

RTD2660H series

Flat Panel Display Controller

Preliminary

Revision

Version 1.00

Last updated: 2007/6

1. Features

General

- Embedded 3 DDC with DDC1/2B/CI
- Zoom scaling up and down
- Embedded one MCU with SPI flash controller.
- It contains 8 ADCs in D-connector, LED backlight, and key pad application
- It supports infrared remote function
- Require only one crystal to generate all timing.
- Programmable internal low-voltage-reset (LVR)
- High resolution 6 channels PWM output, and wide range selectable PWM frequency.
- Support input format up to 1920(WUXGA)/1440-pixel width(option)

Analog RGB Input Interface

- 2 Analog input supported with internal switch
- Integrated 8-bit triple-channel 210/165MHz ADC/PLL(option)
- Embedded programmable Schmitt trigger of HSYNC
- Support Sync-On-Green (SOG) and various kinds of composite sync modes
- On-chip high-performance hybrid PLLs
- High resolution true 64 phase ADC PLL
- Y/Pb/Pr support up to HDTV 1080p resolution

Embedded Video Decoder

- High performance AV 2D Comb-filter
- Support Composite, S Video, Component input
- Support VBI with Closed caption/ V chip slicer

Video Input Interface

- Support 8-bit video (ITU 656) format input

HDMI 1.1 Compliant Digital Input Interface with HDCP

- Dual HDMI Input with embedded high speed switch
- Single link on-chip TMDS receiver
- Long cable support to 165Mhz
- Adaptive algorithm for TMDS capability
- Data enable only mode support
- High-Bandwidth Digital Content Protection (HDCP 1.1)
- Enhanced protection of HDCP secret key
- CEC function supported
- Capable of 8-channel I2S/SPDIF output in HDMI application

Embedded MCU

- Industrial standard 8051 core with serial flash up to 256K bytes
- Low speed ADC for various application
- Infrared function supported
- I2C Master or Slave hardware supported

Auto Detection /Auto Calibration

- Input format detection
- Compatibility with standard VESA mode and support user-defined mode
- Smart engine for Phase/Image position/Color calibration

Scaling

- Fully programmable zoom ratios
- Independent horizontal/vertical scaling
- Advanced zoom algorithm provides high image quality
- Sharpness/Smooth filter enhancement
- Support non-linear scaling from 4:3 to 16:9 or 16:9 to 4:3

Color Processor

- True 10 bits color processing engine
- sRGB compliance
- Advanced dithering logic for 18-bit panel color depth enhancement
- Dynamic overshoot-smear canceling engine
- Brightness and contrast control
- Programmable 10-bit gamma support
- Peaking/Coring/XVYCC function for video sharpness
- DLTI/DCTI/ Noise reduction for video quality

VividColor™

- Independent color management (ICM)
- Dynamic contrast control (DCC)

Output Interface

- Fully programmable display timing generator
- Flexible data pair swapping for easier system design.
- Programmable TCON function support
- 1 and 2 pixel/clock panel support and up to 170MHz, 1920/1440-pixel width(option)
- Multi-output interface (LVDS/ TTL) on single PCB
- Spread-Spectrum DPLL to reduce EMI
- Fixed Last Line output for perfect panel capability

Embedded OSD

- Embedded 16.5K SRAM dynamically stores OSD command and fonts
- Support multi-color RAM font, 1, 2 and 4-bit per pixel
- 16 color palette with 24bit true color selection
- Maximum 8 window with alpha-blending/ gradient /dynamic fade-in/fade-out, bordering/ shadow/3D window type
- Rotary 90,180,270 degree

- Independent row shadowing/bordering
- Programmable blinking effects for each character
- OSD-made internal pattern generator for factory mode
- Support 12x18~4x18 proportional font
- Hardware decompression for OSD font
- Special function for closed-caption and CGMS

Power & Technology

- 3.3V / 1.8V power supply

(I/O Legend: A = Analog, I = Input, O = Output, P = Power, G = Ground)

Name	I/O	Pin #	Description	Note
TMDS_VDD	AP	1	TMDS power	(3.3 V)
TMDS_REXT	AI	2	Impedance Match Reference Resistor For Scan mode, it should be pulled low Scan mode: SI[7:0] is assigned to {124~121, 114~111} SO[7:0] is assigned to {110~108, 105~101} SE is assigned to 100.	Ref value: 1K ohm
RX2P_0/V8_0	AI	3	TMDS Differential signal Input/VIDEO 8-0	
RX2N_0/V8_1	AI	4	TMDS Differential signal Input/VIDEO 8-1	
RX1P_0/V8_2	AI	5	TMDS Differential signal Input/VIDEO 8-2	
RX1N_0/V8_3	AI	6	TMDS Differential signal Input/VIDEO 8-3	
RX0P_0/V8_4	AI	7	TMDS Differential signal Input/VIDEO 8-4	
RX0N_0/V8_5	AI	8	TMDS Differential signal Input/VIDEO 8-5	
RXCP_0/V8_6	AI	9	TMDS Differential signal Input/VIDEO 8-6	
RXCN_0/V8_7	AI	10	TMDS Differential signal Input/VIDEO 8-7	
TMDS_GND	AG	11	TMDS ground	
RX2P_1	AI	12	TMDS Differential signal Input	
RX2N_1	AI	13	TMDS Differential signal Input	
RX1P_1	AI	14	TMDS Differential signal Input	
RX1N_1	AI	15	TMDS Differential signal Input	
RX0P_1	AI	16	TMDS Differential signal Input	
RX0N_1	AI	17	TMDS Differential signal Input	
RXCP_1	AI	18	TMDS Differential signal Input	
RXCN_1	AI	19	TMDS Differential signal Input	
TMDS_VDD	AP	20	TMDS power	(3.3 V)
AVS0	I	21	ADC vertical sync input	no power 5V tolerance
AHS0	I	22	ADC horizontal sync input AVS0 and AHS0 could be used to select one of three scan chain. AHS0/AVS0: 2'b00: {i_chain[2:0], mcu_chain[1:0], vbi_chain[2:0]} 2'b01: d_chain 2'b10: vdec_chain Other are reserved	no power 5V tolerance
ADC_VDD	AG	23	ADC Power	(1.8V)
B0-	AI	24	Negative BLUE analog input (Pb-)	
B0+	AI	25	Positive BLUE analog input (Pb+)	
G0-	AI	26	Negative GREEN analog input (Y-)	
G0+	AI	27	Positive GREEN analog input (Y+)	
SOG0	AI	28	Sync-On-Green	
R0-	AI	29	Negative RED analog input (Pr-)	

R0+	AI	30	Positive RED analog input (Pr+)	
B1-/V8_7	AI	31	Negative BLUE analog input (Pb-)/VIDEO 8-7	
B1+/V8_6	AI	32	Positive BLUE analog input (Pb+)/VIDEO 8-6	
G1-/V8_5	AI	33	Negative GREEN analog input (Y-)/VIDEO 8-5	
G1+/V8_4	AI	34	Positive GREEN analog input (Y+)/VIDEO 8-4	
SOG1/V8_3	AI	35	Sync-On-Green/ VIDEO 3	
R1-/V8_2	AI	36	Negative RED analog input (Pr-)/VIDEO 8-2	
R1+/V8_1	AI	37	Positive RED analog input (Pr+)/VIDEO 8-1	
ADC_GND/VADC_GND	AP	38	ADC/VADC GND	
AHS1/V8_0	I	39	ADC horizontal sync input/VIDEO 8-0	no power 5V tolerance
AVS1/VCLK	I	40	ADC horizontal sync input/VIDEO clock	no power 5V tolerance
Vin+0/V8_7	AI	41	Positive video analog input 0/VIDEO 8-7	
Vin-0/V8_6	AI	42	Negative video analog input 0/VIDEO 8-6	
Vin+1/V8_5	AI	43	Positive video analog input 1/VIDEO 8-5	
Vin-1/V8_4	AI	44	Negative video analog input 1/VIDEO 8-4	
Vin+2/V8_3	AI	45	Positive video analog input 2/VIDEO 8-3	
Vin-2/V8_2	AI	46	Negative video analog input 2/VIDEO 8-2	
Vin+3/V8_1	AI	47	Positive video analog input 3/VIDEO 8-1	
Vin-3/V8_0	AI	48	Negative video analog input 3/VIDEO 8-0	
VADC_VDD	AG	49	Video decoder ADC POWER	(3.3V)
A-ADC0/GPIO/AVOUT/VCLK	IO	50	MCU ADC Input /MCU GPIO/AVOUT/VIDEO clock	
A-ADC1/GPIO	IO	51	6-bit MCU ADC Input/MCU GPIO	6 bit
A-ADC2/GPIO	IO	52	6-bit MCU ADC Input /MCU GPIO	6 bit
A-ADC3/GPIO	IO	53	6-bit MCU ADC Input/MCU GPIO	6 bit
A-ADC4/GPIO	IO	54	6-bit MCU ADC Input /MCU GPIO	6 bit
B-ADC0/GPIO/PWM1/PWM5	IO	55	10-bit MCU ADC Input/MCU GPIO/PWM	10 bit
B-ADC1/GPIO/IIC_SCL	IO	56	10-bit MCU ADC Input /MCU GPIO/IIC BUS	10 bit
B-ADC2/GPIO/IIC_SDA	IO	57	10-bit MCU ADC Input/MCU GPIO/IIC BUS	10 bit
DDCSCL1/GPIO	IO	58	DDC1(pen drain I/O)/MCU GPIO	No power 5V tolerance
DDCSDA1/GPIO	IO	59	DDC1(Open drain I/O)/MCU GPIO	No power 5V tolerance
VCKK	P	60	Digital Power	(1.8V)
GNDK	G	61	Digital Ground	
PVCC	P	62	Pad power	3.3V
NC	--	63	Not connected	

SD0/SPDIF0/TCON[0]/GPIO/IrDA	IO	64	IIS-SD0 / SPDIF0 / TCON / MCU GPIO/ Infrared remote data pin	
WS/GPIO/TCON[7][1]/PWM1	IO	65	IIS-WS / MCU GPIO / TCON / PWM	
SCK/TCON[4][2]/GPIO/BLU7	IO	66	IIS-SCK / TCON / MCU GPIO/TTL Data Bus	
MCK/TCON[5][9]/GPIO/BLU6	IO	67	IIS-MCK / TCON / MCU GPIO/TTL Data Bus	
SD0/SPDIF0/TCON[13][3]/GPIO/BLU5	IO	68	IIS-SD0 / SPDIF0 / TCON / MCU GPIO/TTL Data Bus	
SPDIF1/SD1/TCON[7][3]/GPIO/IIC_SCL/BLU4	IO	69	SPDIF1 / IIS-SD1 / TCON / MCU GPIO/IIC BUS / TTL Data Bus	
SPDIF2/SD2/TCON[9][1]/GPIO/IIC_SDA/BLU3	IO	70	SPDIF2 / IIS-SD2 / TCON / MCU GPIO/IIC bus/TTL Data Bus	
SPDIF3/SD3/TCON[10][8]/GPIO/PWM1/PWM5/BLU2	IO	71	SPDIF3 / IIS-SD3 / TCON / MCU GPIO/PWM / TTL Data Bus	
NC	--	72	Not connected	
VCCK	P	73	Digital Power	(1.8V)
BLU7/BLU1/TXO3+/GPIO	IO	74	TTL Data Bus(BLU7,BLU1)/LVDS /MCU GPIO	
BLU6/BLU0/TXO3-/GPIO	IO	75	TTL Data Bus(BLU6,BLU0)/LVDS /MCU GPIO	
BLU5/GRN7/TXOC+/GPIO	IO	76	TTL Data Bus(BLU5,BLU7)/LVDS/MCU GPIO	
BLU4/GRN6/TXOC-/GPIO	IO	77	TTL Data Bus(BLU4,BLU6)/LVDS/MCU GPIO	
BLU3/GRN5/TXO2+/GPIO	IO	78	TTL Data Bus(BLU3,BLU5)/LVDS/MCU GPIO	
BLU2/GRN4/TXO2-/GPIO	IO	79	TTL Data Bus(BLU2,BLU4)/LVDS/MCU GPIO	
GRN7/GRN3/TXO1+/GPIO	IO	80	TTL Data Bus(GRN7,GRN3)/LVDS/MCU GPIO	
GRN6/GRN2/TXO1-/GPIO	IO	81	TTL Data Bus(GRN6,GRN2)/LVDS/MCU GPIO	
GRN5/GRN1/TXO0+/GPIO	IO	82	TTL Data Bus(GRN5,GRN1)/LVDS/MCU GPIO	
GRN4/GRN0/TXO0-/GPIO	IO	83	TTL Data Bus(GRN4,GRN0)/LVDS/MCU GPIO	
PVCC	P	84	Pad power	3.3V
PGND	G	85	Pad ground	
GRN3/RED7/TXE3+	O	86	TTL Data Bus(GRN3,RED7)/LVDS	
GRN2/RED6/TXE3-	O	87	TTL Data Bus(GRN2,RED6)/LVDS	
RED7/RED5/TXEC+	O	88	TTL Data Bus(RED7,RED5)/LVDS	
RED6/RED4/TXEC-	O	89	TTL Data Bus(RED6,RED4)/LVDS	
RED5/RED3/TXE2+	O	90	TTL Data Bus(RED5,RED3)/LVDS	
RED4/RED2/TXE2-	O	91	TTL Data Bus(RED4,RED2)/LVDS	
RED3/RED1/TXE1+	O	92	TTL Data Bus(RED3,RED1)/LVDS	
RED2/RED0/TXE1-	O	93	TTL Data Bus(RED2,RED0)/LVDS	
TXE0+/DENA	O	94	LVDS/TTL Data enable	
TXE0-/DHS	O	95	LVDS/TTL Display H-sync	
GPIO/PWM0/DCLK	IO	96	MCU GPIO/PWM/TTL Display clock	No power 5V tolerance
GPIO/PWM1/DVS	IO	97	MCU GPIO/PWM/TTL Display V-sync	No power 5V tolerance

GPIO/PWM2	IO	98	MCU GPIO/PWM	No power 5V tolerance
GPIO/PWM3/TCON[11][6]	IO	99	MCU GPIO/PWM/TCON	No power 5V tolerance
GPIO/PWM4/TCON[12][3]	IO	100	MCU GPIO/PWM/TCON	No power 5V tolerance
GPIO/PWM5/TCON[0]	IO	101	MCU GPIO/PWM/TCON	No power 5V tolerance
SD3/SPDIF3/TCON[10]/GPIO/PWM0	IO	102	IIS-SD3/SPDIF3/TCON/MCU GPIO/PWM	No power 5V tolerance
SD2/SPDIF2/TCON[8]/GPIO/IICSL/PWM1	IO	103	IIS-SD2/SPDIF2/TCON[8]/MCU GPIO/IICSL/PWM1	No power 5V tolerance
SD1/SPDIF1/TCON[5]/GPIO/IRQB/IICSDA	IO	104	IIS-SD1/SPDIF1/TCON[5]/MCU GPIO/IRQ Bar/IICSDA	No power 5V tolerance
SD0/SPDIF0/TCON[9]/GPIO	IO	105	IIS-SD0/SPDIF0/TCON/MCU GPIO	No power 5V tolerance
PVCC	P	106	Pad 3.3V power	3.3V
PGND	P	107	Pad 3.3V GND	
MCK/TCON[7]/GPIO	IO	108	IIS-MCK/TCON/MCU GPIO	No power 5V tolerance
SCK/TCON[3]/GPIO	IO	109	IIS-SCK/TCON/MCU GPIO	No power 5V tolerance
WS/TCON[6]/GPIO	IO	110	IIS-WS/TCON/MCU GPIO	No power 5V tolerance
SD0/SPDIF0/TCON[4]/GPIO	IO	111	IIS-SD0/SPDIF0/TCON/MCU GPIO	No power 5V tolerance
SD1/SPDIF1/TCON[9]/GPIO	IO	112	IIS-SD1/SPDIF1/TCON/MCU GPIO	No power 5V tolerance
SD2/SPDIF2/TCON[1]/GPIO/IrDA	IO	113	IIS-SD2/SPDIF2/TCON/MCU GPIO/Infrared remote data pin	No power 5V tolerance
SD3/SPDIF3/TCON[13]/GPIO/VCLK	IO	114	IIS-SD3/SPDIF3/TCON/MCU GPIO/VIDEO 8-clock	No power 5V tolerance
SPI_SCLK/SDIO	IO	115	SPI flash serial data input/external MCU serial control I/F data in	No power 5V tolerance
SI/MCU_SCLK	IO	116	SPI flash serial clock/external MCU serial control I/F clock	No power 5V tolerance
SO/SCSB	IO	117	SPI flash serial data output /external MCU serial control I/F chip select	No power 5V tolerance
CEB/IRQB	IO	118	SPI flash chip enable bar/IRQ Bar Note:It should be pulled down to 0 v or pulled up to 3.3 v in order to designate the MCU type(Internal MCU(0 volts) or External MCU(3.3 volts)).	No power 5V tolerance
NC	--	119	Not connected	
VCCK	P	120	Digital 1.8V Power	1.8V
DDCSCL3/GPIO	IO	121	DDC3(Open drain I/O)/MCU GPIO	No power 5V tolerance
DDCSDA3/GPIO	IO	122	DDC3(Open drain I/O)/MCU GPIO	No power 5V tolerance
DDCSDA2/GPIO	IO	123	DDC2(Open drain I/O)/MCU GPIO	No power 5V tolerance
DDCSCL2/GPIO	IO	124	DDC2(Open drain I/O)/MCUGPIO	No power 5V

				tolerance
RESETB	I	125	Chip Reset Bar	Low active; No power 5V tolerance
CEC	I/O	126	CEC bus	Pull up 27k ohm resistance to 3.3V power; No power 5V tolerance
XO	AO	127	Crystal Output	No power 5V tolerance
XI	AI	128	Crystal Input	No power 5V tolerance

MCU GPIO assignment

PIN No.	MCU GPIO Name
50	P6.0
51	P6.1
52	P6.2
53	P6.3
54	P6.4
55	P6.5
56	P6.6
57	P6.7
58	P3.0/RXD(I/O)
59	P3.1/TXD(O)
64	P1.0/T2(I)
65	P1.1/T2EX(I)
66	P1.2/CLKO2(O)
67	P1.3
68	P1.4
69	P1.5
70	P1.6
71	P1.7
74	P9.0
75	P9.1
76	P9.2
77	P9.3
78	P9.4
79	PA.0
80	PA.1
81	PA.2
82	PA.3
83	PA.4
94	P5.0 (removed)
95	P5.1 (removed)
96	P5.2
97	P5.3

98	P5.4
99	P5.5
100	P5.6
101	P5.7
102	P7.6
103	P7.5
104	P7.4
105	P8.0
108	P8.1/CLKO1(O)
109	P3.2/INT0(I)
110	P3.3/INT1(I)
111	P3.4/T0
112	P3.5(BS)/T1
113	P3.6
114	P3.7
121	P7.3
122	P7.2
123	P7.1

2. Chip Data Path Block Diagram

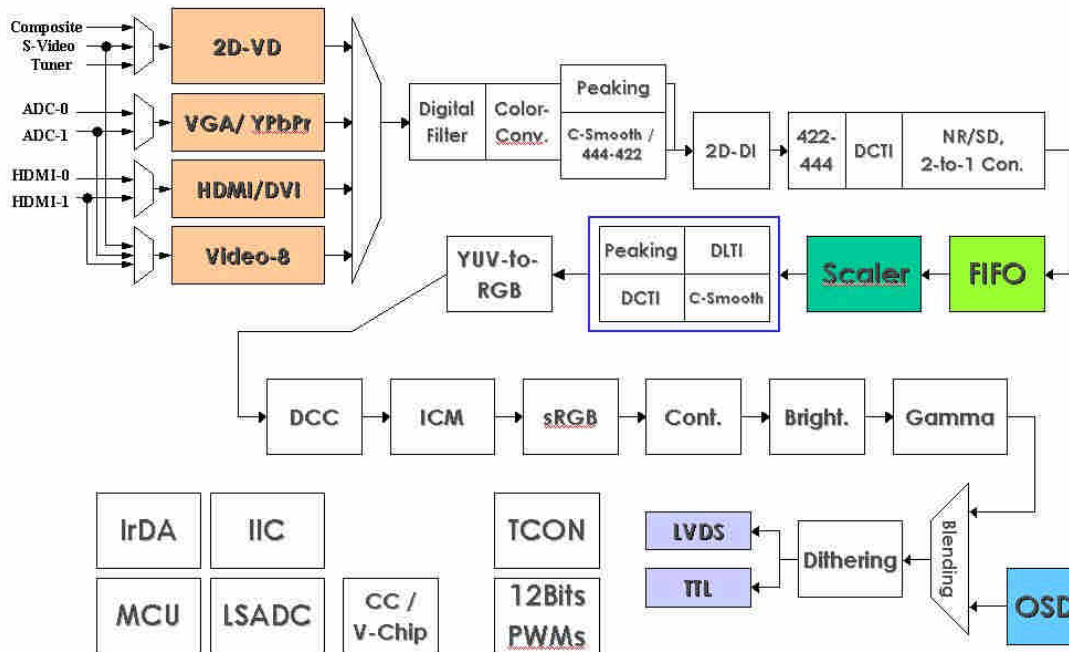


Figure 1

4. Electric Specification

DC Characteristics

Table 2 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Voltage on Input (5V tolerant)	V_{IN}	-1		5	V
Electrostatic Discharge	V_{ESD}			± 2.5	kV
Latch-Up	I_{LA}			± 100	mA
Ambient Operating Temperature	T_A	0		70	°C
Storage temperature (plastic)	T_{STG}	-55		125	°C
Thermal Resistance (Junction to Air)	θ_{JA}			25	°C/W
Junction Acceptable Temperature	T_j			125	°C

Table 3 DC Characteristics/Operating Condition

(0°C<T_A<70°C)

【Power consumption : Embedded MCU】

Dot-pattern(check_11).

【1】 VGA-in: 1600x1200/75Hz , display to 1680x1050/75Hz , DCLK=170MHz.

Pattern Generator : 『 Chroma 2227 』 ; Pattern Name : 『 Dot 』 pattern

【2】 HDMI-in: 1600x1200/60Hz , display to 1680x1050/60Hz.

Pattern Generator : 『 QunatumData 882 』 ; Pattern Name : 『 Check11 』 (256 gray scale)

【3】 Video Decoder-in : DVD-player ; AV-in ; display to 1680x1050

Power Name	Voltage	Operating(mA)	Power saving(mA)	Power down(mA)
VCCK(core)(VGA)	1.8V	438	14.9	5.9
VCCK(core)(HDMI)	1.8V	455	8.5	6.1
VCCK(core)(Video Decoder)	1.8V	232	8.6	6.1
ADC_VDD	1.8V	123	0.1	0.1
TMDS_VDD	3.3V	173	19.9	19.9
VADC_VDD	3.3V	65.6	0.1	0.1
PVCC(LVDS)	3.3V	78.5	2.5	2.5
PVCC(TTL)	3.3V	34.1	12.8	12.8

5. Mechanical Specification

128 Pin Package

