

DECODER

A decoder is a circuit that changes a code into a set of signals. It is called a decoder because it does the reverse of encoding, but we will begin our study of encoders and decoders with decoders because they are simpler to design. A decoder is a logic device that converts an N bit binary input code into M output lines such that only one output line is activated for each one of the possible combinations of inputs.

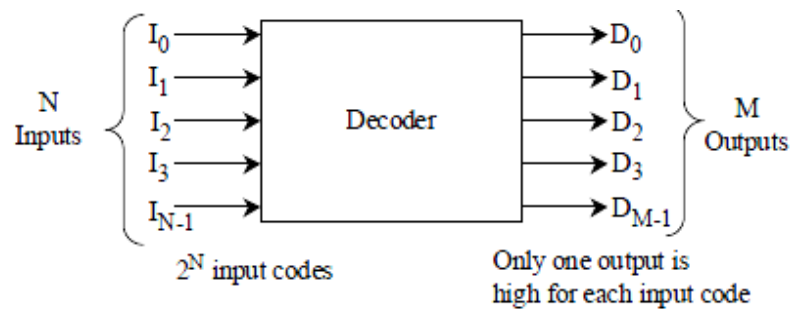


Fig: Logic symbol

A common type of decoder is the line decoder which takes an n -digit binary number and decodes it into 2^n data lines. The simplest is the 1-to-2 line decoder. The truth table is

A	D_1	D_0
0	0	1
1	1	0

Only slightly more complex is the 2-to-4 line decoder. The truth table is

A_1	A_0	D_3	D_2	D_1	D_0
0	0	0	0	0	1
0	1	0	0	1	0
1	0	0	1	0	0
1	1	1	0	0	0

Developed into a circuit it looks like

Example 1:

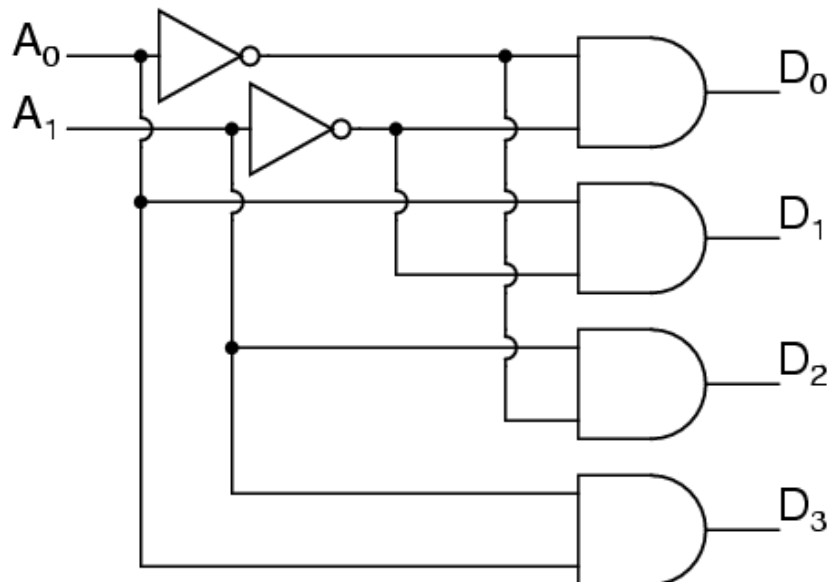
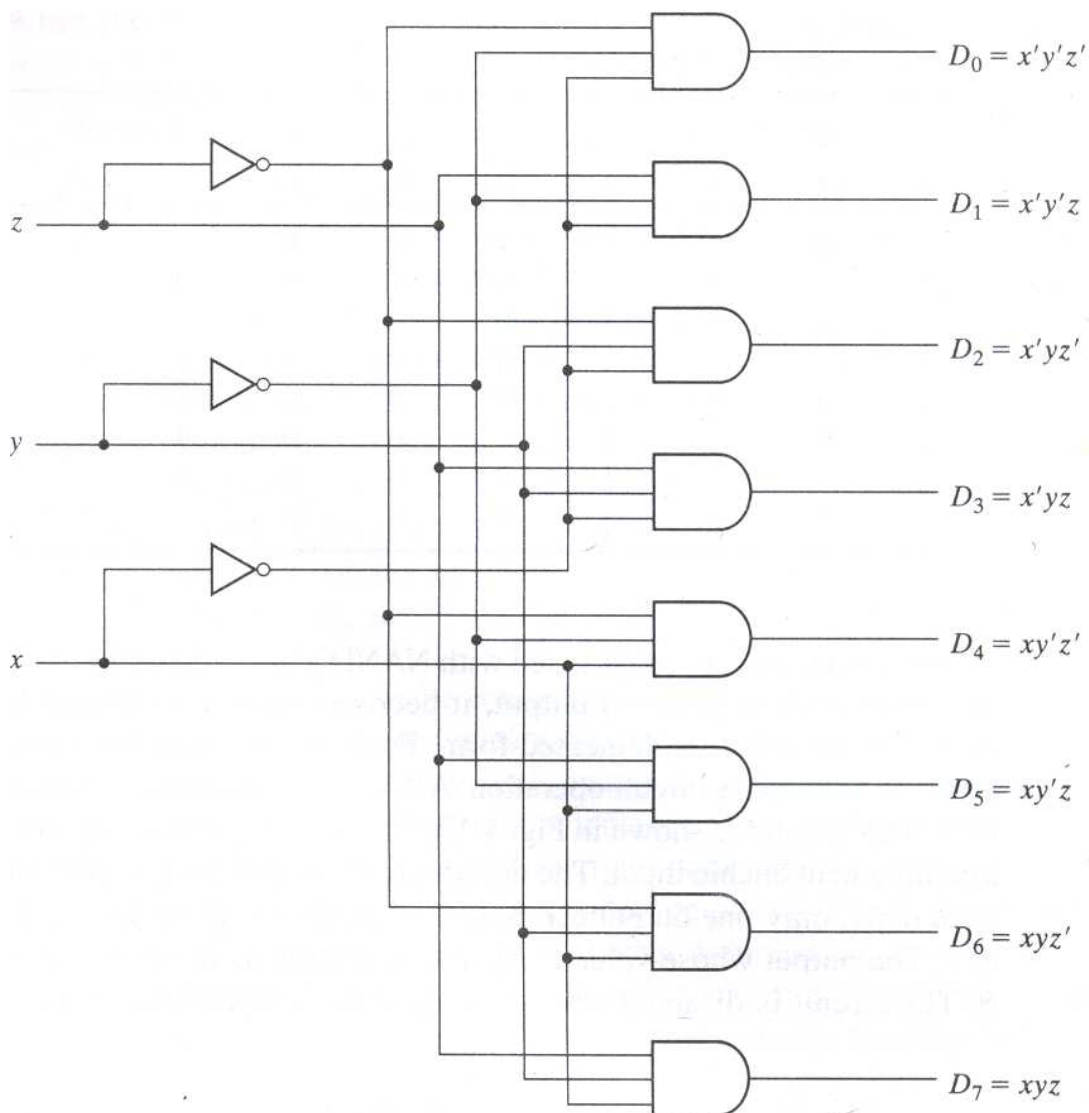


Fig: 2 to 4 line decoder

Example 2:**3 TO 8 DECODER**

IF the n-bit coded information has unused combinations, the decoder may have fewer than 2^n outputs

The decoders presented here are called n-to-m-line decoders, where $m \leq 2^n$. Their purpose is to generate the 2^n (or fewer) minterms of n input variables. The name decoder is also used in conjunction with other code converters such as a BCD-to-seven-segment decoder.



As an example, consider the 3-to-8 line decoder circuit Fig 1. The three inputs are decoded into eight outputs, each representing one of the minterms of the three input variables. The three inverters provide the complement of the inputs, and each one of the eight AND gates generates one of the minterms. A particular application of this decoder is binary-to-octal conversion. The input variables represent a binary number, and the outputs represent the eight digits in the octal number system. However, a 3-to-8-line decoder can be used for decoding any 3-bit code to provide eight outputs, one for each element of the code.

The operation of the decoder may be clarified by the truth table listed in Table 1. For each possible input combination, there are seven outputs that are equal to 0 and only one that is equal to 1. The output whose value is equal to 1 represents the minterm equivalent of the binary number presently available in the input lines

Truth Table of a 3-to-8-Line Decoder

Inputs			Outputs							
<i>x</i>	<i>y</i>	<i>z</i>	<i>D</i> ₀	<i>D</i> ₁	<i>D</i> ₂	<i>D</i> ₃	<i>D</i> ₄	<i>D</i> ₅	<i>D</i> ₆	<i>D</i> ₇
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1