

REALTEK

RTD2785T-CG

MULTI-FUNCTION DISPLAY CONTROLLER

DATASHEET

(CONFIDENTIAL: Development Partners Only)

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USING THIS DOCUMENT

This document is intended for the software engineer’s reference and provides detailed programming information.

Though every effort has been made to ensure that this document is current and accurate, more information may have become available subsequent to the production of this guide.

REVISION HISTORY

Revision	Release Date	Summary
0.01	2015/12/28	First release.
0.02	2016/02/26	Modify Pin table and Diagram

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1. General Description

The Realtek RTD2785T-CG monitor controller combines an analog RGB input interface, multiple DP1.2 digital input interfaces with HDCP1.4/HDCP2.2, multiple HDMI1.4 digital input interfaces with HDCP1.4/HDCP2.2, multiple DVI digital input interfaces with HDCP1.4 and multiple MHL2.2 digital input interfaces with HDCP1.4. The embedded MCU is based on an industrial standard 8051 core with external serial flash.

The RTD2785T-CG is suitable for multiple market segments and display applications, such as monitor, All in One PC, and embedded applications.

2. Features

General

- RTD2785T-CG supports input format up to 2560x1600 @ 60Hz, 2560x2048 @ 50Hz.
- Support LVDS panel interfaces
- Zoom scaling up and down
- Embedded one MCU with SPI flash controller.
- It contains 4 ADCs in key pad application
- 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.

Crystal

- Support 14.318MHz crystal type

Analog RGB Input Interface

- 1 Analog input supported
- Integrated 8-bit triple-channel 210MHz ADC/PLL
- 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

- YPbPr support up to HDTV 1080p resolution

High Speed Receiver

- RTD2785T-CG supports 4 ports of high speed receivers including one port of DisplayPort1.2 receiver, one port of HDMI1.4, MHL2.2 and DisplayPort1.2 Combo receiver and two ports of HDMI1.4/MHL/DVI Combo receiver.
- In HDMI mode, the latest HDMI1.4 is supported
- In HDMI mode, data enable only mode is supported
- In HDMI mode, 6-bit, 8-bit, 10-bit, and 12-bit color depth transport is supported
- In HDMI mode, High-Bandwidth Digital Content Protection (HDCP 1.4/HDCP2.2) is supported
- In HDMI mode, HDMI audio is allowed to transmit to I2S/SPDIF output
- In HDMI mode, AMD HDMI Freesync technology is supported
- In MHL mode, MHL2.2 is supported
- In MHL mode, High-Bandwidth Digital Content Protection (HDCP 1.4) is supported
- In MHL mode, packet pixel mode is supported
- In DisplayPort mode, the latest DisplayPort 1.2 is supported

- In DisplayPort mode, two link layer speed HBR (2.7GHz), RBR (1.62GHz) are supported
- In DisplayPort mode, 6-bit, 8-bit, 10-bit, and 12-bit color depth transport is supported
- In DisplayPort mode, High-Bandwidth Digital Content Protection (HDCP 1.4/HDCP2.2) is supported
- In DisplayPort mode, audio is allowed to transmit to I2S/SPDIF output
- In DisplayPort mode, VESA Adaptive Sync technology is supported
- In MHL mode, MHL2.2 is supported
- In MHL mode, High-Bandwidth Digital Content Protection (HDCP 1.4) is supported
- In MHL mode, packet pixel mode is supported
- In DVI mode, Digital Content Protection (HDCP 1.4) is supported
- In DVI mode, two adjacent receivers to support dual-link DVI with HDCP

Embedded MCU

- Industrial standard 8051 core with external serial flash
- Low speed ADC for various application
- 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

Audio

- Output: IIS , SPDIF
- Embedded Audio DAC
- Embedded headphone amp

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 12-bit color processing engine
- Programmable 14-bit gamma support
- Programmable 12-bit 3D gamma support
- xvYCC supported
- Adobe/sRGB compliance
- Advanced dithering logic for the fewer panel color depth enhancement
- Dynamic overshoot-smear canceling engine
- Brightness and contrast control
- Peaking/Coring function for video sharpness

- Support UltraVivid III function to enhance image quality with minimal artificial effect on productivity applications

- Panel Uniformity (Brightness and color uniformity)

VividColor™

- Independent color management (ICM)
- Dynamic contrast control (DCC)
- 2nd generation of Precise color mapping (PCM)
- Image Adaptive Power Saving (IAPS)
- Support ADC Noise Reduction

Output Interface

- Support 8-bit / 10-bit output through either LVDS
- Support 4-port LVDS with the speed of each port up to 93MHz
- Fully programmable display timing generator
- Flexible data pair swapping for easier system design.
- Fixed Last Line output for perfect panel capability

Embedded OSD

- Embedded 30K SRAM dynamically stores OSD command and fonts
- Support multi-color RAM font, 1, 2 and 4-bit per pixel

- 64 color palette

- Maximum 26 window with alpha-blending /

- gradient / gradient target color / gradient reversed color/ dynamic fade-in/fade-out, bordering/ shadow

- Rotate 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

- Support OSD scrolling

- Support 2 independent font based OSD

Frame Buffer Support

- LiveShow™ Function, High-performance RTC (response time compensation).
- Frame Rate Control Function
- Embedded frame buffer

Power Supply

- 3.3V / 2.5V / 1.1V power supply

3. System Applications

- Display System on Motherboard, Monitor
- Display System for All in One PCs and embedded applications

4. Block Diagram

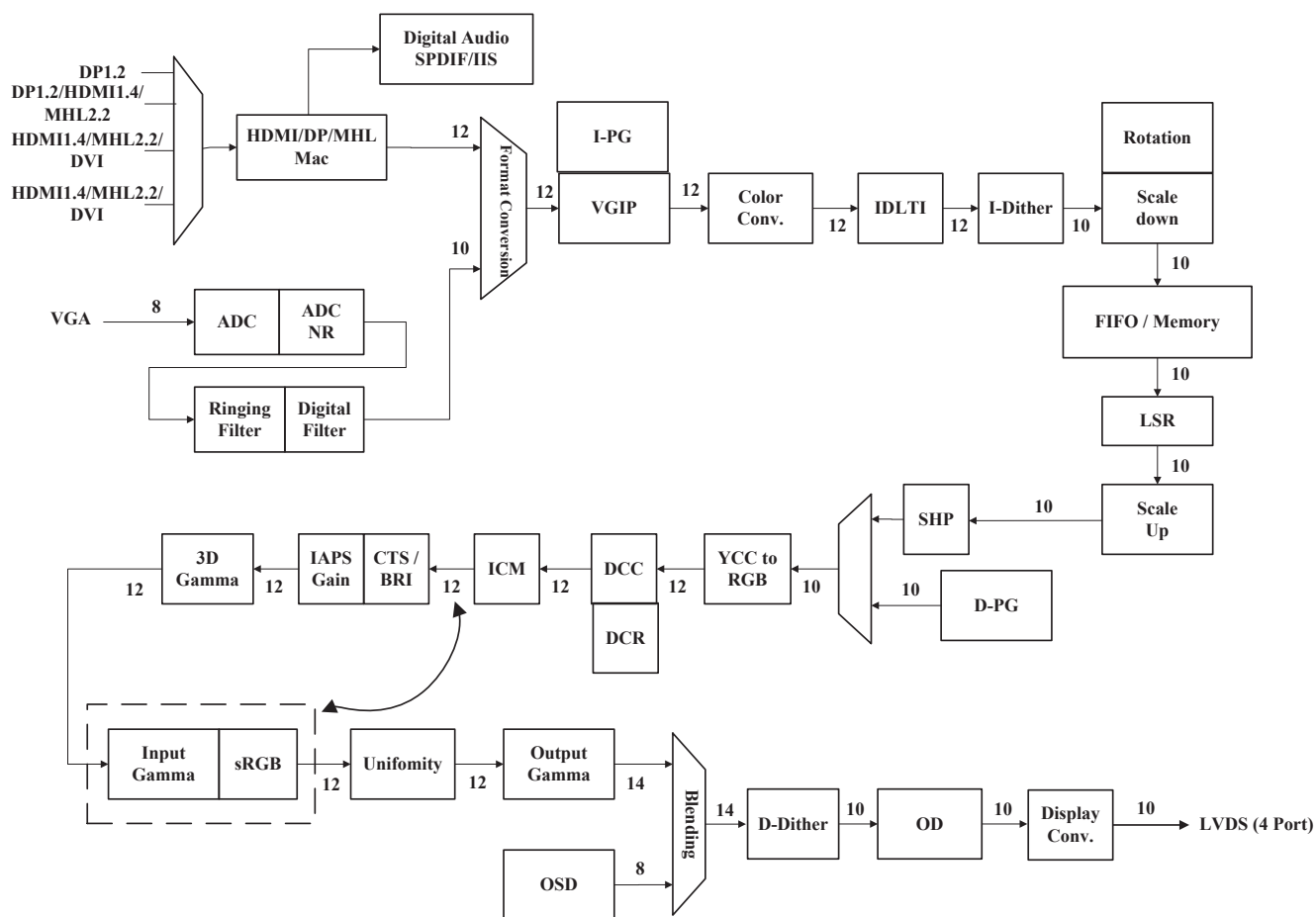


Figure 1. Block Diagram

5. Pin Assignments

LQFP216

GPIO / Test4b	1	GPIO / Test4b	161	TXA0N_10b / TXA0N_8b / GPIO	161
TMDS_REXT	2	TMDS_REXT	160	TXA0P_10b / TXA0P_8b / GPIO	160
CBUS3 / GPIO / HDMI_HPD	3	CBUS3 / GPIO / HDMI_HPD	159	TXA1N_10b / TXA1N_8b / GPIO	159
RX_33V	4	RX_33V	158	TXA1P_10b / TXA1P_8b / GPIO	158
RXCP_3	5	RXCP_3	157	TXA2N_10b / TXA2N_8b / GPIO	157
RXCEN_3	6	RXCEN_3	156	TXA2P_10b / TXA2P_8b / GPIO	156
RX2P_3 / MHLN	7	RX2P_3 / MHLN	155	TXACN_10b / TXACN_8b / GPIO	155
RX2N_3 / MHLN	8	RX2N_3 / MHLN	154	TXACP_10b / TXACP_8b / GPIO	154
TMDS_GND	9	TMDS_GND	153	TXA3N_10b / TXA3N_8b / GPIO	153
RX1P_3	10	RX1P_3	152	TXA3P_10b / TXA3P_8b / GPIO	152
RX1N_3	11	RX1N_3	151	TXA4N_10b / GPIO	151
RX0P_3	12	RX0P_3	150	TXA4P_10b / GPIO	150
RX0N_3	13	RX0N_3	149	PVCC	149
GDI_11V	14	GDI_11V	148	TXB0N_10b / TXB0N_8b / GPIO	148
CBUS2 / GPIO / HDMI_HPD	15	CBUS2 / GPIO / HDMI_HPD	147	TXB0P_10b / TXB0P_8b / GPIO	147
RX_33V	16	RX_33V	146	TXB1N_10b / TXB1N_8b / GPIO	146
RXCP_2	17	RXCP_2	145	TXB1P_10b / TXB1P_8b / GPIO	145
RXCEN_2	18	RXCEN_2	144	TXB2N_10b / TXB2N_8b / GPIO	144
RX2P_2 / MHLN	19	RX2P_2 / MHLN	143	TXB2P_10b / TXB2P_8b / GPIO	143
RX2N_2 / MHLN	20	RX2N_2 / MHLN	142	TXB3N_10b / TXB3N_8b / GPIO	142
TMDS_GND	21	TMDS_GND	141	TXB3P_10b / TXB3P_8b / GPIO	141
RX1P_2	22	RX1P_2	140	TXB4N_10b / GPIO	140
RX1N_2	23	RX1N_2	139	TXB4P_10b / GPIO	139
RX0P_2	24	RX0P_2	138	VCCX_OFF	138
RX0N_2	25	RX0N_2	137	TXCON_10b / TXCON_8b	137
GDI_11V	26	GDI_11V	136	TXC0P_10b / TXC0P_8b	136
CBUS1 / GPIO / HDMI_HPD	27	CBUS1 / GPIO / HDMI_HPD	135	TXC1N_10b / TXC1N_8b	135
RX_33V	28	RX_33V	134	TXC1P_10b / TXC1P_8b	134
LANE0P_1 / RX2P_1	29	LANE0P_1 / RX2P_1	133	TXC2N_10b / TXC2N_8b	133
LANE0N_1 / RX2N_1	30	LANE0N_1 / RX2N_1	132	TXC2P_10b / TXC2P_8b	132
DP_GND	31	DP_GND	131	TXCCN_10b / TXCCN_8b	131
LANE1P_1 / RX1P_1	32	LANE1P_1 / RX1P_1	130	TXCCP_10b / TXCCP_8b	130
LANE1N_1 / RX1N_1	33	LANE1N_1 / RX1N_1	129	TXC3N_10b / TXC3N_8b	129
DP_GND	34	DP_GND	128	TXC3P_10b / TXC3P_8b	128
LANE2P_1 / RX0P_1	35	LANE2P_1 / RX0P_1	127	LVDS_VDD11	127
LANE2N_1 / RX0N_1	36	LANE2N_1 / RX0N_1	126	TXC4N_10b	126
DP_GND	37	DP_GND	125	TXC4P_10b	125
LANE3P_1 / RXCP_1	38	LANE3P_1 / RXCP_1	124	LVDS_VDD33	124
LANE3N_1 / RXCN_1	39	LANE3N_1 / RXCN_1	123	TXD0N_10b / TXD0N_8b	123
GDI_11V	40	GDI_11V	122	TXD0P_10b / TXD0P_8b	122
LANE0P_0	41	LANE0P_0	121	LVDS_VDD11	121
LANE0N_0	42	LANE0N_0	120	TXD1N_10b / TXD1N_8b	120
DP_GND	43	DP_GND	119	TXD1P_10b / TXD1P_8b	119
LANE1P_0	44	LANE1P_0	118	TXD2N_10b / TXD2N_8b	118
LANE1N_0	45	LANE1N_0	117	TXD2P_10b / TXD2P_8b	117
DP_GND	46	DP_GND	116	TXD3N_10b / TXD3N_8b	116
LANE2P_0	47	LANE2P_0	115	TXD3P_10b / TXD3P_8b	115
LANE2N_0	48	LANE2N_0	114	NC	114
DP_GND	49	DP_GND	113	TXD4N_10b	113
LANE3P_0	50	LANE3P_0	112	TXD4P_10b	112
LANE3N_0	51	LANE3N_0	111	VCCX_OFF	111
GDI_11V	52	GDI_11V	110	DDR1_V25	110
TCON[0] / GPIO / Test4b	53	TCON[0] / GPIO / Test4b	109	AUDIO_VDD33	109
TCON[8] / GPIO / Test4b	54	TCON[8] / GPIO / Test4b	108	AUDIO_GND	108
			107	AUDIO_S0UTN / S0I / SP0P1 / GPIO	107
			106	AUDIO_S0UTN / S0I / SP0P0 / GPIO	106
			105	AUDIO_REF / MCK / GPIO	105
			104	LINE_INN / SCL / GPIO	104
			103	LINE_INP / WS / GPIO	103
			102	AUDIO_HP_AVD033	102
			101	AUDIO_HP_GND	101
			99	AUDIO_H0UTN / S03 / SP0P3 / GPIO	99
			98	AUDIO_H0UTN / S02 / SP0P2 / GPIO	98
			97	GPIO / PWM1_in	97
			96	VCCX_ON	96
			95	PVCC	95
			94	MHL_CABLE_DET1 / TCON[9] / A-ADCI / GPIO / Test4b	94
			93	MHL_CABLE_DET0 / TCON[9] / A-ADCI / GPIO / Test4b	93
			92	A-ADCI / INT1 / GPIO / Test4b	92
			91	A-ADCI / INT0 / GPIO / Test4b	91
			90	GPIO	90
			89	GPIO	89
			88	DDR1_V25	88
			87	X0	87
			86	X1	86
			85	NC	85
			84	NC	84
			83	VCCX_OFF	83
			82	NC	82
			81	NC	81
			80	PVCC	80
			79	NC	79
			78	NC	78
			77	VCCX_OFF	77
			76	NC	76
			75	NC	75
			74	DOCS0A1 / DOCS0A_AJUN_D1 / GPIO	74
			73	DOCS0C1 / DOCS0C_AJUN_D1 / GPIO	73
			72	DOCS0A_AJUN_D0 / GPIO	72
			71	DOCS0C_AJUN_D0 / GPIO	71
			70	VCCX_ON	70
			69	PVCC	69
			68	PWM0 / TCON[9] / GPIO / Test4b	68
			67	DOCS0A_V0A / GPIO	67
			66	DOCS0C_V0A / GPIO	66
			65	A0C_GND	65
			64	R+	64
			63	R-	63
			62	S0S	62
			61	G+	61
			60	G-	60
			59	B+	59
			58	B-	58
			57	AHS	57
			56	AVS	56
			55	A0C_VDD33	55

GPIO / Test4b

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6. Pin Assignments Table

Table 1. Signals Pin Assignment of LQFP216

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

Pin Name	I/O	Pin #	Description	Note
GPIO / Test4b	IO	1	MCU_GPIO / Test4b	5V Tolerance when power off
TMDS REXT	AI	2	Impedance Match Resistor	12K ohm Reference to GND
CBUS3 / GPIO / HDMI_HPD	AI O	3	MHL CBus / MCU_GPIO / HDMI Hot-plug	5V Tolerance when power off
RX_33V	AP	4	GDI 3.3V Power	(3.3V)
RXCP_3	AI	5	TMDS Differential Signal Input	
RXCN_3	AI	6	TMDS Differential Signal Input	
RX2P_3 / MHLP	AI	7	TMDS Differential Signal Input	
RX2N_3 / MHLN	AI	8	TMDS Differential Signal Input	
TMDS_GND	AG	9	TMDS Ground	
RX1P_3	AI	10	TMDS Differential Signal Input	
RX1N_3	AI	11	TMDS Differential Signal Input	
RX0P_3	AI	12	TMDS Differential Signal Input	
RX0N_3	AI	13	TMDS Differential Signal Input	
GDI_11V	AP	14	GDI 1.1V Power	(1.1V)
CBUS2/ GPIO / HDMI_HPD	AI O	15	MHL CBus / MCU_GPIO / HDMI Hot-plug	5V Tolerance when power off
RX_33V	AP	16	GDI 3.3V Power	(3.3V)
RXCP_2	AI	17	TMDS Differential Signal Input	
RXCN_2	AI	18	TMDS Differential Signal Input	
RX2P_2 / MHLP	AI	19	TMDS Differential Signal Input	
RX2N_2 / MHLN	AI	20	TMDS Differential Signal Input	
TMDS_GND	AG	21	TMDS Ground	
RX1P_2	AI	22	TMDS Differential Signal Input	
RX1N_2	AI	23	TMDS Differential Signal Input	
RX0P_2	AI	24	TMDS Differential Signal Input	
RX0N_2	AI	25	TMDS Differential Signal Input	
GDI_11V	AP	26	GDI 1.1V Power	(1.1V)
CBUS1/ GPIO / HDMI_HPD	AI O	27	MHL CBus / MCU_GPIO / HDMI Hot-plug	
RX_33V	AP	28	GDI 3.3V Power	(3.3V)

LANE0P_1 / RX2P_1	AI	29	DP Differential Signal Input / TMDS Differential Signal Input	
LANE0N_1 / RX2N_1	AI	30	DP Differential Signal Input / TMDS Differential Signal Input	
DP_GND	AG	31	DP Ground	
LANE1P_1 / RX1P_1	AI	32	DP Differential Signal Input / TMDS Differential Signal Input	
LANE1N_1 / RX1N_1	AI	33	DP Differential Signal Input / TMDS Differential Signal Input	
DP_GND	AG	34	DP Ground	
LANE2P_1 / RX0P_1	AI	35	DP Differential Signal Input / TMDS Differential Signal Input	
LANE2N_1 / RX0N_1	AI	36	DP Differential Signal Input / TMDS Differential Signal Input	
DP_GND	AG	37	DP Ground	
LANE3P_1 / RXCP_1	AI	38	DP Differential Signal Input / TMDS Differential Signal Input	
LANE3N_1 / RXCN_1	AI	39	DP Differential Signal Input / TMDS Differential Signal Input	
GDI_11V	AP	40	GDI 1.1V Power	(1.1V)
LANE0P_0	AI	41	DP Differential Signal Input	
LANE0N_0	AI	42	DP Differential Signal Input	
DP_GND	AG	43	DP Ground	
LANE1P_0	AI	44	DP Differential Signal Input	
LANE1N_0	AI	45	DP Differential Signal Input	
DP_GND	AG	46	DP Ground	
LANE2P_0	AI	47	DP Differential Signal Input	
LANE2N_0	AI	48	DP Differential Signal Input	
DP_GND	AG	49	DP Ground	
LANE3P_0	AI	50	DP Differential Signal Input	
LANE3N_0	AI	51	DP Differential Signal Input	
GDI_11V	AP	52	GDI 1.1V Power	(1.1V)
TCON[0] / GPIO / Test4b	IO	53	TCON / MCU_GPIO / Test4b	5V Tolerance when power off
TCON[8] / GPIO / Test4b	IO	54	TCON / MCU_GPIO / Test4b	5V Tolerance when power off
ADC_VDD33	AP	55	ADC 3.3V Power	(3.3V)
AVS	AI	56	ADC Vertical Sync Input	5V Tolerance when power off
AHS	AI	57	ADC Horizontal Sync Input	5V Tolerance when power

				off
B-	AI	58	Negative Blue analog input (Pb-)	3.3V Tolerance
B+	AI	59	Positive Blue analog input (Pb+)	3.3V Tolerance
G-	AI	60	Negative Green analog input (Y-)	3.3V Tolerance
G+	AI	61	Positive Green analog input (Y+)	3.3V Tolerance
SOG	AI	62	Sync-On-Green	3.3V Tolerance
R-	AI	63	Negative RED analog input (Pr-)	3.3V Tolerance
R+	AI	64	Positive RED analog input (Pr+)	3.3V Tolerance
ADC_GND	AG	65	ADC Ground	
DDCSCL_VGA / GPIO	IO	66	DDC VGA (Open drain I/O) / MCU GPIO	5V Tolerance when power off
DDCSDA_VGA / GPIO	IO	67	DDC VGA (Open drain I/O) / MCU GPIO	5V Tolerance when power off
PWM0 / TCON[4] / GPIO / Test4b	IO	68	PWM / TCON / MCU_GPIO / Test4b	5V Tolerance when power off
PVCC	DP	69	Pad Power	(3.3V)
VCKK_ON	DP	70	Core Power	(1.1V)
DDCSCL_AUXP_D0 / GPIO	IO	71	AUX-CH / MCU GPIO	5V Tolerance when power off
DDCSDA_AUXN_D0 / GPIO	IO	72	AUX-CH / MCU GPIO	5V Tolerance when power off
DDCSCL1 / DDCSCL_AUXP_D1 / GPIO	IO	73	DDC Channel (Open drain I/O) / DPRX AUX-CH / MCU GPIO	5V Tolerance when power off
DDCSDA1 / DDCSDA_AUXN_D1 / GPIO	IO	74	DDC Channel (Open drain I/O) / DPRX AUX-CH / MCU GPIO	5V Tolerance when power off
NC	NC	75	NC Pin	
NC	NC	76	NC Pin	
VCKK_OFF	DP	77	Core Power	(1.1V)
NC	NC	78	NC Pin	
NC	NC	79	NC Pin	
PVCC	DP	80	Pad Power	(3.3V)

NC	NC	81	NC Pin	
NC	NC	82	NC Pin	
VCKK_OFF	DP	83	Core Power	(1.1V)
NC	NC	84	NC Pin	
NC	NC	85	NC Pin	
XI	AI	86	Crystal Input	3.3V Tolerance
XO	AO	87	Crystal Output	3.3V Tolerance
DDR1_V25	AP	88	DDR1 2.5V Power	(2.5V)
GPIO	IO	89	MCU GPIO	3.3V Tolerance
GPIO	IO	90	MCU GPIO	3.3V Tolerance
A-ADC0/ INT0 / GPIO / Test4b	AI O	91	5bits MCU ADC Input / MCU EXINT / MCU GPIO / Test4b	3.3 V tolerance when using ADC Input; 5V Tolerance power on when using GPIO
A-ADC1 / INT1 / GPIO / Test4b	AI O	92	5bits MCU ADC Input / MCU EXINT / MCU GPIO / Test4b	3.3 V tolerance when using ADC Input; 5V Tolerance power on when using GPIO
MHL_CABLE_DE T0 / TCON[9] / A-ADC2 / GPIO / Test4b	AI O	93	MHL_Cable_Detect / TCON / 5bits MCU ADC Input / MCU GPIO / Test4b	3.3 V tolerance when using ADC Input; 5V Tolerance power on when using GPIO
MHL_CABLE_DE T1 / TCON[10] / A-ADC3 / GPIO / Test4b	AI O	94	MHL_Cable_Detect / TCON / 5bits MCU ADC Input / MCU GPIO / Test4b	3.3 V tolerance when using ADC Input; 5V Tolerance power on when using

				GPIO
PVCC	DP	95	Pad Power	(3.3V)
VCCK_ON	DP	96	Core Power	(1.1V)
GPIO / pwm_out / PWM1	IO	97	MCU GPIO / PWM_OUT / PWM	5V Tolerance when power off
GPIO / pwm_in	IO	98	MCU GPIO / PWM_IN	5V Tolerance when power off
AUDIO_HOUTL / SD2 / SPDIF2 / GPIO	AI O	99	AUDIO_HOUTL / I2S / SPDIF / MCU GPIO	3.3V Tolerance
AUDIO_HOUTR / SD3 / SPDIF3 / GPIO	AI O	100	AUDIO_HOUTL / I2S / SPDIF / MCU GPIO	3.3V Tolerance
AUDIO_HP_GND	AG	101	AUDIO HP Ground	
AUDIO_HP_AVD D33	AP	102	AUDIO HP 3.3V Power	(3.3V)
LINE_INL / WS / GPIO	AI O	103	LINE_INL / I2S / MCU GPIO	3.3V Tolerance
LINE_INR / SCK / GPIO	AI O	104	LINE_INR / I2S / MCU GPIO	3.3V Tolerance
AUDIO_REF / MCK / GPIO	AI O	105	AUDIO_REF / I2S / MCU GPIO	3.3V Tolerance
AUDIO_SOUTL / SD0 / SPDIF0 / GPIO	AI O	106	AUDIO_SOUTL / I2S / SPDIF / MCU GPIO	3.3V Tolerance
AUDIO_SOUTR / SD1 / SPDIF1 / GPIO	AI O	107	AUDIO_SOUTR / I2S / SPDIF / MCU GPIO	3.3V Tolerance
AUDIO_GND	AG	108	Audio DAC Ground	
AUDIO_VDD33	AP	109	Audio DAC 3.3V Power	(3.3V)
DDR1_V25	AP	110	DDR1 2.5V Power	(2.5V)
VCCK_OFF	DP	111	Core Power	(1.1V)
TXD4P_10b	AO	112	LVDS	3.3V Tolerance
TXD4N_10b	AO	113	LVDS	3.3V Tolerance
NC	NC	114	NC Pin	
TXD3P_10b / TXD3P_8b	AO	115	LVDS	3.3V Tolerance
TXD3N_10b / TXD3N_8b	AO	116	LVDS	3.3V Tolerance
TXD2P_10b / TXD2P_8b	AO	117	LVDS	3.3V Tolerance

TXD2N_10b / TXD2N_8b	AO	118	LVDS	3.3V Tolerance
TXD1P_10b / TXD1P_8b	AO	119	LVDS	3.3V Tolerance
TXD1N_10b / TXD1N_8b	AO	120	LVDS	3.3V Tolerance
LVDS_VDD11	AP	121	LVDS 1.1V Power	(1.1V)
TXD0P_10b / TXD0P_8b	AO	122	LVDS	3.3V Tolerance
TXD0N_10b / TXD0N_8b	AO	123	LVDS	3.3V Tolerance
LVDS_VDD33	AP	124	LVDS 3.3V Power	(3.3V)
TXC4P_10b	AO	125	LVDS	3.3V Tolerance
TXC4N_10b	AO	126	LVDS	3.3V Tolerance
LVDS_VDD11	AP	127	LVDS 1.1V Power	(1.1V)
TXC3P_10b / TXC3P_8b	AO	128	LVDS	3.3V Tolerance
TXC3N_10b / TXC3N_8b	AO	129	LVDS	3.3V Tolerance
TXCCP_10b / TXCCP_8b	AO	130	LVDS	3.3V Tolerance
TXCCN_10b / TXCCN_8b	AO	131	LVDS	3.3V Tolerance
TXC2P_10b / TXC2P_8b	AO	132	LVDS	3.3V Tolerance
TXC2N_10b / TXC2N_8b	AO	133	LVDS	3.3V Tolerance
TXC1P_10b / TXC1P_8b	AO	134	LVDS	3.3V Tolerance
TXC1N_10b / TXC1N_8b	AO	135	LVDS	3.3V Tolerance
TXC0P_10b / TXC0P_8b	AO	136	LVDS	3.3V Tolerance
TXC0N_10b / TXC0N_8b	AO	137	LVDS	3.3V Tolerance
VCCK_OFF	DP	138	Core Power	(1.1V)
TXB4P_10b / GPIO	AI O	139	LVDS / MCU GPIO	3.3V Tolerance
TXB4N_10b / GPIO	AI O	140	LVDS / MCU GPIO	3.3V Tolerance
TXB3P_10b / TXB3P_8b / GPIO	AI O	141	LVDS / MCU GPIO	3.3V Tolerance
TXB3N_10b /	AI	142	LVDS / MCU GPIO	3.3V

TXB3N_8b / GPIO	O			Tolerance
TXB2P_10b / TXB2P_8b / GPIO	AI O	143	LVDS / MCU GPIO	3.3V Tolerance
TXB2N_10b / TXB2N_8b / GPIO	AI O	144	LVDS / MCU GPIO	3.3V Tolerance
TXB1P_10b / TXB1P_8b / GPIO	AI O	145	LVDS / MCU GPIO	3.3V Tolerance
TXB1N_10b / TXB1N_8b / GPIO	AI O	146	LVDS / MCU GPIO	3.3V Tolerance
TXB0P_10b / TXB0P_8b / GPIO	AI O	147	LVDS / MCU GPIO	3.3V Tolerance
TXB0N_10b / TXB0N_8b / GPIO	AI O	148	LVDS / MCU GPIO	3.3V Tolerance
PVCC	DP	149	Pad Power	(3.3V)
TXA4P_10b / GPIO	AI O	150	LVDS / MCU GPIO	3.3V Tolerance
TXA4N_10b / GPIO	AI O	151	LVDS / MCU GPIO	3.3V Tolerance
TXA3P_10b / TXA3P_8b / GPIO	AI O	152	LVDS / MCU GPIO	3.3V Tolerance
TXA3N_10b / TXA3N_8b / GPIO	AI O	153	LVDS / MCU GPIO	3.3V Tolerance
TXACP_10b / TXACP_8b / GPIO	AI O	154	LVDS / MCU GPIO	3.3V Tolerance
TXACN_10b / TXACN_8b / GPIO	AI O	155	LVDS / MCU GPIO	3.3V Tolerance
TXA2P_10b / TXA2P_8b / GPIO	AI O	156	LVDS / MCU GPIO	3.3V Tolerance
TXA2N_10b / TXA2N_8b / GPIO	AI O	157	LVDS / MCU GPIO	3.3V Tolerance
TXA1P_10b / TXA1P_8b / GPIO	AI O	158	LVDS / MCU GPIO	3.3V Tolerance
TXA1N_10b / TXA1N_8b / GPIO	AI O	159	LVDS / MCU GPIO	3.3V Tolerance
TXA0P_10b / TXA0P_8b / GPIO	AI O	160	LVDS / MCU GPIO	3.3V Tolerance
TXA0N_10b / TXA0N_8b / GPIO	AI O	161	LVDS / MCU GPIO	3.3V Tolerance
VCKK_OFF	DP	162	Core Power	(1.1V)
PVCC	DP	163	Pad Power	(3.3V)
WS / TCON[12] / GPIO / Test4b	IO	164	I2S / TCON / MCU GPIO / Test4b	5V Tolerance when power off
SCK / TCON[13] / GPIO / Test4b	IO	165	I2S / TCON / MCU GPIO / Test4b	5V Tolerance when power

				off
MCK / GPIO / Test4b	IO	166	I2S / MCU GPIO / Test4b	5V Tolerance when power off
SPDIF0 / SD0 / GPIO / Test4b	IO	167	SPDIF / I2S / MCU GPIO / Test4b	5V Tolerance when power off
USB_SPI_CLK / CLKO / GPIO / T0	IO	168	SPI Serial Clock / CLKO / MCU GPIO / Timer	5V Tolerance when power off
USB_SPI_SI /INT0/ GPIO / T1	IO	169	SPI Serial Data Input / MCU EXINT / MCU GPIO / Timer	5V Tolerance when power off
USB_SPI_SO/ INT1 / GPIO / T2	IO	170	SPI Serial Data Output / MCU EXINT / MCU GPIO / Timer	5V Tolerance when power off
USB_SPI_CEB0 / IRQB / GPIO / DVS	IO	171	SPI Chip Enable / IRQB / MCU GPIO / DVS	5V Tolerance when power off
USB_SPI_CEB1 / T2EX / GPIO	IO	172	SPI Chip Enable / T2EX / MCU GPIO	5V Tolerance when power off
TCON[8] / GPIO	IO	173	TCON / MCU GPIO	5V Tolerance when power off
PWM3 / TCON[6] / GPIO	IO	174	PWM / TCON / MCU GPIO	5V Tolerance when power off
PWM1_0/ TCON[7] / GPIO	IO	175	PWM / TCON / MCU GPIO	5V Tolerance when power off
PGND	DP	176	Pad Ground	
DDR1_V25	AP	177	DDR1 2.5V Power	(2.5V)
PWM5 / TCON[2] / GPIO / Test4b	IO	178	PWM / TCON / MCU GPIO / Test4b	5V Tolerance when power off
GPIO / TCON[6] / IIC_SCL_1	IO	179	MCU GPIO / TCON / IIC BUS	5V Tolerance when power off
GPIO / TCON[7] / IIC_SDA_1	IO	180	MCU GPIO / TCON / IIC BUS	5V Tolerance when power off
DDR1_VREF	AP	181	DDR1 1.25V Vref Power	(1.25V)
VCKK_OFF	DP	182	Core Power	(1.1V)
GPIO / TCON[5] /	IO	183	MCU GPIO / TCON	5V Tolerance

AUDIO_EN				when power off
DDR1_V25	AP	184	DDR1 2.5V Power	(2.5V)
SPI_CLK	IO	185	SPI flash serial clock	3.3V Tolerance
SPI_SI	IO	186	SPI flash serial Data Input	3.3V Tolerance
SPI_SO	IO	187	SPI flash serial Data Output	3.3V Tolerance
SPI_CEB	IO	188	SPI flash Chip Enable	3.3V Tolerance
FLASH_WP / GPIO	IO	189	FLASH Write Protect / MCU GPIO	3.3V Tolerance
RESETB	I	190	Chip reset bar	Low active; 5V tolerance even when power-off
VCKK_ON	DP	191	Core Power	(1.1V)
PWM2_1 / TCON[1] / IR_RECEIVER / GPIO	IO	192	PWM / TCON / IR Receiver / MCU GPIO	5V Tolerance when power off
PWM4_1 / TCON[3] / GPIO / Test4b	IO	193	PWM / TCON / MCU GPIO / Test4b	5V Tolerance when power off
TCON[5] / GPIO / Test4b	IO	194	TCON / MCU GPIO / Test4b	5V Tolerance when power off
TCON[4] / GPIO / Test4b	IO	195	TCON / MCU GPIO / Test4b	5V Tolerance when power off
GPIO / Test4b	IO	196	GPIO / Test4b	5V Tolerance when power off
PWM5 / TCON[11] / GPIO	IO	197	PWM / TCON / MCU GPIO	5V Tolerance when power off
IIC_SCL_2 / PWM4 / TCON[11] / GPIO	IO	198	IIC BUS / PWM / TCON / MCU GPIO	5V Tolerance when power off
PWM3 / IIC_SDA_2 / TCON[0] / GPIO	IO	199	PWM / IIC BUS / TCON / MCU GPIO	5V Tolerance when power off
int1/ UART_RX / GPIO / Test4b	IO	200	MCU EXINT / UART RX / MCU GPIO / Test4b	5V Tolerance when power

				off
int0 / UART_TX / GPIO / Test4b	IO	201	MCU EXINT / UART TX / MCU GPIO / Test4b	5V Tolerance when power off
TCON[13] / GPIO / Test4b	IO	202	TCON / MCU GPIO / Test4b	5V Tolerance when power off
TCON[12] / GPIO / Test4b	IO	203	TCON / MCU GPIO / Test4b	5V Tolerance when power off
TCON[10] / GPIO / Test4b	IO	204	TCON / MCU GPIO / Test4b	5V Tolerance when power off
TCON[9] / GPIO / Test4b	IO	205	TCON / MCU GPIO / Test4b	5V Tolerance when power off
PVCC	DP	206	Pad Power	(3.3V)
PGND	DG	207	Pad Ground	
GPI	IO	208	MCU GPI	5V Tolerance power on
PWM2 / TCON[3] / GPIO	IO	209	PWM / TCON / MCU GPIO	3.3V Tolerance
EEI2CSCL / PWM0 / TCON[1] / GPIO	IO	210	EEPROM IIC BUS / PWM / TCON / MCU GPIO	3.3V Tolerance
EEI2CSDA / PWM1 / TCON[2] / GPIO	IO	211	EEPROM IIC BUS / PWM / TCON / MCU GPIO	3.3V Tolerance
DDCSCL2 / GPIO	IO	212	DDC Channel (Open drain I/O) / MCU GPIO	5V Tolerance when power off
DDCSDA2 / GPIO	IO	213	DDC Channel (Open drain I/O) / MCU GPIO	5V Tolerance when power off
DDCSCL3 / GPIO	IO	214	DDC Channel (Open drain I/O) / MCU GPIO	5V Tolerance when power off
DDCSDA3 / GPIO	IO	215	DDC Channel (Open drain I/O) / MCU GPIO	5V Tolerance when power off
GPIO / Test4b	IO	216	MCU GPIO / Test4b	5V Tolerance when power off

7. Electrical Specifications

Electrical Specifications

LQFP216 DC Characteristics (RTD2785T-CG Series)

7.1. Recommended Operating Conditions

Table 2. Recommended Operating Conditions of LQFP216

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Voltage on Input (5V tolerance)	V _{IN}	-1		5.3	V
Supply Voltage	PVCC	3.14	3.30	3.47	V
DDR Voltage	2.5V_DDR	2.38	2.5	2.63	V
Core Power On Voltage	VCCK_ON	1.05	1.1	1.15	V
Core Power Off Voltage	VCCK_OFF	1.05	1.1	1.15	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		110	°C
Thermal Resistance (Junction to Air)	θ _{JA}		26.0		°C/W
Thermal Resistance (Junction to Case)	θ _{JC}		9.9		°C/W
Junction Acceptable Temperature	T _j			125	°C

7.2. Absolute Maximum Ratings

Table 3. Absolute Maximum Ratings of LQFP216

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Supply Voltage	PVCC			3.6	V
Storage Temperature (plastic)	T _{STG}			150	°C
Junction Acceptable Temperature	T _j			125	°C

Note : Operation under the absolute maximum ratings does not imply well-functioning. Long-term stress to the absolute maximum ratings would probably affect the device reliability or further cause permanent damage.

7.3. Reset Period

Table 4. Reset Period of LQFP216

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Reset Pulse Period	Trst-en ¹	1120			ns
Power-on-Reset Period	Tpor-rst ²	145	146.5	148	ms

1. 16 * Xtal_cycle(1/14.3Mhz)

2. 65536*16*2*Xtal_cycle(1/14.3Mhz)

8. Mechanical Specifications

Low Profile Plastic Quad Flat Package 216 Leads

24x24mm² Outline

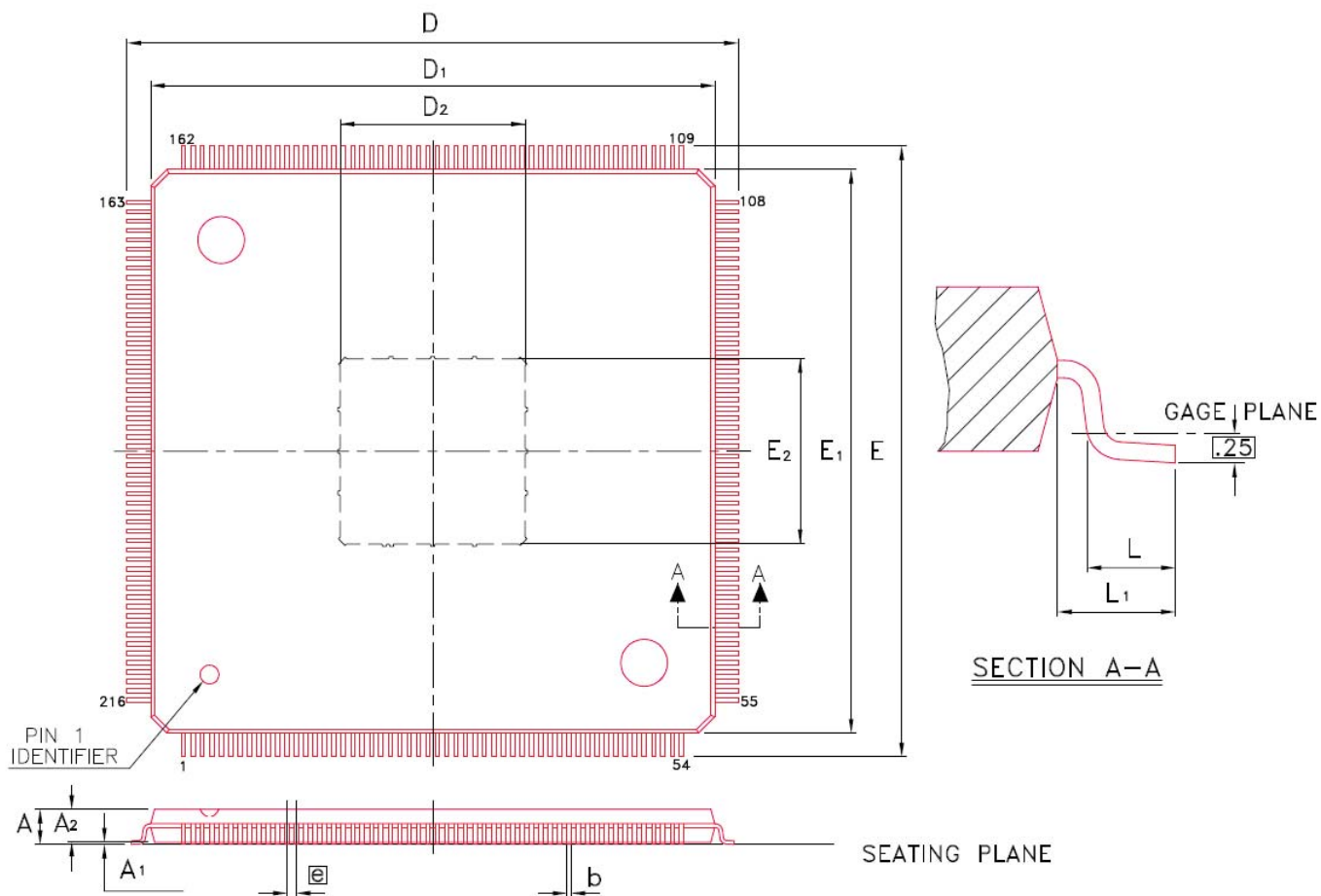


Figure 3. Mechanical Specification of LQFP216 Leads

Table 5. Mechanical Specification of LQFP216 Leads

Symbol	Dimension in mm			Dimension in inch		
	Min	Nom	Max	Min	Nom	Max
A	—	—	1.60	—	—	0.063
A ₁	0.05	—	0.15	0.002	—	0.006
A ₂	1.35	1.40	1.45	0.053	0.055	0.057
b	0.13	0.18	0.23	0.005	0.007	0.009
D/E	26.00 BSC			1.024 BSC		
D ₁ /E ₁	24.00 BSC			0.945 BSC		
D ₂ /E ₂	7.62	7.87	8.12	0.300	0.310	0.320
e	0.40 BSC			0.016 BSC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00 REF			0.039 REF		

Notes :

1. CONTROLLING DIMENSION : MILLIMETER(mm).
2. REFERENCE DOCUMENTL : JEDEC MS-26.

9. Ordering Information

Table 6. Ordering Information

Part No.	Max. Resolution	Input : VGA	Input : DP1.2	Input : DP1.2/ HDMI1.4/ MHL2.2	Input : HDMI1.4/ MHL2.2/ DVI	Output : LVDS	FRC	OD	PKG
RTD2785T -CG	2560x1600 @60Hz	•	1 Ports	1 Ports	2 Ports	•	•	•	LQFP216

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