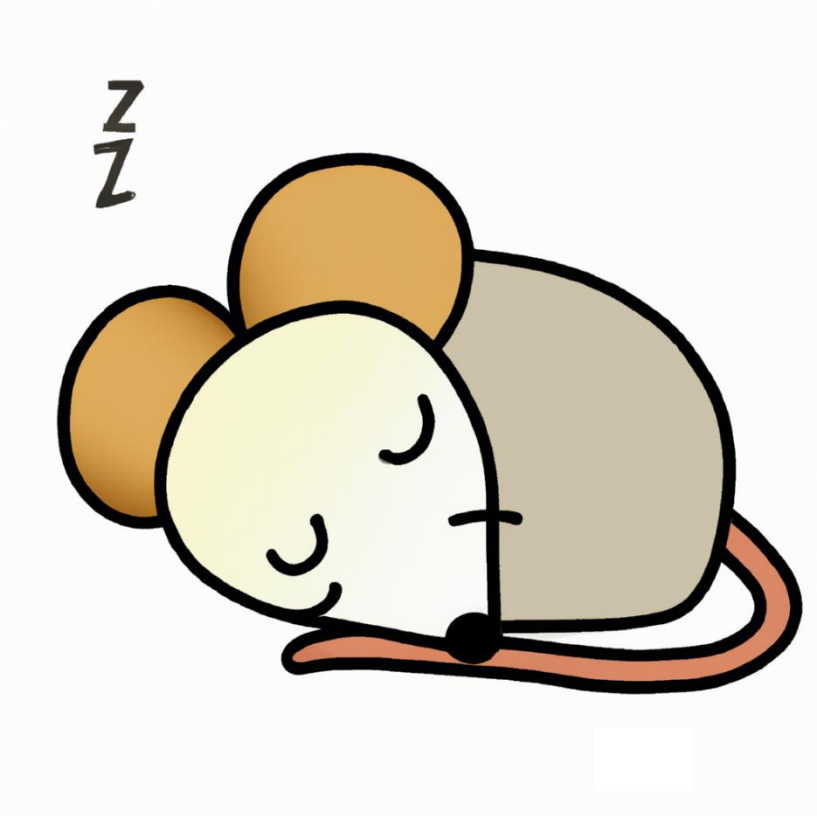
PROM Programmer and Editor

Instruction Manual & Functional Description



Contents

1 Introduction

This card has been designed to allow the programming and editing of 32 x 8 PROM's.

Manufacturer	**Part Number**
National	74S188
Fujitsu	7111
Signetics	82S23
AMD	827S1
MMI	6330
TI	18SA30
Harris	7602

2 Components

Reference	Value	Qty	Notes
C1	600pF	1	
C2	330uF	1	Electrolytic
C3	100uF	1	Electrolytic
C4	10nf	1	
C5	100nF	1	Electrolytic
C11	10nF	1	
C12	1nF	1	
C13	1uF	1	Electrolytic
C14	8n2	1	
D1, D2, D3, D4, D5, D6, D7, D8, D9, D11	LED	10	
D10	1N5819	1	
D13	10V	1	
D14	1N4148	1	
J1	Control / Program Select Switch	1	PBH4UEENAGX
J2	USB_C_Receptacle_PowerOnly_6P	1	USB4125-GF-A
J3	Conn_01x02	1	
J4	USB_A	1	
J5	Barrel Jack	1	
L1	50uH	1	744772470 (47uH)
Q2, Q3, Q5, Q6	2N3904	4	
Q4	BD139	1	
R1	1K1	1	
R2	13K	1	
R3	0.25	1	
R4	180	1	
R5	5K6	1	

R6, R7	5.1K	2	Optional on J2 being used
R8	220	1	
R10, R11	1.5K	2	
R12	4K7	1	
R21	470K	1	
R22	560K	1	
R23, R24, R25, R26, R28, R30	10K	6	
R29	820	1	Use a 1W Resistor
R32	6K	1	5K6 is acceptable
R33	47	1	
RN1	1.5K	1	
RV1	25K	1	
SW1, SW2, SW3, SW4, SW5, SW6	SW SPDT	6	GW12LCP
SW8	SW SPDT	1	2MS1T2B3M2QES
SW11, SW12, SW13, SW14, SW15, SW16, SW17, SW18	SW Push SPDT	8	800USP8P1A1M2RE
TP1	10KHz	1	Insert test pin if required
TP2	+16V	1	Insert test pin if required
TP3	+5V	1	Insert test pin if required
TP4	PULSE	1	Insert test pin if required
TP5	PRG_PWR 10V	1	Insert test pin if required
TP6	PROM_ENABLE	1	Insert test pin if required
TP8	X1	1	Insert test pin if required
TP9	X2	1	Insert test pin if required
TP10	X3	1	Insert test pin if required
TP11	X4	1	Insert test pin if required
U1	74S188	1	Use socket / ZIF socket
U2	MC34063AP	1	
U6	4043	1	
U7	4017	1	
U8	HEF4093B	1	
U9	TL431LP	1	Precision Programmable Reference

3 Construction

Read everything here before starting

3.1 Before you start construction

Inspect the PCB for any visible signs of damage

Select your components:

- Turned pin sockets are recommended due to robustness and reliability
- The 820-ohm resistor (R29) is rated at 1W

The IC's are static sensitive. Handling precautions need to be observed.

3.2 Order of construction

The recommended order of construction is:

- Resistors
- Sockets
- Disc capacitors
- Electrolytic capacitors
- Switches
- LED
- Insert IC's
- Other items, text pins etc.

Also, to consider is constructing the board by functional area to aid in diagnostics. Each area can be implemented then tested

- Power delivery / connectors
- 16V power supply
- Timing logic
- Remaining parts

3.3 Things to Note Before Starting

Be very careful when inserting switches to get their polarity correct

1. The capacitor at C5 is optional. Its purpose is to smooth out poor ***wall wart*** PSU's
2. The on/off switch is optional and may be bypassed with a wire link between the OUT and IN positions
3. The 820-ohm resistor (R29) and the BD139 transistor (Q4) can get quite warm in operation
4. The 820-ohm resistor (R29) should be rated at 1W
5. The inductor (L1) is rated at 50uH. The easier to source inductor rated at 47uH is an acceptable substitute
6. Numerous test points have been included to allow for ease of diagnostics

7. The through-plated-holes for the PROM socket are wide enough to accept a ZIF socket but I recommend not soldering one in as they are easy to damage and expensive. Use a normal socket and a sacrificial spacer socket before the ZIF socket
8. The 0.25-ohm resistor is not very common. Consider using 0.5 or 1.0-ohm resistors in parallel
9. R6 and R7 are only required if the USB-C connector is used

4 Functionality

The high-level design is based on an article for a PROM programmer from 1980

Link

The design has been reworked with:

- Only requires a 5V supply
- New design for 16V generation
- Full LED display for address and data
- Improved switch selection

The original design also had a bug where it would sequence the steps but not stop at the required step. I presume the original designed did not have access sufficient test equipment to see the issue?

4.1 Current Source

A current source is implemented using a TL431 Programmable Precision Reference. This is used to generate a 2.5 reference. The current is then set by R8 and R33. For 65mA, we would need:

Resistor = 2.5 / Io

R = 2.5/0.065 = 38 ohm

Since 38 ohm resistors and not exactly common, this can be done with two resistors in parallel, 47 ohms and 220 ohms.

R = 1/(1/47 + 1/220) = 38.2 ohm

If a different current level is required, change the values of these two resistors.

4.2 Timing

The core to the design is the decade counter (4017) which generates a sequence of outputs spaced at 100uS. These are then used to sequence various activities, such as enabling/disabled the CS. The state of these activities is held by the four latches in the 4043.

The latches control:

Latch 0: Program sequence start – See TP X1

Latch 1: 5V / 10V power for Vcc – See TP X2

Latch 3: 16V Programming pulse – See TP X3

Latch 2: CE – See TP X4

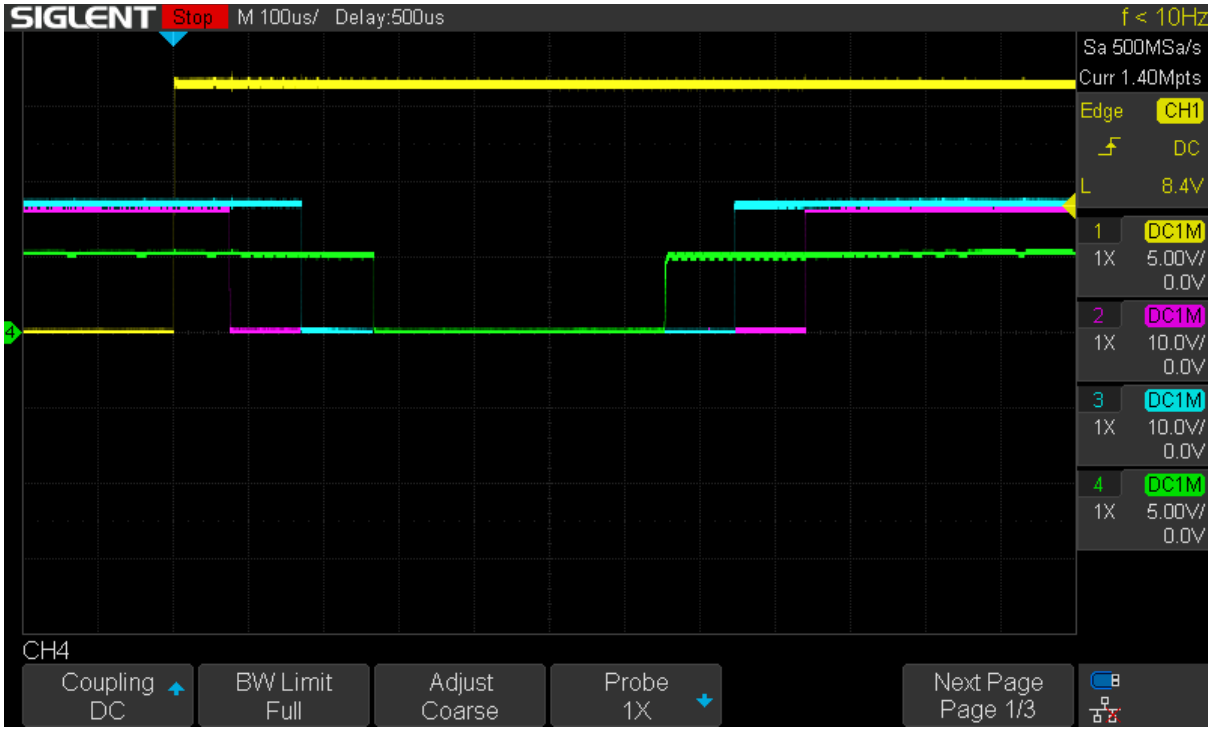
4.3 Timing Visualization

Yellow – Start

Pink – Vcc

Cyan – Programming Pulse

Green – Chip Enable



5 Usage of the Programmer

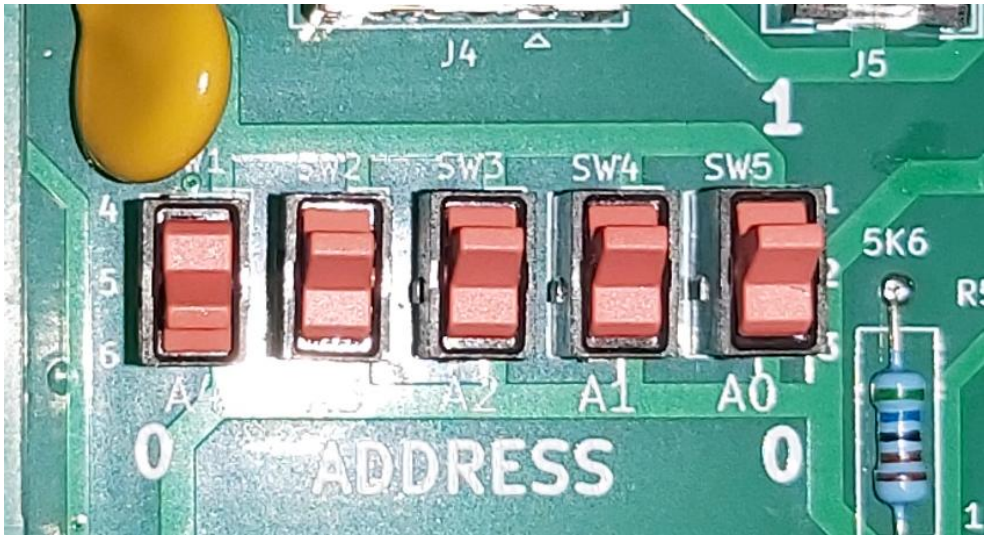
The programmer can be used in two modes. Read (Control) and Program.

The modes are controlled by the 4PDT push switch in location J1

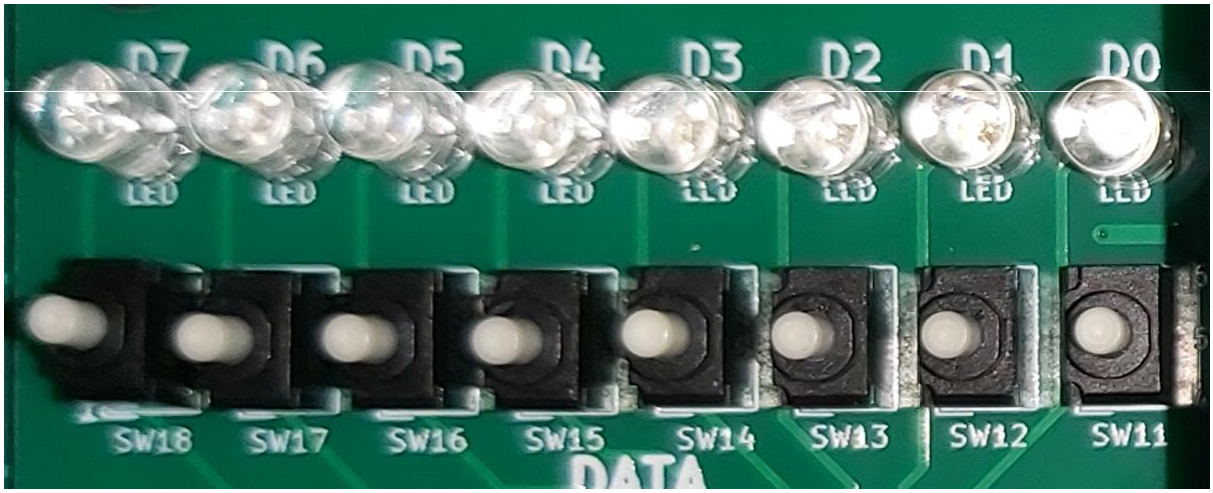
5.1 Read Mode

The switch at J1 is in the out position.

This mode allows any address to be examined in the PROM. The address is select using the five address switches labelled A0 through A4. Down is zero, Up is one.



The values at the address selected is displayed on the LED's D0 through D1



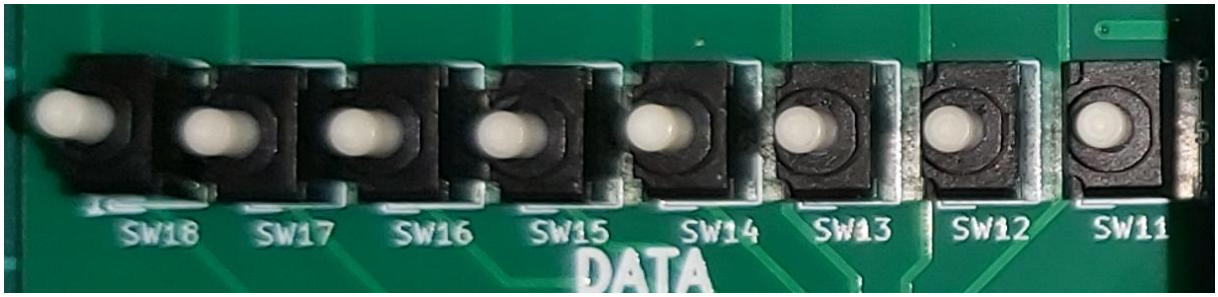
5.2 Program Mode

The sequence to program a bit is as follows:

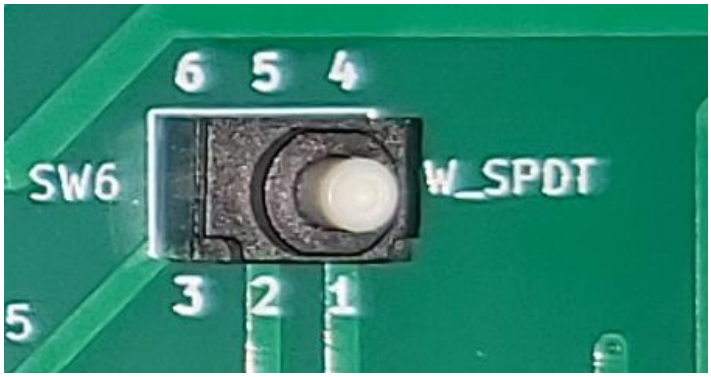
Use Read Mode to select the required address and identify which bit you want to program

Push the switch at J1 in to select Program Mode

Hold down the Data switch under the bit (LED) you want to program



Press the Program switch to program the required bit



Switch J1 back to Read Mode to verify that the required bit has been programmed

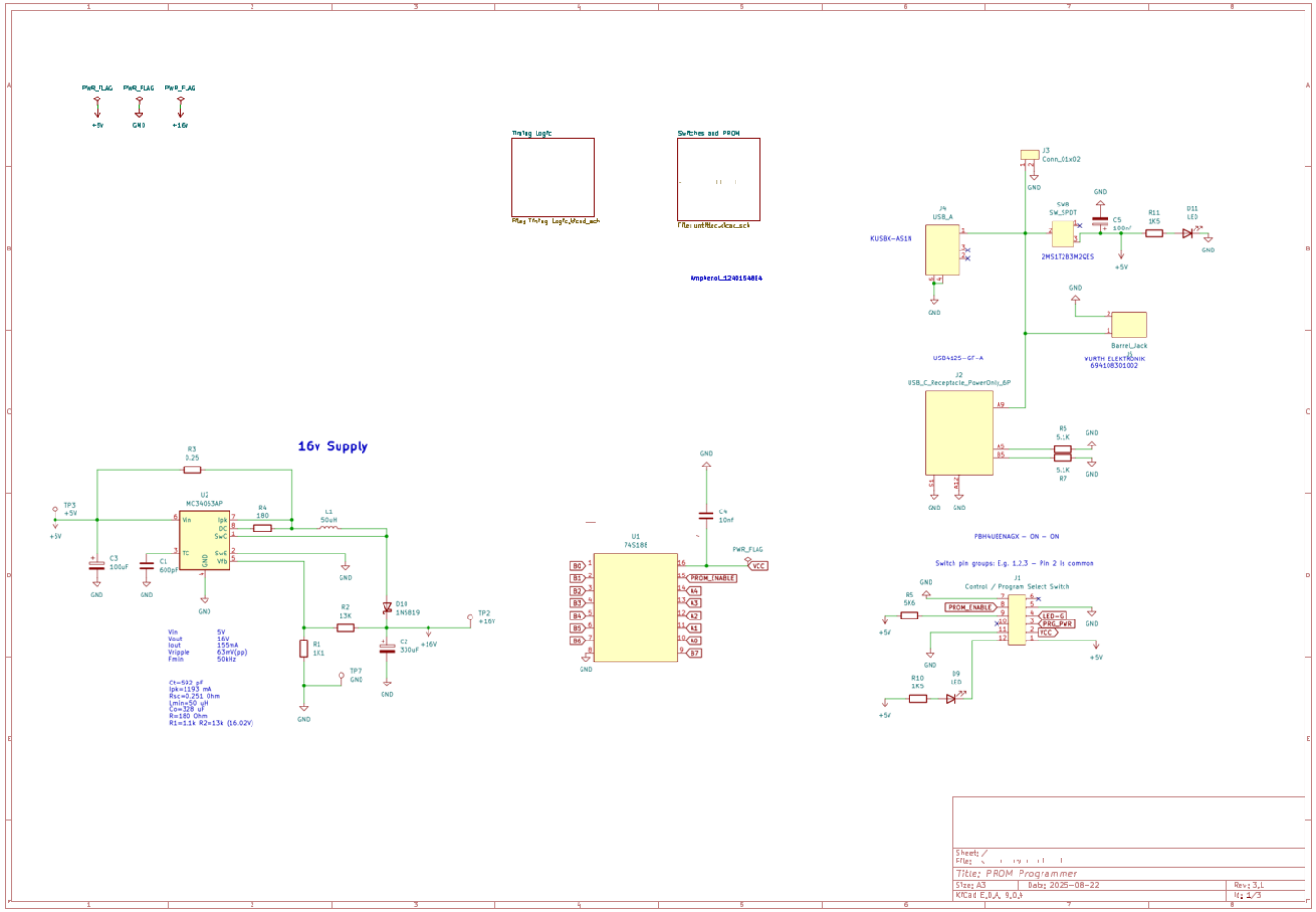
5.3 Warning

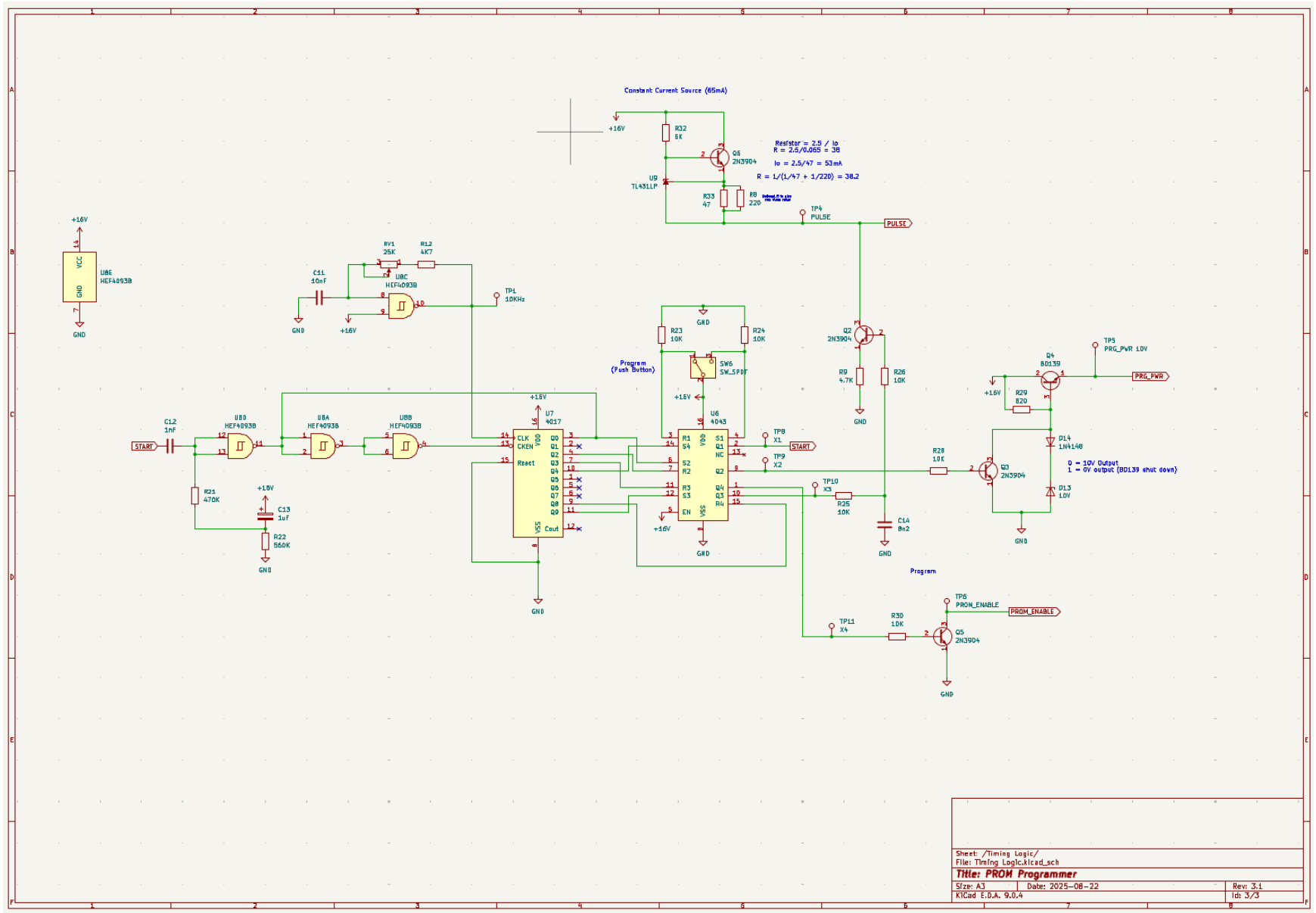
Note that one a fuse has been programmed, it is an irreversible process. Make sure that the bit to be programmed is the one you want to program!

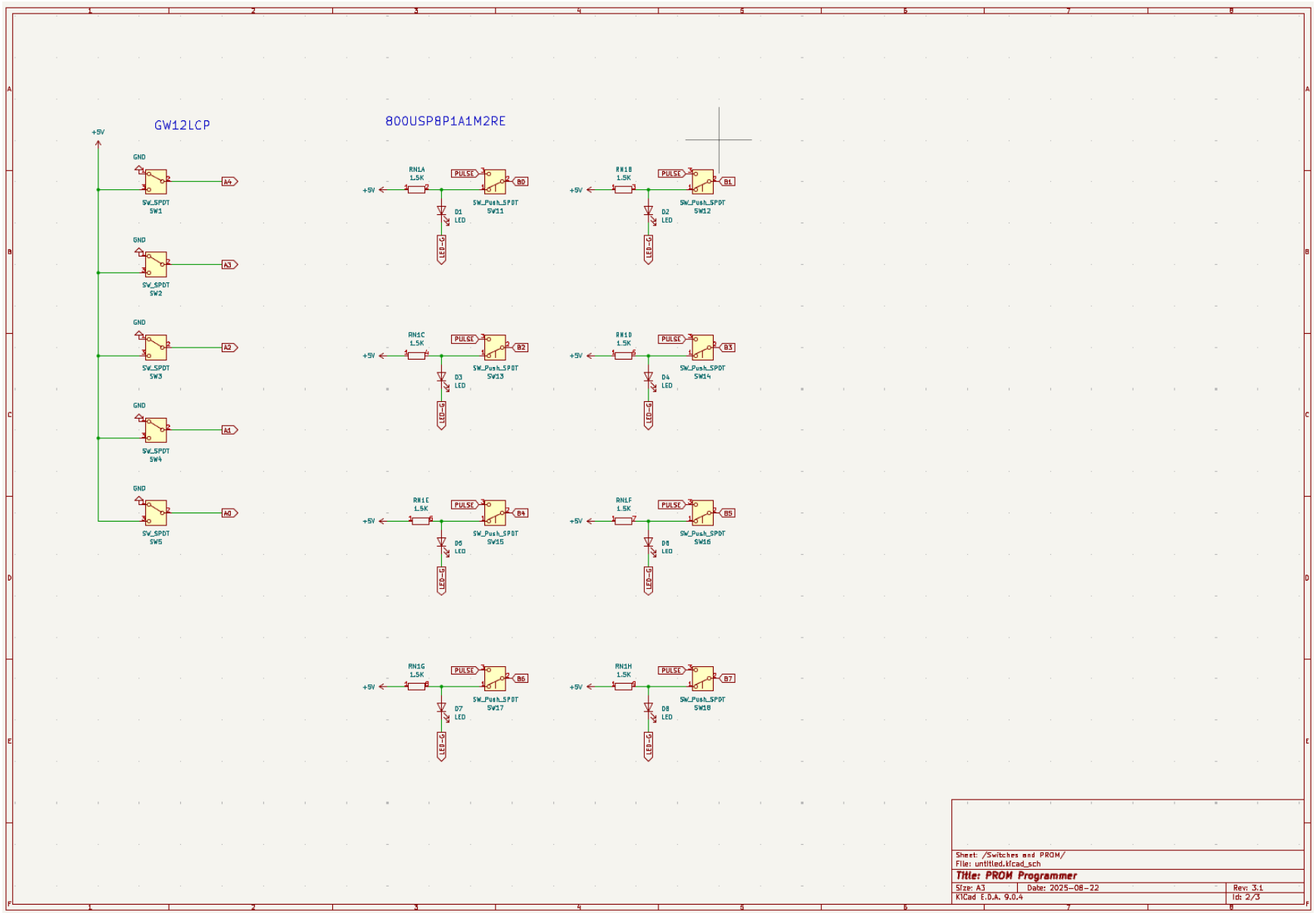
6 Notes on Components

All the components used have been selected at time of design to be readily available via commercial component suppliers.

7 Circuit Diagrams




Constant Current Source (65mA)
Resistor = 2.5 / Io
R = 2.5/0.065 = 38
Io = 2.5/47 = 53mA
R = 1/(1/47 + 1/220) = 38.2
Program
(Push Button)
Program
Sheet: /Timing Logic/
File: Timing Logic.kicad_sch
Title: PROM Programmer
Size: A3
Date: 2025-08-22
Rev: 3.1
KiCad E.D.A. 9.0.4
Id: 3/3


GW12LCP
800USP8P1A1M2RE
+5V
GND
SW_SPDT
SW1
SW2
SW3
SW4
SW5
A4
A3
A2
A1
A0
RN1A
RN1B
RN1C
RN1D
RN1E
RN1F
RN1G
RN1H
1.5K
PULSE
SW_Push_SPDT
SW11
SW12
SW13
SW14
SW15
SW16
SW17
SW18
B0
B1
B2
B3
B4
B5
B6
B7
D1
D2
D3
D4
D5
D6
D7
D8
LED
LED-G
Sheet: /Switches and PROM/
File: untitled.kicad_sch
Title: PROM Programmer
Size: A3
Date: 2025-08-22
Rev: 3.1
KiCad E.D.A. 9.0.4
Id: 2/3

8 Errata – Changed and Fixed Items

8.1 Version 3.1

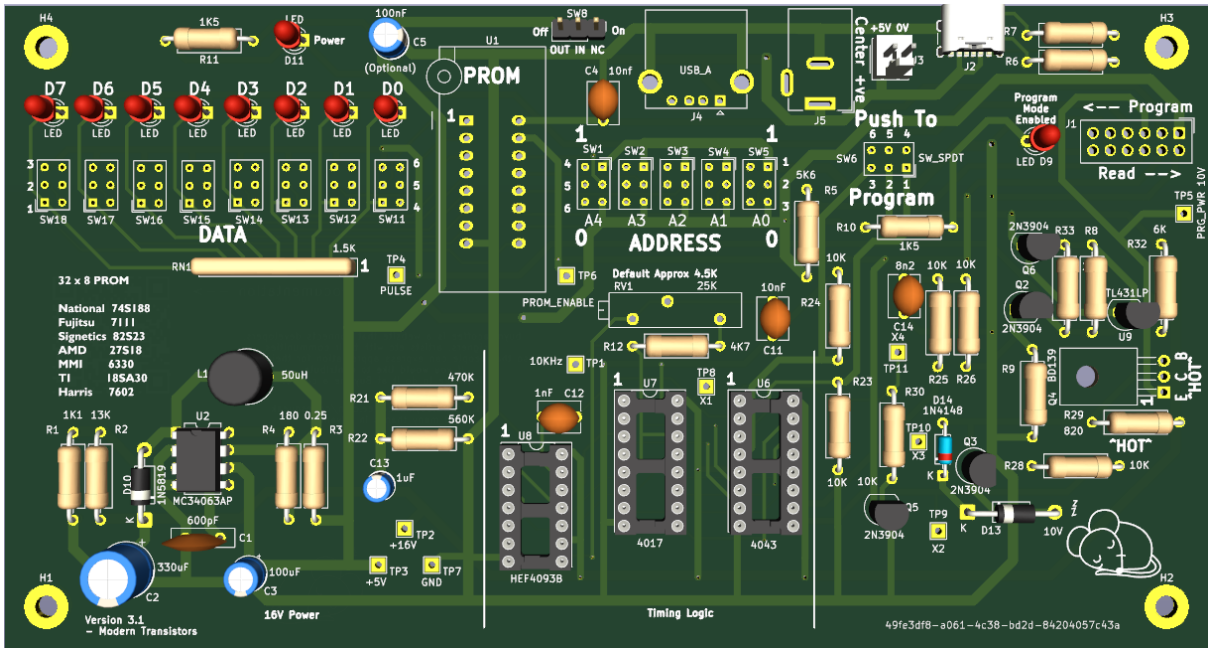
Change transistors to something more modern

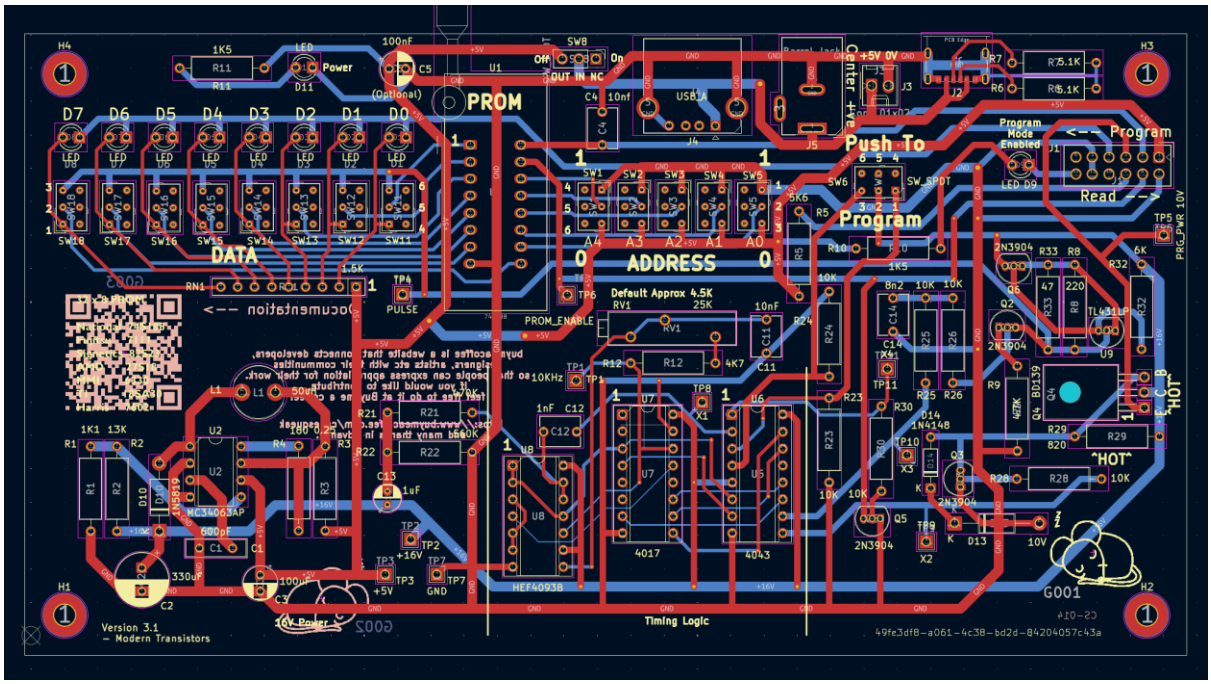
Add warnings LED’s for power and programming mode

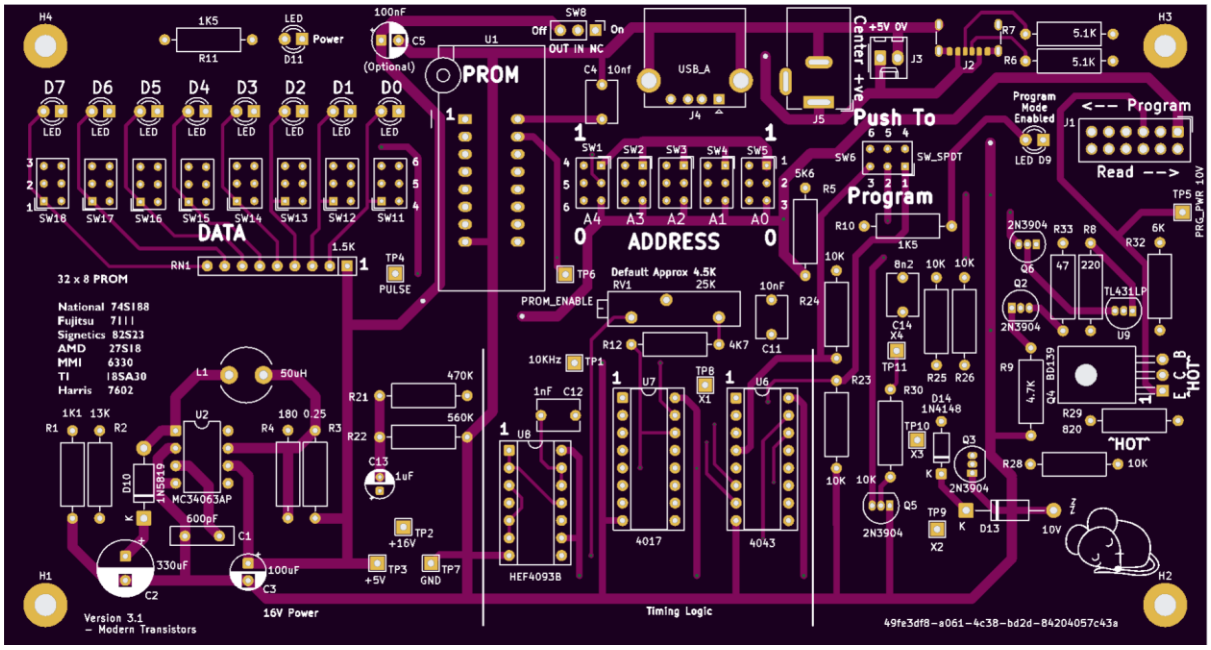
Minor silkscreen changes

9 Reference Images

9.1 PCB






D7 D6 D5 D4 D3 D2 D1 D0
DATA
ADDRESS
PROM
Push To
Program
Read -->
<-- Program
32 x 8 PROM
National 74S188
Fujitsu 7111
Signetics 82S23
AMD 27S18
MMI 6330
TI 18SA30
Harris 7602
MC34063AP
HEF4093B
4017
4043
16V Power
Timing Logic
Version 3.1
– Modern Transistors
49fe3df8-a061-4c38-bd2d-84204057c43a

9.2 Built