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DETAILED OPERATION OF FLIP—FLOP

Herbert Grossman, FSDM, New Hyde Park, New York

A binary counter is composed of cascaded Flip-Flop stages. Each flip-flop depends on its' previous stage for operation. The flip-flops in a counter circuit are designated 2^0, 2^1, 2^2, 2^3, etc. The counter has two conditions for each flip-flop, either "set" ("1") "logic one" or "reset" ("0") "logic zero". The voltage normally appearing on the "1" or "set" side of a set, flip-flop is high (transistor turned on) while that on the corresponding "reset" side is low (transistor turned off) depending on whether the flip-flop has been "set" or "reset".

Let us discuss the operation of a flip-flop stage.

Figure 1 shows the schematic of a flip-flop. Figure 2 shows the logic drawing for a control flip-flop.

Each flip-flop has a "set" and a "reset" side. When a flip-flop is set, the one ("1") side will be at ground potential or zero volts; during this time the "reset" zero ("0") side will be at -6.0 volts.

In order to set a flip-flop, pin A must be at zero volts when a positive going pulse (or level) arrives at pin B. This condition is true for the resetting of a flip-flop at pin D. Pin E requires only a pulse to reset. Flip-flop diode gates may be used for set or reset operation. (See Figure 2) This circuit is a common emitter type flip-flop. The -6 volts is the bias supply, the -6 volts is the clamping reference for all collectors, and the -18 volts is the collector supply voltage. Assuming the circuit is in the reset state, and the voltage at the collector of Q1 is -6 volts, Q1 is cut off and CR1 is used to clamp the collector voltage to the -6V reference level. The -6 volts applied through resistor R3 places enough of a negative voltage on the base of Q2 to keep it conducting in saturation. The voltage at the collector of Q2 is approximately at ground potential (since Q2 is in saturation) and Q1 is held at cut off by the positive bias due to the voltage division of resistors R4 and R5. Between the +6 volts point and the collector of Q2 (which is at ground potential) are two resistors (R5 and R4) in series, with the base of Q1 connected to the junction of the two. This puts approximately 10% of the +6 volts on the base of Q1. Because of the effect of leakage current which is always present in the transistor, this is 10% less than what would normally result from the voltage divider effect, but it is still sufficient to keep Q1 cut-off.

To change the state of the flip-flip (to a "set" condition) a positive pulse is applied to the base of the conducting transistor Q2, through the associated gate. Q2 begins to turn off and the voltage at its collector starts to fall, the rate of all being determined by the RC network (which includes the load) tied to the collector. The collector is clamped at the -6 volt level to decrease the fall time, of which only the linear portion is used. This negative voltage change is coupled through the feedback network to the base of Q1 and turns the transistor on. As Q1 turns on, the voltage at its collector rises and is coupled through the feedback network to the base of Q2, holding it off. This type of circuit is capable of bigger action at a rate of 300kHz per second. There are two triggering input gates to the circuit. One gate feeds the base of Q1 and 2 gates are combined at the base of Q2. The diode gates are "primed" by grounding the DC inputs, and inhibited by applying -6 volts to the inputs (terminals A and C). Resistor R17 is permanently grounded in some applications making that half of the gate permanently "primed". The cathodes of the diodes are tied to the bases of the transistors, where the potential is always approximately at ground level. When a gate is inhibited, the anode of the diode is at -6 volts; therefore, there is a 6 volt reverse biase across the diode. A 6 volt positive voltage change applied to the capacitor inputs to the gate will be coupled through the capacitor and cause a 6 volt change in a positive direction at the anode of the diode. The voltage at the diode anode will rise to ground potential and there will be no forward voltage drop across the diode. Consequently, no current will flow to the base of the transistors. A 6 volt positive change applied to terminal E will cause current to flow to the base of Q2 since the associated DC input is permanently grounded.

When the gates are "primed" the anodes of the diodes are at ground potential. A positive going pulse applied to the capacitor inputs will cause the anodes to go positive with respect to the cathode and current will flow through the diode to the transistor base. The positive going pulse (-6 volts to zero, then zero to -6 volts) will have a new reference level after going through the capacitor. Effectively, it will be from -3 volts to +3 volts. This accounts for the anode of the diode going positive with respect to the cathode.

The RC networks on the inputs are integrating circuits to prevent a spurious pulse on the DC input from priming or inhibiting the gate.

Figure 2 shows 2 stages. The above explanation described the action of one stage (Q1 and Q2), the other stage (Q3 and Q4) action is identical.

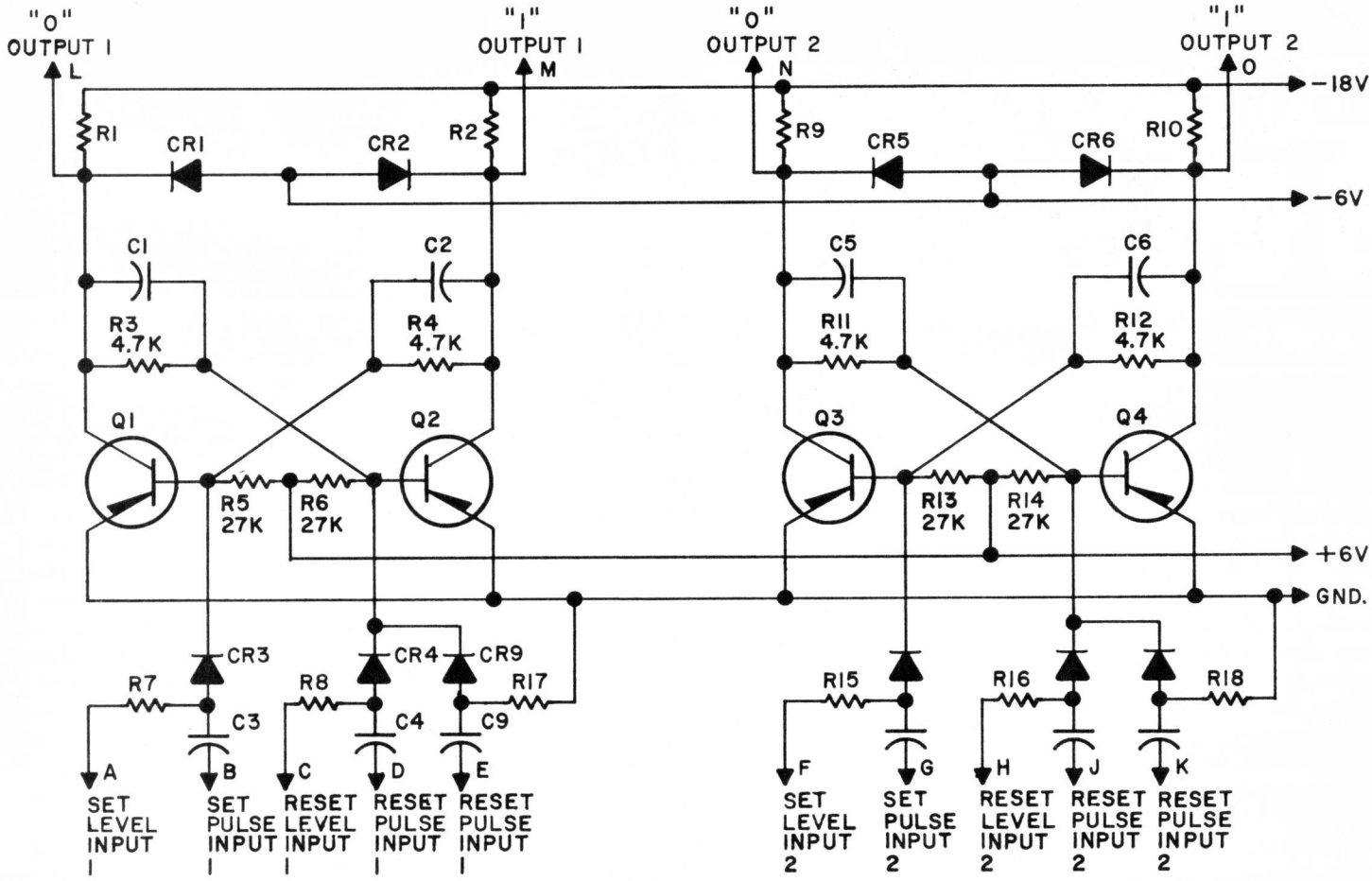

Figure 1

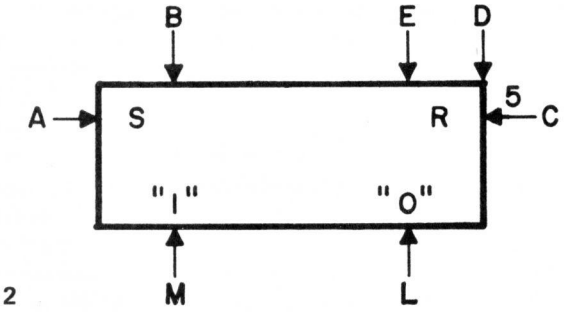

Figure 2

USE IT . . . STORE IT . . . SELL IT . . . GIVE IT . . . OR JUNK IT . . .

At this time of the year there is an innate national deisre to clean up, to get everything ship-shape for Spring. For a few weeks everyone seems efficiency minded. Statistics tell us that junk accumulates at a rate of 2 lbs. per person per day, or about 58,400,000 tons a year!

If you are one of those (and who isn't?) who has accumulated a pile of assorted "stuff," these five questions may help you during this Spring Sorting Season:

1. USE IT? If it's something you can actually use, that's fine! Is it functionally valuable, or aesthetically beautiful, or is it simply a dust collector and space stealer?
2. STORE IT? If you decide to keep it for future use, store it - well marked and protected.
3. SELL IT? If it has commercial value, sell it - (a) to people you know, (b) by ad in local paper, (c) to second-hand or scrap dealer. Better to realize a few dollars now than keep it for 10 years in the attic.
4. GIVE IT? The most satisfying way to dispose of unneeded things is to give them to friends and neighbors who can use them. There are always rummage sales and social agencies that need help.
5. JUNK IT? Don't be afraid to use the trash can as a depository for junk. Better to get rid of it now and make your home safer and healthier.

Remember, one man's junk may be another man's jewel. Profitable collector items not of obvious value are often found in homes. Old books, magazines, newspapers, pictures, furniture, toys, guns, textiles, buttons, and dishware are just some of the items that could be profitable.

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