Basic Electric Circuit Concepts

Circuit Elements:

We classify circuit elements as passive and active.

Passive elements cannot generate energy. Common examples of passive elements are resistors, capacitors and inductors. We will see later than capacitors and inductors can store energy but cannot generate energy.

Active elements can generate energy. Common examples of active elements are power supplies, batteries, operational amplifiers.

For the present time we will be concerned only with sources. The types of sources we consider are independent and dependent.
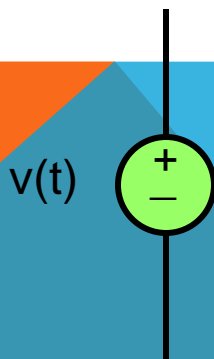
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Basic Electric Circuit Concepts

Ideal independent voltage source

An *ideal dependent voltage source* is characterized as having a constant voltage across its terminals, regardless of the load connected to the terminals.

The ideal voltage source can supply any amount of current. Furthermore, the ideal independent voltage source can supply any amount of power.

The standard symbols of the ideal independent voltage source are shown below.
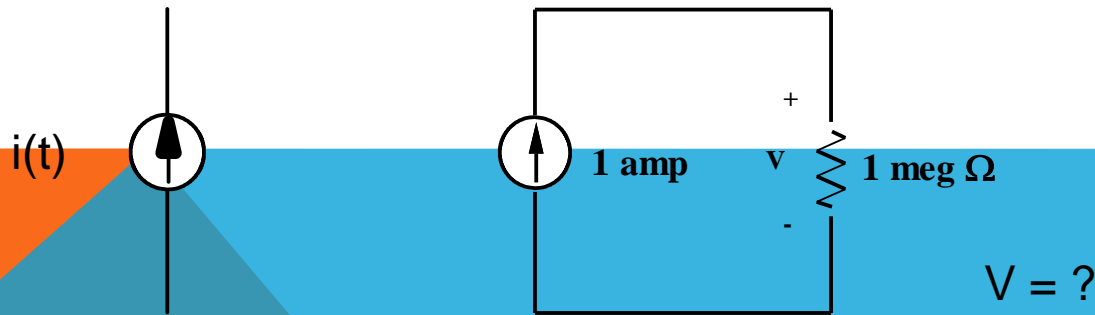
v(t) ⊕ Most often used   E ⊨ Sometimes used

Basic Electric Circuit Concepts

Ideal independent current sources

An ideal independent current source is characterized as providing a constant value of current, regardless of the load.

If the current source is truly ideal, it can provided any value of voltage and any amount of power.

The standard symbol used for the ideal independent current source is shown below.

i(t)

1 amp   V   1 meg Ω

V = ?

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Basic Electric Circuit Concepts

Comments about ideal model

The ideal independent voltage and current sources are models. As such, they are subject to limitations.

For example, an independent voltage source, that one commonly works with, cannot put-out $1x10^{320}$ volts.

Neither can an ordinary independent current source put out $4x10^{765}$ amps.

We must always keep these limitations in mind. Otherwise one might think that one could start an automobile engine with a 12 V radio battery!
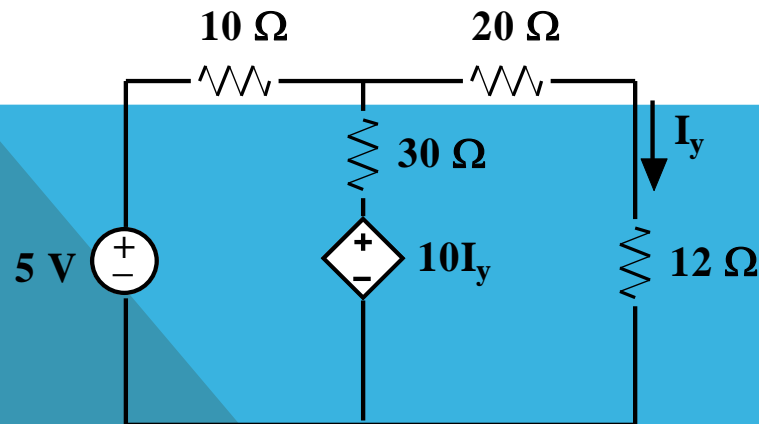
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Basic Electric Circuit Concepts

Dependent voltage source

A dependent voltage source is characterized by depending on a voltage or current somewhere else in the circuit. The symbol For the current source is shown below. Note the diamond shape.

A circuit containing a dependent voltage source is shown below.

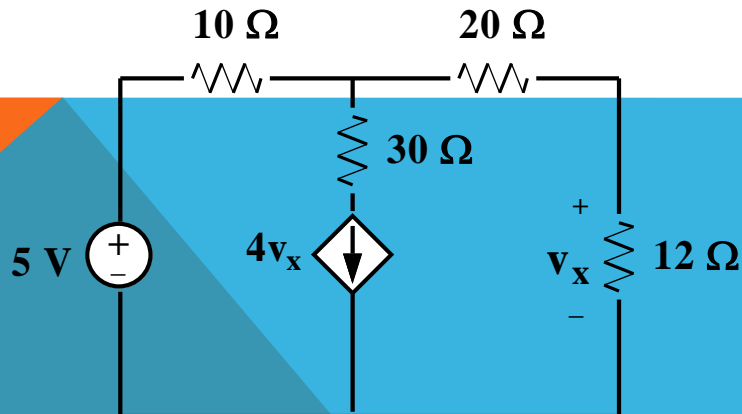A circuit with a current controlled dependent voltage source.

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Basic Electric Circuit Concepts

Dependent current source

A dependent current source is characterized by depending on a voltage or current somewhere else in the circuit. The symbol for a dependent current source is shown as follows:

A circuit containing a dependent current source is shown below.

10 Ω	20 Ω

30 Ω

5 V $4v_x$ v_x 12 Ω

A circuit with a voltage controlled dependent current source