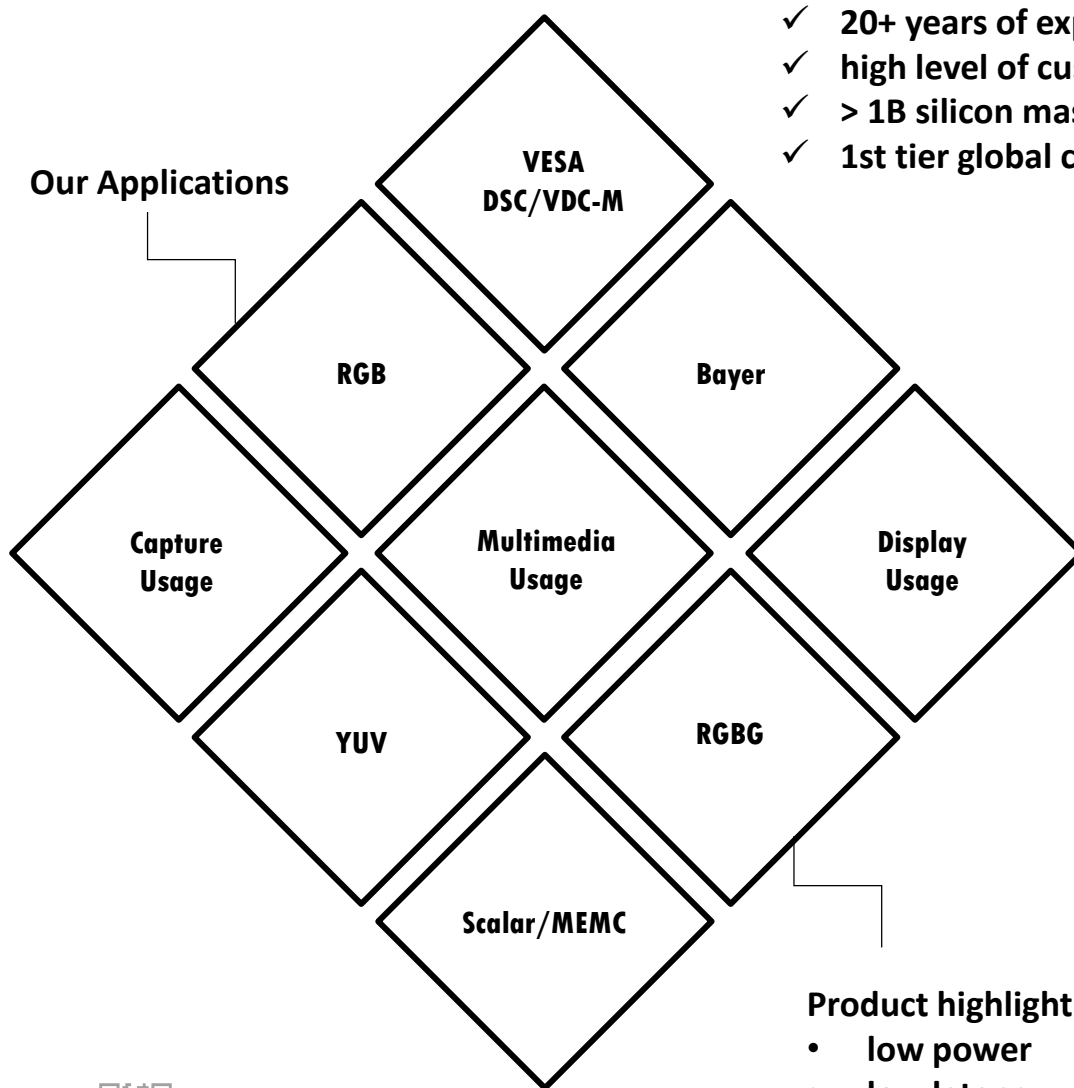Taiwan **Imaging** **Tek** Corp.

TITC

TITC

Image Compression IP specialist

✓ **20+ years of experience**
✓ **high level of customization**
✓ **> 1B silicon mass produced**
✓ **1st tier global customers**

Our Applications

- VESA DSC/VDC-M
- RGB
- Bayer
- Capture Usage
- Multimedia Usage
- Display Usage
- YUV
- RGBG
- Scalar/MEMC

Product highlight features:
- **low power**
- **low latency**
- **small area**

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☺ www.titc-usa.com

TITC YB-Series IP
YUV for Video Encoder/Decoder

YB-series IPs are collection of propietary algorithm which are used for real-time compress/decompress block-based YUV subsample data. These IPs/algorithm are designed for video encoding/decoding device, which facilitate temporal storage efficiency of ME(motion estimation)/MC(motion compensation) data. End products like cinema camcoder, mobile multimedia system, TV system may benefit from YB-series IPs.

YB-series IPs are featured by customized bitdepth/ratio support, reasonable hardware resources, friendly IP integration, and flexible access/store compressed bitstream. Feature support/algorithm are tailored for picture quality requirement and hardware budget via TITC engineer team.
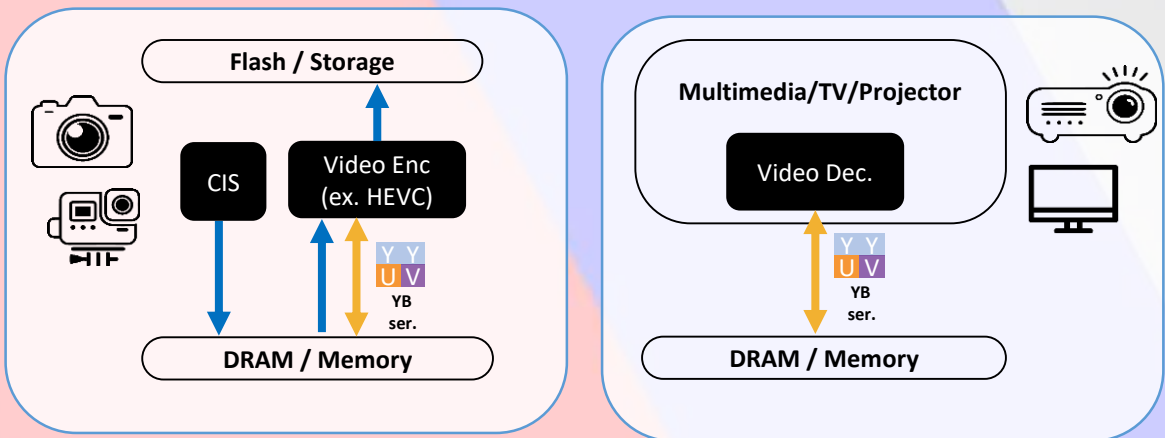
➢ TITC YB-Series IP

Usage / Series		capture, multimedia / YB-series	
IP Name		YB v1	YB v2
Data	Type	YUV422/YUV420	YUV420/Y-Only
	Bit-Depth	8/10/12-bit	8/10-bit
Compression	Type	Lossy/Lossless	Lossy
	Ratio(Lossy)	1.33~2X	2~4X
	Unit	H4V4/ H8V8/ H8V4	H8V8
Performance	Throughput	2-pix/4-comp (per T)	64-comp (per T)
Note		* compression unit can be customized * lossless+lossy is encouraged	* focus on high ratio, high thoughput

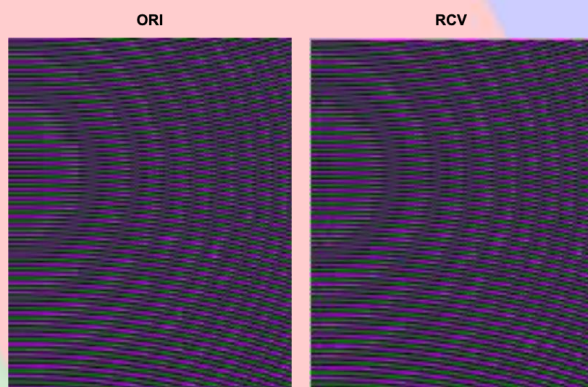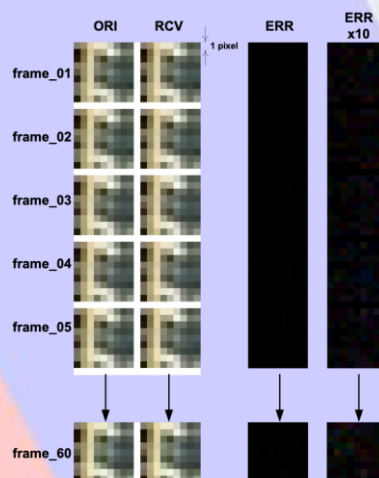# TITC S-Series IP
RGB/YUV for FRC & Scalar

Frame Rate Conversion(FRC) and Scalar have been long developed in multimedia. FRC techniques generate pseudo image frames between at least two consecutive frames, usually by the technique of Motion Estimation and Motion Compensation (MEMC) to get better motion picture qualities. At least one frame picture stored in memory. Scalar techniques as well generate pseud image lines between at least two consecutive lines. Several image lines are required to be in memory. Both techniques need high memory i/o bandwidth when image resolution get higher.

TITC proposed segment-based or block-based, fixed-ratio, visual-lossless compression in RGB/YUV format. This mass production proven technique can ease the pain point of i/o bandwidth hunger. Supporting bit depth up to 12 meets mainstream requirement. Compression unit and bit depth can also be customized.
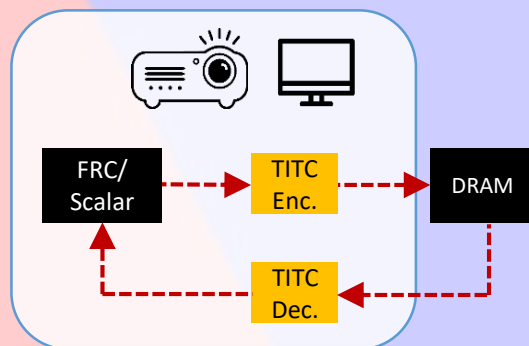
YUV422 / 3X (20->7 bit)

RGB / 3X (30->10 bit)

➤ TITC S-Series IP

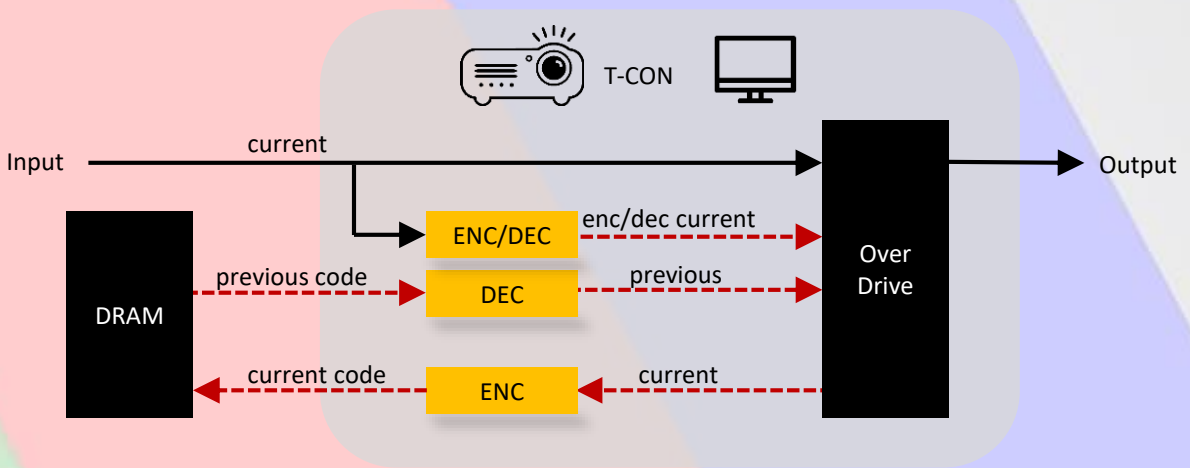| Usage / Series		multimedia / S-series
IP Name		**FRV v1**
Data	Type	RGB/YUV444/YUV422
	Bit-Depth	10/12-bit
Compression	Type	Lossy
	Ratio(Lossy)	2~3X
	Unit	H64V1 / H64V2
Performance	Throughput	2-pix (per T)
Note		* compression unit can be customized

TITC O-Series IP
RGB for Over-Drive

Over-Drive technology is used to compensate the LCD reaction speed, which was not fast enough in high refreshing frame rate. Over drive provides higher level of voltage than the usual when the pixel's bright level gap between current and previous frame is large. Previous frame should be stored in memory to be the reference. Memory cost and bandwidth is considered from system's point of view.

Reference frame data of over drive do not necessarily visual lossless. Higher lossy level may be acceptable. Therefore, FPGA for moving picture quality check is needed when adopting this IP. TITC proposed several types of compression, from small block 2x2 to 4x4 to slice-based, from RGB to Y-only, from compression ratio 2 to 12. Customization is possible.

➢ TITC O-Series IP

Usage / Series		multimedia / O-series	
IP Name		**OD v1**	**OD v2**
Data	Type	RGB	**Y-only**
	Bit-Depth	8-bit	8-bit
Compression	Type	Lossy	Lossy
	Ratio(Lossy)	2.28X	4X
	Unit	H2V2	H4V4
Performance	Throughput	4-pix (per T)	16-pix (per T)
Note		* light resource	* high throughput * for DDI