Attention Please: Under the technology license agreement between MStar and Dolby/SRS/BBE/DivX/Microsoft/QSound, MStar is obliged not to provide samples that incorporate Dolby/SRS/BBE/DivX/Microsoft/QSound technology to any third party who is not a qualified licensee of Dolby/SRS/BBE/DivX/Microsoft/QSound respectively.

FEATURES

TSUMV59XUS is a highly integrated single chip solution for analog TV systems supporting TV channel and various multi-media decoding

Key features includes,

1. *Analog TV Front-End Demodulator*
2. *Multi-Standard A/V Format Decoder*
3. *The MStarACE-6 Video Processor*
4. *Home Theater Sound Processor*
5. *Embedded Memory for optimized BOM cost*
6. *Transport-Stream Input for Extended DTV System*
7. *Peripherals and Low-Power Standby Mode*

■ High Performance Micro-processor
- High speed/performance 32-bit RISC CPU
- Two full duplex UARTs
- Supports USB and ISP programming
- DMA Engine

■ MPEG-2 Video Decoder
- ISO/IEC 13818-2 MPEG-2 video MP@HL
- Automatic frame rate conversion
- Supports resolution up to HDTV (1080i, 720p) and SDTV

■ MPEG-4 Video Decoder
- ISO/IEC 14496-2 MPEG-4 ASP video decoding
- Supports resolutions up to HDTV (1080p@30fps)
- Supports DivX[1] Home Theater & HD profiles**Optional**
- Supports VC-1, FLV video format decoding

■ H.264 Decoder
- ITU-T H.264, ISO/IEC 14496-10 (main and high profile up to level 4.1) video decoding
- Supports resolutions for all DVB, ATSC, HDTV, DVD and VCD
- Supports resolution up to 1080p@30fps
- Supports CABAC and CAVLC stream types
- Processing of ES and PES streams, extraction

and provision of time stamps
- Up to 40 Mbits bitrate (Blu-ray spec.)

■ RealMedia Decoder
- Supports maximum resolution up to 1080p@30fps
- Supports RV8, RV9, RV10, and RA8-LBR decoders
- Supports file formats with RM and RMVB
- Supports Picture Re-sampling
- Supports in-loop de-block for B-frame

■ AVS Video Decoder
- Jizhun profile, level 6.0
- Max. resolutions up to 1920x1080@30fps
- Supports bit rate up to 20Mbps
- Supports TSP and file mode input

■ Hardware JPEG
- Supports sequential mode, single scan
- Supports both color and grayscale pictures
- Following the file header scan the hardware decoder fully handles the decode process
- Supports programmable Region of Interest (ROI)
- Supports formats: 422/411/420/444/422T
- Supports scaling down ratios: 1/2, 1/4, 1/8
- Supports picture rotation

■ NTSC/PAL/SECAM Video Decoder
- Supports NTSC-M, NTSC-J, NTSC-4.43, PAL (B, D, G, H, M, N, I, Nc), and SECAM standards
- Automatic standard detection
- Motion adaptive 3D comb filter
- Three configurable CVBS & Y/C S-video inputs
- Supports Closed Caption (analog CC 608/ analog CC 708/digital CC 608/digital CC 708), V-chip and SCTE

■ Multi-Standard TV Sound Processor
- SIF audio decoding
- Supports BTSC/A2/EIA-J demodulation
- Supports FM/AM demodulation
- Supports MTS Mode Mono/Stereo/SAP in BTSC/ EIA-J mode

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[1] **Trademark of DivX, Inc.**

Optional **Please contact MStar sales for the correct suffix.**

- Supports Mono/Stereo/Dual in A2 mode
- Built-in audio sampling rate conversion (SRC)
- Audio processing for loudspeaker channel, including volume, balance, mute, tone, EQ, virtual stereo/surround and treble/bass controls
- Advanced sound processing options available, for example: Dolby[1], SRS[2], BBE[3], QSound[4]
- Supports digital audio format decoding:
  - MPEG-1, MPEG-2 (Layer I/II), MP3, Dolby Digital (AC-3) **Optional**, AAC-LC, WMA
  - Dolby Digital Plus **Optional**

■ Audio Interface

- Four L/R audio line-inputs
- Two L/R outputs for main speakers and additional line-outputs
- I2S digital audio input & output
- S/PDIF digital audio output
- HDMI audio channel processing
- Programmable delay for audio/video synchronization

■ Analog RGB Compliant Input Ports

- Two analog ports support up to 1080P
- Supports PC RGB input up to SXGA@75Hz
- Supports HDTV RGB/YPbPr/YCbCr
- Supports Composite Sync and SOG Sync-on-Green
- Automatic color calibration
- AV-link support

■ Analogue RGB Auto-Configuration & Detection

- Auto input signal format and mode detection
- Auto-tuning function including phasing, positioning, offset, gain, and jitter detection
- Sync Detection for H/V Sync

■ DVI/HDCP/HDMI Compliant Input Ports

- Two HDMI/DVI Input ports
- HDMI 1.3/1.4 Compliant
- HDCP 1.2 Compliant
- 225MHz @ 1080P 60Hz input with 12-bit Deep-color support
- Supports CEC
- Supports HDMI 3D format input
- Supports HDMI 4Kx2K input
- Supports HDMI ARC
- Single link DVI 1.0 compliant
- Robust receiver with excellent long-cable support

■ MStar Advanced Color Engine (MStarACE-6[UC])

- 10-bit Data Processing Path
- Fully programmable multi-function scaling engine
  - Nonlinear video scaling supports various modes including Panorama
  - Supports dynamic scaling for RM, VC-1
- Advanced video processing engine
  - Mstar Ultra-Clear video deinterlacer with edge and artifact smoother
  - Mstar Ultra-Clear Noise Reduction Engine
  - Edge-oriented deinterlacer with edge and artifact smoother
  - Automatic 3:2/2:2/M:N pull-down detection and recovery
  - 3D noise reduction for lousy air/cable input
  - Automatic de-blocking
  - MStar Cross-Color Compression Technology
  - Arbitrary frame rate conversion
- MStar Professional Picture Enhancement:
  - Dynamic brilliant and fresh color
  - Dynamic *Blue Stretch*
  - Intensified contrast and details
  - Dynamic *Vivid Skin*
  - Dynamic sharpened Luma/Chroma edges
  - Global and local dynamic depth of field perception
  - Accurate and independent color control
  - Supports sRGB and xvYCC color processing
  - Supports HDMI 1.3 deep color format
- Programmable 12-bit RGB gamma CLUT

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[1] **Trademark of Dolby Laboratories**
[2] **Trademark of SRS Labs, Inc.**
[3] **Registered trademark of BBE Sound, Inc.**
[4] **Registered trademark of QSound Labs, Inc.**
Optional **Please see Ordering Guide for details.**

- ■ Output Interface
  - Single/dual link 10-bit LVDS output
  - Supports panel resolution up to Full-HD (1920x1080) @ 60Hz
  - Supports TH/TI format
  - Supports dithering options to 6/8-bit output
  - Spread spectrum output for EMI suppression
  - Supports 60Hz 3D passive panel (Line alternative mode)
- ■ CVBS Video Outputs
  - Supports CVBS bypass output
- ■ 3D-like Graphics Engine
  - Hardware Graphics Engine for responsive interactive applications
  - Supports point draw, line draw, rectangle draw/fill, text draw and trapezoid draw
  - BitBlt, stretch BitBlt, trapezoid BitBlt, mirror BitBlt and rotate BitBlt
  - Supports alpha and destination alpha compare
  - Raster Operation (ROP)
  - Support Porter-Duff

- ■ VIF Demodulator
  - Compliant with NTSC M/N, PAL B, G/H, I, D/K, SECAM L/L' standards
  - Digital low IF architecture
  - Audio/Video dual-path processor
  - Stepped-gain PGA with 25 dB tuning range and 1 dB tuning resolution
  - Maximum IF gain of 37 dB
  - Programmable TOP to accommodate different tuner gain and SAW filter insertion loss to optimize noise and linearity performance
  - Multi-standard processing with dual SAW or sawless
  - Supports silicon tuner low IF output architecture
- ■ Connectivity
  - Two USB 2.0 host ports
  - USB architecture designed for efficient support of external storage devices in conjunction with off air broadcasting
- ■ Miscellaneous
  - Bootable SPI interface with serial flash support
  - Lower power standby mode
  - 128-pin EPLQFP package
  - Operating Voltages: 1.26V (core), 1.8V and 3.3V (I/O and analog)

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GENERAL DESCRIPTION

The TSUMV59XUS is a highly integrated TV SoC solution for advanced analog television platform. Integrating latest advanced technologies from Mstar Semiconductor, the world leading TV SoC provider in TV industry, TSUMV59XUS provides the most cost-efficient solution for multimedia TV application with creative and attractive features exclusively presented.

In order to achieve the lowest BOM cost in a multi-media TV platform, TSUMV59XUS integrates TV/multi-media all-purpose AV decoder, VIF demodulator, and advanced Sound/Video processors into a single device. This not only reduced the overall BOM significantly, but also facilitates the design of originally-complicated TV systems for developers. In addition, the memory-embedded solution by TSUMV59XUS can reduce the excessive work of memory interface routing on board and the risk of memory performance degradation while powering cost-down in the total system.

The powerful multimedia A/V decoder inside TSUMV59XUS is hosted with a dedicated hardware video codec engine to secure fast and stable video streaming playback. Moreover, TSUMV59XUS is equipped with a DSP specifically designated for audio application, including digital audio format decoding and advanced sound effects, and a high performance RISC CPU to manipulate all possible routines and house-keeping activities. With extendable USB 2.0 interface, an TSUMV59XUS based system can turn into a high quality media-center in a simple manner.

For standard users, the TSUMV59XUS provides multi-standard analog TV support with adaptive 3D video decoding and VBI data extraction. The build-in audio decoder is capable of decoding FM, AM, A2, BTSC and EIA-J sound standards. TSUMV59XUS also supplies all the necessary A/V inputs and outputs to complete a receiver design including HDMI receivers and component video ADCs. All input selection multiplexers for video and audio are integrated, including full SCART support with CVBS output. The equipped MStar MStarACE-6 color engine is the latest masterpiece of MStar technologies, providing excellent video and picture quality in Full-HD and large-scale display system.

Lastly, TSUMV59XUS supports an ultra low power standby mode to meet the latest energy legislative requirements without any additional hardware. TSUMV59XUS also supports one serial transport-stream input for the extended application of low-cost digital TV system for DTMB market.

ELECTRICAL SPECIFICATIONS
Analog Interface Characteristics

Parameter	Min	Typ	Max	Unit
VIDEO ADC Resolution		10		Bits
DC ACCURACY				
Differential Nonlinearity		TBD		LSB
Integral Nonlinearity		TBD		LSB
VIDEO ANALOG INPUT				
Input Voltage Range				
Minimum		0.5		V p-p
Maximum		TBD		V p-p
Input Bias Current			1	uA
SWITCHING PERFORMANCE				
Maximum Conversion Rate	170			MSPS
Minimum Conversion Rate			12	MSPS
HSYNC Input Frequency	15		200	kHz
PLL Clock Rate	12		170	MHz
PLL Jitter		TBD		ps p-p
Sampling Phase Tempco		TBD		ps/°C
DIGITAL INPUTS				
Input Voltage, High (V_{IH})	2.5			V
Input Voltage, Low (V_{IL})			0.8	V
Input Current, High (I_{IH})			-1.0	uA
Input Current, Low (I_{IL})			1.0	uA
Input Capacitance		5		pF
DIGITAL OUTPUTS				
Output Voltage, High (V_{OH})	VDDP-0.1			V
Output Voltage, Low (V_{OL})			0.1	V
VIDEO ANALOG OUTPUT				
CVBS Buffer Output				
Output Low		0.2		V
Output High		1.2		V
AUDIO				
ADC Input		2.8		V p-p
DAC Output		2.8		V p-p
SIF Input Range				
Minimum			0.1	V p-p
Maximum	1.0			V p-p
SAR ADC Input	0		3.3	V
FB ADC Input*	0		1.2	V

Specifications subject to change without notice.
Note: Input full scale is 1.2V, but input range is 0 ~ 3.3V.

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Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units
3.3V Supply Voltages	V_{VDD_33}	3.14		3.46	V
1.8V Supply Voltages	V_{VDD_18}	1.70		1.90	V
1.26V Supply Voltages	V_{VDD_126}	1.20		1.32	V
Ambient Operating Temperature	T_A	0		70	°C
Junction Temperature	T_J			125	°C

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
3.3V Supply Voltages	V_{VDD_33}		3.6	V
1.8V Supply Voltages	V_{VDD_18}		1.99	V
1.26V Supply Voltages	V_{VDD_126}		1.32	V
Input Voltage (5V tolerant inputs)	$V_{IN5Vtol}$		5.0	V
Input Voltage (non 5V tolerant inputs)	V_{IN}		V_{VDD_33}	V
Storage Temperature	T_{STG}	-40	150	°C

Note: Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and does not imply functional operation of the device. Exposure to absolute maximum ratings for extended periods may affect device reliability.

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ORDERING GUIDE

Part Number	Temperature Range	Package Description	Package Option
TSUMV59XUS	0°C to +70°C	EPLQFP	128

MARKING INFORMATION

X X X X X X X X X X

Part Number (refer to ORDERING GUIDE)

Lot Number
Operation Code A

Operation Code B
Date Code (YYWW)
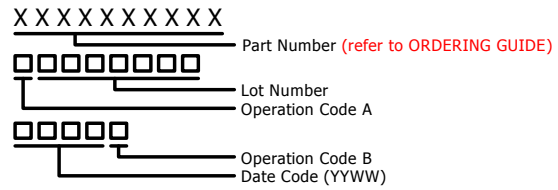
The SRS TruSurround XT™ **SRS(O) TruSurround XT** and SRS TruSurround HD™ **SRS(O) TruSurround HD** technology rights incorporated in the TSUMV59XUS are owned by SRS Labs, a U.S. Corporation and licensed to MStar. Purchaser of TSUMV59XUS must sign a license for use of the chip and display of the SRS Labs trademarks. Any products incorporating the TSUMV59XUS must be sent to SRS Labs for review. SRS TruSurround XT and SRS TruSurround HD are protected under US and foreign patents issued and/or pending. SRS TruSurround XT, SRS TruSurround HD, SRS and (O) symbol are trademarks of SRS Labs, Inc. in the United States and selected foreign countries. Neither the purchase of the TSUMV59XUS, nor the corresponding sale of audio enhancement equipment conveys the right to sell commercialized recordings made with any SRS technology. SRS Labs requires all set makers to comply with all rules and regulations as outlined in the SRS Trademark Usage Manual separately provided.

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Electrostatic charges accumulate on both test equipment and human body and can discharge without detection. TSUMV59XUS comes with ESD protection circuitry; however, the device may be permanently damaged when subjected to high energy discharges. The device should be handled with proper ESD precautions to prevent malfunction and performance degradation.

REVISION HISTORY

Document	Description	Date
TSUMV59XUS_ds_v01	• Initial release	Jun 2012

REGISTER TABLE REVISION HISTORY

Date	Bank	Register
06/06/12		Created first version.