

AMSynths

AM8125 Roland 100M VCO

Project Notes V1.0

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1 Module Description

This module is a clone of the Voltage Controlled Oscillator from the legendary Roland 100M analog modular synthesizer. It is a precision VCO with minor upgrades to further improve stability.

INPUTS: FM1, FM2
SYNC IN, PWM

OUTPUTS: AUDIO SIGNAL
SYNC OUT

POTS: RANGE, PITCH
FM1, FM2
PWM

SWITCHES: SYNC, WAVE

ERRORS IN MAIN PCB - VERSION marked 21 09 13

1. The Zener Diode IC5 must be replaced with a resistor, 7K5 for 12V power and 10K for 15V power. This will provide the correct 10V peak to peak waveforms.
2. IC6 is incorrectly wired, pin 5 and 6 need reversing. This can be achieved by breaking the track between Pin 5 and R40 by drilling a hole through the PCB trace, then connecting Pin 5 and 6 on the rear of the PCB with a wire, and finally connect Pin 6 to R40.
3. A 100nF ceramic capacitor needs to be connected between Pin 2 and 6 of IC1. This is best achieved on the underside of the PCB.

IMPORTANT NOTE:

The value of some resistors varies depending on whether you use 15V or 12V power, these differences are clearly listed in the BOM.

2 The Original Circuit

The AM8125 is a traditional sawtooth core VCO similar to many designs of the 1970's using dual NPN transistors and a capacitor based integrator. The waveform converters are similar to those in early Roland designs, from the Modular 700 onwards. The AM8125 provides the rich sound of true analog oscillator but with the precision of the 21st century.

This 16HP wide module has an ultra stable VCO core with precision power regulation and the latest HF trimming design. The dual transistor exponential generator uses a modern SSM2210 with a 1K Tempco resistor for temperature compensation. There is a 5 octave range switch (32 to 2 feet) and a Pitch tuning potentiometer for +/- 7 semitones.

The VCO produces the usual waveforms; Sawtooth, Square with pulse width modulation and Triangle. There is a sync facility with Off, Strong and Weak settings on a 3-way toggle switch. Pulse Width is variable from 10 to 50%, and there is external pulse width modulation as well as 2x Frequency modulation inputs.

This VCO module is setup for accurate 1V/octave tracking, using the high precision voltage rails. Please use an accurate 1V/octave MIDI to CV converter with the keyboard pitch voltage connected to the standard Pin 13 and 14 of the 16-pin Doepfer bus.

3 Front Panel Format

The AM8125 is designed to be used with a standard 3U high EuroRack or 3" wide FracRac panel, although other shapes and sizes can be used, for example MOTM.

4 PCB, Pots and Power

The two PCB's are high quality, double sided with solder mask, component names are shown in the silk screen but not the component values.

The Pot PCB is held to the front panel in parallel by the use of the jack sockets. The PCB is designed to take vertical Alpha PCB mounted pots with a clear shaft. Other makes of the same pin spacing and size will work.



The module should be powered from a well regulated +/-12V or +/-15V power supply, current consumption is around 25mA. The power connector is the standard 10-pin Doepfer DIL socket or a two ground MOTM/Oakley 4-pin Molex connector can be fitted. One ground is for the circuit, the other is for the panel (PAD).

5 Building the Module

This module is simple to build. The recommended build order is:

- Resistors
- Inductors
- IC Sockets
- Capacitors
- Trimmers
- Connectors
- Transistors
- Pot Brackets and Potentiometers

Check all the electrolytic capacitors and transistors are fitted the right way round. Before fitting the IC's its worth connecting up the module to a power supply and checking that the power rail voltages are as expected at each IC socket, then power down, and fit the IC's ensuring correct orientation. This is highly recommended!

Power up and try out the filter. Then proceed to trimming. Job done!

7 Trimming

This module has five trimmers which need to be adjusted for accurate operation of the filter.

FTRIM This trimmer adjusts the initial frequency of the VCO. Trim to 16Hz when the lowest range is selected.

V/OCT This trimmer adjust the octave accuracy of the VCO. Adjust this in conjunction with FTRIM to give exactly one octave between each of the range values. No keyboard is needed.

HFT This trimmer adjusts the frequency of the VCO at higher frequencies, 1K plus. Trim in conjunction with FTRIM and V/OCT to achieve 1V octaves at high frequencies.

TRI This trimmer adjusts the shape of the Triangle wave. Observe on an oscilloscope or listen for a smooth sound.

50% This trimmer adjusts shape of the Pulse wave. Set the PW control to midway and adjust trimmer for 50% duty cycle on an oscilloscope or listen.

8 Parts Listing - VCO PCB

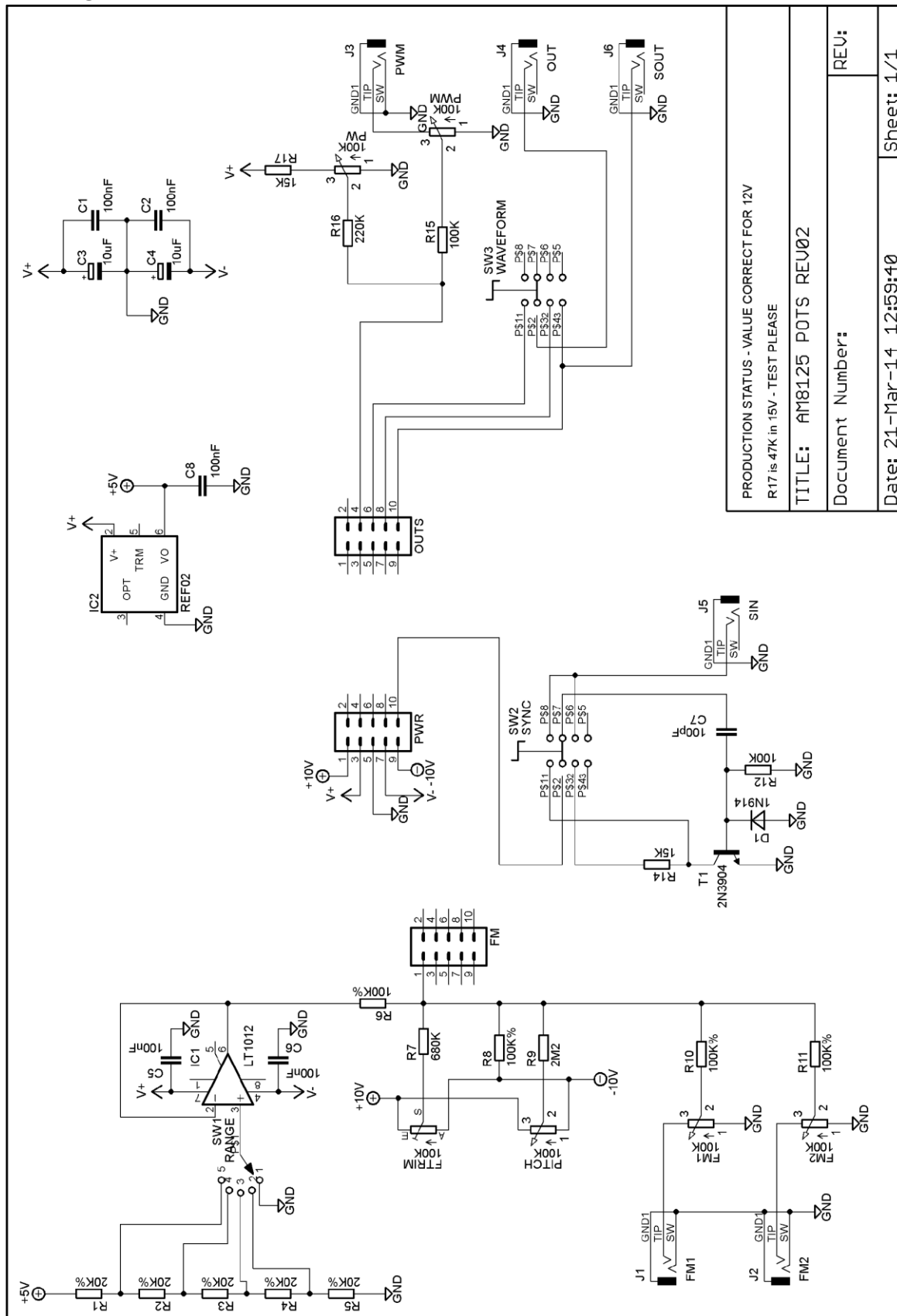
| Part Number | Value | Description |
|--|--------------------------|--|
| C1, C2, C3, C4, C9,C10, C12, C13, C15, C16 | 100nF | Ceramic 2.5mm spacing |
| C5 | 2n2F | Polyester 5mm spacing |
| C6 | 22pF | Ceramic 2.5mm spacing |
| C7 | 1nF | Polyester 5mm spacing |
| C8 | 2n2F | Polystyrene C-HFXS |
| C11, C14 | 22uF | Electrolytic 2.5mm spacing |
| D1, D3, D4 | 1N914 | Diode |
| D5, D6 | 1N4001 | Diode |
| DT1 | SSM2210 | Transistor Array |
| FM, OUTS PWR | 2x5 pin | 0.1" Header |
| 50% | 100K | Multi Turn Trimmer 3396 |
| HFT | 2K | Multi Turn Trimmer 3396 |
| IC1 | REF01 | Voltage Reference |
| IC2, IC6 | OP2277 | Dual Precision Op Amp |
| IC3 | TL072 | Dual Op Amp |
| IC4 | TL074 | Quad Op Amp |
| IC5 | NO FIT | Replace with 7K5 1% metal film resistor (12V) Replace with 10K 1% metal film resistor (15V) |
| L1, L2 | 0.1uH | Inductor |
| P1, P2 | 50V 170mA | Polyfuse |
| PTC1 | 1K | PT146 Tempco Resistor |
| PWR1 | 16-pin DIL | Doepfer Connector |
| R1 | 100K | 1/4W 0.1% Metal Film Resistor |
| R2 | 68K | 1/4W 1% Metal Film Resistor |
| R3 | 39K | 1/4W 1% Metal Film Resistor |
| R4 | 39K | 1/4W 1% Metal Film Resistor |
| R5 | 390K | 1/4W 1% Metal Film Resistor |
| R6 | 2K | 1/4W 1% Metal Film Resistor |
| R7 | 100K | 1/4W 1% Metal Film Resistor |
| R8 | 100K | 1/4W 1% Metal Film Resistor |
| R9 | 1K2 | 1/4W 1% Metal Film Resistor |
| R10 | 33K | 1/4W 1% Metal Film Resistor |
| R11 | 10K | 1/4W 1% Metal Film Resistor |
| R12 | 10K | 1/4W 1% Metal Film Resistor |
| R14 | 4K7 | 1/4W 1% Metal Film Resistor |
| R15 | 22K (15V) 10K (12V) | 1/4W 1% Metal Film Resistor |
| R16 | 47K | 1/4W 1% Metal Film Resistor |
| R17 | 15K | 1/4W 1% Metal Film Resistor |
| R18 | 10K | 1/4W 1% Metal Film Resistor |
| R19 | 22K | 1/4W 1% Metal Film Resistor |
| R20 | 15K | 1/4W 1% Metal Film Resistor |
| R21 | 56K | 1/4W 1% Metal Film Resistor |
| R22 | 82K | 1/4W 1% Metal Film Resistor |
| R23 | 150K (15V) 120K (12V) | 1/4W 1% Metal Film Resistor |
| R24 | 82K (15V) | 1/4W 1% Metal Film Resistor |

| | | |
|------------|--------------------------|-------------------------------|
| | 68K (12V) | |
| R25 | 470K | 1/4W 1% Metal Film Resistor |
| R26 | 1K | 1/4W 1% Metal Film Resistor |
| R27 | 100K | 1/4W 1% Metal Film Resistor |
| R28 | 39K (15V) 30K (12V) | 1/4W 1% Metal Film Resistor |
| R29 | 12K | 1/4W 1% Metal Film Resistor |
| R30 | 200K | 1/4W 1% Metal Film Resistor |
| R31 | 1K | 1/4W 1% Metal Film Resistor |
| R32 | 1M5 | 1/4W 1% Metal Film Resistor |
| R33 | 47K | 1/4W 1% Metal Film Resistor |
| R34 | 330K (15V) 180K (12V) | 1/4W 1% Metal Film Resistor |
| R35 | 22K | 1/4W 1% Metal Film Resistor |
| R36 | 100R | 1/4W 1% Metal Film Resistor |
| R37 | 100K | 1/4W 1% Metal Film Resistor |
| R38 | 4K7 | 1/4W 1% Metal Film Resistor |
| R39 | 10K | 1/4W 1% Metal Film Resistor |
| R40, R41 | 22K | 1/4W 0.1% Metal Film Resistor |
| T1 | J112 | FET transistor |
| T3, T5 | 2N3906 | Transistor |
| T4 | 2N3904 | Transistor |
| TRI, V/OCT | 10K | Multi Turn Trimmer 3396 |

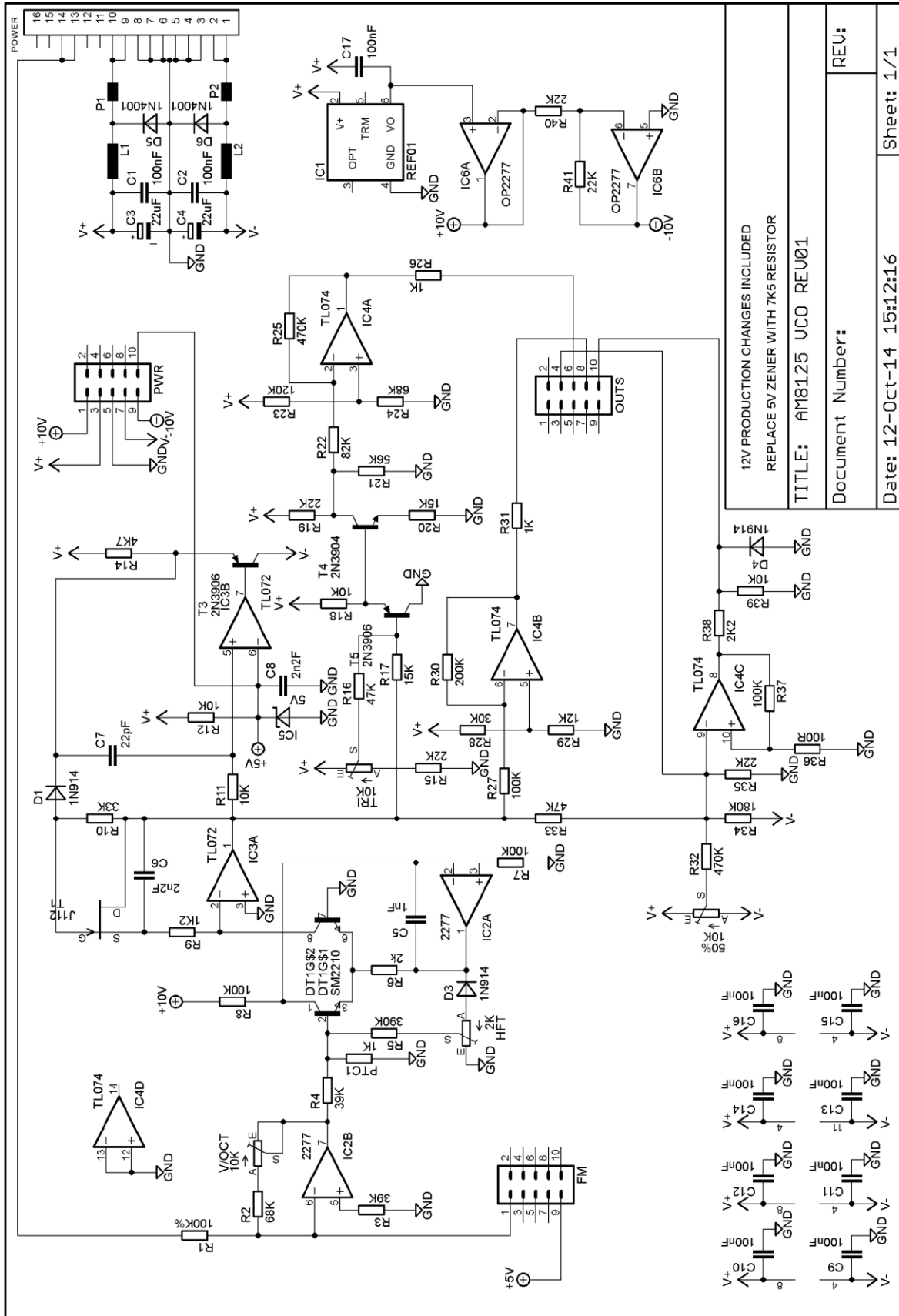
Parts Listing - POTS PCB

| Part Number | Value | Description |
|--------------------------|------------------------|---|
| C1, C2, C5, C6, C8 | 100nF | Ceramic 2.5mm spacing |
| C3, C4 | 10uF | Electrolytic 2.5mm spacing |
| C7 | 100pF | Ceramic 2.5mm spacing |
| D1 | 1N914 | Diode |
| FM, OUTS, PWR | 2x5 pin | 0.1" Socket |
| FM1, FM2, PITCH, PW, PWM | 100K | Potentiometer ALPHA-RV141F Available from Small Bear |
| FTRIM | 100K | Multi Turn Trimmer 3396 |
| IC1 | LT1012 | Single Precision Op Amp or OP177 |
| IC2 | REF02 | Reference Voltage |
| J1, J2, J3, J4, J5, J6 | FM1 | Vertical Jack Earthenvar PJ301B |
| R1, R2, R3, R4, R5 | 20K | 1/4W 0.1% Metal Film Resistor |
| R6, R8, R10, R11 | 100K | 1/4W 0.1% Metal Film Resistor |
| R7 | 680K | 1/4W 1% Metal Film Resistor |
| R9 | 2M2 | 1/4W 1% Metal Film Resistor |
| R12, R15 | 100K | 1/4W 1% Metal Film Resistor |
| R14 | 15K | 1/4W 1% Metal Film Resistor |
| R16 | 220K | 1/4W 1% Metal Film Resistor |
| R17 | 47K (15V) 15K (12V) | 1/4W 1% Metal Film Resistor |
| SW1 | RANGE | ALPS 5W Rotary Switch (Mouser) |
| SW2, SW3 | SYNC | MHS223K Slide Switch (Mouser) |
| T1 | 2N3904 | Transistor |

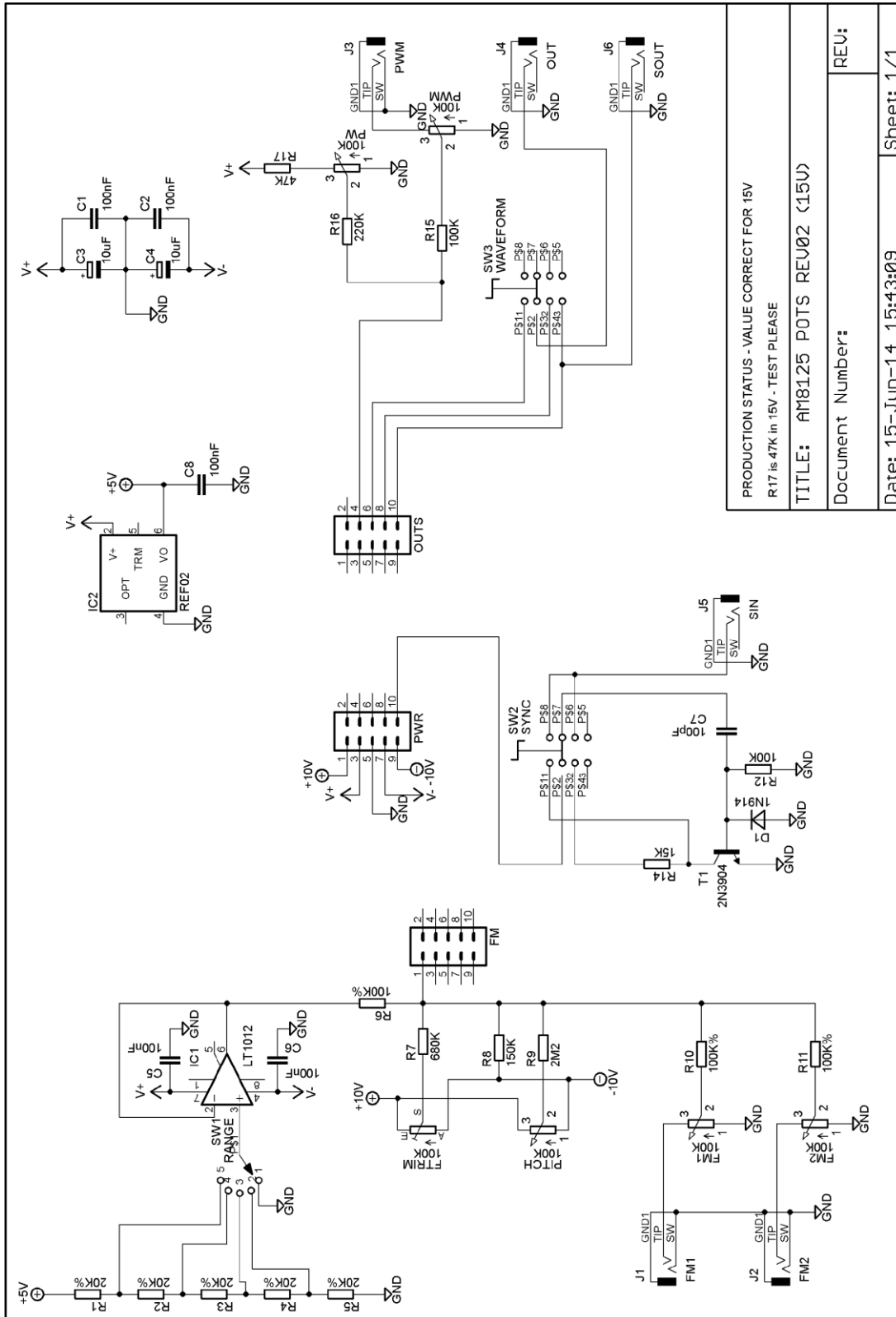
12V POWER



PRODUCTION STATUS - VALUE CORRECT FOR 12V
 R17 is 47K in 15V - TEST PLEASE
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 Document Number:
 Date: 21-Mar-14 12:59:40
 Sheet: 1/1



15V POWER

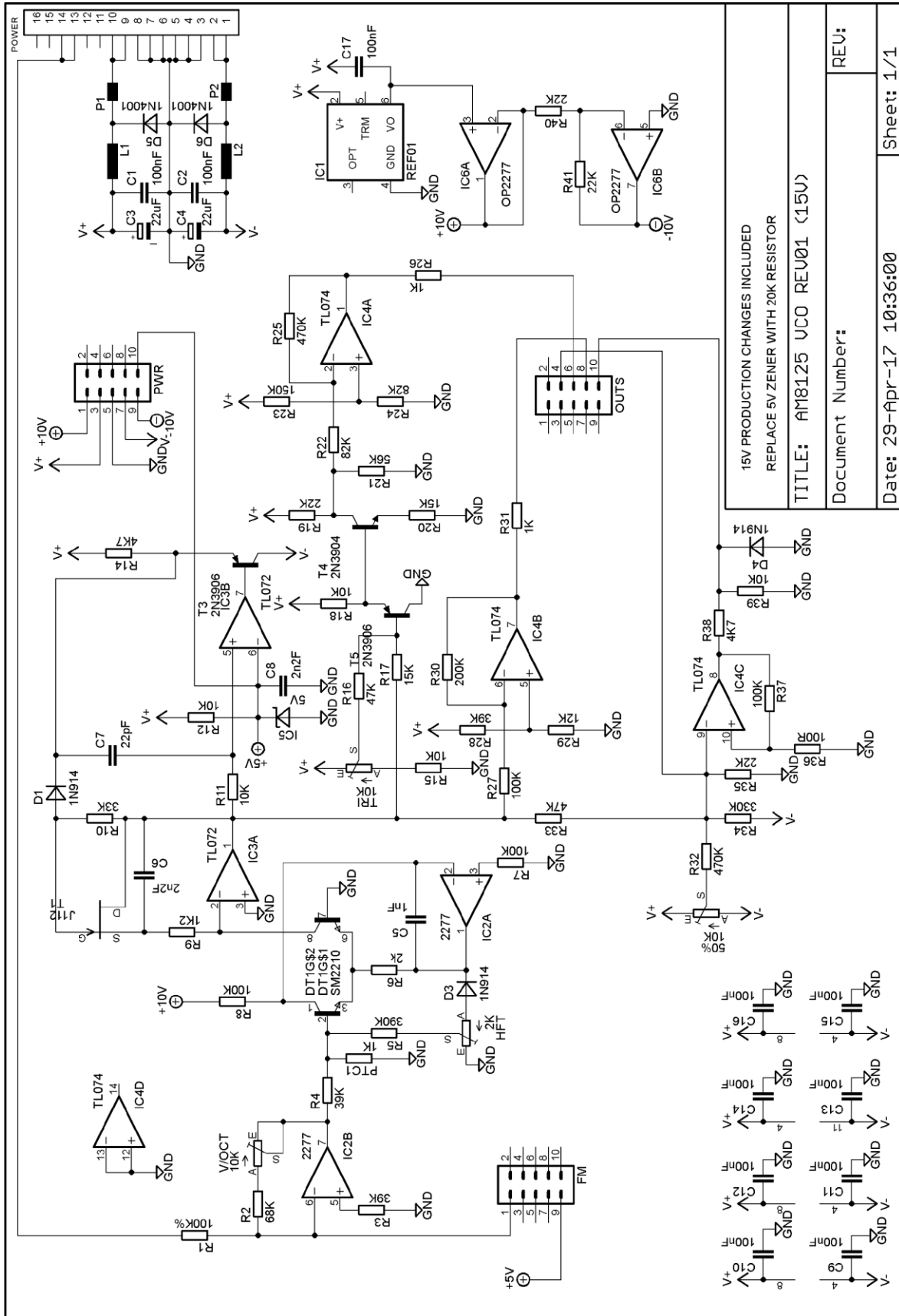


PRODUCTION STATUS - VALUE CORRECT FOR 15V
 R17 is 47k in 15V - TEST PLEASE

TITLE: AM8125 POTS REV02 (15V)

Document Number: REV1

Date: 15-Jun-14 15:43:09 Sheet: 1/1



15V PRODUCTION CHANGES INCLUDED
 REPLACE 5V ZENER WITH 20K RESISTOR

TITLE: AM8125 VCO REV01 (15U)

Document Number:

Date: 29-Apr-17 10:36:00

Sheet: 1/1