# RTD2795QT-NG-CG

# MULTI-FUNCTION DISPLAY CONTROLLER

# DATASHEET

**Rev. 1.2**
**19 Sep. 2023**

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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 |
|---|---|---|
| 1.0 | 2019/06/15 | First release. |
| 1.1 | 2020/12/29 | Update the VCCK range |
| 1.2 | 2023/09/19 | Update the support usage up to QHD180Hz. |

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# 1. General Description

The Realtek RTD2795QT-NG-CG monitor controller combines an analog RGB input interface, multiple HDMI 2.0 compliant digital input interfaces with HDCP1.4/HDCP2.2, multiple DP1.4 digital input interfaces with HDCP1.4/HDCP2.2. The embedded MCU is based on an industrial standard 8051 core with external serial flash.

The RTD2795QT-NG-CG is suitable for multiple market segments and display applications, such as monitor, All in One PC, and embedded applications.

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# 2. Features

**General**

- RTD2795QT-NG-CG supports input format up to 4096x2160 @ 60Hz or 2560x1440 @ 180Hz
- RTD2795QT-NG-CG supports one analog RGB input and six multiple-digital-interface combo inputs
- Support multiple panel interfaces like V-by-1, and eDP
- 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

**Ultra-High Speed Receiver**

- RTD2795QT-NG-CG supports 2 ports of Ultra-High Speed Receiver can support DisplayPort1.4
- In DisplayPort mode, three link layer speed HBR2 (5.4GHz), 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, DisplayPort audio is allowed to transmit to I2S/SPDIF output
- RTD2795QT-NG-CG supports 2 ports of Ultra-High Speed Receiver can support HDMI2.0.
- In HDMI mode, the latest HDMI2.0 (6GHz) 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

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- 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

**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)
- Support EOTF(electro-optical transfer function): 10 bits SMPTE 2084
- Support Adaptive Tone-Mapping
- Support BT 2020

**VividColorTM**

- Independent color management (ICM)
- Dynamic contrast control (DCC)
- 2nd generation of Precise color mapping (PCM)
- Content adaptive backlight control (CABC)

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- Support ADC Noise Reduction

**Output Interface**

- Support 8-bit / 10-bit output through either V-by-1 and eDP
- Supports 8-lane V-by-One or 8-lane eDP (HBR) with the output format up to 4096x2160 @ 60Hz or 2560x1440 @ 180Hz
- Support 4-lane eDP (HBR2) with the output format up to 4096x2160 @ 60Hz or 2560x1440 @ 180Hz
- Flexible data pair swapping for easier system design.
- Fixed Last Line output for perfect panel capability

**Embedded OSD**

- Embedded 36K 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 Buufer Support**

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

**Power Supply**

- 3.3V / 1.8V / 1.1V power supply

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# 3. System Applications

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

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# 4. Pin Assignments

## LQFP216

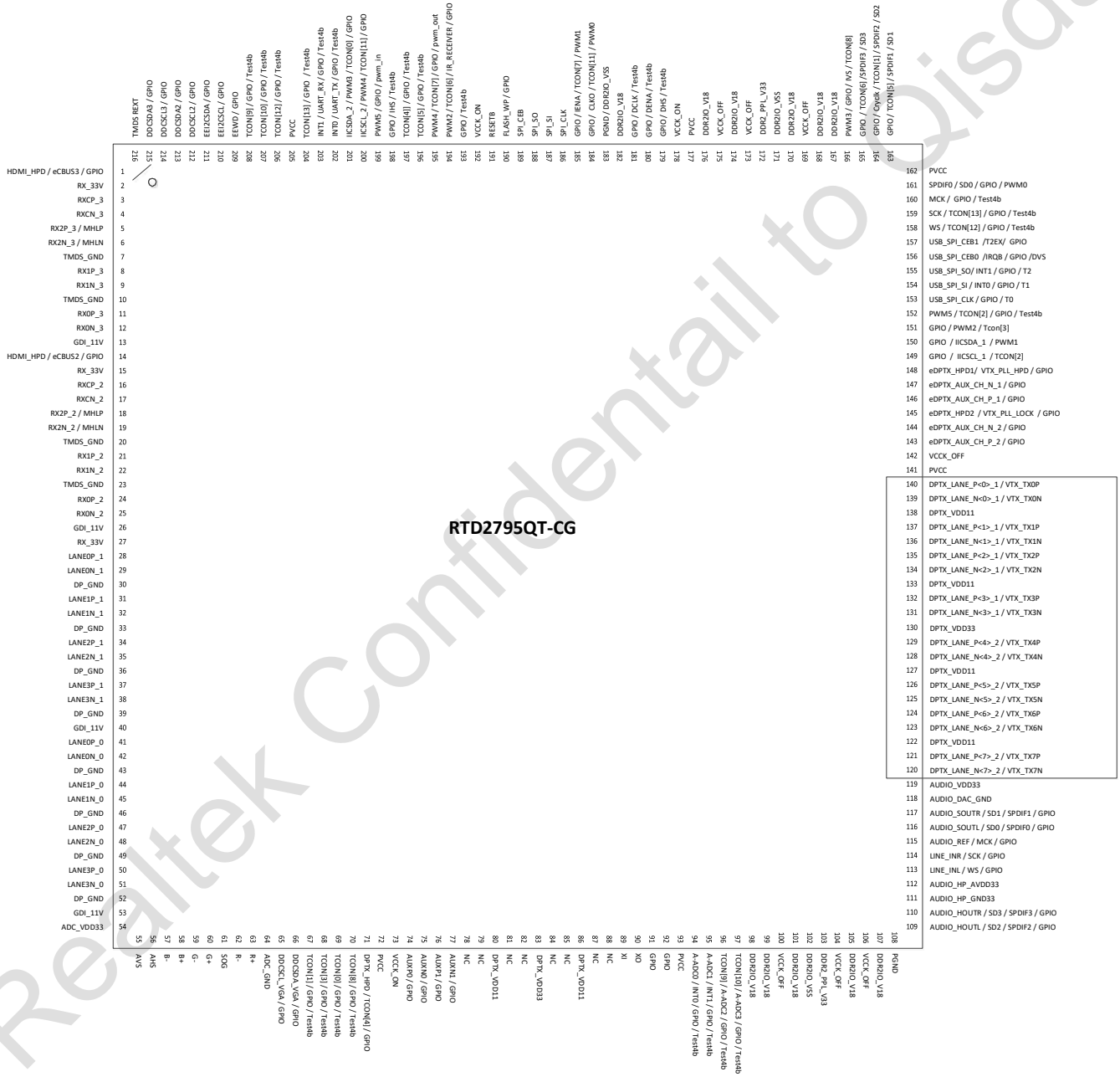



**Figure 1. Pin Diagram of LQFP216**

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# 5. Pin Assignments Table

### LQFP216 Pin Table

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

Table 1. Signals Pin Assignment

| Pin Name | I/O | Pin # | Description | Note |
|---|---|---|---|---|
| HDMI_HPD / eCBUS3 / GPIO | IO | 1 | MHL Cbus / MCU_GPIO / HDMI Hot-plug | 5V Tolerance when power off |
| RX_33V | AP | 2 | GDI 3.3V Power | (3.3V) |
| RXCP_3 | AI | 3 | TMDS Differential Signal Input | |
| RXCN_3 | AI | 4 | TMDS Differential Signal Input | |
| RX2P_3 / MHLP | AI | 5 | TMDS Differential Signal Input | |
| RX2N_3 / MHLN | AI | 6 | TMDS Differential Signal Input | |
| TMDS_GND | AG | 7 | TMDS Ground | |
| RX1P_3 | AI | 8 | TMDS Differential Signal Input | |
| RX1N_3 | AI | 9 | TMDS Differential Signal Input | |
| TMDS_GND | AG | 10 | TMDS Ground | |
| RX0P_3 | AI | 11 | TMDS Differential Signal Input | |
| RX0N_3 | AI | 12 | TMDS Differential Signal Input | |
| GDI_11V | AP | 13 | TMDS Differential Signal Input | (1.1V) |
| HDMI_HPD / eCBUS2/ GPIO | IO | 14 | MHL Cbus / MCU_GPIO / HDMI Hot-plug | 5V Tolerance when power off |
| RX_33V | AP | 15 | GDI 3.3V Power | (3.3V) |
| RXCP_2 | AI | 16 | TMDS Differential Signal Input | |
| RXCN_2 | AI | 17 | TMDS Differential Signal Input | |
| RX2P_2 / MHLP | AI | 18 | TMDS Differential Signal Input | |
| RX2N_2 / MHLN | AI | 19 | TMDS Differential Signal Input | |
| TMDS_GND | AG | 20 | TMDS Ground | |
| RX1P_2 | AI | 21 | TMDS Differential Signal Input | |
| RX1N_2 | AI | 22 | TMDS Differential Signal Input | |
| TMDS_GND | AG | 23 | TMDS Ground | |
| 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) |
| RX_33V | AP | 27 | GDI 3.3V Power | (3.3V) |
| LANE0P_1 | AI | 28 | DP Differential Signal Input | |
| LANE0N_1 | AI | 29 | DP Differential Signal Input | |
| DP_GND | AG | 30 | DP Ground | |
| LANE1P_1 | AI | 31 | DP Differential Signal Input | |
| LANE1N_1 | AI | 32 | DP Differential Signal Input | |

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| | | | | |
|---|---|---|---|---|
| DP_GND | AG | 33 | DP Ground | |
| LANE2P_1 | AI | 34 | DP Differential Signal Input | |
| LANE2N_1 | AI | 35 | DP Differential Signal Input | |
| DP_GND | AG | 36 | DP Ground | |
| LANE3P_1 | AI | 37 | DP Differential Signal Input | |
| LANE3N_1 | AI | 38 | DP Differential Signal Input | |
| DP_GND | AG | 39 | DP Ground | |
| 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 | |
| DP_GND | AG | 52 | DP Ground | |
| GDI_11V | AP | 53 | GDI 1.1V Power | (1.1V) |
| ADC_VDD33 | AP | 54 | ADC 3.3V Power | (3.3V) |
| AVS | AI | 55 | ADC Vertical Sync Input | 5V Tolerance when power off |
| AHS | AI | 56 | ADC Horizontal Sync Input | 5V Tolerance when power off |
| B- | AI | 57 | Negatice Blue analog input (Pb-) | 3.3V Tolerance |
| B+ | AI | 58 | Positive Blue analog input (Pb+) | 3.3V Tolerance |
| G- | AI | 59 | Negatice Green analog input (Y-) | 3.3V Tolerance |
| G+ | AI | 60 | Positive Green analog input (Y+) | 3.3V Tolerance |
| SOG | AI | 61 | Sync-On-Green | 3.3V Tolerance |
| R- | AI | 62 | Negative RED analog input (Pr-) | 3.3V Tolerance |
| R+ | AI | 63 | Positive RED analog input (Pr+) | 3.3V Tolerance |
| ADC_GND | AG | 64 | ADC Ground | |
| DDCSCL_VGA/ | IO | 65 | DDC VGA (Open drain I/O) / | 5V Tolerance |

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| | | | | |
|---|---|---|---|---|
| GPIO | | | MCU GPIO | when power off |
| DDCSDA_VGA / GPIO | IO | 66 | DDC VGA (Open drain I/O) / MCU GPIO | 5V Tolerance when power off |
| TCON[1] / GPIO / Test4b | IO | 67 | TCON / MCU_GPIO / Test4b | 5V Tolerance when power off |
| TCON[3] / GPIO / Test4b | IO | 68 | TCON / MCU_GPIO / Test4b | 5V Tolerance when power off |
| TCON[0] / GPIO / Test4b | IO | 69 | TCON / MCU_GPIO / Test4b | 5V Tolerance when power off |
| TCON[8] / GPIO / Test4b | IO | 70 | TCON / MCU_GPIO / Test4b | 5V Tolerance when power off |
| DPTX_HPD / TCON[4] / GPIO | IO | 71 | DPTX_HPD / TCON / GPIO | 5V Tolerance when power off |
| PVCC | DP | 72 | Pad Power | (3.3V) |
| VCCK_ON | DP | 73 | Core Power | (1.1V) |
| AUXP0 / GPIO | IO | 74 | DPRX AUX-CH / MCU GPIO | 5V Tolerance when power off |
| AUXN0 / GPIO | IO | 75 | DPRX AUX-CH / MCU GPIO | 5V Tolerance when power off |
| AUXP1 / GPIO | IO | 76 | DPRX AUX-CH / MCU GPIO | 5V Tolerance when power off |
| AUXN1 / GPIO | IO | 77 | DPRX AUX-CH / MCU GPIO | 5V Tolerance when power off |
| NC | | 78 | NC | |
| NC | | 79 | NC | |
| DPTX_VDD11 | AP | 80 | DPTX 1.1V Power | |
| NC | | 81 | NC | |
| NC | | 82 | NC | |
| DPTX_VDD33 | AP | 83 | DPTX 3.3V Power | |
| NC | | 84 | NC | |
| NC | | 85 | NC | |
| DPTX_VDD11 | AP | 86 | DPTX 1.1V Power | |
| NC | | 87 | NC | |
| NC | | 88 | NC | |

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|---|---|---|---|---|
| XI | AI | 89 | Crystal Input | 3.3V Tolerance |
| XO | AO | 90 | Crystal Output | 3.3V Tolerance |
| GPIO | IO | 91 | MCU GPIO | 5V Tolerance when power off |
| GPIO | IO | 92 | MCU GPIO | 5V Tolerance when power off |
| PVCC | DP | 93 | Pad Power | (3.3V) |
| A-ADC0/ INT0 / GPIO / Test4b | AI O | 94 | 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 | 95 | 5bits MCU ADC Input / MCU EXINT / MCU GPIO / Test4b | 3.3 V tolerance when using ADC Input; 5V Tolerance power on when using GPIO |
| TCON[9] / A-ADC2 / GPIO / Test4b | AI O | 96 | TCON / 5bits MCU ADC Input / MCU GPIO / Test4b | 3.3 V tolerance when using ADC Input; 5V Tolerance power on when using GPIO |
| TCON[10] / A-ADC3 / GPIO / Test4b | AI O | 97 | TCON / 5bits MCU ADC Input / MCU GPIO / Test4b | 3.3 V tolerance when using ADC Input; 5V Tolerance power on when using GPIO |
| DDR2IO_V18 | AP | 98 | DDR2 1.8V Power | (1.8V) |
| DDR2IO_V18 | AP | 99 | DDR2 1.8V Power | (1.8V) |

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| | | | | |
|---|---|---|---|---|
| VCCK_OFF | DP | 100 | Core Power | (1.1V) |
| DDR2IO_V18 | AP | 101 | DDR2 1.8V Power | (1.8V) |
| DDR2IO_VSS | AG | 102 | DDR2 IO Ground | |
| DDR2_PPL_V33 | AP | 103 | DDR PLL 3.3V Power | (3.3V) |
| VCCK_OFF | DP | 104 | Core Power | (1.1V) |
| DDR2IO_V18 | AP | 105 | DDR2 1.8V Power | (1.8V) |
| VCCK_OFF | DP | 106 | Core Power | (1.1V) |
| DDR2IO_V18 | AP | 107 | DDR2 1.8V Power | (1.8V) |
| PGND | DG | 108 | Pad Ground | |
| AUDIO_HOUTL / SD2 / SPDIF2 / GPIO | AIO | 109 | AUDIO_HOUTL / I2S / SPDIF / MCU GPIO | 3.3V Tolerance |
| AUDIO_HOUTR / SD3 / SPDIF3 / GPIO | AIO | 110 | AUDIO_HOUTL / I2S / SPDIF / MCU GPIO | 3.3V Tolerance |
| AUDIO_HP_GND | AG | 111 | AUDIO HP Ground | |
| AUDIO_HP_AVDD33 | AP | 112 | AUDIO HP 3.3V Power | (3.3V) |
| LINE_INL / WS / GPIO | AIO | 113 | LINE_INL / I2S / MCU GPIO | 3.3V Tolerance |
| LINE_INR / SCK / GPIO | AIO | 114 | LINE_INR / I2S / MCU GPIO | 3.3V Tolerance |
| AUDIO_REF / MCK / GPIO | AIO | 115 | AUDIO_REF / I2S / MCU GPIO | 3.3V Tolerance |
| AUDIO_SOUTL / SD0 / SPDIF0 / GPIO | AIO | 116 | AUDIO_SOUTL / I2S / SPDIF / MCU GPIO | 3.3V Tolerance |
| AUDIO_SOUTR / SD1 / SPDIF1 / GPIO | AIO | 117 | AUDIO_SOUTR / I2S / SPDIF / MCU GPIO | 3.3V Tolerance |
| AUDIO_DAC_GND | AG | 118 | Audio DAC Ground | |
| AUDIO_VDD33 | AP | 119 | Audio DAC 3.3V Power | (3.3V) |
| DPTX_LANE_N<7>_2/ VTX_TX7N | AO | 120 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_LANE_P<7>_2/ VTX_TX7P | AO | 121 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_VDD11 | AP | 122 | DPTX 1.1V Power | (1.1V) |
| DPTX_LANE_N<6>_2/ VTX_TX6N | AO | 123 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_LANE_P<6>_2 / VTX_TX6P | AO | 124 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_LANE_N<5>_2 / VTX_TX5N | AO | 125 | eDPTX / VbyOne | 3.3V Tolerance |

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|---|---|---|---|---|
| DPTX_LANE_P<5>_2 / VTX_TX5P | AO | 126 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_VDD11 | AP | 127 | DPTX 1.1V Power | (1.1V) |
| DPTX_LANE_N<4>_2 / VTX_TX4N | AO | 128 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_LANE_P<4>_2/ VTX_TX4P | AO | 129 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_VDD33 | AP | 130 | DPTX 3.3V Power | (3.3V) |
| DPTX_LANE_N<3>_1 / VTX_TX3N | AO | 131 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_LANE_P<3>_1 / VTX_TX3P | AO | 132 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_VDD11 | AP | 133 | DPTX 1.1V Power | (1.1V) |
| DPTX_LANE_N<2>_1 / VTX_TX2N | AO | 134 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_LANE_P<2>_1 / VTX_TX2P | AO | 135 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_LANE_N<1>_1 / VTX_TX1N | AO | 136 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_LANE_P<1>_1 / VTX_TX1P | AO | 137 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_VDD11 | AP | 138 | DPTX 1.1V Power | (1.1V) |
| DPTX_LANE_N<0>_1 / VTX_TX0N | AO | 139 | eDPTX / VbyOne | 3.3V Tolerance |
| DPTX_LANE_P<0>_1 / VTX_TX0P | AO | 140 | eDPTX / VbyOne | 3.3V Tolerance |
| PVCC | DP | 141 | Pad Power | (3.3V) |
| VCCK_OFF | DP | 142 | Core Power | (1.1V) |
| eDPTX_AUX_CH_P_2 / GPIO | IO | 143 | eDPTX_AUX / MCU GPIO | 5V Tolerance when power off |
| eDPTX_AUX_CH_N_2 / GPIO | IO | 144 | eDPTX_AUX / MCU GPIO | 5V Tolerance when power off |
| eDPTX_HPD2 / VTX_PLL_LOCK / GPIO | IO | 145 | eDPTX_HPD / MCU GPIO | 5V Tolerance when power off |
| eDPTX_AUX_CH_P_1 / GPIO | IO | 146 | eDPTX_AUX / MCU GPIO | 5V Tolerance when power off |
| eDPTX_AUX_CH_N_1 / GPIO | IO | 147 | eDPTX_AUX / MCU GPIO | 5V Tolerance when power off |
| eDPTX_HPD1/ VTX_PLL_HPD / | IO | 148 | eDPTX_HPD / MCU GPIO | 5V Tolerance when power |

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| | | | | |
|---|---|---|---|---|
| GPIO | | | | off |
| GPIO / IICSCL_1 / TCON[2] | IO | 149 | TCON / MCU_GPIO / IIC BUS | 5V Tolerance when power off |
| GPIO / IICSDA_1 / PWM1 | IO | 150 | PWM / MCU_GPIO / IIC BUS | 5V Tolerance when power off |
| GPIO / PWM2 / Tcon[3] | IO | 151 | PWM / TCON / MCU_GPIO | 5V Tolerance when power off |
| GPIO / PWM5 / TCON[2] / Test4b | IO | 152 | PWM / TCON / MCU_GPIO / Test4b | 5V Tolerance when power off |
| USB_SPI_CLK / CLKO / GPIO / T0 | IO | 153 | SPI Serial Clock / CLKO / MCU GPIO / Timer | 5V Tolerance when power off |
| USB_SPI_SI /INT0/ GPIO / T1 | IO | 154 | SPI Serial Data Input / MCU EXINT / MCU GPIO / Timer | 5V Tolerance when power off |
| USB_SPI_SO/ INT1 / GPIO / T2 | IO | 155 | SPI Serial Data Output / MCU EXINT / MCU GPIO / Timer | 5V Tolerance when power off |
| USB_SPI_CEB0 / IRQB / GPIO / DVS | IO | 156 | SPI Chip Enable / IRQB / MCU GPIO / DVS | 5V Tolerance when power off |
| USB_SPI_CEB1 / T2EX / GPIO | IO | 157 | SPI Chip Enable / T2EX / MCU GPIO | 5V Tolerance when power off |
| WS / TCON[12] / GPIO / Test4b | IO | 158 | I2S / TCON / MCU GPIO / Test4b | 5V Tolerance when power off |
| SCK / TCON[13] / GPIO / Test4b | IO | 159 | I2S / TCON / MCU GPIO / Test4b | 5V Tolerance when power off |
| MCK / GPIO / Test4b | IO | 160 | I2S / MCU GPIO / Test4b | 5V Tolerance when power off |
| SPDIF0 / SD0 / GPIO / PWM0 | IO | 161 | PWM / SPDIF / I2S / MCU GPIO | 5V Tolerance when power off |
| PVCC | DP | 162 | Pad Power | (3.3V) |
| GPIO / TCON[5] / SPDIF1 / SD1 | IO | 163 | TCON / SPDIF / I2S / MCU GPIO | 5V Tolerance when power off |
| GPIO / Cryclk / | IO | 164 | TCON / SPDIF / I2S / MCU GPIO | 5V Tolerance |

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| | | | | |
|---|---|---|---|---|
| TCON[1] / SPDIF2 / SD2 | | | | when power off |
| GPIO / TCON[6] / SPDIF3 / SD3 | IO | 165 | TCON / SPDIF / I2S / MCU GPIO | 5V Tolerance when power off |
| PWM3 / GPIO / IVS / TCON[8] | IO | 166 | TCON / PWM / MCU GPIO | 5V Tolerance when power off |
| DDR2IO_V18 | AP | 167 | DDR2 1.8V Power | (1.8V) |
| DDR2IO_V18 | AP | 168 | DDR2 1.8V Power | (1.8V) |
| VCCK_OFF | DP | 169 | Core Power | (1.1V) |
| DDR2IO_V18 | AP | 170 | DDR2 1.8V Power | (1.8V) |
| DDR2IO_VSS | AG | 171 | DDR2 IO Ground | |
| DDR2_PPL_V33 | AP | 172 | DDR PLL 3.3V Power | (3.3V) |
| VCCK_OFF | DP | 173 | Core Power | (1.1V) |
| DDR2IO_V18 | AP | 174 | DDR2 1.8V Power | (1.8V) |
| VCCK_OFF | DP | 175 | Core Power | (1.1V) |
| DDR2IO_V18 | AP | 176 | DDR2 1.8V Power | (1.8V) |
| PVCC | IO | 177 | Pad Power | (3.3V) |
| VCCK_ON | IO | 178 | Core Power | (1.1V) |
| GPIO / DHS / Test4b | IO | 179 | MCU GPIO / Test4b | 5V Tolerance when power off |
| GPIO / DENA / Test4b | IO | 180 | MCU GPIO / Test4b | 5V Tolerance when power off |
| GPIO / DCLK / Test4b | IO | 181 | MCU GPIO / Test4b | 5V Tolerance when power off |
| DDR2IO_V18 | AP | 182 | DDR2 1.8V Power | (1.8V) |
| PGND / DDR2IO_VSS | AG | 183 | DDR2 IO Ground | |
| GPIO / CLKO / TCON[11] / PWM0 | IO | 184 | TCON / PWM / MCU GPIO | 5V Tolerance when power off |
| PWM1 / GPIO / IENA / TCON[7] | IO | 185 | TCON / PWM / MCU GPIO | 5V Tolerance when power off |
| SPI_CLK | IO | 186 | SPI flash serial clock | 3.3V Tolerance |
| SPI_SI | IO | 187 | SPI flash serial Data Input | 3.3V Tolerance |
| SPI_SO | IO | 188 | SPI flash serial Data Output | 3.3V Tolerance |

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| | | | | |
|---|---|---|---|---|
| SPI_CEB | IO | 189 | SPI flash Chip Enable | 3.3V Tolerance |
| FLASH_WP / GPIO | IO | 190 | FLASH Write Protect / MCU GPIO | 5V Tolerance when power off |
| RESETB | I | 191 | Chip reset bar | Low active; 5V tolerance even when power-off |
| VCCK_ON | DP | 192 | Core Power | (1.1V) |
| GPIO / Test4b | IO | 193 | MCU GPIO / Test4b | 5V Tolerance power on |
| PWM2 / TCON[6] / IR_RECEIVER / GPIO | IO | 194 | PWM / TCON / IR Receiver / MCU GPIO | 5V Tolerance when power off |
| PWM4 / TCON[7] / GPIO / pwm_out | IO | 195 | PWM / TCON / PWM OUT / MCU GPIO | 5V Tolerance when power off |
| TCON[5] / GPIO / Test4b | IO | 196 | TCON / MCU GPIO / Test4b | 5V Tolerance when power off |
| TCON[4]] / GPIO / Test4b | IO | 197 | TCON / MCU GPIO / Test4b | 5V Tolerance when power off |
| GPIO / IHS / Test4b | IO | 198 | MCU GPIO / Test4b | 5V Tolerance when power off |
| PWM5 / GPIO / pwm_in | IO | 199 | PWM / PWM IN / MCU GPIO | 5V Tolerance when power off |
| IICSCL_2 / PWM4 / TCON[11] / GPIO | IO | 200 | PWM / TCON / IIC BUS / MCU GPIO | 5V Tolerance when power off |
| IICSDA_2 / PWM3 / TCON[0] / GPIO | IO | 201 | PWM / TCON / IIC BUS / MCU GPIO | 5V Tolerance when power off |
| INT0 / UART_TX /GPIO / Test4b | IO | 202 | MCU EXINT / UART TX / MCU GPIO / Test4b | 5V Tolerance when power off |
| INT1/ UART_RX / GPIO / Test4b | IO | 203 | MCU EXINT / UART RX / MCU GPIO / Test4b | 5V Tolerance when power off |
| TCON[13] / GPIO / Test4b | IO | 204 | TCON / MCU GPIO / Test4b | 5V Tolerance when power off |

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| | | | | |
|---|---|---|---|---|
| PVCC | DP | 205 | Pad Power | (3.3V) |
| TCON[12] / GPIO / Test4b | IO | 206 | TCON / MCU GPIO / Test4b | 5V Tolerance when power off |
| TCON[10] / GPIO / Test4b | IO | 207 | TCON / MCU GPIO / Test4b | 5V Tolerance when power off |
| TCON[9] / GPIO / Test4b | IO | 208 | TCON / MCU GPIO / Test4b | 5V Tolerance when power off |
| EEWD / GPIO | IO | 209 | MCU GPIO | 5V Tolerance when power off |
| EEI2CSCL / GPIO | IO | 210 | EEprome IIC BUS / MCU GPIO | 5V Tolerance when power off |
| EEI2CSDA / GPIO | IO | 211 | EEprome IIC BUS / MCU GPIO | 5V Tolerance when power off |
| 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 |
| TMDS REXT | AI | 216 | Impedance Match Resistor | 12K ohm Reference to GND |

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# 6. Electrical Specifications

Electrical Specifications
**LQFP216 DC Characteristics (RTD2795QT-NG-CG Series)**

## *6.1. 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 | V |
| Supply Voltage | PVCC | 3.14 | 3.30 | 3.47 | V |
| DDR Voltage | DDR2_V18 | 1.7 | 1.8 | 1.9 | V |
| Core Power On Voltage | VCCK_ON | 1.08 | 1.13 | 1.18 | V |
| Core Power Off Voltage | VCCK_OFF | 1.08 | 1.13 | 1.18 | V |
| Electrostatic Discharge | $V_{ESD}$ | | | ±2.5 | kV |
| Latch-Up | $I_{LA}$ | | | ±100 | mA |
| Ambient Operating Temperature | $T_A$ | 0 | | 70 | ºC |
| Storage Temperature (plastic) | $T_{STG}$ | -55 | | 110 | ºC |
| Thermal Resistance (Junction to Air) | $\theta_{JA}$ | | 21.5 | | ºC/W |
| Thermal Resistance (Junction to Case) | $\theta_{JC}$ | | 8.8 | | ºC/W |
| Junction Acceptable Temperature | $T_j$ | | | 125 | ºC |

## *6.2. Absolute Maximum Ratings*

**Table 3. Absolute Maximum Ratings of LQFP216**

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Supply Voltage | PVCC | | | 3.6 | V |
| DDR Voltage | DDR2_V18 | | | 1.98 | V |
| Core Power On Voltage | VCCK_ON | | | 1.21 | V |
| Core Power Off Voltage | VCCK_OFF | | | 1.21 | V |
| Storage Temperature (plastic) | $T_{STG}$ | | | 150 | ºC |
| Junction Acceptable Temperature | $T_j$ | | | 125 | ºC |

**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.**

## *6.3. 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)

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# 7. Mechanical Specifications

Low Profile Plastic Quad Flat Package 216 Leads

24x24mm$^2$ Outline

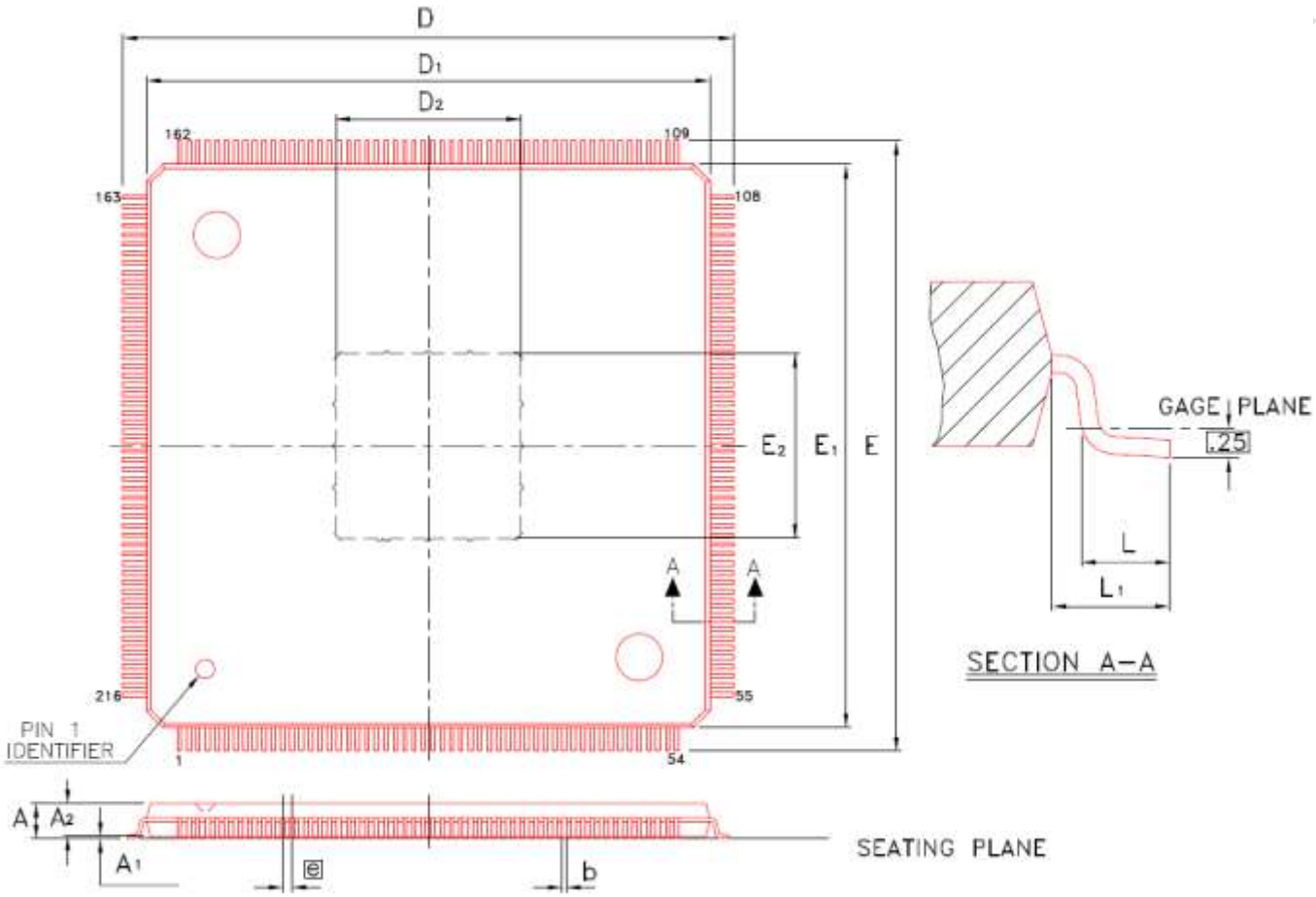



**Figure 2. Mechanical Specification of LQFP216 Leads**

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| 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.

**Table 5. Mechanical Specification of LQFP216 Leads**

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# 8. Ordering Information

**Table 6. Ordering Information**

| Part No. | Max. Resolution | Input : VGA | Input : DP1.4 HBR2 | Input : HDMI2.0 | Output : Vx1/eDP HBR (x8) | Output : eDP HBR2 (x4) | FRC | OD | PKG |
|---|---|---|---|---|---|---|---|---|---|
| RTD2795QT-NG-CG | 4K2K @ 60Hz /QHD@180Hz | ● | 2 Ports | 2 Ports | ● | ● | ● | ● | LQFP216 |

Notes：

1. For QHD@180Hz usage, please check the panel timing table feasibility with RTK first.

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