

## TW9992

Low Power NTSC/PAL Video Decoder with Differential CVBS Inputs and MIPI-CSI2 Output Interface

The [TW9992](#) is a low power NTSC/PAL analog video decoder that is designed for automotive applications. It supports single-ended, differential and pseudo differential composite video inputs. Integrated short-to-battery and short-to-ground detection, advanced image enhancement capabilities such as the programmable Automatic Contrast Adjustment (ACA) and the MIPI-CSI2 output interface make the TW9992 an ideal solution for demanding automotive camera applications.

### Features

- **Analog Video Decoder**
  - Software selectable analog input control allows for combinations of single-ended CVBS, and differential CVBS
  - Built-in analog anti-alias filter
  - Two 10-bit ADCs and analog clamping circuit
  - Fully programmable static gain or automatic gain control for the Y channel
  - Programmable white peak control for the Y channel
  - 4-H adaptive comb filter Y/C separation
  - PAL delay line for color phase error correction
  - Digital subcarrier PLL for accurate color decoding
  - Digital horizontal PLL for synchronization processing and pixel sampling
  - Advanced synchronization processing and sync detection for handling nonstandard and weak signal
  - Automatic color control and color killer
  - Chroma IF compensation
  - Programmable output cropping
- **Video Processing**
  - Automatic Contrast Adjustment (ACA)
  - RGB565
  - Programmable hue, brightness, saturation, contrast and sharpness.
  - Image enhancement with peaking and CTI
- **MIPI Output**
  - MIPI 1.1 compliant unidirectional output format
  - YUV 422 or RGB565 output format
- **Digital Output**
  - Output voltage 1.8V to 3.3V with 3.3V tolerance
- **Miscellaneous**
  - Low power consumption: 100mW typical
  - Power save and Power-down mode
  - Short-to-battery detection test
  - Short-to-ground detection test
  - Two-wire MPU serial bus interface
  - Supports real time control interface
  - Single 27MHz crystal for all operations
  - Supports 24.54MHz and 29.5MHz crystal for high resolution square pixel format decoding
  - 3.3V tolerant I/O
  - 1.8V/3.3V power supply
  - 32 Ld QFN (WQFN with wettable flanks)
  - TW9992AT-NA1-GE is [AEC-Q100](#) qualified

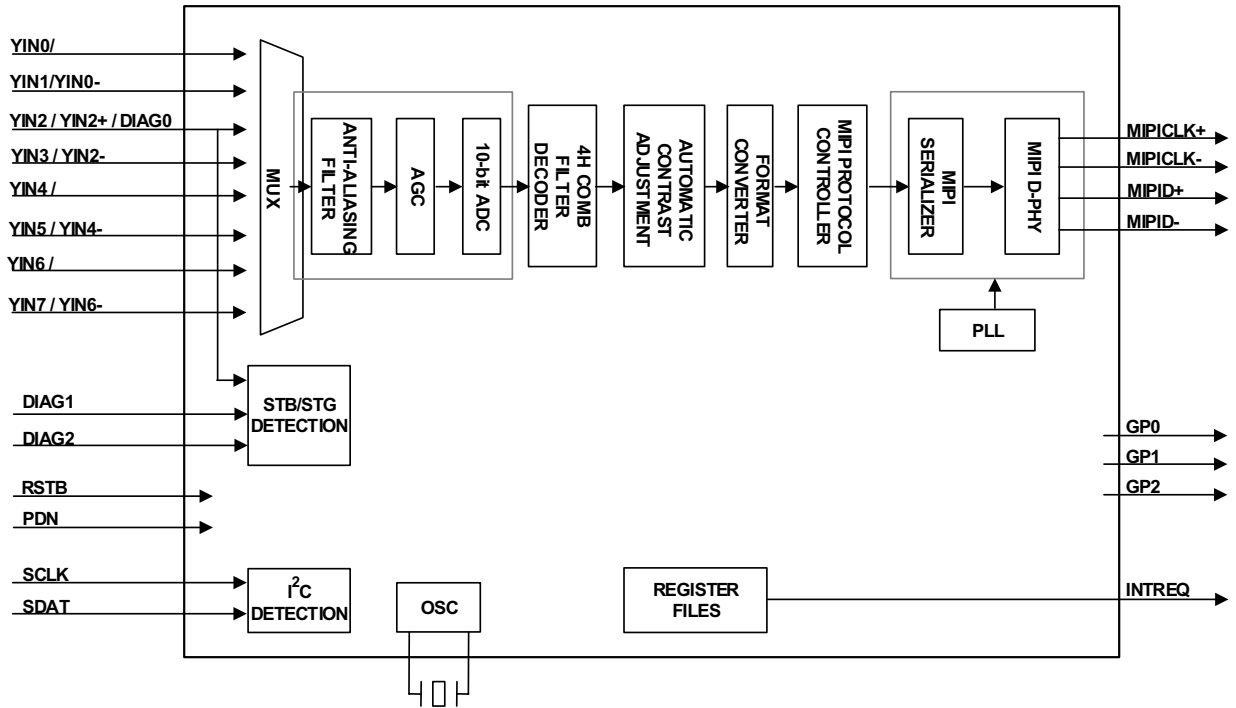


Figure 1. TW9992 Functional Block Diagram

## 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 be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. 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.
6. 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.

7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION ("Vulnerability Issues"). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. 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.