

# Design of a Multicode Bi-Phase Encoder for Data Transmission

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## Abstract

In this paper, we present a versatile Multicode Bi-Phase Encoder (MBPE) circuit capable of encoding five different Bi-Phase line codes, namely: Bi-Phase-Level (Bi- $\Phi$ -L), Bi-Phase-Mark (Bi- $\Phi$ -M), Bi-Phase-Space (Bi- $\Phi$ -S), Differential Manchester (DM) and Inverse Differential Manchester (IDM) codes. The design methodology is based on a new definition of these codes in terms of encoding rules and state diagrams, instead of the traditional way of representing them in terms of their bit transition. The operation mode of the MBPE is set by three selection lines, which can be either hardware or software controlled. This will facilitate the process of altering the data transmission protocol without the need of changing the encoder hardware. The functionality and design of the MBPE is outlined. VHDL has been used to describe the behavior of the MBPE whose operation was verified using the ModelSim XE II Simulation tools. Implementation and testing of the MBPE on XILINX Spartan-II FPGA showed that the MBPE circuit is capable of encoding NRZ data into any of the five codes.