SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++'
Grade Approved by AICTE, New Delhi & Affiliated to Anna University,
Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

III YEAR/ VI SEMESTER

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UNIT 2 : DEVICES AND EMERGING BUS STANDARDS

TOPIC 2.3 : Communication from serial devices-UART

Outline

- Introduction to Serial Buses

- UART

- SPI

- I2C

COMMUNICATION FROM SERIAL DEVICES

UART

- Universal Asynchronous Receiver/Transmitter

- Hardware that translates between parallel and serial forms

- Commonly used in conjunction with communication standards such as EIA, RS-232, RS-422 or RS-485

- The universal designation indicates that the data format and transmission speeds are configurable and that the actual electric signaling levels and methods (such as differential signaling etc.) typically are handled by a special driver circuit external to the UART.

UART

Protocol

- Each character is sent as
  - a logic *low* **start** bit
  - a configurable number of data bits (usually 7 or 8, sometimes 5)
  - an optional parity bit
  - *one or more logic high* **stop** *bits*
  - with a particular bit timing ("baud")
- Examples
  - "9600-N-8-1" →
    <baudrate><parity><databits><stopbits>
  - "9600-8-N-1" →
    <baudrate><databits><parity><stopbits>

Start	Data 0	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7	Stop

Variations and fun times

- UART is actually a generic term that includes a large number of different devices/standards.

  – RS-232 is a standard that specifies

    - "electrical characteristics and timing of signals, the meaning of signals, and the physical size and pin out of connectors.

UART

SIGNALS (ONLY MOST COMMON)

- The **RXD** signal of a UART is the signal receiving the data. This will be an input and is usually connected to the TXD line of the downstream device.

- The **TXD** signal of a UART is the signal transmitting the data. This will be an output and is usually connected to the RXD line of the downstream device.

- The **RTS#** (Ready to Send) signal of a UART is used to indicate to the downstream device that the device is ready to receive data. This will be an output and is usually connected to the CTS# line of the downstream device.

- The **CTS#** (Clear to Send) signal of a UART is used by the downstream device to identify that it is OK to transmit data to the upsteam device. This will be an input and is usually connected to the RTS# line of the upstream device.
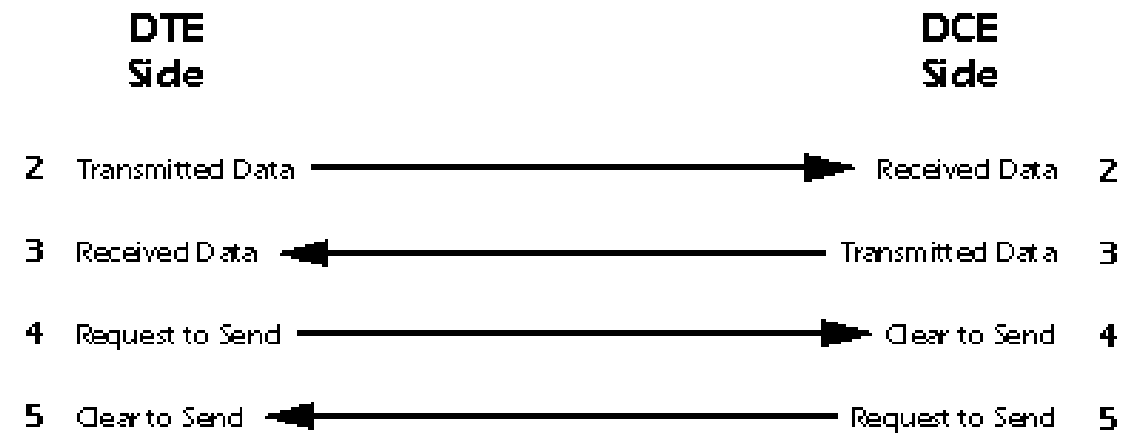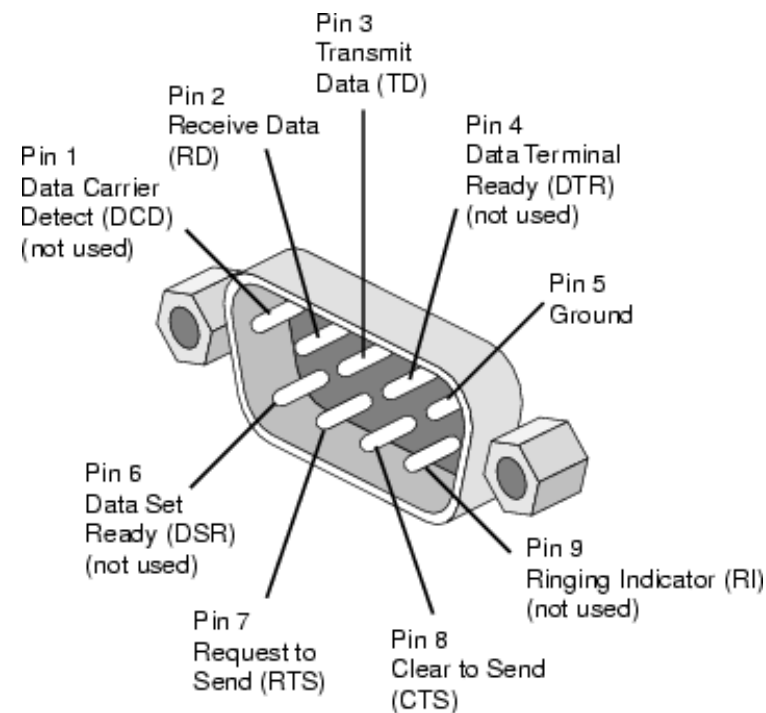
19ECT312/Emb.Sys /
Dr.Sivasankari.B/Professor/ECE/SNSCT

UART

DB9 STUFF

- DTE vs DCE
- Pinout of a DCE?
- Common ground?
- Noise effects?

Pin 2 Receive Data (RD)	Pin 3 Transmit Data (TD)	Pin 4 Data Terminal Ready (DTR) (not used)

Pin 1
Data Carrier
Detect (DCD)
(not used)

Pin 5
Ground

Pin 6
Data Set
Ready (DSR)
(not used)

Pin 9
Ringing Indicator (RI)
(not used)

Pin 7
Request to
Send (RTS)

Pin 8
Clear to Send
(CTS)

DTE Side — DCE Side

2 Transmitted Data	⟶	Received Data 2
3 Received Data	⟵	Transmitted Data 3
4 Request to Send	⟶	Clear to Send 4
5 Clear to Send	⟵	Request to Send 5

Pin Number	Signal	Description
1	DCD	Data carrier detect
2	RxD	Receive Data
3	TxD	Transmit Data
4	DTR	Data terminal ready
5	GND	Signal ground
6	DSR	Data set ready
7	RTS	Ready to send
8	CTS	Clear to send
9	RI	Ring Indicator

Wiring a DTE device to a DCE device for communication is easy.
The pins are a one-to-one connection, meaning all wires go from pin x to pin x.
A straight through cable is commonly used for this application.
In contrast, wiring two DTE devices together requires crossing the transmit and receive wires.
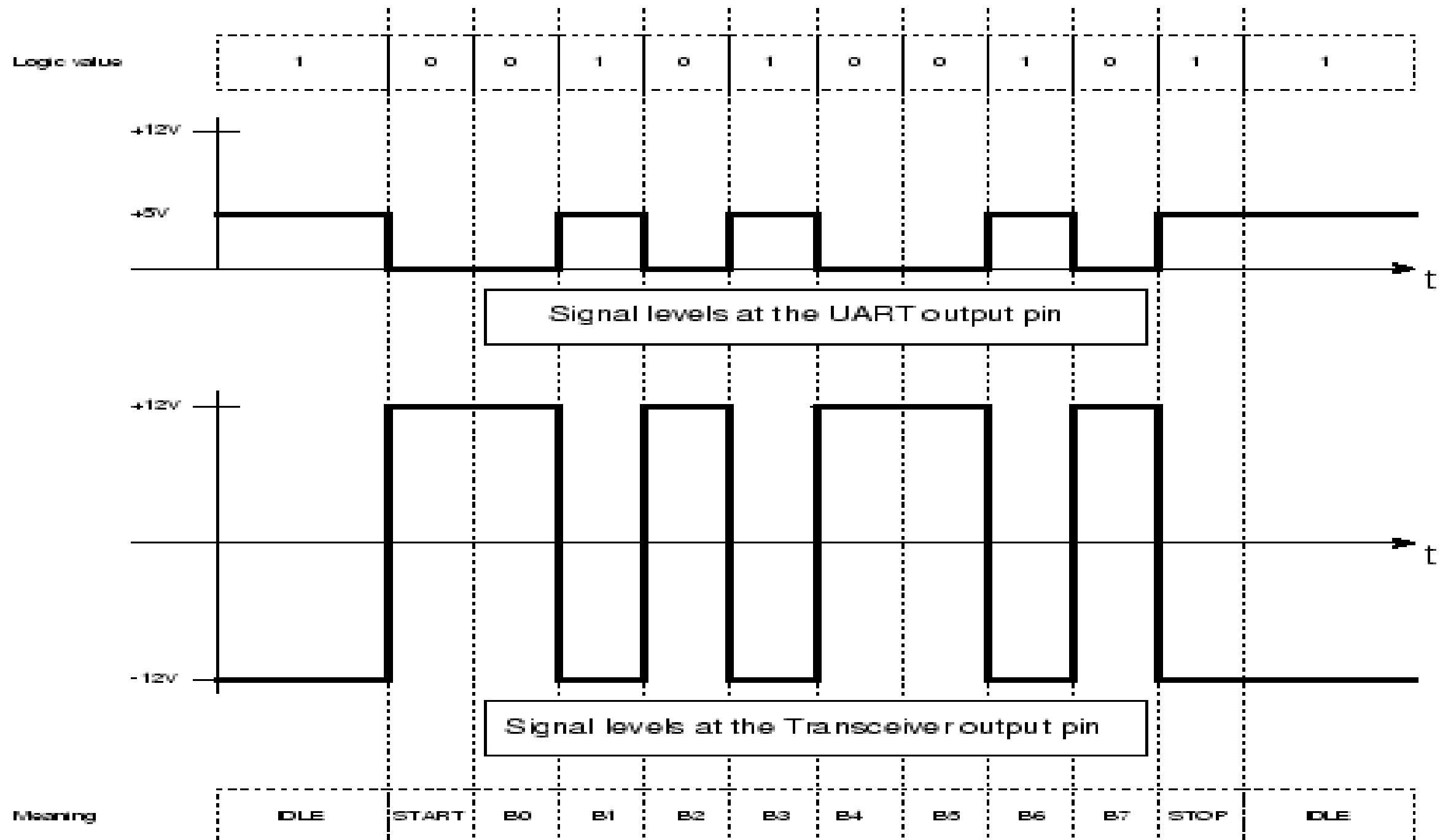This cable is known as a null modem or crossover cable.

UART

RS-232 TRANSMISSION EXAMPLE

RS232 Transmission of the letter 'J'

Discussion Questions

- How fast can we run a UART?

- What are the limitations?

- Why do we need start/stop bits?

- How many data bits can be sent?

  − 9600-8-N-1 is ok. Is 9600-8192-N-1 ok too?

SUMMARY & THANK YOU