What is Decoder

A binary code is converted to be a decimal number.

For example:

0000  ➞  0
0001  ➞  1
...
1001  ➞  9
...
1111  ➞  15
2 to 4 Decoder

- **Binary codes 00, 01, 10, and 11** are converted to be respective **decimal numbers 0, 1, 2, and 3**.

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>B A</td>
<td>0 1 3 4</td>
</tr>
<tr>
<td>0 0</td>
<td>1 0 0 0</td>
</tr>
<tr>
<td>0 1</td>
<td>0 1 0 0</td>
</tr>
<tr>
<td>1 0</td>
<td>0 0 1 0</td>
</tr>
<tr>
<td>1 1</td>
<td>0 0 0 1</td>
</tr>
</tbody>
</table>

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3 to 8 Decoder

- **BCD codes 000, 001, 010, ..., 100, and 111** are converted to be respective **decimal numbers 0, 1, 2, ..., 6, and 7**.

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>C B A</td>
<td>0 1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>0 0 0</td>
<td>1 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>0 0 1</td>
<td>0 1 0 0 0 0 0 0</td>
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<tr>
<td>0 1 0</td>
<td>0 0 1 0 0 0 0 0</td>
</tr>
<tr>
<td>0 1 1</td>
<td>0 0 0 1 0 0 0 0</td>
</tr>
<tr>
<td>1 0 0</td>
<td>0 0 0 0 1 0 0 0</td>
</tr>
<tr>
<td>1 0 1</td>
<td>0 0 0 0 0 1 0 0</td>
</tr>
<tr>
<td>1 1 0</td>
<td>0 0 0 0 0 0 1 0</td>
</tr>
<tr>
<td>1 1 1</td>
<td>0 0 0 0 0 0 0 1</td>
</tr>
</tbody>
</table>

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3 to 8 Decoder with Active Low

TTL 74138: 3 to 8 decoder with active low output.

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>/0</td>
</tr>
<tr>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td>0</td>
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</tr>
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</tbody>
</table>

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## BCD to Decimal Decoder

**TTL 7442**: BCD to decimal decoder with active low output.

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
<th>/Y0</th>
<th>/Y1</th>
<th>/Y2</th>
<th>/Y3</th>
<th>/Y4</th>
<th>/Y5</th>
<th>/Y6</th>
<th>/Y7</th>
<th>/Y8</th>
<th>/Y9</th>
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</thead>
<tbody>
<tr>
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<td>1</td>
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<td>1</td>
</tr>
</tbody>
</table>

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## 7-segment Display

**Common Anode 7-segment display**

![7-segment Display Diagram]

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Example of CA 7-segment Display

BCD to 7-segment Decoder

- **TTL 7447**: BCD to CA 7-segment decoder with active low output.

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>C</td>
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</table>
BCD to 7-segment Decoder

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