



*The Data  
Coding Leader*

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*FOR IMMEDIATE RELEASE*

**AHA Announces Turbo Product Code  
Forward Error Correction Technology**

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PULLMAN – November 2, 1998 – Advanced Hardware Architectures (AHA) Incorporated today announced the introduction of Forward Error Correction (FEC) integrated circuit technology based on Turbo Product Codes (TPCs).

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TPCs are similar in concept to Turbo Convolutional Codes (TCCs) that were first discovered in 1993 by French researchers. TPCs differ from TCCs as they are based on the iterative decoding of Block Codes such as Hamming Codes instead of Convolutional Codes. Forward Error Correction hardware based on TPCs has several major advantages over other competing technologies:

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1. TPCs provide up to 1.5 dB of coding gain over that achievable by concatenated Reed-Solomon/Viterbi technology.
2. TPCs do not have an error floor as is commonly exhibited by Turbo Codes that are based on Convolutional Codes.
3. TPCs are extremely efficient and are able to operate close to Shannon's limit of theoretical efficiency when operating at high code rates. For example at a 0.8 code rate, TPCs can operate within 1 dB of the Shannon limit.
4. Commercially viable TPC silicon can be built that significantly improves the cost performance ratio of a system over a wide range of market segments.

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The first product in a planned family of TPC solutions, the AHA4501, is available for sampling and evaluation by qualified users with production units slated for the first Quarter of 1999. The AHA4501 is a single-chip TPC encoder/decoder that operates at encoded rates of up to 36 Mbits/sec.

Fabricated in 0.35  $\mu\text{m}$  CMOS technology, the AHA4501 has a programmable architecture that can operate over a range of code rates from 0.325 up to 0.793. Block sizes range from 256 bits up to 4096 bits which means this technology may be used in a wide range of applications including burst mode systems utilizing TDMA protocols. Introductory pricing for this first product is less than \$50 in quantities of 10 units.

In addition to silicon, AHA has Windows™ based evaluation software that may be used to verify the performance of the AHA4501 prior to system level design. A PC compatible evaluation board will be available in late fourth quarter of 1998 that will operate at the full rated speed of the AHA4501.

According to Dr. Pat Owsley, Chief Operating Officer for AHA: "The flexibility of the TPC architecture will enable us to design products targeted toward a diverse array of market segments, including: satellite communications, wireless local and wide area networks, wired communications such as gigabit Ethernet and xDSL, point to point terrestrial data links, LMDS, telemetry and instrumentation data links, cellular, and Wireless Local Loop systems. Since TPC technology is based on block codes, it is likely that the codes will be useful for data storage products as well".

"Turbo Product Codes perform significantly better than the Turbo Convolution Codes at high code rates" said Dr. Bill Thesling, President of Efficient Channel Coding, Inc., AHA's partner in the development of TPC technology. "As a result, Turbo Product Codes, as implemented in AHA's 4501 are better suited to real world applications where maximizing data throughput in a bandwidth limited channel is important."

AHA envisions a wide range of TPC based products including the licensing of configurable cores that will be able to address applications ranging from Gbit/sec data rates down to low rate, cost sensitive systems. A second product now in the concept stage is targeted toward systems requiring OC3 data rates (155 Mbits/sec) and is expected to support data rates as high as 250 Mbits/sec utilizing 0.35  $\mu\text{m}$  CMOS technology.

AHA's TPC technology was developed in conjunction with Efficient Channel Coding, Inc. (ECC) of Eastlake, Ohio. Both ECC and AHA have patents pending on Turbo Product Code technology. In addition, AHA and ECC have a continuing partnership for the development of coding and communications technology.

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Headquartered in Pullman, WA, AHA is a fabless semiconductor company that develops, markets and licenses data coding technologies such as Reed-Solomon, Viterbi, Turbo Product Codes, and both lossless and lossy data compression. In 1989, AHA's founders pioneered the world's first commercially viable single chip Reed-Solomon FEC decoder which has since become the preferred standard for much of the world's communications and data storage applications.

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