

$$\boxed{B_{00}} = \text{X} \quad \boxed{B_{01}} = \text{X} \begin{array}{c} \bullet \\ \bullet \end{array} \begin{array}{c} \bullet \\ \bullet \end{array} \begin{array}{c} \oplus \\ \bullet \end{array}$$

Def 3: $\text{X} := \begin{array}{c} \text{H} \quad \bullet \quad \text{H} \quad \bullet \quad \text{H} \quad \bullet \\ \text{H} \quad \bullet \quad \text{H} \quad \bullet \quad \text{H} \quad \bullet \end{array}$

C7: (1) $\begin{array}{c} \bullet \\ \bullet \end{array} \boxed{S} = \boxed{S} \begin{array}{c} \bullet \\ \bullet \end{array}$ (2) $\begin{array}{c} \bullet \\ \bullet \end{array} \boxed{S} = \boxed{S} \begin{array}{c} \bullet \\ \bullet \end{array}$

R18: (1) $\boxed{S} \text{X} = \text{X} \boxed{S}$ (2) $\boxed{S} \text{X} = \text{X} \boxed{S}$

R23: $\boxed{S} \oplus = \begin{array}{c} \oplus \quad \bullet \\ \bullet \quad \bullet \end{array} \begin{array}{c} \text{S} \\ \text{Z} \quad \text{Z} \quad \text{S} \end{array} \cdot w^2$

Lem 27 By Def 3, C7, R18 & R23,

11. (1) $\begin{array}{c} \text{S} \\ \text{B}_{00} \end{array} = \text{B}_{00} \text{S}$

(2) $\begin{array}{c} \text{S} \\ \text{B}_{01} \end{array} = \text{B}_{01} \begin{array}{c} \bullet \\ \bullet \end{array} \begin{array}{c} \text{S} \\ \text{Z} \quad \text{Z} \quad \text{S} \end{array} \cdot w^2$

Proof: 11. (1). LHS := $\begin{array}{c} \text{S} \\ \text{B}_{00} \end{array} \xrightarrow{\text{def}} \boxed{\text{X} \begin{array}{c} \bullet \\ \bullet \end{array}} \xrightarrow{\text{R18}} \text{X} \boxed{\begin{array}{c} \text{S} \\ \bullet \end{array}}$

$\xrightarrow{\text{C7}} \boxed{\text{X}} \begin{array}{c} \bullet \\ \bullet \end{array} \text{S} \xrightarrow{\text{def}} \text{B}_{00} \text{S} =: 11. (1). \text{RHS}$

11. (2). LHS := $\begin{array}{c} \text{S} \\ \text{B}_{01} \end{array} \xrightarrow{\text{def}} \boxed{\text{X} \begin{array}{c} \bullet \\ \bullet \end{array} \begin{array}{c} \bullet \\ \bullet \end{array} \oplus} \xrightarrow[\text{R18}]{\text{C7}} \text{X} \begin{array}{c} \bullet \\ \bullet \end{array} \begin{array}{c} \bullet \\ \bullet \end{array} \boxed{\begin{array}{c} \text{S} \\ \oplus \end{array}}$

$\xrightarrow{\text{R23}} \boxed{\text{X} \begin{array}{c} \bullet \\ \bullet \end{array} \begin{array}{c} \bullet \\ \bullet \end{array} \oplus} \begin{array}{c} \text{S} \\ \text{Z} \quad \text{Z} \quad \text{S} \end{array} \cdot w^2$

$\xrightarrow{\text{def}} \text{B}_{01} \begin{array}{c} \bullet \\ \bullet \end{array} \begin{array}{c} \text{S} \\ \text{Z} \quad \text{Z} \quad \text{S} \end{array} \cdot w^2 =: 11. (2). \text{RHS}$

□

$$B_{02} = \text{circuit diagram}$$

$$B_{10} = \text{circuit diagram}$$

$$B_{11} = \text{circuit diagram}$$

$$B_{12} = \text{circuit diagram}$$

$$B_{20} = \text{circuit diagram}$$

$$B_{21} = \text{circuit diagram}$$

$$B_{22} = \text{circuit diagram}$$

$$B_{1b}$$

$$= \text{circuit diagram}$$

$$B_{2b}$$

$$= \text{circuit diagram}$$

In each B_{ab} ,
the circuit before
| is B'_{ab} .

$$B_{ab} =$$

$$B'_{ab} \oplus \text{where}$$

$$B'_{ab} \stackrel{R_{18}}{=} \stackrel{C_7}{=}$$

$$B'_{ab} \oplus$$

Lem 28 By Def 3, C_7 , R_{18} & R_{23} ,

$$11. (3) \quad \text{circuit diagram} = \text{circuit diagram} \cdot w^2$$

$$(4) \quad \text{circuit diagram} = \text{circuit diagram} \cdot w^2$$

$$(5) \quad \text{circuit diagram} = \text{circuit diagram} \cdot w^2$$

$$(6) \quad \text{circuit diagram} = \text{circuit diagram} \cdot w^2$$

$$(7) \quad \text{circuit diagram} = \text{circuit diagram} \cdot w^2$$

$$(8) \quad \text{circuit diagram} = \text{circuit diagram} \cdot w^2$$

$$(9) \quad \text{circuit diagram} = \text{circuit diagram} \cdot w^2$$

$$\text{Proof: } 11. (3)-(9). \text{LHS} := \text{circuit diagram} \stackrel{\text{def}}{=} \text{circuit diagram} \stackrel{R_{18}}{=} \stackrel{C_7}{=} \text{circuit diagram}$$

$$\stackrel{R_{23}}{=} \text{circuit diagram} \cdot w^2$$

$$\stackrel{\text{def}}{=} \text{circuit diagram} \cdot w^2 =: 11. (3)-(9). \text{RHS}$$