

# DIGITAL WAVEFORMS



# Line Coding



- Digital signals are CODED representation of signals.
- Binary Codes has two symbols “0 & 1”.
- These are combined to formed binary words to represent the characters.
- *Binit* for **B**inary **D**igit.
- The information carried by a binit is equal to a unit of information is known as **Bit**.
- Line coding refers to the process of representing the bit stream (1s and 0s) in the form of voltage or current variations optimally tuned for the specific properties of the physical channel being used.

# Digital Waveforms



- The digital information is transmitted by a waveform.
- These are referred to as *digital waveforms*.
- Although they are analog representation of the digital information being transmitted.
- The duration of a bit is referred to as *bit period* or *bit interval* ( $T_b$ ).
- Bits per second is called *bit rate* ( $R_b$ ).

$$R_b = 1 / T_b$$

# Digital Waveforms

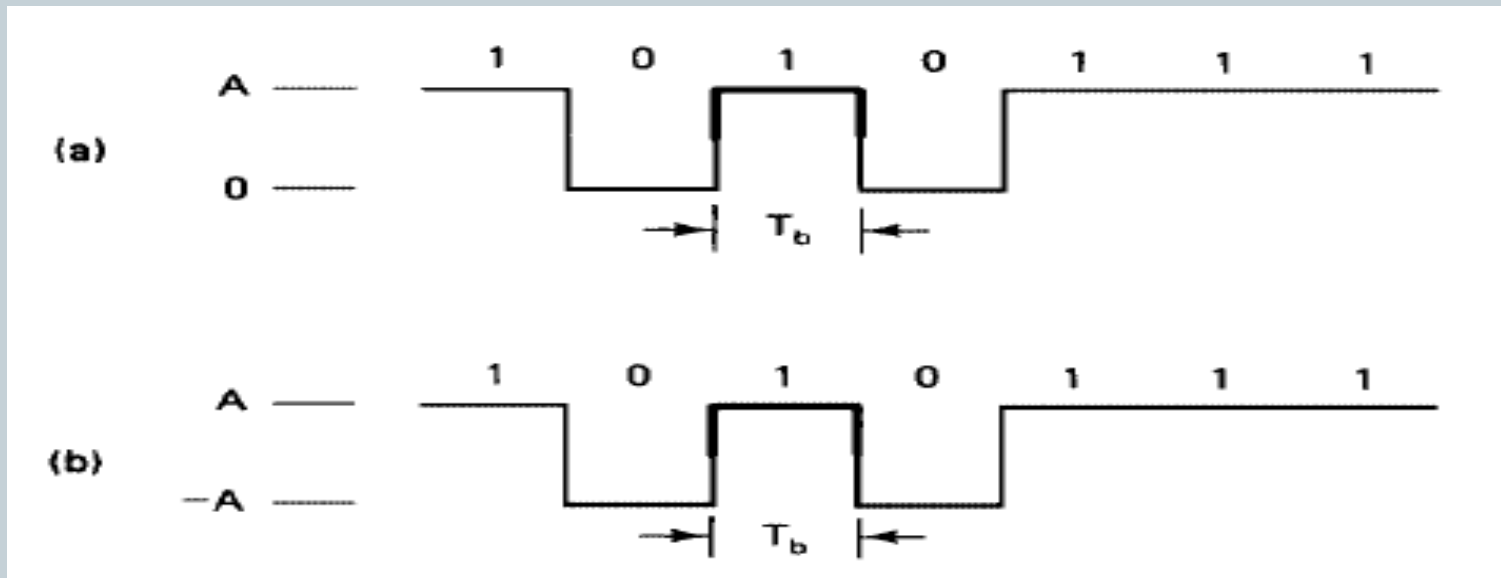


- **Unipolar waveform:** waveform excursions from zero are always in same direction (either +ve or -ve).
- **Polar waveform:** which utilizes +ve and -ve polarities.
- Bit Timing is derived from the zero crossovers in the waveform.
- There are numerous ways digital information can be coded onto a transmission medium. e.g

# Nonreturn to Zero Waveform



- Nonreturn to zero (NRZ) waveform: which does not return to the zero baseline during the bit period.

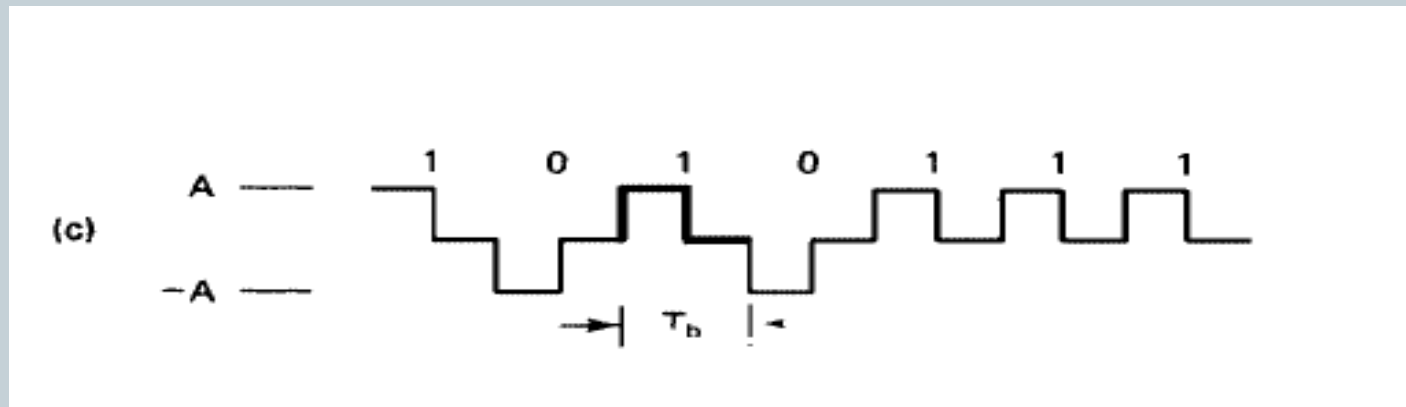


(a) unipolar NRZ    (b) polar NRZ

# Return to Zero Waveform



- **Return to zero (RZ) waveform:** which returns to zero baseline in the middle of the bit period.
- Transitions always occur even in the long string of like symbols and bit timing can be extracted.

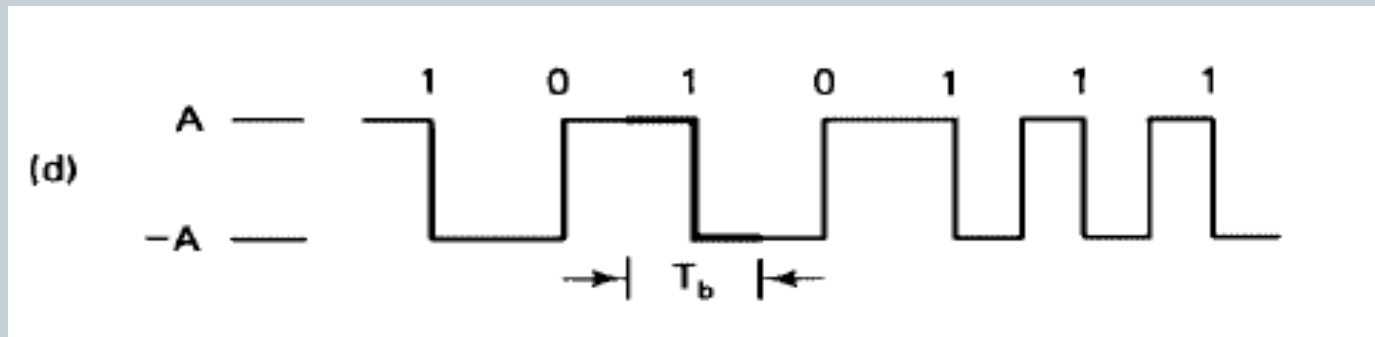


(c) Polar RZ waveform

# Split Phase or Manchester Encoding



- **Split Phase or Manchester Encoding:** a transition between +ve and -ve levels occur in the middle of each bit.
- Transitions always occur even in the long string of like symbols and bit timing can be extracted.
- It is known as a self-clocking code.

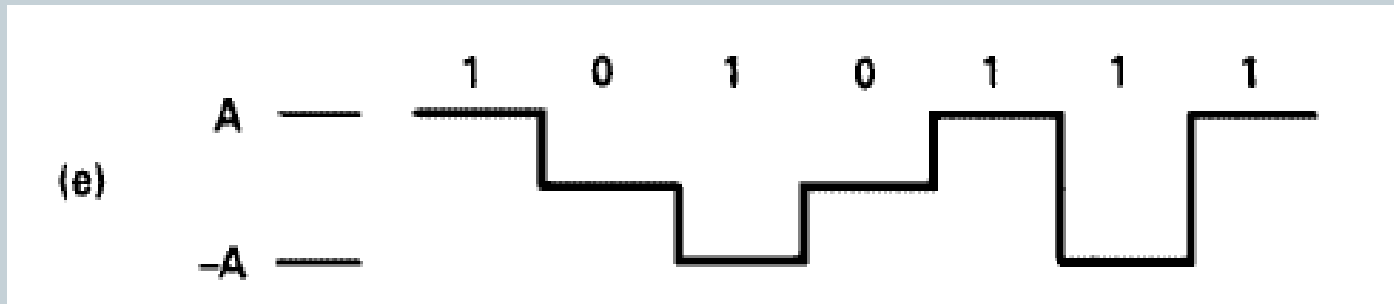


(d) Split Phase or Manchester Encoding

# Alternate Mark Inversion (AMI) Code



- **Alternate Mark Inversion code:** the binary 0s at the zero baseline level and the binary 1s alternate in polarity.
- Bit timing can be extracted easily except long strings of zeros occur.



(e) Alternate Mark Inversion