Advanced Micro-controllers - ARM

DESD @ Sunbeam Infotech

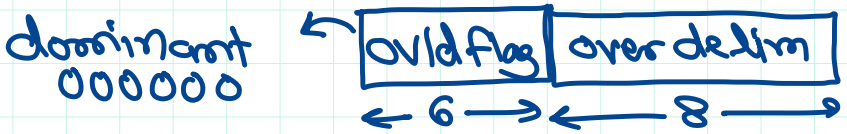
CAN error handling

① error types → 5
- ⓐ CRC ⓑ Form
- ⓒ Ack ⓓ Bit
- ⓔ Stuff

② when err is seen by a node, it reports the error → CAN err frame.

err frame → 14-bits

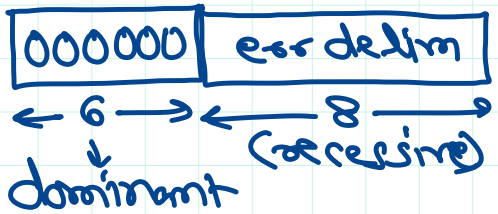
overload frame
- looks like err frame



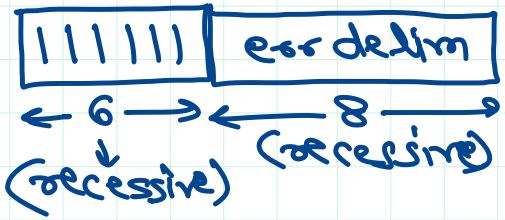
- indicate that device is busy.
- sent during/after IFS.

③ Node States
- CAN errors are counted in each CAN node.
  - TEC → Tx Error Cnt
  - REC → Rx Error Cnt

ⓐ Error Active State. → Comm okay
- TEC < 128 and REC < 128
- Report err as err frame



ⓑ Error Passive State → Comm okay
- TEC ≥ 128 or REC ≥ 128
- Report err as err frame



* Err frames sent while Rx/Tx of current frame (in-betn).

ⓒ Bus off
- TEC > 255 (threshold)
- Node comm on CAN bus is stopped.

→ Automatic Recovery
- → monitors bus
- → 11 recessive x 128
  - waiting
- → reset TEC & REC (= 0, = 0)
- → Comm start again

→ manual recovery
- → repair faulty node
- → reset mcu
- → reconnect.

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CAN Timing

CAN1 → APB1

CCLK = 72 MHz

PCLK = 36 MHz

CAN PR = 18 ← (1 to 1024)

$$\text{CAN peri freq} = \frac{PCLK}{PR} = \frac{36MHz}{18} = 2MHz$$

$$\text{Time Quanta} = \frac{1}{\text{CAN Peri Freq}}$$

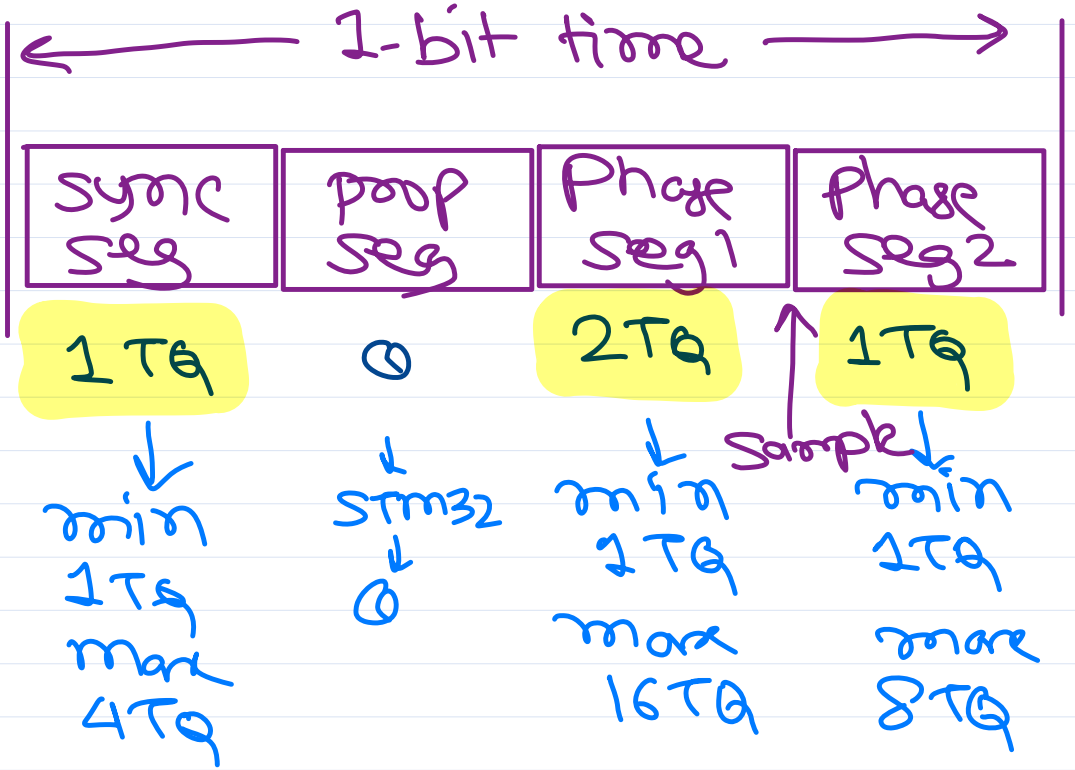
$$= \frac{1}{2}\mu s = 0.5\mu s = 500\,ns$$

Nominal Bit Time = 1TQ + 2TQ + 1TQ

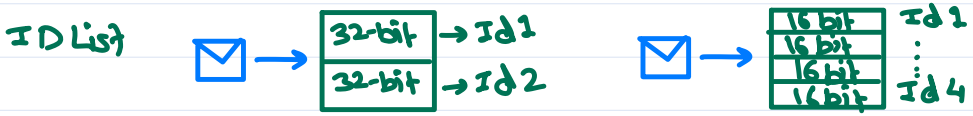
= 4TQ

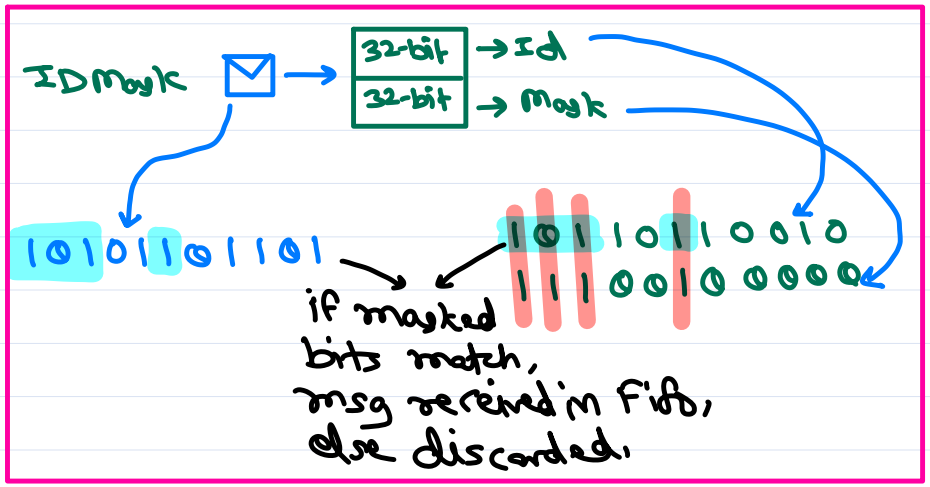
= 4 × 500 ns = 2 µs

CAN o/p bit ~~rate~~ = $\frac{1}{2}$ MHz = 0.5 MHz



Acceptance Filter





Acceptance Filter Config: 32-bit ID Mask

e.g. ID (to cmp) → 0x0A8 : 0000 1010 1000

Mask (bits to cmp) → 0x7F8 : 1111 1111 1000

e.g. incoming msg id :

accepted.

- 0x0A8 → 0000 1010 1000
- 0A9 → 0000 1010 1001
- 0AA → 0000 1010 1010
- 0AB → 0000 1010 1011
- 0AC → 0000 1010 1100
- 0AD → 0000 1010 1101
- 0AE → 0000 1010 1110
- 0AF → 0000 1010 1111

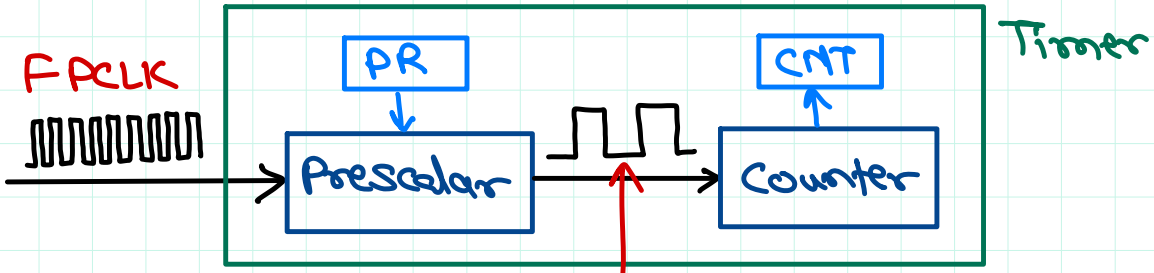
not accepted

- X 0A5 → 0000 1010 0101

Time Management

Absolute Time
aka. Wall time
- Calendar date & clock time
- Hw: RTC

Relative time
- Time w.r.t. event
- Hw: SysTick
  - STM32 Timers
    - Basic/Advanced
    - 16-bit/32-bit
  - WDT
  - DWT (Debug Timer)



$Freq = FPCLK/PR$ Hz.

$Period = \frac{PR}{FPCLK}$ sec

Example1: FPCLK = 16 MHz, PR = 16, CNT = 1000, time = ?

$time = period \times CNT = \frac{PR}{FPCLK} \times CNT$

$= \frac{16}{16000000} \times 1000 = \frac{1}{1000}$ sec $= 1$ ms

$$time = \frac{PR}{FPCLK} \times CNT \times 1000 \text{ ms}$$

$$CNT = \frac{time\_ms}{1000} \times \frac{FPCLK}{PR}$$

$$CNT = \frac{FPCLK}{1000} \times \frac{time\_ms}{PR}$$

Timer vs Counter

Counter: Cct that counts ext. pulses/edges

Timer: is a counter that counts pulses with a fixed freq. Usually timer hw also produces intrs.

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Thank You!

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