The TW8823C incorporates many of the features required to create a multi-purpose in-car LCD display system into a single package. It integrates a high-quality 3D comb NTSC/PAL/SECAM video decoder, triple high speed RGB ADCs, high-quality scaler, bit-mapped OSD, triple DACs and image enhancement functions that include features such as Black and White Stretch and favorite color enhancement. It also supports panoramic scaling for conversion to wide screen display format. On the input side, it supports a rich combination of CVBS, S-video, analog RGB, and digital YCbCr/RGB. On the output side, it supports both digital and analog panel types with its built-in timing controller and analog RGB output. In addition, the TW8823C supports LVDS type panels.

The TW8823C also has two PIP (Picture-in-Picture) engines that can display three display sources simultaneously in a single window. It also has a built-in bit-mapped OSD with 16-bit color depth and an acceleration function. It can also accept 18-bit external OSD inputs. In addition, TW8823C has a built-in high-performance microcontroller with cache. Its SPI interface supports various serial flash types.

Features

ANALOG VIDEO DECODER

- NTSC (M, 4.43) and PAL (B, D, G, H, I, M, N, N combination), PAL (60), SECAM with automatic format detection
- Two 10-bit ADCs and analog clamping circuit
- Fully programmable static gain or automatic gain control for the Y or CVBS channel
- Programmable white peak control for the Y or CVBS channel
- Software selectable analog inputs allows either composite or S-video input
- High quality motion adaptive 3D comb filter for both NTSC and PAL with concurrent 3D noise reduction
- PAL delay line for color phase error correction
- Image enhancement with 2D dynamic peaking and CTI

- Digital sub-carrier PLL for accurate color decoding
- Digital horizontal PLL and advanced synchronization processing for VCR playback and weak signal performance.
- Programmable hue, brightness, saturation, contrast, sharpness
- High quality horizontal and vertical filtered down scaling with arbitrary scale down ratio

ANALOG RGB INPUTS

- Triple high-speed 10-bit ADCs with clamping and programmable gain amplifier
- SOG and H/V sync support for YPbPr or RGB input
- Built-in line locked PLL with sync separator
- Supports analog input resolution up to 1080i or WXGA

DUAL DIGITAL INPUTS SUPPORT

- Dual channel digital inputs support with following combination:
  - 1-channel 18/16-bit inputs and 1-channel 8-bit inputs
  - 1-channel 24-bit digital RGB/YCbCr inputs
- Supports both 656 and 601 video formats
- Allows connection to external HDMI receiver

BUILT-IN MICROCONTROLLER

- Built-in 8052 MCU up to 72MHz clock
- Built-in code cache memory to enhance CPU performance
- Supports Single/Dual/Quad IO SPI Flash with 24-bit/32-bit addressing
- System programming through UART
- Supports SPI DMA Read/Write to OSD memory
- Supports I2C Master interface with GPIO
- Supports two UART interface up to 115200bps and 8 bytes RX FIFO
- Supports IR receiver and interrupt output
- Supports 24-bit contiguous addressing mode
**TFT PANEL SUPPORT**
- Built-in both analog and digital timing controller with programmability
- Supports optional single channel LVDS panel with resolution up to WXGA, 80MHz
- Supports 3, 4, 6, or 8 bits per pixel up to 16.8 million colors with built-in dithering engine
- Supports analog panel with resolution up to WQVGA 20MHz

**ON SCREEN DISPLAY**
- Supports three window bitmapped OSD, one 16 bits and two 8 bits bitmap OSD
- Built-in OSD controller with Bit-Blit Engine
- Supports a variety of functions including blinking, transparency, and blending
- Supports External OSD with external alpha blending
- Supports OSD compression
- Supports window width up to 1366

**IMAGE PROCESSING**
- High quality scaler with both up/down and nonlinear scaling support
- Built-in 2D de-interlacing function
- Programmable hue, brightness, saturation, contrast
- Sharpness control with vertical peaking up to +12db
- Programmable color transient improvement control
- Programmable cropping of input video and graphics
- Independent RGB gain and offset controls
- Panorama/water-glass scaling
- DTV hue adjustment
- Programmable 10-bit Gamma correction for each color
- Operated in Frame Sync mode only
- Black/white stretch
- Programmable favorite color enhancement

**DDR-SDRAM**
- Supports 16 bits 155MHz DDR-SDRAM up to 256Mb

**HOST INTERFACE**
- Supports 2-wire serial bus interface
- Supports 8-bits Parallel Host Interface

**CLOCK GENERATION**
- Frequency synthesizer with spread spectrum generate DDR memory and display clocks
- Spread spectrum profile based on triangular modulation with center spread
- Modulation frequency and spread width can be selectable

**POWER MANAGEMENT**
- Supports Panel power sequencing
- Supports DPMS for monitor power management
- 1.8/2.5V/3.3 V operation

**MISCELLANEOUS**
- Built-in single CCFL backlight controller
- Built-in single LED backlight controller
- Built-in touch screen controller with 12-bit ADC
- Power-down mode
- Single 27MHz crystal
- 216 Ld LQFP package
- TW8823AT-LC2-GE is AEC-Q100 qualified

**Applications**
- In-car display controller
- Portable DVD and DVRs players
- Portable media player
Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.

2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.

3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.

4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.

5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations, etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.

6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, “General Notes for Handling and Using Semiconductor Devices” in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.

7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain usage conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.

8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.

9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.

10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.

11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.

12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Rev.4.0-1 November 2017)

Corporate Headquarters
TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact Information
For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact

Trademarks
Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

© 2019 Renesas Electronics Corporation. All rights reserved.