Answer the following questions:

1. For the oscillator in Figure 1:
   a. Determine the oscillation frequency of the 555 astable oscillator.
   b. To what value must $C_{ext}$ be changed to achieve a frequency of 25 kHz?

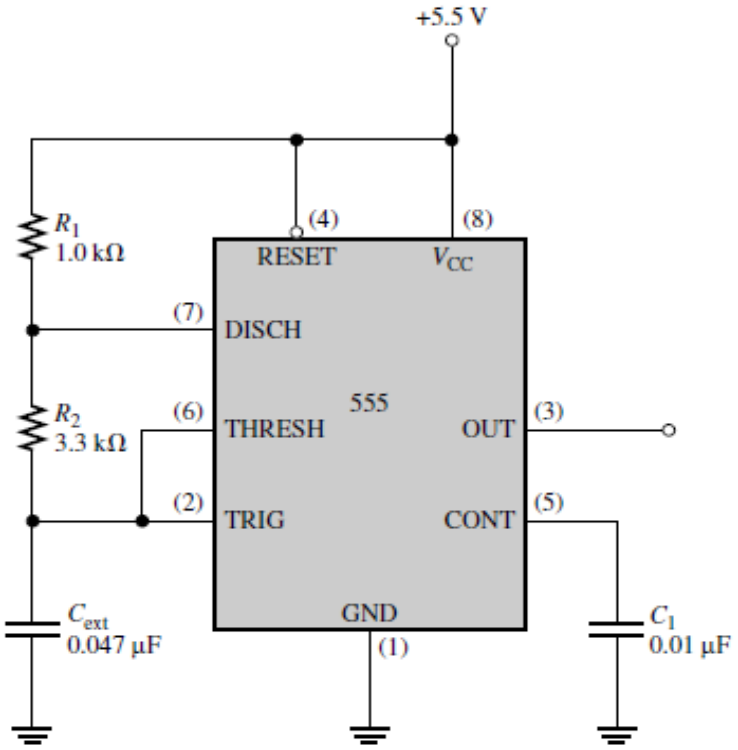


Figure 1

2. A 555 timer connected in the monostable configuration has a 56kΩ external resistor and a 0.22µF external capacitor. What is the pulse width of the output?
3. The output pulse width of a certain 555 one-shot is 12ms. If $C_{ext}$=2.2ΩF, what is $R_{ext}$?
4. The nominal output voltage of a certain regulator is 8 V. The output changes by 2 mV when the input voltage reduces from 12 V to 18 V. Complete the following:
   a. Determine the line regulation and express it as a percentage change.
   b. Express the line regulation in %/V.

5. Label the functional blocks for the voltage regulator in Figure 2.

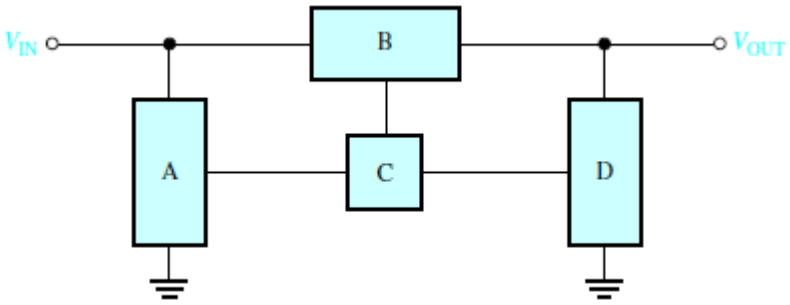


Figure 2

| Block | Label |
|---|---|
| A | |
| B | |
| C | |
| D | |

6. With reference to Figure 3, complete the following:
   a. Determine the output voltage for the series regulator.
   b. If $R_3$ is increased to 4.7 kΩ, what will happen to the output voltage?
   c. If the zener voltage is 2.7 V instead of 2.4 V, what would be the output voltage?

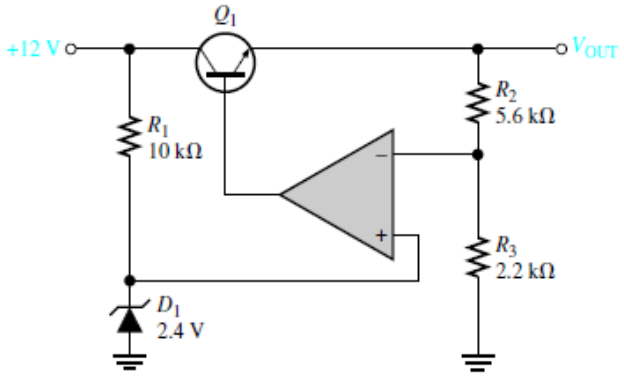


Figure 3

7. Using the shunt regulator in Figure 4, answer the following:
   a. When the current through $R_L$ increases, does $Q1$ conduct more or less? Explain.
   b. Assume the current through $R_L$ remains constant and $V_{IN}$ changes by 1 V. What is the change in the collector current of $Q1$?

c. With a constant input voltage of 17 V, the load resistance is varied from 1.0 kΩ to 1.2 kΩ. Neglecting any change in output voltage, how much does the shunt current through $Q_1$ change?

d. Assume the maximum allowable input voltage is 25 V.

- What is the maximum possible output current when the output is short-circuited?
- What power rating should *R*1 have?

e. In the regulator circuit, determine $R_{ext}$ if the maximum internal regulator current is to be 250 mA.

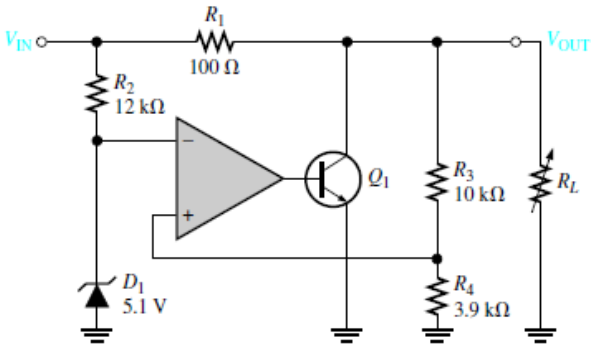


Figure 4

8. Using a 7812 voltage regulator and a 10 Ω load in Figure 5, how much power will the external pass transistor have to dissipate? (The maximum internal regulator current is set at 500 mA by $R_{ext}$)

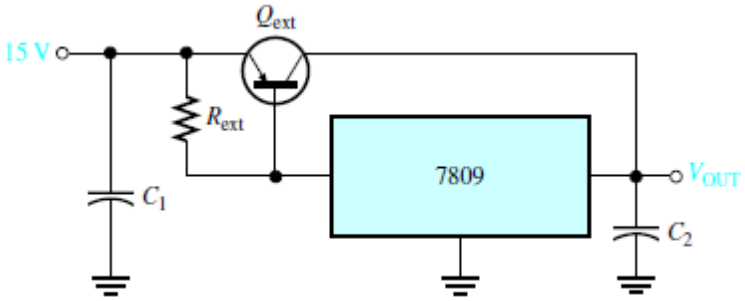


Figure 5

**Submission Requirements:**

Submit the completed exercise containing your responses to the instructor for evaluation.

**Evaluation Criteria:**

Your submission will be evaluated against the following criteria:

- Did you answer all questions correctly?
- Did you show work for all the calculations?