

OMX Media Component

User's Manual: VC-1 Decoder Part

32

— Preliminary —

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OMX Media Component VC-1 Decoder Part

1. Overview

1.1. About This Document

This document is the User's Manual for OMX Media Component. It describes the specifications of VC-1 Decoder Media Component. For the specifications that are common to OMX video decoder, see related documents [1] and [2].

1.2. VC-1 Decoder Media Component Overview and Scope

Figure 1-1 illustrates the software stacks for the VC-1 Decoder Media Component and shows the scope of this document. OMX Media Component VC-1 Decoder Library is a library that provides VC-1 Video decoding functions. It requires OMX Media Component Video Decoder Common Library and OMX Media Component Common Library.

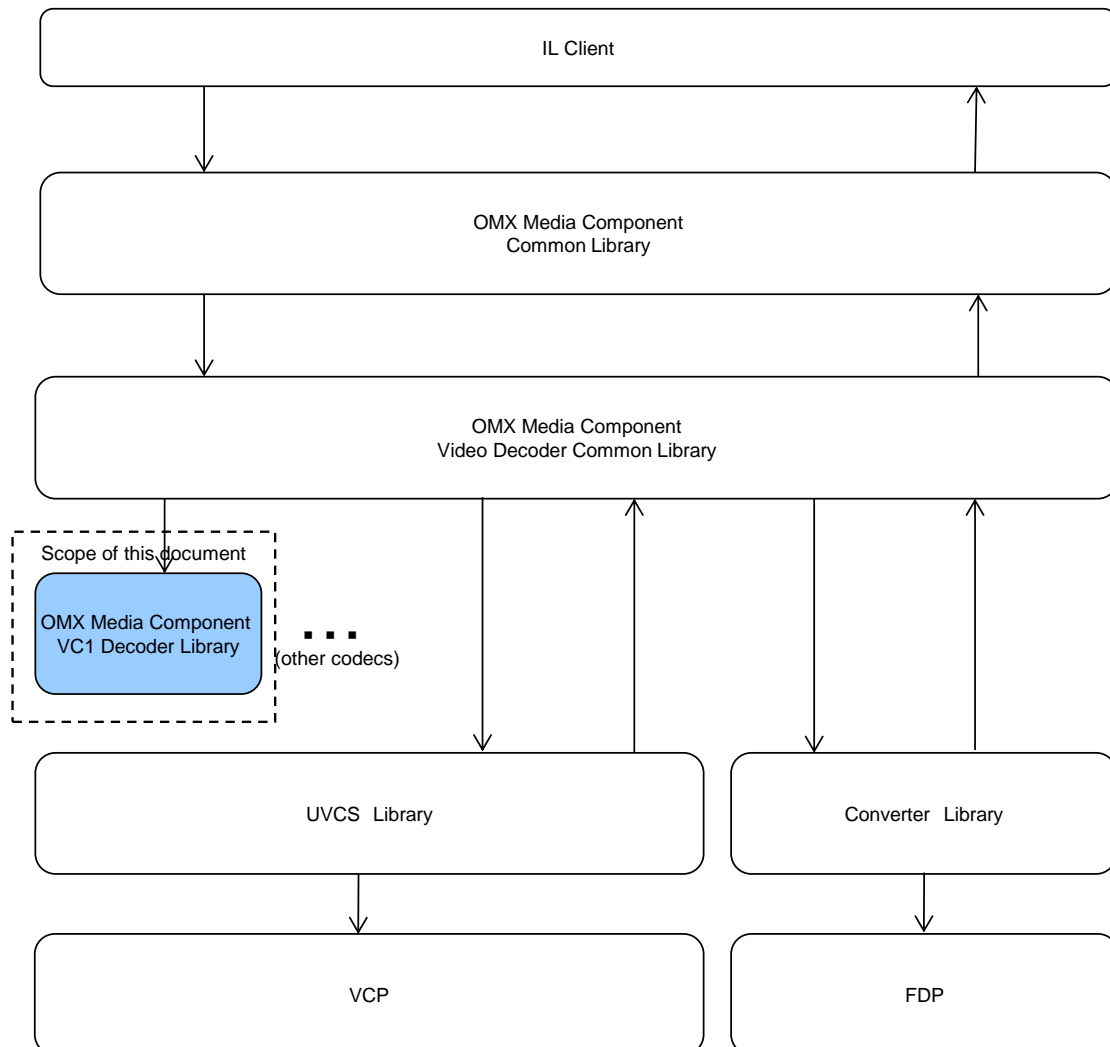


Figure 1-1 Software Stacks and Scope

This document describes the specifications of OMX Media Component VC-1 Decoder library part. For the specifications of OMX Media Component Video Decoder Common Library and OMX Media Component Common Library, see related documents [1] and [2] respectively.

1.3. Required Header Files

Table 1-1 lists the header files that are required to use the OMX extended indexes and structures that are described in this document. Regarding the other header files, see related documents [1] and [2].

Table 1-1 Required Header Files

| File name | Remarks |
|-----------------------|---------|
| OMXR_Extension_vc1.h | - |
| OMXR_Extension_vc1d.h | - |

1.4. Role Name and Component Name

Table 1-2 shows the role name and the component name for VC-1 Decoder Media Component.

Table 1-2 Role Name and Component Name

| Role name | Component name |
|-------------------|-------------------------------|
| video_decoder_vc1 | OMX.RENESAS.VIDEO.DECODER.VC1 |

1.5. Related Documents

Table 1-3 lists the related documents.

Table 1-3 List of Related Documents

| No. | Document Name | Remarks |
|-----|--|---|
| [1] | OMX Media Component User's Manual Common Part | The common specifications for OMX Media Component |
| [2] | OMX Media Component User's Manual Video Decoder Common Part | The common specifications for OMX Video Decoder Media Component |
| [3] | OpenMAX Integration Layer Application Programming Interface Specification Version 1.1.2, September 1, 2008 | http://www.khronos.org/registry/omxil/specs/OpenMAX_IL_1_1_2_Specification.pdf |
| [4] | OMX Integration Guide for <OS > | Integration guide for OMX Media Component. Substitute <OS> with your target operating system name. |

1.6. Terminology

Table 1-4 lists the terms that are used in this document.

Table 1-4 Terminology

| Term | Abbreviation | Description |
|-----------------|--------------|---|
| Video Port Base | VPB | The base value of the port index of the Video Media Component. The port index values of the input and output ports are obtained by adding offset values to this base value. |
| UVCS | - | Renesas proprietary video codec software module that provides multi-processing function for video decoding and encoding. OMX Video Codec products contain UVCS library. |

2. Functions

VC-1 Decoder Media Component is a media component which provides functions to decode video stream that is compressed according to the VC-1 standard. VC-1 Decoder Media Component receives encoded stream data on the input port and emits the decoded video frame data on the output ports.

For the specifications that are common to OMX video decoders, see related document [2].

2.1. Function Details

2.1.1. Decode Functions

Table 2-1 shows the codec standard and functions that VC-1 Decoder Media Component supports.

Table 2-1 Supported Codec Standard and Functions

| | |
|-------------------|---|
| Codec standard | SMPTE 421M |
| Profile | Simple / Main / Advanced |
| Level | Low / Medium (Simple Profile) Low / Medium / High (Main Profile) L0 / L1 / L2 / L3 (Advanced Profile) |
| Unsupported tools | - |
| Picture size | <p><Progressive> ^{Note1}</p> <ul style="list-style-type: none"> - Width : 80 - 1920 (must be multiple of 2) - Height : 80 - 1088 (must be multiple of 2) <p><Interlace> ^{Note1}</p> <ul style="list-style-type: none"> - Width : 80 - 1920 (must be multiple of 2) - Height : 80 - 1088 (must be multiple of 4) |
| Bit rate | Maximum 40Mbps/s ^{Note2} |
| Frame rate | Maximum 60p / 60i ^{Note2} |
| Input format | RCV Ver.2 Format VC-1 Elementary Stream Format |
| Output format | YUV420 Semi-Planar format YUV420 Planar format |

Note1: The allowable width and height are 1920 and the maximum number of macroblocks per picture is up to 8160 that is equals to the one of 1920x1088 stream. Therefore, 1088x1920 stream is supported.

Note2: Regarding the throughput, the following description should be noticed:

- The maximum throughput is different for each LSI. For the detail, see the LSI hardware manual.
- The throughput may fall depends on CPU load and bus traffic caused by modules except OMX Media Component.

3. I/O Data Format

3.1. Buffer Payload

3.1.1. Input Buffer Payload

The input data format of VC-1 Decoder Media Component depends on the profile of an input stream. Thus, IL client shall be aware of the profile before the video decoding.

(1) For Simple and Main Profile

- The input data unit is one frame data.
- The Sequence Layer Structure and a frame data must be stored in separate buffers. `OMX_BUFFERFLAG_CODECONFIG` must be set in the *nFlags* member of the `OMX_BUFFERHEADERTYPE` structure of a buffer contains the Sequence Layer Structure. For details of Sequence Layer Structure, see section 3.2.
- If an input data starts with Frame Header, set '8' to the *nOffset* member of the `OMX_BUFFERHEADERTYPE` structure. Otherwise, set '0' to the member.
- `OMX_BUFFERFLAG_ENDOFFRAME` must be set in the *nFlags* member of the `OMX_BUFFERHEADERTYPE` structure only when a buffer payload contains the last data of a frame data.
- When input is the end-of-stream, `OMX_BUFFERFLAG_EOS` must be set in the *nFlags* member of the `OMX_BUFFERHEADERTYPE` structure. For the details of `OMX_BUFFERFLAG_EOS`, see related document [2].

ATTENTION:

- There is a performance disadvantage to store a frame data into multiple buffers. Therefore IL client should store a frame data into a single buffer.

(nFlags)

CONFIG : OMX_BUFFERFLAG_CODECCONFIG

EOF : OMX_BUFFERFLAG_ENDOFFRAME

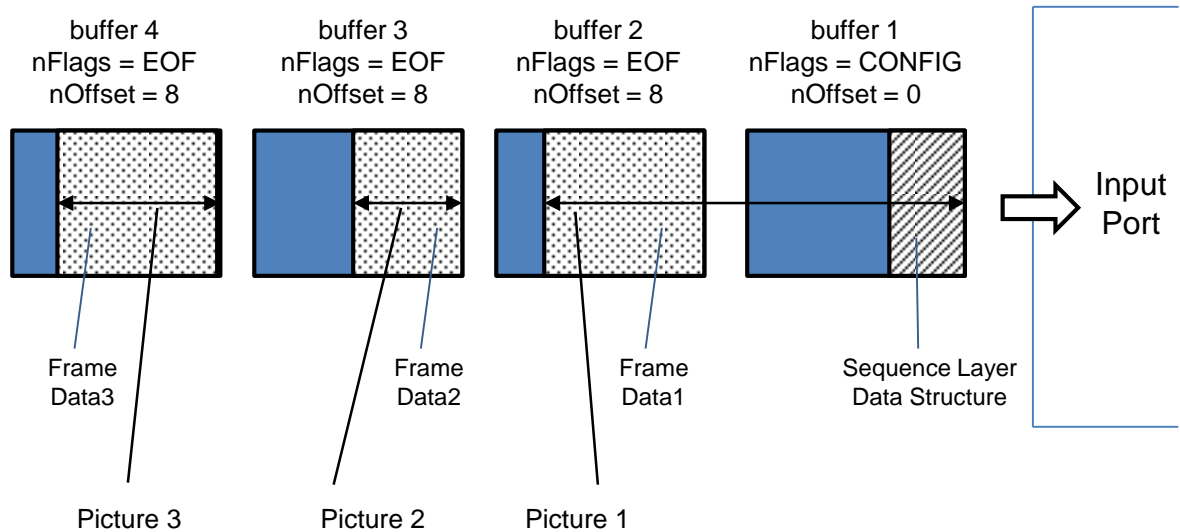


Figure 3-1 Example of Input Buffer Sequence - A Frame Data Unit (SP and MP)

(2) For Advanced Profile

- The input data unit is one picture data that is defined as either of the following:
 - A frame data of progressive contents (see Figure 3-2)
 - An interlaced field (see Figure 3-3)
 - A pair of interlaced fields (see Figure 3-4)
- In the case where the Sequence Header and the Entry Point Header are stored in separate buffers, OMX_BUFFERFLAG_CODECCONFIG must be set in the *nFlags* member of the OMX_BUFFERHEADERTYPE structure of a buffer contains the Sequence Header or the Entry Point Header (see Figure 3-5, Figure 3-6).
- OMX_BUFFERFLAG_ENDOFFRAME must be set in the *nFlags* member of the OMX_BUFFERHEADERTYPE structure only when a buffer payload contains the last data of a picture data.
- When an input is the end-of-stream, OMX_BUFFERFLAG_EOS must be set in the *nFlags* member of the OMX_BUFFERHEADERTYPE structure. For the details of OMX_BUFFERFLAG_EOS, see related document [2].

ATTENTION:

- There is a performance disadvantage to divide one picture data into multiple buffers. Therefore IL client should store one picture data into a single buffer.

(nFlags)

EOF : OMX_BUFFERFLAG_ENDOFFRAME

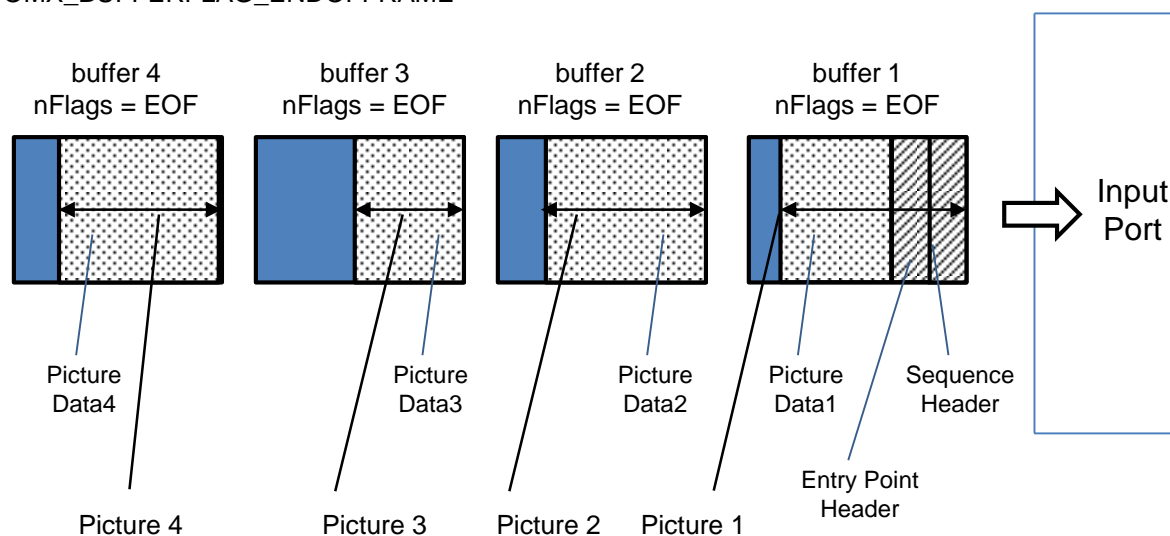


Figure 3-2 Example of Input Buffer Sequence – A Frame Data Unit (AP)

(nFlags)

EOF : OMX_BUFFERFLAG_ENDOFFRAME

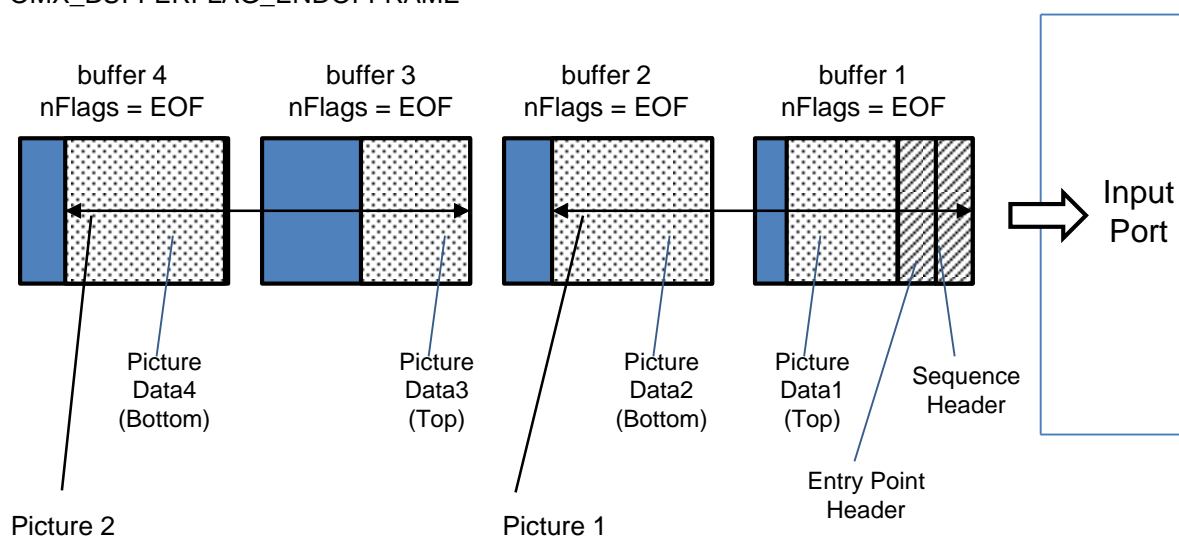


Figure 3-3 Example of Input Buffer Sequence – An Interlaced Field Unit

(nFlags)

EOF : OMX_BUFFERFLAG_ENDOFFRAME

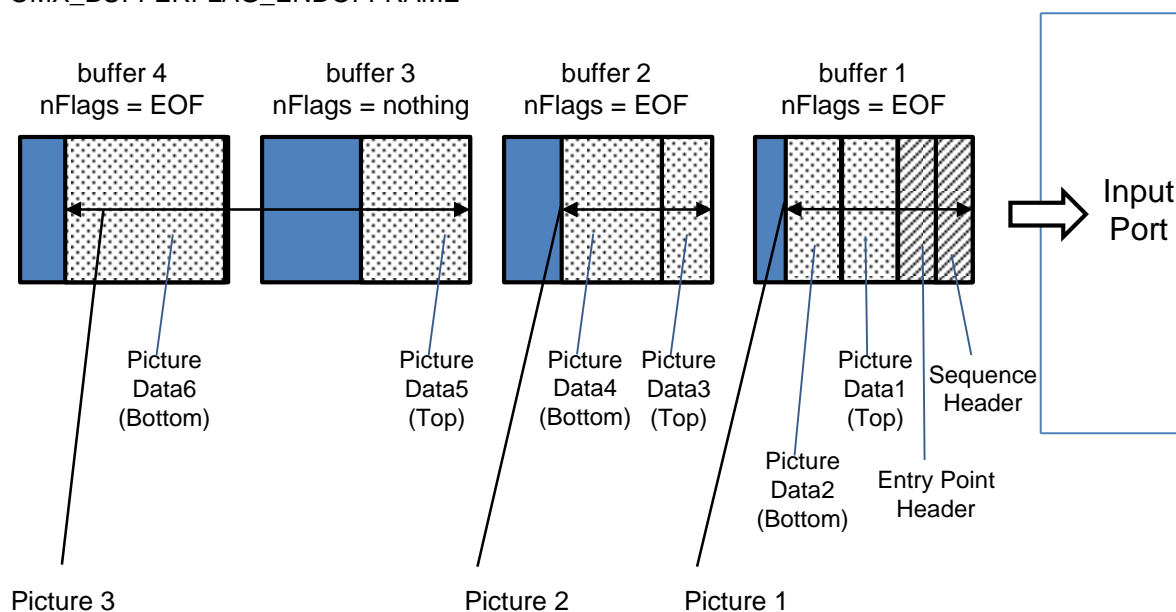


Figure 3-4 Example of Input Buffer Sequence – A Pair of Interlaced Fields Unit

(nFlags)

CONFIG : OMX_BUFFERFLAG_CODECCONFIG

EOF : OMX_BUFFERFLAG_ENDOFFRAME

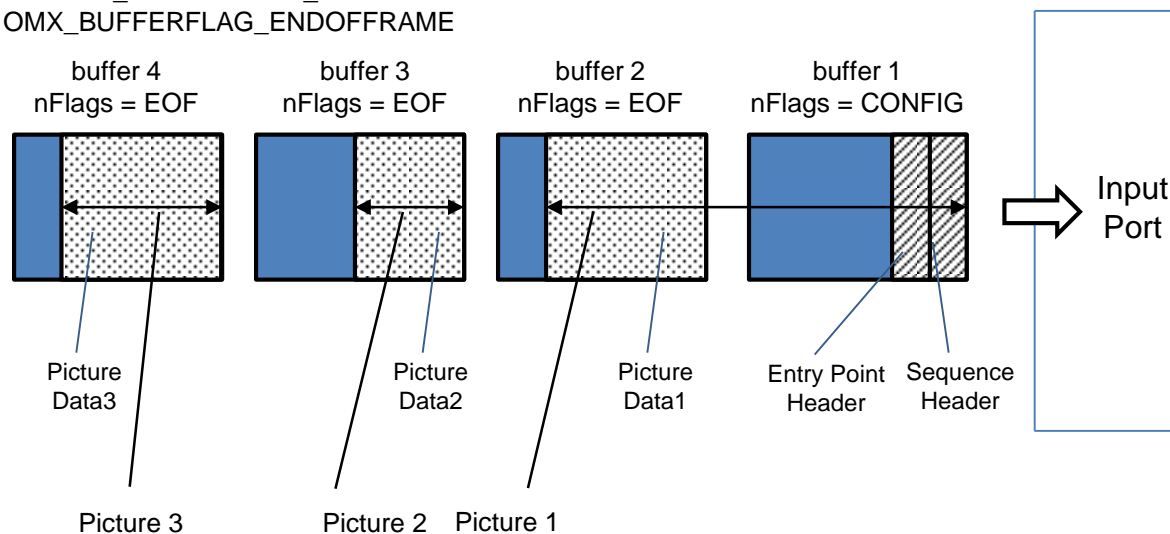


Figure 3-5 Example of Input Buffer Sequence – Sequence Header and Entry Point Header in the Same Buffer

(nFlags)

CONFIG : OMX_BUFFERFLAG_CODECCONFIG

EOF : OMX_BUFFERFLAG_ENDOFFRAME

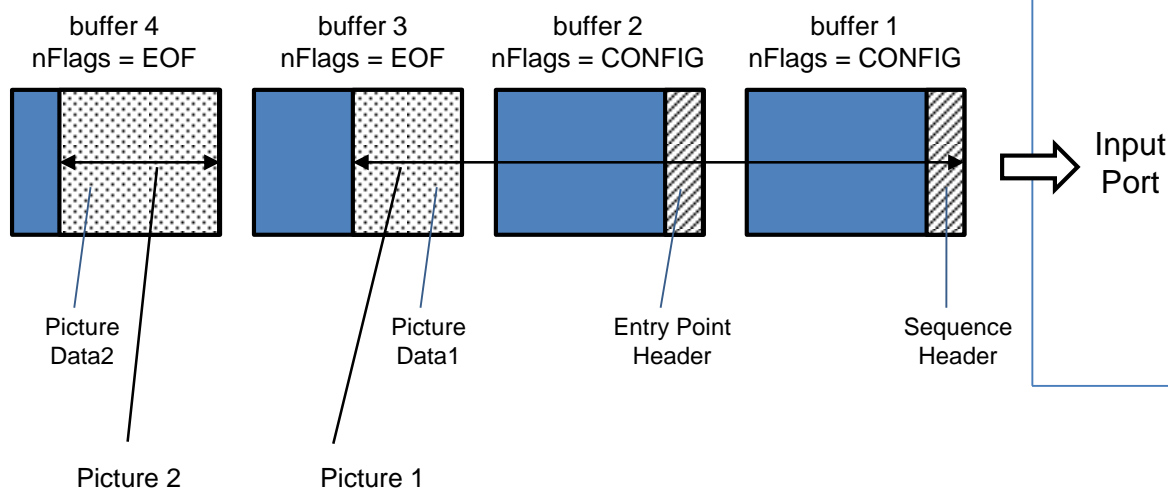


Figure 3-6 Example of Input Buffer Sequence – Sequence Header and Entry Point Header in Different Buffers

3.1.2. Output Buffer Payload

See related document [2].

3.2. Input Stream Data Format

(1) RCV V2.0 Format for Simple and Main Profiles

Figure 3-7 illustrates the input stream data format of the RCV V2.0 format of Simple and Main profiles.

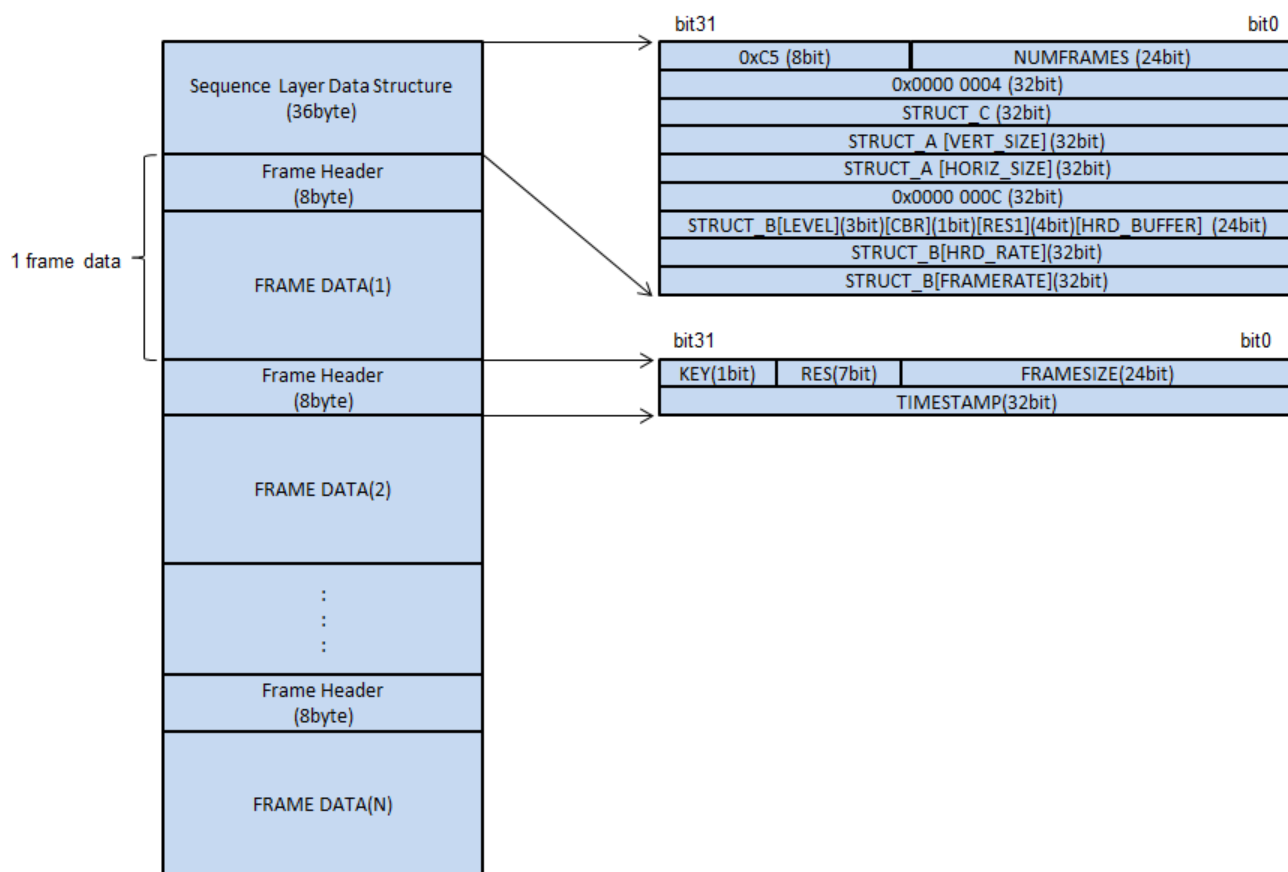


Figure 3-7 Input Stream Data Format for SP/MP (RCV Ver.2 Format)

Table 3-1 describes the member of the Sequence Layer Data Structure. For the details of each structure, refer to the VC-1 standard.

Table 3-1 : Sequence Layer Data Structure

| STRUCT Name | Mandatory | Note |
|-------------|-----------|---|
| STRUCT_C | YES | - |
| STRUCT_A | YES | - |
| STRUCT_B | NO | When there is no STRUCT_B in the contents, the IL Client must not input STRUCT_B data to OMX Media Component. |

(2) Elementary Stream for Simple and Main Profiles

Figure 3-8 illustrates the input stream data format of the Elementary Stream of Simple and Main profiles. The sequence Layer Data Structure that is described in (1) must be input at the top of the decoding. Therefore, the IL client needs to prepare the Sequence Layer Data Structure by using such as the header information of the container.

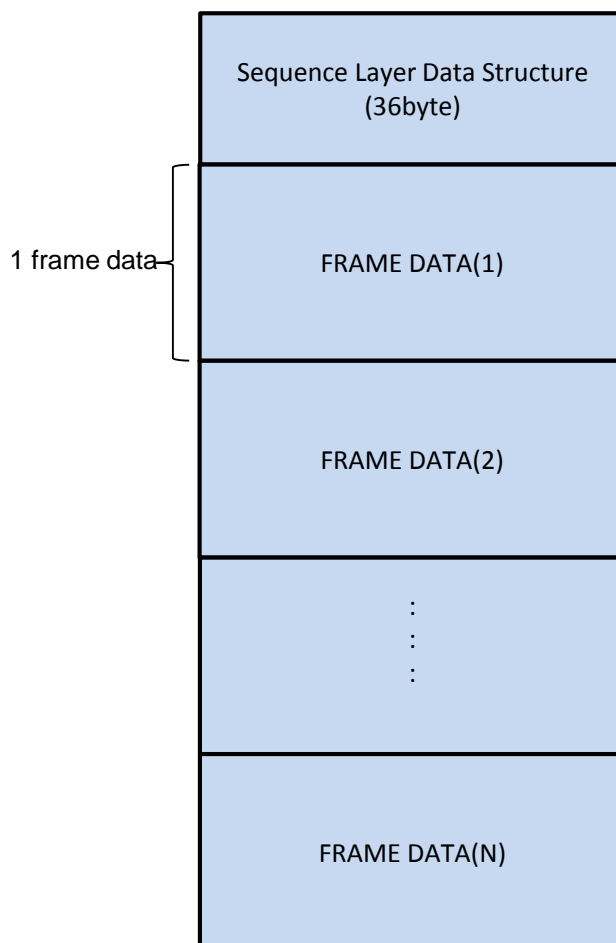


Figure 3-8 Input Stream Data Format for SP/MP (Elementary Stream Format)

(3) Elementary Stream for Advanced Profile

Figure 3-9 illustrates the input stream data format of the Elementary Stream of Advanced profile.

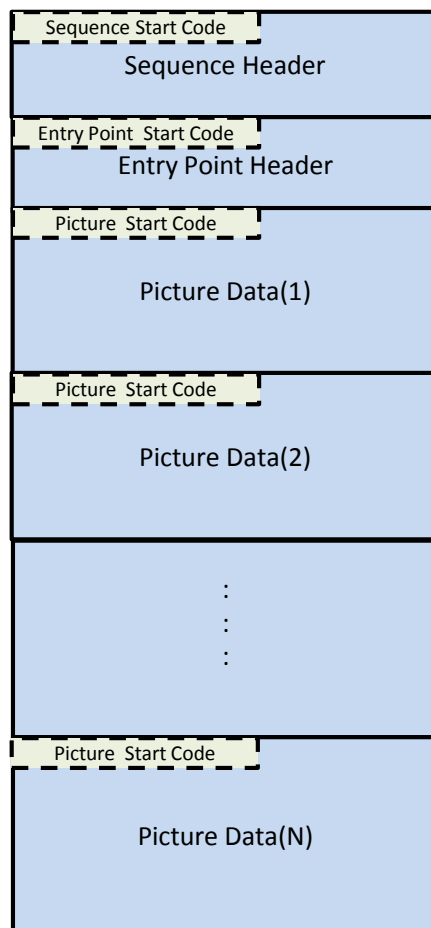


Figure 3-9 Input Stream Data Format for AP (Elementary Stream Format)

3.3. Output Picture Data Format

See related document [2].

4. API Reference

See related document [2].

5. Indexes

5.1. Standard Indexes of VC-1 Decoder Media Component

Table 5-1 lists the OpenMAX IL standard indexes that are available for VC-1 Decoder Media Component.

Table 5-1 Available Standard Indexes for VC-1 Decoder Media Component

| Index | Description |
|---|--------------------------|
| OMX_IndexParamPortDefinition | See related document [2] |
| OMX_IndexParamVideoPortFormat | |
| OMX_IndexConfigCommonOutputCrop | |
| OMX_IndexConfigCommonScale | |
| OMX_IndexParamVideoProfileLevelQuerySupported | |
| OMX_IndexParamVideoProfileLevelCurrent | |
| OMX_IndexParamVideoVC1 | See section 5.1.1 |

5.1.1. OMX_IndexParamVideoVC1

[Description] An index to access VC-1 Video codec related parameters.

[Corresponding Structure] OMX_VIDEO_PARAM_VC1TYPE structure

[Notes] None

5.2. Extended Indexes of VC-1 Decoder Media Component

Table 5-2 lists the OMX extended indexes that are available for VC-1 Decoder Media Component.

Table 5-2 Available extended indexes for VC-1 Decoder Media Component

| Index | Description |
|--|--------------------------|
| OMXR_MC_IndexParamVideoReorder | See related document [2] |
| OMXR_MC_IndexParamVideoDeinterlaceMode | |

5.3. Valid Indexes for OpenMAX IL Macro Functions

Table 5-3 shows which index is available for each port and which OpenMAX IL Macro function can be called to access the index.

Table 5-3 Valid Indexes and OpenMAX IL Macro Function

| PortIndex | Index | Get/SetParameter | | Get/SetConfig | |
|-----------|---|--------------------------|-----|---------------|-----|
| | | Get | Set | Get | Set |
| VPB+0 | OMX_IndexParamPortDefinition | See related document [2] | | | |
| | OMX_IndexParamVideoPortFormat | | | | |
| | OMX_IndexParamVideoProfileLevelQuerySupported | | | | |
| | OMX_IndexParamVideoProfileLevelCurrent | | | | |
| | OMX_IndexParamVideoVC1 | X | X | - | - |
| VPB+1 | OMX_IndexParamPortDefinition | See related document [2] | | | |
| | OMX_IndexParamVideoPortFormat | | | | |
| | OMX_IndexConfigCommonOutputCrop | | | | |
| | OMX_IndexConfigCommonScale | | | | |
| | OMXR_MC_IndexParamVideoReorder | | | | |
| | OMXR_MC_IndexParamVideoDeinterlaceMode | | | | |

X : Valid
- : Invalid

6. Structures

Table 6-1 lists VC-1 Decoder Media Component specific structures.

Table 6-1 VC-1 Decoder Media Component Specific Structures

| Structure Name | Description |
|-------------------------|-----------------|
| OMX_VIDEO_PARAM_VC1TYPE | See section 6.1 |

Table 6-2 shows the notation for the access attribute of a structure member described in this section.

Table 6-2 Notation for the access attribute of a structure member

| Member Name | Get | Set |
|---------------------------|--|---|
| Indicates the member name | Indicates the access attribute of the member in the OMX_GetParameter() or OMX_GetConfig(). “R” means IL client can get a value from the member. “W” means IL client must specify a value for the member. | Indicates the access attribute of the member in the OMX_SetParameter() or OMX_SetConfig(). “W” means IL client must/can specify a value for the member. “-“ means a specified value is ignored and not reflected. |

6.1. OMX_VIDEO_PARAM_VC1TYPE

[Description] The structure to access VC-1 Video codec related parameters.

[Definition]

```
typedef struct tagOMX_VIDEO_PARAM_VC1TYPE {
    OMX_U32                nSize;
    OMX_VERSIONTYPE        nVersion;
    OMX_U32                nPortIndex;
    OMX_VIDEO_VC1PROFILETYPE eProfile;
    OMX_VIDEO_VC1LEVELTYPE eLevel;
} OMX_VIDEO_PARAM_VC1TYPE;
```

[Index] OMX_IndexParamVideoVC1

| Member Name | Get | Set |
|-------------------|-----|-----|
| <i>nSize</i> | W | W |
| <i>nVersion</i> | W | W |
| <i>nPortIndex</i> | W | W |
| <i>eProfile</i> | R | - |
| <i>eLevel</i> | R | - |

[Details]

nSize

| | |
|----------------------|-------------------------------------|
| Write Value | The size of the structure in bytes. |
| Read Value | - |
| Initial Value | - |
| Notes | - |

nVersion

| | |
|----------------------|---|
| Write Value | The version number of OpenMAX IL specifications 1.1.2 |
| Read Value | - |
| Initial Value | - |
| Notes | - |

nPortIndex

| | |
|----------------------|---------|
| Write Value | VPB + 0 |
| Read Value | - |
| Initial Value | - |
| Notes | - |

eProfile

| | |
|----------------------|--|
| Write Value | - |
| Read Value | OMX_VIDEO_VC1ProfileSimple OMX_VIDEO_VC1ProfileMain OMX_VIDEO_VC1ProfileAdvanced OMX_VIDEO_VC1ProfileNone |
| Initial Value | OMX_VIDEO_VC1ProfileSimple |
| Notes | This member is the profile of the video stream that is currently being processed. |

eLevel

| | |
|----------------------|--|
| Write Value | - |
| Read Value | OMX_VIDEO_VC1LevelLow OMX_VIDEO_VC1LevelMedium OMX_VIDEO_VC1LevelHigh OMX_VIDEO_VC1Level0 OMX_VIDEO_VC1Level1 OMX_VIDEO_VC1Level2 OMX_VIDEO_VC1Level3 OMX_VIDEO_VC1Level4 OMX_VIDEO_VC1LevelNone |
| Initial Value | OMX_VIDEO_VC1LevelLow |
| Notes | This member is the level of the video stream that is currently being processed. |

6.2. Specific Usage on Common Structure Members

This section describes VC-1 Decoder Media Component specific usage of the structures that are described in related document [2].

6.2.1. OMX_VIDEO_PORTDEFINITIONTYPE (Input Port)

[Index] OMX_IndexParamPortDefinition

[Details]

nFrameWidth

| | |
|----------------------|---|
| Write Value | 80 - 1920 |
| Read Value | (Current setting) |
| Initial Value | 176 |
| Notes | <ul style="list-style-type: none"> – An odd value is rounded down to the closest even value. – No effects on the decode processing. |

nFrameHeight

| | |
|----------------------|---|
| Write Value | 80 - 1920 |
| Read Value | (Current setting) |
| Initial Value | 144 |
| Notes | <ul style="list-style-type: none"> – An odd value is rounded down to the closest even value. – No effects on the decode processing. |

eCompressionFormat

| | |
|----------------------|---------------------|
| Write Value | - |
| Read Value | OMX_VIDEO_CodingVC1 |
| Initial Value | OMX_VIDEO_CodingVC1 |
| Notes | - |

6.2.2. OMX_VIDEO_PARAM_PORTFORMATTYPE (Input Port)

[Index] OMX_IndexParamVideoPortFormat

[Details]

eCompressionFormat

| | |
|----------------------|---------------------|
| Write Value | - |
| Read Value | OMX_VIDEO_CodingVC1 |
| Initial Value | OMX_VIDEO_CodingVC1 |
| Notes | - |

6.2.3. OMX_VIDEO_PARAM_PROFILELEVELTYPE (ProfileLevelQuerySupport)

[Index] OMX_IndexParamVideoProfileLevelQuerySupported

[Details]

eProfile

| | |
|----------------------|--|
| Write Value | - |
| Read Value | OMX_VIDEO_VC1ProfileSimple (nProfileIndex=0) OMX_VIDEO_VC1ProfileMain (nProfileIndex=1) OMX_VIDEO_VC1ProfileAdvanced (nProfileIndex=2) |
| Initial Value | OMX_VIDEO_VC1ProfileSimple |
| Notes | - |

eLevel

| | |
|----------------------|---|
| Write Value | - |
| Read Value | OMX_VIDEO_VC1LevelMedium (nProfileIndex=0) OMX_VIDEO_VC1LevelHigh (nProfileIndex=1) OMX_VIDEO_VC1Level3 (nProfileIndex=2) |
| Initial Value | OMX_VIDEO_VC1LevelMedium |
| Notes | - |

nProfileIndex

| | |
|----------------------|---------|
| Write Value | 0, 1, 2 |
| Read Value | - |
| Initial Value | - |
| Notes | - |

6.2.4. OMX_VIDEO_PARAM_PROFILELEVELTYPE (ProfileLevelCurrent)

[Index] OMX_IndexParamVideoProfileLevelCurrent

[Details]

eProfile

| | |
|----------------------|--|
| Write Value | - |
| Read Value | OMX_VIDEO_VC1ProfileSimple OMX_VIDEO_VC1ProfileMain OMX_VIDEO_VC1ProfileAdvanced OMX_VIDEO_VC1LevelNone |
| Initial Value | OMX_VIDEO_VC1ProfileSimple |
| Notes | - |

eLevel

| | |
|----------------------|--|
| Write Value | - |
| Read Value | OMX_VIDEO_VC1LevelLow OMX_VIDEO_VC1LevelMedium OMX_VIDEO_VC1LevelHigh OMX_VIDEO_VC1Level0 OMX_VIDEO_VC1Level1 OMX_VIDEO_VC1Level2 OMX_VIDEO_VC1Level3 OMX_VIDEO_VC1Level4 OMX_VIDEO_VC1LevelNone |
| Initial Value | OMX_VIDEO_VC1LevelLow |
| Notes | - |

nProfileIndex

| | |
|----------------------|---|
| Write Value | - |
| Read Value | 0 |
| Initial Value | 0 |
| Notes | - |

6.2.5. OMXR_MC_VIDEO_DECODERESULTTYPE

[Index] N/A

[Details]

u32PictWidth

| | |
|----------------------|---|
| Write Value | - |
| Read Value | The width of the decoded picture data in pixels |
| Initial Value | - |
| Notes | If there is frame size change in the bitstream (Dynamic resolution change of VC-1), the value is pre-scaled frame size. |

u32PictHeight

| | |
|----------------------|---|
| Write Value | - |
| Read Value | The height of the decoded picture data in pixels |
| Initial Value | - |
| Notes | If there is frame size change in the bitstream (Dynamic resolution change of VC-1), the value is pre-scaled frame size. |

6.2.6. Buffer Flags (*nFlags*)

VC-1 Decoder Media Component has specific usage for the buffer flags listed in Table 6-3. For the other flags, see related document [2].

Table 6-3 Specific Usage on Buffer Flags

| Flag | Description |
|----------------------------|--------------------|
| OMX_BUFFERFLAG_CODECCONFIG | See section 3.1.1. |

7. Memory Requirement

Table 7-1 describes the types of the memory that VC-1 Decoder Media Component requires.

Table 7-1 Required Memory Types

| Memory Type | Accessible from | Description |
|---------------|------------------|---|
| input buffer | Hardware and CPU | Buffers for the input port. The required memory size is $1,572,864 \times nBufferCountActual$. For details of the <i>nBufferCountActual</i> member, see related document [2]. |
| output buffer | Hardware and CPU | Buffers for the output port. The required memory size is $(nStride \times nSliceHeight \times 3 / 2) \times nBufferCountActual$. For details of the <i>nBufferCountActual</i> member, see related document [2]. In the case IL client uses OMX_UseBuffer() for the output port, the allocated buffers must be accessible from hardware and need not be accessible from CPU. |
| work buffer | Hardware and CPU | Work buffers for decoding. |
| stream_work_0 | Hardware | Work buffers for decoding. |
| stream_work_1 | Hardware and CPU | |
| stream_work_2 | Hardware | Work buffers for decoding. stream_work_2 is mv information work area. |
| stream_work_4 | Hardware and CPU | Work buffers for decoding. |
| stream_work_5 | Hardware and CPU | |
| frame_mem | Hardware | Frame buffers used for reference decoding and output. |

Note: For hardware restrictions of memory, see related document [4].

Table 7-2 shows the memory requirement in the case of 1920x1080 Advanced Profile stream decoding per component instance. Multiple component instances require their own work memory, respectively.

Table 7-2 Memory Requirement for 1920x1080 Advanced Profile Stream Decoding

| Memory Type | Size | Notes |
|---------------|---------------|--|
| input buffer | 3 [Mbyte] | In the case where the <i>nBufferCountActual</i> for the input port is set to 2. |
| output buffer | 9 [Mbyte] | In the case where the <i>nBufferCountActual</i> for the output port is set to 3. |
| work buffer | 3 [Mbyte] | - |
| stream_work_0 | 20 [Mbyte] | - |
| stream_work_1 | 139 [Kbyte] | Fixed size |
| stream_work_2 | 1,599 [Kbyte] | - |
| stream_work_4 | 4 [Kbyte] | - |
| stream_work_5 | 1 [Kbyte] | Fixed size |
| frame_mem | 30 [Mbyte] | - |

| | |
|-------------------------|--|
| REVISION HISTORY | OMX Media Component User's Manual : VC-1 Decoder Part |
|-------------------------|--|

| Rev. | Date | Description | |
|-------|---------------|-------------|--|
| | | Page | Summary |
| 0.04 | Jan. 31, 2013 | — | Draft revision based on Japanese User's Manual Rev.0.04. |
| 0.05 | Mar. 25, 2014 | 31 | Add the detailed information of Memory Requirement. |
| 0.06 | May. 29, 2014 | 4,16 | Fixed Figure1-1: "Video Common Library" to "Video Decoder Common Library" Fixed Figure 3-8: add "Sequence Layer Data Structure" |
| | May. 30, 2014 | 31 | Correct the descriptions for stream_work_x and lib_work_mem in Table 7-1 |
| | June. 4, 2014 | 31 | Correct the value for stream_work_2 size in Table 7-2 |
| | Jul. 4, 2014 | 31 | Updated Description of stream_work_* in Table7-1 Updated Notes and Size in Table7-2 |
| 0.07 | Jul. 29, 2014 | 31 | Highlight reference to the related document of Table 7-1.. |
| 1.00 | Aug. 20 2014 | 30 | Add section 6.3.5.OMXR_MC_VIDEO_DECODERESULTTYPE. |
| | Aug. 20 2014 | 31 | Fixed Table 7-1 |
| | Aug. 26, 2014 | 6 | Delete VCP, FDP and Converter of term. |
| 1.0.1 | Oct.14 2014 | 32-33 | Added the "work buffer" in Table7-1/Table7-2. |
| | Dec.08 2014 | 15 | Updated Sequence Layer Data Structure in Figure 3-7. |
| | Dec. 15 2014 | 32-33 | Remove "lib_work_mem", "stream_work_3" and "tmp_work_mem" from Table7-1 and Table7-2. |
| | | | |

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