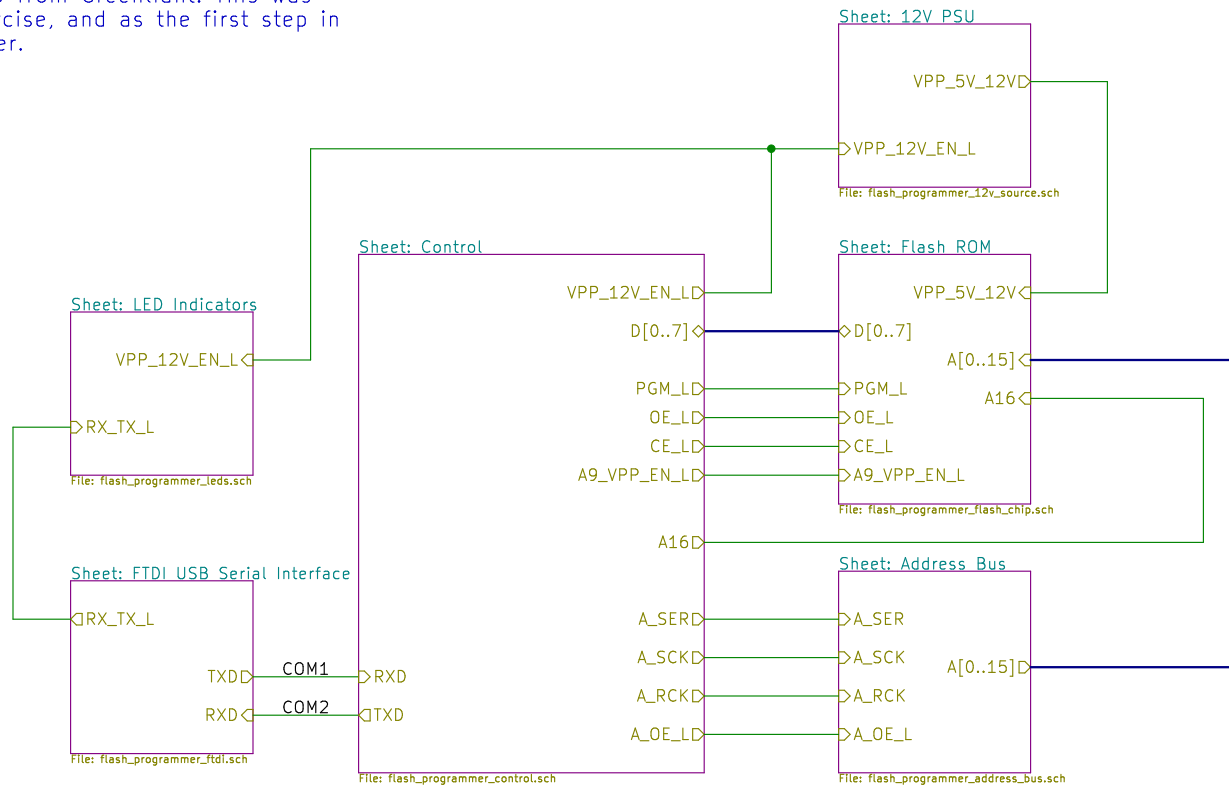# 128K 17-bit Addressed 32-pin Flash ROM Programmer

USB device that reads, erases, and writes flash ROMs such as the GLS27SF010 from Greenliant. This was made as a learning exercise, and as the first step in building a 6502 computer.

Sheet: 12V PSU

VPP_5V_12V

VPP_12V_EN_L

File: flash_programmer_12v_source.sch

Sheet: Control

VPP_12V_EN_L

D[0..7]

PGM_L

OE_L

CE_L

A9_VPP_EN_L

A16

A_SER

A_SCK

A_RCK

A_OE_L

File: flash_programmer_control.sch

Sheet: LED Indicators

VPP_12V_EN_L

RX_TX_L

File: flash_programmer_leds.sch

Sheet: FTDI USB Serial Interface

RX_TX_L

TXD   COM1   RXD

RXD   COM2   TXD

File: flash_programmer_ftdi.sch

Sheet: Flash ROM

VPP_5V_12V

D[0..7]

A[0..15]

A16

PGM_L

OE_L

CE_L

A9_VPP_EN_L

File: flash_programmer_flash_chip.sch

Sheet: Address Bus

A_SER

A_SCK

A_RCK

A[0..15]

A_OE_L

File: flash_programmer_address_bus.sch

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Sheet: /
File: flash_programmer.sch

Title: GLS27SF010 Flash Programmer

Size: USLetter	Date: 2017-03-11	Rev: 5
KiCad E.D.A. kicad 4.0.5		Id: 1/7

FTDI USB Serial Interface

Ferrite bead and capacitor should be as close as possible to the USB port to prevent any noise from going back to the USB host.

Note: The 10nF capacitor must come before the ferrite bead.

100nF capacitor should be as close to the VCCIO pin as possible to act as a bypass capacitor for it.

Handles 300 baud to 3 Mbaud.

GND

C202
10nF

L201
Ferrite_Bead

VCC

C206
100nF

VCCIO

VCC

U201

Pin	Signal
12	VCC
3	VCCIO
10	3V3OUT
9	USBDM
8	USBDP
11	RESET#
5	GND
13	GND

FT230X

Signal	Pin
TXD	1
RXD	4
RTS#	2
CTS#	6
CBUS0	15
CBUS1	14
CBUS2	7
CBUS3	16

TXD
RXD

RX_TX_L

USB_B shield

VBUS
D-
D+
GND

P201

1 VBUS
2 D-
3 D+
4 GND
5

GND

VBUS
D-
D+

R201
27 USBDM
R202
27 USBDP

C204
47pF

C205
47pF

GND

VCC

C201
100nF

C203
4.7uF

GND

Bypass capacitors for FT230X (not including bypass on 3V3OUT)

GND

Signal Descriptions

TXD
   UART Transmit for FTDI to USB Serial

RXD
   UART Receive for FTDI to USB Serial

RX_TX_L
   Indication of USB Serial transmit or receive

Sheet: /FTDI USB Serial Interface/
File: flash_programmer_ftdi.sch

Title: GLS27SF010 Flash Programmer

Size: USLetter	Date: 2017-03-11	Rev: 5
KiCad E.D.A. kicad 4.0.5		Id: 2/7

Flash ROM

Signal Descriptions

D[0..7]
Data bus

A[0..15]
First 16-bits of the address bus.

A16
The 17th bit of the address bus. This had to be separate from A[0..15] due to KiCad limitations since it's coming from Control instead of from the Address Bus.
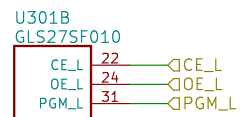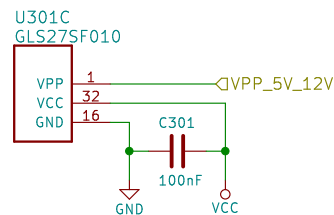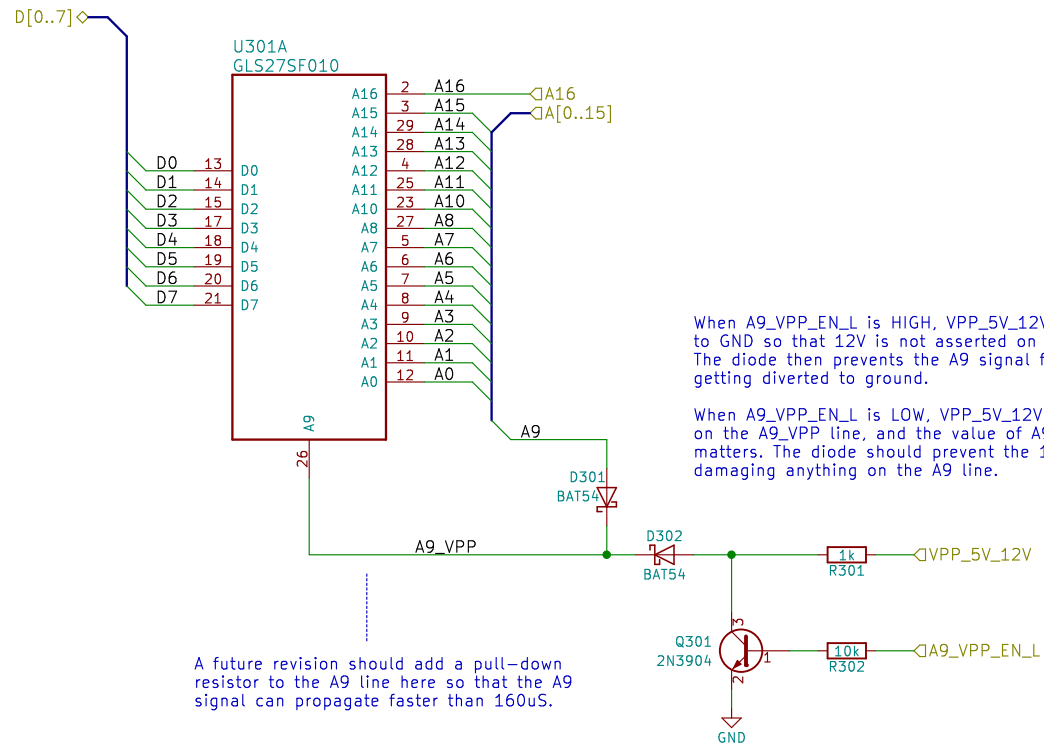
VPP_12V
Input from 12V power supply.

A9_VPP_EN_L
Enable for asserting 12V on the A9 line.

CE_L
Enable for the Flash ROM. Pulled LOW for all read, erase, and write operations.

OE_L
Enable for outputting data to the data bus from the Flash ROM.

PGM_L
Enable for erasing/writing the Flash ROM.

D[0..7]

U301A
GLS27SF010

A16	2	A16
A15	3	A15
A14	29	A14
A13	28	A13
A12	4	A12
A11	25	A11
A10	23	A10
A8	27	A8
A7	5	A7
A6	6	A6
A5	7	A5
A4	8	A4
A3	9	A3
A2	10	A2
A1	11	A1
A0	12	A0

D0	13	D0
D1	14	D1
D2	15	D2
D3	17	D3
D4	18	D4
D5	19	D5
D6	20	D6
D7	21	D7

A16
A[0..15]

A9
26

A9_VPP

D301
BAT54

D302
BAT54

A9

1k
R301

VPP_5V_12V

Q301
2N3904

10k
R302

A9_VPP_EN_L

GND

When A9_VPP_EN_L is HIGH, VPP_5V_12V is diverted to GND so that 12V is not asserted on the A9_VPP line. The diode then prevents the A9 signal from also getting diverted to ground.

When A9_VPP_EN_L is LOW, VPP_5V_12V gets asserted on the A9_VPP line, and the value of A9 no longer matters. The diode should prevent the 12V from damaging anything on the A9 line.

A future revision should add a pull-down resistor to the A9 line here so that the A9 signal can propagate faster than 160uS.

U301C
GLS27SF010

VPP	1	VPP_5V_12V
VCC	32	
GND	16	

C301
100nF

GND   VCC

U301B
GLS27SF010

CE_L	22	CE_L
OE_L	24	OE_L
PGM_L	31	PGM_L

Sheet: /Flash ROM/
File: flash_programmer_flash_chip.sch

Title: GLS27SF010 Flash Programmer

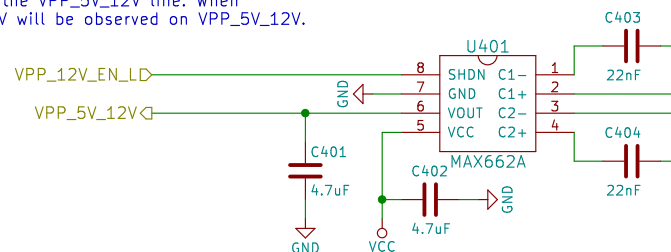| Size: USLetter	Date: 2017-03-11	Rev: 5
KiCad E.D.A. kicad 4.0.5		Id: 3/7

12V Step Up Voltage Supply

Signal Descriptions

VPP_12V_EN_L
  Enables voltage boost to 12V when LOW.

VPP_5V_12V
  Output from step up converter. Should be 12V when VPP_12V_EN_L is LOW, and 5V when it is HIGH.

When VPP_12V_EN_L is pulled HIGH, the MAX662A will supply 12V (50mA absolute max.) on the VPP_5V_12V line. When VPP_12V_EN_L is HIGH, then 5V will be observed on VPP_5V_12V.

VPP_12V_EN_L

VPP_5V_12V

U401

8	SHDN	C1-	1
7	GND	C1+	2
6	VOUT	C2-	3
5	VCC	C2+	4

MAX662A

GND

C403
22nF

C404
22nF

C401
4.7uF

C402
4.7uF

GND

VCC

GND

The charge-pump capacitors must be ceramic or tantalum in the 0.22uF to 1.0uF range.

The input and output capacitors can be tantalums, ceramics, or aluminum electrolytics. Ceramics have been chosen here for their small profile. The capacitance value will change if other capacitor types are selected. See the datasheet's Capacitor Selection section for more information.

Sheet: /12V PSU/
File: flash_programmer_12v_source.sch

Title: GLS27SF010 Flash Programmer

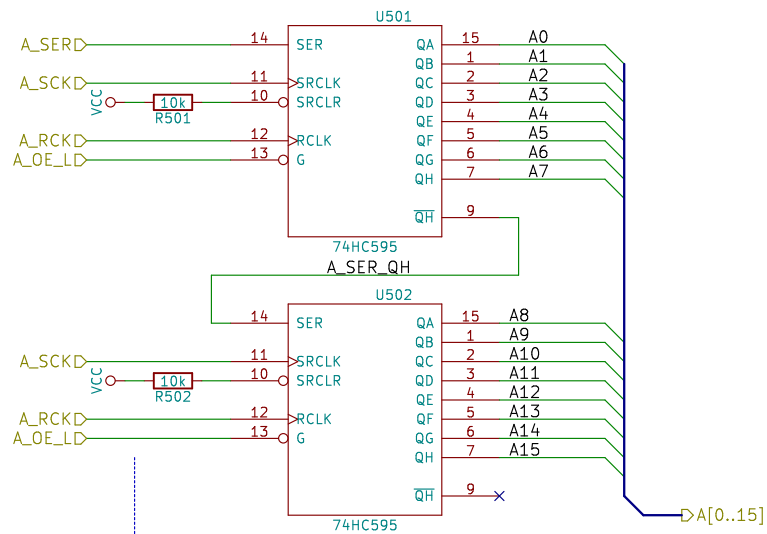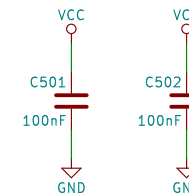| Size: USLetter | Date: 2017-03-11 | Rev: 5 |
| KiCad E.D.A. kicad 4.0.5 | | Id: 4/7 |

Address Bus

Signal Descriptions

A_SER
Serial input for the shift registers.

A_SCK
Shift register clock input. Shifts input from A_SER on its rising edge.

A_RCK
Storage register clock input. Moves register contents to output latches on rising edge.

A_OE_L
Output enable for shift registers. When HIGH, the address pins will go into tri−state.

A[0..15]
Address bus output.

U501

Pin	Signal		Pin	Out	Addr
14	SER		15	QA	A0
11	SRCLK		1	QB	A1
10	SRCLR		2	QC	A2
			3	QD	A3
			4	QE	A4
12	RCLK		5	QF	A5
13	G		6	QG	A6
			7	QH	A7
			9	QH	

A_SER — R501 10k — VCC

74HC595

A_SER_QH

U502

Pin	Signal		Pin	Out	Addr
14	SER		15	QA	A8
11	SRCLK		1	QB	A9
10	SRCLR		2	QC	A10
			3	QD	A11
			4	QE	A12
12	RCLK		5	QF	A13
13	G		6	QG	A14
			7	QH	A15
			9	QH	

A_SCK — R502 10k — VCC

A_RCK
A_OE_L

74HC595

A[0..15]

A future revision can remove the A_OE_L signal and instead just pull these pins low since the signal had to always be kept low in software anyway.

VCC — C501 100nF — GND

VCC — C502 100nF — GND

Bypass capacitors for 74HC595 (one per IC)

Sheet: /Address Bus/
File: flash_programmer_address_bus.sch

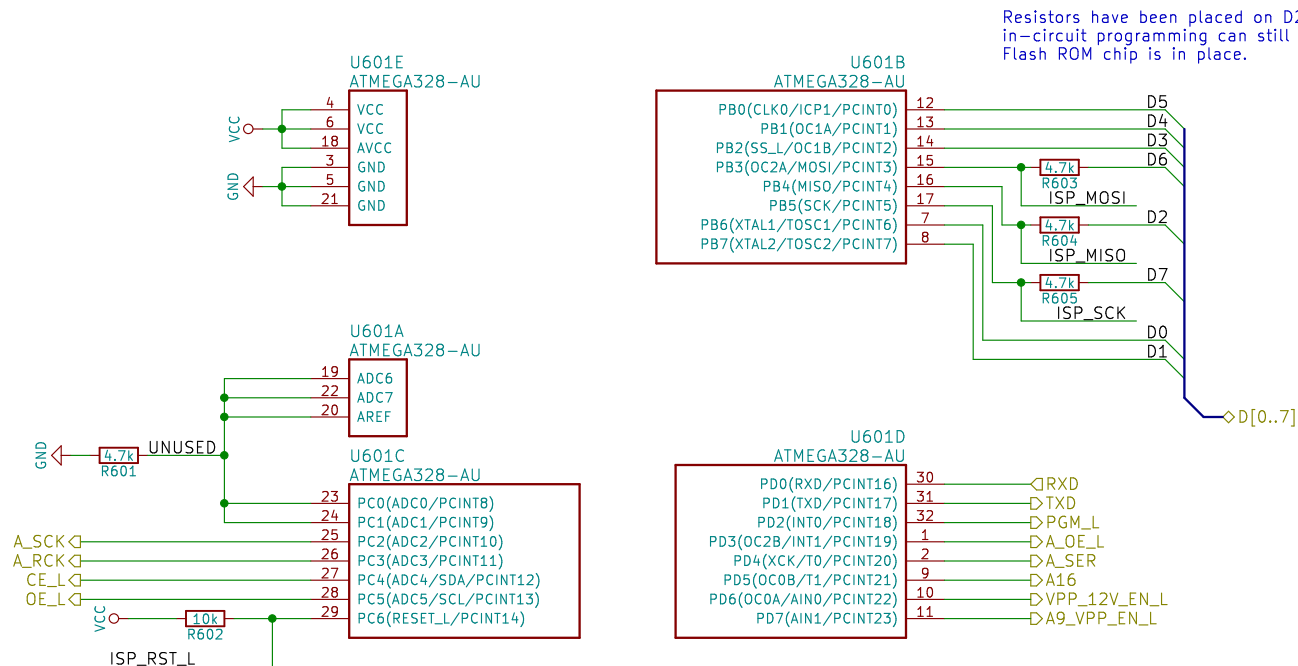**Title: GLS27SF010 Flash Programmer**

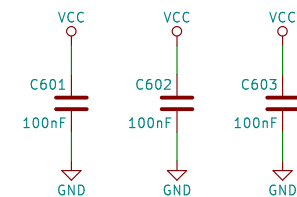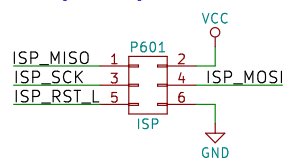| Size: USLetter	Date: 2017−03−11	Rev: 5
KiCad E.D.A. kicad 4.0.5		Id: 5/7

Control

Signal descriptions are on the other sheets.

Resistors have been placed on D2, D6, and D7 so that
in-circuit programming can still occur while the
Flash ROM chip is in place.

U601E
ATMEGA328-AU

4	VCC	
6	VCC	
18	AVCC	
3	GND	
5	GND	
21	GND	

VCC
GND

U601B
ATMEGA328-AU

PB0(CLK0/ICP1/PCINT0)	12	D5
PB1(OC1A/PCINT1)	13	D4
PB2(SS_L/OC1B/PCINT2)	14	D3
PB3(OC2A/MOSI/PCINT3)	15	D6
PB4(MISO/PCINT4)	16	
PB5(SCK/PCINT5)	17	
PB6(XTAL1/TOSC1/PCINT6)	7	D2
PB7(XTAL2/TOSC2/PCINT7)	8	

4.7k
R603
ISP_MOSI

4.7k
R604
ISP_MISO

4.7k
R605
ISP_SCK

D7
D0
D1

D[0..7]

U601A
ATMEGA328-AU

19	ADC6	
22	ADC7	
20	AREF	

GND
4.7k
R601
UNUSED

U601C
ATMEGA328-AU

23	PC0(ADC0/PCINT8)	
24	PC1(ADC1/PCINT9)	
25	PC2(ADC2/PCINT10)	
26	PC3(ADC3/PCINT11)	
27	PC4(ADC4/SDA/PCINT12)	
28	PC5(ADC5/SCL/PCINT13)	
29	PC6(RESET_L/PCINT14)	

A_SCK
A_RCK
CE_L
OE_L

VCC
10k
R602
ISP_RST_L

U601D
ATMEGA328-AU

PD0(RXD/PCINT16)	30	RXD
PD1(TXD/PCINT17)	31	TXD
PD2(INT0/PCINT18)	32	PGM_L
PD3(OC2B/INT1/PCINT19)	1	A_OE_L
PD4(XCK/T0/PCINT20)	2	A_SER
PD5(OC0B/T1/PCINT21)	9	A16
PD6(OC0A/AIN0/PCINT22)	10	VPP_12V_EN_L
PD7(AIN1/PCINT23)	11	A9_VPP_EN_L

ISP Programming Interface

P601

ISP_MISO	1	2	VCC
ISP_SCK	3	4	ISP_MOSI
ISP_RST_L	5	6	

ISP
GND

VCC
C601
100nF
GND

VCC
C602
100nF
GND

VCC
C603
100nF
GND

Bypass capacitors for ATMEGA328-AU

Sheet: /Control/
File: flash_programmer_control.sch

Title: GLS27SF010 Flash Programmer

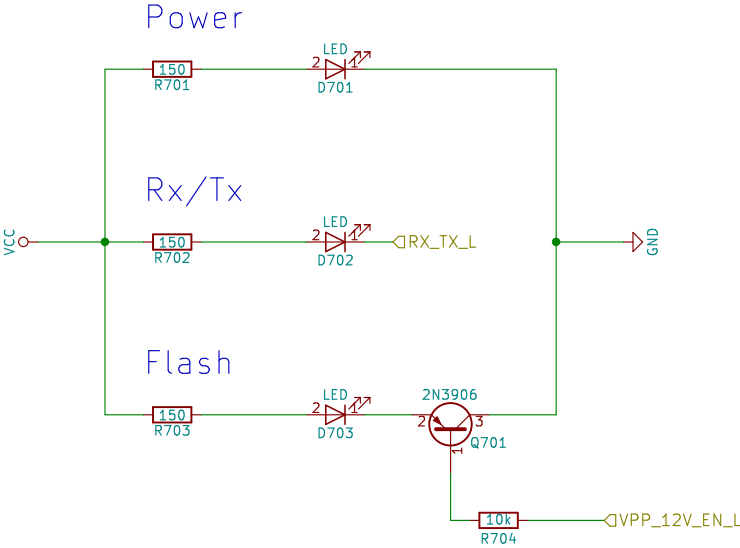| Size: USLetter	Date: 2017-03-11	Rev: 5
KiCad E.D.A. kicad 4.0.5		Id: 6/7

LED Indicators

Power

R701 150
D701 LED

Rx/Tx

VCC

R702 150
D702 LED
RX_TX_L

GND

Flash

R703 150
D703 LED
Q701 2N3906

R704 10k
VPP_12V_EN_L

Signal Descriptions

RX_TX_L
   Enable for the Rx/Tx indicator. When LOW, the
   Rx/Tx LED should turn on. Latching is expected
   to already be done at the signal source.

VPP_12V_EN_L
   Enable for the Flash indicator. When LOW, the
   Flash LED should turn on.

Sheet: /LED Indicators/
File: flash_programmer_leds.sch

Title: GLS27SF010 Flash Programmer

Size: USLetter | Date: 2017-03-11 | Rev: 5

KiCad E.D.A. kicad 4.0.5 | Id: 7/7