

7. Tunnel Diode Differential Pulse Height Discriminator

The circuits we have already mentioned are known as level detectors or integral discriminators. It means that all the input signals whose amplitude, above the threshold level are allowed to pass. But when we use two of such discriminators together, one of which has the threshold level higher than the other, we obtain, with the help of the so called anti-coincidence circuit, a differential pulse height discriminator. The difference between the threshold levels of both integral discriminators under used is called the window of the differential discriminator. This circuit allows only the signals which lie within the window to pass while the signal pulses whose amplitude lies out-side the window will be blocked by the anticoincidence circuit. The differential discriminator is the heart of a pulse height analyzer. The block diagram and the corresponding schematic are shown in Fig. 7.1 and Fig. 7.2 respectively.

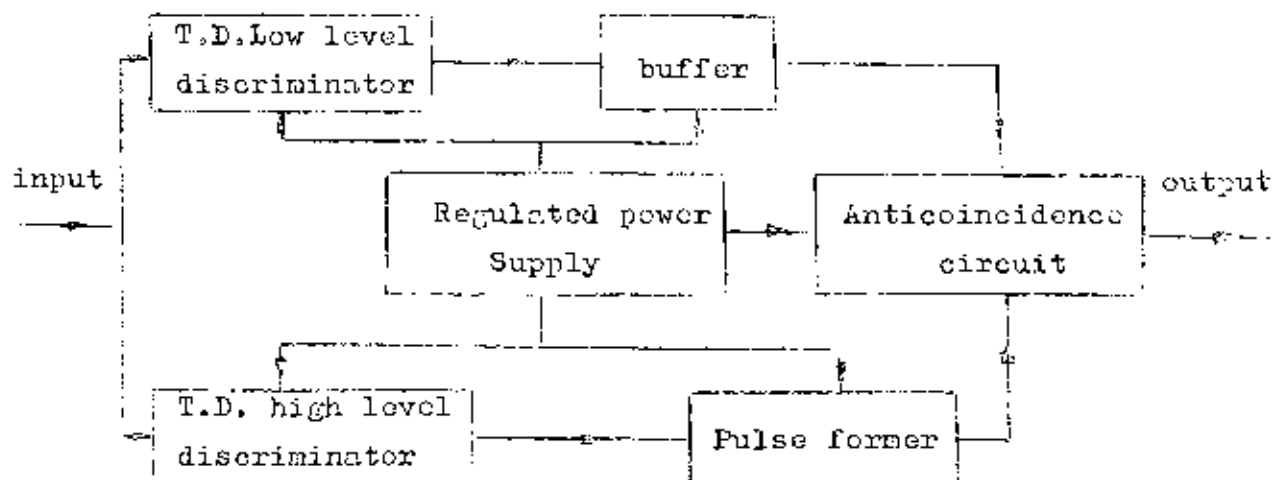


Fig. 7.1 Block diagram of a tunnel diode pulse height discriminator.

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The circuit shown in Fig. 7.2 consists of two parts. The first part called low level discriminator has a tunnel diode TD 1 connected across the base and emitter of Q_1 . When a mono-pulse enters its input circuit with an amplitude high enough to trigger the tunnel diode TD 1, then TD 1 will conduct and switch to high voltage level causing the transistor Q_1 to conduct. The output pulse at Q_1 is differentiated by an R - C circuit and the resulting negative going pulse is used to trigger the transistor Q_2 and the emitter follower Q_3 to conduct respectively. In this case an output pulse will appear at the emitter of Q_3 .

Assuming the switch S1 is at the "ON" position, the input signal will also try to go through the second path called the upper level discriminator. Owing to the variable resistance R , the input pulse may not be allowed to trigger TD 2 and in this case the output pulse at Q_3 is that coming through the lower level discriminator alone. On the other hand if the input pulse is high enough to trigger TD 2, TD 2 will switch to the higher voltage level causing Q_4 to conduct. The output pulse of Q_4 will actuate the monostable multivibrator Q_5 and Q_6 to send a rectangular pulse to hold the base of Q_7 positive with respect to the emitter. At this period if any positive signal pulse via Q_2 tries to actuate Q_3 , the base of Q_3 will be shorted to ground through collector of Q_7 and the incoming signal to Q_3 will be by-passed to ground and no output signal appears at the collector of Q_3 . And in this manner the circuit works as a differential pulse height discriminator since only the signals that lie within the window defined by R are allowed to pass through the discriminator.