MSD6369IV
All-In-One DTV Processor

Preliminary Product Brief Version 0.2

REVISION HISTORY

Revision No.	Description	Date
0.1	Initial release	09/04/2012
0.2	Updated Features	10/02/2012

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

Single chip iDTV solution that supports dual 8/10bit LVDS output, channel decoding, MPEG decoding, VP decoding, 3D formatter, security OS, andmedia-center functionality enabled by a high performance AV CODEC,CPU, and security engine.

Key features includes,

1. *DVB-T/C Front-End Demodulator*
2. *3D Formatter Engine*
3. *A Multi-Standard A/V Format Decoder*
4. *The MACE-PRO2^{UC} Video Processor*
5. *Home Theater Sound Processor*
6. *Internet and Variety of Connectivity Support*
7. *Advanced dual Core CPU and four Core GPU*
8. *Peripheral and Power Management*
9. *Robust and efficient security engine*

- High Performance Micro-processor
  - ARM Cortex A9 Dual Core CPU
  - Memory Management Unit for Linux support
  - Full duplex UARTs
  - DMA Engine
- Transport Stream De-multiplexer
  - Supports two parallel TS interfaces, with or without sync signal
  - Supports TS input and output for external CI module
  - Supports external demodulator of ISDB, DMB
  - Maximum TS data rate is 16 MB/sec
  - 64 general purpose PID filters and section filters for each transport stream de-multiplexer
  - Supports additional audio/video/PCR filters
  - Supports TS DMA channel for time-shift
  - Supports 3DES/DES and AES encryption/decryption
- MPEG-2 A/V Decoder
  - ISO/IEC 13818-2 MPEG-2 video MP@HL and HD level
  - Automatic frame rate conversion
  - Supports resolution up to HDTV (1080i, 720p) and SDTV
  - Supports MPEG-1, MPEG-2 (Layer I/II), Dolby[1] Digital (AC-3)[Optional], and AAC audio decoding
  - Supports[Optional] Dolby Digital Plus decoding (E-AC-3)[2]
  - Optional Dolby Digital Compatible Output transcoding (DDCO) for HE-AAC to DD
  - Supports dual stream decoding for 3D content
- MPEG-4 Video Decoder
  - ISO/IEC 14496-2 MPEG-4 ASP video decoding up to HD level
  - Supports resolutions up to HDTV (1080p@30fps)
  - Supports DivX[3] Home Theater & HD profiles[Optional]
  - Supports VC-1[Optional], FLV video format decoding
  - Supports dual stream decoding for 3D content
- H.264 Decoder
  - ITU-T H.264, ISO/IEC 14496-10 (main and high profile up to level stereo 4.2) video decoding
  - Supports SVAF 2ES (for Dual Decode)
  - Profile Level 4.2
  - Supports resolutions for all DVB, ATSC, HDTV, DVD and VCD
  - Supports resolution up to 1080p@50fps
  - Supports CABAC and CAVLC stream types

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[1] **Trademark of Dolby Laboratories**

[2] **The implementation of Dolby Digital Plus is in the approval process by Dolby Laboratories. Please contact MStar sales for details.**

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

[Optional] **Please see Ordering Guide for details.**

- Processing of ES and PES streams, extraction and provision of time stamps
- Up to 50 Mbits bitrate (Blu-ray spec.)

- H.264 MVC Decoder
  - ITU-T H.264, ISO/IEC 14496-10 video decoding (Main and high profile up to level 4.1)
  - Support resolution up to 1080p@24fps
- VP Decoder[Optional]
  - Supports VP8 decoder
- AVS Decoder[Optional]
  - Supports Jizhun profile, level 6.0
  - Supports resolution up to 1920x1088 @30fps
  - Supports bit-rate up to 40Mbps
  - Supports dual stream decoding
- RealMedia Decoder[Optional]
  - Supports maximum resolution up to 1080p@30fps
  - Supports RV8, RV9, RV10, RA8-LBR and HE-AAC decoders
  - Supports file formats with RM and RMVB
  - Supports Picture Re-sampling
  - Supports in-loop de-block for B-frame
  - Supports dual stream decoding
- H.264 Encoder
  - Supports H.264 baseline encoding, BP level 3.0
  - Supports MVs: 16x16, 16x8, 8x16, 8x4, 4x8, 4x4
  - Supports up to quarter-pel
  - Supports up to two reference frames
  - Maximum output resolution: 1280x720 @ 30fps
- 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
  - Four configurable CVBS & Y/C S-video inputs
  - Supports Teletext, 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 A2/NICAM/FM/AM demodulation
  - Supports MTS Mode Mono/Stereo/SAP in BTSC/ EIA-J mode
  - Supports Mono/Stereo/Dual in A2/NICAM 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, SRS[4], BBE[5], QSound[6]
  - Supports digital audio format decoding:
    MPEG-1, MPEG-2 (Layer I/II), MP3, Dolby Digital (AC-3)[Optional], AAC-LC, HE-AAC, WMA, and WMA9 Pro
    Supports[Optional] Dolby Digital Plus, Dolby Pulse, and MS10 multistream decoder, including Dolby Digital Encoder for trans-coding streams to Dolby Digital 5.1
  - Supports MPEG Audio, Dolby Digital, Dolby Digital Plus, HE-AAC format AD (Audio Description)
  - Supports MPEG audio encoding
  - Supports PVR and time-shifting

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4 **Trademark of SRS Labs, Inc.**
5 **Registered trademark of BBE Sound, Inc.**
6 **Registered trademark of QSound Labs, Inc.**
Optional **Please see Ordering Guide for details.**

- Audio Interface
  - One SIF audio input interface without any external SAW filter
  - Four L/R audio line-inputs including Mic. input
  - Two L/R outputs for main speakers and additional line-outputs
  - Supports stereo headphone driver
  - I2S digital audio output
  - S/PDIF digital audio output and input
  - HDMI audio channel processing
  - Programmable delay for audio/video synchronization
  - HDMI digital output for ARC
- Analog RGB Compliant Input Ports
  - Three 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
- 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/MHL Compliant Input Port
  - Four HDMI/DVI/MHL Input ports
  - HDMI 1.3/1.4/1.4a Compliant
  - MStar iSwitch for fast HDMI switching
  - HDCP 1.1/1.3 Compliant
  - 225MHz @ 1080P 60Hz input with 12-bit Deep-color support
  - Supports HDMI CEC
  - Supports HDMI 1.4a 3D formats
  - Supports HDMI 1.4 ARC
  - Supports HDMI 1.4 4Kx2K 30Hz input downscaling
  - Single link DVI 1.0 compliant
  - Robust receiver with excellent long-cable support
- MHL Input Ports
  - One MHL Input port (combo with HDMI/DVI)
  - MHL 1.2 compliant
  - Support up to 75MHz @ 1080p 24/30Hz MHL input signal
- MStar Advanced Color Engine - Professional UC Edition (MACE-PRO2^{UC})
  - 12-bit Data Processing
  - Dual-Engine Architecture supporting PIP/PBP
  - MACE-PRO2^{UC} Advanced Scaling Engine
    - Multi-directional Scaling Technology
    - High-Tap Filters with Programmable Parameter
    - De-jagging Support
    - Video Feather Artifact Detection and Removal
    - Nonlinear Video Scaling
    - Dynamic Scaling for RM, VC-1^{Optional}
  - MACE-PRO2^{UC} DTV Video Processing Technology
    - UltraClear-PRO2 Video Deinterlacing with Motion Object Stabilizer
    - Edge-Oriented Deinterlacer with Edge Smoothing and Artifact Removal
    - Automatic 3:2/2:2/M:N Pull-Down Detection and Recovery
    - UltraClear-PRO2 Noise Reduction
    - Video Detection & Repairing Technology for Lousy Inputs such as Internet Streaming
    - MACE^{LIVE}-PRO Color Engine with Accurate Color Tuning Support
    - Cross-Color Suppression Support
    - Support Hanging Dot Search & Removal
    - UltraClear-Based De-Flickering
    - MPEG Artifact Removal Including Blocking and Mosquito Noise Cancellation
    - Arbitrary Frame Rate Conversion
  - MACE-PRO2^{UC} Picture Enhancement:
    - Enhancements in All Features of MACE-3/4 Engine
    - Super Resolution for Detail Enhancement & Recovery
    - Scene Detection
    - 3D Adaptive Color Control
    - 3D Adaptive Sharpness Control
    - sRGB and xvYCC Color Processing Engine
    - Supports HDMI 1.3 Deep Color Format

Optional **Please see Ordering Guide for details.**

Supports HDMI 1.4 sYCC601 / AdobeRGB / AdobeYCC601 Color Formats
Supports Enhanced and Seamless Color Mapping for Wide Gamut Panels
- Programmable 12-bit RGB gamma CLUT
- Top/Bottom, Left-Right and ChessBoard 3D Format Auto-Detection
- Support 2D to 3D conversion

- Output Interface
  - Single/Dual link 8/10-bit LVDS output
  - Supports programmable timing controller
  - Supports panel resolution up to Full HD (1920x1080) @ 60Hz
  - Supports dithering options
  - Supports OSD bypass to MStar FRC 120Hz/240Hz chip[Optional]
  - Spread spectrum output frequency for EMI suppression
  - Supports direct and edge types local dimming
  - Supports 60Hz 3D polarizd panel (line interleave)
  - Supports Cinema output mode
- CVBS Video Encoder
  - Supports all NTSC/PAL TV Standard
  - Stand-alone scaling engine
  - Programmable Hue, Contract, Brightness
  - Supports TTX/CC/WSS output
- CVBS Video Output
  - Allows CVBS output of digital content to SCART
  - 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
- 3D Graphic GPU
  - ARM Mali400 MP4 GPU
  - Supports OpenGL ES 1.1/2.0
  - Supports OpenGL VG 1.1
  - Supports rendering size up to 2Kx2K
  - Supports fill-rate up to 1.1G pixel/sec, and polygon-rate up to 30M tri/s
  - Supports Flash graphic format
- VIF
  - 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 without any external SAW filter
  - Supports silicon tuner low IF output architecture
- DVB-T/DVB-C Demodulator
  - Digital carrier frequency offset correction: 500KHz
  - Optimised for SFN channels with pre/post-cursive echoes inside/outside the guard
  - Acquisition range 857kHz includes up to 3x 1/6 MHz transmitter offset
  - Meets Nordig Unified 1.0.3, D-Book 5.0, EICTA E-Book/C-Book test requirement
  - ITU J.83 Annex A/C, DVB-C (EN 300 429) compliant
  - Supports DVB-C 0.7-7M Baud symbol rate
  - 400kHz internal carrier offset recovery range
  - 6.8 usecs echo cancellation at 7 Msym/s
  - Supports IF, low-IF inputs
  - Ultra-fast automatic blind UHF/VHF channel scan (constellations and symbol rate)

Optional **Please see Ordering Guide for details.**

- Connectivity
  - Three USB 2.0 host ports
  - One USB 3.0 host ports
  - USB architecture designed for efficient support of external storage devices in conjunction with off air broadcastingUSB port supports efficient battery charger
  - Built-in 10/100Mbps Ethernet with PHY interface

- Miscellaneous
  - DRAM interface supporting one 16-bit DDR3 and one 32-bit DDR3 @ 1.6GHz
  - Supports PVR
  - Supports Video Conferencing System (Skype)
  - Supports Common Interface for conditional access support
  - Bootable SPI interface with serial flash support
  - Parallel interface for external parallel EMMC (optional) flash and NAND flash support
  - Power control module with ultra low power MCU available in standby mode
  - 953-ball BGA package
  - Operating Voltages: 1.15V (core), 1.5V (DDR3), 2.5V and 3.3V (I/O and analog)

GENERAL DESCRIPTION

The MSD6369IV is MStar's most up-to-date system-on-chip solution for flat panel integrated digital television products. Building on the success of MStar's current solutions, the MSD6369IV hosts the most advanced picture processing engine, MStarACE-PRO2^{UC}, for all the *Experts* in various TV video quality tuning fields to develop the state-of-the-art TV and DTV system.

MACE-PRO2^{UC}, the Professional UC Edition of MStar video processor, includes all MStar's successful color-tuning tools and a newly added multi-dimensional color/sharpening/NR formula that can quickly reflect subtle or sudden changes in even darker, brighter, or mixture scenes. With this ultimate color processor, a specially designed color remapping system for modern wider gamut displays, and an easy-to-use color-tool UI, developers can quickly and easily identify PQ characteristic from the most high-end panel models to the most conventional panel models. The MStar innovated UltraClear DTV video processor adopts multi-frame video recovery technology to perfectly restore the contents/details, and eliminate the noise/artifacts from broadcasting or Internet videos.

The MSD6369IV integrates DTV/multi-media all-purpose AV decoder, DVB-T/DVB-C demodulator, and Sound/Video processor into a single device. This allows the overall BOM to be reduced significantly making the MSD6369IV a very cost effective multi-media DTV solution.

The MSD6369IV enables feature rich products that bring differentiation to the iDTV market. By the use of AV decoder capable of decoding a plethora of high definition content with Ethernet, USB 3.0 connectivity, MHL and powerful CPU/GPU, an MSD6369IV based system can provide a high quality media-center experience.

As you may expect, the MSD6369IV provides legacy multi-standard analog TV support with adaptive 3D video decoding and VBI data extraction. Similarly the audio decoder is capable of decoding FM, AM, NICAM, A2, BTSC and EIA-J sound standards.

The MSD6369IV supplies all the necessary A/V inputs and outputs to complete a receiver design including a multi-port HDMI receiver and component video ADC. All input selection multiplexed for video and audio are integrated, including full SCART support with CVBS output.

To meet the increasingly popular energy legislative requirements without the use of additional hardware, the MSD6369IV has an ultra low power standby mode during which an embedded MCU can act upon standby events and wake up the system as required.

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		400		ps p-p
Sampling Phase Tempco		15		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		0.3		V
Output High		1.3		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.
VDDP is 3.3V supply voltages

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
3.3V Supply Voltages	V_{VDD_33}	3.14		3.46	V
2.5V Supply Voltages	V_{VDD_25}	2.38		2.62	V
1.8V Supply Voltages	V_{VDD_18}	1.70		1.90	V
1.5V Supply Voltages	V_{VDD_15}	1.43		1.57	V
1.15V Supply Voltages	V_{VDD_115}	1.104	1.15	1.196	V
Ambient Operating Temperature	T_A	0		70	°C
Junction Temperature	T_J			125	°C

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
3.3V Supply Voltages	V_{VDD_33}		3.6	V
2.5V Supply Voltages	V_{VDD_25}		2.75	V
1.8V Supply Voltages	V_{VDD_18}		1.98	V
1.5V Supply Voltages	V_{VDD_15}		1.65	V
1.15V Supply Voltages	V_{VDD_115}		1.26	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

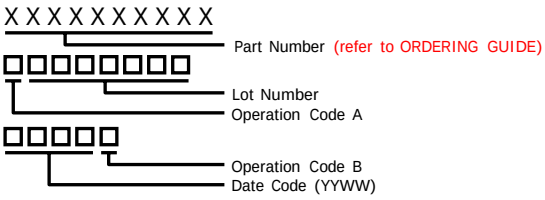
Note: Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and does not imply functional operation of the device. Exposure to absolute maximum ratings for extended periods may affect device reliability.

ORDERING GUIDE

Part Number	Temperature Range	Package Description	Package Option
MSD6369IV	0 C to +70 C	BGA	953-ball
MSD6369IV-XX	0 C to +70 C	BGA	953-ball

Note:
XX suffix represents advanced features. Please contact MStar sales for details.

MARKING INFORMATION



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Electrostatic charges accumulate on both test equipment and human body and can discharge without detection. MSD6369IV 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.