Sheet: Loader

File: Loader.sch

Sheet: CPU

File: CPU.sch

Sheet: RAM

File: RAM.sch

Memory Map
$000000 $0FFFFF 1MiB RAM
$100000 $17FFFF 1MiB Pseudo ROM
$180000 $1FFFFF INVALID
$200000 $27FFFF 1MiB Pseudo IO
$280000 $3FFFFF INVALID
$400000 $7FFFFF UNMAPPED

RAM A20 address A19-A1
ROM A21 address A19-A1
IO A23 address A19-A1
LOADER (A1-A23)

Pseudo IO Memory Map
$200001 CONSOLERX (A1)
$200002 CONSOLETX (A2)
$200004 LED0 (A3)
$200008 LED1 (A4)
$200010 LED2 (A5)
$200020 LED3 (A6)
$200040 LED4 (A7)
$200080 LED5 (A8)
$200100 LED6 (A9)
$200200 LED7 (A10)
$200400 RTCRX (A11)
$200800 RTCTX (A12)
$201000 FUTURE (A13)
$202000 FUTURE (A14)
$204000 FUTURE (A15)
$208000 FUTURE (A16)
$210000 FUTURE (A17)
$220000 FUTURE (A18)
$240000 FUTURE (A19)

```
$ echo "obase=16; ibase=2; 01000000000010000000000" | bc
200400
```

JLCPCB Part Reference

74HC00D,653 Quad 2-input NAND gate
74HC138D,653 3-to-8 line decoder/demultiplexer; inverting
74HC165D,653 8-bit parallel-in/serial out shift register
74HC245D,653 Octal bus tranceiver; 3-state
74HC595D,118 8-bit serial-in, serial or parallel-out shift register with output latches; 3-state
74HCT04 Hex inverter
74HCT14 Hex inverting Schmitt trigger

2N7002 MOSFET N TRENCH 60V 115MA 2.5V @ 250UA 7.5
AMS1117-3.3 1A LOW DROPOUT VOLTAGE REGULATOR

FT232RL-REEL USB UART I.C.
ATMEGA2560-16AU 8-bit Atmel Microcontroller with 16/32/64KB In-System Programmable Flash
IS62WV51216BLL-55TLI 512K x 16 LOW VOLTAGE,ULTRA LOW POWER CMOS STATIC RAM

TAJA106K016RNJ TANTALUM CAPACITORS 10UF 16V CASE-A_3216

19-217/GHC-YR1S2/3T LIGHT EMITTING DIODES (LED) GREEN 520535NM 112258MCD@20MA TOP VIEW 0603 ROHS Basic Part
vcc=5; i=20; vf=3.3; (vcc-vf)/(i/1000) = 85 Ohms (0.066W) (82 Ohms 0.1W)
0603WAF820JT5E CHIP RESISTOR - SURFACE MOUNT 820HMS ±1% 1/10W 0603 ROHS Basic Part ?

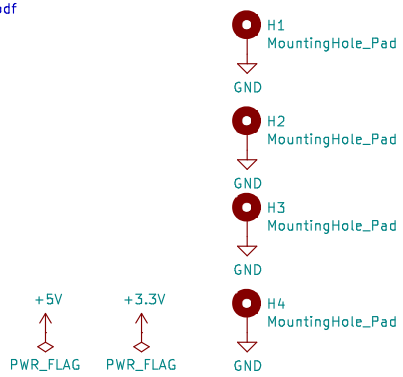
KT-0603R LIGHT EMITTING DIODES (LED) RED 520625NM 90100M
vcc=5; i=20; vf=2.1; (vcc-vf)/(i/1000) = 145 Ohms (0.042) (150 Ohms 0.1W)
0603WAF1500T5E CHIP RESISTOR - SURFACE MOUNT 1500HMS ±1% 1/10W 060
https://ohmslawcalculator.com/led-resistor-calculator

URLS

https://jlcpcb.com/parts
https://hackaday.com/2016/12/05/taking-it-to-another-level-making-3-3v-and-5v-logic-communicate-with-level-shifters/
https://electronics.stackexchange.com/questions/81580/step-up-3-3v-to-5v-for-digital-i-o
https://electronics.stackexchange.com/questions/476140/driving-a-74hc245-in-one-direction-with-3-3v-when-vcc-is-5v
https://www.eejournal.com/article/ultimate-guide-to-switch-debounce-part-4/
https://www.newark.com/pdfs/techarticles/microchip/3_3vto5vAnalogTipsnTricksBrchr.pdf
http://ee-classes.usc.edu/ee459/library/documents/I2C.pdf
https://www.hobbytronics.co.uk/mosfet-voltage-level-converter
https://rosco-m68k.com/
https://www.aslak.net/
http://www.users.cloud9.net/stark/hardw68k.htm
http://www.bitsavers.org/pdf/peripheralTechnology/PT68K2/PT68K-2_Users_Manual_Jun88.pdf
https://www.nxp.com/docs/en/reference-manual/MC68000UM.pdf
http://ww1.microchip.com/downloads/en/appnotes/atmel-2521-avr-hardware-design-considerations_applicationnote_avr042.pdf

TODO
halt led
reset led
68k clock
68k addressing, /as /dtack, /uds /lds

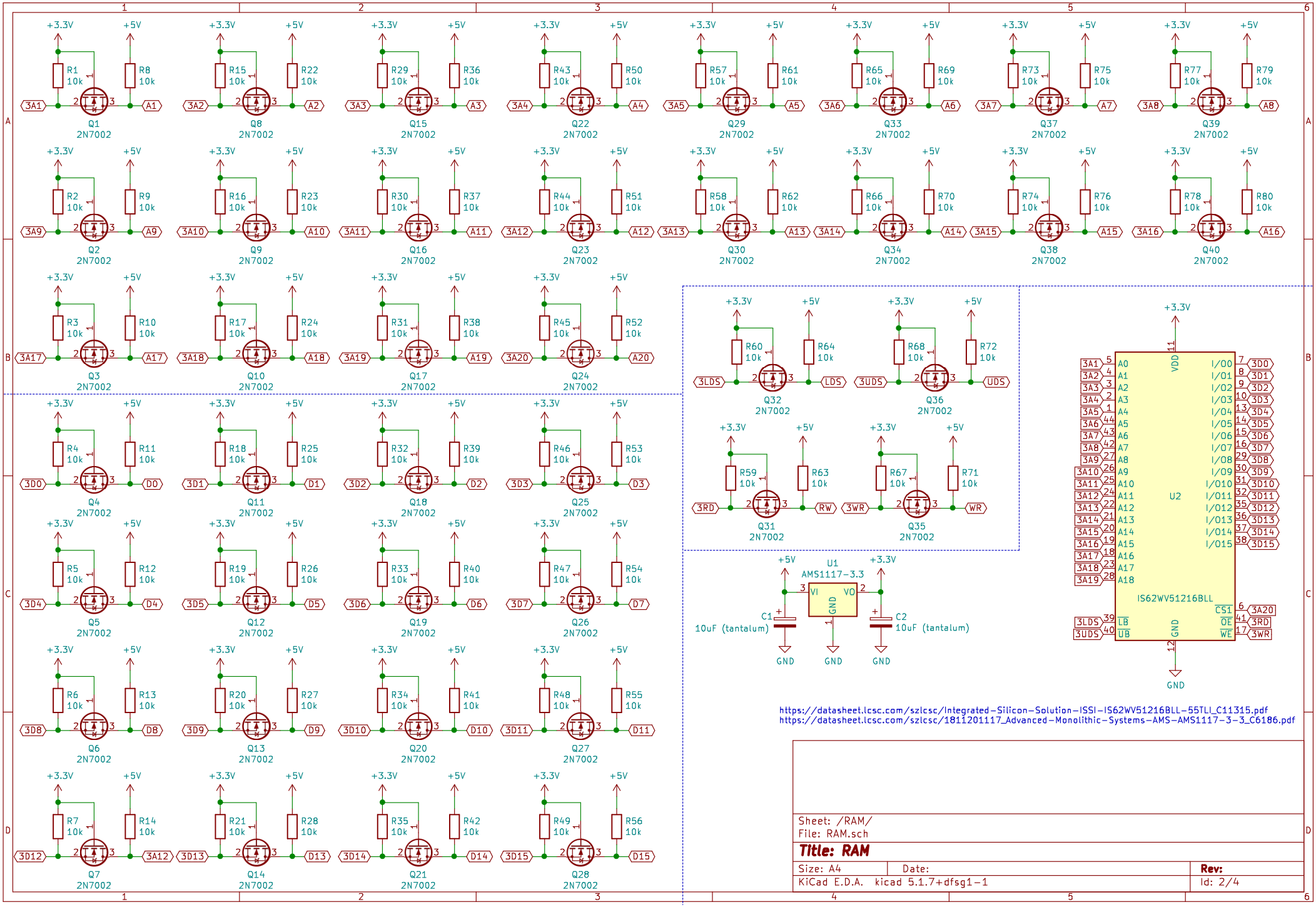
https://www.nxp.com/docs/en/user-guide/MC68332UM.pdf

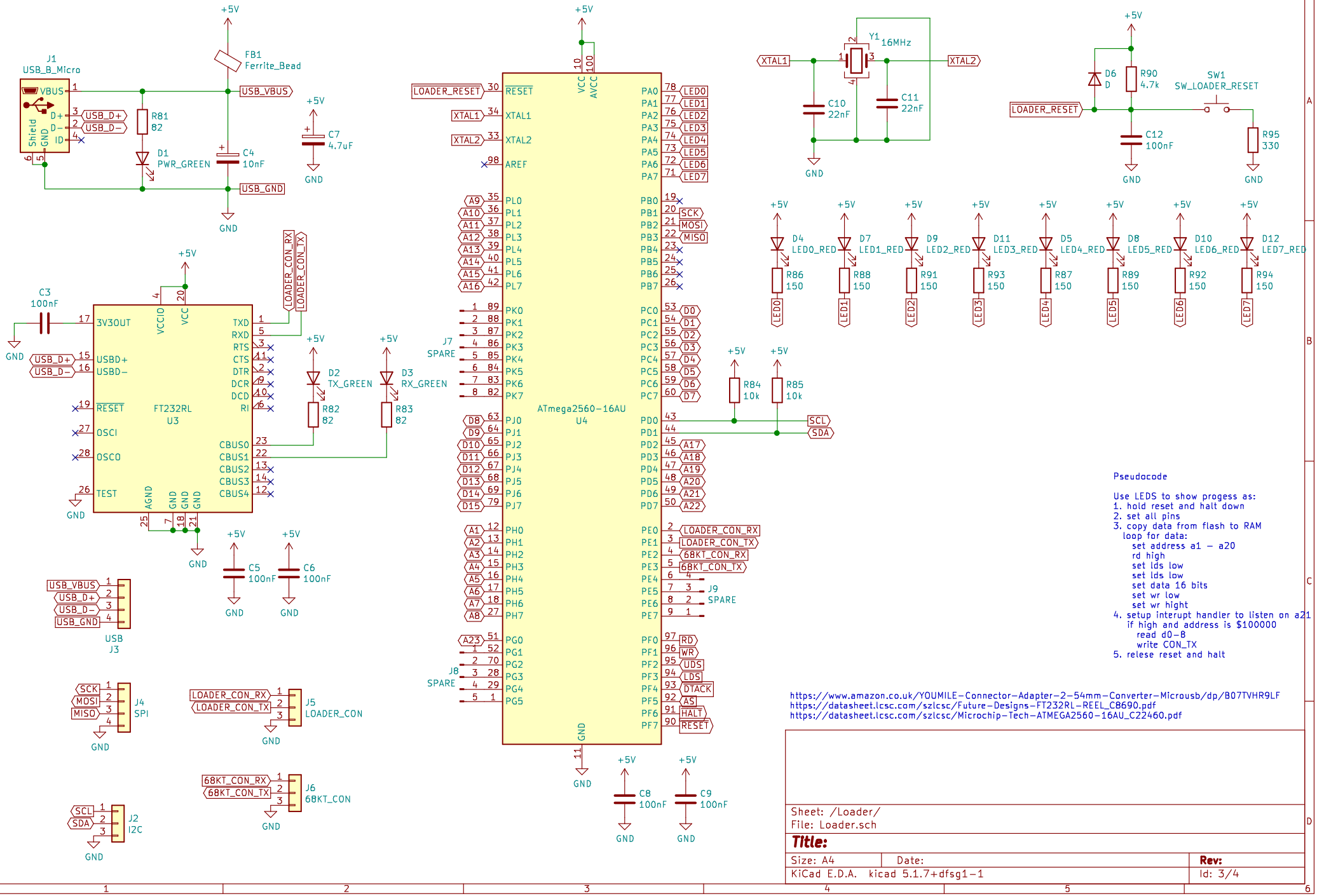


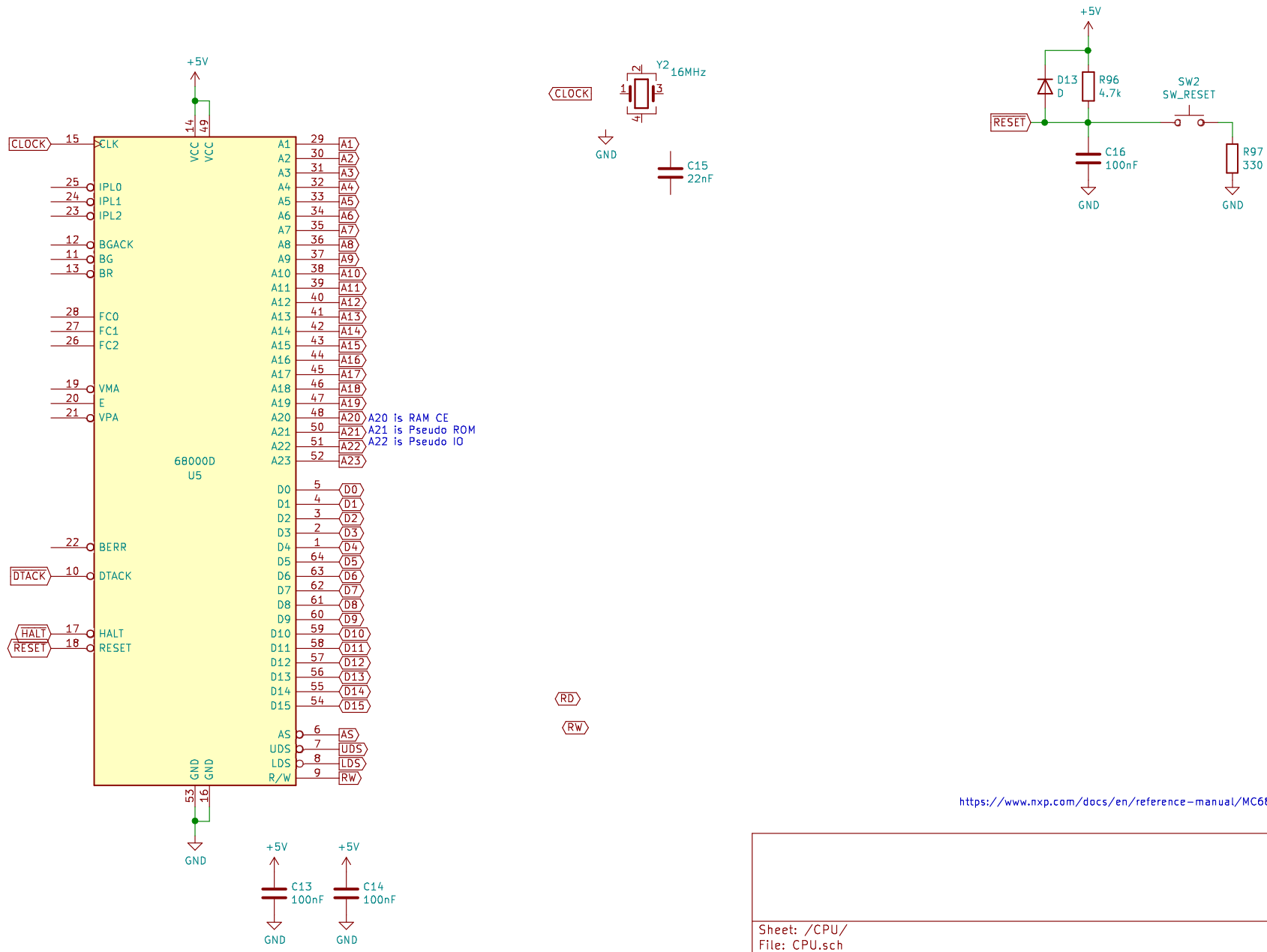
Sheet: /
File: 68kt.sch

Title:

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 5.1.7+dfsg1-1		Id: 1/4


+3.3V
+5V
R1 10k
R8 10k
3A1
A1
Q1 2N7002
R15 10k
R22 10k
3A2
A2
Q8 2N7002
R29 10k
R36 10k
3A3
A3
Q15 2N7002
R43 10k
R50 10k
3A4
A4
Q22 2N7002
R57 10k
R61 10k
3A5
A5
Q29 2N7002
R65 10k
R69 10k
3A6
A6
Q33 2N7002
R73 10k
R75 10k
3A7
A7
Q37 2N7002
R77 10k
R79 10k
3A8
A8
Q39 2N7002
R2 10k
R9 10k
3A9
A9
Q2 2N7002
R16 10k
R23 10k
3A10
A10
Q9 2N7002
R30 10k
R37 10k
3A11
A11
Q16 2N7002
R44 10k
R51 10k
3A12
A12
Q23 2N7002
R58 10k
R62 10k
3A13
A13
Q30 2N7002
R66 10k
R70 10k
3A14
A14
Q34 2N7002
R74 10k
R76 10k
3A15
A15
Q38 2N7002
R78 10k
R80 10k
3A16
A16
Q40 2N7002
R3 10k
R10 10k
3A17
A17
Q3 2N7002
R17 10k
R24 10k
3A18
A18
Q10 2N7002
R31 10k
R38 10k
3A19
A19
Q17 2N7002
R45 10k
R52 10k
3A20
A20
Q24 2N7002
R4 10k
R11 10k
3D0
D0
Q4 2N7002
R18 10k
R25 10k
3D1
D1
Q11 2N7002
R32 10k
R39 10k
3D2
D2
Q18 2N7002
R46 10k
R53 10k
3D3
D3
Q25 2N7002
R5 10k
R12 10k
3D4
D4
Q5 2N7002
R19 10k
R26 10k
3D5
D5
Q12 2N7002
R33 10k
R40 10k
3D6
D6
Q19 2N7002
R47 10k
R54 10k
3D7
D7
Q26 2N7002
R6 10k
R13 10k
3D8
D8
Q6 2N7002
R20 10k
R27 10k
3D9
D9
Q13 2N7002
R34 10k
R41 10k
3D10
D10
Q20 2N7002
R48 10k
R55 10k
3D11
D11
Q27 2N7002
R7 10k
R14 10k
3D12
3A12
Q7 2N7002
R21 10k
R28 10k
3D13
D13
Q14 2N7002
R35 10k
R42 10k
3D14
D14
Q21 2N7002
R49 10k
R56 10k
3D15
D15
Q28 2N7002
R60 10k
R64 10k
3LDS
LDS
Q32 2N7002
R68 10k
R72 10k
3UDS
UDS
Q36 2N7002
R59 10k
R63 10k
3RD
RW
Q31 2N7002
R67 10k
R71 10k
3WR
WR
Q35 2N7002
U1
AMS1117-3.3
VI
VO
GND
C1
10uF (tantalum)
C2
10uF (tantalum)
U2
IS62WV51216BLL
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
VDD
I/O0
I/O1
I/O2
I/O3
I/O4
I/O5
I/O6
I/O7
I/O8
I/O9
I/O10
I/O11
I/O12
I/O13
I/O14
I/O15
CS1
LB
UB
OE
WE
GND
https://datasheet.lcsc.com/szlcsc/Integrated-Silicon-Solution-ISSI-IS62WV51216BLL-55TLI_C11315.pdf
https://datasheet.lcsc.com/szlcsc/1811201117_Advanced-Monolithic-Systems-AMS-AMS1117-3-3_C6186.pdf
Sheet: /RAM/
File: RAM.sch
Title: RAM
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 5.1.7+dfsg1-1
Id: 2/4


J1
USB_B_Micro
VBUS
D+
D-
ID
GND
Shield
USB_D+
USB_D-
R81
82
D1
PWR_GREEN
C4
10nF
FB1
Ferrite_Bead
USB_VBUS
USB_GND
C7
4.7uF
+5V
GND
C3
100nF
3V3OUT
VCCIO
VCC
USBD+
USBD-
RESET
OSCI
OSCO
TEST
AGND
FT232RL
U3
TXD
RXD
RTS
CTS
DTR
DCR
DCD
RI
CBUS0
CBUS1
CBUS2
CBUS3
CBUS4
LOADER_CON_RX
LOADER_CON_TX
D2
TX_GREEN
D3
RX_GREEN
R82
82
R83
82
C5
100nF
C6
100nF
USB
J3
J4
SPI
SCK
MOSI
MISO
J5
LOADER_CON
68KT_CON_RX
68KT_CON_TX
J6
68KT_CON
J2
I2C
SCL
SDA
ATmega2560-16AU
U4
LOADER_RESET
XTAL1
XTAL2
AREF
VCC
AVCC
PL0
PL1
PL2
PL3
PL4
PL5
PL6
PL7
PK0
PK1
PK2
PK3
PK4
PK5
PK6
PK7
PJ0
PJ1
PJ2
PJ3
PJ4
PJ5
PJ6
PJ7
PH0
PH1
PH2
PH3
PH4
PH5
PH6
PH7
PG0
PG1
PG2
PG3
PG4
PG5
PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PB0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
PC0
PC1
PC2
PC3
PC4
PC5
PC6
PC7
PD0
PD1
PD2
PD3
PD4
PD5
PD6
PD7
PE0
PE1
PE2
PE3
PE4
PE5
PE6
PE7
PF0
PF1
PF2
PF3
PF4
PF5
PF6
PF7
J7
SPARE
J8
J9
LED0
LED1
LED2
LED3
LED4
LED5
LED6
LED7
SCK
MOSI
MISO
D0
D1
D2
D3
D4
D5
D6
D7
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
A19
A20
A21
A22
A23
RD
WR
UDS
LDS
DTACK
AS
HALT
RESET
C8
100nF
C9
100nF
Y1
16MHz
C10
22nF
C11
22nF
D4
LED0_RED
D7
LED1_RED
D9
LED2_RED
D11
LED3_RED
D5
LED4_RED
D8
LED5_RED
D10
LED6_RED
D12
LED7_RED
R86
150
R88
150
R91
150
R93
150
R87
150
R89
150
R92
150
R94
150
R84
10k
R85
10k
D6
D
R90
4.7k
SW1
SW_LOADER_RESET
C12
100nF
R95
330
Pseudocode
Use LEDS to show progess as:
1. hold reset and halt down
2. set all pins
3. copy data from flash to RAM
loop for data:
set address a1 – a20
rd high
set lds low
set lds low
set data 16 bits
set wr low
set wr hight
4. setup interupt handler to listen on a21
if high and address is $100000
read d0-8
write CON_TX
5. relese reset and halt
https://www.amazon.co.uk/YOUMILE-Connector-Adapter-2-54mm-Converter-Microusb/dp/B07TVHR9LF
https://datasheet.lcsc.com/szlcsc/Future-Designs-FT232RL-REEL_C8690.pdf
https://datasheet.lcsc.com/szlcsc/Microchip-Tech-ATMEGA2560-16AU_C22460.pdf
Sheet: /Loader/
File: Loader.sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 5.1.7+dfsg1-1
Id: 3/4


+5V
CLOCK
15
CLK
14
VCC
49
VCC
25
IPL0
24
IPL1
23
IPL2
12
BGACK
11
BG
13
BR
28
FC0
27
FC1
26
FC2
19
VMA
20
E
21
VPA
22
BERR
DTACK
10
DTACK
HALT
17
HALT
RESET
18
RESET
68000D
U5
A1 29
A2 30
A3 31
A4 32
A5 33
A6 34
A7 35
A8 36
A9 37
A10 38
A11 39
A12 40
A13 41
A14 42
A15 43
A16 44
A17 45
A18 46
A19 47
A20 48
A21 50
A22 51
A23 52
A20 is RAM CE
A21 is Pseudo ROM
A22 is Pseudo IO
D0 5
D1 4
D2 3
D3 2
D4 1
D5 64
D6 63
D7 62
D8 61
D9 60
D10 59
D11 58
D12 57
D13 56
D14 55
D15 54
AS 6
UDS 7
LDS 8
R/W 9
GND
GND
53
16
GND
+5V
C13
100nF
GND
+5V
C14
100nF
GND
CLOCK
Y2
16MHz
1
2
3
4
GND
C15
22nF
RD
RW
+5V
D13
D
R96
4.7k
SW2
SW_RESET
RESET
C16
100nF
GND
R97
330
GND
https://www.nxp.com/docs/en/reference-manual/MC68000UM.pdf
Sheet: /CPU/
File: CPU.sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 5.1.7+dfsg1-1
Id: 4/4