

## Advanced HD decoder

Data brief

### Features

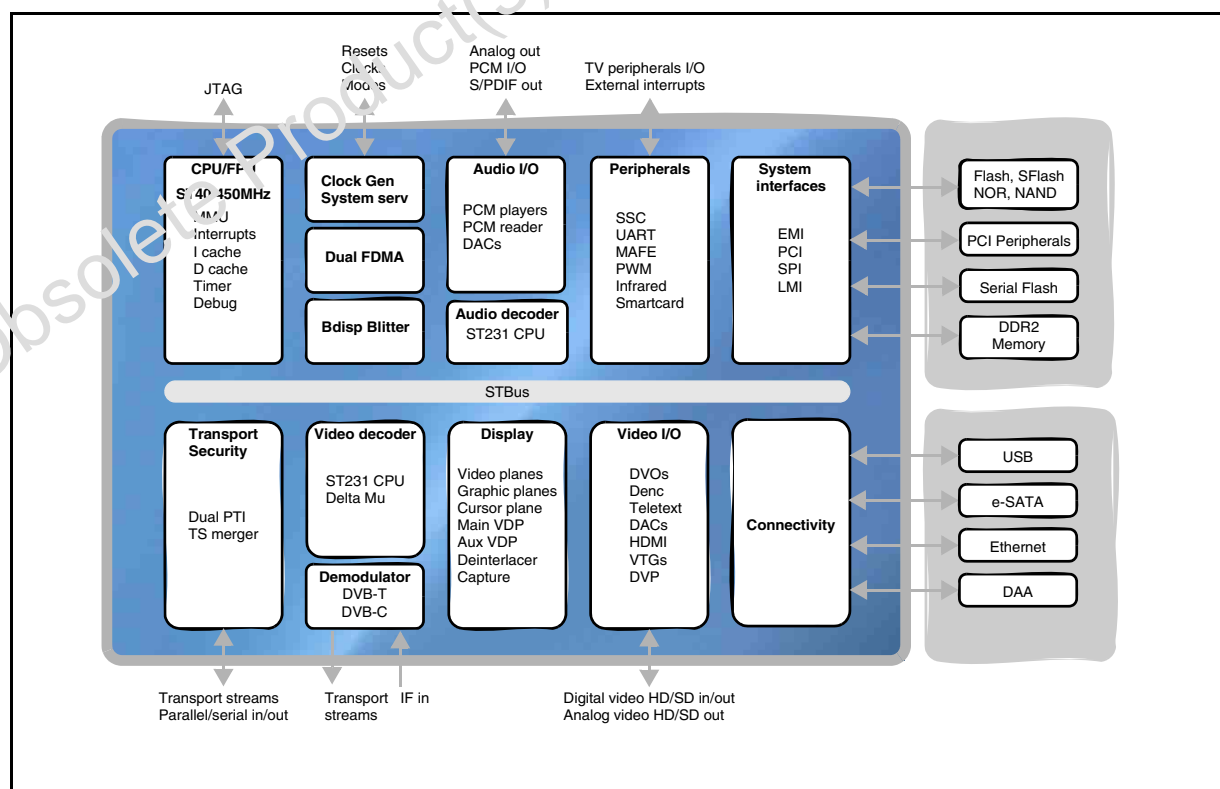
- Advanced high-definition video decoding (H264/VC-1/MPEG2/AVS)
- Advanced standard-definition video decoding (H264/VC-1/MPEG2/AVS)
- Advanced multi-channel audio decoding (MPEG 1, 2, MP3, DD/DD+, AAC/AAC+, WMA9/WMA9pro, Dolby TrueHD, DTS/DTS-HD/DTS-HD master)
- Linux, Windows CE, and OS21 compatible ST40 applications CPU (450 MHz)
- 16/32-bit DDR2 compatible local memory interface
- Multi-stream, DVR capable transport stream processing

- Extensive connectivity (dual USB hosts, dual e-SATA, Ethernet MAC/MII/RMII/GMII, 2<sup>nd</sup> Ethernet MAC/MII/RMII, MMC/SD/SDIO, and PCI)
- Advance security and DRM support including SVP, MS-DRM, DivX, and DTCP-IP
- BD/DVD data decryption and advanced content protection

### Description

The ST-9160 uses ST's state of the art process technology to provide a fully featured HD AVC decoder IC.

It is a highly integrated system-on-chip suitable for TV markets across all networks (cable/satellite/DTT/x-DSL/IP) worldwide.



# 1 Introduction

The ST-9160 is targeted at the latest operator and CE manufacturer requirements for TVs which utilize advanced HD decoding (H264/VC-1/MPEG2/AVS), and which conform to DVB, ISMA, ATIS-IIF, SCTE, DirecTV, ATSC, ARIB, CEA, ITU, OpenCable, MSTV, and BD specifications.

The ST-9160 provides a solution for operators to specify a range of cost-efficient, high performance HD TVs including cost-efficient Zappers, IP clients, Interactive TVs, DVR standalone and DVR server/home network capable TVs, and with content delivery possible using broadcast or broadband networks, or both (hybrid TVs).

The ST-9160 keeps pace with the latest conditional access, DRM and trusted platform requirements of major operators worldwide by incorporating the latest generation of advanced security features.

The ST-9160 offers current users of ST's growing family of advanced decoding ICs enhancements in performance and features whilst reducing cost and time-to-market for the next generation deployments.

Features	Benefits
NAND Flash or Serial Flash based secure boot and code storage	Enables further BOM optimization and cost reduction of advanced decoding HD TVs
ST40-300 applications CPU @450MHz, 32 KI cache, 32 KD cache	Up to 800DMIPs superscalar performance from a single CPU core using standard tools and operating systems (Linux, OS21)
ST's DELTA decoding system with ST231 processor	Decoding of advanced high definition standards for broadcast (MPEG2, H264, VC-1, and AVS for China markets) plus performance and flexibility for web-based content decoding such as Flash, DivX, MJPEG and Real
Dual USB 2.0 hosts, Dual e-SATA, PCI, SD-MMC/SDIO, 10/100 Ethernet MAC/MII and a 10/100/1000 Ethernet MAC with MII/RMII/TMII and GMII interfaces	Extensive high speed connectivity for attaching to the widest range of TV peripherals, such as Flash drives, internal and external HDDs, Home network controllers (e.g. MoCA, Wifi, Homeplug), DOCSIS modem, Memory Cards and support for Gigabit Ethernet interfacing
Low power process, design and architecture	Best in class lowest power standby mode to meet emerging energy standards for TVs. Dynamic configuration of power to individual sub-systems enables power efficient active standby modes
Advanced 2D graphics and display subsystem with Tile RAM bandwidth saver supports also 3D user interface effects	Allows more visually appealing program guides, user interfaces and video rich navigation to be offered to consumers
1080p60 display output with deep color support over HDMI 1.3	High quality progressive output can be watched on the latest high definition displays with enhanced color vividness

## 1.1 ST-9160 features summary

The ST-9160 has the following main features:

### CPU

- High performance CPUs for applications (ST40) and audio/video decoding (2 x ST231)
  - ST40-300, dual-issue, applications CPU, 32 KI, 32 KD caches, MMU, FPU
  - Target speed 450 MHz delivering > 800 DMIPs

### System and memory interfaces

- Single 16/32-bit DDR2 local memory interface (LMI), up to 400 MHz
- 16-bit External Memory and Peripheral Interface (EMI) - up to five banks
- Interfacing to, and boot from, parallel NOR or NAND FLASH
- High Speed SPI port for interfacing to and boot from Serial FLASH
  - Supports standard SPI and dual I/O protocols
- 32-bit, 33 MHz, PCI Interface, shared on EMI with access interleaving possible
- Disc-less timeslip feature supported via NAND Flash (Raw or Managed) attached to EMI, USB, or MMC interfaces

### Video decoding

- Latest generation “Delta” video decoder with ST231 programmable CPU core:
  - MPEG2, H264, VC-1/WM9, HD or SD advanced video decoding
  - AVS HD/SD decoding
  - Provides flexibility to support other codecs (DivX, XviD, H263 encode/decode, Flash, Real, MJPEG)
  - HD and SD decoding or dual SD decoding, PIP & Mosaic capable
  - Real-time transcoding of MPEG2 SD to H264 SIF
- Advanced de-blocking, mosquito noise reduction of decoded MPEG2 SD sources based on ST’s Digital Source Enhancer (DSE) technology with 2D analysis window and Texture Adaptive Filter

### Audio

- ST231 CPU based Audio Decoder. MPEG1 I/II, MP3, Dolby Digital/DD+, MPEG4 AAC/AAC+, Dolby TrueHD, DTS, DTS-HD, DTS HD Master audio multi-channel audio decoding
  - Concurrent audio description decoding
  - DD+ and AAC+ transcoding
- Integrated stereo audio DAC
- 7.1-channel audio PCM output interface and separate stereo audio PCM output interface
- Stereo audio PCM input interface
- Independent SPDIF output

## Display and output

- Main and Aux Video display pipelines:
  - Main: high quality H & V reformatting/resizing with sample rate conversion/filtering. Motion and detail adaptive spatial and temporal de-interlacing for 480p/576p and 1080p60 progressive output; Film mode detection
  - Aux: high quality H & V reformatting/resizing with sample rate conversion/filtering
- Three independent graphics planes with H&V resize, CLUT and anti-flicker filtering
- Link list based 2D graphics blitter
  - Up to 266 Mpixels/sec with destination alpha blending
  - Capable of high performance animated 3D user interface effects with tile RAM bandwidth saver enhancement
  - Run length decoding support for BD
- Independent main and aux display compositions (Video/Graphics mixing)
- Pass-through display for graphics, main video or aux video output concurrently with main and aux compositions
- HD display capture and down-conversion for concurrent HD and SD output of the main composition
- HDMI interface with HDCP copy protection (HD/ED/SD formats up to 1080p60)
  - Is in full compliance with all features of v1.3a, including deep color, enhanced colorimetry pass through (xvYCC, gamut metadata), 8 ch PCM, high bit rate (HBR) audio, and CEC
- Display output:
  - 16-bit Digital Video Output (DVO) for main display composition (HD/ED/SD formats up to 1080p60)
  - Second 24-bit DVO for pass through display or main/aux display compositions (HD/ED/SD formats up to 1080p60)
  - Macrovision and Dwight Cavendish copy protection support
  - PAL/NTSC/SECAM digital encoder
  - Six 10-bit DACs for component/composite analog video output (HD/ED/SD formats up to 1080i)
- SD/HD Digital Video Input port, 8- or 16-bit YCbCr

## Connectivity

- Dual USB 2.0 host interfaces both with PHY
- Integrated 10/100/1000 Ethernet GMAC, Wake on LAN, multiple h/w address filters
  - Supports 10/100 MII/RMII, Turbo-MII (TMII) up to 300 Mbits/sec and GMII up to 1000 Mbits/sec
- Second Ethernet MAC supporting 10/100 MII/RMII
- Soft Modem support: integrated MAFE: integrated system side DAA (Si-Labs)

### Transport/Security

- Quadruple external TS inputs, triple internal TS from memory
- Dual DVB-CI+ (HD/SD profiles) modules supported
- Multi-stream transport stream de-multiplexing, 400 Mbits/sec, Quadruple tuner DVR capable
- DVB/DES/TDES/AES/Multi-2/ICAM descrambling
- DVR supported, with HDD attachment through e-SATA, EIDE (PIO mode) or USB
- CSS (DVD-video) and CPPM (DVD-audio) decryption is provided for the DVD stream
- Blu-Ray (BD) security: BD+/AACs
- Advanced security:
  - Secure control words
  - Secure boot with code authentication
  - JTAG locking
  - Network/DVR copy protection

### TV Peripherals, package

- On-chip TV peripherals:
  - Two Smart Card interfaces
  - Four UARTs
  - Four SSC/I2C
  - GPIO banks with alternate functions
  - IR Tx/Rx
  - UHF Rx/SCP
  - PWM
  - ILC
  - HDMI CEC
  - 4 x 4 key matrix scanner
- Package:
  - FPGBA 27 x 27mm
  - 620 balls
  - Pitch 0.8 mm
  - Ball 0.5 mm
  - Ball to ball compatible with ST-9150 with additional balls assigned
- Dual Multi-channel Flexible DMA Controllers

## 2 Target applications

The ST-9160 integrates in a single IC, multi-stream transport demultiplexing, applications CPU, A/V decode, video processing, graphics and display, advanced security, TV peripherals, audio/video DACs, digital A/V outputs, HDMI, dual e-SATA ports, dual USB ports, dual Ethernet controllers (1x GbE capable) and MMC/SD/SDIO card controller.

**Figure 1. IP client HD TV (wired Ethernet or Wi-Fi connection)**

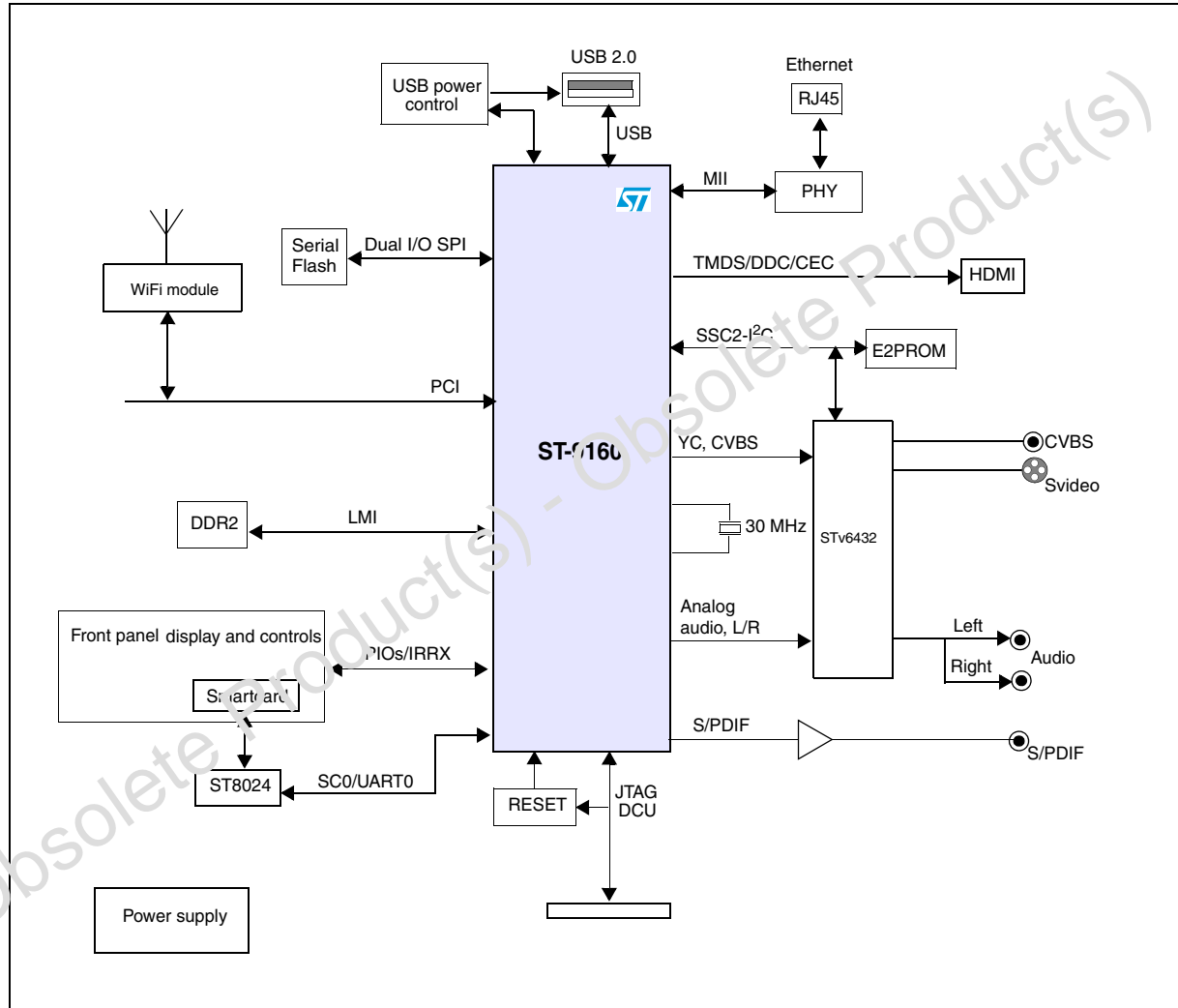


Figure 2. Hybrid DTT/IP HD TV

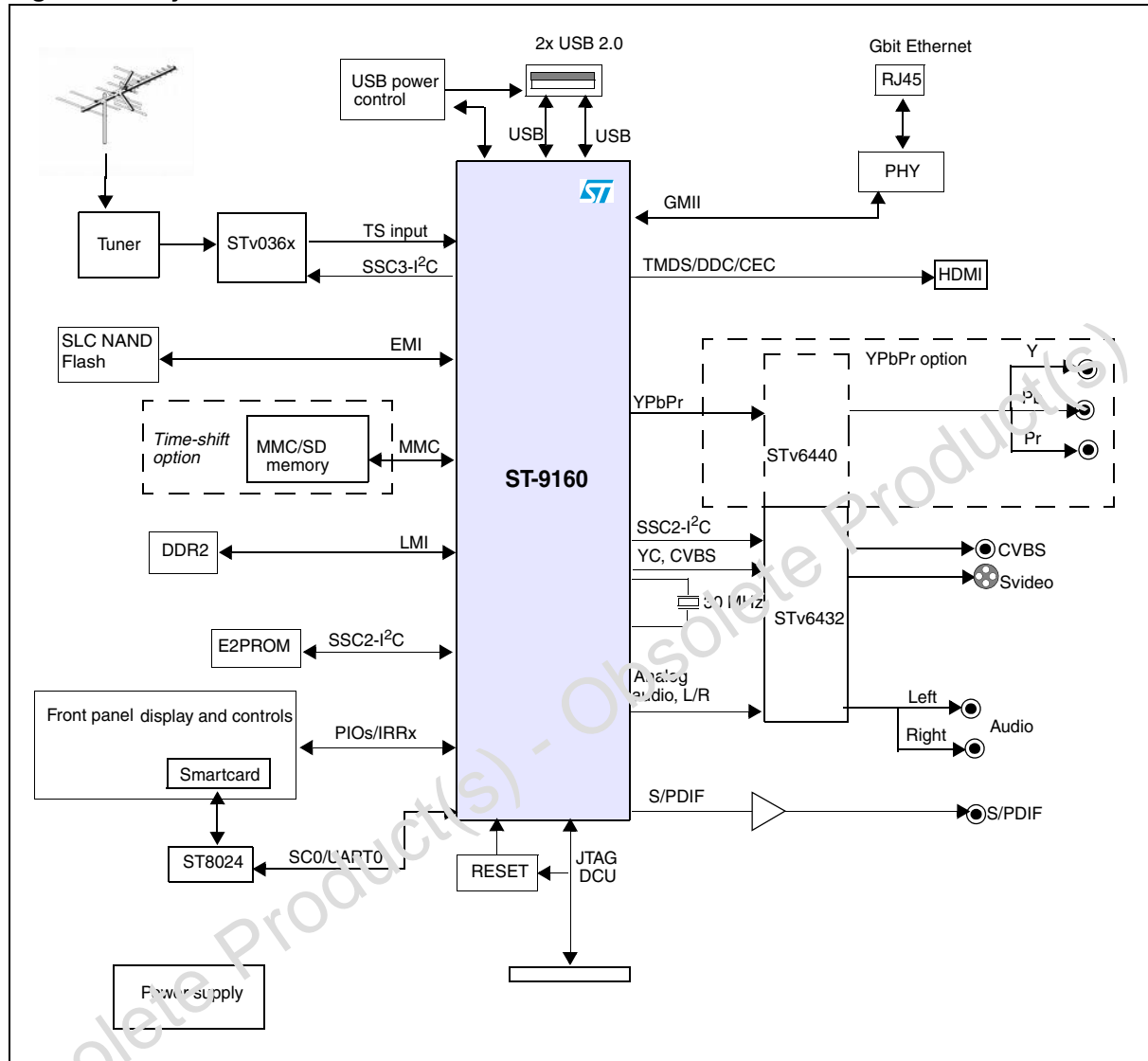


Figure 3. Dual tuner DVB-C/IP HD DVR TV with MoCA

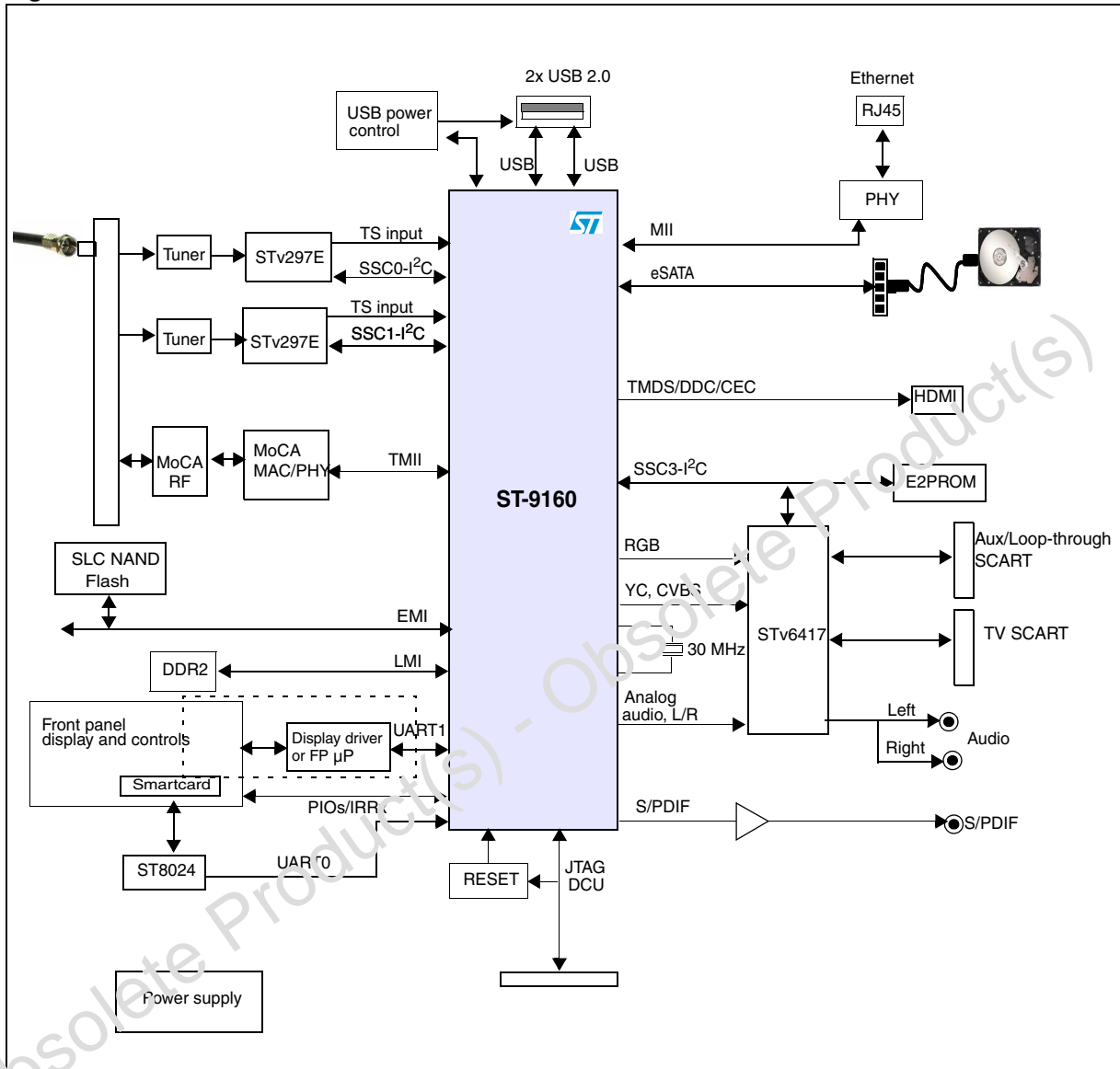


Figure 4. Multi tuner DVB-C/IP HD DVR TV with DOCSIS

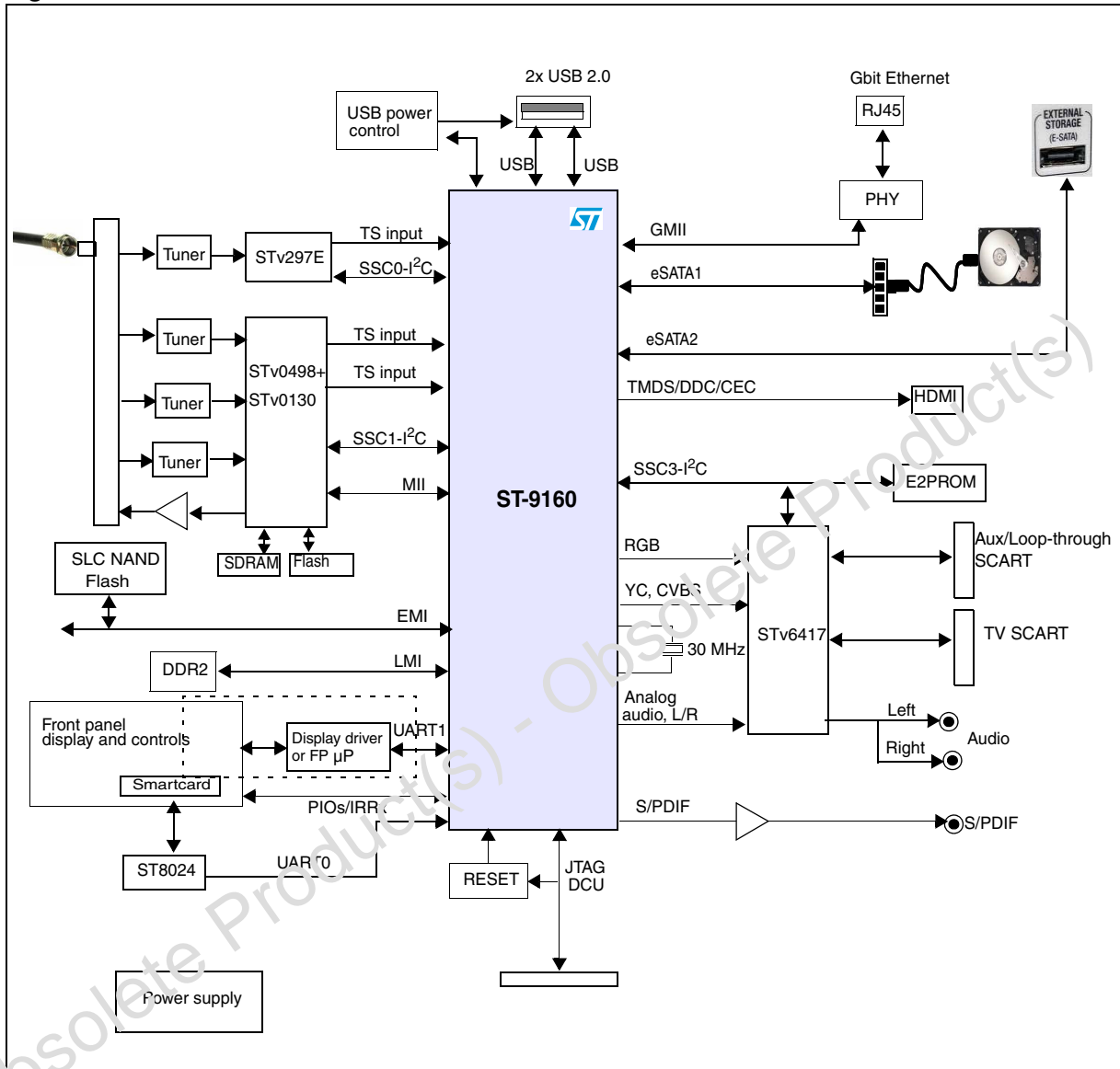
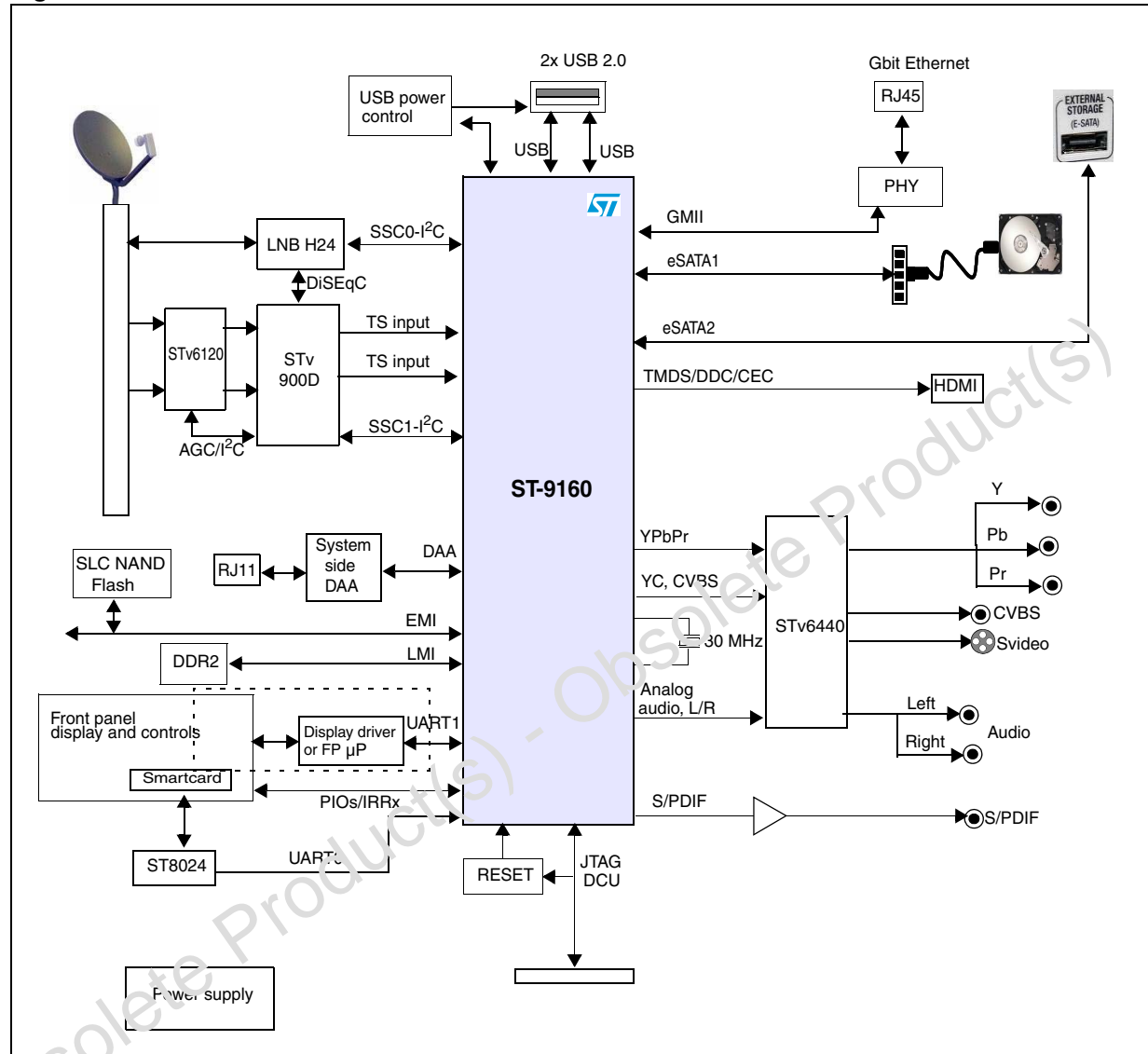


Figure 5. Dual tuner DVB-S2/IP HD DVR TV



### 3 Ordering information

**Table 1. Ordering information**

Order code	Packaging	Description
ST-9160ZUA	FPBGA 27 x 27 mm	Development version, all options

## 4 Revision history

**Table 2. Document revision history**

Date	Revision	Changes
25-Jan-2010	1	Initial release.
14-Sep-2010	2	Removed reference to CPRM in Section 1.1.

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