BISTABLE UNITS UN1/535 AND UN9/528

Introduction

These units are electrically identical bistable circuits constructed on printed wiring boards 2 inches by $1\frac{7}{32}$ inches (UN9/528) and $4\frac{5}{8}$ inches by $1\frac{7}{32}$ inches (UN1/535).

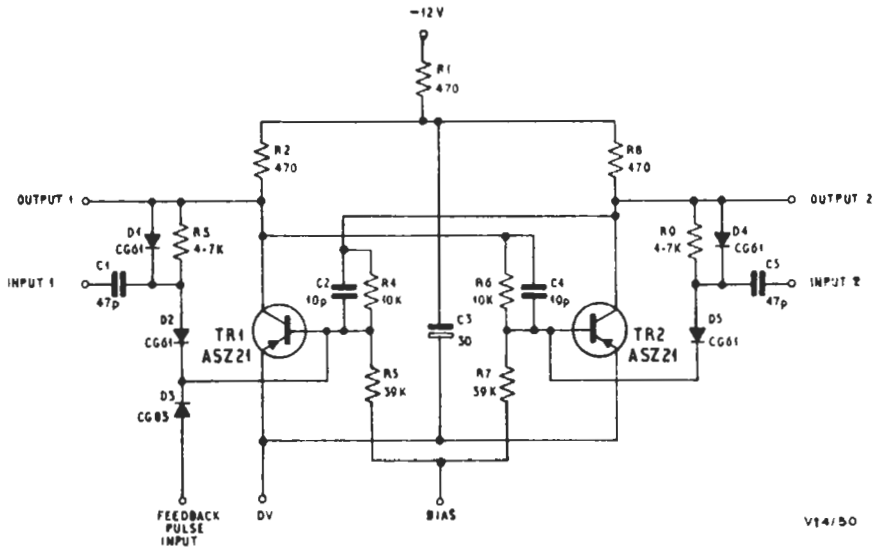

Fig. 1 Circuit of UN9/528

Circuit Description

The circuit diagram of the UN9/528 and the UN1/535 is given in Fig. 1. These bistable circuits (see also Television Engineering Vol. 3) operate in one of two stable states:

(a) Transistor TR1 conducting and transistor TR2 cut off is known as the *Set* state.

(b) Transistor TR1 cut off and transistor TR2 conducting is known as the *Reset* or *Clear* state.

Because the circuit is symmetrical, except for the feedback input, the definitions given for set and reset are arbitrary and may be found defined in the opposite sense in some Instructions.

The bistable circuit is changed from one state to the other by means of input signals. The behaviour of the basic bistable circuit is modified by the inclusion of input coupling capacitors C1 and C5 and by the inclusion of gating diodes D1 to D5. These are sometimes called steering diodes.

A positive-going voltage transition applied to input 1 changes the bistable circuit from the set state to the reset state. A positive-going transition applied to input 2 changes the bistable circuit from the reset state to the set state. Application of simultaneously positive-going voltage transitions at inputs 1 and 2 change the state of the bistable circuit due to the action of the gating diodes. In these changes it is assumed that the feedback input is either open circuit or is negative with respect to a trigger voltage. If a voltage is applied to the feedback input which is positive with respect to this trigger voltage the bistable circuit changes to the reset state irrespective of the other input signals.

An input signal does not change the state of the bistable circuit if it is already in the state to which it would otherwise be switched.

Use of Bistables in Logic Circuits

Fig. 2 shows the logic diagram symbol for a bistable unit together with the pin designations

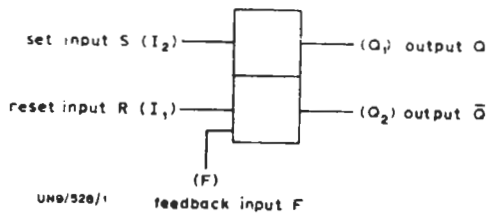

Fig. 2 Logic Symbol for UN9/528 (Positive Logic)

used on the UN9/528 and the normal nomenclature for inputs and outputs. This symbol is applicable to the UN9/528 in logic diagrams using positive logic (see Instruction G.1, Section 8). A transition from 0 to 1 (a positive-going transition in this instance) at any of the inputs switches the state of the corresponding output to a value of 1. Also a value of 1 at input F maintains the state of Q_2 at a value of 1. In the UN9/528, output Q_2 corresponds to input I_1 and output Q_1 corresponds to input I_2. With the symbol used in the position shown (with the main signal flow from left to right) and an output value of 1 at the Q_1 (or upper) terminal the bistable is said to be in the set state. Conversely with a value of 1 at the Q_2 (or lower) terminal the bistable is said to be in the reset state. Similarly the input terminals I_1 and I_2 can be referred to as the reset and set terminals respectively.

Because the two outputs of a bistable are normally complementary they may be labelled output Q and output $\bar{Q}$ (NOT-Q). $\bar{Q}$ is sometimes written as Q'. The behaviour of the UN9/528 is sometimes given in the form shown in Table 1.

TABLE 1

Inputs			*Outputs*	
			(Q_1)	(Q_2)
S	R	F	Q_n	$\bar{Q}_n$
0	0	0	Q_{n-1}	$\bar{Q}_{n-1}$
0	0	1	0	1
0	1	0	0	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	$\bar{Q}_{n-1}$	Q_{n-1}
1	1	1	0	1

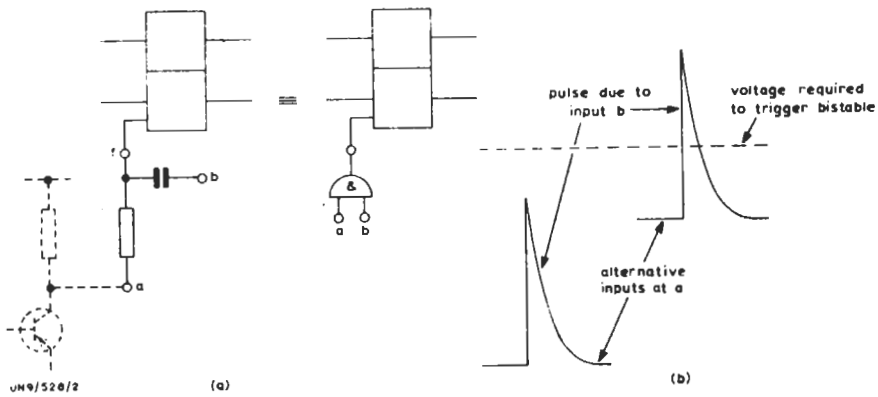

Fig. 3 And Gate Input Circuit

Table 1 shows different combinations for the three inputs; set, reset and feedback. The output columns give the resulting states of the outputs. The subscript used with Q denotes one of a series of output states because under certain conditions the output state depends upon a previous output state. For example: if all the input conditions change to a value of 0 the set output state Q_n does not change and is therefore the same as the previous output state Q_{n-1}. Similarly if the input conditions change to (S=1, R=1 and F=0) the output Q_n changes and is therefore the complement of the previous output state; that is $\bar{Q}_{n-1}$.

Feed-back Input Gating

The feedback input terminal of the bistable unit is often fed via a capacitor and resistor as shown in Fig. 3. This input circuit can be represented as an AND gate. The resistive input is usually fed from the collector of a transistor whose two alternative output voltages are insufficient to trigger the feedback input. The circuit values are arranged so that, with the more negative (0) resistive input, a pulse at the capacitor input is insufficient to trigger the feedback input but, with the more positive (1) resistive input, the pulse is sufficient to trigger the feedback input as shown in Fig. 3(b).

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