MSO9280MC
Smart Set-Top Box Controller for IP/DRM Application

Product Brief Version 0.3

REVISION HISTORY

Revision No.	Description	Date
0.1	Ÿ Initial release	02/17/2015
0.2	Ÿ Updated features: HDMI transmitter (from 1.4 to 2.0) Removed Embedded 512MB DDR3	06/01/2015
0.3	Ÿ Updated electrical specifications: core power	08/04/2015

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FEATURES

MSO9280MC is MStar's Powerful ARM-based, highly-integrated smart IP box solution which supports all-purpose multi-media decoding, 3D formatter, media-center function, and smart entertainment platform enabled by high performance CODEC Engine, CPU and GPU

Key features include,

n **High Performance Micro-processor**
- Ÿ ARM Cortex A7 quad Core CPU
- Ÿ 32KB/32KB I/D cache
- Ÿ 512KB L2 cache
- Ÿ Neon supported

n **3D Graphic GPU**
- Ÿ 6 core ARM Mali-450MP4 3D GPU
- Ÿ 4 Fragment Processor
- Ÿ 2 Vertex Processor
- Ÿ Supports OpenGL ES 1.1/2.0
- Ÿ Supports OpenGL VG 1.1

n **HEVC/H.265 video decoder**
- Ÿ Supports Main-10 profile, level 5.1, high tier
- Ÿ Supports resolution up to 4096x2160@30fps

n **MPEG-2 Video Decoder**
- Ÿ ISO/IEC 11172-2 MPEG-1 video format decoding
- Ÿ ISO/IEC 13818-2 MPEG-2 video MP@HL and HD level
- Ÿ Supports resolution up to HDTV (1080p@60fps)
- Ÿ Supports dual stream decoding for 3D content

n **MPEG-4 Video Decoder**
- Ÿ ISO/IEC 14496-2 MPEG-4 ASP video decoding up to HD level
- Ÿ Supports resolutions up to HDTV (1080p@60fps)
- Ÿ Supports DivX[1] Home Theater & HD & Plus HD profiles[Optional]
- Ÿ Supports FLV version 1 video format decoding
- Ÿ Supports dual stream decoding for 3D content

n **H.264 Decoder**
- Ÿ ITU-T H.264, ISO/IEC 14496-10 video decoding
- Ÿ Supports SVAF 2ES (for Dual Decode)
- Ÿ Profile Level 5.0
- Ÿ Supports resolutions for all DVB, ATSC, HDTV, DVD and VCD
- Ÿ Supports resolution up to 4096x2160@30fps
- Ÿ Supports CABAC and CAVLC stream types
- Ÿ Processing of ES and PES streams, extraction and provision of time stamps
- Ÿ Max Bit Rate up to 135 Mbps

n **H.264 MVC Decoder**
- Ÿ ITU-T H.264, ISO/IEC 14496-10 video decoding
- Ÿ Supports resolution up to 1080p@60fps

n **VP Decoder** [Optional]
- Ÿ Supports VP8 decoder
- Ÿ Supports resolution up to 1920x1080@30p.
- Ÿ Supports maximum bitrate up to 25Mbps

n **AVS+ Decoder** [Optional]
- Ÿ Supports Broadcasting profile, level 6.0.0.08.60
- Ÿ Supports bitrate up to 30Mbps
- Ÿ Supports resolution up to 1920x1080@30fps

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

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

n RealMedia Decoder^{Optional}

- Ÿ Supports maximum resolution up to 1080p@30fps
- Ÿ Supports RV8, RV9, RV10 decoders
- Ÿ Supports file formats with RM and RMVB
- Ÿ Supports Picture Re-sampling
- Ÿ Supports in-loop de-block for B-frame
- Ÿ Supports dual stream decoding

n H.264 Encoder

- Ÿ Supports H.264 baseline encoding, BP level 3.0
- Ÿ Supports MVs: 16x16, 16x8, 8x16, 8x4, 4x8, 4x4
- Ÿ Supports up to quarter-pel
- Ÿ Maximum output resolution: 1920x1080
- Ÿ Supports up to two reference frames

n Hardware PNG / GIF Decoder

- Ÿ Supports up to 8192 x 8192 (8 bits per channel), or 4096 x 8192 (16 bits per channel) pixel image
- Ÿ PNG format 1bpp/2bpp/4bpp/8bpp index(palette) mode support
- Ÿ PNG transparency mode support interlaced/ non-interlaced GIF support
- Ÿ ARGB8888, RGB565, YUV422 (YUYV), YUV422 (YVYU), gray, gray with alpha output format support

n Hardware JPEG Decoder

- Ÿ Supports sequential mode, single scan
- Ÿ Supports both color and grayscale pictures
- Ÿ Following the file header scan the hardware decoder fully handles the decode process
- Ÿ Supports programmable Region of Interest (ROI)
- Ÿ Supported formats: 422/411/420/444/422T
- Ÿ Supported scaling down ratios: 1/2x1/2, 1/4x1/4, 1/8x1/8
- Ÿ Supports 1280x720@30p

n VC-1 Video Decoder^{Optional}

- Ÿ Supports SMPTE-421 (WMV video) decoding up to MH@HL
- Ÿ Supports SMPTE-421 (VC1 video) decoding up to AP@L3
- Ÿ Supports dual stream decoding for 3D content

n Multi-Standard TV Sound Processor

- Ÿ Built-in audio sampling rate conversion (SRC)
- Ÿ Audio processing for loudspeaker channel, including volume, balance, mute, tone, Parametric EQ, and treble/bass controls
- Ÿ Supports digital audio format decoding:
  - MPEG-1, MPEG-2 (Layer I/II), MP3, Dolby Digital (AC-3), AAC-LC, HE-AAC, WMA, and WMA9 Pro
  - Supports Dolby Digital Plus, Dolby Pulse, and MS10/MS11 multistream decoder, including Dolby Digital Encoder for trans-coding streams to Dolby Digital 5.1 (DDCO)
- Ÿ Supports MPEG audio encoding
- Ÿ Supports programmable delay for audio/video synchronization

- **n** Audio Interface
  - Ÿ One L/R Line Output
  - Ÿ I2S digital audio output
  - Ÿ S/PDIF digital audio output and input
- **n** HDMI TX Output Interface
  - Ÿ HDMI 2.0 Transmitter
  - Ÿ HDCP 1.4 Encryption Engine
  - Ÿ Supports IEC60958 PCM / IEC61937
  - Ÿ Supports RGB/YCbCr 4:2:0/4:2:2/4:4:4 formats
  - Ÿ Supports Deep Color Mode up to 2160p/60Hz
  - Ÿ Supports Data Rate up to 3.4 GHz
  - Ÿ Supports 3D Format
- **n** 2D Graphics Engine
  - Ÿ Hardware Graphics Engine for responsive interactive applications
  - Ÿ Supports point draw, line draw, rectangle draw/fill and text draw
  - Ÿ Supports BitBlt, stretch BitBlt, italic Bitblt, Mirror BitBlt and rotate BitBlt
  - Ÿ Supports alpha-blending operation
  - Ÿ Supports source/destination color key and alpha key
  - Ÿ Supports dither
  - Ÿ Supports color space conversion and format transformation
  - Ÿ Raster Operation (ROP)
  - Ÿ Supports DFB and Porter-Duff operation
- **n** CVBS Video Output
  - Ÿ Supports 480i and 576i CVBS composite output
  - Ÿ Programmable YC delay
  - Ÿ Programmable hue, contrast, brightness
  - Ÿ Format conversion between different supported formats
  - Ÿ Supports Macrovision 7.1.L1
  - Ÿ Supports DCS
  - Ÿ Supports CGMS/A
  - Ÿ Digital video encoder
    - – Supports all NTSC/PAL/SECAM TV Standard
    - – Supports TTX/CC/WSS/CGMS-A

- **n** Support DRAM Type
  - Ÿ DDR3 and DDR3L
- **n** Connectivity
  - Ÿ Two USB 2.0 host ports
  - Ÿ One Programmable USB 2.0 host/device port
  - Ÿ USB architecture designed for efficient support of external storage devices in conjunction with off-air broadcasting
  - Ÿ Built-in 10/100Mbps Ethernet MAC with PHY interface
 - Ÿ One SDIO 3.0 Interface
- **n** Miscellaneous
  - Ÿ External 32-bit DDR3 Interface up to 1.86GHz
  - Ÿ Bootable SPI interface with serial flash support
  - Ÿ Parallel interface for external parallel flash, NAND flash and eMMC support
  - Ÿ Power control module with ultra low power MCU available in standby mode
  - Ÿ PBGA package
  - Ÿ Operating Voltages: TBD (Core Power), 1.5V (DDR3), and 3.3V (I/O and analog)
- **n** Security Protection
  - Ÿ Built-in Advanced Security Environment that meets DRM requirements
  - Ÿ Separate Document Available Upon Request

BLOCK DIAGRAM
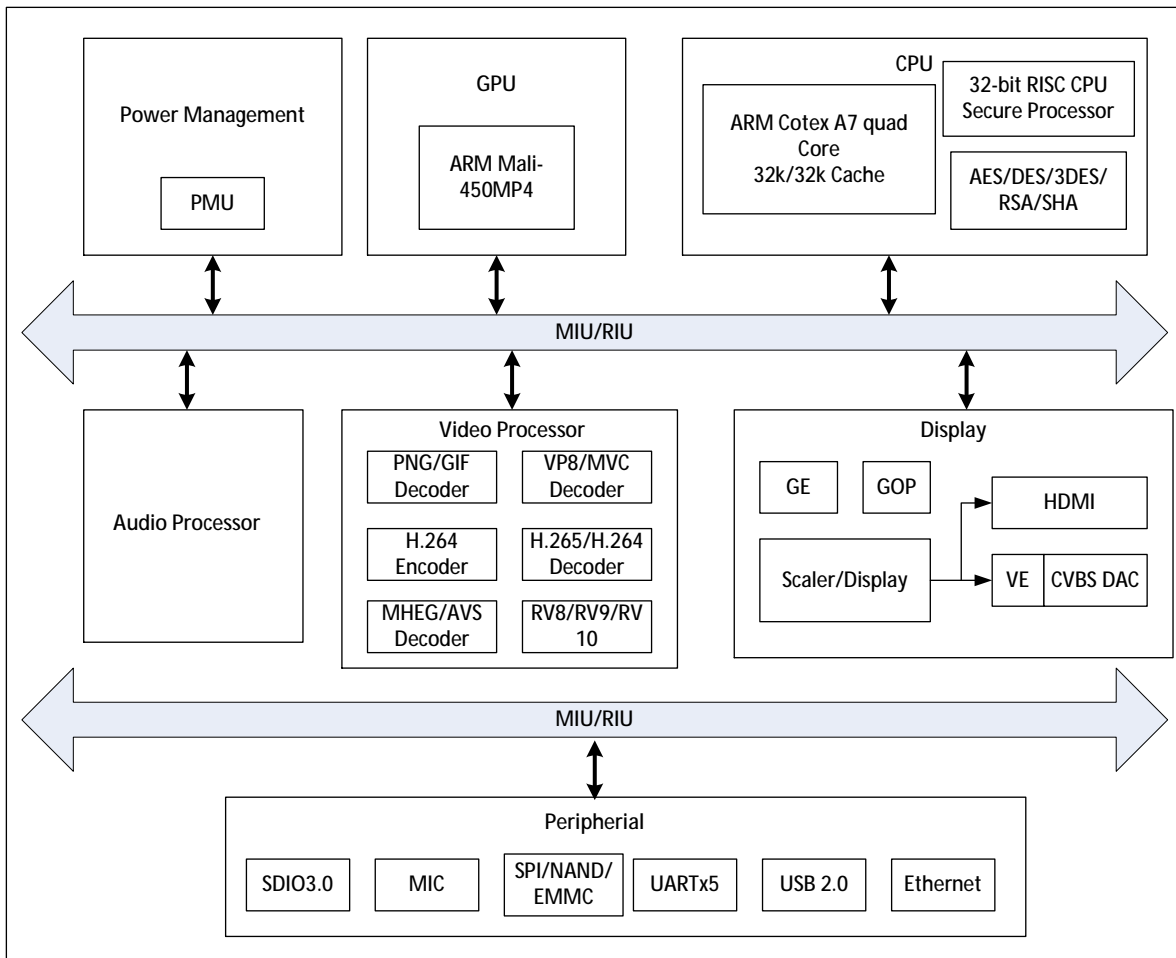
GENERAL DESCRIPTION

The MSO9280MC is MStar's highly integrated solution for smart Set-Top Box products. Built on the success of MStar's advanced technologies, the powerful CPUs and GPUs deliver high performance for modern set-top boxes with Linux or Android operating systems. The popular ARM and Mali architectures ensure the best software compatibility. Applications with HTML5, Java, Flash, etc., can be realized on MSO9280MC with minimized developers' effort. This undoubtedly makes MSO9280MC the best platform for IP Set-Top Boxes.

MSO9280MC also integrates all-purpose AV decoders and AV processors interfaces for DTV and multi-media applications. This allows the overall BOM to be reduced significantly, making MSO9280MC a cost effective multi-standard Set-Top Box solution.

MSO9280MC enables feature-rich products that bring differentiation to the smart set-top box market. By the use of powerful CPU/GPU and AV decoders capable of decoding a plethora of high definition content from Ethernet, USB and other connectivity, MSO9280MC based systems can provide a high quality media-center experience.

MSO9280MC also supplies all the necessary A/V interfaces to complete a receiver design including a microphone input receiver and HDMI 2.0 transmitter output.

ELECTRICAL SPECIFICATIONS

Analog Interface Characteristics

Parameter	Min	Typ	Max	Unit
VIDEO ANALOG OUTPUT				
CVBS Output				
Output Low		0		V
Output High		1.3		V
AUDIO				
Line driver Output		1		V_{rms}
SAR ADC Input	0		AVDD_NODIE	V
HDMI TX Output				
Single Ended Output Current	8	10	12	mA
Output Leakage Current	0		200	uA
Differential Signal Rise Time	75		0.4*Tbit	ps
Differential Signal Fall Time	75		0.4*Tbit	ps
Differential Clock Duty Cycle	40	50	60	%
Differential Data Jitter			0.3	Tbit
DIGITAL INPUTS				
Input Voltage, High (V_{IH})	2			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

Note: 1. Specifications subject to change without notice.
    2. AVDD33_AU, AVDD_NODIE and VDDP are 3.3V Supply Voltages.

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 (EMMC/SDIO 3.0)	V_{VDD_18}	1.71		1.89	V
1.5V Supply Voltages (DDR3)	V_{VDD_15}	1.425		1.575	V
1.5V Supply Voltages (DDR3L)	V_{VDD_15}	1.2825		1.4175	V
Core Supply Voltages	V_{VDD_core}		1.1		V
CPU Supply Voltages	V_{VDD_cpu}		TBD		V
Ambient Operating Temperature	T_A	0		70	°C
Junction Temperature	T_J			125	°C

Absolute Maximum Ratings

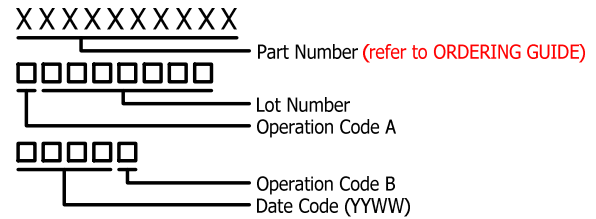| Parameter	Symbol	Min	Max	Units
3.3V Supply Voltages	V_{VDD_33}		3.63	V
1.8V Supply Voltages	V_{VDD_18}		1.98	V
1.5V Supply Voltages	V_{VDD_15}		1.575	V
Core Supply Voltages	V_{VDD_core}		1.47	V
CPU Supply Voltages	V_{VDD_cpu}		TBD	V
Input Voltage (5V tolerant inputs)	$V_{IN5Vtol}$		5.3	V
Input Voltage (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
MSO9280MC	0°C to +70°C	BGA	303-ball
MSO9280MC-XX	0°C to +70°C	BGA	303-ball

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

MARKING INFORMATION

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— Part Number (refer to ORDERING GUIDE)

— Lot Number
— Operation Code A

— Operation Code B
— Date Code (YYWW)

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Electrostatic charges accumulate on both test equipment and human body and can discharge without detection. MSO9280MC 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.