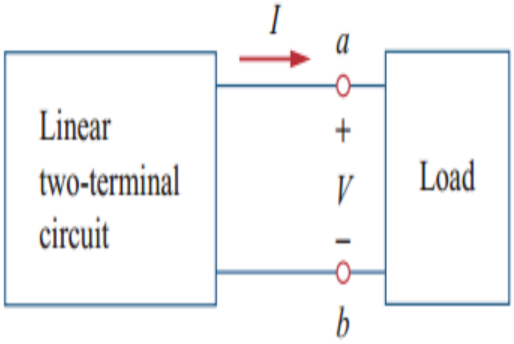
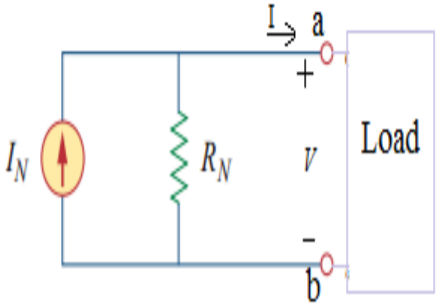
9 - Norton

Norton's Theorem

Norton's theorem states that a linear two-terminal circuit can be replaced by any equivalent circuit consisting of a current source I_N in parallel with resistor R_N, where I_N is the short-circuit current through the terminals and R_N is the input or equivalent resistance at the terminals when the independent sources are turned off

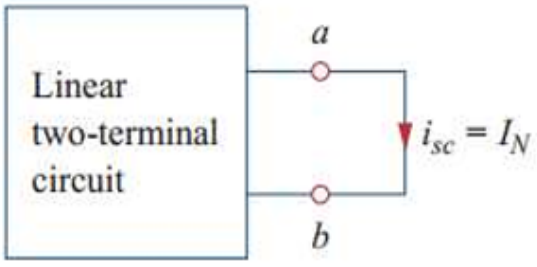


Linear two-terminal circuit

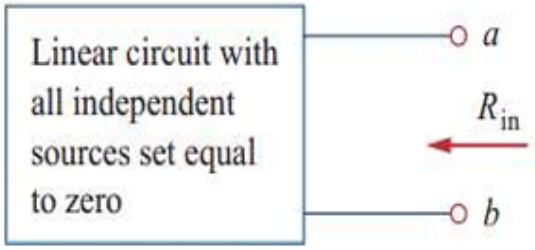


Norton equivalent circuit

Two circuits are said to be equivalent if they have the same voltage-current relation at their terminals.



$I_N = i_{sc}$



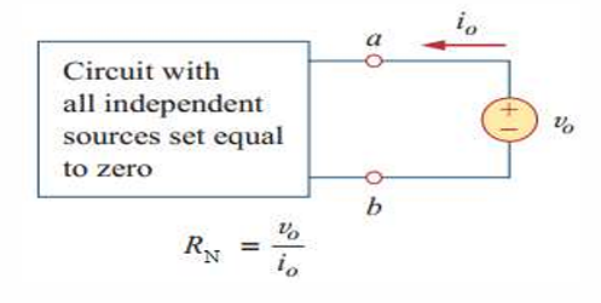
$R_N = R_{in}$

Thevenin and Norton resistances are equal, $R_N = R_{Th}$

Relationship between Norton's and Thevenin's theorem is

$$I_N = \frac{V_{Th}}{R_{Th}}$$

If the network had dependent sources, we turn of all independent sources. Dependent sources are not to be turned off because they are controlled by circuit variables. We apply a voltage source v_o at terminals a and be and determine the resulting current. Then $R_N = \frac{v_o}{i_o}$



Alternatively, we may insert a current source at terminals i_o a-b as shown in figure and find the terminal voltage. Again then $R_N = \frac{v_o}{i_o}$