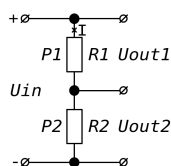


Делитель напряжения на 2-х резисторах

версия 4.1 (наброски), черновик

Схема делителя



$R1$ - она же переменная, он же резистор $R1$.
 $R2$ - она же переменная, он же резистор $R2$.

Формулы

—[Выходное напряжение U_{out1} , U_{out2}]—

$$U_{out1} = \frac{R1}{R1 + R2} \cdot U_{in}$$

$$U_{out2} = \frac{R2}{R1 + R2} \cdot U_{in}$$

$$U_{out1} = U_{in} - U_{out2}$$

$$U_{out2} = U_{in} - U_{out1}$$

—[Входное напряжение U_{in}]—

$$U_{in} = \frac{R1 + R2}{R1} \cdot U_{out1}$$

$$U_{in} = \frac{R1 + R2}{R2} \cdot U_{out2}$$

$$U_{in} = U_{out1} + U_{out2}$$

—[Сопротивление $R1$, $R2$, и их R_{total}]—

$$R1 = \frac{U_{in} \cdot R2}{U_{out2}} - R2$$

$$R2 = \frac{U_{in} \cdot R1}{U_{out1}} - R1$$

$$R1 = \frac{U_{out1} \cdot R_{total}}{U_{in}}$$

$$R2 = \frac{U_{out2} \cdot R_{total}}{U_{in}}$$

Примечание.

R_{total} - суммарное сопротивление резисторов $R1 + R2$.

$$R1 = \frac{U_{out1} \cdot R_{total}}{U_{out1} + U_{out2}}$$

$$R2 = \frac{U_{out2} \cdot R_{total}}{U_{out1} + U_{out2}}$$

$$R1 = R_{total} - R2$$

$$R2 = R_{total} - R1$$

$$R_{total} = \frac{U_{in}}{I}$$

—[Рассеиваемая мощность на $R1$, $R2$ ($P1$, $P2$)]—

$$P1 = \frac{U_{out1} \cdot U_{out1}}{R1}$$

$$P2 = \frac{U_{out2} \cdot U_{out2}}{R2}$$

—[Ток I]—

$$I = \frac{U_{out1}}{R1}$$

$$I = \frac{U_{out2}}{R2}$$

$$I = \frac{U_{in}}{R1 + R2}$$

$$I = \frac{U_{in}}{R_{total}}$$

Расчёты

—[Выходное напряжение U_{out1} , U_{out2}]—

$$U_{out1} = \frac{1000_{R1}}{1000_{R1} + 2000_{R2}} \cdot 10_{U_{in}} = 3.33B$$

$$U_{out2} = \frac{2000_{R2}}{1000_{R1} + 2000_{R2}} \cdot 10_{U_{in}} = 6.66B$$

$$U_{out1} = 10_{U_{in}} - 6.66_{U_{out2}} = 3.33B$$

$$U_{out2} = 10_{U_{in}} - 3.33_{U_{out1}} = 6.66B$$

—[Входное напряжение U_{in}]—

$$U_{in} = \frac{1000_{R1} + 2000_{R2}}{1000_{R1}} \cdot 3.33_{U_{out1}} = 10B$$

$$U_{in} = \frac{1000_{R1} + 2000_{R2}}{2000_{R2}} \cdot 6.66_{U_{out2}} = 10B$$

$$U_{in} = 3.33_{U_{out1}} + 6.66_{U_{out2}} = 10B$$

—[Сопротивление $R1$, $R2$, и их R_{total}]—

$$R1 = \frac{10_{U_{in}} \cdot 2000_{R2}}{6.66_{U_{out2}}} - 2000_{R2} = 10000M$$

$$R2 = \frac{10_{U_{in}} \cdot 1000_{R1}}{3.33_{U_{out1}}} - 1000_{R1} = 20000M$$

$$R1 = \frac{3.33_{U_{out1}} \cdot 3000_{R_{total}}}{10_{U_{in}}} = 10000M$$

$$R2 = \frac{6.66_{U_{out2}} \cdot 3000_{R_{total}}}{10_{U_{in}}} = 20000M$$

Примечание.

R_{total} - суммарное сопротивление резисторов $R1 + R2$
($1000_{R1} + 2000_{R2} = 3000_{R_{total}}$).

$$R1 = \frac{3.33_{U_{out1}} \cdot 3000_{R_{total}}}{3.33_{U_{out1}} + 6.66_{U_{out2}}} = 10000M$$

$$R2 = \frac{6.66_{U_{out2}} \cdot 3000_{R_{total}}}{3.33_{U_{out1}} + 6.66_{U_{out2}}} = 20000M$$

$$R1 = 3000_{R_{total}} - 2000_{R2} = 10000M$$

$$R2 = 3000_{R_{total}} - 1000_{R1} = 20000M$$

$$R_{total} = \frac{10_{U_{in}}}{0.00333_I} = 30000 \Omega$$

—[Рассеиваемая мощность на R_1 , R_2 (P_1 , P_2)]—

$$P_1 = \frac{3.33_{U_{out1}} \cdot 3.33_{U_{out1}}}{1000_{R_1}} = 0.0110 \text{ Вт}$$

$$P_2 = \frac{6.66_{U_{out2}} \cdot 6.66_{U_{out2}}}{2000_{R_2}} = 0.0221 \text{ Вт}$$

—[Ток I]—

$$I = \frac{3.33_{U_{out1}}}{1000_{R_1}} = 0.00333 \text{ А}$$

$$I = \frac{6.66_{U_{out2}}}{2000_{R_2}} = 0.00333 \text{ А}$$

$$I = \frac{10_{U_{in}}}{1000_{R_1} + 2000_{R_2}} = 0.00333 \text{ А}$$

$$I = \frac{10_{U_{in}}}{3000_{R_{total}}} = 0.00333 \text{ А}$$

Расчёты (задачи)

—[Задача 1]—

Дано:

$$\begin{aligned} U_{in} &= 10 \text{ В} \\ R_1 &= 10000 \Omega = 1 \text{ кОм} \\ R_2 &= 20000 \Omega = 2 \text{ кОм} \end{aligned}$$

Найти: U_{out1} , U_{out2} , P_1 , P_2 , I

Решение:

$$U_{out1} = \frac{1000_{R_1}}{1000_{R_1} + 2000_{R_2}} \cdot 10_{U_{in}} = 3.33 \text{ В}$$

$$U_{out2} = \frac{2000_{R_2}}{1000_{R_1} + 2000_{R_2}} \cdot 10_{U_{in}} = 6.66 \text{ В}$$

$$P_1 = \frac{3.33_{U_{out1}} \cdot 3.33_{U_{out1}}}{1000_{R_1}} = 0.0110 \text{ Вт}$$

$$P_2 = \frac{6.66_{U_{out2}} \cdot 6.66_{U_{out2}}}{2000_{R_2}} = 0.0221 \text{ Вт}$$

$$I = \frac{10_{U_{in}}}{1000_{R_1} + 2000_{R_2}} = 0.00333 \text{ А}$$

Ответ:

$$\begin{aligned} U_{out1} &= 3.33 \text{ В} \\ U_{out2} &= 6.66 \text{ В} \\ P_1 &= 0.0110 \text{ Вт} \\ P_2 &= 0.0221 \text{ Вт} \\ I &= 0.00333 \text{ А} \end{aligned}$$

—[Задача 2]—

Дано:

$$\begin{aligned} U_{out1} &= 3.33 \text{ В} \\ R_1 &= 10000 \Omega = 1 \text{ кОм} \\ R_2 &= 20000 \Omega = 2 \text{ кОм} \end{aligned}$$

Найти: U_{in} , U_{out2} , P_1 , P_2 , I

Решение:

$$U_{in} = \frac{1000_{R_1} + 2000_{R_2}}{1000_{R_1}} \cdot 3.33_{U_{out1}} = 10 \text{ В}$$

$$U_{out2} = 10_{U_{in}} - 3.33_{U_{out1}} = 6.66 \text{ В}$$

$$P_1 = \frac{3.33_{U_{out1}} \cdot 3.33_{U_{out1}}}{1000_{R_1}} = 0.0110 \text{ Вт}$$

$$P_2 = \frac{6.66_{U_{out2}} \cdot 6.66_{U_{out2}}}{2000_{R_2}} = 0.0221 \text{ Вт}$$

$$I = \frac{10_{U_{in}}}{1000_{R_1} + 2000_{R_2}} = 0.00333 \text{ А}$$

Ответ:

$$\begin{aligned} U_{in} &= 10 \text{ В} \\ U_{out2} &= 6.66 \text{ В} \\ P_1 &= 0.0110 \text{ Вт} \\ P_2 &= 0.0221 \text{ Вт} \\ I &= 0.00333 \text{ А} \end{aligned}$$

—[Задача 3]—

Дано:

$$\begin{aligned} U_{out2} &= 6.66 \text{ В} \\ R_1 &= 10000 \Omega = 1 \text{ кОм} \\ R_2 &= 20000 \Omega = 2 \text{ кОм} \end{aligned}$$

Найти: U_{in} , U_{out1} , P_1 , P_2 , I

Решение:

$$U_{in} = \frac{1000_{R_1} + 2000_{R_2}}{2000_{R_2}} \cdot 6.66_{U_{out2}} = 10 \text{ В}$$

$$U_{out1} = 10_{U_{in}} - 6.66_{U_{out2}} = 3.33 \text{ В}$$

$$P_1 = \frac{3.33_{U_{out1}} \cdot 3.33_{U_{out1}}}{1000_{R_1}} = 0.0110 \text{ Вт}$$

$$P_2 = \frac{6.66_{U_{out2}} \cdot 6.66_{U_{out2}}}{2000_{R_2}} = 0.0221 \text{ Вт}$$

$$I = \frac{10_{U_{in}}}{1000_{R_1} + 2000_{R_2}} = 0.00333 \text{ А}$$

Ответ:

$$\begin{aligned} U_{in} &= 10 \text{ В} \\ U_{out1} &= 3.33 \text{ В} \\ P_1 &= 0.0110 \text{ Вт} \\ P_2 &= 0.0221 \text{ Вт} \\ I &= 0.00333 \text{ А} \end{aligned}$$

—[Задача 4]—

Дано:

$$\begin{aligned} U_{out1} &= 3.33 \text{ В} \\ U_{out2} &= 6.66 \text{ В} \end{aligned}$$

Найти: U_{in}

Решение:

$$U_{in} = 3.33_{U_{out1}} + 6.66_{U_{out2}} = 10 \text{ В}$$

Ответ:

$$U_{in} = 10 \text{ В}$$

—[Задача 5]—

Дано:

$$\begin{aligned}U_{in} &= 10B \\ U_{out2} &= 6.66B \\ R2 &= 20000\Omega = 2k\Omega\end{aligned}$$

Найти: $U_{out1}, R1, P1, P2, I$

Решение:

$$\begin{aligned}U_{out1} &= 10_{U_{in}} - 6.66_{U_{out2}} = 3.33B \\ R1 &= \frac{10_{U_{in}} \cdot 2000_{R2}}{6.66_{U_{out2}}} - 2000_{R2} = 10000\Omega \\ P1 &= \frac{3.33_{U_{out1}} \cdot 3.33_{U_{out1}}}{1000_{R1}} = 0.0110B\Gamma \\ P2 &= \frac{6.66_{U_{out2}} \cdot 6.66_{U_{out2}}}{2000_{R2}} = 0.0221B\Gamma \\ I &= \frac{10_{U_{in}}}{1000_{R1} + 2000_{R2}} = 0.00333A\end{aligned}$$

Ответ:

$$\begin{aligned}U_{out1} &= 3.33B \\ R1 &= 10000\Omega = 1k\Omega \\ P1 &= 0.0110B\Gamma \\ P2 &= 0.0221B\Gamma \\ I &= 0.00333A\end{aligned}$$

—[Задача 6]—

Дано:

$$\begin{aligned}U_{in} &= 10B \\ U_{out1} &= 3.33B \\ R1 &= 10000\Omega = 1k\Omega\end{aligned}$$

Найти: $U_{out2}, R2, P1, P2, I$

Решение:

$$\begin{aligned}U_{out2} &= 10_{U_{in}} - 3.33_{U_{out1}} = 6.66B \\ R2 &= \frac{10_{U_{in}} \cdot 1000_{R1}}{3.33_{U_{out1}}} - 1000_{R1} = 20000\Omega \\ P1 &= \frac{3.33_{U_{out1}} \cdot 3.33_{U_{out1}}}{1000_{R1}} = 0.0110B\Gamma \\ P2 &= \frac{6.66_{U_{out2}} \cdot 6.66_{U_{out2}}}{2000_{R2}} = 0.0221B\Gamma \\ I &= \frac{10_{U_{in}}}{1000_{R1} + 2000_{R2}} = 0.00333A\end{aligned}$$

Ответ:

$$\begin{aligned}U_{out2} &= 6.66B \\ R2 &= 20000\Omega = 2k\Omega \\ P1 &= 0.0110B\Gamma \\ P2 &= 0.0221B\Gamma \\ I &= 0.00333A\end{aligned}$$

—[Задача 7]—

Дано:

$$\begin{aligned}U_{in} &= 10B \\ U_{out1} &= 3.33B \\ R_{total} &= 30000\Omega = 3k\Omega\end{aligned}$$

Найти: $U_{out2}, R1, R2, P1, P2, I$

Решение:

$$\begin{aligned}U_{out2} &= 10_{U_{in}} - 3.33_{U_{out1}} = 6.66B \\ R1 &= \frac{3.33_{U_{out1}} \cdot 3000_{R_{total}}}{10_{U_{in}}} = 10000\Omega \\ R2 &= 3000_{R_{total}} - 1000_{R1} = 20000\Omega \\ P1 &= \frac{3.33_{U_{out1}} \cdot 3.33_{U_{out1}}}{1000_{R1}} = 0.0110B\Gamma \\ P2 &= \frac{6.66_{U_{out2}} \cdot 6.66_{U_{out2}}}{2000_{R2}} = 0.0221B\Gamma \\ I &= \frac{10_{U_{in}}}{3000_{R_{total}}} = 0.00333A\end{aligned}$$

Ответ:

$$\begin{aligned}U_{out2} &= 6.66B \\ R1 &= 10000\Omega = 1k\Omega \\ R2 &= 20000\Omega = 2k\Omega \\ P1 &= 0.0110B\Gamma \\ P2 &= 0.0221B\Gamma \\ I &= 0.00333A\end{aligned}$$

—[Задача 8]—

Дано:

$$\begin{aligned}U_{in} &= 10B \\ U_{out2} &= 6.66B \\ R_{total} &= 30000\Omega = 3k\Omega\end{aligned}$$

Найти: $U_{out1}, R1, R2, P1, P2, I$

Решение:

$$\begin{aligned}U_{out1} &= 10_{U_{in}} - 6.66_{U_{out2}} = 3.33B \\ R2 &= \frac{6.66_{U_{out2}} \cdot 3000_{R_{total}}}{10_{U_{in}}} = 20000\Omega \\ R1 &= 3000_{R_{total}} - 2000_{R2} = 10000\Omega \\ P1 &= \frac{3.33_{U_{out1}} \cdot 3.33_{U_{out1}}}{1000_{R1}} = 0.0110B\Gamma \\ P2 &= \frac{6.66_{U_{out2}} \cdot 6.66_{U_{out2}}}{2000_{R2}} = 0.0221B\Gamma \\ I &= \frac{10_{U_{in}}}{3000_{R_{total}}} = 0.00333A\end{aligned}$$

Ответ:

$$\begin{aligned}U_{out1} &= 3.33B \\ R1 &= 10000\Omega = 1k\Omega \\ R2 &= 20000\Omega = 2k\Omega \\ P1 &= 0.0110B\Gamma \\ P2 &= 0.0221B\Gamma \\ I &= 0.00333A\end{aligned}$$

—[Задача 9]—

Дано:

$$\begin{aligned}U_{out1} &= 3.33B \\ U_{out2} &= 6.66B \\ R_{total} &= 30000\Omega = 3k\Omega\end{aligned}$$

Найти: $U_{in}, R1, R2, P1, P2, I$

