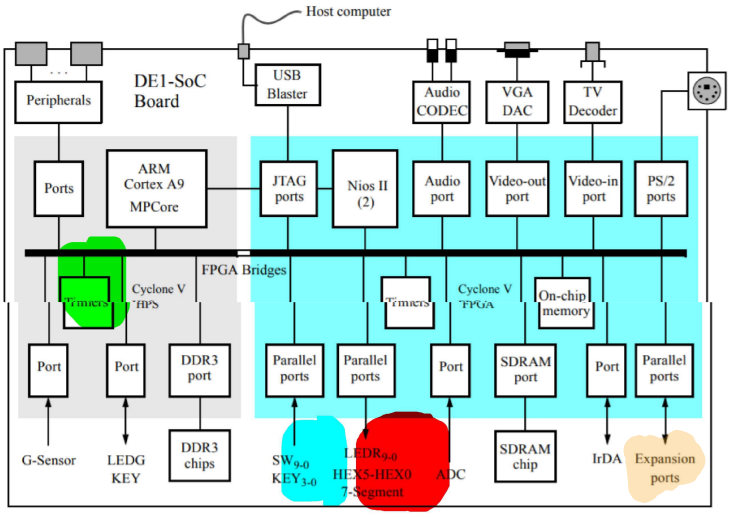


Parallel ports: in an n-bit parallel port data is transferred n-bits at once.

Address. parallel ports regs.

base	Data
+4	Direction
+8	mask
+C	Edge capture.

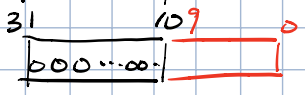
Data: always present (input or output)

Direction: not used except for expression ports (input/outputs)

mask: used for interrupts

Edge capture: like the Data register, except it is persistant

Recall: LEDR: 0xFF200000

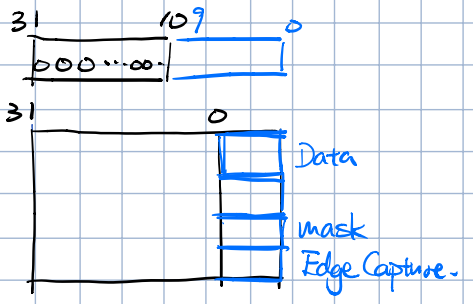


HEX3-0: 0xFF200020

HEX5-4: 0xFF200030

SW: 0xFF200040

KEY: 0xFF200050



Data: each bit = 1 when a key is being pressed.

mask: (later)

Edge Capture: Pressing a key sets its Edgecapture bit to 1; it remains set until manually reset (by writing a 1 into it)

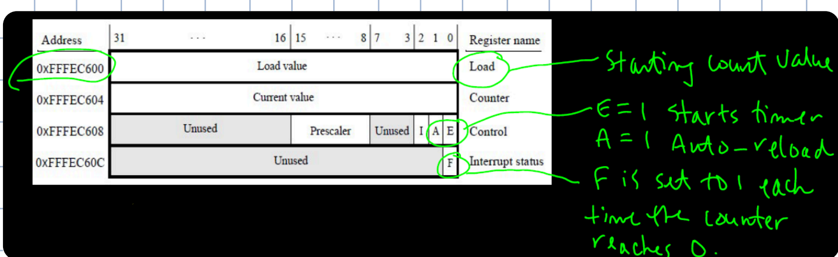
Example: rotate a pattern across HEX3-0, using a delay-loop

```
.text
.global _start
_start: LDR  R0, =0xFF200000 //LEDR address.
        MOV  R1, #0x7F

DISPLAY: LDR  R4, [R0, #0x40] // Load from FF200040 (SW)
         STR  R4, [R0]
```

```
         LDR   R5, [R0, #0X50]   // read from FF200050 (KEY)
         CMP   R5, #0
         BEQ   NO_KEY
         MOV   R1, R4            // use SW as the pattern.

WAIT :   LDR   R5, [R0, #0X50]  ] (*)
         CMP   R5, #0           ]  polled I/O
         BNE   WAIT             ]
NO_KEY:  STR   R1, [R0, #0X20]   // write to FF200020 (HEX3-0)
         ROR   R1, #1

         LDR   R2, =50000000

DELAY:   SUBS  R2, #1
         BNE   DELAY

         B     DISPLAY.
```

Using a hardware timer to provide an Exact delay

- A timer is an I/O device that has a counter which you can load with an initial value. It then counts down to 0 at a known clock rate. (e.g. 200MHZ)




```
         .text
         .global  _start
_start:  LDR   R0, = 0xFF200000    // LEDR address.
         MOV   R1, #0x7F
         LDR   R8, = 0xFFFEC600    // Timer base address.
         LDR   R2, = 20000000      // timeout = 1/200MHZ x 2^7 = 0.1 sec
         STR   R2, [R8]
         MOV   R2, #0b011
         STR   R2, [R8, #8]

DISPLAY : (*)  same as before.

DELAY :  LDR   R2, [R8, #0xC]      // read status reg.  ] this is another
         CMP   R2, #0                                   ] example of
```

polled I/O

```
BEQ   DELAY
STR   R2, [R8, #0xC] // reset F
B     DISPLAY
```