SH7268/SH7269 Group

Digital Video Decoder Driver User's Manual

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Introduction

This document explains the usage of SH7268/SH7269 Digital Video Decoder (hereafter referred to as 'VDEC') Driver.

Target Device

SH7268/SH7269

Contents

1. Overview

1.1 Environment

This program was developed and tested in the following environments.

- CPU
  - SH7269
- Development Environment
  - HEW (SuperH RISC engine microcomputer software integrated development environment) Version 4.09.00.007
  - Renesas SuperH RISC engine Standard Toolchain Version 9.4.1.0
    - SH C/C++ Compiler Version 9.04.01
    - SH Assembler Version 7.01.02
    - SH C/C++ Standard Library Generator Version 3.00.03
    - Optimizing Linkage Editor Version 10.01.00
- Evaluation Board
  - SH7269 CPU board (Part number: R0K572690C000BR)
  - SH7269 VDC4 board (Part number: R0K572690B000BR)

1.2 Features

The following table lists the features supported by this driver program.

Table 1 Digital Video Decoder Driver Functions

Item	Function
Input video signal	• Video Signal Composite video signal (CVBS) • A/D convertor for video signal input VIN1 and VIN2 pin input selection Programmable gain amplifier (PGA)
Sync separation	• Noise reduction LPF • Auto level control sync slicer • Horizontal auto frequency control (AFC) • Vertical count-down • Interlace detection • Auto gain control (AGC) / peak limiter control
Burst controlled oscillator (BCO)	• Color sub-carrier reproduction • Color system detection
Y/C separation	• NTSC 2D, PAL 2D, SECAM 1D
Chroma decoding	• Supporting NTSC, PAL and SECAM • Color killer • Auto color control (ACC) • TINT correction, R-Y axis correction
Digital clamp	• Pedestal clamp (Y) • Center clamp (Cb/Cr) • Noise detection
Output adjustment	• Contrast and color adjustment

1.3 File Configuration

The file configuration of this driver is shown below.

Table 2 File Configuration

File Name	Description
vdec_api.c	Source file for VDEC driver functions.
vdec_api.h	Header file including the prototype declarations for the VDEC driver calls and definitions of constants.
vdec_para.c	Source file checking arguments.
vdec_user.h	Header file for compilation option.

This driver requires external header files as below.

Table 3 External File Dependencies

File Name	Description
typedefine.h	Header file including the typedef declarations for the basic types.
iodefine.h	Header file including IO definitions.

1.4 Program Size and Section

Program size and section used by this driver are shown below.

Table 4 Program Size and Section

"Renesas SuperH RISC engine Standard Toolchain 9.4.1.0"
"Speed & size optimization enabled"

Type	Section name	Size [byte]	Description
ROM	P_VDEC	2.5K (4.2K)	Program area
	C_VDEC	0	Constant area
	D_VDEC	0	Initialized data area
RAM	B_VDEC	0	Uninitialized data area

Note: Program size does not include Input Video Buffer size.
Values in the parentheses are program size when parameter checking is defined.

1.5 Compilation Switches

This driver has compilation switches in vdec_user.h.

1.5.1 Parameter Checking

When `_VDEC_PARAMETER_CHECK` is defined, the driver checks the arguments of driver functions. Arguments are checked and error codes are returned if there are errors. For error codes, see 2.2 Error and 2.3 API Function.

1.6 Restriction

1.6.1 Reserved Word

To separate from the other program, the prefix ‘VDEC’ is appended to the API names, variable names and other symbols in this driver. Therefore, the names started with ‘VDEC’ (in both uppercase and lowercase letters) should not be used in the other program.

1.6.2 Dependency

The video decoder output signal which is the result of the decoding is processed as an input signal to the Video Display Controller 4 (VDC4). When the video decoder output signal is recorded in the memory and/or is displayed on the LCD, VDC4 driver is required. For VDC4 driver, refer to the Video Display Controller 4 Driver User’s Manual (R01AN0778EJ).

2. API

2.1 Common Definition

2.1.1 Typedef

In this driver, data types in Table 5 are used. These declarations are defined in typedefine.h (see 1.3 File Configuration).

Table 5 Typedef Declarations

Typedef	Type
_SBYTE	signed char
_UBYTE	unsigned char
_SWORD	signed short
_UWORD	unsigned short
_SINT	signed int
_UINT	unsigned int
_SDWORD	signed long
_UDWORD	unsigned long
_SQWORD	signed long long
_UQWORD	unsigned long long

2.1.2 Definition of Enumeration Constants

The `vdec_OnOff` enumeration defines ON and OFF.

```
typedef enum {
    VDEC_OFF = 0,
    VDEC_ON = 1
} vdec_OnOff ;
```

Enum	Value	Description
VDEC_OFF	0	OFF
VDEC_ON	1	ON

2.2 Error

API function calls returns an error code. The error codes are shown in Table 6.

Table 6 Error Code List

Error	Value	Description
VDEC_ERR_NONE	0	Normal end.
VDEC_ERR_PARAM_RANGE	1	Parameter error. Specified value was out of range.
VDEC_ERR_PARAM_UNDEF	2	Parameter error. Null should not be specified.
VDEC_ERR_PARAM_INVALID	3	Parameter error. Invalid parameter was specified.
VDEC_ERR_OTHERS	4	Error. Others.

2.3 API Function

A list of VDEC driver calls is shown in Table 7.

Table 7 VDEC Driver Calls

Driver Call	Function
VDEC_Initialize	Video decoder driver initialization
VDEC_Terminate	Video decoder driver termination
VDEC_Input	Video decoder driver input
VDEC_SyncSep	Video decoder driver sync separation
VDEC_YcSep	Video decoder driver y/c separation
VDEC_ChromaDec	Video decoder driver chroma decoding
VDEC_DigitalClamp	Video decoder driver digital clamp
VDEC_Output	Video decoder driver output
VDEC_QueryVDEC	Querying Video decoder parameter values

2.3.1 VDEC_Initialize

Syntax	#include "vdec_api.h" vdec_ErrorCode VDEC_Initialize(vdec_VinPin Adc_vinsel void (*init_func)(_UDWORD), _UDWORD user_num) ;	
Parameters	• [in]vdec_VinPin Adc_vinsel	Input pin control
	• [in]void (*init_func)(_UDWORD)	Pointer to the user-defined function
	• [in]_UDWORD user_num	User-defined number
Return Values	• vdec_ErrorCode	Error code
	VDEC_ERR_NONE	Normal end.
	VDEC_ERR_PARAM_INVALID	Parameter error. Invalid parameter.

Description

In this function, the operations are performed as below.

- The specified user-defined function is executed.
- The pin for inputting composite video signals is selected.

Before VDEC driver initialization, user-defined function specified by `init_func` is called. For information about the process of user-defined function, see 3.1.

It is not always necessary to specify the user-defined function pointer. If user-defined function is not specified, the operation stated below should be performed before this VDEC driver initialization.

- Supply the clock to the VDEC.
- Set the environment specific parameters (e.g. related to input video image).

Arguments Settings

Type Parameter Name	Input / Output	Description
vdec_VinPin Adc_vinsel	in	Input pin control Composite video signal (CVBS) input pin • VDEC_VIN_1: VIN1 input • VDEC_VIN_2: VIN2 input
void (*init_func)(_UDWORD)	in	Pointer to the user-defined function If '0' is not specified, user-defined function will be called with an argument specified by user-defined number (user_num). If necessary, user-defined function must be implemented by the user. Syntax void Init_Func(_UDWORD User_Num) ; Parameters • [in]_UDWORD User_Num User-defined number Return Values • void Description Processing implemented by the user is performed.
_UDWORD user_num	in	User-defined number This parameter is used as an argument to the user-defined function. This parameter is ignored, when pointer to the user-defined function (init_func) is set to '0'.

2.3.2 VDEC_Terminate

Syntax	#include "vdec_api.h" vdec_ErrorCode VDEC_Terminate(void (*quit_func)(_UDWORD), _UDWORD user_num) ;	
Parameters	• [in]void (*quit_func)(_UDWORD)	Pointer to the user-defined function
	• [in]_UDWORD user_num	User-defined number
Return Values	• vdec_ErrorCode VDEC_ERR_NONE	Error code Normal end.

Description

In this function, the operations are performed as below.

- The specified user-defined function is executed.

After VDEC driver termination, user-defined function specified by `quit_func` is called. For information about the process of user-defined function, see 3.2.

It is not always necessary to specify the user-defined function pointer. If user-defined function is not specified, the operation stated below may be performed after this VDEC driver termination.

- Halt the clock supply to the VDEC.
- Set the environment specific parameters (e.g. related to input video image).

Arguments Settings

Type Parameter Name	Input / Output	Description
void (*quit_func)(_UDWORD)	in	Pointer to the user-defined function If '0' is not specified, user-defined function will be called with an argument specified by user-defined number (user_num). If necessary, user-defined function must be implemented by the user. Syntax void Quit_Func(_UDWORD User_Num) ; Parameters • [in]_UDWORD User_Num — User-defined number Return Values • void Description Processing implemented by the user is performed.
_UDWORD user_num	in	User-defined number This parameter is used as an argument to the user-defined function. This parameter is ignored, when pointer to the user-defined function (quit_func) is set to '0'.

2.3.3 VDEC_Input

Syntax	#include "vdec_api.h" vdec_ErrorCode VDEC_Input(const vdec_InputSelection *Input) ;	
Parameters	• [in]const vdec_InputSelection *Input	Input selection parameter
Return Values	• vdec_ErrorCode	Error code
	VDEC_ERR_NONE	Normal end.
	VDEC_ERR_PARAM_UNDEF	Parameter error. Undefined.
	VDEC_ERR_PARAM_RANGE	Parameter error. Out of range.

Description

In this function, the operations are performed as below.

- The specified parameters for active image period are set.

The active image period parameters set up in this function are applied only to the Digital Video Decoder module. These parameters do not correspond to the display size of the input video. To set the display size of the input video, Video Display Controller 4 module should be used.

Before the settings are reflected, it will take a period of time equal to 1 Vsync period time at the most.

Arguments Settings

Type Parameter Name	Input / Output	Description
vdec_InputSelection * Input	in	Input selection parameter Active image period parameter of input video signal NULL should not be specified.

Members of the structure `vdec_InputSelection` are shown below.

```
typedef struct {
    _UWORD Srcleft ;
    _UWORD Srctop ;
    _UWORD Srcheight ;
    _UWORD Srcwidth ;
} vdec_InputSelection ;
```

Type Member Name	Input/ Output	Description
_UWORD Srcleft	in	Left end of input video signal capturing area [27MHz clock cycles] 0x0000 ~ 0x01FF
_UWORD Srctop	in	Top end of input video signal capturing area [lines] 0x0000 ~ 0x003F
_UWORD Srcheight	in	Height of input video signal capturing area [lines] 0x0000 ~ 0x03FF
_UWORD Srcwidth	in	Width of input video signal capturing area [27MHz clock cycles] 0x0000 ~ 0x07FF

2.3.4 VDEC_SyncSep

Syntax	#include "vdec_api.h" vdec_ErrorCode VDEC_SyncSep(const vdec_SyncSeparation *SyncSeparation) ;	
Parameters	• [in]const vdec_SyncSeparation * SyncSeparation	Sync separation parameter
Return Values	• vdec_ErrorCode VDEC_ERR_NONE VDEC_ERR_PARAM_UNDEF VDEC_ERR_PARAM_RANGE VDEC_ERR_PARAM_INVALID	Error code Normal end. Parameter error. Undefined. Parameter error. Out of range. Parameter error. Invalid parameter.

Description

In this function, the operations are performed as below.

- Noise reduction LPF parameters are set.
- Auto level control sync slicer parameters are set.
- Horizontal AFC parameters are set.
- Vertical count-down parameters are set.
- AGC / PGA parameters are set.
- Peak limiter control parameters are set.

The setting process for the sync separation is performed in this function.

When the AGC is turned off, programmable gain amp (PGA) is set to the manual mode. Before the PGA settings are reflected, it will take a period of time equal to 1 Vsync period time at the most.

When the AGC is turned off, peak limiter is not operated, though the setting process is performed.

Arguments Settings

Type Parameter Name	Input / Output	Description
vdec_SyncSeparation * SyncSeparation	in	Sync separation parameter NULL should not be specified.

Members of the structure `vdec_SyncSeparation` are shown below.

```
typedef struct {
    vdec_NoiseRdLPF *NoiseRdLPF ;
    vdec_AtLvCtrlSyncSlicer *AtLvCtrlSyncSlicer ;
    vdec_HorizontalAfc *HorizontalAfc ;
    vdec_VcountDown *VcountDown ;
    vdec_Agc *Agc ;
    vdec_PeakLimCtrl *PeakLimCtrl ;
} vdec_SyncSeparation ;
```

Type Member Name	Input/ Output	Description
vdec_NoiseRdLPF * NoiseRdLPF	in	Noise reduction LPF parameter Settings will be left unchanged if NULL is specified.
vdec_AtLvCtrlSyncSlicer * AtLvCtrlSyncSlicer	in	Auto level control sync slicer parameter Settings will be left unchanged if NULL is specified.
vdec_HorizontalAfc * HorizontalAfc	in	Horizontal AFC parameter Settings will be left unchanged if NULL is specified.
vdec_VcountDown * VcountDown	in	Vertical count-down parameter Settings will be left unchanged if NULL is specified.
vdec_Agc * Agc	in	AGC / PGA parameter Settings will be left unchanged if NULL is specified.
vdec_PeakLimCtrl * PeakLimCtrl	in	Peak limiter control parameter Settings will be left unchanged if NULL is specified.

Members of the structure `vdec_NoiseRdLPF` are shown below.

```
typedef struct {
    vdec_LPFVsync Lpfvsync ;
    vdec_LPFHsync Lpfhsync ;
} vdec_NoiseRdLPF ;
```

Type Member Name	Input/ Output	Description
vdec_LPFVsync Lpfvsync	in	LPF cutoff frequency before vertical sync separation • VDEC_LPF_VSYNC_NONE: None • VDEC_LPF_VSYNC_0_94: 0.94 MHz • VDEC_LPF_VSYNC_0_67: 0.67 MHz • VDEC_LPF_VSYNC_0_54: 0.54 MHz • VDEC_LPF_VSYNC_0_47: 0.47 MHz • VDEC_LPF_VSYNC_0_34: 0.34 MHz • VDEC_LPF_VSYNC_0_27: 0.27 MHz • VDEC_LPF_VSYNC_0_23: 0.23 MHz

vdec_LPFHsync Lpfhsync	in	LPF cutoff frequency before horizontal sync separation • VDEC_LPF_HSYNC_NONE: None • VDEC_LPF_HSYNC_2_15: 2.15 MHz • VDEC_LPF_HSYNC_1_88: 1.88 MHz • VDEC_LPF_HSYNC_1_34: 1.34 MHz • VDEC_LPF_HSYNC_1_07: 1.07 MHz • VDEC_LPF_HSYNC_0_94: 0.94 MHz • VDEC_LPF_HSYNC_0_67: 0.67 MHz • VDEC_LPF_HSYNC_0_54: 0.54 MHz

Members of the structure `vdec_AtLvCtrlSyncSlicer` are shown below.

```
typedef struct
{
    vdec_VelocityShift Velocityshift_H ;
    vdec_SliceMode Slicermode_H ;
    vdec_SliceMode Slicermode_V ;
    _UWORD Syncmaxduty_H ;
    _UWORD Syncminduty_H ;
    vdec_ClipLv Ssclipsel ;
    _UWORD Csyncslice_H ;
    _UWORD Syncmaxduty_V ;
    _UWORD Syncminduty_V ;
    vdec_OnOff Vsyncdelay ;
    _UWORD Vsyncslice ;
    _UWORD Csyncslice_V ;
} vdec_AtLvCtrlSyncSlicer ;
```

Type **Member Name**	**Input/ Output**	**Description**
vdec_VelocityShift Velocityshift_H	in	Reference level operation speed control for composite sync separation • VDEC_VELOCITY_SHIFT_1: x1 • VDEC_VELOCITY_SHIFT_2: x2 • VDEC_VELOCITY_SHIFT_4: x 4 • VDEC_VELOCITY_SHIFT_8: x 8 • VDEC_VELOCITY_SHIFT_16: x 16 • VDEC_VELOCITY_SHIFT_32: x 32 • VDEC_VELOCITY_SHIFT_64: x 64 • VDEC_VELOCITY_SHIFT_128: x 128 • VDEC_VELOCITY_SHIFT_256: x256
vdec_SliceMode Slicermode_H	in	Auto-slice level setting for composite sync separator circuit (for horizontal sync signal) • VDEC_SLICE_MODE_MANULAL: Manual setting • VDEC_SLICE_MODE_AUTO_25: 25% of sync depth (Auto) • VDEC_SLICE_MODE_AUTO_50: 50% of sync depth (Auto) • VDEC_SLICE_MODE_AUTO_75: 75% of sync depth (Auto)
vdec_SliceMode Slicermode_V	in	Auto-slice level setting for composite sync separation circuit (for vertical sync signal) • VDEC_SLICE_MODE_MANULAL: Manual setting • VDEC_SLICE_MODE_AUTO_25:

		25% of sync depth (Auto) • VDEC_SLICE_MODE_AUTO_50: 50% of sync depth (Auto) • VDEC_SLICE_MODE_AUTO_75: 75% of sync depth (Auto)
_UWORD Syncmaxduty_H	in	Max ratio of horizontal cycle to horizontal sync signal pulse width (for horizontal sync separation) 0x0000 ~ 0x003F This parameter is valid only when auto slice level setting is active (Slicemode_H is not set to VDEC_SLICE_MODE_MANUAL).
_UWORD Syncminduty_H	in	Min ratio of horizontal cycle to horizontal sync signal pulse width (for horizontal sync separation) 0x0000 ~ 0x003F This parameter is valid only when auto slice level setting is active (Slicemode_H is not set to VDEC_SLICE_MODE_MANUAL).
vdec_ClipLv Ssclipsel	in	Clipping level • VDEC_CLIP_LV_512: 512 • VDEC_CLIP_LV_546: 546 • VDEC_CLIP_LV_580: 580 • VDEC_CLIP_LV_614: 614 • VDEC_CLIP_LV_648: 648 • VDEC_CLIP_LV_682: 682 • VDEC_CLIP_LV_716: 716 • VDEC_CLIP_LV_750: 750 • VDEC_CLIP_LV_785: 785 • VDEC_CLIP_LV_819: 819 • VDEC_CLIP_LV_853: 853 • VDEC_CLIP_LV_887: 887 • VDEC_CLIP_LV_921: 921 • VDEC_CLIP_LV_955: 955 • VDEC_CLIP_LV_989: 989 • VDEC_CLIP_LV_1023: 1023
_UWORD Csyncslice_H	in	Slice level for composite sync signal separation (for horizontal sync signal) 0x0000 ~ 0x03FF This parameter is valid only when manual slice level setting is active (Slicemode_H is set to VDEC_SLICE_MODE_MANUAL).
_UWORD Syncmaxduty_V	in	Max ratio of horizontal cycle to horizontal sync signal pulse width (for vertical sync separation) 0x0000 ~ 0x003F This parameter is valid only when auto slice level setting is active (Slicemode_V is not set to VDEC_SLICE_MODE_MANUAL).
_UWORD Syncminduty_V	in	Min ratio of horizontal cycle to horizontal sync signal pulse width (for vertical sync separation) 0x0000 ~ 0x003F This parameter is valid only when auto slice level setting is active (Slicemode_V is not set to VDEC_SLICE_MODE_MANUAL).
vdec_OnOff Vsyncdelay	in	Delays the separated vertical sync signal for 1/4 horizontal cycle

		• VDEC_OFF: Disable 1/4fH delay • VDEC_ON: Enable 1/4fH delay
_UWORD Vsyncslice	in	Threshold for vertical sync separation 0x0000 ~ 0x001F
_UWORD Csyncslice_V	in	Slice level for composite sync signal separation (for vertical sync signal) 0x0000 ~ 0x03FF This parameter is valid only when manual slice level setting is active (Slicemode_V is set to VDEC_SLICE_MODE_MANUAL).

Members of the structure `vdec_HorizontalAfc` are shown below.

```
typedef struct
{
    _UWORD Hafcgain ;
    vdec_OnOff Hafcfreerun ;
    _UWORD Hafctyp ;
    _UWORD Hafcstart ;
    _UWORD Nox2Hosc ;
    _UWORD Dox2Hosc ;
    _UWORD Hafcmax ;
    _UWORD Hafcend ;
    _UWORD Hafcmode ;
    _UWORD Hafcmin ;
    _UWORD Phdet_Fix ;
    vdec_PhDetDiv Phdet_Div ;
} vdec_HorizontalAfc ;
```

Type **Member Name**	**Input/ Output**	**Description**
_UWORD Hafcgain	in	Horizontal AFC loop gain 0x0000 ~ 0x000F
vdec_OnOff Hafcfreerun	in	Horizontal AFC free-run oscillation mode ON/OFF • VDEC_OFF • VDEC_ON
_UWORD Hafctyp	in	Horizontal AFC center oscillation frequency [27MHz clock cycles] 0x0000 ~ 0x03FF
_UWORD Hafcstart	in	Start line of horizontal AFC normal operation (VBI process end line) 0x0000 ~ 0x000F
_UWORD Nox2Hosc	in	Disable of horizontal AFC double speed detection • 0: Auto control • 1: Double speed oscillation disabled
_UWORD Dox2Hosc	in	Horizontal AFC forced double-speed oscillation • 0: Auto control • 1: Forced double-speed oscillation In the NTSC, PAL and SECAM formats, this parameter should always be set to '0'.
_UWORD Hafcmax	in	Maximum oscillation frequency of horizontal AFC [27MHz clock cycles] 0x0000 ~ 0x03FF
_UWORD	in	End line of horizontal AFC normal operation (VBI process

Hafcend		start line) 0x0000 ~ 0x000F
_UWORD Hafcmode	in	Horizontal AFC VBI period operating mode Loop gain control for low S/N and horizontal AFC control during VBI period • 0: Loop gain is fixed and phase comparison is stopped during VBI period. • 1: Loop gain is fixed and loop gain is reduced during VBI period. • 2: Loop gain is automatically controlled and phase comparison is stopped during VBI period. • 3: Loop gain is automatically controlled and loop gain is reduced during VBI period.
_UWORD Hafcmin	in	Min oscillation frequency of horizontal AFC [27MHz clock cycles] 0x0000 ~ 0x03FF
_UWORD Phdet_Fix	in	Forcible or LOWGAIN control • 0: LOWGAIN determination result used • 1: Forcibly controlled (adjusted with Phdet_Div)
vdec_PhDetDiv Phdet_Div	in	Phase comparator feedback adjust for low sync signal lock stability • VDEC_PHDET_DIV_1_1: 1/1 • VDEC_PHDET_DIV_1_2: 1/2 • VDEC_PHDET_DIV_1_4: 1/4 • VDEC_PHDET_DIV_1_8: 1/8 • VDEC_PHDET_DIV_1_16: 1/16 • VDEC_PHDET_DIV_1_32: 1/32

Members of the structure `vdec_VcountDown` are shown below.

```
typedef struct
{
    vdec_OnOff Vcdfreerun ;
    vdec_OnOff Novcd50 ;
    vdec_OnOff Novcd60 ;
    vdec_VCntDwFreq Vcddefault ;
    _UWORD Vcdwindow ;
    _UWORD Vcdoffset ;
} vdec_VcountDown ;
```

Type **Member Name**	**Input/ Output**	**Description**
vdec_OnOff Vcdfreerun	in	Vertical countdown free-run oscillation mode ON/OFF • VDEC_OFF • VDEC_ON
vdec_OnOff Novcd50	in	Vertical countdown 50-Hz oscillation mode • VDEC_OFF • VDEC_ON
vdec_OnOff Novcd60	in	Vertical countdown 60-Hz (59.94Hz) oscillation mode • VDEC_OFF • VDEC_ON
vdec_VCntDwFreq Vcddefault	in	Vertical countdown center oscillation frequency • VDEC_VCNT_FRQ_AUTO: Auto-detection

		• VDEC_VCNT_FRQ_50HZ: 50.00 Hz • VDEC_VCNT_FRQ_59_94HZ: 59.94 Hz • VDEC_VCNT_FRQ_60HZ: 60.00 Hz
_UWORD Vcdwindow	in	Vertical countdown sync area [0.1ms] 0x0000 ~ 0x003F
_UWORD Vcdoffset	in	Vertical countdown minimum oscillation frequency [0.1ms] 0x0000 ~ 0x001F

Members of the structure `vdec_Agc` are shown below.

```
typedef struct
{
    vdec_OnOff Agcmode ;
    _UWORD Doreduce ;
    _UWORD Noreduce ;
    _UWORD Agcresponse ;
    _UWORD Agclevel ;
    _UWORD Agcprecis ;
    _UWORD Pga_gain ;
} vdec_Agc ;
```

Type Member Name	**Input/ Output**	**Description**
vdec_OnOff Agcmode	in	A/D converter AGC ON/OFF control & PGA switch • VDEC_OFF: AGC OFF, PGA manual • VDEC_ON: AGC ON, automatic
_UWORD Doreduce	in	Manual control of sync signal amplitude detection during VBI period • 0: Sets sync amplitude to AGC standard value. • 1: Sets AGC gain to 3/4 times the normal gain value.
_UWORD Noreduce	in	Control of sync signal amplitude detection during VBI period • 0: Detects sync amplitude. • 1: Does not detect sync amplitude.
_UWORD Agcresponse	in	AGC response speed 0x0000 ~ 0x0007
_UWORD Agclevel	in	Sync signal reference amplitude 0x0000 ~ 0x01FF
_UWORD Agcprecis	in	AGC gain adjustment accuracy 0x0000 ~ 0x003F
_UWORD Pga_gain	in	PGA gain 0x0000 (0.8Vpp) ~ 0x001F (1.6Vpp) This parameter is valid when Agcmode is set to VDEC_OFF.

Members of the structure `vdec_PeakLimCtrl` are shown below.

```
typedef struct
{
    vdec_PeakLevel Peaklevel ;
    _UWORD Peakattack ;
    _UWORD Peakrelease ;
    vdec_PeakRatio Peakratio ;
    _UWORD Maxpeaksamples ;
} vdec_PeakLimCtrl ;
```

Type Member Name	Input/ Output	Description
vdec_PeakLevel Peaklevel	in	Peak luminance value to operate peak limiter (video signal level) • VDEC_PEAKLV_LIM_OFF: Limiter OFF • VDEC_PEAKLV_1008: 1008 LSB • VDEC_PEAKLV_992: 992 LSB • VDEC_PEAKLV_960: 960 LSB Peak limiter is not operated if AGC is OFF.
_UWORD Peakattack	in	Response speed with peak limiter gain decreased 0x0000 ~ 0x0003
_UWORD Peakrelease	in	Response speed with peak limiter gain increased 0x0000 ~ 0x0003
vdec_PeakRatio Peakratio	in	Maximum compression rate of peak limiter • VDEC_PEAKRATIO_50: Compressed up to 50% • VDEC_PEAKRATIO_25: Compressed up to 25% • VDEC_PEAKRATIO_12_5: Compressed up to 12.5% • VDEC_PEAKRATIO_0: Compressed up to 0%
_UWORD Maxpeaksamples	in	Allowable number of overflowing pixels [1024 pixels] 0x0000 ~ 0x00FF

2.3.5 VDEC_YcSep

Syntax	#include "vdec_api.h" vdec_ErrorCode VDEC_YcSep(const vdec_YcSeparation *YcSeparation) ;	
Parameters	• [in]const vdec_YcSeparation * YcSeparation	Y/C separation parameter
Return Values	• vdec_ErrorCode VDEC_ERR_NONE VDEC_ERR_PARAM_UNDEF VDEC_ERR_PARAM_RANGE VDEC_ERR_PARAM_INVALID	Error code Normal end. Parameter error. Undefined. Parameter error. Out of range. Parameter error. Invalid parameter.

Description

In this function, the operations are performed as below.

- Y/C separation control parameters are set.
- Chroma filter TAP coefficient parameters for Y/C separation are set.
- Over-range control parameters are set.

Arguments Settings

Type Parameter Name	Input / Output	Description
vdec_YcSeparation * YcSeparation	in	Y/C separation parameter NULL should not be specified.

Members of the structure `vdec_YcSeparation` are shown below.

```
typedef struct
{
    vdec_YcSepCtrl *YcSepCtrl ;
    vdec_ChrFilTAP *Wa ;
    vdec_ChrFilTAP *Wb ;
    vdec_ChrFilTAP *Na ;
    vdec_ChrFilTAP *Nb ;
    vdec_OverRange *OverRange ;
} vdec_YcSeparation ;
```

Type Member Name	Input/ Output	Description
vdec_YcSepCtrl * YcSepCtrl	in	Y/C separation control parameter Settings will be left unchanged if NULL is specified.
vdec_ChrFilTAP * Wa	in	Chroma filter TAP coefficient parameter for Y/C separation Two-dimensional cascade broadband (3.58/4.43/SECAM-DR)/TAKE-OFF filter TAP coefficient Settings will be left unchanged if NULL is specified.
vdec_ChrFilTAP * Wb	in	Chroma filter TAP coefficient parameter for Y/C separation Two-dimensional cascade broadband (SECAM-DB) filter TAP coefficient Settings will be left unchanged if NULL is specified.
vdec_ChrFilTAP * Na	in	Chroma filter TAP coefficient parameter for Y/C separation Two-dimensional cascade narrowband (3.58/4.43/SECAM-DR) filter TAP coefficient Settings will be left unchanged if NULL is specified.
vdec_ChrFilTAP * Nb	in	Chroma filter TAP coefficient parameter for Y/C separation Two-dimensional cascade narrowband (SECAM-DB) filter TAP coefficient Settings will be left unchanged if NULL is specified.
vdec_OverRange * OverRange	in	Over-range control parameter Settings will be left unchanged if NULL is specified.

Members of the structure `vdec_YcSepCtrl` are shown below.

```
typedef struct
{
    _UWORD K15 ;
    _UWORD K13 ;
    _UWORD K11 ;
    _UWORD K16 ;
    _UWORD K14 ;
    _UWORD K12 ;
```

```
    _UWORD K22A ;
    _UWORD K21A ;
    _UWORD K22B ;
    _UWORD K21B ;
    _UWORD K23B ;
    _UWORD K23A ;
    _UWORD K24 ;
    vdec_FilterSel Hbpf_Narrow ;
    vdec_FilterSel Hvbpf_Narrow ;
    vdec_BpfSel Hbpf1_9Tap_On ;
    vdec_BpfSel Hvbpf1_9Tap_On ;
    vdec_BpfSel Hfil_Tap_Sel ;
    vdec_OnOff Det2_On ;
    vdec_FilMixRatio Hsel_Mix_Y ;
    vdec_FilMixRatio Vsel_Mix_Y ;
    vdec_FilMixRatio Hvsel_Mix_Y ;
    _UWORD V_Y_Level ;
    vdec_FilMixRatio Det2_Mix_C ;
    vdec_FilMixRatio Det2_Mix_Y ;
    vdec_FilterModeSel Fil2_Mode_2D ;
    vdec_FilterSel Fil2_Narrow_2D ;
} vdec_YcSepCtrl ;
```

Type Member Name	Input/ Output	Description
_UWORD K15	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x000F
_UWORD K13	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x003F
_UWORD K11	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x003F
_UWORD K16	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x000F
_UWORD K14	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x003F
_UWORD K12	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x003F
_UWORD K22A	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x00FF
_UWORD K21A	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x003F
_UWORD K22B	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x00FF
_UWORD K21B	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x003F
_UWORD K23B	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x000F
_UWORD K23A	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x000F
_UWORD K24	in	Two-dimensional Y/C separation filter select coefficient * 0x0000 ~ 0x001F
vdec_FilterSel Hbpf_Narrow	in	Latter-stage horizontal BPF select • VDEC_FILSEL_BYPASS: Bypass • VDEC_FILSEL_17TAP: 17 TAP

vdec_FilterSel Hvbpf_Narrow	in	Latter-stage horizontal/vertical BPF select • VDEC_FILSEL_BYPASS: Bypass • VDEC_FILSEL_17TAP: 17 TAP
vdec_BpfSel Hbpf1_9Tap_On	in	Former-stage horizontal BPF select • VDEC_BPFSEL_17TAP: 17 TAP • VDEC_BPFSEL_9TAP: 9 TAP
vdec_BpfSel Hvbpf1_9Tap_On	in	Former-stage horizontal/vertical BPF select • VDEC_BPFSEL_17TAP: 17 TAP • VDEC_BPFSEL_9TAP: 9 TAP
vdec_BpfSel Hfil_Tap_Sel	in	Horizontal filter and horizontal/vertical filter bandwidth switch signal • VDEC_BPFSEL_17TAP: 17 TAP • VDEC_BPFSEL_9TAP: 9 TAP
vdec_OnOff Det2_On	in	Two-dimensional filter mixing select After passing the correlation detection filter, signals are mixed or not. • VDEC_OFF: Not mixed • VDEC_ON: Mixed
vdec_FilMixRatio Hsel_Mix_Y	in	Mixing ratio of signal after passing horizontal filter to signal after passing former-stage horizontal filter Mixing ratio of signal after passing former-stage horizontal filter can be specified as follows: • VDEC_FILMIX_RATIO_0: 0% • VDEC_FILMIX_RATIO_12_5: 12.5% • VDEC_FILMIX_RATIO_25: 25% • VDEC_FILMIX_RATIO_37_5: 37.5% • VDEC_FILMIX_RATIO_50: 50% • VDEC_FILMIX_RATIO_62_5: 62.5% • VDEC_FILMIX_RATIO_75: 75% • VDEC_FILMIX_RATIO_87_5: 87.5% • VDEC_FILMIX_RATIO_100: 100%
vdec_FilMixRatio Vsel_Mix_Y	in	Mixing ratio of signal after passing vertical filter to signal after passing former-stage horizontal/vertical filter Mixing ratio of signal after passing former-stage horizontal/vertical filter can be specified as follows: • VDEC_FILMIX_RATIO_0: 0% • VDEC_FILMIX_RATIO_12_5: 12.5% • VDEC_FILMIX_RATIO_25: 25% • VDEC_FILMIX_RATIO_37_5: 37.5% • VDEC_FILMIX_RATIO_50: 50% • VDEC_FILMIX_RATIO_62_5: 62.5% • VDEC_FILMIX_RATIO_75: 75% • VDEC_FILMIX_RATIO_87_5: 87.5% • VDEC_FILMIX_RATIO_100: 100%
vdec_FilMixRatio Hvsel_Mix_Y	in	Mixing ratio of signal after passing horizontal/vertical filter to signal after passing former-stage horizontal/vertical filter Mixing ratio of signal after passing former-stage horizontal/vertical filter can be specified as follows: • VDEC_FILMIX_RATIO_0: 0% • VDEC_FILMIX_RATIO_12_5: 12.5% • VDEC_FILMIX_RATIO_25: 25% • VDEC_FILMIX_RATIO_37_5: 37.5% • VDEC_FILMIX_RATIO_50: 50%

		• VDEC_FILMIX_RATIO_62_5: 62.5% • VDEC_FILMIX_RATIO_75: 75% • VDEC_FILMIX_RATIO_87_5: 87.5% • VDEC_FILMIX_RATIO_100: 100%
_UWORD V_Y_Level	in	Vertical luminance detection level for correlation detection filter 0x0000 ~ 0x01FF
vdec_FilMixRatio Det2_Mix_C	in	Mixing ratio of C signal after passing horizontal/vertical adaptive filter to signal after passing correlation detection filter Mixing ratio of signal after passing correlation detection filter can be specified as follows: • VDEC_FILMIX_RATIO_0: 0% • VDEC_FILMIX_RATIO_12_5: 12.5% • VDEC_FILMIX_RATIO_25: 25% • VDEC_FILMIX_RATIO_37_5: 37.5% • VDEC_FILMIX_RATIO_50: 50% • VDEC_FILMIX_RATIO_62_5: 62.5% • VDEC_FILMIX_RATIO_75: 75% • VDEC_FILMIX_RATIO_87_5: 87.5% • VDEC_FILMIX_RATIO_100: 100%
vdec_FilMixRatio Det2_Mix_Y	in	Mixing ratio of C signal for Y generation after passing horizontal/vertical adaptive filter to signal after passing correlation detection filter Mixing ratio of signal after passing correlation detection filter can be specified as follows: • VDEC_FILMIX_RATIO_0: 0% • VDEC_FILMIX_RATIO_12_5: 12.5% • VDEC_FILMIX_RATIO_25: 25% • VDEC_FILMIX_RATIO_37_5: 37.5% • VDEC_FILMIX_RATIO_50: 50% • VDEC_FILMIX_RATIO_62_5: 62.5% • VDEC_FILMIX_RATIO_75: 75% • VDEC_FILMIX_RATIO_87_5: 87.5% • VDEC_FILMIX_RATIO_100: 100%
vdec_FilterModeSel Fil2_Mode_2D	in	Two-dimensional cascade/TAKE-OFF filter mode select • VDEC_FILMODE_BYPASS: Bypass • VDEC_FILMODE_CASCADE: Cascade filter • VDEC_FILMODE_TAKEOFF: TAKE-OFF filter
vdec_FilterSel Fil2_Narrow_2D	in	Two-dimensional cascade filter select • VDEC_FILSEL_BYPASS: Bypass • VDEC_FILSEL_17TAP: 17 TAP

Note: * For details about two-dimensional Y/C separation filter select coefficient, refer to SH7268 Group, SH7269 Group User's Manual: Hardware (R01UH0048EJ).

Members of the structure `vdec_ChrFilTAP` are shown below. The value `VDEC_CHRFIL_TAPCOE_NUM` is '9'.

```
typedef struct
{
    _UWORD Fil2_2D_F[ VDEC_CHRFIL_TAPCOE_NUM ] ;
} vdec_ChrFilTAP ;
```

Type	Input/	Description

Member Name	Output	
_UWORD Fil2_2D_F[VDEC_CHRFIL_TAPCOE_NUM]	in	Chroma filter TAP coefficient for Y/C separation Sign (MSB) + absolute value (0 ~ 4095) 0x0000 ~ 0x0FFF: 0 ~ 4095 0x1000 ~ 0x1FFF: -0 ~ -4095

Members of the structure `vdec_OverRange` are shown below.

```
typedef struct
{
    _UWORD Radj_O_Level0 ;
    _UWORD Radj_U_Level0 ;
    _UWORD Radj_O_Level1 ;
    _UWORD Radj_U_Level1 ;
    _UWORD Radj_O_Level2 ;
    _UWORD Radj_U_Level2 ;
    _UWORD Test_Moni ;
    _UWORD Radj_Mix_K_Fix ;
    vdec_OnOff Ucmp_Sw ;
    vdec_OnOff Dcmp_Sw ;
    vdec_OnOff Hwide_Sw ;
} vdec_OverRange ;
```

Type Member Name	Input/ Output	Description
_UWORD Radj_O_Level0	in	A/D over-threshold level (between levels 0 and 1) 0x0000 ~ 0x03FF
_UWORD Radj_U_Level0	in	A/D under-threshold level (between levels 2 and 3) 0x0000 ~ 0x03FF
_UWORD Radj_O_Level1	in	A/D over-threshold level (between levels 1 and 2) 0x0000 ~ 0x03FF
_UWORD Radj_U_Level1	in	A/D under-threshold level (between levels 2 and 1) 0x0000 ~ 0x03FF
_UWORD Radj_O_Level2	in	A/D over-threshold level (between levels 2 and 3) 0x0000 ~ 0x03FF
_UWORD Radj_U_Level2	in	A/D under-threshold level (between levels 1 and 0) 0x0000 ~ 0x03FF
_UWORD Test_Moni	in	Test mode • 0 ~ 3: Normal operation • 4: Level 0 part is output as black • 5: Level 1 part is output as black • 6: Level 2 part is output as black • 7: Level 3 part is output as black
_UWORD Radj_Mix_K_Fix	in	Forced range over/under mode • 0 ~ 3: Auto detection • 4: Level 0 (normal state) • 5: Fixed to level 1 (almost normal) • 6: Fixed to level 2 (almost over the range) • 7: Fixed to level 3 (completely over the range)
vdec_OnOff Ucmp_Sw	in	Over-range detection enable • VDEC_OFF: Disables over-range detection • VDEC_ON: Enables over-range detection
vdec_OnOff	in	Under-range detection enable

Dcmp_Sw		• VDEC_OFF: Disables under-range detection • VDEC_ON: Enables under -range detection
vdec_OnOff Hwide_Sw	in	Horizontal enlargement of over/under-range level • VDEC_OFF: Does not provide horizontal enlargement • VDEC_ON: Provides horizontal enlargement

2.3.6 VDEC_ChromaDec

Syntax	#include "vdec_api.h" vdec_ErrorCode VDEC_ChromaDec(const vdec_ChromaDec *ChromaDec) ;	
Parameters	• [in]const vdec_ChromaDec * ChromaDec	Chroma decoding parameter
Return Values	• vdec_ErrorCode VDEC_ERR_NONE VDEC_ERR_PARAM_UNDEF VDEC_ERR_PARAM_RANGE VDEC_ERR_PARAM_INVALID	Error code Normal end. Parameter error. Undefined. Parameter error. Out of range. Parameter error. Invalid parameter.

Description

In this function, the operations are performed as below.

- Color system detection parameters are set.
- BCO parameters are set.
- Color killer parameters are set.
- ACC control parameters are set.
- TINT / R-Y axis correction parameters are set.
-

Arguments Settings

Type Parameter Name	Input / Output	Description
vdec_ChromaDec * ChromaDec	in	Chroma decoding parameter NULL should not be specified.

Members of the structure `vdec_ChromaDec` are shown below.

```
typedef struct
{
    vdec_ColorSysDet *ColorSysDet ;
    vdec_Bco *Bco ;
    vdec_ColorKiller *ColorKiller ;
    vdec_AccCtrl *AccCtrl ;
    vdec_TintRy *TintRy ;
} vdec_ChromaDec ;
```

Type Member Name	Input/ Output	Description
vdec_ColorSysDet *ColorSysDet	in	Color system detection parameter Settings will be left unchanged if NULL is specified.
vdec_Bco *Bco	in	BCO parameter Settings will be left unchanged if NULL is specified.
vdec_ColorKiller *ColorKiller	in	Color killer parameter Settings will be left unchanged if NULL is specified.
vdec_AccCtrl *AccCtrl	in	ACC control parameter Settings will be left unchanged if NULL is specified.
vdec_TintRy *TintRy	in	TINT / R-Y axis correction parameter Settings will be left unchanged if NULL is specified.

Members of the structure `vdec_ColorSysDet` are shown below.

```
typedef struct
{
    vdec_ColorSys Defaultsys ;
    vdec_OnOff Nontsc358 ;
    vdec_OnOff Nontsc443 ;
    vdec_OnOff Nopalm ;
    vdec_OnOff Nopaln ;
    vdec_OnOff Nopal443 ;
    vdec_OnOff Nosecam ;
    _UWORD Lumadelay ;
    vdec_OnOff Chromalpf ;
    vdec_DemodMode Demodmode ;
} vdec_ColorSysDet ;
```

Type Member Name	Input/ Output	Description
vdec_ColorSys Defaultsys	in	Default color system • VDEC_CSYS_NTSC: NTSC • VDEC_CSYS_PAL: PAL

		• VDEC_CSYS_SECAM: SECAM • VDEC_CSYS_NON: Not specified
vdec_OnOff Nontsc358	in	NTSC-M detection control • VDEC_OFF • VDEC_ON
vdec_OnOff Nontsc443	in	NTSC-4.43 detection control • VDEC_OFF • VDEC_ON
vdec_OnOff Nopalm	in	PAL-M detection control • VDEC_OFF • VDEC_ON
vdec_OnOff Nopaln	in	PAL-N detection control • VDEC_OFF • VDEC_ON
vdec_OnOff Nopal443	in	PAL-B、G、H、I、D detection control • VDEC_OFF • VDEC_ON
vdec_OnOff Nosecam	in	SECAM detection control • VDEC_OFF • VDEC_ON
_UWORD Lumadelay	in	Luminance signal delay adjustment 0x0010 (-16) ~ 0x0000 (0) ~ 0x000F (15) Set a value by the 2s complement.
vdec_OnOff Chromalpf	in	LPF for demodulated chroma • VDEC_OFF: Not used • VDEC_ON: Used
vdec_DemodMode Demodmode	in	Averaging processing for pre-demodulated line • VDEC_DEMMD_NO: No processing • VDEC_DEMMD_PAL: For PAL

Members of the structure `vdec_Bco` are shown below.

```
typedef struct
{
    vdec_BstLckRange Lockrange ;
    _UWORD Loopgain ;
    _UWORD Locklimit ;
    vdec_OnOff Bcofreerun ;
    _UWORD Bgpcheck ;
    _UWORD Bgpwidth ;
    _UWORD Bgpstart ;
} vdec_Bco ;
```

Type **Member Name**	**Input/ Output**	**Description**
vdec_BstLckRange Lockrange	in	Burst lock PLL lock range • VDEC_BST_LCKRNG_400HZ: ±400 Hz • VDEC_BST_LCKRNG_800HZ: ±800 Hz • VDEC_BST_LCKRNG_1200HZ: ±1200 Hz • VDEC_BST_LCKRNG_1600HZ: ±1600 Hz
_UWORD Loopgain	in	Burst lock PLL loop gain 0x0000 ~ 0x0003
_UWORD	in	Level for burst lock PLL to re-search free-run frequency

Locklimit		0x0000 ~ 0x0003
vdec_OnOff Bcofreerun	in	Burst lock PLL free-run oscillation mode ON/OFF • VDEC_OFF • VDEC_ON
_UWORD Bgpcheck	in	Burst gate pulse position check • 0: Not checked • 1: Checked
_UWORD Bgpwidth	in	Burst gate pulse width [27MHz clock cycles] 0x0000 ~ 0x007F
_UWORD Bgpstart	in	Burst gate pulse start position [27MHz clock cycles] 0x0000 ~ 0x00FF

Members of the structure `vdec_ColorKiller` are shown below.

```
typedef struct
{
    _UWORD Killeroffset ;
    vdec_OnOff Killermode ;
    _UWORD Killerlevel ;
} vdec_ColorKiller ;
```

Type Member Name	Input/ Output	Description
_UWORD Killeroffset	in	Color killer offset 0x0000 ~ 0x000F Killerlevel + Killeroffset is the level to turn off the color killer.
vdec_OnOff Killermode	in	Forced color killer mode ON/OFF • VDEC_OFF: Auto-detection • VDEC_ON: Killer mode is forcedly ON
_UWORD Killerlevel	in	Color killer operation start point 0x0000 ~ 0x003F This parameter controls the level to make the killer ON.

Members of the structure `vdec_AccCtrl` are shown below.

```
typedef struct
{
    _UWORD Accmode ;
    vdec_AccMaxGain Accmaxgain ;
    _UWORD Acclevel ;
    vdec_ChromaSubGain Chromasubgain ;
    _UWORD Chromamaingain ;
    _UWORD Accresponse ;
    _UWORD Accprecis ;
} vdec_AccCtrl ;
```

Type Member Name	Input/ Output	Description
_UWORD Accmode	in	ACC operating mode • 0: Auto gain • 1: Manual gain
vdec_AccMaxGain	in	Maximum ACC gain

Accmaxgain		• VDEC_ACC_MAXGAIN_6: 6 times • VDEC_ACC_MAXGAIN_8: 8 times • VDEC_ACC_MAXGAIN_12: 12 times • VDEC_ACC_MAXGAIN_16: 16 times This parameter is valid only when Accmode is set to '0'.
_UWORD Acclevel	in	ACC reference color burst amplitude 0x0000 ~ 0x01FF This parameter is valid only when Accmode is set to '0'.
vdec_ChromaSubGain Chromasubgain	in	Chroma manual gain (sub) • VDEC_CHR_SUBGAIN_1: 1 time • VDEC_CHR_SUBGAIN_2: 2 times • VDEC_CHR_SUBGAIN_4: 4 times • VDEC_CHR_SUBGAIN_8: 8 times This parameter is valid only when Accmode is set to '1'.
_UWORD Chromamaingain	in	Chroma manual gain (main) 0x0000 ~ 0x01FF This parameter is valid only when Accmode is set to '1'. The value 0x0100 corresponds to 1 time.
_UWORD Accresponse	in	ACC response speed 0x0000 ~ 0x0003
_UWORD Accprecis	in	ACC gain adjustment accuracy 0x0000 ~ 0x003F

Members of the structure `vdec_TintRy` are shown below.

```
typedef struct
{
    _UWORD Tintsub ;
    _UWORD Tintmain ;
} vdec_TintRy ;
```

Type **Member Name**	**Input/ Output**	**Description**
_UWORD Tintsub	in	Fine adjustment of R-Y demodulation axis [360/1024 degrees] 0x0000 ~ 0x003F 2s complement This parameter is valid only for NTSC/PAL.
_UWORD Tintmain	in	Hue adjustment level [360/1024 degrees] 0x0000 ~ 0x03FF 2s complement This parameter is valid only for NTSC/PAL.

2.3.7 VDEC_DigitalClamp

Syntax	#include "vdec_api.h" vdec_ErrorCode VDEC_DigitalClamp(const vdec_DigitalClamp *DigitalClamp) ;	
Parameters	• [in]const vdec_DigitalClamp *DigitalClamp	Digital clamp parameter
Return Values	• vdec_ErrorCode	Error code
	VDEC_ERR_NONE	Normal end.
	VDEC_ERR_PARAM_UNDEF	Parameter error. Undefined.
	VDEC_ERR_PARAM_RANGE	Parameter error. Out of range.
	VDEC_ERR_PARAM_INVALID	Parameter error. Invalid parameter.

Description

In this function, the operations are performed as below.

- Pedestal clamp parameters are set.
- Center clamp parameters are set.
- Noise detection parameters are set.

Arguments Settings

Type Parameter Name	Input / Output	Description
vdec_DigitalClamp * DigitalClamp	in	Digital clamp parameter NULL should not be specified.

Members of the structure `vdec_DigitalClamp` are shown below.

```
typedef struct
{
    vdec_PdstlCntrClamp *PdstlCntrClamp ;
    vdec_NoiseDet *NoiseDet ;
} vdec_DigitalClamp ;
```

Type Member Name	Input/ Output	Description
vdec_PdstlCntrClamp * PdstlCntrClamp	in	Pedestal/center clamp parameter Settings will be left unchanged if NULL is specified.
vdec_NoiseDet * NoiseDet	in	Noise detection parameter Settings will be left unchanged if NULL is specified.

Members of the structure `vdec_PdstlCntrClamp` are shown below.

```
typedef struct
{
    _UWORD Dcpresponse ;
    _UWORD Dcpstart ;
    _UWORD Dcpend ;
    _UWORD Dcpwidth ;
    vdec_PedestalClamp *PedestalClamp ;
    vdec_CenterClamp *CenterClamp ;
} vdec_PdstlCntrClamp ;
```

Type Member Name	Input/ Output	Description
_UWORD Dcpresponse	in	Digital clamp response speed 0x0000 ~ 0x0007
_UWORD Dcpstart	in	Digital clamp start line [lines] 0x0000 ~ 0x003F
_UWORD Dcpend	in	Digital clamp end line [lines] 0x0000 ~ 0x003F
_UWORD Dcpwidth	in	Digital clamp pulse width [27MHz clock cycles] 0x0000 ~ 0x007F
vdec_PedestalClamp * PedestalClamp	in	Pedestal clamp parameter Settings will be left unchanged if NULL is specified.
vdec_CenterClamp * CenterClamp	in	Center clamp parameter Settings will be left unchanged if NULL is specified.

Members of the structure `vdec_PedestalClamp` are shown below.

```
typedef struct
{
    _UWORD Dcpmode_Y ;
    _UWORD Dcpcheck ;
    _UWORD Dcppos_Y ;
    _UWORD Blanklevel_Y ;
    vdec_OnOff Clp_Hold_On_Y ;
} vdec_PedestalClamp ;
```

Type Member Name	Input/ Output	Description
_UWORD Dcpmode_Y	in	Clamp level setting mode (Y signal) • 0: Manual clamp level setting • 1: Auto clamp level setting
_UWORD Dcpcheck	in	Digital clamp pulse position check • 0: Not checked • 1: Checked
_UWORD Dcppos_Y	in	Digital clamp pulse horizontal start position (Y signal) [27MHz clock cycles] 0x0000 ~ 0x00FF
_UWORD Blanklevel_Y	in	Clamp offset level (Y signal) 0x0000 ~ 0x03FF Set the subtraction value. 2s complement
vdec_OnOff Clp_Hold_On_Y	in	Clamp data hold processing ON/OFF (Y) • VDEC_OFF • VDEC_ON

Members of the structure `vdec_CenterClamp` are shown below.

```
typedef struct
{
    _UWORD Dcpmode_C ;
    _UWORD Dcppos_C ;
    _UWORD Blanklevel_Cb ;
    _UWORD Blanklevel_Cr ;
    vdec_OnOff Clp_Hold_On_Cb ;
    vdec_OnOff Clp_Hold_On_Cr ;
} vdec_CenterClamp ;
```

Type Member Name	Input/ Output	Description
_UWORD Dcpmode_C	in	Clamp level setting mode (Cb/Cr signal) • 0: Manual clamp level setting • 1: Auto clamp level setting
_UWORD Dcppos_C	in	Digital clamp pulse horizontal start position (Cb/Cr signal) [27MHz clock cycles] 0x0000 ~ 0x00FF
_UWORD Blanklevel_Cb	in	Clamp offset level (Cb signal) 0x0000 ~ 0x003F Set the subtraction value.

		2s complement
_UWORD Blanklevel_Cr	in	Clamp offset level (Cr signal) 0x0000 ~ 0x003F Set the subtraction value. 2s complement
vdec_OnOff Clp_Hold_On_Cb	in	Clamp data hold processing ON/OFF (Cb) • VDEC_OFF • VDEC_ON
vdec_OnOff Clp_Hold_On_Cr	in	Clamp data hold processing ON/OFF (Cr) • VDEC_OFF • VDEC_ON

Members of the structure `vdec_NoiseDet` are shown below.

```
typedef struct
{
    vdec_Acfinput Acfinput ;
    _UWORD Acflagtime ;
    _UWORD Acffilter ;
} vdec_NoiseDet ;
```

Type **Member Name**	**Input/ Output**	**Description**
vdec_Acfinput Acfinput	in	Video signal for autocorrelation function • VDEC_VDSIG_ATCRR_Y: Y signal • VDEC_VDSIG_ATCRR_CB: Cb signal • VDEC_VDSIG_ATCRR_CR: Cr signal
_UWORD Acflagtime	in	Delay time for autocorrelation function calculation [27MHz clock cycles] 0x0000 ~ 0x001F
_UWORD Acffilter	in	Smoothing parameter of autocorrelation function data 0x0000 ~ 0x0003

2.3.8 VDEC_Output

Syntax	#include "vdec_api.h" vdec_ErrorCode VDEC_Output(const vdec_OutAdj *OutAdj) ;	
Parameters	• [in]const vdec_OutAdj *OutAdj	Output adjustment parameter
Return Values	• vdec_ErrorCode	Error code
	VDEC_ERR_NONE	Normal end.
	VDEC_ERR_PARAM_UNDEF	Parameter error. Undefined.
	VDEC_ERR_PARAM_RANGE	Parameter error. Out of range.

Description

In this function, the operations are performed as below.

- Signal output gain parameters are set.

Arguments Settings

Type Parameter Name	Input / Output	Description
vdec_OutAdj * OutAdj	in	Output adjustment parameter NULL should not be specified.

Members of the structure `vdec_OutAdj` are shown below.

```
typedef struct
{
    _UWORD Y_Gain2 ;
    _UWORD Cb_Gain2 ;
    _UWORD Cr_Gain2 ;
} vdec_OutAdj ;
```

Type Member Name	Input/ Output	Description
_UWORD Y_Gain2	in	Y signal gain coefficient 0x0000 ~ 0x03FF (0: 0 times, 0x0200: 1.0 time, 0x03FF: Approx. 2.0 times)
_UWORD Cb_Gain2	in	Cb signal gain coefficient 0x0000 ~ 0x03FF (0: 0 times, 0x0200: 1.0 time, 0x03FF: Approx. 2.0 times)
_UWORD Cr_Gain2	in	Cr signal gain coefficient 0x0000 ~ 0x03FF (0: 0 times, 0x0200: 1.0 time, 0x03FF: Approx. 2.0 times)

2.3.9 VDEC_QueryVDEC

Syntax	#include "vdec_api.h" vdec_ErrorCode VDEC_QueryVDEC(vdec_Queries *param) ;	
Parameters	• [out]vdec_Queries *param	Pointer to the result of the query
Return Values	• vdec_ErrorCode VDEC_ERR_NONE VDEC_ERR_PARAM_UNDEF	Error code Normal end. Parameter error. Undefined.

Description

In this function, the parameters shown below are retrieved from the VDEC read registers.

- Sync separation parameters
- AGC parameters
- Chroma decoding parameters
- Digital clamp parameters

Arguments Settings

Type Parameter Name	Input / Output	Description
vdec_Queries * param	out	Pointer to the result of the query NULL should not be specified.

Members of the structure `vdec_Queries` are shown below.

```
typedef struct
{
    vdec_Q_Sync *q_Sync ;
    vdec_Q_Agc *q_Agc ;
    vdec_Q_ChromaDec *q_ChromaDec ;
    vdec_Q_DigitalClamp *q_DigitalClamp ;
} vdec_Queries ;
```

Type Member Name	Input/ Output	Description
vdec_Q_Sync * q_Sync	out	Pointer to the memory where the sync separation parameter is stored. If it is unnecessary, NULL can be set.
vdec_Q_Agc * q_Agc	out	Pointer to the memory where the AGC parameter is stored. If it is unnecessary, NULL can be set.
vdec_Q_ChromaDec * q_ChromaDec	out	Pointer to the memory where the chroma decoding parameter is stored. If it is unnecessary, NULL can be set.
vdec_Q_DigitalClamp * q_DigitalClamp	out	Pointer to the memory where the digital clamp parameter is stored. If it is unnecessary, NULL can be set.

Members of the structure `vdec_Q_Sync` are shown below.

```
typedef struct
{
    vdec_Lock Fhlock ;
    _UWORD Isnoisy ;
    vdec_FhMode Fhmode ;
    _UWORD Nosignal ;
    vdec_Lock Fvlock ;
    vdec_FvMode Fvmode ;
    vdec_InterDet Interlaced ;
    _UWORD Fvcount ;
    _UDWORD Fhcount ;
    _UWORD Isreduced ;
    _UWORD Syncdepth ;
} vdec_Q_Sync ;
```

Type Member Name	Input/ Output	Description
vdec_Lock Fhlock	out	Horizontal AFC lock detection result • VDEC_UNLOCK: Unlocked

		• VDEC_LOCK: Locked
_UWORD Isnoisy	out	Detection result of low S/N signal by sync separation • 0: Not low S/N signal • 1: Low S/N signal
vdec_FhMode Fhmode	out	Speed detection result • VDEC_FHMODE_I: Normal speed (525i/625i, etc.) • VDEC_FHMODE_P: Multiplied speed (525p/625p, etc.)
_UWORD Nosignal	out	No-signal detection result • 0: Vertical sync signal detected • 1: No vertical sync signal detected
vdec_Lock Fvlock	out	Vertical countdown lock detection result • VDEC_UNLOCK: Unlocked • VDEC_LOCK: Locked
vdec_FvMode Fvmode	out	Vertical countdown oscillation mode • VDEC_FVMODE_50HZ: 50Hz • VDEC_FVMODE_60HZ: 60Hz
vdec_InterDet Interlaced	out	Interlace detection result • VDEC_PROGRESSIVE: Progressive • VDEC_INTERLACE: Interlace
_UWORD Fvcount	out	Vertical cycle measurement result [0.1ms] 0 ~ 255
_UDWORD Fhcount	out	Horizontal AFC oscillation cycle [1/64 of 27MHz clock cycle] 0x00000 ~ 0x1FFFF
_UWORD Isreduced	out	Sync amplitude detection result during VBI period • 0: Amplitude is larger than that in image active period. • 1: Amplitude is equal to that in image active period.
_UWORD Syncdepth	out	Sync pulse amplitude detection result 0x0000 ~ 0x03FF

Members of the structure `vdec_Q_Agc` are shown below.

```
typedef struct
{
    _UWORD Highsamples ;
    _UWORD Peaksamples ;
    _UWORD Agcconverge ;
    _UWORD Agcgain ;
} vdec_Q_Agc ;
```

Type **Member Name**	**Input/ Output**	**Description**
_UWORD Highsamples	out	Number of pixels which have larger luminance value than peak luminance limited by peak limiter [1024pixels] 0x0000 ~ 0x00FF
_UWORD Peaksamples	out	Number of overflowing pixels [1024pixels] 0x0000 ~ 0x00FF
_UWORD Agcconverge	out	AGC convergence detection result • 0: Not converged • 1: Converged
_UWORD Agcgain	out	Current AGC gain value 0x0000 ~ 0x00FF The value 64 corresponds to x1.

Members of the structure `vdec_Q_ChromaDec` are shown below.

```
typedef struct
{
    vdec_ColorSys Colorsys ;
    _UWORD Fscmode ;
    vdec_Lock Fsclock ;
    _UWORD Noburst ;
    vdec_ChromaSubGain Accsubgain ;
    _UWORD Accmaingain ;
    _UWORD Issecam ;
    _UWORD Ispal ;
    _UWORD Isntsc ;
    _UWORD Locklevel ;
} vdec_Q_ChromaDec ;
```

Type Member Name	Input/ Output	Description
vdec_ColorSys Colorsys	out	Color system detection result • VDEC_CSYS_NTSC: NTSC • VDEC_CSYS_PAL: PAL • VDEC_CSYS_SECAM: SECAM • VDEC_CSYS_NON: Undetectable
_UWORD Fscmode	out	Color sub-carrier frequency detection result • 0: 3.58MHz • 1: 4.43MHz
vdec_Lock Fsclock	out	Burst lock PLL lock state detection result • VDEC_UNLOCK: Unlocked • VDEC_LOCK: Locked
_UWORD Noburst	out	Color burst detection result • 0: Color burst present • 1: No color burst present
vdec_ChromaSubGain Accsubgain	out	Current ACC gain value (sub) • VDEC_CHR_SUBGAIN_1: 1 time • VDEC_CHR_SUBGAIN_2: 2 times • VDEC_CHR_SUBGAIN_4: 4 times • VDEC_CHR_SUBGAIN_8: 8 times
_UWORD Accmaingain	out	Current ACC gain value (main) 0x0000 ~ 0x01FF The value 256 corresponds to 1 time.
_UWORD Issecam	out	SECAM detection result • 0: Not SECAM signal • 1: SECAM signal
_UWORD Ispal	out	PAL detection result • 0: Not PAL signal • 1: PAL signal
_UWORD Isntsc	out	NTSC detection result • 0: Not NTSC signal • 1: NTSC signal
_UWORD Locklevel	out	Low S/N signal detection result by burst lock PLL 0x0000 ~ 0x00FF

Members of the structure `vdec_Q_DigitalClamp` are shown below.

```
typedef struct
{
    _UWORD Clamplevel_Y ;
    _UWORD Clamplevel_Cb ;
    _UWORD Clamplevel_Cr ;
    _UWORD Acfstrength ;
} vdec_Q_DigitalClamp ;
```

Type Member Name	Input/ Output	Description
_UWORD Clamplevel_Y	out	Digital clamp subtraction value (Y signal) 0x0000 ~ 0x03FF 2s complement
_UWORD Clamplevel_Cb	out	Digital clamp subtraction value (Cb signal) 0x0000 ~ 0x003F 2s complement
_UWORD Clamplevel_Cr	out	Digital clamp subtraction value (Cr signal) 0x0000 ~ 0x003F 2s complement
_UWORD Acfstrength	out	Noise autocorrelation strength at digital clamp pulse position (normal pedestal position) 0x0000 ~ 0xFFFF

3. User-defined Functions

Driver calls VDEC_Initialize and VDEC_Terminate allow execution of user-defined functions. Examples of the user-defined function are shown below.

3.1 Example of User-defined Function within VDEC_Initialize

```
/*****************************************************************//**
 * Function Name : Init_VDEC_CallBack
 * @brief
 * @param      [in]_UDWORD mode
 * @retval     void
 *********************************************************************/
void Init_VDEC_CallBack( _UDWORD mode )
{
    /* standby control register 10 (STBCR10)
           b7      0------- ; MSTP107 : 0 : Video Decoder enable */
       CPG.STBCR10.BYTE &= ~0x80u ;
   }
```

3.2 Example of User-defined Function within VDEC_Terminate

```
/*****************************************************************//**
 * Function Name : Quit_VDEC_CallBack
 * @brief
 * @param      [in]_UDWORD mode
 * @retval     void
 *********************************************************************/
void Quit_VDEC_CallBack( _UDWORD mode )
{
    /* standby control register 10 (STBCR10)
           b7      1------- ; MSTP107 : Video Decoder disable */
       CPG.STBCR10.BYTE |= 0x80u ;
   }
```

4. Example Usage

4.1 Recommended Setting

The recommended values and initial values set in the structures as the argument parameter of the API function are stated below. If recommended values of all members in the structures are equal to initial values, recommended values are not stated. In this section, initial value indicates the value immediately after a power-on reset.

4.1.1 Setting for VDEC_Input

Table 8 Recommended Value for the Structure vdec_InputSelection

Member Name	Initial Value	Recommended Value	
		NTSC-3.58 PAL-M	NTSC-4.43 PAL-4.43 PAL-N SECAM
Srcleft	316	256	256
Srctop	20	16	19
Srcheight	232	241	288
Srcwidth	1280	1428	1412

4.1.2 Setting for VDEC_SyncSep

Table 9 Recommended Value for the Structure vdec_NoiseRdLPF

Member Name	Initial Value	Recommended Value
Lpfvsync	VDEC_LPF_VSYNC_0_54	VDEC_LPF_VSYNC_0_54
Lpfhsync	VDEC_LPF_HSYNC_1_34	VDEC_LPF_HSYNC_0_94

Table 10 Recommended Value for the Structure vdec_AtLvCtrlSyncSlicer

Member Name	Initial Value	Recommended Value
Velocityshift_H	VDEC_VELOCITY_SHIFT_1	VDEC_VELOCITY_SHIFT_4
Slicermode_H	VDEC_SLICE_MODE_AUTO_50	VDEC_SLICE_MODE_AUTO_50
Slicermode_V	VDEC_SLICE_MODE_AUTO_50	VDEC_SLICE_MODE_AUTO_50
Syncmaxduty_H	15u	15u
Syncminduty_H	10u	10u
Ssclipsel	VDEC_CLIP_LV_1023	VDEC_CLIP_LV_1023
Csyncslice_H	146u	146u
Syncmaxduty_V	15u	15u
Syncminduty_V	10u	9u
Vsyncdelay	VDEC_OFF	VDEC_OFF
Vsyncslice	11u	10u
Csyncslice_V	146u	146u

Table 11 Recommended Value for the Structure vdec_HorizontalAfc

Member Name	Initial Value	Recommended Value	
		NTSC-3.58 PAL-M	NTSC-4.43 PAL-4.43 PAL-N SECAM
Hafcgain	6u	12u	12u
Hafcfreerun	VDEC_OFF	VDEC_OFF	VDEC_OFF
Hafctyp	692u	692u	704u
Hafcstart	0	0	0
Nox2Hosc	0	1u	1u
Dox2Hosc	0	0	0
Hafcmax	742u	792u	785u
Hafcend	8u	8u	8u
Hafcmode	2u	2u	2u
Hafcmin	642u	592u	630u
Phdet_Fix	0	0	0
Phdet_Div	VDEC_PHDET_DIV_1_32	VDEC_PHDET_DIV_1_32	VDEC_PHDET_DIV_1_32

Table 12 Recommended Value for the Structure vdec_VcountDown

Member Name	Initial Value	Recommended Value	
		NTSC-3.58 PAL-M	NTSC-4.43 PAL-4.43 PAL-N SECAM
Vcdfreerun	VDEC_OFF	VDEC_OFF	VDEC_OFF
Novcd50	VDEC_ON	VDEC_OFF	VDEC_ON
Novcd60	VDEC_ON	VDEC_ON	VDEC_OFF
Vcddefault	VDEC_VCNT_FRQ_AUTO	VDEC_VCNT_FRQ_59_94HZ	VDEC_VCNT_FRQ_50HZ
Vcdwindow	20u	30u	30u
Vcdoffset	10u	15u	15u

Table 13 Recommended Value for the Structure vdec_Agc

Member Name	Initial Value	Recommended Value	
		NTSC-3.58 NTSC-4.43	PAL-4.43 PAL-M PAL-N SECAM
Agcmode	VDEC_OFF	VDEC_ON	VDEC_ON
Doreduce	0	0	0
Noreduce	0	0	0
Agcresponse	5u	4u	4u
Agclevel	236u	230u	242u
Agcprecis	10u	10u	10u
Pga_gain	0	0	0

Table 14 Recommended Value for the Structure vdec_PeakLimCtrl

Member Name	Initial Value	Recommended Value
Peaklevel	VDEC_PEAKLV_LIM_OFF	VDEC_PEAKLV_992
Peakattack	2u	2u
Peakrelease	0	3u
Peakratio	VDEC_PEAKRATIO_50	VDEC_PEAKRATIO_50
Maxpeaksamples	0	20u

4.1.3 Setting for VDEC_YcSep

Table 15 Recommended Value for the Structure vdec_YcSepCtrl

Member Name	Initial Value	Recommended Value		
		NTSC-3.58 NTSC-4.43	PAL-4.43 PAL-M PAL-N	SECAM
K15	2u	2u	2u	2u
K13	8u	8u	8u	8u
K11	4u	4u	3u	4u
K16	3u	3u	4u	3u
K14	16u	16u	63u	16u
K12	1u	8u	2u	1u
K22A	64u	32u	32u	32u
K21A	6u	6u	10u	10u
K22B	16u	8u	15u	15u
K21B	6u	6u	10u	6u
K23B	6u	6u	3u	3u
K23A	3u	3u	3u	3u
K24	5u	5u	8u	8u
Hbpf_Narrow	VDEC_FILSEL_-17TAP	VDEC_FILSEL_BYPASS		
Hvbpf_Narrow	VDEC_FILSEL_-17TAP	VDEC_FILSEL_BYPASS		
Hbpf1_9Tap_On	VDEC_BPFSEL_-17TAP	VDEC_BPFSEL_17TAP		
Hvbpf1_9Tap_On	VDEC_BPFSEL_-17TAP	VDEC_BPFSEL_17TAP		
Hfil_Tap_Sel	VDEC_BPFSEL_-17TAP	VDEC_BPFSEL_17TAP		
Det2_On	VDEC_ON	VDEC_ON	VDEC_OFF	VDEC_ON
Hsel_Mix_Y	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_75	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_75
Vsel_Mix_Y	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_75	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_75
Hvsel_Mix_Y	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_0
V_Y_Level	3u	0	0	0
Det2_Mix_C	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_0
Det2_Mix_Y	VDEC_FILMIX_-RATIO_75	VDEC_FILMIX_-RATIO_25	VDEC_FILMIX_-RATIO_0	VDEC_FILMIX_-RATIO_0
Fil2_Mode_2D	VDEC_FILMODE_-CASCADE	VDEC_FILMODE_-CASCADE	VDEC_FILMODE_-BYPASS	VDEC_FILMODE_-CASCADE
Fil2_Narrow_2D	VDEC_FILSEL_-17TAP	VDEC_FILSEL_17TAP		

The recommended values of the chroma filter TAP coefficient parameter for Y/C separation are shown below. The recommended values for the filter TAP coefficient parameters vary depending on the settings in `Fil2_Mode_2D` and `Fil2_Narrow_2D`. In case of PAL format, the recommended value of `Fil2_Mode_2D` is `VDEC_FILMODE_BYPASS` (see Table 15), so it is unnecessary to set the chroma filter TAP coefficient parameter for Y/C separation. In case of NTSC format, the recommended values are equal to the initial values.

Table 16 Recommended Value for the Structure vdec_ChrFilTAP

Member Name	Initial Value	Recommended Value		
		NTSC-3.58 NTSC-4.43	PAL-4.43 PAL-M PAL-N	SECAM
Fil2_2D_F[ ] (WA_F0 ~ WA_F8)	0x0018	0x0018 (24)	-	0x1014 (-20)
	0x002C	0x002C (44)	-	0x0018 (24)
	0x0014	0x0014 (20)	-	0x0040 (64)
	0x1034	0x1034 (-52)	-	0x0028 (40)
	0x1080	0x1080 (-128)	-	0x104C (-76)
	0x1080	0x1080 (-128)	-	0x10A4 (-164)
	0x100C	0x100C (-12)	-	0x1054 (-84)
	0x0084	0x0084 (132)	-	0x006C (108)
	0x00C8	0x00C8 (200)	-	0x00D8 (216)
Fil2_2D_F[ ] (WB_F0 ~ WB_F8)	0x100C	-	-	0x100C (-12)
	0x0028	-	-	0x0028 (40)
	0x003C	-	-	0x003C (60)
	0x000C	-	-	0x000C (12)
	0x1068	-	-	0x1068 (-104)
	0x109C	-	-	0x109C (-156)
	0x1040	-	-	0x1040 (-64)
	0x0078	-	-	0x0078 (120)
	0x00D0	-	-	0x00D0 (208)
Fil2_2D_F[ ] (NA_F0 ~ NA_F8)	0x0018	0x0018 (24)	-	0x13F0 (-1008)
	0x002C	0x002C (44)	-	0x07B8 (1976)
	0x0014	0x0014 (20)	-	0x17E8 (-2024)
	0x1034	0x1034 (-52)	-	0x01BC (444)
	0x1080	0x1080 (-128)	-	0x074C (1868)
	0x1080	0x1080 (-128)	-	0x1B30 (-2864)
	0x100C	0x100C (-12)	-	0x0548 (1352)
	0x0084	0x0084 (132)	-	0x0560 (1376)
	0x00C8	0x00C8 (200)	-	0x18C0 (-2240)
Fil2_2D_F[ ] (NB_F0 ~ NB_F8)	0x1438	-	-	0x1438 (-1080)
	0x0AF0	-	-	0x0AF0 (2800)
	0x1CEC	-	-	0x1CEC (-3308)
	0x065C	-	-	0x065C (1628)
	0x05A4	-	-	0x05A4 (1444)
	0x1CEC	-	-	0x1CEC (-3308)
	0x085C	-	-	0x085C (2140)
	0x0178	-	-	0x0178 (376)
	0x1568	-	-	0x1568 (-1384)

Note: Values in the parentheses are presented in decimal form.

Table 17 Recommended Value for the Structure vdec_OverRange

Member Name	Initial Value	Recommended Value
Radj_O_Level0	1023u	992u
Radj_U_Level0	0	64u
Radj_O_Level1	1023u	960u
Radj_U_Level1	0	48u
Radj_O_Level2	1023u	928u
Radj_U_Level2	0	32u
Test_Moni	0	0
Radj_Mix_K_Fix	0	0
Ucmp_Sw	VDEC_OFF	VDEC_ON
Dcmp_Sw	VDEC_OFF	VDEC_ON
Hwide_Sw	VDEC_ON	VDEC_ON

4.1.4 Setting for VDEC_ChromaDec

Table 18 Recommended Value for the Structure vdec_ColorSysDet

Member Name	Initial Value	Recommended Value					
		NTSC-3.58	NTSC-4.43	PAL-4.43	PAL-M	PAL-N	SECAM
Defaultsys	VDEC_-CSYS_-NTSC	VDEC_CSYS_NTSC		VDEC_CSYS_PAL			VDEC_-CSYS_-SECAM
Nontsc358	VDEC_ON	VDEC_ON	VDEC_OFF	VDEC_OFF	VDEC_OFF	VDEC_OFF	VDEC_OFF
Nontsc443	VDEC_ON	VDEC_OFF	VDEC_ON	VDEC_OFF	VDEC_OFF	VDEC_OFF	VDEC_OFF
Nopalm	VDEC_ON	VDEC_OFF	VDEC_OFF	VDEC_OFF	VDEC_ON	VDEC_OFF	VDEC_OFF
Nopaln	VDEC_ON	VDEC_OFF	VDEC_OFF	VDEC_OFF	VDEC_OFF	VDEC_ON	VDEC_OFF
Nopal443	VDEC_ON	VDEC_OFF	VDEC_OFF	VDEC_ON	VDEC_OFF	VDEC_OFF	VDEC_OFF
Nosecam	VDEC_ON	VDEC_OFF	VDEC_OFF	VDEC_OFF	VDEC_OFF	VDEC_OFF	VDEC_ON
Lumadelay	0	0					
Chromalpf	VDEC_OFF	VDEC_OFF					
Demodmode	VDEC_-DEMMD_-PAL	VDEC_DEMMD_PAL					

Table 19 Recommended Value for the Structure vdec_Bco

Member Name	Initial Value	Recommended Value
Lockrange	VDEC_BST_LCKRNG_800HZ	VDEC_BST_LCKRNG_800HZ
Loopgain	1u	3u
Locklimit	2u	1u
Bcofreerun	VDEC_OFF	VDEC_OFF
Bgpcheck	0	0
Bgpwidth	36u	54u
Bgpstart	130u	110u

Table 20 Recommended Value for the Structure vdec_ColorKiller

Member Name	Initial Value	Recommended Value
Killeroffset	8u	5u
Killermode	VDEC_OFF	VDEC_OFF
Killerlevel	9u	4u

Table 21 Recommended Value for the Structure vdec_AccCtrl

Member Name	Initial Value	Recommended Value	
		NTSC-3.58 NTSC-4.43 PAL-4.43 SECAM	PAL-M PAL-N
Accmode	0	0	0
Accmaxgain	VDEC_ACC_MAXGAIN_6	VDEC_ACC_MAXGAIN_6	VDEC_ACC_MAXGAIN_6
Acclevel	292u	220u	230u
Chromasubgain	VDEC_CHR_SUBGAIN_1	VDEC_CHR_SUBGAIN_1	VDEC_CHR_SUBGAIN_1
Chromamaingain	256u	210u	210u
Accresponse	1u	1u	1u
Accprecis	20u	8u	8u

4.1.5 Setting for VDEC_DigitalClamp

Table 22 Recommended Value for the Structure vdec_PdstlCntrClamp

Member Name	Initial Value	Recommended Value
Dcpresponse	5u	0
Dcpstart	16u	16u
Dcpend	16u	16u
Dcpwidth	54u	27u
PedestalClamp	-*	-*
CenterClamp	-*	-*

Note: * For the settings of PedestalClamp and CenterClamp, see Table 23 and Table 24.

Table 23 Recommended Value for the Structure vdec_PedestalClamp

Member Name	Initial Value	Recommended Value
Dcpmode_Y	1u	1u
Dcpcheck	0	0
Dcppos_Y	162u	162u
Blanklevel_Y	0	984u (-40)*
Clp_Hold_On_Y	VDEC_ON	VDEC_OFF

Note: * The recommended value is -40, but it is necessary to be set in 10-bit 2's complement form. Therefore it is set to 984 (0x03D8).

Table 24 Recommended Value for the Structure vdec_CenterClamp

Member Name	Initial Value	Recommended Value
Dcpmode_C	0	0
Dcppos_C	27u	54u
Blanklevel_Cb	0	0
Blanklevel_Cr	0	0
Clp_Hold_On_Cb	VDEC_ON	VDEC_OFF
Clp_Hold_On_Cr	VDEC_ON	VDEC_OFF

Table 25 Recommended Value for the Structure vdec_NoiseDet

Member Name	Initial Value	Recommended Value
Acfinput	VDEC_VDSIG_ATCRR_Y	VDEC_VDSIG_ATCRR_Y
Acflagtime	0	0
Acffilter	0	3u

4.1.6 Setting for VDEC_Output

Table 26 Recommended Value for the Structure vdec_OutAdj

Member Name	Initial Value	Recommended Value
Y_Gain2	512u	816u
Cb_Gain2	512u	663u
Cr_Gain2	512u	663u

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Revision Record

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General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

1. Handling of Unused Pins
   Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.
   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.
2. Processing at Power-on
   The state of the product is undefined at the moment when power is supplied.
   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
   In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.
3. Prohibition of Access to Reserved Addresses
   Access to reserved addresses is prohibited.
   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.
4. Clock Signals
   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.
   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.
5. Differences between Products
   Before changing from one product to another, i.e. to one with a different type number, confirm that the change will not lead to problems.
   — The characteristics of MPU/MCU in the same group but having different type numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different type numbers, implement a system-evaluation test for each of the products.

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