The Ideal Diode Circuit Analysis Guide

Follow these easy steps to successfully analyze a circuit containing one or more ideal diodes!

**Step 1:** **ASSUME** a bias state for each ideal diode.

⇒ In other words, **GUESS** !!

Either,

a) **ASSUME** an ideal diode is **forward biased**, or

b) **ASSUME** it is **reversed biased**.

**Step 2:** **ENFORCE** the **equality** condition consistent with your assumption.

a) If you assume an ideal diode is f.b., then **ENFORCE** the equality:

\[ v'_D = 0 \]

HOW? ⇒ By replacing the ideal diode with a short circuit!
b) If you assumed an ideal diode was r.b., then **ENFORCE** the condition that:

\[ i^i_D = 0 \]

**HOW?**  \( \Rightarrow \) By replacing the ideal diode with an **open** circuit.

**IMPORTANT !!!** Retain the **same** current and voltage definitions when you replace the ideal diode!

\[ i^i_D \]

\[ v^i_D \]

If, then, or

\[ i^i_D = 0 \]

\[ v^i_D \]

\[ i^i_D = 0 \]

\[ v^i_D \]

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**Step 3:** **ANALYZE** the circuit.

After the all **ideal** diodes have been replaced with either **shorts** or **opens**:

a) Determine **all** desired (required) circuit values.

b) Determine \( i^i_D \) through each **short** circuit and \( v^i_D \) across each **open** circuit.
**Step 4:** CHECK the inequality consistent with your assumption to see if this assumption is correct.

**HOW??**

a) An ideal diode cannot have negative current flowing through it. If you ASSUMED the ideal diode was forward biased, CHECK to see if the short circuit current is positive, i.e.:

\[ i_D^f > 0 \]

If true, you ASSUMED correctly! If not, your f.b. assumption is wrong.

b) An ideal diode cannot have positive voltage across it. If you ASSUMED the ideal diode was reversed biased, CHECK to see if the open circuit voltage is negative, i.e.:

\[ v_D^i < 0 \]

If true, you ASSUMED correctly! If not, your r.b. assumption is wrong.

**Step 5:** If you ASSUMED incorrectly, then change your assumptions and return to step 1!
Notes on ideal diode circuit analysis:

1) You **must** check all assumptions in this form:

\[ i_D^i = 2 \text{ mA} > 0 \checkmark \quad \text{or} \quad v_D^i = 2.2 > 0 \times \]

2) Do **not** check the condition that you enforced!

3) For **every** circuit, one and only one assumption will be valid.