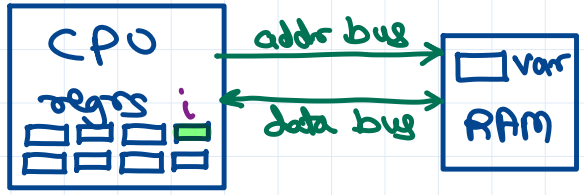
Advanced Micro-controllers - ARM

DESD @ Sunbeam Infotech

register vs volatile




```
register int i;
for(i=0; i<1000; i++){
  ~~
}
```

register → request to system
var will be "register"
subject to availability.

```
int i;
for(i=0; i<1000; i++){
  ~~
}
```

var will be kept in RAM.
But since accessed repeatedly, Compiler optimization makes it "register" temp.

Side effect of optimization / register keyword:

- if var is modified outside current exec context, it will modify var copy in RAM & changes may not be seen in CPU regr.
- var may be modified in external ctx.
  1. in intr handler / ISR.
  2. in another thread of execution (OS)

  } var is modified in code
  3. var is mem-mapped io regr. → hw based chang

- volatile keyd disable compiler optimisation for particular var i.e. now var will be always accessed from its RAM location.

var (RAM) → regr (CPU)
var ← regr

- const keyword tells compiler that the var is not intended to be modified in code. So Compiler will not allow to use operators like =, ++, --, +=, ...
- static const volatile var = _;
  - static: scope is limited to fn / file (declared).
  - const volatile: no optimization & no modification in code.

Const volatile

↳ read only mem-mapped var (io regr)
e.g. adc val regr.

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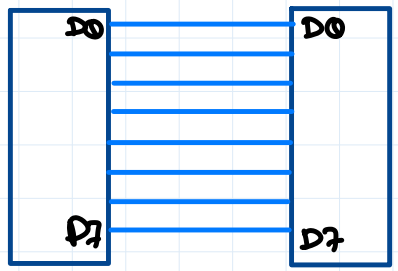
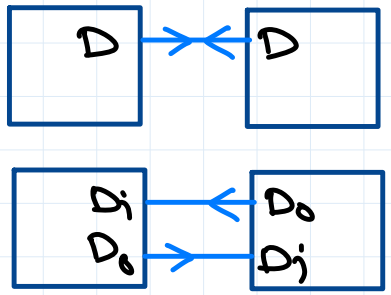
Communication Protocols

① Parallel Comm^n ② Serial Comm^n



multiple bits transfer per clock.
e.g. lcd (hd44780), printers (old).



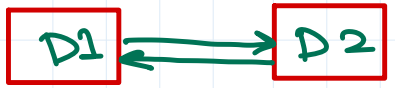
single bit transfer per clock
e.g. kbd, mouse, pendrive, ...

Serial Comm^n types

① Simplex

② half duplex

③ full duplex

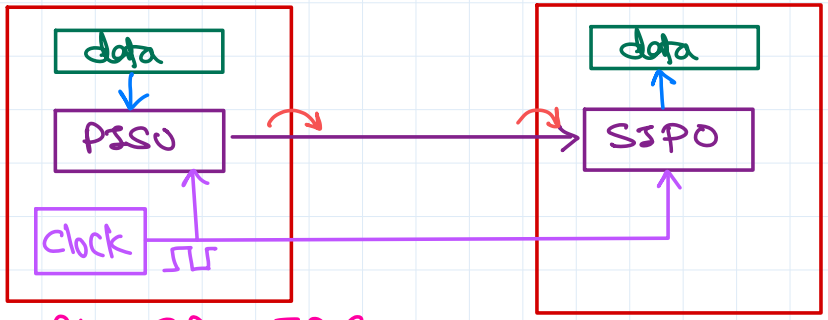


Serial Comm^n Protocols

① RS-232, (Uart) RS-485
② I2C
③ SPI
④ USB
⑤ CAN
⑥ PS-2
⑦ JTAG
⑧ SWD

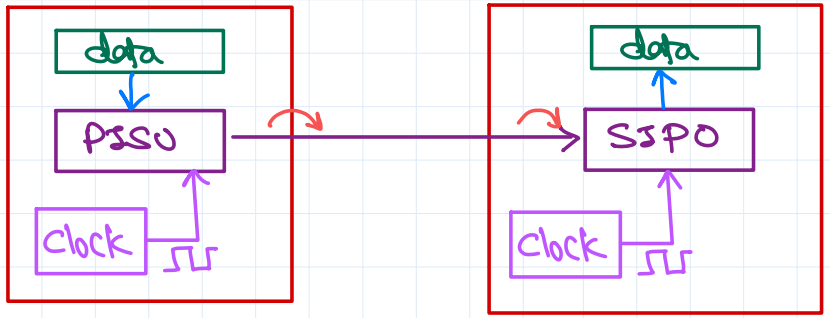
Serial Comm^n Internals

sync serial Comm^n



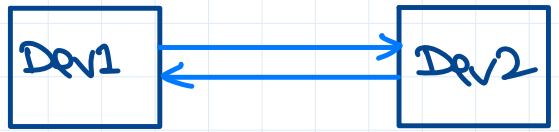
e.g. SPI, I2C

async serial Comm^n

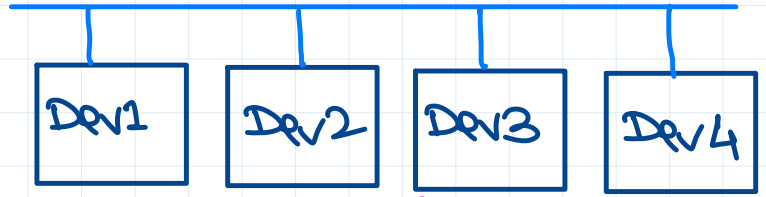


e.g. RS-232, CAN

Serial Comm^n Protocol classification



Peer to Peer Comm^n
e.g. RS-232, PS-2, ...



bus Comm^n
e.g. SPI, I2C, CAN, ...

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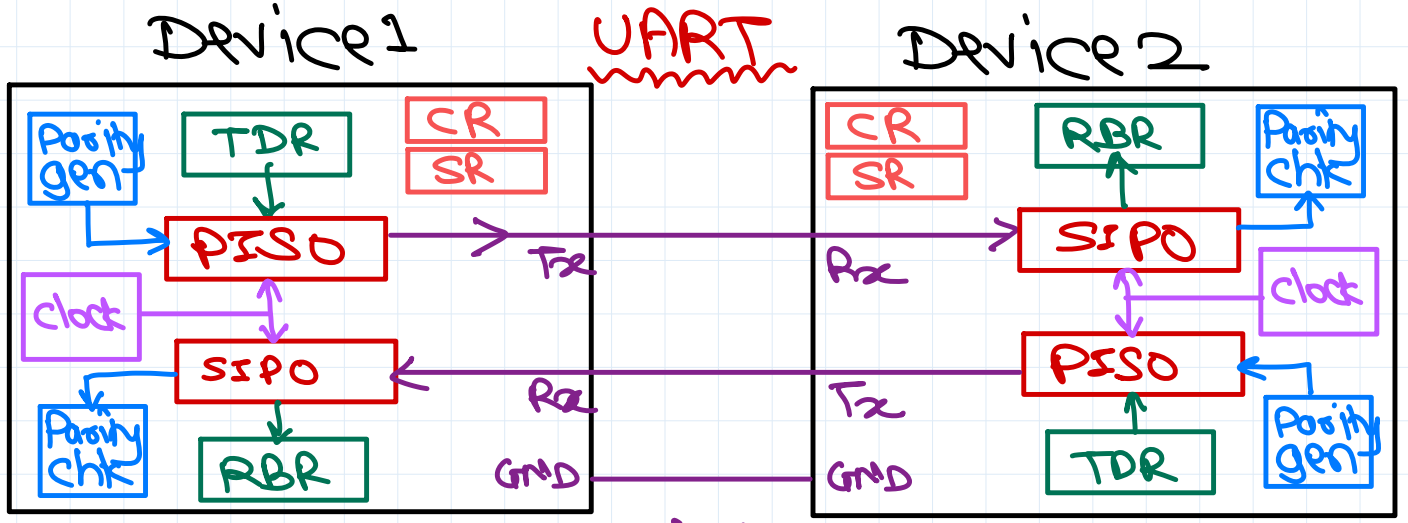
RS-232 protocol

e.g. Modem, Bth, ..

Physical characteristics

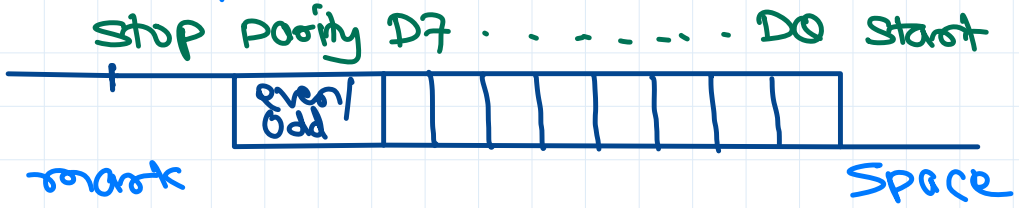
1. 3-wire protocol (rx, tx, gnd)
2. full duplex
3. frequency → baud (bps)
   e.g. 9600, 38400, 115200
4. peer to peer protocol
5. long distance comm^{n} (no)
6. voltage levels - MOS levels.
   +3V to +25V → 0 (space)
   -3V to -25V → 1 (mark)

- TTL to CMOS level change is done by RS-232 line driver chip e.g. MAX 232.



logical characteristics

1. LSB (first) → MSB (last)
2. data frame



error conditions

1. parity error
2. frame error
3.
4.

Thank You!

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