

ECE 376 - Homework #1

PIC Background. Due Monday, August 30th, 2021

Please make the subject "ECE 376 HW#1" if submitting homework electronically to Jacob_Glower@yahoo.com (or on blackboard)

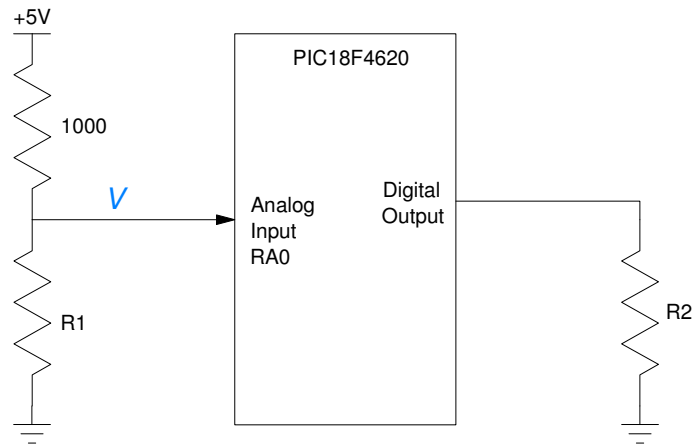
<p>1) A PIC processor can drive up to 25mA on its I/O pins. Assuming the output is 5V, what is the smallest resistance you can connect to an output pin?</p> <ul style="list-style-type: none"> • i.e. how small can R2 be (figure next page) 	
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A PIC can measure voltage to 4.88mV. To give an idea of how small this is....

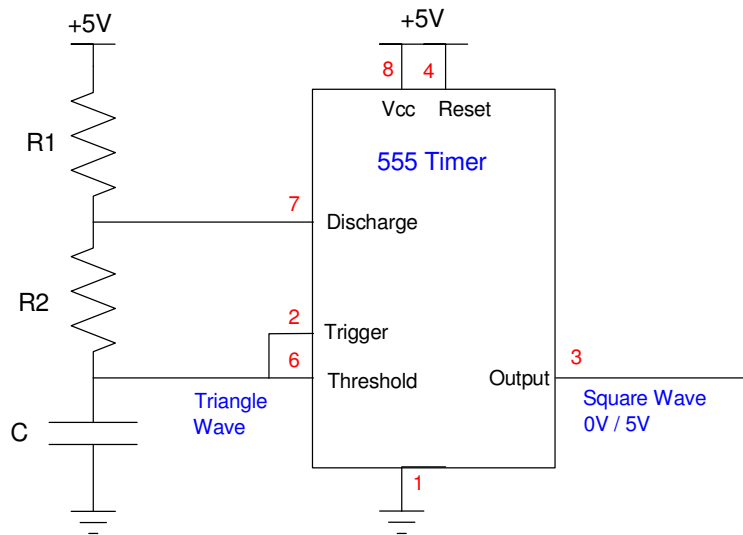
<p>2) What is the smallest change in R1 a PIC can measure if R1 = 2000 Ohms nominally?</p> $V = \left(\frac{R_1}{1000+R_1} \right) \cdot 5V$	
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A PIC can measure time to 100ns. To give an idea of how small 100ns is...

<p>3) The X-man <i>Quicksilver</i> can run 2050 miles per second. How far can <i>Quicksilver</i> go in 100ns?</p>	
<p>4) Due to relativity, time slows down the faster you go. How fast do you have to travel for time to slow down by 100ns over the span of one year?</p>	
<p>5) A 555 timer (next page) outputs a square wave with the period of $T = (R1 + 2R2) * C * \ln(2)$ seconds What frequency does the 555 timer output if R1 = 1k, R2 = 10k, C = 10uF?</p>	
<p>6) What is the smallest change in frequency a PIC can detect?</p> <ul style="list-style-type: none"> • i.e. how much does the frequency have to change for the period to change by 100ns? 	
<p>7) With this circuit, you can build an ohm-meter: by measuring the period, you can compute the resistance.</p> <ul style="list-style-type: none"> • What is the smallest change in R2 a PIC can detect? • i.e. how much does R2 have to change for the period to change by 100ns? 	
<p>8) With this circuit, you can build a temperature sensor: by measuring the period, you can compute the resistance and from that determine the temperature.</p> <ul style="list-style-type: none"> • What is the smallest change in temperature a PIC can detect? • i.e. how much does R2 have to change for the period to change by 100ns? <p>Assume the temperature - resistance relationship of R2 is as follows where T is the temperature in degrees C. Also assume the temperature is 25C (R2 = 10k Ohms)</p> $R_2 = 10,000 \cdot \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right) \Omega$	



Problem #1 & #2



Astable 555 Timer: Problems 5-8

The square wave at the Output has a period of $T = (R_1 + 2R_2) \cdot C \cdot \ln(2)$ seconds