

A

A

B

B

C

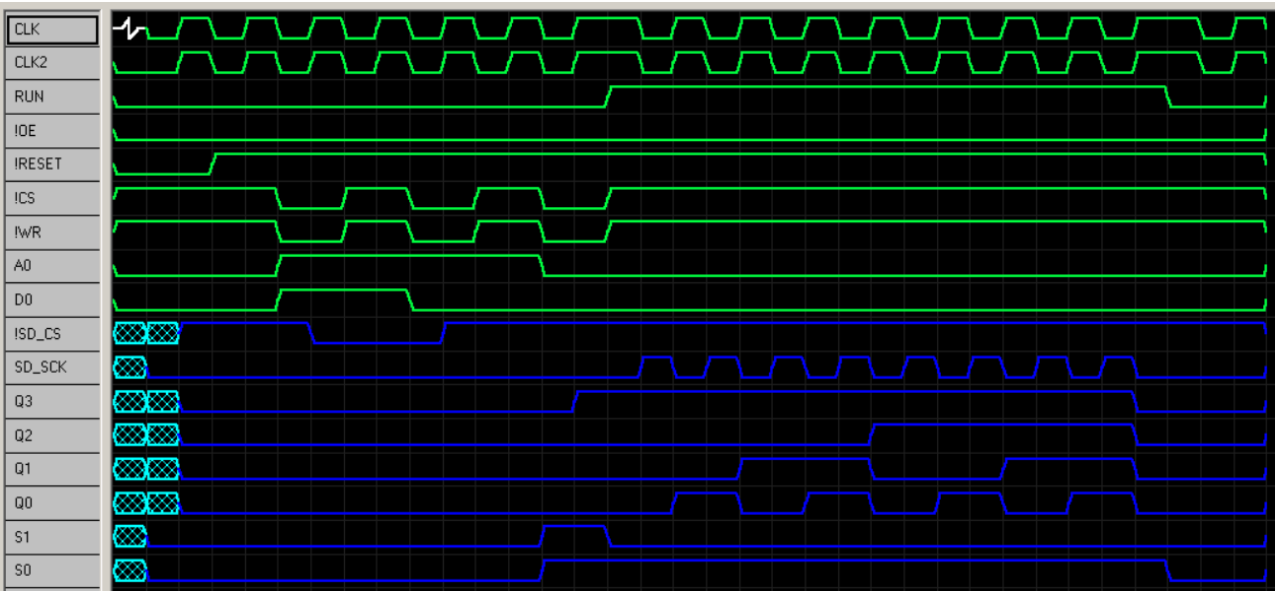
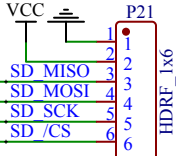
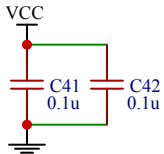
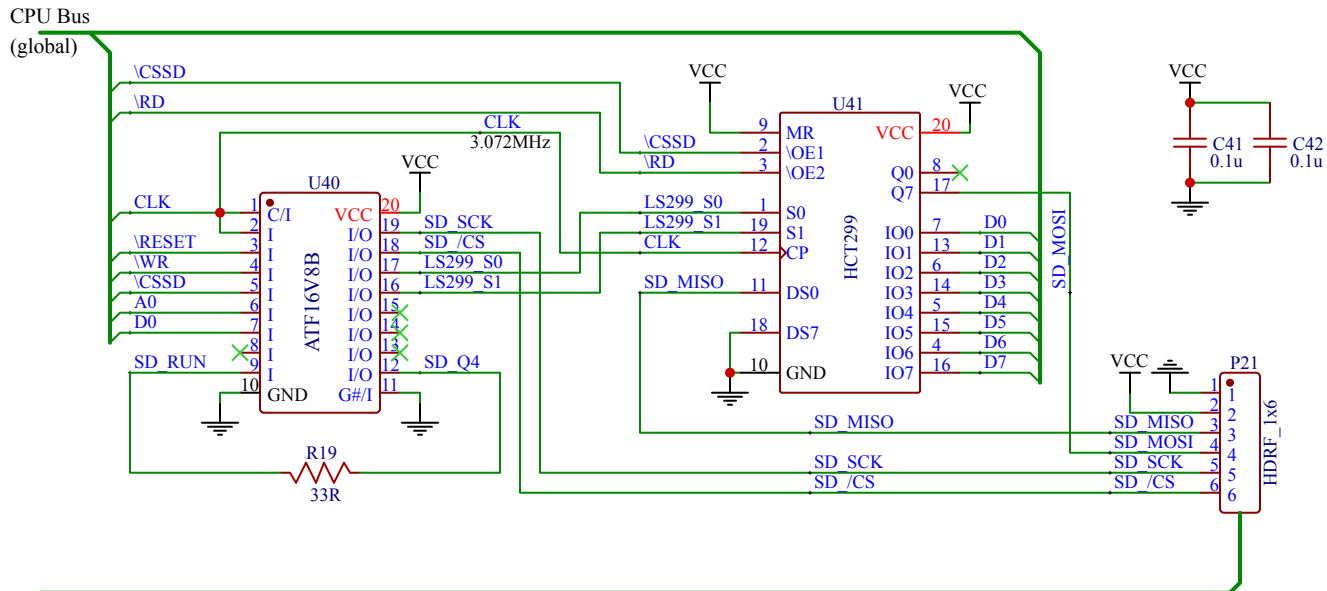
C

D

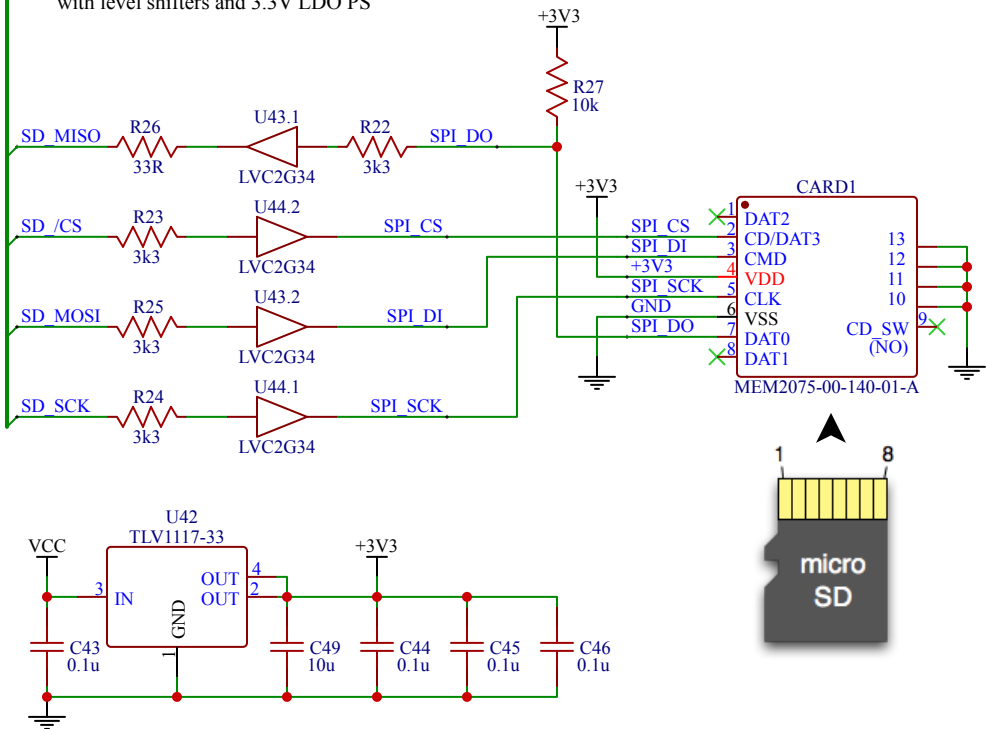
D

E

E



Alternative 1:  
An optional built-in micro SD card  
with level shifters and 3.3V LDO PS



Alternative 2:  
P21 connector connected to  
an external MicroSD card reader.

Alternative 2 can be cheaper than Alternative 1.

Pin	SD	SPI
1	DAT2	X
2	CD/DAT3	CS
3	CMD	DI
4	VDD	VDD
5	CLK	SCLK
6	VSS	VSS
7	DAT0	DO
8	DAT1	X

SPI\_CS << SD\_CS  
SPI\_DI << SD\_MOSI  
SPI\_SCK << SD\_SCK  
SPI\_DO >> SD\_MISO

```
U40
    CLK x---|1
    CLK2 x---|2
    !RESET x---|3
    !WR x---|4
    !CS x---|5
    A0 x---|6
    D0 x---|7
    RUN x---|9
    GND x---|10
    GP40_SD
    20|---x Vcc
    19|---x SD_SCK
    18|---x !SD_CS
    17|---x S0
    16|---x S1
    15|---x Q0
    14|---x Q1
    13|---x Q2
    12|---x Q3
    11|---x !OE

/*
 74LS299 states
 S1 = 0, S0 = 0 : Hold
 S1 = 1, S0 = 1 : Load
 S1 = 0, S0 = 1 : Shift
*/

S1      = CS & WR & !A0 ;
S0      = RUN # S1 ;
SD_SCK  = RUN & !CLK2 ;

sequence SD_CS
{
    present 'b'0
        if RESET next 'b'0 ;
        /* writing D0 = 1 sets SD_CS = 1 */
        if CS & WR & A0:1 & D0:1 next 'b'1 ;
        default next 'b'0 ;
    present 'b'1
        if RESET next 'b'0 ;
        /* writing D0 = 0 sets SD_CS = 0 */
        if CS & WR & A0:1 & D0:0 next 'b'0 ;
        default next 'b'1 ;
}
```

```
field shift_counter = [Q0..3];

$define C0 'b'0000
$define C1 'b'1000
$define C2 'b'1001
$define C3 'b'1010
$define C4 'b'1011
$define C5 'b'1100
$define C6 'b'1101
$define C7 'b'1110
$define C8 'b'1111

sequence shift_counter
{
    present C0
        if RESET next C0 ;
        /* writing D0-D7 to LS299 starts serial IO */
        if CS & WR & A0:0 next C1;
        default next C0 ;
    present C1 if RESET next C0 ; default next C2 ;
    present C2 if RESET next C0 ; default next C3 ;
    present C3 if RESET next C0 ; default next C4 ;
    present C4 if RESET next C0 ; default next C5 ;
    present C5 if RESET next C0 ; default next C6 ;
    present C6 if RESET next C0 ; default next C7 ;
    present C7 if RESET next C0 ; default next C8 ;
    present C8 if RESET next C0 ; default next C0 ;
}
```



40th anniversary tribute  
January 2024

PCB by Mikica

