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Lecture 13 : Receiver circuits

1. **The figure bellow shows a block diagram of such a receiver. Its components can be arranged into three groups – 1. the front end, 2. the linear channel, and 3. the decision circuit.**

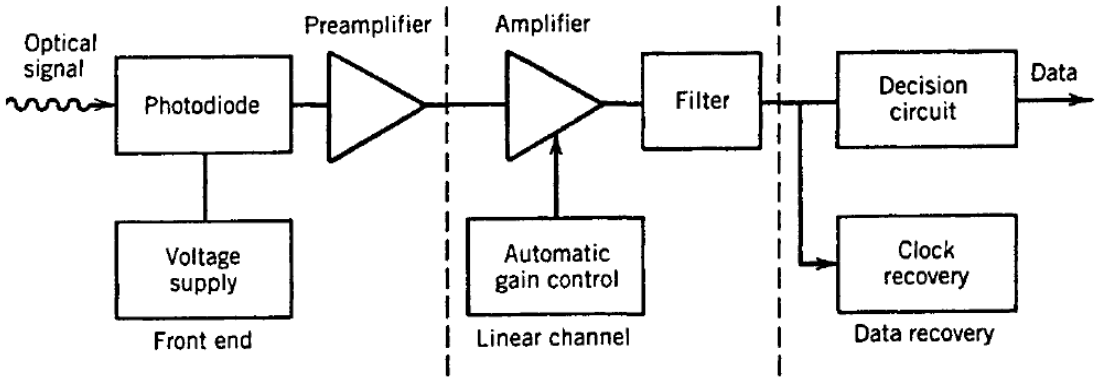
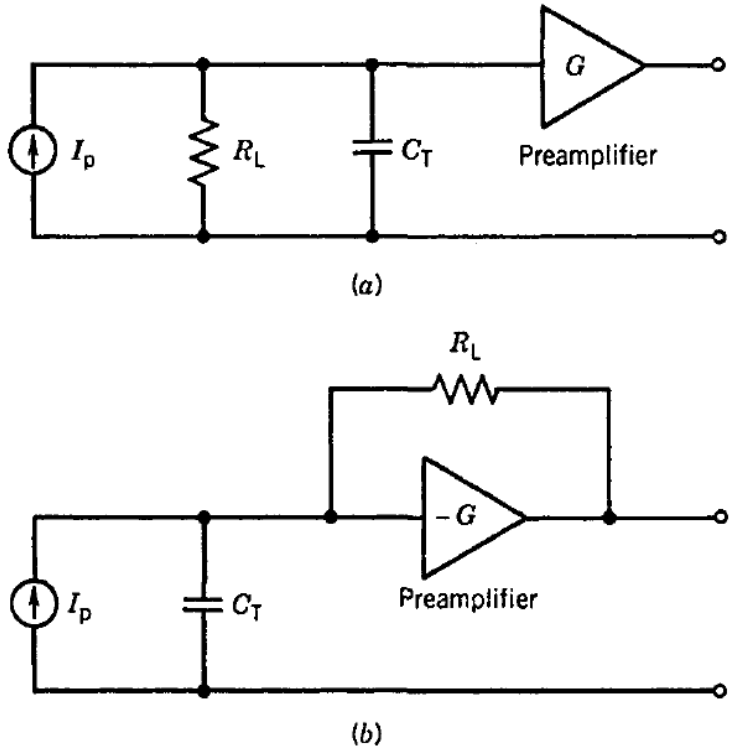


Diagram of a digital optical receiver showing various components. Vertical dashed lines group receiver components into three sections.

(1) FRONT END

a. **The front end of a receiver consists of a photodiode followed by a preamplifier.**
b. **The photodiode converts the optical bit stream into an electrical time-varying signal.**
c. **The role of the preamplifier is to amplify the electrical signal for further processing.**

The design of the front end requires a trade-off between speed and sensitivity.



Equivalent circuit for (a) high-impedance and (b) transimpedance front ends in optical receivers. The photodiode is modeled as a current source in both cases.

NOTICES

- **The large R_L reduces the thermal noise and improves the receiver sensitivity as well is its duty to produce readable voltage.**
- **The disadvantage (drawback) is that the receiver bandwidth is limited by its slowest component.**
- **An equalizer is sometimes used to increase the bandwidth. The equalizer acts as a filter that attenuates low-frequency components of the signal.**

(2) LINEAR CHANNEL

The linear channel in optical receivers consists of a high-gain amplifier (the main amplifier) and a low-pass filter. An equalizer is sometimes included just before the amplifier to correct for the limited bandwidth of the front end. The amplifier gain is controlled

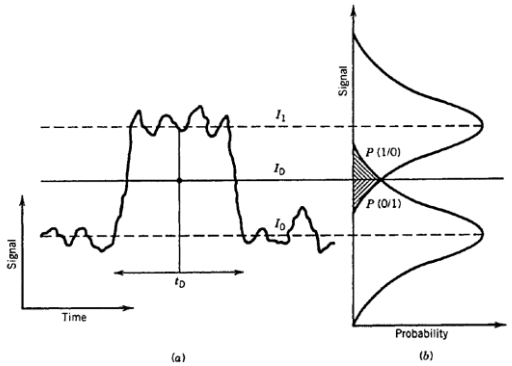
automatically to limit the average output voltage to a fixed level irrespective of the incident average optical power at the receiver. The purpose of the low-pass is to reduce the noise. The receiver noise is proportional to the receiver bandwidth and can be reduced by using a low-pass filter whose bandwidth is smaller than the bit rate.

(1)DECISION CIRCUIT

Each digital receiver has a decision circuit that decides whether an incoming binary signal is at the logical 0 level or at the logical 1 level by sampling the received signal and comparing the sample value to a threshold . In a noise-free system, the received signal would have only two states, namely 2 or 0. In a real system, these two signal levels can vary considerably due to additive noise and the linear and nonlinear distortions caused by the transmission medium or line equipment.

The purpose of the data recovery is to isolate a spectral component from the received signal. This component provides information about the bit to the decision circuit and helps to synchronize the decision process.

Thus, A circuit that measures the probable value of a signal element and makes an output signal decision based on the value of the input signal.



(a) Fluctuating signal generated at the receiver. (b) Gaussian probability densities of 1 and 0 bits. The dashed region shows the probability of incorrect identification.