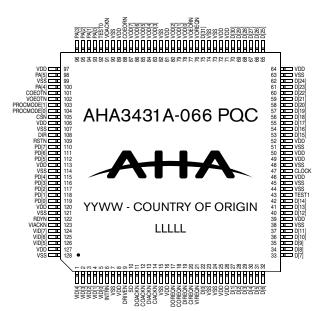
AHA3431 StarLite

SIMULTANEOUS COMPRESSOR/DECOMPRESSOR IC, 3.3V

AHA3431 is a high speed lossless compression coprocessor IC for the hardcopy systems on many standard platforms. The AHA3431 is functionally backward compatible to the AHA3411.

Simultaneous compression and decompression, flexible interfaces and advanced banding support make this a unique solution for high performance Raster Image Processing (RIP) controller designs. Advanced banding support handles blank, uncompressed and compressed bands during decompression mode. Scan line and record length counters accommodate various print resolutions and band buffer sizes.

Software simulation and an analysis of the algorithm for printer and copier images of various complexity are available for evaluation.



NOTE: YYWW = DATE CODE, LLLLL = LOT NUMBER

FEATURES

PERFORMANCE:

- 66 MBytes/sec compression/decompression rates
- 264 MBytes/sec burst data rate over a 32-bit data bus
- 66 MBytes/sec synchronous optional 8-bit video in and video out ports
- Simultaneous compression and decompression at full bandwidth
- Average 15 to 1 compression ratio for 1200 dpi bitmap image data
- Advanced banding support

FLEXIBILITY:

- Big Endian or Little Endian; 32 or 16-bit bus width and data bit/byte reordering for duplex printing support
- Programmable Record Length, Record Count and Scan Length Registers may be prearmed
- Scan line length up to 2K bytes
- Interfaces directly with various Motorola 68xxx and Cold FIRE and Intel i960 embedded processors
- Pass-through mode passes raw data through compression and decompression engines

SYSTEM INTERFACE:

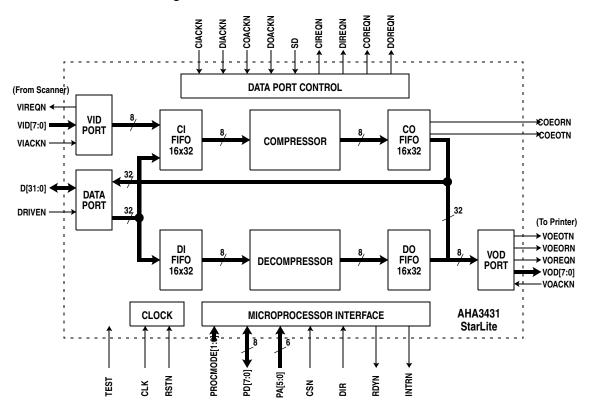
- Single chip compression/decompression solution—no external SRAM required
- Four internal 16 × 32-bit FIFOs
- Maskable interrupts
- Tristatable outputs to facilitate board level testing **OTHERS**:
- Low power modes
- Optional counter checks errors in decompression
- Software emulation program available
- 128 pin quad flat package
- 3.3V operation
- RoHS compliant

APPLICATIONS

- Digital copiers
- Printer controllers
- Multifunction printers and copiers



Figure 1: AHA3431 Block Diagram



FUNCTIONAL DESCRIPTION

The coprocessor device has three external high speed synchronous data ports each capable of transferring once every clock. These are a 32-bit bidirectional data port, an 8-bit Video Input Data (VID) port and a Video Output Data (VOD) port. The data port is capable of transferring up to 32 bits per clock. The VID and VOD are also capable of one transfer per clock.

The device accepts uncompressed data through the data port or optionally through the 8-bit VID port into its Compression In FIFO (CI FIFO). Compressed data is available through the data port via the Compressed Output FIFO (CO FIFO). The sustained data rate through the compression engine is 66 MBytes/sec.

Decompression data is accepted through the data port, buffered in the Decompression Input FIFO (DI FIFO), and decompressed. The output data is made available on the data port via the Decompression Output FIFO (DO FIFO) or optionally on the 8-bit Video Output port. The decompression engine runs on the 66 MHz clock and is capable of processing an uncompressed byte every clock.

The four FIFOs are organized as 16×32 each. For data transfers through the three ports, the "effective" FIFO widths differ according to their data bus widths.

Data transfer for compression or decompression is synchronous over the three data ports functioning as DMA masters. To initiate a transfer into or out of the Video ports, the device asserts VxREQN, the external device responds with VxACKN and begins to transfer data over the VID or VOD busses on each succeeding rising edge of the clock until VxREQN is deasserted. The data port relies on the FIFO Threshold settings to determine the transfer. *Note:x is referred to I or O.*

SYSTEM APPLICATION

The device is intended for memory intensive applications, such as digital copiers or printers. These applications require the simultaneous compression and decompression capability of the device. Copiers use this feature to feed the compressed bit maps through the decompressor to the printer engine while another process uses the compressor to input and compress scanned images. Movement for both processes is typically controlled by a DMA controller that is programmed by the local microprocessor.

StarLite IMAGE COMPRESSION RESULTS - 1200 x 1200 DPI

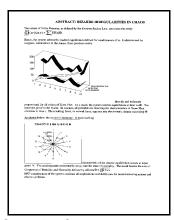
Uncompressed file size = 16 MBytes; Image dimensions = 10200×13200 pels

FONTS - Simple Text

the total energy density is propositional to the amplitude represent. For extending seen we have $\frac{dE}{dx} = \mu \sin^2 Z_{\pm} \cos^2 (kx - \omega z)$	the total unwarpy density is proportional to the amplitude operator. For a constitute over a variety of $\frac{dE}{dx} = \mu \text{to} ^2 Z_{\odot} \cos^2(kx - \text{to} t)$	to toki energy density is proportional to the amplitude systemal. For a remaining wave for know $\frac{dE}{dx} = \mu \omega^{-1} Z_{\odot} \cos^{2}(kx - \omega s)$
For domination which and translating which, the self-straig states in the angular shape states for translating and translating and the property $\frac{d\mathcal{E}}{dx} = \mu \omega^2 Z_1 \cos^2 (kx - \omega r)$	Fig. dette Effektion, Weists and The Atlantin Weists. We still rings dending by proportional on the templated reports for a transling nature on term $\frac{dE}{dX} = \text{period} Z_{ij} \cos \theta^i(kx-i) \ell$	FOR SCTE 21ARDRES WAREA WERE TRAVELLED YOUR fits much energy density to propositional to the implicate operand. For a transfer energy we constitute $\frac{d\dot{E}}{dx} = \text{pices}^{-1}Z_{0}\cos^{2}(kx-\omega t)$
for full showing work and travelling warres, the total energy density is proportional to the amplitudes of arrest ling wave we have $\frac{dE}{dx} = \mu \cos^2 Z_{\mu} \cos^2 (kx - \omega_I)$	For hall standing some and true Eig states, we need energy dentity in proportional to the amplitude expects. For a terrolling water to larve $\frac{dE}{dx} = \mu(\phi^{-1}Z_{\pm}\cos \phi^{-1}(kx - \omega s))$	For both standing warm and numbing sures, she total energy density is proportional to the amplitude equation. For a contribution were so have $\frac{dE}{dx} = \mu \omega^{-1}Z_{ij} \cos s^{2}(kx - \omega r)$
For both standing wares and providing waves, the total energy density is proportional to the step lastle squared. For a trovelling manume have $\frac{dE}{dx} = \mu \omega^{-1} Z_{ij} \cos^{2}(kx - \omega x)$	For hell-charling waves additionally which as a set coupy thereby in proper leads to the application operation. For a standing wave vectors $\frac{dE}{dx} = \# m^2 Z_+ \cos s^2 (kx - mr)$	For bits statistic wines and insorting variation design density is proportional to the amplitude operator. For a travisling ratio we have $\frac{dZ}{dx} = \mu \omega^2 Z_g \cos^2(kx - \omega r)$
For both shouling nerver and travelling verse, the total energy density is propertient in the rapidal speed. For a traviling was no ten $\frac{dE}{dx} = \mu \omega^+ Z_{ij} \cos \sigma^2 (kx = \omega \tau)$	For short meeting waves and inter-Englander, the first interpt density is projective to the staglish space). The a transling wave we have $\frac{dE}{dx} = \mu\omega^2 Z_y \cos^2(\lambda x - \omega t)$	For host randing values and rewarding remon, the hold energy density is proportional to the auglitisk space. For a breaking was no loss $\frac{dE}{dx} = \mu \sin^2 Z_0 \cos^2 (kx - \omega x)$
For both standing waves and horselving waves, for total energy density in proportional to the amplitude operand. For a travelling wave we have $\frac{dE}{dx} = \mu \omega^{-2}Z_0 \cos^2(kx-\omega r)$	For high stateling winns, and instrating warms, the head energy density in proportional to the engineers expect, the stateling which is have $\frac{dE}{dx} = \mu m^3 Z_0 \cos^4(kx - \omega t)$	For both standing waves and travelling varies, the conditioning distribution is a summation of the standing wave or three $\frac{dE}{dx} = \mu \Omega^{-1} Z_{+} \cos^{-1}(kx - 4\pi x)$
For each similing inspect and transiting value, the total energy density is proportional to the complicate squares. For a transiting wave we have $\frac{dE}{dx} = \mu \omega^2 Z_y \cos^2(kx - \omega_f)$	For both shading wave, and investing energy, the half-energy density is proportional to the completed equation. For a harvelling wave we for $\frac{dE}{dx} = \mu a e^2 Z_0 \cos^2(kx - a x)$	For help standing waves, and travalling waves, the bold energy density is popurated to the variability sourced. For a travelling wave as have $\frac{dE}{dx} = \mu \cos^2 Z_{ij} \cos \cos^2 (kx - \cos t)$
, the last enemgy waves and constiting waves, is set any court in property to a small last operature. For a travelling waves we have $\frac{dE}{dx} = \mu \omega^2 Z_{\perp} \cos^2(kx - \omega x)$	For harholding winds and concil by words, the individually details in physician to the september upward. For a knowledge state we have $\frac{dE}{dx} = \mu_{BF}^{-1}Z_{+0}\cos^{4}(kx-a_{BF})$	For both standing water and standing waters, the initial energy density is proportional to the simplicial explanet. For a wearding more we have $\frac{dE}{dx} = \mu\omega^{\frac{1}{2}}Z_{0}\cos^{\frac{1}{2}}(kx-\omega)$
For both standing warms and translating varies, the total energy density is proportional to the amplitude equated. For a manching wave we have $\frac{dE}{dx} = \mu \alpha^2 Z_y \cos^2 \left(kx - \alpha x\right)$	The transformation transform of the transformation of the transfo	For both modely name and counting inverse, the total caseign density is propertiesed to the squared. For a convolute term we have $\frac{dE}{dx} = \mu(\omega)^2 Z_{\phi} \cos^2(\delta x - \omega t)$
We both standing waves and cased for waves, the total energy density is preparation to the explicitle autocol. For a noted large wave we have $\frac{dE}{dx} \equiv \mu \Omega^{-1} Z_{+1} \cos^{-2}(kx-\omega t)$	For both modify wave, and conditing turns, the total energy density is proportional to the conditional variables with the both $\frac{dE}{dx} = \mu_1 m^2 Z_{ij} \cos^2(kx - \eta_0 t)$	For both Washing waves and sprelling waves, the tend energy density is proportional to the enabled network. For a transition wave weight $\frac{dE}{dx} = \mu \omega^2 Z_{\phi} \cos^2(kx - \omega r)$

Output File Size = 783,848 Compression Ratio = 21.5

MATH - Simple Text and Lineart



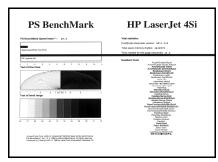
Output File Size = 79,245 Compression Ratio = 212.4

MP - Text and Simple Graphics



Output File Size = 86,525 Compression Ratio = 194.5

BENCH2 - Text and Graphics with Pictorials



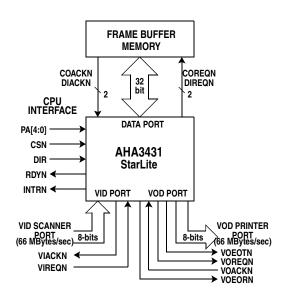
Output File Size = 424,995 Compression Ratio = 39.6

BALLS - Complex Graphics with Pictorials



Output File Size = 3,665,167 Compression Ratio = 4.6

COMPRESSOR/DECOMPRESSOR FOR MID-RANGE MULTIFUNCTION COPIER/PRINTER APPLICATIONS - AN EXAMPLE



ABOUT AHA

Comtech AHA Corporation (AHA) develops and markets superior integrated circuits, boards, and intellectual property core technology for communications systems architects worldwide. AHA has been setting the standard in Forward Error Correction and Lossless Data Compression technology for many years and provides flexible, cost-effective solutions for today's growing bandwidth and reliability challenges. Comtech AHA Corporation is a wholly owned subsidiary of Comtech Telecommuncations Corp. (NASDAQ: CMTL). For more information, visit www.aha.com.

ORDERING INFORMATION

PART NUMBER	DESCRIPTION
	50 MBytes/sec Simultaneous Compressor/Decompressor IC
AHA3431A-066 PQC	66 MBytes/sec Simultaneous Compressor/Decompressor IC



A subsidiary of Comtech Telecommunications Corporation

1126 Alturas Drive Moscow ID 83843-8331 tel: 208.892.5600 fax: 208.892.5601 e-mail: sales@aha.com www.aha.com