to the parent instance object. If there is no parent object, this parameter must be set to `NULL`.

The last argument is a pointer to a structure that defines the algorithm initialization parameters.

For more details, see *TMS320 DSP Algorithm Standard API Reference* (literature number SPRU360).

|| See Also

`algAlloc()`, `algMoved()`

4.3.3 Control API

Control API is used for controlling the functioning of the algorithm instance during run-time. This is done by changing the status of the controllable parameters of the algorithm during run-time. These controllable parameters are defined in the `Status` data structure (see Data Structures section for details).

|| Name

`control()` – change run time parameters and query the status

|| Synopsis

```
XDAS_Int32 (*control) (IVIDDEC_Handle handle, IVIDDEC_Cmd
id, IVIDDEC_DynamicParams *params, IVIDDEC_Status
*status);
```

|| Arguments

```
IVIDDEC_Handle handle; /* algorithm instance handle */
IVIDDEC_Cmd id; /* algorithm specific control commands*/
IVIDDEC_DynamicParams *params /* algorithm run time
parameters */
IVIDDEC_Status *status /* algorithm instance status
parameters */
```

|| Return Value

```
IALG_EOK; /* status indicating success */
IALG_EFAIL; /* status indicating failure */
```

|| Description

This function changes the run time parameters of an algorithm instance and queries the algorithm's status. `control()` must only be called after a successful call to `algInit()` and must never be called after a call to `algFree()`.

The first argument to `control()` is a handle to an algorithm instance.

The second argument is an algorithm specific control command. See `XDM_CmdId` enumeration for details.

The third and fourth arguments are pointers to the `IVIDDEC_DynamicParams` and `IVIDDEC_Status` data structures respectively.

Note:

If you are using extended data structures, the third and fourth arguments must be pointers to the extended `DynamicParams` and `Status` data structures respectively. Also, ensure that the `size` field is set to the size of the extended data structure. Depending on the value set for the `size` field, the algorithm uses either basic or extended parameters.

|| Preconditions

The following conditions must be true prior to calling this function; otherwise, its operation is undefined.

- ❑ `control()` can only be called after a successful return from `algInit()` and `algActivate()`.
- ❑ If algorithm uses DMA resources, `control()` can only be called after a successful return from `DMAN3_init()`.
- ❑ `handle` must be a valid handle for the algorithm's instance object.

|| Postconditions

The following conditions are true immediately after returning from this function.

- ❑ If the control operation is successful, the return value from this operation is equal to `IALG_EOK`; otherwise it is equal to either `IALG_EFAIL` or an algorithm specific return value.
- ❑ If the control command is not recognized, the return value from this operation is not equal to `IALG_EOK`.

|| Example

See test application file, `TestAppDecoder.c` available in the `\Client\Test\Src` sub-directory.

|| See Also

`algInit()`, `algActivate()`, `process()`

4.3.4 Data Processing API

Data processing API is used for processing the input data.

|| Name

`algActivate()` – initialize scratch memory buffers prior to processing.

|| Synopsis

```
Void algActivate(IALG_Handle handle);
```

|| Arguments

```
IALG_Handle handle; /* algorithm instance handle */
```

|| Return Value

Void

|| Description

`algActivate()` initializes any of the instance's scratch buffers using the persistent memory that is part of the algorithm's instance object.

The first (and only) argument to `algActivate()` is an algorithm instance handle. This handle is used by the algorithm to identify various buffers that must be initialized prior to calling any of the algorithm's processing methods.

For more details, see *TMS320 DSP Algorithm Standard API Reference*. (literature number SPRU360).

|| See Also

`algDeactivate()`

|| Name

`process()` – basic encoding/decoding call

|| Synopsis

```
XDAS_Int32 (*process)(IVIDDEC_Handle handle, XDM_BufDesc
*inBufs, XDM_BufDesc *outBufs, IVIDDEC_InArgs *inargs,
IVIDDEC_OutArgs *outargs);
```

|| Arguments

```
IVIDDEC_Handle handle; /* algorithm instance handle */
XDM_BufDesc *inBufs; /* algorithm input buffer descriptor
*/
XDM_BufDesc *outBufs; /* algorithm output buffer descriptor
*/
IVIDDEC_InArgs *inargs /* algorithm runtime input
arguments */
IVIDDEC_OutArgs *outargs /* algorithm runtime output
arguments */
```

|| Return Value

```
IALG_EOK; /* status indicating success */
IALG_EFAIL; /* status indicating failure */
```

|| Description

This function does the basic encoding/decoding. The first argument to `process()` is a handle to an algorithm instance.

The second and third arguments are pointers to the input and output buffer descriptor data structures respectively (see `XDM_BufDesc` data structure for details).

The fourth argument is a pointer to the `IVIDDEC_InArgs` data structure that defines the run time input arguments for an algorithm instance object.

The last argument is a pointer to the `IVIDDEC_OutArgs` data structure that defines the run time output arguments for an algorithm instance object.

Note:

If you are using extended data structures, the fourth and fifth arguments must be pointers to the extended `InArgs` and `OutArgs` data structures respectively. Also, ensure that the `size` field is set to the size of the extended data structure. Depending on the value set for the `size` field, the algorithm uses either basic or extended parameters.

|| Preconditions

The following conditions must be true prior to calling this function; otherwise, its operation is undefined.

- ❑ `process()` can only be called after a successful return from `algInit()` and `algActivate()`.
- ❑ If algorithm uses DMA resources, `process()` can only be called after a successful return from `DMAN3_init()`.
- ❑ `handle` must be a valid handle for the algorithm's instance object.
- ❑ Buffer descriptor for input and output buffers must be valid.
- ❑ Input buffers must have valid input data.

|| Postconditions

The following conditions are true immediately after returning from this function.

- ❑ If the process operation is successful, the return value from this operation is equal to `IALG_EOK`; otherwise it is equal to either `IALG_EFAIL` or an algorithm specific return value.
- ❑ After successful return from `process()` function, `algDeactivate()` can be called.

|| Example

See test application file, `TestAppDecoder.c` available in the `\Client\Test\Src` sub-directory.

|| See Also

`algInit()`, `algDeactivate()`, `control()`

Note:

A video encoder or decoder cannot be preempted by any other encoder or decoder instance. That is, you cannot perform task switching while encode/decode of a particular frame is in progress. Pre-emption can happen only at frame boundaries and after `algDeactivate()` is called.

|| Name

`algDeactivate()` – save all persistent data to non-scratch memory

|| Synopsis

```
Void algDeactivate(IALG_Handle handle);
```

|| Arguments

```
IALG_Handle handle; /* algorithm instance handle */
```

|| Return Value

Void

|| Description

`algDeactivate()` saves any persistent information to non-scratch buffers using the persistent memory that is part of the algorithm's instance object.

The first (and only) argument to `algDeactivate()` is an algorithm instance handle. This handle is used by the algorithm to identify various buffers that must be saved prior to next cycle of `algActivate()` and processing.

For more details, see *TMS320 DSP Algorithm Standard API Reference* (literature number SPRU360).

|| See Also

`algActivate()`

4.3.5 Termination API

Termination API is used to terminate the algorithm instance and free up the memory space that it uses.

|| Name

`algFree()` – determine the addresses of all memory buffers used by the algorithm

|| Synopsis

```
XDAS_Int32 algFree(IALG_Handle handle, IALG_MemRec  
memTab[]);
```

|| Arguments

```
IALG_Handle handle; /* handle to the algorithm instance */  
IALG_MemRec memTab[]; /* output array of memory records */
```

|| Return Value

```
XDAS_Int32; /* Number of buffers used by the algorithm */
```

|| Description

`algFree()` determines the addresses of all memory buffers used by the algorithm. The primary aim of doing so is to free up these memory regions after closing an instance of the algorithm.

The first argument to `algFree()` is a handle to the algorithm instance.

The second argument is a table of memory records that describe the base address, size, alignment, type, and memory space of all buffers previously allocated for the algorithm instance.

For more details, see *TMS320 DSP Algorithm Standard API Reference* (literature number SPRU360).

|| See Also

```
algAlloc()
```