

Sampled Analog Video Transport - Enhanced Color Reproduction

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Abstract

Video signal bandwidth continues to grow, with pressure to deliver higher resolution, wider color gamut, greater contrast, and faster refresh rates over longer distances. For conventional display drivers, accommodating this growing bandwidth means skyrocketing complexity and power.

Sampled-Analog Video Transport (SAVT™) technology is 10x more efficient and has ample headroom to carry performance of large display roadmaps into the future within the established cost and power envelope.

Author Keywords

Video Transport; Display driver IC; Sampled Analog; SAVT; High efficiency; High performance.

1. Introduction

The bandwidth required for digital video signals is continuing to grow, as pressure builds to deliver higher resolution, a wider color gamut, greater contrast, and faster refresh rates. For conventional display drivers, this means skyrocketing complexity and power requirements, and compromises like video compression, which are at odds with consumer expectations for affordability, energy efficiency, and performance.

Sampled-Analog Video Transport (SAVT™) technology delivers a 10-times increase in video payload, with greater accuracy and reliability than traditional methods, without increasing the cost of display-driving hardware.

In 2024, the first generation of display driver ICs (DDICs) using SAVT technology was developed [1], resulting in a prototype IC intended for performance evaluation.

The DDICs were assembled on a 65" 8K as well as a 65" 4K LCD panel, and the video performance was evaluated.

2. Accurate video translation

Translating video data into linear luminance data requires accurate translation: The video data, which has been pre-encoded for equally spaced perceived luminance values ("inverse gamma"), needs to be decoded, and the non-linearity of the Electro-Optic Transfer Function (EOTF) must be compensated for. Presently, EOTF and gamma correction are done in the DDIC by applying a non-linear voltage ladder of reference voltages to the on-board resistor-ladder D/A Converter (DAC). This has its limitations:

- The number of reference voltages is limited (typically 18)

- The interpolation between the references is usually linear
- The reference voltages are usually hard-wired (although some meta-data driven exceptions exist).

SAVT technology performs its digital-to-analog conversion at the transmission end of the chain, so the EOTF and gamma

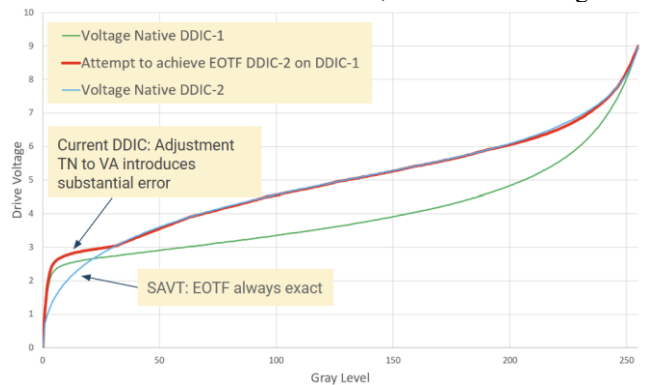


Figure 1: EOTF / Gamma adjustment

correction can be implemented with the same accuracy as the DAC (typically 12-bits): the result is 12-bit accuracy in reproducing the display's EOTF. This means adjusting the display response to another panel technology is as easy as uploading another 12 bits LUT, immediately implementing the EOTF and gamma with unprecedented accuracy. Figure 1 shows an example of DDICs with manually set correction for another LCD technology, and the result of the SAVT correction.

3. Consequences of accurate translation

Having a better definition of EOTF and gamma doesn't just benefit changes in display technology, but also provides more flexibility in HDR response and a multi-segment approach of gamma.

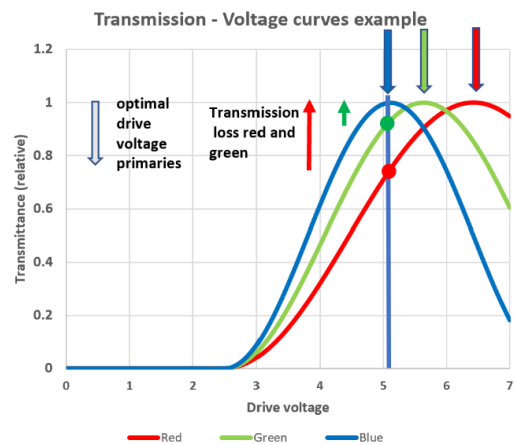


Figure 2: T-V curve dispersion

Additionally, the RGB color channels can have independent correction factors, meaning each display color can work at the most efficient voltage range, eliminating a problem caused by the dispersion of the liquid crystal refractive index, as shown in Figure 2.

4. Conclusion

Building the prototype has proven that it is possible to design an analog transmission system that produces no visible errors and greatly improves color reproduction. Using SAVT technology, the image bit-depth and color reproduction can be significantly increased. Improved prototypes are planned to be demonstrated in the first half of 2026, and the first commercial products are expected as early as 2027.

Commercial application of HYPHY's video transport technology will reduce the manufacturing costs of larger, faster, and more vivid television sets and gaming monitors, while maintaining excellent signal robustness, low EMI emissions, superior video quality, and reduced power consumption.

References

- [1] Henzen, A; Rockoff, T; Modulated Analog driving of high framerate UHD displays", Proceedings of the SID/DSCC 2023
- [2] Henzen, A; Rockoff, T; Caulkins, W: Modulated Analog Driving and Evaluation of Image Quality; Proceedings of the SID 2024