



#### Circuit operation:

This circuit can be made with an op-amp or a comparator. It is shown here using an LM324 and a single-polarity power supply, but it could be made using +/- voltage supply. The first op-amp is configured as a variable-frequency square-wave generator. The frequency is controlled by RV1. When RV1 is set to 22K ohms, the frequency is approximately 1KHz. Note that R1 and R2 form a voltage divider which would ordinarily provide 1/2 VSS to the + input of the op-amp. However, R3 provides a large amount of hysteresis, such that when the op-amp output is high, the voltage at the + input is approximately 9/10 VSS; when the output is low, the voltage at the + input is approximately 1/10 VSS. This large hysteresis allows the charge on C1 to vary from approximately 1/10 VSS to approximately 9/10 VSS in a roughly triangular wave at the rate determined by RV1. This wave is fed into the - input of the second op-amp, where it is compared to the voltage output from RV2. The output this op-amp is a true PWM output -- the length of the positive pulse is determined by the portion of the triangular wave that is below the voltage at RV2. Note that the length of this pulse as a percentage of the pulse rate will remain constant for a given setting of RV2 even when the pulse rate frequency is changed via RV1.

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