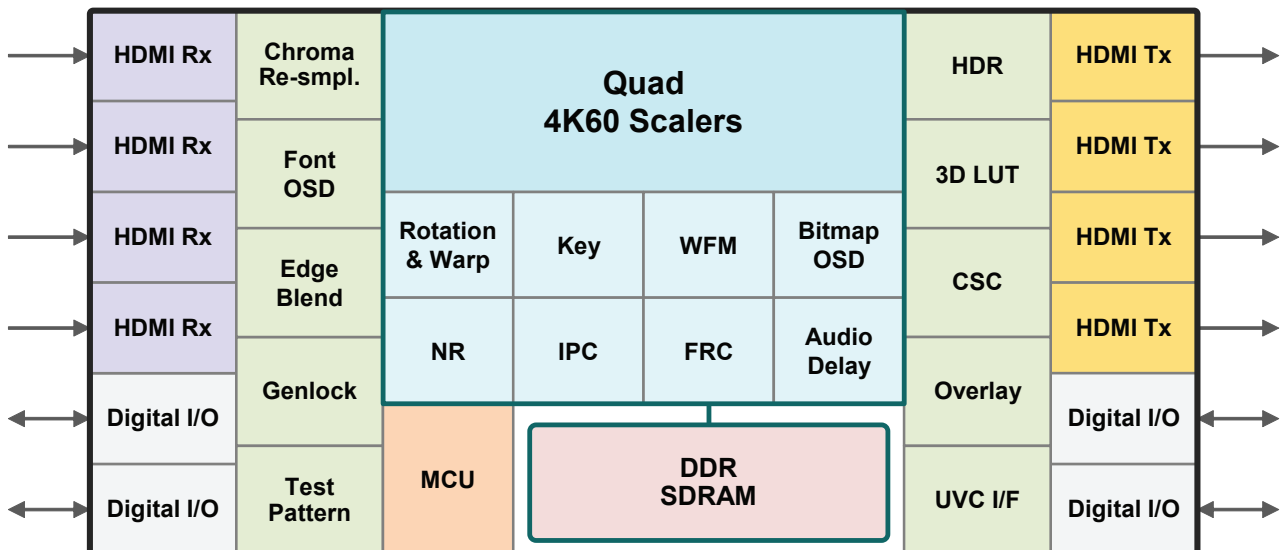
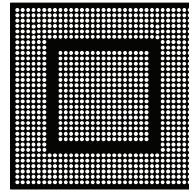


# 4K60 Video Display Processor of Quad Scalers

with Embedded SDRAM

## MDIN-640



- ◆ **MDIN-640** is a highly integrated SoC that can do UHD(4K60) video processing for quad scalers with embedded SDRAMs. It includes many I/O interfaces, such as quad HDMI receivers, quad HDMI transmitters, quad digital video I/O ports, digital audio ports, and a USB/UVC controller interface. The video resolution of the I/O interface is up to 4096x2160@60Hz for progressive video and up to 1080i for interlaced video.
- ◆ **MDIN-640** provides a lot of functions including, up/down scaling, seamless switching, frame rate conversion, deinterlacing, HDR/SDR conversion, any degree rotation, warping, edge blending, genlock, up/downstream color keying, waveform display, vectorscope, histogram display, keystone correction, bitmap OSD & font OSD, and noise reduction. MDIN-640 supports YCbCr(4:4:4 or 4:2:2) and RGB 4:4:4 color processing with 8/10/12-bit precision per color component.
- ◆ **MDIN-640** is suitable for many industry 4K60 video products, such as digital signages, matrix switchers, multi-view displays, video wall displays, KVM switchers, converter boxes, broadcast monitors, medical imaging, video projectors, and video presentation systems.

# Main Features

- ◆ Quad HDMI Receivers & Quad HDMI Transmitters
- ◆ Four Digital Video Input/Output Ports
- ◆ I<sup>2</sup>S and SPDIF Digital Audio Input & Output
- ◆ Quad Scalers
- ◆ Warping & Rotation
- ◆ Keystone Correction with Edge Blending
- ◆ Frame Rate Conversion
- ◆ HDR Conversion
- ◆ Bitmap OSD & Font OSD
- ◆ Luma & Chroma Keying
- ◆ Waveform Monitor, Vectorscope & Histogram display
- ◆ Embedded 32-bit MCU and SDRAM

# Specifications

## HDMI Receiver & Transmitter

Quad HDMI Receivers & Quad HDMI Transmitters  
 Support up to 4096x2160@60Hz Video  
 Max. 18Gbps per HDMI port  
 HDMI 1.4/2.0 compliant  
 250Mbps ~ 6.0Gbps per channel  
 Fully compliant with HDMI Repeater  
 DVI 1.0 backward compatible  
 HDCP 1.4/2.x compliant  
 HDCP Repeater capability  
 Pre-programmed HDCP 1.4 & 2.x device key  
 HDCP 1.4 to/from HDCP 2.x conversion  
 On-chip EDID RAM  
 RGB 4:4:4, YCbCr 4:4:4/4:2:2/4:2:0  
 8/10/12-bit per color component (Deep color)

## Digital Video Input & Output

In : Up to 4096x2160@60Hz, Max. 600MHz pixel rate  
 Out : Up to 4096x2160@30Hz, Max. 300MHz pixel rate  
 Up to 4096x2160@60Hz, Max. 600MHz pixel rate (MDIN-640R1)  
 RGB/YCbCr 4:4:4 24/30/36-bit  
 YCbCr 4:2:2 8/10/12/16/24-bit(Y/C Multiplexed or Separated)  
 Single/Dual-edge & Single/Dual-pixel clock mode

## USB/UVC Controller Interface

MJPEG compressed video output up to 4K@60Hz for YC 4:2:2  
 Uncompressed video output up to 4K@20/30Hz for YC 4:2:2/4:2:0  
 2-channel 48KHz PCM audio output

## Audio Input & Output

Eights sets of digital audio input and output port  
 8-channel I<sup>2</sup>S and 1-channel SPDIF per digital audio port  
 I<sup>2</sup>S & SPDIF : Up to 192kHz  
 Flexible switching among digital audio in/out and HDMI Rx/Tx audio  
 Adjustable audio delay for A/V synchronization

## Format Conversion

Independent H&V scaling with arbitray scaling ratio  
 Down-scaling ratio : Up to x1/127  
 Up-scaling ratio : Unlimited(no rotation) or Up to x8(45° rotation)

## Warping

Video warping with image size up to 4096x2160  
 Any angle rotation with minimum 0.01° step  
 Keystone Correction  
 Edge blending with horizontal and vertical overlap at a time

## Display Functions

Zoom, PIP, POP, Quad-view, Video wall display  
 Seamless video scaling & switching  
 Video-to-video blending with 64 level blending ratio  
 Lock-to-input sync mode or free-run mode  
 Programmable output sync generation

## Frame Rate Conversion

Frame rate conversion from 3-250Hz to 3-250Hz  
 Conversion ratio : x1/31 ~ x31

## Image Processing

HDR conversion for HDR10 & HLG  
 3D LUT for accurate color management  
 Gamma, brightness, contrast, hue, and saturation control  
 Motion adaptive 3D Deinterlace  
 2D/3D noise reduction  
 Overlap area edge blending  
 High order programmable horizontal and vertical peaking filter  
 Dithering for 12/10-bit to 10/8-bit output

## Bitmap OSD & Font OSD

Bitmap OSD & Graphic Accelerator  
 Max. 6 layers with 1 cursor and 1 background layers  
 1/2/4/8-bit indexed color mode & 16/24/32-bit full color mode  
 32-level pixel based alpha blending  
 Graphic acceleration for rectangle fill/copy & character drawing  
 Font OSD  
 SRAM based Font OSD with Max. 128 horizontal and 64 vertical fonts  
 Fixed font size of 24x32, 32x32, 48x64 or 64x64  
 Variable horizontal font size  
 Rotation of 90°/180°/270°

## Keying

Upstream Key 1 layer, Downstream Key 1 layer  
 Key tolerance control  
 Despill & Key filter  
 Internal key generation  
 Transition with various patterns

## Signal Monitor Functions

Waveform, Vectorscope and Histogram display  
 Up to 4 display windows & R/G/B or Y/Cb/Cr display for each window  
 Zebra and color pattern display  
 Focus Assist  
 Blue-only & Mono-only display

## MCU and Communication Interface

Embedded 32-bit MCU  
 External serial flash memory interface with Quad-bit SPI master  
 External host interface with 4-wire SPI and 2-wire I<sup>2</sup>C

## Miscellaneous

Auto detection of input video/sync  
 Internal programmable PLLs  
 Genlock to external video sync

## Electrical and Mechanical Characteristics

1.0V/1.2V/1.8V/3.3V supply voltage  
 937-ball BGA package (35mm x 35mm, 1.0mm ball pitch)