CA Lab1 Tutorial

Guideline

- Modifications in `.ucf` file
- Additional module `clk2to1` to change the clock rate
- Modifications in `top.v` due to **common anode / common cathode**

UCF

The pins of clock should be changed, which are listed as follows. What's more, an additional module `clk2to1` should be added to the top module.

Please check the differences in the naming of signals. In fact, there's no need to change the pins of signals except of clock rate.

```
##system clock
NET "CLK_200M_P"    LOC = AC18  |    IOSTANDARD = LVDS ;
NET "CLK_200M_N"    LOC = AD18  |    IOSTANDARD = LVDS ;
NET "CLK_200M_P"    TNM_NET = TM_CLK ;
TIMESPEC TS_CLKIN = PERIOD "TM_CLK"        5 ns HIGH 50%;



##Reset or CR
NET "rst_n"             LOC = W13       | IOSTANDARD = LVCMOS18 ;

##Please adapt btn_x or btn_y to YOUR design
NET "btn_x[0]"          LOC = V17       | IOSTANDARD = LVCMOS18 ;
NET "btn_x[1]"          LOC = W18       | IOSTANDARD = LVCMOS18 ;
NET "btn_x[2]"          LOC = W19       | IOSTANDARD = LVCMOS18 ;
NET "btn_x[3]"          LOC = W15       | IOSTANDARD = LVCMOS18 ;
NET "btn_x[4]"          LOC = W16       | IOSTANDARD = LVCMOS18 ;

NET "btn_y[0]"          LOC = V18       | IOSTANDARD = LVCMOS18 ;
NET "btn_y[1]"          LOC = V19       | IOSTANDARD = LVCMOS18 ;
NET "btn_y[2]"          LOC = V14       | IOSTANDARD = LVCMOS18 ;
NET "btn_y[3]"          LOC = W14       | IOSTANDARD = LVCMOS18 ;
#NET "btn_y[4]"         LOC = V16       | IOSTANDARD = LVCMOS18 ;

NET "RDY"           LOC = U21       | IOSTANDARD = LVCMOS33 ;
NET "readn"         LOC = U22       | IOSTANDARD = LVCMOS33 ;
NET "CR"                LOC = V22       | IOSTANDARD = LVCMOS33 ;
#NET "tri_led1_r_n"         LOC = U24       | IOSTANDARD = LVCMOS18 ;
#NET "tri_led1_g_n"         LOC = U25       | IOSTANDARD = LVCMOS18 ;
#NET "tri_led1_b_n"         LOC = V23       | IOSTANDARD = LVCMOS18 ;

##
```

```
#NET "tri_led0_b_n"     LOC = V22       | IOSTANDARD = LVCMOS33 ;
#NET "tri_led0_g_n"     LOC = U22       | IOSTANDARD = LVCMOS33 ;
#NET "tri_led0_r_n"     LOC = U21       | IOSTANDARD = LVCMOS33 ;
#NET "tri_led1_b_n"     LOC = V23       | IOSTANDARD = LVCMOS33 ;
#NET "tri_led1_g_n"     LOC = U25       | IOSTANDARD = LVCMOS33 ;
#NET "tri_led1_r_n"     LOC = U24       | IOSTANDARD = LVCMOS33 ;

## SSeg7_Dev
NET "seg_clk"           LOC = M24   | IOSTANDARD = LVCMOS33 ;
NET "seg_pen"           LOC = R18   | IOSTANDARD = LVCMOS33 ;
NET "seg_do"            LOC = L24   | IOSTANDARD = LVCMOS33 ;
NET "seg_clrn"          LOC = M20   | IOSTANDARD = LVCMOS33 ;

##LED: SPIO
NET "led_clk"           LOC = N26   | IOSTANDARD = LVCMOS33 ;
NET "led_pen"           LOC = P18   | IOSTANDARD = LVCMOS33 ;
NET "led_do"            LOC = M26   | IOSTANDARD = LVCMOS33 ;
NET "led_clrn"          LOC = N24   | IOSTANDARD = LVCMOS33 ;

##switch
NET "switch[0]"         LOC = AA10  | IOSTANDARD = LVCMOS15 ;
NET "switch[1]"         LOC = AB10  | IOSTANDARD = LVCMOS15 ;
NET "switch[2]"         LOC = AA13  | IOSTANDARD = LVCMOS15 ;
NET "switch[3]"         LOC = AA12  | IOSTANDARD = LVCMOS15 ;
NET "switch[4]"         LOC = Y13   | IOSTANDARD = LVCMOS15 ;
NET "switch[5]"         LOC = Y12   | IOSTANDARD = LVCMOS15 ;
NET "switch[6]"         LOC = AD11  | IOSTANDARD = LVCMOS15 ;
NET "switch[7]"         LOC = AD10  | IOSTANDARD = LVCMOS15 ;
NET "switch[8]"         LOC = AE10  | IOSTANDARD = LVCMOS15 ;
NET "switch[9]"         LOC = AE12  | IOSTANDARD = LVCMOS15 ;
NET "switch[10]"        LOC = AF12  | IOSTANDARD = LVCMOS15 ;
NET "switch[11]"        LOC = AE8   | IOSTANDARD = LVCMOS15 ;
NET "switch[12]"        LOC = AF8   | IOSTANDARD = LVCMOS15 ;
NET "switch[13]"        LOC = AE13  | IOSTANDARD = LVCMOS15 ;
NET "switch[14]"        LOC = AF13  | IOSTANDARD = LVCMOS15 ;
NET "switch[15]"        LOC = AF10  | IOSTANDARD = LVCMOS15 ;

##VGA
#NET "vga_blue[0]"          LOC = T20   | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "vga_blue[1]"          LOC = R20   | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "vga_blue[2]"          LOC = T22   | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "vga_blue[3]"          LOC = T23   | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "vga_green[0]"     LOC = R22   | IOSTANDARD = LVCMOS33 | SLEW = FAST ;
#NET "vga_green[1]"     LOC = R23   | IOSTANDARD = LVCMOS33 | SLEW = FAST ;
#NET "vga_green[2]"     LOC = T24   | IOSTANDARD = LVCMOS33 | SLEW = FAST ;
#NET "vga_green[3]"     LOC = T25   | IOSTANDARD = LVCMOS33 | SLEW = FAST ;
#NET "vga_red[0]"       LOC = N21   | IOSTANDARD = LVCMOS33 | SLEW = FAST ;
#NET "vga_red[1]"       LOC = N22   | IOSTANDARD = LVCMOS33 | SLEW = FAST ;
#NET "vga_red[2]"       LOC = R21   | IOSTANDARD = LVCMOS33 | SLEW = FAST ;
#NET "vga_red[3]"       LOC = P21   | IOSTANDARD = LVCMOS33 | SLEW = FAST ;
#NET "vga_h_sync"       LOC = M22   | IOSTANDARD = LVCMOS33 | SLEW = FAST ;
```

```
#NET "vga_v_sync"       LOC = M21    | IOSTANDARD = LVCMOS33 | SLEW = FAST ;


## Keyboard
#NET "keyboard_clk"         LOC = N18      | IOSTANDARD = LVCMOS33 ;
#NET "keyboard_dat"         LOC = M19      | IOSTANDARD = LVCMOS33 ;


## DB9 Uart
#NET "uart_rx"          LOC = L25       | IOSTANDARD = LVCMOS33 | SLEW = FAST
|              PULLUP ;
#NET "uart_tx"          LOC = P24       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 16 | PULLUP ;


## SRAM
#NET "sram_addr[0]"     LOC = D20       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_addr[1]"     LOC = D18       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_addr[2]"     LOC = E16       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_addr[3]"     LOC = E18       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_addr[4]"     LOC = E17       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_addr[5]"     LOC = E20       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_addr[6]"     LOC = F15       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_addr[7]"     LOC = F18       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_addr[8]"     LOC = H19       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_addr[9]"     LOC = J16       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_addr[10]"        LOC = J18       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_addr[11]"        LOC = J20       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_addr[12]"        LOC = G19       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_addr[13]"        LOC = H17       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_addr[14]"        LOC = F20       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_addr[15]"        LOC = G17       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_addr[16]"        LOC = F17       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_addr[17]"        LOC = F19       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_addr[18]"        LOC = H18       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
```

```
#NET "sram_addr[19]"        LOC = G20       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_ce_n[0]"     LOC = E15       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_ce_n[1]"     LOC = G15       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_ce_n[2]"     LOC = K20       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[0]"     LOC = M16       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[1]"     LOC = L19       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[2]"     LOC = L17       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[3]"     LOC = K18       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[4]"     LOC = L18       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[5]"     LOC = K17       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[6]"     LOC = K16       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[7]"     LOC = M17       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[8]"     LOC = H26       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[9]"     LOC = H23       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_data[10]"        LOC = H21       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[11]"        LOC = J26       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[12]"        LOC = L20       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[13]"        LOC = J19       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[14]"        LOC = J21       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[15]"        LOC = K21       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[16]"        LOC = B26       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[17]"        LOC = C22       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[18]"        LOC = A24       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[19]"        LOC = A23       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[20]"        LOC = E22       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[21]"        LOC = E23       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[22]"        LOC = C24       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
```

```
#NET "sram_data[23]"        LOC = D23       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[24]"        LOC = B20       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[25]"        LOC = A20       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[26]"        LOC = C21       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[27]"        LOC = B21       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[28]"        LOC = A22       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[29]"        LOC = B22       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[30]"        LOC = D21       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[31]"        LOC = E21       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[32]"        LOC = H24       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[33]"        LOC = E26       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[34]"        LOC = G25       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[35]"        LOC = F24       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[36]"        LOC = F25       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[37]"        LOC = G24       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[38]"        LOC = G21       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[39]"        LOC = G26       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[40]"        LOC = F22       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[41]"        LOC = G22       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[42]"        LOC = C26       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[43]"        LOC = D24       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[44]"        LOC = E25       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[45]"        LOC = F23       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[46]"        LOC = D25       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_data[47]"        LOC = D26       | IOSTANDARD = LVCMOS33 | SLEW =
FAST | DRIVE = 4 ;
#NET "sram_oe_n[0]"     LOC = D19       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_oe_n[1]"     LOC = U19       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
```

```
#NET "sram_oe_n[2]"     LOC = P16       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_we_n[0]"     LOC = J15       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_we_n[1]"     LOC = T19       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_we_n[2]"     LOC = P23       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_ub_n[0]"     LOC = R26       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_ub_n[1]"     LOC = P20       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_ub_n[2]"     LOC = P18       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_lb_n[0]"     LOC = K26       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_lb_n[1]"     LOC = M20       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;
#NET "sram_lb_n[2]"     LOC = R17       | IOSTANDARD = LVCMOS33 | SLEW = FAST
| DRIVE = 4 ;


## BPI Flash
#NET "flash_addr[0]"        LOC = C12       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_addr[1]"        LOC = J11       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_addr[2]"        LOC = H13       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_addr[3]"        LOC = H12       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_addr[4]"        LOC = J13       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_addr[5]"        LOC = H11       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_addr[6]"        LOC = J10       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_addr[7]"        LOC = J8        | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_addr[8]"        LOC = F9        | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_addr[9]"        LOC = F8        | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_addr[10]"   LOC = E10       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[11]"   LOC = F10       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[12]"   LOC = D9        | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[13]"   LOC = D8        | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[14]"   LOC = G14       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[15]"   LOC = H14       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
```

```
#NET "flash_addr[16]"   LOC = B9        | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[17]"   LOC = G11       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[18]"   LOC = H9        | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[19]"   LOC = G12       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[20]"   LOC = F12       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[21]"   LOC = H8        | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[22]"   LOC = A8        | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[23]"   LOC = C9        | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[24]"   LOC = D10       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_addr[25]"   LOC = A9        | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_ce_n[0]"    LOC = D11       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_ce_n[1]"        LOC = F14       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[0]"        LOC = D14       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[1]"        LOC = D13       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[2]"        LOC = E13       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[3]"        LOC = E12       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[4]"        LOC = C14       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[5]"        LOC = C13       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[6]"        LOC = B12       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[7]"        LOC = B11       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[8]"        LOC = B14       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[9]"        LOC = A14       | IOSTANDARD = LVCMOS33 | SLEW =
FAST ;
#NET "flash_data[10]"   LOC = B10       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[11]"   LOC = A10       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[12]"   LOC = B15       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[13]"   LOC = A15       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[14]"   LOC = A13       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
```

```
#NET "flash_data[15]"   LOC = A12       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[16]"   LOC = J14       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[17]"   LOC = J25       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[18]"   LOC = C18       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[19]"   LOC = J23       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[20]"   LOC = K23       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[21]"   LOC = B17       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[22]"   LOC = L22       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[23]"   LOC = D15       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[24]"   LOC = H22       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[25]"   LOC = K15       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[26]"   LOC = J24       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[27]"   LOC = K22       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[28]"   LOC = C17       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[29]"   LOC = D16       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[30]"   LOC = A17       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_data[31]"   LOC = L23       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_oe_n"       LOC = F13       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_rst_n"      LOC = G9        | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_ready[0]"   LOC = C11       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_ready[1]"   LOC = E11       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;
#NET "flash_we_n"       LOC = G10       | IOSTANDARD = LVCMOS33 | SLEW = FAST
;

## SD Card SPI mode
#NET "sd_cs_n"          LOC = Y20       | IOSTANDARD = LVCMOS33 | PULLUP ;
#NET "sd_sclk"          LOC = AF23      | IOSTANDARD = LVCMOS33 | PULLUP ;
#NET "sd_mosi"          LOC = AE25      | IOSTANDARD = LVCMOS33 | PULLUP ;
#NET "sd_miso"          LOC = AD25      | IOSTANDARD = LVCMOS33 ;


## SD Card SD mode
#NET "sd_cd"                LOC = AE26       | IOSTANDARD = LVCMOS33 | PULLUP
;
```

```
#NET "sd_sck"           LOC = AF23      | IOSTANDARD = LVCMOS33;
#NET "sd_cmd"           LOC = AD25      | IOSTANDARD = LVCMOS33 | PULLUP ;
#NET "sd_dat0"          LOC = AE25      | IOSTANDARD = LVCMOS33 | PULLUP ;
#NET "sd_dat1"          LOC = AE22      | IOSTANDARD = LVCMOS33 | PULLUP ;
#NET "sd_dat2"          LOC = AF22      | IOSTANDARD = LVCMOS33 | PULLUP ;
#NET "sd_dat3"          LOC = Y20      | IOSTANDARD = LVCMOS33 | PULLUP ;


##Pmod interface
#NET "pmodsd_cs_n"      LOC = "C16" | IOSTANDARD = "LVCMOS33"; #Bank = 2, Pin
no 0
#NET "pmodsd_mosi"      LOC = "C19" | IOSTANDARD = "LVCMOS33"; #Bank = 2, Pin
no 1
#NET "pmodsd_miso"      LOC = "A18" | IOSTANDARD = "LVCMOS33"; #Bank = 2, Pin
no 2
#NET "pmodsd_sclk"      LOC = "H16" | IOSTANDARD = "LVCMOS33"; #Bank = 2, Pin
no 3
#NET "JE_I[1]"          LOC = "B16" | IOSTANDARD = "LVCMOS33"; #Bank = 2, Pin
no 4
#NET "JE_I[2]"          LOC = "B19" | IOSTANDARD = "LVCMOS33"; #Bank = 2, Pin
no 5
#NET "JE_I[3]"          LOC = "A19" | IOSTANDARD = "LVCMOS33"; #Bank = 2, Pin
no 6
#NET "JE_I[4]"          LOC = "G16" | IOSTANDARD = "LVCMOS33"; #Bank = 2, Pin
no 7



##Arduino-Sword-002-Basic IO
NET "buzzer"            LOC = AF25  | IOSTANDARD = LVCMOS33 ;
## Seg7_Dev
NET "segment[0]"        LOC = AB22      | IOSTANDARD = LVCMOS33 ;#a
NET "segment[1]"        LOC = AD24       | IOSTANDARD = LVCMOS33 ;#b
NET "segment[2]"        LOC = AD23       | IOSTANDARD = LVCMOS33 ;
NET "segment[3]"        LOC = Y21        | IOSTANDARD = LVCMOS33 ;
NET "segment[4]"        LOC = W20        | IOSTANDARD = LVCMOS33 ;
NET "segment[5]"        LOC = AC24       | IOSTANDARD = LVCMOS33 ;
NET "segment[6]"        LOC = AC23       | IOSTANDARD = LVCMOS33 ;#g
NET "segment[7]"        LOC = AA22       | IOSTANDARD = LVCMOS33 ;#point

## Seg7_Dev
NET "an[0]"             LOC = AD21      | IOSTANDARD = LVCMOS33 ;
NET "an[1]"             LOC = AC21      | IOSTANDARD = LVCMOS33 ;
NET "an[2]"             LOC = AB21      | IOSTANDARD = LVCMOS33 ;
NET "an[3]"             LOC = AC22      | IOSTANDARD = LVCMOS33 ;

## PIO
NET "a_led[0]"          LOC = AF24  | IOSTANDARD = LVCMOS33 ;
NET "a_led[1]"          LOC = AE21  | IOSTANDARD = LVCMOS33 ;
NET "a_led[2]"          LOC = Y22   | IOSTANDARD = LVCMOS33 ;
NET "a_led[3]"          LOC = Y23   | IOSTANDARD = LVCMOS33 ;
NET "a_led[4]"          LOC = AA23  | IOSTANDARD = LVCMOS33 ;
NET "a_led[5]"          LOC = Y25   | IOSTANDARD = LVCMOS33 ;
NET "a_led[6]"          LOC = AB26  | IOSTANDARD = LVCMOS33 ;
NET "a_led[7]"          LOC = W23   | IOSTANDARD = LVCMOS33 ;
```

`clk2to1` Module

The code of the module is shown below.

```
`timescale 1ns / 1ps
module clk_2to1(
    input CLK_200M_P,
    input CLK_200M_N,
    input rst,
    output clk_100mhz
);

    IBUFDS sclk(.I(CLK_200M_P), .IB(CLK_200M_N), .O(clk_100mhz));

endmodule
```

Utilization in `top` module:

```
`timescale 1ns / 1ps
module top(
    input CLK_200M_P,
    input CLK_200M_N,
    input rst_n,
    ...
    );

    wire clk_100mhz;

    clk_2to1 C0(CLK_200M_P, CLK_200M_N, rst_n, clk_100mhz);

    clk_div U8(.clk(clk_100mhz), .rst(rst), .SW2(SW_OK[2]),
                .clkdiv(Div), .Clk_CPU(Clk_CPU));

    ...
endmodule
```

Modifications in `top.v`

PIO & SPIO in the new device are different from the ones in the original device (i.e. the difference of **common anode** & **common cathode**).

Therefore, the signal should be inverse.

```
SPIO U7(.clk(clk_100mhz), .rst(rst), .EN(GPIOf0000000_we), .Start(Div[20]),
.P_Data(CPU2IO), .counter_set(counter_set), .LED_out(LED_out), .GPIOf0(),
.led_clk(led_clk), .led_sout(led_do_inverse), .LED_PEN(led_pen),
.led_clrn(led_clrn));
assign led_do = ~led_do_inverse;

PIO U71(.clk(IO_clk), .rst(rst), .EN(GPIOf0000000_we), .PData_in(CPU2IO),
LED_out(a_led_inverse), .GPIOf0());
assign a_led = ~a_led_inverse;
```

Recall

Obviously, `a_led` instructs PIO which LED to turn on. However, the same trick does NOT work in SPIO for the limit of PINs. Hence, serialization is used in SPIO to reduce the burden of pins. We use only one signal and let it change in a period of 16 to display the state of 16 LEDs, which is also called time-sharing. Therefore, we should make `led_do`(or `led_sout` in your case) inverse, to change the display of the LEDs.