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cycle at the output. For functions in modulo 11, 13, or 15, the 9305 requires only two additional NAND gates or one gate and an inverter. These design combinations provide controllable four-bit modulos with an output duty cycle of nearly 50%.

Thanks to its high-speed counting capability (typically 26 megahertz) the 9305 is ideal for multistage counting operations when programed for modulos of 10, 12, 14 or 16. Multistage dividers with large odd or even divide ratios can be designed using two or more 9205s and only very little additional logic. With only one ripple delay per four bits, the 9305 operates much faster than conventional ripple counters which have a built-in delay for every bit. The unit also can be used in designing TV sync generators, one-of-10 sequencers, rate multipliers, and many other multistage counting functions.

Smith says that in TV applications, the 9305 can be used for both the horizontal and vertical drives. "By using three 9305s," says Smith, "we can produce the 625 lines needed for European circuits or the 525 needed for American sets. And all of the decoding logic is included in the three packages."

The 9305 is available from Fairchild distributors in a 14-pin dual in-line package, and is priced at $3.45 in quantities of 100.

Fairchild Semiconductor Inc., 313 Fairchild Drive, Mountain View, Calif. 94040 **[444]**

Low-cost bipolar encoder aimed at keyboard market

Many of the new keyboard encoders are metal oxide semiconductor types. But a low-cost bipolar monolithic encoder is Harris Semiconductor's entry into this lucrative market. Housed in a dual in-line package, the encoder will be priced at under $5 and will be able to handle up to 16 keys, sufficient for small calculators. For larger keyboards with up to 256 keys, only two encoders are necessary. They can be wired for any of the popular codes, including the 7-bit ASCII and the 8-bit EBCDIC.

According to Harris, the encoder will provide exceptional flexibility in shifting from one code to another without time-consuming keyboard modifications. Adaptation is achieved by using the truth tables supplied. These tell the user how to hook up the encoder inputs.

Called the HD-0165, the bipolar encoder contains a 16 x 5 matrix and 13 gates. The 24-pin dual in-line package has 16 inputs, four binary outputs, a two-key rollover detection output, a strobe output, and two input power pins. When a key is depressed, a binary four-bit code is generated (an eight-bit code for two encoders) together with a strobe level. The outputs are compatible with diode-transistor and transistor-transistor logic levels; the HD-0165 is not compatible with p-channel MOS. Since the output is a straight binary code, parity must be provided by external circuitry. The encoder inputs are compatible with all closure-type keys, as well as other types that provide +5 volt signal, pulsed or steady state. Total propagation time through the matrix is 115 nanoseconds, so input pulses must be at least that long.

The encoder operates from a +5 volt power supply and draws 51.5 milliamperes maximum when one key is depressed and 80 mA max when all 16 keys are held down. The voltage out corresponding to a binary 0 is 0.4 V; it's 2.4 V for a binary 1.

To develop a complete encoder, the HD-0165 requires only a 3 milisecond one-shot for timing and a four-bit latch to accumulate data until it's ready for processing.

"Cost is the strong point of the encoder," says David Uimari, applications manager, "since it will compete with discretes and hybrids." The HD-0165 is priced at $4.60 each in quantities of 100 and higher. "Discretes cost more than $6," adds Uimari. Deliveries begin this month.

Harris Semiconductor, division of Harris-Intertype Corp., Melbourne, Fla., 32901 **[445]**